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SUGAR CANE VARIETIES OF PORTO RICO, II

BY

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**SUGAR-CANE VARIETIES OF PORTO RICO—II.**

By F. S. EARLE.

IN THE JOURNAL OF THE DEPARTMENT OF AGRICULTURE, Vol. III, No. 2, under date of April 1919, there appeared a preliminary paper on the "Sugar-Cane Varieties of Porto Rico." The purpose of the present paper is to present the results obtained in the continued study of this vitally important subject. Additional data will be given concerning varieties mentioned in the previous paper, some other varieties will be discussed and the attempt will be made to briefly outline the history of cane varieties in Porto Rico. The paper entitled "An Annotated List of Sugar-Cane Varieties" which appeared as Vol. IV, No. 3 of the JOURNAL and which contains an alphabetical list of all of the names applied to sugar-cane varieties in different part of the world, so far as they could be found in the accessible literature, was prepared as a part of this series of studies. This was found necessary in attempting to trace the history of the older varieties found in Porto Rico on account of the great confusion in the use of varietal names that exists in all of the cane literature. This study, with the synonymy that it has been possible to trace with some certainty, has served to clear up a number of points that have heretofore been obscure, but there are many other cases that can not be definitely determined without a first-hand study of authentic living material as it occurs in other parts of the world. The great practical importance of the variety question in cane cultivation would amply warrant the use of the time and money necessary for such a study if the means could be found for carrying it out. The selection of the proper variety for each local planting is the one

most important factor in sugar-cane production. Its importance strangely overlooked by the average planter, who only too often plants his one favorite kind in all kinds of soils and under all kinds of circumstances with no thought at all as to its adaptability; and as so often happens in Porto Rico, he plants a miscellaneous mixture of kinds in the same field. Neither plan will give really satisfactory results. In the present state of the sugar market (Jan. 1921) the most painstaking care is necessary at all points in order to secure a reasonable profit. Each variety is particularly adapted to certain soils and certain conditions and will only give its best results when these requirements are complied with. It is, however, in connection with insect pests and diseases that the question of variety becomes most important. Some are susceptible to each of these plagues while others are more or less resistant or even immune. In every important cane-growing country in the world the industry has been seriously threatened at one time or another by the sudden appearance of some one of these plagues. In each case, after heavy losses and much effort, the situation has been saved by the substitution of more resistant kinds for the ones previously in general cultivation. Aside from strictly preventive measures no practical remedy is known for any sugar-cane disease except that of substituting some more resistant kind. As this fact came to be realized it led to the searching of all sugar-growing countries for desirable kinds and the establishment of large living collections first in Mauritius, then in Java and later in Australia, Brazil, Jamaica, Louisiana, Hawaii and various other countries. Then came the discovery that sugar-cane produced fertile seed and with it the making of many new seedling kinds. For the past twenty years this has so absorbed the attention of sugar-cane investigators that the older varieties have been forgotten long before most of them had been properly tested and their adaptabilities determined. This is unfortunate. The very fact that these are kinds that had merit enough to survive for generations under the crude agricultural practices of the country of their origin demonstrates their usefulness. When first brought to a new country and planted in trial grounds they have often, perhaps, found, under congenial surroundings and so have made a poor showing and been discarded when under slightly different conditions they would have succeeded admirably. Thus the Uba cane when first brought from Brazil to Mauritius in 1869 was noted as "worthless," but it later since saved the industry in Natal, where it is now the only cane planted and (under the name of Kavangire), it now promises

be of the greatest assistance in freeing Western Porto Rico from the mosaic disease, to which it proves to be absolutely immune. It is not intended to belittle the importance of the work of producing and testing new seedling varieties. It has already done much for the sugar industry in many parts of the world and will unquestionably do much more in the future. It is only wished to call attention to the importance of continuing to test the older kinds until their adaptability is fully determined for all conditions and for all purposes.

In the first paper the subject-matter was divided under two distinct headings, the one dealing with the cultural characteristics and value of the different varieties and the other giving an attempted technical description, thus treating of them taxonomically or botanically. This method has certain obvious advantages, but it will be disregarded in the present paper, where all the available data regarding each variety will be found grouped under the one heading, an arrangement which it is believed will on the whole be more convenient for reference.

In the previous paper the attempt was made to provide a key to all varietal descriptions along one of the familiar lines used in botanical text books. So far as is known to the writer this was the first serious attempt of the kind to be found in the sugar-cane literature. It was frankly artificial in that it made no attempt at securing a natural grouping of the varieties. This key has proved to be exceedingly useful in further varietal studies, but as was to be expected in such a first attempt various imperfections have been noted. One of its most striking faults was the use of the color of the stalk as the character for making the primary division of the varieties. Color is a useful and striking character, but its use as of primary value was unfortunate since it led to the wide separation of such closely related kinds as *Cristalina*, *Rayada*, and *Morada*, which are known to be mere color-variants of the original *Cheribon* stock. Whether this original seedling was a light-colored or a purple cane is not known. It quite certainly was not striped, since striped seedlings are very rare. Either light or dark self-colored canes, however, not infrequently "sport" and produce striped stalks by bud variation and these if planted will come true, thus establishing a striped variety. A number of undoubted cases of this kind are recorded in the literature and several interesting ones have come under the writer's observation in Porto Rico. Color, then, while an obvious character, can not be taken as of primary importance. The

no signs of degeneration unless confronted with radically changed conditions of growth. Ben Davis apples, Barlett pears, Elberta peaches, Concord grapes, and Navel and Valencia oranges are growing today on countless thousands of acres with the widest possible geographical distribution and with no sign whatever of deterioration. Under favorable cultural conditions they show the same vigor and productiveness that they did many years ago at the time of their first introduction. Cultivated varieties of plants may degenerate; it would be difficult to prove the contrary, but the fact remains that no evidence has been brought forward to show that they actually are degenerating except through the action of purely external causes. On the other hand, much evidence could be cited to show that they may be constantly improved by the continued selection of bud variations. This is a phase of the question the great importance of which seems to have only been appreciated by a very few investigators. Shammel's work with citrus varieties in California may be cited as one of the few instances in point.

To return to sugar cane: The Caña Blanca or Otaheite is the one usually cited as a case of deterioration. Scarcely an article on cane varieties has been written during the last fifty years that does not assume the degeneration of the Otaheite as an accepted fact. It is unfortunately true that it has been found necessary to abandon the cultivation of this once popular variety in one after another of all the sugar-producing countries. This forced change of varieties has only too often been accompanied by heavy financial losses and sometimes by the threatened ruin of the sugar industry. This does not prove, however, that the Otaheite had degenerated. Its nature today seems much the same as it was a century and a quarter ago when it so dramatically replaced the old Caña Criolla that was then universally cultivated. As always, it is a cane adapted to a narrow range of cultural conditions. It requires a well-aerated soil abundantly supplied with vegetable matter. These conditions are admirably supplied by virgin forest lands. It was on such lands that Otaheite was first planted in the West Indies and on such lands it gained its great reputation. When it became necessary to plant cane on old compacted lands where the humus and other elements of fertility were partially exhausted, then the Otaheite failed, and failed miserably. Its root system is not adapted to these conditions and it is unduly susceptible to most cane diseases. Planted today on virgin land it grows with its old-time vigor. It is conditions that have changed. The soil has deteriorated, but not the Otaheite cane.

It is only a striking example of the necessity of selecting varieties adapted to the particular soil conditions under which they are to grow.

The Cristalina may be taken as another example to show that deterioration is not an inherent characteristic of cane varieties. In so far as we can trace its history this is as old a cane as the Otaheite. Coming originally from Java it has been carried to all sugar-cane growing countries. It seems to have been brought to the West Indies at about the same time as the Otaheite and to have had about the same distribution. It was not a favorite with the early planters since it did not mill quite as easily as the Otaheite and its juices were harder to handle under the old open-kettle methods. It was, however, so much hardier and was adaptable to so much wider a range of conditions that in one country after another it has quite completely driven out and replaced the Otaheite, notwithstanding the prejudices of the older planters, and is today under one name or another considered as the standard cane in many of the largest sugar-producing countries. This cane is adapted to a much wider range of soil conditions than the Otaheite and is more resistant to most insects and diseases. It is easily our one best general-purpose cane. That it is not degenerating may be proven by its continued good behavior in thousands of fields and in many countries, in fact wherever reasonably good cultural conditions are still found. The recorded yield of an average of 81 tons per acre on a 40-acre field of the irrigated lands at Aguirre two years ago gives testimony to its continued vigor and productiveness. Although so much more hardy and resistant than Otaheite, it is, however, failing in many localities from the same causes; mainly from root disease induced by unduly compacted and exhausted soils and the failure to give rational tillage. It is being replaced by other kinds, not because it has deteriorated but because other kinds have been found that are still more resistant, or that are better adapted to the changed soil conditions.

#### THE POSSIBILITY OF IMPROVING EXISTING VARIETIES THROUGH THE SELECTION OF BUD VARIATIONS.

The belief expressed in the previous paragraphs that cane varieties are not inherently deteriorating does not imply that they are necessarily fixed and immutable. In fact, the contrary is known to be the case. Change is the universal law of living beings. Within limits like produces like, but this inheritance is not absolute. It is

true, also, that plants propagated asexually from buds resemble the parent form much more closely than those propagated from true seeds, but no two buds even from the same shoot will produce plants that are absolutely identical. Sporting, a sudden and pronounced form of bud variation, is known to occur with many plants. It seems to be particularly prevalent in the tropics. Several striking cases of it among different ornamental plants have fallen under the writer's observation in Cuba. It is known to have been the origin of many well-marked horticultural varieties. The not infrequent occurrence of striking color variants in sugar cane has been noted in a previous paragraph and the case of the three differently colored forms of the Cheribon cane, Rayadâ, and Cristalina, and Morada, has been cited. An exactly similar case occurs with the Tanna canes, Yellow Caledonia, Black Tanna and Big Ribbon or Striped Tanna being color variants of the same stock. Otaheite has produced two differently colored striped bud sports, one yellow and green and one yellow and red, and the latter has sported again to produce a solid-colored red cane. Here we have four distinct color forms from the one stock. At least four striking instances of striped sports appearing in cultures of self-colored canes have been observed by the writer in Porto Rico during the last year and a half. In three of the cases the striped sports were planted and the resulting progeny has uniformly been striped. The fact that canes are known to produce such striking differently colored bud sports at once suggest the question as to whether or not they are not also sporting in other directions which perhaps may have more practical importance though less easily detected by the eye. Are there not "sports" having a greater or a less sugar content than the normal? Or do not some individuals have greater vigor and greater resistance to certain diseases than the others? There are many indications that this may be the case; and the inherent probabilities all favor the idea of such variations, or of such mutations if it is preferred to so consider them. The idea of a possible inheritable variation in sugar content has occurred to many investigators and there have been numerous attempts at experimental proof. Such work has been done by Edson and Stubbs in Louisiana, d'Albuquerque in Barbados, Watts and various others workers in the other British West Indies, Rosenfeld in Argentina, Greimley in Australia and particularly by Kobus in Java. Various methods have been followed, mostly based on the idea of the chemical selection of the stalks richest in sugar. In some cases the attempt has been made to find and isolate un-

usually rich strains from which to propagate, but Kobus' method looked toward the general improvement of the variety by mass selection based on the use of those seed pieces showing the greatest specific gravity, this usually being an indication of high sugar content. He seemed to get very favorable results, but later workers in Java consider his methods impractical. In fact, no really practical results have come from any of these efforts. One of the greatest difficulties in this line of work is the fact that sugar content is dependent not only on the inherited characteristics of the cane, but to a much greater degree on soil and weather conditions with their influence on the maturity of the plant. Age is another important factor. Different stalks in the same stool when of different age and maturity differ widely in sugar contents, as do the different joints in the same stalk. This makes any form of chemical selection a difficult problem, but it by no means proves it to be insoluble. The question is worth further careful and continued effort.

The other phase of the problem of selection within the variety, that of trying to find and propagate strains or variants that show greater vegetative vigor and more resistance to specific diseases, has been strangely neglected, the only reference found being an account of an attempt in Java to find strains of Black Cheribon that would resist Sereh. This line of work would be much easier to carry out than the other since such valuable strains, if they do exist, may be detected by the eye by a careful inspection of fields exposed to the unfavorable condition which it is desired to combat, whether this is soil exhaustion, root disease, gum disease, mosaic or any other specific trouble. It is a matter of common knowledge and observation that in such exposed fields there are always certain stools that seem to be thriving better than their neighbors. In most cases this simply means a better local soil condition, but the possibility always presents itself that some of these better stools may represent inherently different strains. This can only be proven by taking seed cuttings from these promising stools and planting them side by side where they will be exposed to the same unfavorable condition. As a case in point, on the older cane lands of Cuba where the practice of long ratooning prevails and where little attention is given to replanting the vacancies in old fields, areas are frequently found where the cane has died out from root disease. These open areas, or *sabanas* as they are locally called, often reach an area of an acre or more before the field is abandoned and plowed up.

Almost always, however in the midst of these open grassy places

will be found an occasional stool of cane still growing vigorously, notwithstanding absolute neglect, and often living on for years after all of its immediate neighbors have died from root disease. The conclusion is irresistible that some, at least, of these stools represent cases of real immunity. So many such cases came under the observation of the writer some ten years ago while acting as consulting agriculturalist for the Cuban American Sugar Company, and the chances seemed so good for practical results from the selection and propagation of these possibly resistant strains that the appointment was secured of H. B. Cowgill, a graduate in plant-breeding, and he was set to work searching for and propagating all promising material of this kind. At the end of six months several hundred selections had been secured and planted in a nursery for further testing and propagation. A complete change in the policy of the company, however, caused the work to be suddenly abandoned, so that no results whatever were obtained.

Another example of the possibilities in this line of selection is afforded in the cane fields of western Porto Rico that have been so completely invaded by the mosaic disease. There are some fields that are absolutely a hundred per cent infected. In the great majority of even the worst cases, however, here and there a stalk will be seen that is still healthy. These stand up well above their infected neighbors and are quite conspicuous from their darker green color. Of course such cases are largely accidental; however, the possibility exists that some of them may represent real resistance or even immunity. A strain of Rayada or Cristalina having real resistance to this disease would have such great practical value as to amply repay the effort of searching for it. A few of these striking cases have been brought in and are now growing on the station grounds. The danger however of bringing in incipient cases of mosaic disease has been too great to do this work of selection on a large scale here where it is necessary to keep the grounds free from mosaic. The planting of a cooperative immunity experiment last spring on the grounds of the Agricultural College at Mayagüez seemed to offer an opportunity for this work. Some fifty or sixty healthy canes were therefore selected from heavily diseased fields in the Añasco valley and were brought and planted with this experiment. Continued drouth led to the complete failure of this planting and again the attempt at asexual selection for disease resistance has given no results. This attractive field still remains open for future investigators.

## THE FLOWERING OF SUGAR CANE.

Some varieties of sugar-cane flower or "arrow" freely, the fields in the late fall with their waving pampas like plumes being much more striking than a corn field in tassel. Other kinds seldom or never flower, at least under Porto Rican conditions. Some of the older writers attempted to use this distinction as the basis of a classification dividing cane varieties into two groups, one containing the kinds which arrow and the other those that do not arrow. This grouping is of little practical use, however, since there are many kinds, including such standard widely planted varieties as *Cristalina* and *Rayada*, which bloom freely in some years and on certain soils while under other conditions and in other years they completely fail to bloom. Thus in Cuba where *Cristalina* is grown so extensively it very seldom blooms on the red lands while on the black lands it frequently blooms very freely. Just what the conditions are which induce or inhibit blooming is not well understood. The arrows usually appear in November and December. In Cuba this coincides with the beginning of the dry season and the opinion prevails that it is induced by the sudden checking of growth due to the lack of moisture. In Porto Rico, however, cane blooms at about the same season, though November and December, at least on the north coast, are usually wet months. The age of the cane is, of course, a factor of importance. As a rule, arrowing does not occur when the cane is less than twelve months old. Spring-planted cane, therefore, arrows much less than fall-planted or *gran cultura* cane. There are some varieties, however, that will arrow with the coming of November even if planted as late as May or June. With the craze for new seedling varieties that has dominated the sugar-cane world during the last twenty years the question of arrowing has taken on new importance since only those canes which flower freely could be used as parents for new varieties. All of these newer kinds are thus descended from free flowering kinds and it is natural that most of them tend to arrow more freely than is usual with the older varieties which have been propagated asexually for a great number of years. It seems necessary, therefore, to note somewhat carefully the tendency to arrow in each of the varieties under study and to determine the effect of arrowing on sugar production and on the general usefulness of the variety. Arrowing, of course, stops the further growth in length of the cane and thus tends to limit tonnage. As it is a sign of maturity it is popularly supposed that arrowing

indicates the time of greatest richness in sugar cane and that if left in the field after arrowing it will soon begin to deteriorate and go off in sugar content. As a rule, however, arrowed cane does not die. The arrow breaks off and three or four of the upper buds grow out into new shoots and the old stalk may remain in usable condition for weeks or months. The Insular Station has this year done considerable chemical work to try and determine just what effect on the sugar content of the juice is produced by the flowering and the subsequent sprouting and growth of the axillary buds. Duplicate samples have been taken at different stages from a number of varieties that showed both arrowed and non-arrowed stalks in the same row. The results of these analyses are given in the following table:

Variety	Date	Age	Arrow	Extr.	Brix.	Suc.	R. S.	Puri.	Fiber
D-109	12-30-20	Rat. 9 Mo.	No	70.0	18.94	16.38	0.91	85.58	10.80
D-109	12-30-20	Rat. 9 Mo.	Yes	67.3	20.01	17.85	1.15	89.70	13.08
D-109	2-4-21	Pl. 16 Mo.	No	65.2	18.00	16.33	0.89	90.72	11.18
D-109	2-4-21	Pl. 16 Mo.	Yes	61.0	17.50	15.34	0.62	87.65	12.24
D-109	4-6-21	Pl. 17 Mo.	No	68.7	16.30	13.50	1.26	83.37	12.52
D-109	4-6-21	Pl. 17 Mo.	Yes	67.8	19.00	17.00	0.618	89.47	12.35
D-117	12-30-20	Rat. 9 Mo.	No	69.13	15.13	12.15	1.69	80.30	11.58
D-117	12-30-20	Rat. 9 Mo.	Yes	67.2	16.53	13.66	1.71	82.52	11.80
D-117	12-20-20	Rat. 14 Mo.	No	67.6	16.30	13.78	0.72	84.54	10.36
D-117	12-20-20	Rat. 14 Mo.	Yes	68.7	17.20	15.03	0.21	87.38	10.60
D-117	2-2-21	Rat. 16 Mo.	No	75.0	15.15	12.40	1.36	81.84	11.00
D-117	2-2-21	Rat. 16 Mo.	Yes	67.0	18.30	15.82	0.76	86.44	11.22
D-117	2-4-21	Pl. 16 Mo.	No	64.7	17.20	14.71	1.50	85.52	12.60
D-117	2-4-21	Pl. 16 Mo.	Yes	61.5	17.50	15.20	1.13	86.85	12.32
D-117	4-6-21	Pl. 17 Mo.	No	69.2	19.0	17.20	0.77	80.52	12.32
D-117	4-6-21	Pl. 17 Mo.	Yes	68.0	19.45	18.02	0.617	82.64	12.80
Uba	2-7-21	Pl. 16 Mo.	No	63.8	15.50	13.16	0.95	84.90	13.03
Uba	2-7-21	Pl. 16 Mo.	Yes	61.1	17.80	15.83	0.40	88.98	14.00
Uba	2-23-21	Rat. 16 Mo.	No	68.5	17.50	15.93	0.399	90.83	13.86
Uba	2-23-21	Rat. 16 Mo.	Yes	64.1	17.90	16.26	0.43	90.83	14.36
Uba	4-4-21	Pl. 17 Mo.	No	64.8	18.30	15.53	1.06	84.86	12.67
Uba	4-4-21	Pl. 17 Mo.	Yes	63.5	18.40	15.89	1.01	86.35	13.00
P.R. 260	12-22-20	Rat. 14 Mo.	No	70.8	14.33	10.67	2.03	74.04	9.34
P.R. 260	12-22-20	Rat. 14 Mo.	Yes	65.8	16.80	14.0	1.01	83.33	13.08
P.R. 260	1-28-21	Rat. 15 Mo.	No	69.2	15.40	12.45	1.47	80.84	12.44
P.R. 260	1-28-21	Rat. 15 Mo.	Yes	65.0	17.0	14.21	0.61	87.11	14.0
P.R. 260	2-28-21	Pl. 17 Mo.	No	64.2	17.85	15.90	0.62	89.07	12.88
P.R. 260	2-28-21	Pl. 17 Mo.	Yes	65.1	17.95	15.73	0.75	87.47	13.96
P.R. 260	3-30-21	Rat. 14 Mo.	No	70.8	18.0	15.07	0.55	88.72	12.84
P.R. 260	3-30-21	Rat. 14 Mo.	Yes	70.2	18.05	15.00	0.304	89.14	11.92
P.R. 292	12-30-20	Rat. 10 Mo.	No	70.0	15.73	13.80	0.87	87.59	10.80
P.R. 292	12-30-20	Rat. 10 Mo.	Yes	68.5	17.63	15.59	0.65	88.93	12.60
P.R. 292	12-7-21	Pl. 16 Mo.	No	66.6	18.50	16.80	0.65	90.81	12.02
P.R. 292	12-7-21	Pl. 16 Mo.	Yes	61.9	18.20	16.45	0.56	90.38	12.95
P.R. 292	12-28-21	Pl. 17 Mo.	No	60.4	19.00	18.11	0.41	92.39	12.24
P.R. 292	2-28-21	Pl. 17 Mo.	Yes	67.9	19.25	17.28	0.49	89.76	12.84
P.R. 292	3-30-21	Rat. 14 Mo.	No	70.5	17.75	16.05	0.336	90.42	12.98
P.R. 292	3-30-21	Rat. 14 Mo.	Yes	71.4	18.50	16.80	0.33	90.81	11.44
Average above 19 lots non arrowed.....				68.63	17.05	14.78	0.955	86.15	11.95
Average above 19 lots arrowed.....				66.11	18.05	15.05	0.692	88.19	12.63

These figures show that, taking the average for the season, the arrowed cane gives about 1 per cent more sucrose and 2 per cent better purity than the non-arrowed and that the percentage of reducing sugars is appreciably less. On the other hand, fiber averages a little higher and extraction, at least by the small laboratory mill, is about 2 per cent less. An inspection of the detailed figures shows that these differences are more marked early in the season than they are later when the cane reaches better maturity. Close watch has been kept to detect the point at which the supposed deterioration of the arrowed cane would begin. No evidence has been found to show that such deterioration is a necessary or even an usual effect of arrowing. Arrowing is, of course, an indication of maturity. Fully matured cane has less vegetative vigor with which to resist the entrance of *Melanconium* and other rot organisms, and the breaking off of the arrow affords an easy opening for their entrance. It is doubtless true that a larger proportion of arrowed than of non-arrowed cane is lost from rot when the cane stands too long in the field, and it is this that has doubtless led to the idea that arrowing is followed by deterioration.

We may conclude, then, that arrowing is not desirable in late varieties, nor in fields that are to be held for cutting at the last of the crop since it checks growth too early, thus limiting tonnage and it may lead to losses from rotten cane. On the other hand free arrowing may be a distinct advantage in an early cane that is to be cut during the first part of the crop, since, as seen by the foregoing analyses it may frequently at that season give as much as 2 per cent more sucrose while the loss of growth and tonnage would then be negligible.

#### THE RIPENING OF CANE.

It has already been stated that the richness or sugar content of cane depends more on the state of maturity than it does on variety. A well-grown, fully ripened cane of the poorest variety will contain more sugar than a green, immature cane of the richest kind. Different varieties ripen very unevenly, some maturing early and others late. This shows the inadvisability of mixing them together in the same planting. After full maturity is reached cane begins to deteriorate. Cases of top rot often appear and joints injured by borers or by other causes may begin to rot. If a second growth sets in, a portion of the crystalizable sucrose will revert to glucose. All of these causes tend to lower the sucrose content and purity of cane that

has become over ripe. The length of time after maturity before deterioration sets in varies with different varieties and with weather conditions. Thus Otaheite goes to pieces quickly. It must be cut as soon as it is fully mature in order to avoid heavy losses. Cristalina, on the other hand, usually remains long in good condition. If the weather remains dry it will stand in the field for weeks or even months with no loss of sucrose or purity. Heavy rains during the grinding season always result in losses of sucrose since they not only start the cane into new growth but tend to also favor the growth of rot-causing organism. Here again the question of the variety is of great importance since some start new growth with germination of the side buds much more easily than others.

The ripening of cane depends on a number of factors. The nature of the variety is one of the most important since some kinds are mature enough at ten months, with other conditions favorable, to give a very satisfactory yield, while under the same conditions other kinds will not be at their best under fifteen or eighteen months. The amount and distribution of the rainfall or of irrigation is the one most important factor. The highest sugar content is never reached until vegetative growth has entirely stopped. This does not happen as long as the soil is abundantly supplied with moisture. The highest sugar yields are always found in countries with a pronounced dry season during the grinding. In countries with a continuous rain fall the cane never becomes fully ripe. For this reason in irrigated countries it is the custom to withhold water for a time previous to cutting in order to ripen the cane. Temperature is another factor. Cool weather promotes ripening, while heat induces growth. Soil conditions, too, have a considerable influence on ripening. On porous, well-drained lands cane ripens earlier than in low, moist, retentive soils. As a rule, hill lands are earlier than low lands. The chemical composition of the soil and of the fertilizer used also has a marked effect on maturity. Abundance of nitrogen and probably also of potash tend to prolong the season of active growth and hence delays ripening. Phosphoric acid, on the other hand, has some tendency to promote early maturity. The first crops of cane on virgin timber land are notoriously low in sucrose content. After three or four cuttings the cane becomes much sweeter. This is mainly because the over supply of nitrogen on new land unduly stimulates vegetative growth and prevents ripening. All of these factors should be carefully considered in selecting varieties for these different classes of lands. It is an evident mistake to plant such

vigorous, low-sucrose, late-maturing kinds as Yellow Caledonia, Cavangerie or B-3412 on rich, new lands where it is certain that they will not mature sufficiently to be worth grinding. It is equally a mistake to plant high-sucrose canes like B-208 in poor, dry soils where they can not possibly be expected to yield profitable tonnage. Again, in the selection and use of fertilizer it may be profitable to force high-sucrose kinds like the Rayada or Cristalina with heavy applications of fertilizers high in nitrogen, while for the lower sucrose canes like Yellow Caledonia less nitrogen and more phosphoric acid are clearly indicated.

Cultural methods, too, may have some effect on maturity. In some countries the trashing of the cane by stripping off the dead adhearing leaves is widely practiced with the view of letting in more light and air and thus hastening maturity. Under Porto Rican conditions this does not seem to be profitable. The operations of tillage are all calculated to increase the vegetative growth of the cane, but after the cane closes these are discontinued and so do not interfere with normal ripening.

The approach of maturity or ripeness is indicated in several ways. Usually there is a noticeable change in the color of the stalk. Green canes tend to turn yellow and red or purple cane become duller in color or some of them even turn brownish or olive. The leaves, too, become paler and in many kinds there is more of a tendency to droop and be less erect than when the cane is in active growth. Arrowing is, of course, a sign of maturity. Canes with the arrow in full flower quite uniformly show one to two per cent more sucrose than those in the same row that have not arrowed. It is a mistake, however, to assume, as is done by some writers, that flowering marks the time of greatest sucrose content. This is far from being the case, as shown conclusively by the figures given on another page. The fact that a field has flowered freely can not be taken as evidence that it is necessarily ready for cutting. Judging just when a field of cane is in the best condition for cutting is a matter requiring much practical experience. It is also a place where practical men are often at fault. Many a fine field of vigorous, heavy-tonnage cane is sacrificed by cutting it too early when by leaving it a few weeks longer the gain in sucrose would have been great. The present system of buying cane from the *colonos* on a tonnage basis constantly tends to the grinding of immature cane with a corresponding heavy loss in sugar yields. While the trained eye of the field man can judge fairly well in most cases as to the ripeness of cane the fina

judgment must be given by the chemist. Preliminary hand-mill analyses should always be made when there is any doubt as to the ripeness of a given field. This should particularly be the case with the newer and less well-known kinds. Each per cent of additional sucrose in the cane of a forty-ton crops means 600 pounds more sugar per acre in the bags.

#### THE DETERIORATION OF CANE.

It has been noted under the last heading that after reaching full maturity cane becomes over ripe and begins to deteriorate in the field. The rate and extent of this deterioration depends very largely on weather conditions, being much less in periods of continued dry, cool weather and greatest when heavy rains follow a period of prolonged drouth. In cold climates where frosts occur this greatly accelerates deterioration. In such climates it is often necessary to cut and windrow the cane so that it may be protected from freezing. The amount of deterioration, too, will depend largely on the abundance of borers, white grubs or other insect pests that may injure the cane and on the presence or absence of the various organisms connected with root disease and top rot. An extreme case of rapid deterioration and heavy loss from these combined causes is detailed in this JOURNAL, Vol. 4 (1): pp. 16-26, under a discussion of Root Disease. The same citation serves, however, to also demonstrate the great importance of the influence of the variety in a discussion of this question. Of the 171 varieties reported on in this experiment eight showed no appreciable loss when harvested, three were a complete loss, all having died from top rot and rind disease, while the others showed all possible variations between these extremes. Since no analyses were made the notes taken could only consider the evident and complete loss caused by the death of the cane. Had it been possible to make a series of analyses of these plots the results would have been very interesting in showing to what extent the canes which did not die of the different varieties were actually deteriorating and going off in sugar content. With the immense amount of work that has been given to sugar-cane analyses in different parts of the world it is really remarkable that so few cases are recorded where the chemical condition of the cane in the same plot has been followed throughout the season and has been properly correlated with growth and weather conditions. The interesting work done at this Station last year with Yellow Caledonia cane (see paper by the Director E. D. Colón, Ins. Exp. St. Cir. 33) needs to be

repeated with each variety under cultivation, not once but several times under different conditions, before we will be able to fully judge of their desirability for different planting purposes.

After cutting, cane deteriorates much more rapidly than when still standing in the field. The amount and rate of loss varies widely according to weather conditions. In Louisiana, with the thermometer near the freezing point, windrowed cane will keep for several weeks with very little loss from deterioration. On the other hand, with hot weather in the tropics serious losses may occur within three days after cutting. Too little attention is usually given to this most important subject. With the loose harvesting methods prevailing, both in Porto Rico and Cuba, where a week or more often elapses between cutting and grinding, it is certain that enormous losses are annually taking place. No reform is more urgently needed than that of so organizing the work that no cane lies more than two or three days after cutting before grinding. Losses from this source are needless except in cases of accident, and simply result from lack of system and organization. On the other hand, during the first twenty-four or forty-eight hours after cutting, cane often shows an apparent gain in sucrose due to the evaporation of moisture. In India this is sometimes taken advantage of by leaving the cane in the sun for a day without topping, the transpiration from the leaves resulting in a considerable concentration of the juice before grinding.

Little attention seems to have been given to the comparative keeping qualities of different varieties of cane. There can be no question, however, that some will deteriorate after cutting much more rapidly than others. It is a question of great practical importance, especially while present loose-harvesting methods prevail. It could be easily investigated if sufficient chemical assistance was available by making daily analyses from the same piles of cut canes.

Cane that has been burned before cutting deteriorates much more rapidly than that which has not been burned. Accidental cane-field fires frequently occur and burning in advance of cutting is often resorted to as an aid in harvesting. It is well understood that such burned cane must be ground quickly. If rain occurs deterioration is much more rapid than when it continues dry. In Cuba the rule at most mills is to receive burned cane up to five days after the fire if the weather is dry, but if a heavy rain falls no more will be accepted. This limit results in the grinding of much badly deteriorated cane, often almost drowning the factory in molasses, but it

is extended as much as possible as an aid to the *colono* who has been unfortunate enough to have an accidental fire. When for any reason cane is purposely fired before cutting, arrangements should be such that it can be rushed to the mill and ground during the first forty-eight hours. If this can be done no loss of sugar will occur, but the burning of the field may result in loss to the following ratoon crops. The practice can only be recommended in exceptional cases, as when a field is going to be immediately plowed up. There is no data as to whether different varieties have different keeping qualities after burning. Probably such differences, if any, would be slight since the burning kills the cane and thus to a great extent destroys the individuality of the variety.

#### LONG RATOONING.

Closely connected with the keeping quality of cane in the field is the question of long ratooning. In Hawaii the custom widely prevails of letting the ratoons from late spring harvesting go over till the beginning of the second succeeding harvest, thus allowing twenty to twenty-two months' growth. These are known as "long ratoons." Fields cut early in the crop are cut again toward the last of the first following harvest when from fourteen to sixteen months old. These are known as "short ratoons." In like manner early plant cane corresponding to our *gran cultura*, is cut during the following crop when fifteen to eighteen months old but spring plant is held over to the second year and is not cut under twenty months. The enormous yields of sugar per acre so often reported from Hawaii with Yellow Caledonia cane have all come from these old canes. They really represent two seasons' growth rather than one. Whether it is better and more economical to thus cut one big crop every two years or at best two such crops in three years rather than a smaller crop cut every year is a question that must be decided in each locality according to local conditions. In Cuba ratoons are seldom allowed to go over to the second year, though this sometimes happens when rains set in early and prevent the normal closing of the crop season. Late spring-planted cane, however, is frequently held over and is cut as *caña quedada* at the beginning of the second following crop. Many planters hold that this gives more economical results than cutting it and allowing it to ratoon, for though the total tonnage secured will be less the expenses of cultivation will also be materially less, resulting in a cheaper average cost per ton of cane. This again will largely depend on weather conditions. In

winters of severe drouth the cane becomes so weakened that much of it dies if left standing and the expected increase in yield is not realized. In such seasons it is considered best to cut all of the spring cane, even if the tonnage is very small, rather than to let it go over. On the irrigated lands of Hawaii this difficulty in making a long crop is not encountered, but with some varieties it is found necessary to cut off the young cane after it has made two or three months' growth and force a second ratooning in order to avoid premature arrowing during the first November since arrowed cane can not be held over profitably. It makes aerial suckers instead of the continued growth of the stalk. Here in Porto Rico cane is very seldom allowed to go over for a long crop. In fact a large part of the Porto Rican crop is made each year from cane that is less than twelve months old. This probably accounts in great measure for the smaller average *rendimiento* or yield in sugar per ton of cane ground that is secured here as compared with Cuba and Hawaii. This custom has probably come from the long-continued planting of the Otaheite cane. This variety remained in general cultivation much longer here than in Cuba. It deteriorates faster after reaching maturity than any of the other kinds that are usually cultivated thus forcing the short-crop system. That nothing in the local conditions prevents the successful holding over here of late spring plantings of Cristalina and some of the newer seedling canes is shown by some of the preliminary experiments carried out at the Station. In the small plots under observations damage from rats has been heavy, but otherwise the cane has come through in good condition. The comparatively frequent winter showers makes it easier to hold over cane here than in Cuba. In how far it will be more profitable to hold over late spring-planted cane rather than to cut it green during the first crop is a question that deserves the careful attention of plantation managers. It will assume more importance in the future with the system of "buying by dulce"—that is, on the sucrose content of the cane—rather than by its gross weight that is being adopted by some of the centrals. Some varieties will adapt themselves to a system of long cropping very much better than others, but unfortunately our knowledge on this point is limited. In a general way, the non-flowering canes will be better for this purpose than those that arrow freely, and those with strong resistance to root disease and top rot will be better than the more susceptible kinds. Here, again, it is vigor and power of resistance that we count rather than high sucrose content. These are the features that

have adapted the Yellow Caledonia so well to the long cropping methods in Hawaii. The question should be carefully studied whether or not this is also the best method of handling this variety in Porto Rico.

#### THE BOTANY OF SUGAR CANE VARIETIES.

The true sugar canes all belong to the genus *Saccharum*, founded by Linnaeus in the first edition of the "Species Plantarum," published in 1753. He then included two species *S. officinarum* and *S. Spicatum*. The latter was not a true sugar cane and is excluded from the genus by recent authors. The number of supposed species increased rapidly. Thus Willdenow, in the third edition of the "Species Plantarum" in 1797, lists eleven species and Kunth, in 1833 in the "Enumeratio Plantarum," lists 22 species besides various varieties. Roxburg, in his "Flora of India," 1832, gives eleven species for that country alone, eight of them being described as new. Hooker, in the "Flora of British India," 1897, reduces the number to five. Bentham and Hooker, in "Genera Plantarum," 1883, recognize only 12 species for the world. Hackel, in his monumental revision of the grasses in Engler & Prantl, "Pflanzen familien," 1887, also recognizes 12 species, divided into four sections or subgenera, but only two, *S. officinarum* and *S. spontaneum*, belong in section *Eu-Saccharum*, or the true sugar canes. Of these *S. spontaneum* occurs abundantly in the wild state in India and other parts of Southern Asia and in many of the Pacific Islands. According to C. A. Barber (Punjab Canes, Mem. Dept. Agri., India (1) 19195), who has studied the wild forms carefully and used them for crossing on cultivated kinds, this is an exceedingly variable species. The diameter of the stalk varies from no larger than a straw to as much as 2 centimeters or more; the color may be red or yellow, the leaves very narrow or comparatively broad, the leaf sheaths smooth or prickly, and finally the buds may vary through most of the forms found in cultivated varieties. The evidence is conclusive that the slender cultivated kinds of Northern India (including Uba which is attracting so much attention in Porto Rico because of its immunity to mosaic disease) are nothing more than selected forms of this wild species. *S. officinarum* was founded by Linnaeus on the cultivated thick-stemmed tropical sugar canes. It has always been held that these constitute a distinct species, but no wild representative of it has ever been found. It is distinguished from the forms of *S. spontaneum* by the usually thicker stalks and wider leaves and by the

glabrous rachis and peduncle of the flowering panicle. The varieties belonging to the former species all have these parts densely hirsute. In size of stalk and leaf, however, the two series clearly tend to merge into each other. B-1753 and B-3412, for example, are only a little stouter and the leaves are not much broader than in vigorously grown Uba, and now the only really technical distinction between the supposed species gives way for a number of the newer seedling canes have the peduncle and rachis clearly hirsute. This is notably so with P. R.-292, a seedling of D-117, and to a less degree with P. R.-260 of unknown parentage. Those of Kobus' Chunnee X Cheribon hybrids that have been examined, notably 36-P. O. J. and 105-P. O. J. have these parts as densely hirsute as the Uba. This might be held to show that other seedling showing this character are also of hybrid origin. We have no evidence, however, that varieties of Indian origin existed in the Barbados and Demerara collections, from which most of our recent seedlings have sprung. The more likely supposition would seem to be that this hairiness of peduncle and rachis represents a reversion to some remote ancestral type. This would go to substantiate the idea clearly indicated by Barber, even if not openly advocated, that all cultivated sugar canes, both thick-stalked and thin-stalked kinds, are in reality descendants of the wild *Saccharum spontaneum*.

In order to describe sugar-cane varieties so that they may be recognized by others it is necessary to employ the methods and to a considerable extent the terminology used in ordinary descriptive botany or taxonomy, including the construction of keys by which these descriptions may be readily located. This was attempted in the first paper of this series (JOUR. 3 (2) 1919) but with only partial success. When that paper was written the work of C. A. Barber in India and of Dr. J. Jeswit in Java had not been seen. These two writers have laid a broad and secure foundation for the study of sugar-cane taxonomy. For the first time we have descriptions of cane varieties that are sufficiently full to permit of sure identification. It is unfortunate that their studies have not included a much greater range of varieties. Their methods, while essentially similar, having originated independently are naturally not identical. Of the two, that of Barber seems preferable since it more nearly conforms to ordinary botanical usage. Jeswit's method of dividing the parts of the bud and other regions of the plant body into serially numbered, areas for purposes of description, especially for noting the presence or absence of plant hairs, seems to introduce an unnecessary com-

plication. In this, however, he is followed by G. L. Fawcett of the Argentine Sugar Station, who has also recently published some most useful cane descriptions. In the following pages the attempt will be made to follow as closely as may be the terminology of Barber in the hope of helping to standardize cane descriptions. The author must, however, be permitted to express a doubt as to the usefulness of the detailed measurement of length and diameter of different parts since these factors are so greatly altered by conditions of growth and environment.

A cane description should cover notes on all of the following points:

1st. General habit; whether erect or soon prostrate, heavy or light stooling habit, general vigor, and propensity to arrow.

2nd. The stalk as a whole; average diameter, color and bloom. In the following descriptions canes under 3 centimeters in average diameter are characterized as slender; those about 3 centimeters medium slender; 3 to  $3\frac{1}{2}$  centimeters as medium;  $3\frac{1}{2}$  to 4 centimeters as medium stout; and above 4 centimeters as stout or very stout. Of course such measurements refer to the average for ordinary well-grown canes, not to old, half-starved ratoons nor to overgrown suckers. Color of stalk is one of the most obvious characters, but it can be one of the most misleading, since in many varieties color is dependent on growth, vigor and exposure to light. This is particularly true of that large number of varieties which are normally green but which show a more or less pronounced pinkish or reddish flush when exposed to light and air. In the descriptions the color refers to that of fully matured internodes that have been exposed by the falling of the leaves but which have not yet become faded or discolored. The changes in color which accompany ripening have already been mentioned, as well as the striking color changes often brought about by sporting or bud variation. Changes in location and soil often lead to marked color changes. The amount of the waxy coating or bloom should always be carefully noted, though this, too, is a character somewhat dependent on growth conditions.

3rd. *The characters of the internode.*—Here should be noted comparative length, though this can only be stated in general terms, being largely dependent on growth conditions and often varying widely in different parts of the same stalk; general form, whether cylindrical or compressed or barrel-shaped, and whether it is enlarged either above or below; finally, whether or not it has a groove or furrow

on the side above the bud, and if present something regarding its character.

4th. *The nodes*; whether constricted, even, or prominently enlarged; and whether at right angles to the stalk or oblique. The node consists of several elements. Under it should be noted:

(a) *The growth ring*.—This is a narrow region separating the node from the internode above. It may differ from the internode in color or be concolorous and it may be sunken, even, or elevated. The width is also quite variable. The cellular tissue of this region remains in a plastic growing condition much longer than the rest of the stalk, and by the division and growth of the cells on the lower side it enables the younger growing part of the cane to again assume an erect position when it has been thrown down by storms or prostrated by its own weight. In the previous paper this was referred to as the "limiting ring" since it marks the limit between the node and internode, but for the sake of uniformity it seems best to adopt Barber's very appropriate name which refers, of course, to this continued power of growth of the cells in this region.

(b) *The root band*.—This name is applied to the space between the growth ring and the point of attachment of the leaf sheath. In different varieties it varies from about 6 to as much as 12 millimeters in width. It is usually of a somewhat, different shade of color from the internode and is marked by irregular encircling rows of rounded dots which mark the ends of rudimentary roots. These quickly grow out and form a root system when cuttings are planted in moist soil. In some varieties, especially if the weather is wet, they spring into growth prematurely on the standing cane. The number of rows and the color, size and prominence of the rudimentary roots should be noted.

(c) *The leaf scar*.—This is a remnant of the base of the leaf sheath which remains on the stalk when the leaf falls away. It is usually prominent or squarrose under the bud and may be so on all sides, but is more often closely appressed to the stalk behind on the side away from the bud. In very young joints of cane there is usually a conspicuous circlet of long hairs on the base of the leaf sheath. These are usually deciduous, falling away before the maturity of the leaf and thus leaving the leaf scar glabrous. In a few varieties, however, they are persistent, leaving the leaf scar conspicuously ciliate. This is usually a constant character of considerable importance.

(d) *The glaucous band*.—This name is applied to a region usually

about a centimeter wide immediately below the leaf scar which is characterized by heavy deposit of wax even in those varieties in which otherwise this material is scanty or wanting. In fact, it is in the kinds with little bloom that the glaucous band is most conspicuous since it is more or less obscured by a general waxy coating or bloom. This band is often though not always conspicuously sunken or constricted. It is sometimes this and sometimes the root band that constitute the narrowest part of the stalk. In some cases, however, particularly with some of the North Indian canes, these parts are conspicuously swollen, being of a considerably greater diameter than the internodes.

5th. *The buds*.—These give us characters of greater taxonomic importance than any other part of the cane. Bud characters are less variable and less dependent on growth conditions than any of the others, and it is on their careful description that we must mainly depend for recognizing varieties. If this had been thoroughly understood by the older writers on cane varieties it would have prevented much of the unfortunate confusion found in the literature of this subject. Although affording the most stable characters of any part of the cane plant, the appearance of the bud varies greatly at different ages and stages of development and some judgment and experience is required to determine whether or not a given stalk shows buds that are in a typical condition. Unless otherwise stated, bud descriptions should apply to those that are fully grown and developed but which have not started to germinate on the standing stalk. With some varieties this happens very promptly after the bud is mature and it is often difficult to find buds that are in a condition to be really typical. After arrowing it is usually difficult to find buds that are in good condition. As a rule cane that is about ten months old is in the best condition for study.

Under the bud should be noted the general form, whether lanceolate, ovate, oval, suborbicular or broader than long; the apex, whether acute or obtusely rounded; the flat sterile margin, whether narrow and uniform in width, broad and uniform or shouldered, that is abruptly widened below; the point of germination, whether apical, subapical, subdorsal or dorsal, so called when the germinating point issues near the center of the bud and not at or near its apex; the average size should be given, especially in relation to the other elements of the node. In some cases the buds do not reach to the growth ring, while in other varieties they may exceed it by as much as half of their length; finally, the presence or absence of hairs should

be noted, especially at the base, on the sides, and at the apex. In a few kinds the entire back of the bud may be hairy. This character is often obscured in buds where mealy-bugs have been feeding. Such buds should not be selected for study.

6th. *The leaf sheaths*.—In many varieties the leaf sheaths have a dense vestiture or coating of sharp, stiff hairs over the greater part of their surface. This was often referred to as “cane itch” by the older writers, since these sharp hairs prick and irritate the skin of persons handling the cane. This vestiture may be persistent or it may be more or less deciduous, appearing only on the younger sheaths and falling off at maturity. Its general character and abundance and the color of the hairs should be noted. In many other varieties this vestiture is reduced to a few scattered hairs along the median line on the back of the sheath or it may be entirely absent. Such sheaths are called “glabrous,” or if only a very little hair is present “glabrate.” If much wax appears on the sheath it is called “glaucous.” The color is usually green but it may be tinted with red or purple and in some varieties it is quite dark purple. In connection with the sheath should be noted—

(a) *The throat*.—This is a discolored, usually more or less crumpled or wrinkled area in the axil of the leaf where the blade joins the sheath. It is usually lannate, that is, coated with numerous short appressed, wool-like, more or less felted hairs, but it may be only waxy or glaucous. Usually also there are conspicuous tufts of long hairs. All these characters should be noted.

(b) *The collar*.—This is the corresponding region on the outside of the leaf. It consists of two more or less clearly marked triangular discolored areas which may or may not meet and coalesce at the midrib. The surface may be lannate or only glaucous.

(c) *The ligule*.—This is a short, circular, brown, somewhat horny membrane that clasps the stalk at the base of the leaf blade. It varies somewhat in length and shape in different kinds and the edge may be nearly even or conspicuously fimbriate or fringed.

(d) *The ligular process*.—This name is applied by Barber to the coriaceous triangular outgrowths or lobes seen in some varieties at the upper corners or shoulders of the leaf sheaths. These may be large or small, broad and obtuse or slender and acute. They may be present on one shoulder only or on both, or they may be entirely absent.

7th. *The leaf, or more properly the leaf blade*.—The general position should be noted, whether spreading, erect with the tips

declined or strictly erect. The color may be light green or yellowish green, dark green, or glaucous or bluish green. Measurements of the average width should be given. Finally, the character of the serrations on the margin should be noted as well as the presence or absence of long stragling hairs or cilia on the margins near the base.

8th. A full description should include the characters of the arrow or inflorescence, since this is likely to afford many points of value. These characters have not been studied for the varieties described in this paper. The arrows are only in condition for study for a brief period and in many varieties they are seldom or never produced. For practical purposes, therefore, it seems best to largely ignore the characters afforded by them. A tendency to free arrowing or the reverse should, however, always be noted.

With notes on all of the above characters it is believed that it will be fairly easy to locate most of the kinds described in this paper by the use of the Analytical Key (see page 132). The use of such keys, however, requires some practice, and care is always needed not to be thrown off the right trail by the variability of some of the characters used. This is especially necessary as to the color of the stalk and as to the presence of a vestiture on the leaf sheath in those kinds where this is more or less deciduous.

#### THE SUGAR CANE SOILS OF PORTO RICO.

In judging of the agricultural value of the different varieties, it will frequently be necessary to refer to the different soil types to which they are adapted. To do this intelligently it will be necessary to consider briefly the different kinds of soil on which cane is grown in Porto Rico. Unfortunately, existing knowledge is very limited regarding Porto Rican soils and their classification. No comprehensive study of the soils of the Island ever seems to have been undertaken. Some years ago the Division of Soils of the United States Department of Agriculture made some preliminary studies in cooperation with the Mayagüez Station and a report was published with a soil map in colors covering a north-and-south section of the Island from Arecibo to Ponce. This covers at least two important cane-growing districts and should have been of basic importance for the present purpose. Unfortunately, like so much of the work of this Division it is largely lacking in practical value. The classification seems to have been based on the mechanical analyses of the surface soils with scant attention to geological derivation and subsoil conditions, both points having a profound bearing on drainage

and general cultural adaptabilities. It is disturbing to find the same name applied to soils in the coastal plain near Arecibo and to those many miles among the hills of the interior.

The following tentative classification of the cane lands of the Island is based on their most obvious geological and agricultural characteristics and makes no claims to being anything more than an aid in the discussion of varietal adaptabilities. The first five numbers are the more recent geologically, belonging to the mangrove swamp and coral-reef formations, while the last three belong to the older central mountain mass of the Island.

1st. *Maritime Soils*.—These were originally deposits formed at the bottom of salt-water lagoons and estuaries. Each barrier reef cuts off a lagoon of quiet water which gradually fills up with sedimentary deposits. Finally it usually grows up to mangroves, and at last by the continued accumulation of sediments and fallen leaves it is built up above the ordinary tides and becomes usable land, or it may be elevated by oscillations in the shore level. Much of the best cane land in Porto Rico is of this origin. Practically all of the sugar of Demerara is grown on such lands. They are usually stiff and intractable and difficult to work. Being of an impermeable nature and lying so flat and low, drainage is a first requisite, and good drainage is often difficult to secure on account of the impossibility of finding a sufficient outlet. These lands are very rich, but when long in cultivation they become very compact, and without careful cultivation cane, and particularly ratoon cane, suffers from root disease caused by lack of drainage and aeration. Most of these lands still retain a certain amount of salt, and in many places, especially on the dry south coast, they are too salty to permit of cane growing. They are roughly divided by planters into *poyals*, *semi-poyals* and *vegas*, in accordance with their elevation above sea level. The *poyals* are really marshes. They are only slightly above sea level and standing water can always be found in the drainage ditches; as a rule, cultivation must all be done with the hoe. The *vegas* are sufficiently elevated to be above standing water. They may be prepared and cultivated like ordinary uplands, but these operations are impeded by the necessity for numerous drainage ditches. As the name indicates, the *semi-poyals* are intermediate between the other two.

2nd. *Alluvial Soils*.—These are the deposits formed by running water. They always form the bottom lands along streams, and in Porto Rico, especially on the south coast, these deposit spread out

and cover a considerable portion of the coastal plain. These soils are usually lighter in texture and much easier to work than the maritime soils, and as they are often built up from alternating deposits of silt, sand and gravel they are not so retentive and are easier to drain. The very best sugar lands of the Island are of this type. These lands are also called *vegas* in Porto Rico, which is unfortunate since their cultural requirements are quite different from the *vegas* discussed under the last heading.

When alluvial deposits have all come down from the red shale clay hills (described under No. 6), as happens at both the eastern and western ends of the Island, in the Fajardo and Mayagüez-Añasco districts, the resulting soil, being unmixed with sand as in ordinary alluviums, is as heavy and compact as on the hills from which it came, and from its retentiveness it also presents a difficult drainage problem. These clay alluviums are not as rich as the maritime *vegas* and they are equally difficult to cultivate.

3rd. *Dune sands*.—Along the north and east coasts there are considerable areas where the soil is more or less mixed with wind-blown sands. These are really coconut and not cane soils, but considerable areas of cane are found planted on them. They vary in consistency from the almost pure sand of an actual dune to sandy loams where there is a considerable admixture of the red soil discussed in the next paragraph. As cane soils they are of but little importance and no attention has so far been given to selecting varieties particularly adapted to them.

4th. *The Coral Red Lands*.—This is an exceedingly important soil area occupying the valleys between the coral limestone hills all the way from San Juan to Aguadilla and extending back into the interior almost to Utuado and Lares. This soil is red in color. Under forest conditions there may be a shallow surface of black mould, but this soon disappears under cultivation. It seems to be the residue left from the weathering of the coral rock and the dissolving out of the carbonate of lime. In texture it is a fine silt, more or less admixed with sand. There is no subsoil, but the deposit goes down unchanged to the coral bed rock whether it be only 6 inches or 60 feet. It is sufficiently open and permeable for the rain fall to pass through it readily so that drainage ditches are not required. Crops are seldom or never injured by too much rain on these soils, but they often suffer seriously from drouth. When first cleared these lands are sufficiently fertile, but on account of their porous nature they leach and become exhausted much quicker

than more retentive soils. The famous red-cane lands of Cuba and also those of Barbados are of this same general nature, though the Porto Rican red lands have rather more of an admixture of sand than those of Cuba.

5th. *The Black Calcareous Soils.*—These also belong geologically with the coastal coral deposit, but they seem to represent an earlier formation than the red lands and they are quite different agriculturally. They consist of a black loam that is usually rather shallow and which is underlaid by a soft white deposit of carbonate of lime. The area of these lands is not large in Porto Rico. They have been noted near Bayaney on the north side of the Island and on the lower foot hills near Yauco and Ponce on the south side. In Cuba lands of this general character occupy very extensive areas in Havana, Matanzas and Santa Clara Provinces. Next to the "red lands" they comprise the most important cane soils of that Island.

The above five groups comprise all of the cane soils derived from the more recent formations of the coastal region. The following three are the only areas of consequence that are planted to cane derived from the central mountain mass of the Island.

6th. *The Red Shale Clays.*—These soils occupy extensive areas in the foothills, especially on the northern side of the central mountain mass of the Island. They may be found all the way from Fajardo to Mayagüez. In color they closely resemble the coral red lands discussed under No. 4, but they are very different in cultural characters, being tough and impermeable while the former are open and porous. Although difficult to properly prepare and cultivate, they are naturally strong soils and give good yields when properly handled. Large areas of them are planted in cane. The yields secured are usually small, but they could easily be greatly improved by the proper selection of varieties and by better tillage. Like the stiff maritime coast lands, they require frequent cultivations to prevent them from becoming too compact for plant growth. The old methods of hoe cultivation do not give good results on these soils, especially after the humus is exhausted by constant cropping. Green manuring with legumes and better tillage will work wonders on these lands. The application of lime or ground limestone is also very beneficial to them, although it would be worse than useless on the black lands discussed under No. 5.

7th. *Sandy Loam Hill Lands.*—These are really tobacco rather than cane lands, but considerable areas of them are planted in cane, especially between Juncos and Humacao and in the Cayey district.

They seem to have been derived either from decomposed granite or from the so-called volcanic ash that constitute the bed rock in some parts of the central mountain region. They are of minor importance to the cane industry.

8th. *Black Hill Lands*.—At other parts in the hill lands are found rather heavy black soils with a yellow clay subsoil. These are usually marked by scattered masses and boulders of a hard blackish rock the nature of which has not been determined. Considerable areas of these lands are planted in cane, particularly in the districts about Juncos and Trujillo Alto. They are among the best of the hill lands for cane.

In the discussion of different varieties in the following pages references will be given to the types of cane soils as here described to which they are best adapted in so far as this has been determined.

#### HISTORY OF SUGAR CANE VARIETIES IN PORTO RICO.

Sugar cane was taken by Columbus to Santo Domingo on his second voyage in 1493 but this shipments was lost. Cane seems to have been first grown in that Island in 1507, but the first sugar was manufactured there in 1509. From Santo Domingo cane was soon carried to Porto Rico, but the exact date of its first establishment has not been ascertained. The first sugar mill in Porto Rico was established at San Germán about 1524. This first cane to be imported was the Criolla variety (Creole) and it was the only kind grown here for two hundred and fifty or more years. It came originally from India by way of Arabia and Spain.

In the early years of the nineteenth century this kind was rapidly and quite completely superseded by the Otaheite or Caña Blanca. Just when or by whom this cane was first brought to Porto Rico is not known. It was carried to Cuba in 1795 by Francisco de Arango and it probably reached this Island only a little later. At about the same time, quite likely as an admixture in this first importation, a few seeds reached the Island of the kinds now known as Cristalina, Rayada and Morada or Louisiana Purple. These attracted no attention and were not planted in separate cultures until after the epidemic of 1872. They were simply strays occasionally seen in fields of Otaheite, which for seventy-five years after its first importation continued to be the only variety intentionally planted.

In 1872 attention was first seriously called to a disease or epidemic that was devastating the fields of Otaheite cane in the district about Mayagüez on the western side of the Island. To this day the nature

of this outbreak is unknown. It gradually extended until the entire region between San Germán and Arecibo was involved. Various commissions were appointed to study it. Its cause could not be determined and no effective remedy was found. It was noted, however, that these other kinds occasionally mixed with the Otaheite were much less injured. They were finally selected out and planted in place of the susceptible Caña Blanca, and as in so many other instances in the history of the sugar-cane industry the situation was saved by a change in the variety of cane planted. In every instance this has been the only practicable means for combating cane disease. This naturally led here, as in other countries, to a great interest in cane varieties and a considerable number of other ones were imported in the hope of finding still better and more resistant kinds. A full account of this interesting experience has come down to us through the effort of Dr. Agustín Stahl of Bayamón, who gathered together the reports of the various commissions, of one of which I was a member, and published them with various comments of his own in a pamphlet of 138 pages entitled "La Enfermedad de la Caña de Azúcar en Puerto Rico," dated 1880.

From the "Memoria Sobre la Enfermedad de la Caña de Azúcar," by Antonio Ruiz Quiñonez, dated August 1877, as quoted by Dr. Stahl, it seems that at some time prior to that date there had been an importation of Cristalina from Cuba. He also mentions another importation from Cuba made apparently just prior to this date by Patxot, Castello & Cía. of Cabo Rojo, owners of the Hacienda Monserrate, of three kinds called Caña Cristalina de Indias, Caña Cristalina de Otaheite and Caña de Cintas Moradas de Bengala. From the descriptions these seem to have been respectively, Cristalina, Calancana or Green Ribbon and Rayada. Calancana or Green Ribbon is thus the only variety introduced into the Island prior to this outbreak of disease aside from the five that had been here since the early days of the century, namely, Criolla, Otaheite, Rayada, Morada and Cristalina. Interest in introducing new varieties now became active. Dr. Stahl established a nursery at Bayamón for the propagation of new kinds and the sale of seed cane. In the *Revis de Agricultura, Industria y Comercio* for 1887, page 174, is an article describing this nursery and listing the following varieties and the prices at which seed could be obtained:

Cavangerie.  
Criolla.  
Cristalina.

Gigante.  
Imperial de Brasil o Calancana  
Carandali.

Lajaina o Borbón.	Reina de Caledonia.
Kakoe.	Salangore Blanca.
Otahiti o Blanca.	Salangore Rayada.
Malabarde o Morada o Listas Moradas.	Salangore Roja y Morada.
Palo Rojo.	Saconi [Saeuri].
Palo Rojo Claro.	Tamarin.

In the summary of his work on the cane disease, page 134 (1880), Dr. Stahl mentions 23 varieties and gives partial descriptive notes. Saconi and Kakoe are not included and to one he gives no name. Those not included above are the following:

Bambú Rosada.	Pinang.
Bambú Rosada de Rayas Moradas.	Rosada—Morada.
Diard.	Verde Zic-Zae.
Lousier.	

Fernando López Tuero, who was Director of the Spanish Agricultural Experiment Station located at the farm Las Monjas near Río Piedras, published a book in 1895 entitled "Caña de Azúcar." He lists 22 kinds that he has known in Porto Rico. This list corresponds closely with that of Dr. Stahl the only additional names being as follows:

Bengala.	Guingham.	Polvo de Oro.
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From a foot note, page 10, we learn that Carandalí, Salangor, Cavengerie, Palo Rojo, Tamarin, Pinang, Diard, Rosada Morada and others were introduced prior to 1879 from Jamaica, Guadaloupe and the other Antilles by Dr. Grivot Grand-Court of Mayagüez and that Reina Caledonia and Gigante were brought from Trinidad by Dr. Stahl.

This completes the history of cane introductions prior to the American occupation in so far as it has been possible to trace it.<sup>1</sup>

<sup>1</sup> Since the above was written the following interesting communication has been received from the Director, Mr. E. D. Colón, covering some recent historical investigations:

"GOVERNMENT OF PORTO RICO,  
"DEPARTMENT OF AGRICULTURE AND LABOR.  
"INSULAR EXPERIMENT STATION.  
"Río Piedras, P. R., Mayo 23, 1921.

"SR. DON F. S. EARLE,  
"Estación Experimental Insular,  
"Río Piedras, Puerto Rico.

"MI ESTIMADO MR. EARLE:

"Decidí ayer reunir, antes que algo me impidiera hacerlo antes de su partida para Cuba, los datos más significativos que tengo en mi poder con respecto a las variedades de la caña de azúcar que existían en Puerto Rico en 1878 y las importaciones hechas entonces hasta 1880.

"Los he obtenido, a propósito de mis averiguaciones sobre la agricultura de Puerto Rico

Very few of these kinds have been maintained as pure cultures in any part of the Island. Such of them as still exists are scattered through the fields in mixed plantings. Tradition has handed down the names of some of them, but of others even the names are forgotten. The attempt has been made to gather up these forgotten kinds from all parts of the Island and to bring them into the experimental plots at this Station for further study. When a name could be associated with them it has been provisionally retained. Otherwise they have been given serial numbers under the letter "X" to indicate that they are unknown. The attempt to identify them has led to a rather exhaustive search of all available sugar-cane literature. In some cases this has been successful, but many of these strays are still held under their X numbers. Some of them are evidently of considerable value and it is strange that they have not come into more general cultivation. No one in Porto Rico since the time of Dr. Stahl seems to have given the question of the old cane varieties the attention which it so richly deserves. The mere fact that mixed plantings are almost universal shows how completely it has been disregarded. This careless custom of mixing different varieties in the same planting is costing this Island literally millions of dollars annually.

The American occupation and the bringing of Porto Rico inside of the American tariff lines gave the sugar industry a great impetus. Several large American factories were established and the Federal Experimental Station at Mayagüez was founded.

The next introduction of cane varieties seems to have been due

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antes del 1898, de los archivos de la Diputación Provincial de Puerto Rico, del expediente intitulado 'Incidentes de los expedientes sobre la enfermedad de la caña y comisiones nombradas con tal motivo por el Ayuntamiento, Centro Hispano Ultramarino y Sociedad de Agricultura de la Ciudad de Mayagüez,' Número 5, Legajo 17; y, a propósito de las respuestas dadas por los hacendados de la Isla a un interrogatorio enviádoles por la Comisión Permanente de la Diputación Provincial acompañando el 'Informe dado a la Excm. Diputación Provincial sobre la Enfermedad de la Caña de Azúcar en el 4º. Departamento de la Isla de Puerto Rico por los Comisionados al efecto, Drs. D. C. Grivot Grand-Court y Dr. Agustín Stahl, y Ledo. D. José Julián Acosta y Calbo.

"A excepción de algunas notas explicativas, me ha parecido que haría más interesante este informe el citar directamente aquellas porciones contentivas de los datos que creí más significativos. Siguen a continuación:

"1. 'La de lista verde se encuentra en abundancia en algunas haciendas de Guánica.' Carta de L. Bas Nadal de Mayagüez al Sr. Presidente de la Diputación Provincial bajo la fecha julio de 1878.

"2. '... entre la cual (la caña Blanca) se encuentra bastante de listas verdas llamadas vulgarmente (Carandall). En 1870, cuando fomentamos la plantación por necesidad tuvimos que sembrar, mezclada con la Blanca, mucha de la morada y de la morada de listas; pero las hemos extirpado por su escaso rendimiento y mucha dureza. Tenemos ya una cepa de Salangor que nos proponemos multiplicar... y la Salangore que existe hoy plantada

to the initiative of that institution. Its activities in connection with cane varieties are outlined by Director D. W. May in a letter dated January 11, 1921, as follows:

"The first brought into the Island was in December 1904, when we received from the Station at Audubon Park, Louisiana, the following: D-74, D-95, D-117, T-77, B-347, Louisiana Purple, Louisiana Striped, Tibboo Mird, White Bamboo and Rose Bamboo. Since that time we have received a great many seedling canes from the British Islands, especially Barbados. Other countries from which we have received seedling canes are Java, Mauritius, Egypt, Demerara, Martinique, Argentina and the Virgin Islands. This Station began breeding cane in 1906. Some very good varieties were produced and distributed over the Island. When the Sugar Planters' Station was established we stopped the breeding of canes as it was undertaken there. We have again taken it up in the last three or four years. There have been so many canes bred on the Island and sent out not only by this Station but by Guánica and Fajardo Sugar Companies that the question of varieties is intolerably mixed."

The writer wishes to emphatically endorse this final statement made by Director May. Cane varieties in Porto Rico are "intolerably mixed." Nothing in connection with cane culture is more urgently needed than to get them separated again into pure cultures. Of the two hundred varieties bred at the Mayagüez Station from 1906 to 1910 all seem to have been lost in this general mixture. One of them, P. R.-68, turned up in the mosaic-immunity tests at Santa Rita (see Bull. 19.) but no trace of the others has been found.

The next definite information in our possession regarding importations of varieties is contained in the following letter addressed by Mr. Harold J. Sewall of Naguabo to Mr. H. B. Cowgill of this Station under date of April 26, 1915.

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tada en diversos puntos, presto dará a conocer sus buenos o malos resultados . . . . La caña Cristalina que existe en esta Isla ha venido de Cuba, según entiendo, y la Salangore de Jamaica.' *Idem* de Don Pablo Morales, julio de 1878.

"3. 'Desde esa fecha (cosecha del 77) acá, viendo que la enfermedad en esa clase de caña (Blanca) es tenaz y hace cada vez mayores estragos, resolví y he podido conseguir plantar algunas semillas de caña "Cristalina" y la conocida vulgarmente de "Cinta" traídas de la Isla de Cuba. . . .

"En lo que va de este año he importado de Barbados (20 barriles) semillas de caña Blanca que allí llaman de "Bourbon," pero que a juicio de los pocos, pequisimos conocedores de la planta se designa con el nombre también de "Belouquet Blanco" caña que tampoco florece, según de Barbados escriben.

"En poquísima o poqueñísima cantidad he empezado a formar semillero de la caña *Carandall* o *Calancana*. . . . Esta clase de caña me dicen la hay en la costa Este de la Isla (Humacao, Naguabo, Fajardo, etc.) y según voces su rendimiento satisface a aquellos hacendados, tanto, que la propagan cuanto pueden.

"Como prueba positiva hice sembrar en 1877, en magnífico terreno y en gran cultura ocho cuerdas de caña morada o prieta que mucho se conoce en el país por su antigüedad, pero el poquísimo rendimiento al molerla este año me ha hecho desistir de su cultivo en adelante.

“Replying to your inquiry of the 16th ult.: I have received and brought in from Antigua, B. W. I., the following canes:

Introduced 1909:

Sealey Seedling, not here previously.  
 D-109, not here previously.  
 B-109, not here previously.  
 B-156, not here previously.  
 B-4596, not here previously.  
 B-208, already grown at Mayagüez.  
 B-147, already grown at Mayagüez.  
 B-306, already grown at Mayagüez (as B-347).  
 D-74, already grown at Mayagüez.  
 D-625, grown at Canóvanas and Fajardo as D-116.

Introduced 1911:

B-1529, not here previously.  
 B-4507, not here previously.  
 B-6436, not here previously.  
 D-848, not here previously.  
 D-1111, not here previously.

St. Kitts Seedling, a sport of B-268, to which it reverts when grown here.

“The above canes were sent me by J. C. Waldron of Antigua, now returned to South Carolina, and I believe that the planters of this Island are greatly indebted to Mr. Waldron's debt. At the time he shipped the first lot of canes he had never met me, but had corresponded with me on cultivation methods. Later I visited him in Antigua and brought back some important canes.

“With regard to the now famous Yellow Caledonia cane, I am glad to be able to throw light on its history here, but very sorry not to be able to claim its introduction. As early as 1906 Mr. D. W. May received this cane, I believe from the Planters' Station in New Orleans, under the name of Rose Bamboo. In 1908 I got it from him, and on growing it discovered that it was not Rose Bamboo, which is the Hawaiian title for *Cristalina*, but the cane pictured in

“De lo expuesto . . . que tengo en mi Hacienda Josefa, una de las más cultivadas en el Departamento por la enfermedad, seis variedades de cañas, saber:

“*La Otahiti*, que es la atacada de la tisis;

“*La Cristalina*, de Cuba, que no deja de prometer;

“*La Cinta*, veteada de morado y amarillo, también traída de Cuba, que no la conceptúo sino de mediano rendimiento;

“*La Morada o Prieta*, que trato de desechar;

“*La Bourbon o Bellouget Blanche* importada de Barbados;

“*La Carandali o Calancana*, veteada de amarillo y verde, traída o conseguida en un cafetal del interior del Departamento.”

*Idem* de D. José A. Annoni, Hormigueros, julio de 1878.

“4. En cuanto a lo que se dice en el “Informe” de que la caña Morada resiste más, nada tiene de particular si tomamos en cuenta que mucho antes de conocerse dicha enfermedad en la Isla ya se sabía que la caña morada en terrenos estériles es mucho más vivaz que la Blanca. . . . *Idem* de Do Francisco Salichs, Humacao, agosto de 1878.

“5. Al contestar dicha carta debo hacerlo siguiendo las preguntas que la misma encierra; a saber:

“1.º. Las cañas que tengo en cultivo en esta finca son a mi corta entender, cinco clases:

Noel Deerr's book as White Tanna. This in Hawaii is called Yellow Caledonia (see Eckert and Deerr's bulletin on cane nomenclature). This fact became apparent in the spring of 1909, when Mr. E. E. Olding received from his brother-in-law at Eva, Hawaii, a few cuttings of Yellow Caledonia which were turned over to me and planted close to the cane I had over a year previously gotten from Mr. May. Thereafter we called the cane Yellow Caledonia. Probably the report that Mr. Olding introduced the cane here springs from his receipt of these cuttings.

"It is, of course, a fact that cuttings of this famous cane were also sent by Mr. May to other planters, but with the single exception of Guánica no one gave them any care or attention. Seedling work was begun at Guánica at about the same time that I took it up—1908—and they were practically alone in recognizing the value of the new canes. Mr. Marr at Canóvanas had gotten one or two canes from Demerara, notably the cane D-625 which caused so much trouble under the number D-116.

"To Mr. D. W. May belongs the credit of being the pioneer, and it is the fault of the planters themselves that they did not appreciate the value of the canes which he sent to quite a number of them. They did not, however. In fact, seedling canes were decidedly unpopular in 1908 and 1909.

"Yellow Caledonia is today grown everywhere in this section. There are hundreds and hundreds of acres of it in the San Cristóbal fields and both Fajardo and Borinquen are planting it as fast as they can get it. It has added close to five tons an acre to our yields hereabouts.

"Although I may not claim the credit of introducing Yellow Caledonia, I may without presumption insist that I made it stick. On my own lands and on the fields of the company where in the fall of 1909 I planted it in areas of some size, the cane made a phenomenal growth and gave a splendid appearance. In the mill it gave the average amount of sugar. It stood up well on poor soils and under neglect. Everybody wanted it by the planting season of 1911 and I sent cuttings to Aguirre and to Fajardo. All of the Yellow Caledonia in the east end came directly or indirectly from this place. I don't know why it never survived in the west end, but it never did."

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"*Primera.* Caña morada o bambú, de la que queda muy poca en esta finca, pero abundaba anteriormente, y voy haciendo desaparecer por no ser partidario de ella;

"*Segunda.* Las Guingans, o canas de cintas moradas y verdes, de las que hay muy pocas;

"*Tercera.* Las bambús blanches o de cintas verdes y blancas, también en pequeño número;

"*Cuarta.* La Blanca de Otahiti que es la que se cultiva en mayor escala; y

"*Quinta.* La caña verde, verdadero bambú por su forma, y que existe en bastante abundancia en la finca, pero ligada en los mismos tablonos a la caña de Otahiti. Esta caña por su desarrollo, su buena vegetación y el rico jugo que encierra, trato de estudiarla haciendo de ella semilleros con ese objeto, pues creo sea más ventajosa en esta jurisdicción que la caña de Otahiti. Se conserva siempre lozana y verde y aún en el tercer corte la veo sobresalir en desarrollo a la Otahiti. Ignoro su verdadero nombre y cómo haya sido introducida en esta finca, pues la encontré ya aquí en el año 71." *Idem.* por D. S. I, Hacienda Carmen, Vega Alta, agosto 4 de 1878.

"6. Entre ellas (plantaciones de caña Blanca o de Otahiti) se encuentran sin orden ni colocación meditada; y sólo al acaso, algunas cepas de caña morada y alguna que otra de la de listas. Estas, en nuestro concepto, provienen

This interesting letter is of great historical value, since it fixes the date of importation of many kinds and gives so vivid a picture of the first general plantings of the Yellow Caledonia. It also illustrates the difficulty of interesting planters in new varieties except under the stress of some calamity that forces attention on this question.

About 1908 Central Guánica secured the services of Charles T. Murphey of Barbados and actively began the building up of a variety collection and the breeding of new seedlings. This work is still continued. After the death of Mr. Murphey he was followed by Mr. H. Bourne, and he quite recently has been succeeded by Mr. E. H. Barrow, both from Barbados. It seems quite certain that Mr. Murphey brought with him a considerable number of Barbados canes. Many of them are mentioned in his reports for 1910, 1911 and 1912, copies of some of which are available in the files of this Station. Unfortunately, owing to recent changes in personnel and the rush of the grinding season it has been impossible to secure in time for this publication exact data as to Guánica's importations. Their interest in this important matter still continues. Two years ago additional importations were made from Barbados and this year L-511 has been brought from Luisiana.

In 1910 a considerable number of variety plots existed on the Carmen property of Central Aguirre. The seed mainly seems to have come from the Mayagüez Station. This planting was seen by the writer on his visit to the Island at that time. At the same time

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de la morada misma, que en una sucesión de años, que no podemos precisar, sufre esas transformaciones, ya en la propia cepa, ya en otras que de su semilla proceden.' *Idem* por L. Igaravidez, José G. Padilla, Francisco Alero, Vega Baja, Puerto Rico.

"7. 'Que existiendo con alguna abundancia la caña de cintas verdes, llamada *Carandall* o *Calancana* en la costa Este de esta Isla (Humacao, Fajardo, Naguabo, y en los campos de Toa Alta y las Vegas), se envíe a costa de esta Excm. Diputación la mayor cantidad posible de semillas de la misma al 4º. Departamento y que se repartan entre aquellos haciendados.' Comunicación al Señor Comisario de Administración Local de la Excm. Diputación Provincial, por D. Ramón Power, noviembre de 1878.

"8. '... los informantes añaden que por mucho cuidado que se ponga siempre se perderá un 50 por ciento de las semillas importadas de Oriente, como ha acontecido con las encargadas por el tantas veces citado, Dr. Grivot, Grandcourt.' Informe de su Comisión a la Sociedad de Agricultura de Mayagüez, junio 23 de 1879.

"Desde el 1875, Don Santiago McCormick de San Juan hacía propaganda para la importación a Puerto Rico de nuevas variedades de cañas, habiendo dado a la publicidad en el Boletín Mercantil del 3 de julio de 1879 datos sobre ciertas variedades de caña aclimatadas entonces en Trinidad, introducidas de Oriente e islas del Pacífico, por Mr. H. Prestoe, Director de los Jardines Botánicos de Trinidad en esa época y amigo personal del Sr. McCormick desde hacía 25 años.

a much larger collection was seen at Central San Cristóbal, but this seems to have been Mr. Sewell's importation that has already been noted.

Mr. Sewell's letter calls attention to the direct importation of a few canes from Demerara by Mr. Marr of Central Canóvanas at some time prior to 1909. And it is known that Central Mercedita of Ponce has made some direct importations from Barbados. This Station made a direct importation from Barbados in 1911, of the following ten kinds (See 2nd Ann. Rept., p. 11):

B-1809.	B-6835.
B-3750.	B-7169.
B-3859.	B-7245.
B-6293.	B-8660.
B-6341.	Diamond-185.

It has just succeeded in bringing in a few seeds of Badilla and of D-1135 after their detention for nearly three years in quarantine in Washington. This completes the history of cane introductions in Porto Rico in so far as it has been possible to trace them. Central Fajardo maintains a large variety collection and has produced many new seedlings but does not seem to have made direct importations.

In the following pages will be found such data as is available concerning each of the varieties recorded as occurring in Porto Rico.

"En 1º. de agosto de 1870 acordó la Diputación Provincial el envío de D. Santiago McCormick a Trinidad para la importación de nuevas semillas de cañas. En noviembre 10 de 1879, de regreso ya, daba cuenta el Sr. McCormick a la Diputación Provincial de haber llenado su cometido.

"9. 'Nota del contenido de 42 barriles de semillas de cañas introducidas de la Isla de Trinidad por encargo de la Excm. Diputación Provincial

" '23 barriles semillas de La Reina Caledonia.<sup>1</sup>

" 'No. 1.—Barril con Salangore Verde.<sup>2</sup>

<sup>1</sup> Caledonian Queen Cane is a pale or greenish-purple cane, close jointed, and extremely vigorous. The leaves are remarkably broad, and their bases are nearly destitute of the setae or "cowitch" common to most canes. This cane is said to attain enormous dimensions in the East, and to be one of the most sacchariferous. The short joint is a feature which is generally considered objectionable—accompanied as it usually is by great hardness of cane tissue. In this respect, however, the Caledonian Queen Cane is an exception, and the ready way in which both length of joint and diameter of cane is affected by manure—the natural soil at St. Ann's being the poorest—indicates great variability of habit, and suggests gigantic growth under the influence of rich alluvial.

<sup>2</sup> The green Salangore is so named from its retaining a green color on the cane much longer than usual, although when fully ripe the color of the cane is yellow, but not so bright a yellow as that of a well-ripened Otaheite. This variety is the freest growing of all the varieties in the Gardens except the giant Claret Cane, and its erect habit is even more striking than in that variety. Both in respect to length of joint and diameter of cane it is equal to it—thus being the largest yellow cane grown here. The foliage is large and heavy as in Nos. 1 and 2 and 6 of the former series, but completely deciduous so that the operation of "trashing" is with it reduced to a minimum. The most striking feature of this cane—besides its size—is the broad white ring just below each joint.

## CANE VARIETIES RECORDED FOR PORTO RICO.

## THE NAMED VARIETIES.

**Badilla.**

Recently received from Hawaii via Washington. Not tested.

**Bambú Blanca.**

An old variety abundantly mixed with Otaheite, Penang, Rayada and Cavengerie in most of the cane fields or the north coast; not seen in pure cultures. Country or origin and time of importation not known.

Erect, of good vigor, medium stooling, sometimes arrows, stalks of medium diameter, 3 to  $3\frac{1}{4}$  cm., green, no flush and no bloom. Internodes straight, cylindrical, medium length, furrow slight and poorly marked. Nodes prominent, slightly larger than the internode; growth ring narrow 1 to  $1\frac{1}{2}$  mm., not swollen, concolorous; root band slightly enlarged, about 10 mm. wide, paler than the internode; rudimentary roots crowded, swollen, yellowish, the centers dark, in 4 rows; leaf scar glabrous, slightly oblique, appressed behind; glaucous band 8 to 10 mm. wide, conspicuous, not constricted. Bud ovate, acute, about  $10 \times 12$  mm. at first not exceeding growth ring but often enlarged later, margin medium width, uniform, germination subapical, base, sides and apex sparingly hirsute. Leaf sheaths with a dense vestiture of conspicuous erect whitish hairs, somewhat glaucous, green, not tinted; throat lannate and with an abundant vestiture of long hairs; collar broad, conspicuous, reaching the midrib, densely glaucous but not lannate, ligule short, about 3 mm., margin nearly even; ligular processes none or poorly developed. Leaf blade flat, suberect with declined tips, 6 to 7 cm. broad, dark green, serrulations very minute, the margins at base ciliate.

A variant with white stripes in the leaves is not uncommon (see X-25 Station Cultures).

No chemical data are available.

Its general vigor, comparative freedom from root disease and adaptability to varied soil conditions is sufficiently proven by its

"No. 2.—Un paquete con 40 cañas de la Salangore Violeta<sup>1</sup> y otros paquetes de tres variedades de cañas de Mauricio.

"Nos. 3 a 9 (inclusive).—Semillas de la caña Cristalina (Claret) Gigante.

"Nos. 10 al 14 (inclusive).—Cañas de lista; color, cuando maduras, algo morada; de Mauricio.

"No. 15.—Semillas mezcladas de diferentes variedades.

"No. 16.—(Claret) Cristalina Gigante.

"No. 17.—Cañas verdes y semillas de Mauricio.

"No. 18.—Salangore Verde y Claret."

<sup>1</sup>The *Violet Salangore* has the habit of erect growth more strongly developed than is seen in any other of the canes enumerated, as it is distinctly the longest jointed and tallest—with a full average diameter of cane. The leaves are long and narrow as compared with the well-known Otaheite.

persistence as an important element in so many mixed cultures. Its ripening period, sugar production and adaptability to special conditions should be more fully tested. It is, however, quite susceptible to mosaic and to the gum disease.

The cane described on another page as Penang is often found growing with this one and may easily be confused with it. It can be distinguished by the obtuse, more nearly glabrate buds, by the broader, swollen growth ring and by the lilac tint of the leaf sheaths.

Another unknown cane found in these mixed plantings superficially resembles this one but has suborbicular buds and nearly glaucous leaf sheaths (see X-15 and X-21, Station plots.)

The white Bamboo mentioned by Mr. May (see letter, p. 35) as introduced from the Audubon Station, Louisiana, in 1904 has not been traced. Mr. Crawley, the former Director of this Station, in a manuscript note records seeing this cane at Añasco and that it had a conspicuous wine-colored stain on the inside of the leaf sheath at the base as in Yellow Caledonia. This shows it could not be the cane under discussion.

#### Bambú Rayada.

This name may be given to a variant of the above, having white stripes on the stalks and leaf sheaths which is occasionally found growing with the typical form (planted as X-25.)

#### Bambú Rosada.

Mentioned by Dr. Stahl (p. 136), who says—

“A beautiful rose-colored cane which easily loses its color with age and bad cultivation. It can compete with Caña Blanca.”

It seems to be the same cane mentioned by Lopez Tuero (p. 9) under caña Bambú. He describes it as rose-colored when young but later yellowish; says it is very stout, vigorous and resistant

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“En abril de 1880 aparece en los records de la Diputación Provincial constancia del buen resultado que se iba obteniendo de las semillas importadas de Trinidad en la lista que precede, y se expresa la conveniencia de que se proceda a introducir en esta Isla semillas de caña originarias de Oriente y que se cultiven en las Antillas inmediatas.

“En mayo de 1880 ofrece el Dr. Stahl semillas de 23 variedades a la Diputación Provisional para ahorrarse la necesidad y gastos de una importación; y caso que se insistiera en lo de la importación se ofrece él para hacerse cargo de la Comisión sugiriendo al mismo tiempo se importaran sólo la *Salangore*, *Cristalina* y *Reina de Caledonia*, que dice ser son las que él ha visto cultivar en Cuba, Martinica y Trinidad. Cree que la importación de Oriente sería una pérdida total.

“De Ud. atentamente,

“E. D. COLÓN,  
“Director.”

but hard and low in sugar; advises planting it on the outside rows of the fields.

This cane has not been traced.

The Rose Bamboo imported from Louisiana in 1904 (see letter of Mr. May, p. 35) proved to be Yellow Caledonia (see letter of Mr. Sewall, p. 36.)

**Bambú Rosada de Rayas Moradas.**

Listed by Stahl (p. 136), but without description. No other references found. Probably only another name for Rayada.

**Bengala.**

Mentioned by Lopez Tuero (p. 9). He says:

"Very much like Creole, with short, slender joints, juicy, very sweet, leaves strictly erect. But little cultivated, as it is easily attacked by insects. It is originally from Calcutta."

We have no other knowledge of this kind.

**Biloxi.<sup>1</sup>**

In November 1919 some cane cuttings were received by the writer under this name from the late S. M. Tracy of Biloxi, Miss., U. S. A. In the letter accompanying them he said:

"I consider this the best of the Japanese canes, of which I have several. It is much larger and stronger than the others. Syrup growers in the neighborhood to whom I have given it think it the best cane they have grown. I have lost the name, so I call it Biloxi."

Erect, very vigorous, a strong stooler. It arrows, but less freely than Uba. Stalks long, slender,  $1\frac{3}{4}$  to  $2\frac{1}{2}$  cm., green, usually with a lilac flush, considerable bloom. Internodes long, reaching as much as 15 cm., tapering, slightly larger below, furrow none. Nodes conspicuously enlarged; growth ring nearly 2 mm. wide, even or slightly sunken, greenish, root band swollen, 10 to 12 mm. wide, green or tinted; rudimentary roots large, crowded, the centers brown, in 3 rows; glaucous band about 10 mm., poorly defined, tapering sharply, the base being the narrowest part of the stalk; circle of hairs below the bud scanty, soon deciduous. Bud ovate, plump, rather obtuse, about  $10 \times 12$  to 14 mm., at first not exceeding the growth ring, margin medium width, uniform, germination subdorsal, base glabrate, sides and apex with long appressed hairs. Leaf sheaths with scanty vestiture which is more abundant toward the margins, green, scarcely glaucous; throat sparingly lannate, no long hairs except scanty tufts at margins; collar narrow, inconspicuous, not reaching the midrib,

<sup>1</sup> Since the above was written a cane has been seen at the Cuban Experiment Station under the name of Cayania No. 10 which closely resembles this and is probably identical.

glaucous but not lannate, ligule broad with a triangular widening at center where it reaches 5 mm., margin frimbriate; ligular processes none. Leaf blades spreading, flat narrow  $4\frac{1}{2}$  cm. dark green, minutely but sharply serrulate to the base, not ciliate.

This cane is very much like Uba and Zwinga but promises to be even more vigorous and productive. It may be distinguished from Uba by the uniformly swollen nodes, by the vestiture of the leaf sheaths and by the plumper buds, which germinate subdorsally, not apically as in the other two kinds. It resembles Zwinga more closely than the Uba, since both have swollen nodes and vestitures on the leaf sheaths, but they may be distinguished by the buds. In young plantings the first shoots of this cane are erect, not strongly inclined as with Uba.

The following analyses have been made:

		Arrows	Extr.	Brix.	Sucrose	Red. Su.	Puri.	Fiber
1-12-21	Biloxi	No	60.7	16.65	13.51	1.71	81.14	14.14
1-12-21	Cristallina	No	70.0	17.25	15.96	0.37	92.52	9.60
2-11-21	Biloxi	No	67.8	17.10	14.37	0.72	81.03	13.82
2-11-21	Biloxi	Yes	66.6	17.40	14.71	1.04	84.54	14.02
2-11-21	Rayada	No	63.6	17.15	15.25	0.81	88.92	12.37
4-11-21	Biloxi	No	66.6	17.90	16.16	0.897	90.27	12.02
4-11-21	Cristallina	No	70.1	18.10	16.92	0.265	93.48	10.47
4-27-21	Biloxi	No	65.5	20.20	17.50	0.987	86.63	11.04

These figures indicate that at full maturity it develops a satisfactory percentage of sucrose and purity. It seems to be fully equal to Uba in this respect and to promise even heavier tonnage.

Its immunity to mosaic has not been tested. From its close relationship to Uba and Zwinga it is highly probable that like both these kinds it is completely immune.

#### Bois Rouge.

(= Palo Rojo). Stahl (p. 136):

"This cane has given admirable results in Mauritius and Bourbon, but here it is feeble and slender. The buds sprout easily on the standing cane, causing it to dry up."

Lopez Tuero (p. 9) calls it Palo-rojo and speaks of it in almost the same words. It was introduced by Dr. Grivot Grand-Court prior to 1879, probably from Guadaloupe.

No canes have been found that can be connected with this name, though at least two unnamed slender red canes are in the Station collections.

**Bois Rouge Blonde.**

(= Palo Rojo Claro). Stahl (p. 136):

"Color between light and dark; joints short, somewhat barrel-shaped, robust, and resist the disease. It seems to be one of the most valuable varieties for infested lands."

We have no further knowledge of this kind. It probably came from the French islands. At least the name occurs in the literature in connection with Reunion.

**Borbon.**

(= Bourbon.) Both Stahl and Lopez Tuero consider this distinct from the Otaheite, though somewhat closely resembling it. Stahl says:

"Closely resembling Caña Blanca; when young it is spotted with red but later is yellowish green; very rich in sugar; should be planted only one seed in each hole, since it suckers abundantly; in every respect superior to Caña Blanca but it contracts the disease [epidemic of 1872] and should only be planted in districts free from it."

A cane known by this name was found in a colonia near Bayaney. When cultivated at the Station it proved identical with the cane grown at Coloso as Penang. It is quite certain that more than one cane has been included in the group sometimes known as Bourbon and sometimes as Otaheite, but to which one the name Bourbon properly belongs it will be difficult or perhaps impossible to determine.

**Calancana.**

(= Carandalí, = Imperial del Brasil, = Green Ribbon). Stahl 134, Lopez Tuero 9. Imported from Cuba prior to 1877 by Patxot, Castello & Cía. of Cabo Rojo.

This cane seems quite clearly to be only a color variant of Otaheite) which see for further description), although this view has not been expressed in the literature.<sup>1</sup> In this form the stalks and leaf sheaths are striped with green and white. On some soils, especially on full exposure, the white flushes to a delicate pink. It is a strikingly handsome cane, but it seems to have all of the cultural disabilities of the self-colored form, and so far as we know it is equally susceptible to all kinds of diseases. Its reputation as a very sweet cane is not borne out by the following analyses as compared with Cristalina on same date from same field:

<sup>1</sup> Since the above was written a stool of Calancana has been found with two stalks that have reverted to a solid green color and that are absolutely indistinguishable from Otaheite.

		Arrows	Extr.	Brix.	Sucro.	Red.Sug.	Puri.	Fiber	Age
11-29-20	Calacana	No	70.	13.37	9.42	4.34	79.45	12.2	13 Mo.
11-29-20	Cristalina	No			13.69	1.67	85.88	12.01	13 Mo.
1-10-21	Calacana	No	68.8	15.60	12.77	1.50	81.85	12.48	12 Mo.
1-10-21	Cristalina	No	71.3	17.30	15.34	0.64	86.67	12.29	12 Mo.
2-9-21	Calacana	No	67.6	15.25	12.29	1.64	80.46	12.96	15 Mo.
2-9-21	Cristalina	No	68.7	16.20	13.85	0.95	85.49	11.20	15 Mo.

This cane is somewhat widely scattered in mixed plantings, but it nowhere exists in pure cultures. There seems to be no reason for its further planting.

#### Cavengerie.

(= Caña Colorada = Caña Francais, = Rosita, all local names.) Imported by Dr. Grivot Grand-Court of Mayagüez, probably from the French islands, prior to 1878. It now occurs widely in mixed plantings and often in nearly pure cultures in the northern and eastern districts, more especially in hill lands.

Habit erect, very vigorous, strong stooling, seldom or never arrows. Stalks medium diameter, tall, dark wine color with faint bronze stripes; no bloom. Internodes medium to long, straight or slightly staggered, cylindrical or slightly larger below, furrow faint, usually evident but sometimes wanting. Nodes narrow, only slightly constricted; growth ring conspicuous, usually swollen, at first yellowish then dark purple; root band narrow, 6 to 8 mm., concolorous; rudimentary roots inconspicuous, purplish, in 2 to 3 rows; leaf scar glabrous, narrow, somewhat oblique; glaucous band narrow, 6 to 8 mm., at first well marked. Buds ovate, medium size, about 10 to 12 × 10 to 12 mm., exceeding growth ring, margin narrow, uniform, germination apical, base sparingly appressed ciliate, sides and apex glabrous. Leaf sheaths with dense vestiture of short asurgent bristles, tinted, somewhat glaucous, marked with white or sometimes white and pink stripes; throat lannate, and with abundant medium short brownish hairs, especially on the shoulders; collar broad, dark, conspicuous, densely lannate toward the margins; ligule narrow, 3 to 3½ mm., margin nearly even; ligular processes, none. Leaf blades erect, the tips declined, dark green, medium width, about 6 cm., minutely but sharply serrulate to the base, not ciliate.

This is a cane of great vigor and very heavy tonnage and it is a very strong ratooner. It is resistant to drouth and is particularly adapted to the red shale hills of the interior and to the red coral lands of the north coast. It is comparatively low in sucrose and is very late in maturing. It is this latter feature in particular that has made it so unpopular with the mills that some of them refuse to receive it. Occurring as it usually does in mixed plantings, it

is almost always cut too green and comes to the mill with very little available sugar. Analyses of 12-month ratoons made at the Station in February 1913 show as little as 6.77 per cent sucrose and only 60.5 per cent purity. Such cane is evidently valueless and it is a folly to cut it and send it to the mill. This only emphasizes the necessity for separating the varieties in pure cultures so that each may be cut when fit to grind. In the tests at this Station published in Circular 8, 1917, it stood second in total tonnage for three cuttings out of 25 kinds, being only surpassed by D-625 or D-116. It was included in these tests under both numbers and their average result is used for comparison here:

From Circular 8.

	Total ton. 3 cut.	Brix.	Sucrose	Purity
Cavengerie .....	121.48	16.77	12.45	75.3
D-116 and D-625 .....	139.75	15.26	11.59	73.1
Cristalina .....	77.52	16.60	15.02	90.5

There is nothing in this report to indicate the stage of maturity at which these canes were cut. Evidently both Cavengerie and D-625 were quite green, still their tonnage was so much greater than Cristalina that the total yield of sugar per acre was much greater. At Fajardo crop of 1918-19 this cane as second ratoons gave a yield of 48.75 tons cane and 4.64 tons sugar per acre. Only one other analysis is available:

5-6-21	Age	Arrows	Extr.	Brix.	Suc.	R. S.	Pur.
Cavengerie .....	Pl. 17-Mo.	No	66.6	18.17	16.02	1.23	88.20
Cristalina .....	Pl. 17-Mo.	No	65.1	19.55	18.93	.241	96.82

The considerable percentage of reducing sugar shows that the Cavengerie even at this age was still immature.

It seems clear that a cane having such vigor and being so well adapted to conditions where other kinds fail should not be discarded, as is being so frequently urged, until its adaptability to the needs of Porto Rican agriculture is much more fully tested. Most certainly it should not be planted in mixed cultures. *Gran cultura* should not be cut under 18 months. Late spring plantings and late-cut ratoons should be carried over as *caña quedada* until the second season. Handled in this way, this cane will doubtless be more profitable on high, dry lands than the richer kinds now usually planted.

This cane is exceedingly susceptible to mosaic and is often killed outright when attacked. It is quite resistant to the ordinary forms of root disease and so ratoons freely for many years. It is, however, freely attacked by the vascular bundle fungus. In fact, this parasite was first detected in this kind. One of its chief merits at the present time is its strong resistance to gum disease. It is not absolutely immune, since stalks have been found with a few vascular bundles infected, but for all practical purposes it may be considered so. It is this cane which saved the sugar industry of Brazil when the gum disease first appeared in that country about 1850, and it is still the variety principally grown there, though unfortunately usually known under the name of Lousier.

A variant with white stripes in the leaves is not infrequent. In some fields quite a proportion of the plants show this character. Three other variants also occur for which the following names are here proposed for the first time:

#### Cavengerie Negra.

(= Caña Negra, local name; probably = Cheribon of Queensland.) Frequently found with the typical form in all parts of the Island. It shows no striping but is a uniform dark reddish brown that well justifies the local name of black cane. It has been brought into the Station cultures as X-19 and X-26, but is not yet sufficiently tested to know whether it differs from the typical form in anything except color. It seems to have been the "Black Tanna" mentioned in some of the early records of the Station. The following analyses are available:

		Arrows	Extra.	Brix.	Suero.	Red.Sug.	Puri.	Fiber	Age.
1-21-21	Cav. Negra (x19)	No....	70.3	16.10	12.61	2.11	78.32	11.88	14 Mo.
1-21-21	Cristalina .....	No....	70.0	17.25	15.96	0.37	92.52	9.60	14 Mo.
3-3-21	Cav. Negra (x19)	No....	72.4	18.00	15.58	1.20	86.55	12.14	16 Mo.
5-4-21	Cav. Nagra (x19)	No....	68.4	18.20	16.28	1.09	89.45	.....	18 Mo.
5-6-21	Cav. Negra (x26)	No....	72.1	19.87	17.51	1.08	88.12	.....	18 Mo.
5-6-21	Cristalina .....	No....	65.1	19.55	18.93	.241	96.82	.....	18 Mo.

#### Cavengerie Rayada.

Found once at Yabucoa and brought into the Station cultures as X-11. It differs from the typical form in having light-green instead of bronze stripes on the stalks.

#### Cavengerie Roja.

(= Rosita, = Sangre de Toro, local names.) This occurs abundantly mixed with the typical form in all parts of the Island. It is

of the same dark wine color as the type, but has no striping either on stalk or sheath. No differences in cultural characters have been observed. It occurs in the Station cultures as X-39. It is quite possible that the Salangore Rojo of Stahl and Lopez Tuero belongs here.

**Crema.**

A local name that seems to be rather loosely applied. The canes so far brought in under this name have proved to be either B-208 or Penang.

**Creole.**

(Criolla.) The first, and for two hundred and fifty years the only cane planted in Porto Rico. Completely superseded as a commercial cane in the early days of the nineteenth century by Otaheite and since that time only planted for chewing. Now almost extinct, very rarely seen.

Erect, of rather feeble growth, arrows occasionally. Stalks slender, rather short, green with slight flush when fully exposed, scanty bloom. Internodes medium short, straight or slightly staggered, cylindrical furrow shallow but well marked for entire length of internode. Node slightly constricted, somewhat oblique; growth ring narrow, inconspicuous, concolorous; root band narrow, oblique, 5 to 8 mm., rudimentary roots inconspicuous, in about 3 rows; leaf scar glabrous or with a few short scattered cilia, narrow; glaucous band slightly constricted, 8 to 10 mm. conspicuously whitened when young, circle of hairs below bud none. Bud narrowly ovate-triangular, about 8 to 10 mm., exceeding the growth ring, margin narrow, slightly wider below but not shouldered, germination apical, glabrate or nearly so. Leaf sheath glabrous, green, faintly glaucous; throat lannate, dark, with medium long hairs towards the margins; collar narrow, reaching the midrib, glaucous, sparingly lannate at the margins; ligule widest at center, reaching 4 mm. the ends tapering nearly even; ligular processes none. Leaf blades erect, the tips declined, somewhat plicate, narrow 3 to 4½ cm., light green, serrulate with long awned teeth, the base somewhat ciliate.

Of historical value only.

**Cristalina.**

(= Light Cheribon, = White Transparent.) Probably introduced as an admixture with Otaheite in the early part of the nineteenth century. Now widely planted on the south coast (it is the only variety planted at Central Aguirre) and occurring frequently in mixed planting in all parts of the Island. It is probably second in total acreage in Porto Rico, being only surpassed by the Rayada.

It is practically the only cane planted in Cuba and it occurs abundantly in many others parts of the world. It is safe to say that no other variety produces as large a part of the world's sugar supply as the *Cristalina*.

Erect, then declined, vigorous, a good stooler, arrows freely at some times and on some soils, under other conditions it seldom arrows. Stalks medium diameter, green, usually with a strong pink flush, bloom heavy. Internodes medium length, cylindrical or somewhat tumid, straight or slightly staggered, furrow evident of medium depth. Nodes oblique, constricted; growth ring yellowish green, conspicuous, elevated, root band narrow, oblique, slightly constricted; rudimentary roots small, inconspicuous, pallid with brownish centers, in about 3 rows; leaf scar glabrous, wide in front, appressed behind; glaucous band constricted, rather narrow, not very conspicuous, blending with the bloom of the internode. Buds medium size, triangular-ovate with rounded base, exceeding the growth ring, margin wide, strongly shouldered below, germination apical, base and apex appressed ciliate. Leaf sheaths glabrous, greenish, quite glaucous, throat densely lanate and with abundant long coarse hairs; collar conspicuous, reaching the midrib, lanate throughout; ligule medium width, margin even; ligular processes usually only one developed. Leaves abundant, spreading, flat, medium length and width, about 7 cm., bright green, minutely serrulate, the margins at base ciliate for two to three inches.

As indicated by long experience, not only in Porto Rico but in all parts of the world, this is one of the best varieties for general planting and one of the very few on which it is safe to base the entire sugar industry of any region. Its continued planting is strongly urged on all those lands where it still continues to give a satisfactory tonnage. It is adapted to a wide range of soil conditions. In maturity it is a mid-season cane, not being at its best under 15 months except late in the season under conditions of drouth when even 11 or 12 months' cane develops a high percentage of sucrose. Even when immature at the beginning of the grinding season it shows a fair percentage of sucrose and purity. Other varieties frequently surpass it in these respects in special instances, but no other variety in general cultivation surpasses it in average richness at all ages and under all conditions. It usually keeps well in the field after maturity and late plantings or late-cut ratoons may be safely held over for a long crop or *caña quedada*. Unfortunately, this grand kind is beginning to fail on some of the more exhausted and compacted lands. In such situations it is now necessary to either change the prevailing cultural methods or to look for hardier, more resistant varieties. It can only be classed as medium in its

resistance to root disease, vascular bundle fungus, mosaic, and gum disease being attacked by all of these troubles but suffering less damage from them than some other kinds.

The following selected analyses will show about what may be expected from it at different ages and conditions. Other analyses of Cristalina will be found under most of the other varieties where they are given as a basis for comparison:

Date	Age.	Extr.	Brix.	Sucro.	Red. Sug.	Purity	Fiber	
12-8-20	10 Mo. Rat.	74.1	15.33	12.35	2.29	80.56	8.28	Evidently green
1-5-20	14 Mo. Rat.	66.4	19.68	18.10	.....	91.90	.....	Second in sucros
								out of 37 kinds
1-5-21	15 Mo. Pla.	66.6	16.96	15.35	0.56	90.36	11.35	.....
2-4-21	16 Mo. Pla.	65.2	18.40	17.27	0.65	83.85	11.83	.....
11-29-20	20 Mo. Pla.	61.5	16.47	14.52	1.20	88.16	12.32	Caña quedada
4-1918	11 Mo. Pla.	.....	22.30	20.0	.....	98.90	.....	Dry weather
6-1918	13 Mo. Pla.	.....	18.68	16.5	.....	88.32	.....	Effect of rain

In tonnage Cristalina is often surpassed by such low sucrose canes as Yellow Caledonia, B-3412 and Cavengerie. No variety however, responds more readily to better cultivation and the heavier application of fertilizers. This is shown by the remarkable yield of an average of 81 tons per acre on 40-acre field made at Aguirre, crop of 1918. Cristalina is a strong ratooner. It is giving good ratoor crops on the south coast, where up to ten years ago ratooning had been practically abandoned. It is chiefly to the strong ratooning power of Cristalina that Cuba owes her cheap cane supply. As seen from the above analyses, it may be planted either in fall or spring and on any type of soil that would be considered good cane land

#### Diard.

Imported by Dr. Grivot Grand-Court prior to 1879. Mentioned by both Stahl and López Tuero. As nearly as can be determined this = Cristalina. The striped form mentioned by López Tuero = Rayada.

#### Egyptian.

See Java 105-P. O. J.

#### Elephant.

(= Gigante.) Introduced from Trinidad by Dr. Stahl prior to 1879. Only seen in the experimental plots at Central Fajardo and now in those at this Station.

Erect, late, long-continued growth, no arrows. Stalk very brittle, medium tall, very stout, 5 cm. or more, dull purple, very heavy bloom. Internodes short, 5 to 8 cm., nearly straight, cylindrical or the shorter

ones barrel shaped, furrow none. Nodes scarcely constricted, nearly perpendicular; growth ring narrow, concolorous, a little sunken, being usually the narrowest part of the stalk; root band about 10 mm., concolorous; rudimentary roots obscure, in about 4 rows; leaf scar glabrous, short, appressed behind; glaucous band obscured by the bloom of the internode. Buds hemispheric, about 11 mm. in diameter, margin abruptly widened at the middle where it forms an obtuse sterile apex fully 3 mm. long, forming a very conspicuous character, exceeding growth ring only by this sterile apex, germination dorsal, glabrate except for plaes of short appressed hairs at base. Leaf sheaths with a heavy vestiture of stiff assurgent hairs, usually splitting down the back, strongly pouched below the bud, green or somewhat tinted, heavily glaucous, stained purple within; throat very wide, glaucous, usually with transverse checks, glabrate except for scattered tufts of hairs at margins, collar very wide, conspicuous, reaching the midrib, heavily glaucous, not lannate; ligule short, 2 to 3 mm., even; ligular processes none. Leaf blades long, spreading, somewhat revolute, very wide,  $7\frac{1}{2}$  to 9 cm., gray-green, minutely serrulate, the base slightly ciliate.

It is said to be low in sucrose. Probably of no commercial value but of considerable historic interest. It represents a rather distinct type.

#### Guingham.

López Tuero, page 9. Here this name seems to = Rayada. There is no evidence of the occurrence on the Island of the true Guingham = striped Tanna.

#### Japanese Fodder.

See Zwinga.

#### Kakoe.

Listed as for sale by Dr. Stahl. *Revista*, 1887 page 174. Probably introduced from Jamaica, where this variety was grown. Not since reported.

#### Kavangire.

See Uba.

#### Lahaina.

(Lajaina.) Given by Dr. Stahl. *Revista*, 1887, page 174 as a synonym for Borbón, which he always considered as distinct from Otaheite or Caña Blanca.

#### Lahaina Striped.

The records show that a cane was cultivated at this Station under this name in 1913. There is no indication as to its origin. The description on file reads much like the striped form of Bambú.

**Light Stripe.**

A cane under this name was reported on in Circular 8 of this Station where yields for three cuttings and average analyses are given. The origin of this cane can not be traced and no description is on record. It was probably Calancana, but this opinion is based on the probabilities and not on evidence. Possibly it was only Rayada.

**Louisiana Purple.**

See Morada.

**Lousier.**

Stahl, page 136. This is usually supposed to = Otaheite, but here it seems to be used in a different sense. No description is given, so it can not be traced. At Central Coloso it is used as a synonym for Penang.

**Malabarde.**

Sathl, *Revista*, 1887, page 174. López Tuero, page 10. Given as = Morada, but it is listed with the striped canes. Probably as used should be taken to = Rayada. This name can not be traced in the literature. Malabar often occurs and usually = Yellow Caledonia.

**Martinique.**

Reported by Murphy as in cultivation at Guánica in 1911. The name is variously used in the literature for a red and for a green cane. No record is available as to the characters of the one cultivated here.

On the island of Vieques this name is locally used for Morada.

**Morada.**

(= Louisiana Purple, = Black Cheribon.) Probably introduced in the early days of the nineteenth century, mixed with Otaheite. It occurs frequently in mixed plantings in all parts of the Island, but is nowhere grown in pure cultures. There seems no reason other than chance why this cane has been neglected in Porto Rico while the two other Cheribon canes, Crystalina and Rayada, are the two kinds most widely planted. It differs from them only in color, being a uniform dark purple with heavy bloom. It is equally well adapted to a wide range of cultural conditions. In a field planted at this Station last November (Nov. 1920), where there are a number of selections of Cheribon canes from different sources, this has so far made rather the best growth and has stooled rather heavier than any of them. It is a good standard variety that has been completely

overlooked here. For years it has been one of the principal canes of Louisiana. No data is at hand to show whether or not its supposed earlier maturity holds good here.

**Otaheite.**

(= Caña Blanca.) Introduced from the other West Indies, perhaps from Cuba, in the early days of the nineteenth century. It quickly replaced the Creole and for seventy-five years was the only cane planted commercially. On account of the epidemic of 1872 its planting has been largely abandoned. It is still the only cane planted at Central San Francisco at Guayanilla on the south coast, and it occurs rather widely in mixed and sometimes in nearly pure plantings in many other parts of the Island, especially in the hill country of the central and eastern districts.

Erect but soon procumbent, vigorous on suitable soils, medium stooler, arrows frequently. Stalks long, medium stout, bright green, yellow at maturity, sometimes faintly tinted when fully exposed but without a distinct flush, bloom scanty or none. Internodes long, subcylindrical but inclining to barrel shape, straight or a little staggered, furrow evident but poorly developed. Nodes somewhat constricted; growth ring rather narrow, even or slightly sunken, concolorous or pale brownish; root band narrow, 5 to 8 mm., concolorous; rudimentary roots distant, white, then brownish, not conspicuous, in about 3 rows; leaf scar perpendicular to stalk, glabrous, appressed behind; glaucous band clearly marked, usually constricted, narrow, 7 to 10 mm. Buds small, flat, often reddish when exposed, elliptic-ovate, acute, exceeding the growth ring by one-fourth of length, base rounded, margin narrow, 1 mm. or less, uniform, germination apical, places of short crisped hairs at base, margin and apex with conspicuous, appressed long hairs. Leaf sheaths with dense vestiture of pallid, sub-appressed, acicular hairs, greenish, somewhat glaucous; throat brown, lannate with scanty tufts of long soft hairs at the margins; collar brown well marked, not reaching the midrib, sparingly lannate, especially toward the margins; ligule medium width, tapering from about 4 mm. in center to 1 mm. at ends, margin even, ligular processes well developed, unequal, one usually 14 to 18  $\times$  6 to 7 mm., slender but obtuse, the other broader and shorter. Leaf blades suberect, flat, long and rather narrow, about 6 cm., bright but rather light green, minutely but closely serrulate, even or with scattered cilia at base.

This has been a grand cane, but unfortunately it is adapted to a narrow range of conditions, and these have ceased to exist in most cane-growing countries. That it has not deteriorated is shown by its behavior at the Central San Francisco where on rich, porous, alluvial lands, the soil conditions for which it is fitted, it is still

giving highly satisfactory results. It is reputed to be the same cane as the Lahaina of Hawaii and the Bourbon of the British West Indies. Whether this is really the case can only be determined by further comparative studies, for which material has not been available. The buds illustrated by Fawcett as those of Lahaina (Rev. Agri. Tucumán 10; 139, 1919) are too broad to be typical for Otaheite. Here it is heavily mixed with the similar but clearly distinct cane described on another page as Penang, though its right to that name is very doubtful. The native field men distinguish the two kinds readily and never confuse them, always calling the Otaheite, Caña Blanca and often calling the other Borbón. Both Dr. Stahl and López Tuero considered Otaheite and Borbón as distinct, but they also recognized Penang as being a third kind.

Otaheite is and always has been a poor ratooner. The present practice on the south coast of ratooning but little or not at all comes largely from the fact that so recently Otaheite was the only cane planted there. It deteriorates quickly in the field after reaching maturity and can not be safely left over for *caña quedada* or long crop. It has always been considered as an early maturing cane and as being the standard of excellence in sweetness and milling qualities. These claims are not well supported by the analyses in our files. As will be seen below, in every single case where direct comparison is possible with Cristalina from the same field the latter has proved, the better, and more conspicuously so early in the season than at full maturity. The highest record we have is about equal to the best recorded for Cristalina. It is hard to understand why all the early planters so greatly preferred it to the latter kind:

Kind	Date	Age.	Extr.	Brix.	Suc.	Red. Sug.	Purity	Fiber
Otaheite ..	1-5-21 .....	15 Mo. ....	66.6	14.26	10.69	2.13	74.96	13.36
Cristalina ..	1-5-21 .....	15 Mo. ....	66.6	16.96	15.35	0.56	90.56	11.35
Otaheite ..	12-20-20 .....	14 Mo. Rat. .	73.0	17.00	14.46	0.39	85.5	13.50
Cristalina ..	12-20-20 .....	14 Mo. Rat. .	70.0	17.5	15.53	0.28	88.74	9.60
Otaheite ..	1-26-21 .....	15 Mo. Rat. .	71.1	15.85	12.66	1.56	79.87	13.87
Cristalina ..	1-26-21 .....	15 Mo. Rat. .	70.3	17.85	16.14	0.33	90.42	10.69
Otaheite ..	1915 .....	Plant .....	.....	17.58	15.40	.....	87.6	.....
Cristalina ..	1915 .....	Plant .....	.....	17.98	16.55	.....	92.0	.....
Otaheite ..	May 1916 .....	Ratoons .....	.....	18.3	17.0	.....	92.89	.....
Cristalina ..	May 1916 .....	Ratoons .....	.....	18.8	17.8	.....	94.14	.....
Otaheite ..	April 1917 ..	Pl. 14 Mo. ..	.....	21.3	20.10	.....	94.30	.....

This last is our highest record for Otaheite, no comparable analysis for Cristalina was recorded, but it is clear from the above that before reaching full maturity Cristalina is the sweeter cane, a fact that will come as a surprise to most growers. In tonnage Otaheite

is likely to lead *Cristalina* as plant cane on well-drained alluvial soils, but the reverse will be the case for most other locations and always for ratoons.

It is perhaps useless to have spent so much time discussing this interesting old variety, since its doom is now sealed. It must be definitely and immediately discarded in its last stronghold among the hills because it is so heavily infected by gum disease in practically all of that region. It seems to be the most susceptible of all canes to this very serious trouble although *Penang* and *Bambú* are probably in the same class. *Rayada* and *Cristalina* are also attacked by it but suffer much less seriously, while *Yellow Caledonia*, *Cavangerie* and *D-109* seem to be practically immune. *Otaheite* is also extremely susceptible to root disease in all of its forms, to the vascular bundle fungus, and to mosaic. Its susceptibility to all of these serious troubles is so great that it should be ruthlessly exterminated. It will be exceedingly interesting to see how long it will continue to survive in the isolated valley at Central San Francisco, where it has so far escaped serious damage from any of them.

**Palo Rojo.**

See Bois Rouge.

**Palo Rojo Claro.**

See Bois Rouge Blonde.

**Penang.**

(This name as used here applies to Porto Rico only. *Penang* is usually considered as = *Salangor*, but this is quite distinct.) Introduced by Dr. Grivot Grand-Court prior to 1879, probably from Guadalupe. It is still planted in pure cultures at Central Coloso, where it is also known as *Lousier*. Frequently occurring in mixed plantings in all parts of the Island. It has been brought to the Station from Bayaney under the name of *Borbón*. More likely to be confused with *Bambú* than with *Otaheite* by most planters.

Erect, often soon procumbent, good average vigor, good stooler, arrows frequently. Stalks medium diameter, light green, not yellowish, no flush, little or no bloom. Internodes rather long, cylindrical, straight, furrow shallow, poorly defined. Nodes slightly constricted; growth ring broad, 2 to 5 mm. swollen, concolorous; root band narrow, 6 to 10 mm., concolorous, rudimentary roots few, distant, large, whitish with purple centers, in about 3 rows; leaf scar perpendicular, glabrous, appressed, behind; glaucous band narrow, well defined. Buds fringular-ovate, obtuse, 9 to 10 × 9 to 10 mm., often only reaching and never exceeding the growth ring, margin

1½ to 2 mm., flat, slightly wider below, germination subapical, greenish or purplish, nearly glabrous. Leaf sheaths with medium vestiture of short pallid subappressed hairs, glaucous, with a conspicuous lilac tinge, throat pale brown, minutely and sparingly lannate, with conspicuous tufts of marginal hairs; collar pale brown glaucous, sparingly lannate, toward the margins; ligule narrow 1 to 3 mm., tapering toward the margins, edge even; ligular processes none. Leaf blades long, spreading, medium width, about 6 cm., dark green, minutely serrulate.

No conjecture can be made as to the true name of this cane. If it is the Lousier of Mauritius, which seems possible from its history, then that cane is abundantly distinct from Otaheite. It has been so long associated with the name Penang in this Island that that name is provisionally retained for it. It is evidently better adapted to old, compact lands than the Otaheite and it is a better ratooner. According to notes left by Mr. Crawley, the former Director, this was the principal kind planted at Central Coloso in 1913 and its planting was then being extended at other points on the west coast. It was highly recommended by Dr. Stahl, who considered it immune to the epidemic of 1872. Its planting is now being abandoned at Coloso on account of its susceptibility to mosaic. Our notes indicate that it is heavily attacked by gum disease, but in this there may have been confusion with Bambú, the two having only recently been clearly distinguished. In an experimental planting of many varieties made in November 1920 this kind has taken a high place for germination, stooling and general vigor.

The following analyses are available:

	Date	Age	Arrows	Extr.	Brix.	Suc.	R. S.	Pur.	Fiber
Penang.....	2-9-21	Pl. 16 Mo.	No.	68.7	16.00	13.11	1.76	81.98	11.62
Cristalina.....	2-9-21	Pl. 16 Mo.	No.	68.7	16.20	13.85	.95	85.49	11.20
Penang.....	3-3-21	Pl. 17 Mo.	No.	71.4	18.45	16.35	.87	88.61	11.44
Rayada.....	3-3-21	Pl. 17 Mo.	No.	72.7	18.25	16.30	.71	89.31	12.00
Penang.....	3-11-21	Pl. 17 Mo.	No.	70.5	19.95	17.74	1.64	88.92	11.80
Penang.....	5-4-21	Pl. 18 Mo.	No.	61.3	19.70	17.85	.75	90.60	.....
Cristalina.....	5-4-21	Pl. 18 Mo.	No.	65.1	19.55	18.93	.241	96.82	.....
Penang.....	5-5-21	Pl. 18 Mo.	No.	67.3	20.60	18.83	.791	91.47	.....

This indicates a cane of very satisfactory quality but a little later in maturing than Cristalina. It is evidently worth further study.

#### Pesante.

A local name at Mayagüez for the Java 105-P. O. J., or "Egyptian," from the name of the "Colono," on whose place it first attracted attention in that locality.

**Rayada.**

(=Striped Cheribon, =Louisiana Ribbon.) Probably introduced in the early days of the nineteenth century as an admixture with Otaheite. Now found in pure and mixed plantings in all parts of the Island. Since the epidemic of 1872 this has been the most widely planted cane in Porto Rico.

In all respects except color indistinguishable from Cristalina, which see for detailed description. In this variant the stalks are striped with irregular bands of green or yellow and dark purple. The color scheme is quite variable. Sports from one form to the other or to the Morada are frequently found in the fields.

Most planters have a decided preference for either Rayada or Cristalina, but they can seldom give a valid reason for their choice. Considerable study over a term of years has so far failed to detect any constant difference between them in cultural characters. Everything said under Cristalina in regard to disease resistance, and adaptability to general planting may be repeated here. Probably the majority of planters will claim that Chistalina is the richer of the two in sucrose. Our plantings have not been so arranged as to properly test this point. The few analyses in our records that are comparable are given below for what they may be worth, but the evidence is by no means conclusive:

Kind	Date	Age	Extr.	Brix.	Sucro.	Red. Sug.	Purity	Fiber
Rayada.....	2-4-21	Pl. 16 Mo...	64.8	18.55	17.27	0.32	92.93	11.26
Cristalina .....	2-4-21	Pl. 16 Mo...	65.2	18.40	17.27	0.65	93.95	11.83
Rayada.....	1-19-21	Pl. 15 Mo...	69.7	18.25	16.42	0.34	89.91	12.12
Cristalina .....	1-19-21	Pl. 15 Mo...	70.0	17.25	15.96	0.37	92.51	9.60
Rayada.....	11-29-20	Pl. 20 Mo...	61.6	16.20	14.50	0.66	89.05	11.78
Cristalina .....	11-29-20	Pl. 20 Mo...	61.5	16.47	14.52	1.20	88.15	12.32
Rayada.....	12-15-20	Rat. 10 Mo.	68.2	17.73	15.98	0.65	90.12	8.90
Cristalina .....	12-15-20	Rat. 10 Mo.	70.0	17.50	15.53	0.28	88.74	9.60
Rayada.....	12-22-20	Rat. 14 Mo.	69.5	15.33	13.06	0.98	85.12	9.16
Cristalina .....	12-22-20	Rat. 14 Mo.	70.0	17.50	15.53	0.28	88.74	9.60
Rayada.....	4-17-17	Pl. 14 Mo.....	.....	21.31	20.0	.....	93.60	.....

This last is our highest recorded analysis for Rayada and it is almost exactly identical with the highest recorded for Cristalina, though the two were made from different fields and in different years. So far the chemist seems to confirm the view of the field man that the two kinds are only color variants of the same original stock.

**Rayada Mexicana.**

(=Rayada.) Imported from Mexico by Central Guánica in 1919. Now planted at this Station.

**Reina Caledonia.**

Introduced from Trinidad by Dr. Stahl prior to 1879. This name was first proposed in Trinidad for some unknown introduced cane. Later it was considered as = *Cristalina*. The cane received under this name by Dr. Stahl could not have been this kind, for it was poor and feeble in growth. He remarks that "its pompous name is in contrast to its inferior vigor." It seems to have disappeared.

**Rosa Morada.**

Imported by Dr. Grivot Grand-Court under this name, probably from Guadalupe, prior to 1879. Said to come from New Caledonia. As nearly as can be determined from the fragmentary early descriptions this is the cane that still exists rather frequently in mixed plantings in the hill districts between Arecibo and Lares, particularly in the neighborhood of Bayaney. Curiously enough, tradition seems to have handed down no name for this cane. When pressed for a name the planters in this district usually call it "Caledonia." It doubtless has a perfectly good name in other countries, but what it is can not even be guessed at present. The one used here has not been seen elsewhere in the literature. Seed cane from Bayaney was once brought in under the name of "Salangor Rojo," but the descriptions by Dr. Stahl make it clear that he applied this name to the self-colored form of *Cavengerie*, here called *Cavengerie Roja*, and not to the present variety. The name *Sarangola Roja* was once applied to this cane by a *colono* near Lares.

Erect, vigorous, stools well, arrows rather freely. Stalk long, medium to medium stout, dull purple, fading to olive-brown at maturity, little or no bloom. Internodes rather long, usually compressed laterally and somewhat larger below, furrow faint or none. Nodes constricted; growth ring wide, 4 mm., swollen, usually darker in color, conspicuous; root band oblique, 6 to 8 mm., greenish; rudimentary roots, large, crowded, brown with purplish centers, in 2 to 3 rows; leaf scar glabrous, prominent, appressed behind; glaucous band 8 to 10 mm., well defined. Buds rather large, ovate, 12 to 15 × 10 to 14 mm., exceeding the growth ring by one-third of length, margin narrow, uniform, germination apical, vestiture of appressed basal plac and conspicuous apical tuft of long hairs. Leaf sheaths with a moderate vestiture of short hairs, glaucous, usually strongly tinted; throat lannate with short appressed hairs; collar pale brown extending into a broad whitened area along midrib, glaucous not lannate. Leaf-blades suberect the tips declined, 6 to 8 cm. wide, medium dark green, minutely serrulate.

This seems to be strictly a hill-land cane. It is not thriving in our low-land plots. In the red clay hills and on the dry coral red

lands it is very much at home, seeming to be equal in growth and vigor to the Cavengerie when planted in the same fields. The few analyses available indicate that it is much earlier in maturing. It seems to be a fairly sweet cane. It is hard to understand why it has been so completely overlooked while Cavengerie has been so widely planted. Like the latter cane it is resistant to root disease at least on dry lands but unfortunately it is equally susceptible to mosaic, from which it is suffering severely. Its reaction to gum disease is not known. This cane should certainly be tested further for high, dry lands where it can be kept clear of mosaic. It occurs in our cultures as X-17 and X-28.

Kind	Date	Age	Extr.	Brix.	Sucr.	Red. Sug.	Puri.	Fiber
Rosa Morada	12-6-20	Pl. 14 Mo...	71.6	16.19	13.14	1.59	81.82	13.82
AV. 5 Cheri	12-6-20	Pl. 14 Mo...	.....	.....	13.69	1.67	85.88	12.23
Rosa Morada	1-9-11	Pl. 15 Mo...	62.5	15.75	13.13	1.32	83.36	12.0
Cristalina	1-9-21	Pl. 15 Mo...	70.0	17.25	15.96	0.87	92.52	9.60
Rosa Morada	5-5-21	Pl. 18 Mo...	62.2	18.70	16.98	0.653	90.80	.....

#### Rosa Rayada.

This name is proposed for a green and purple striped variant of the above found at Bayaney and brought into the Station collections as X-18. Exactly like the self-colored form except for green stripes on the stalks and leaf sheaths.

#### Sacani.

Dr. Stahl, *Revista de Agri.* 1887, p. 174. This is probably a misprint for Sacuri. If so, it came from Jamaica. No further reference to this kind has been found.

#### Salangor.

(=Salangor Blanca.) Introduced by Dr. Grivot Grand-Court, probably from Guadalupe, prior to 1879. Regarded by Dr. Stahl as a variety of great importance, since he considered it very resistant to the prevailing epidemic. This cane is still grown in pure cultures at Central Coloso, where fields of several acres have been examined showing a cultural value and general vigor fully equal to Rayada. It has been found nowhere else on the Island but it is now growing on the Station grounds.

Erect but often soon declined, vigorous, seldom or never arrows. Stalks long, medium stout, pallid or yellowish, no flush, very heavy bloom, often marked with faint brownish lines that are obscured by the bloom. Internodes medium length, straight, barrel shaped, furrow faint or none. Nodes constricted; growth ring inconspicuous, poorly marked, concolorous; root band narrow, less than 10 mm., at first whitish then greenish; rudimentary roots numerous, crowded, small,

purplish, in about 4 irregular rows: leaf scar glabrous, somewhat oblique, appressed behind; glaucous band obscured by the heavy bloom. Buds ovate-acuminate, rather large, about  $10 \times 15$  mm. exceeding the growth ring by one-third or more of the length, often purplish, germination subapical, margin uniform, rather broad, glabrous except for a heavy tuft of long, curled hairs on either side above the base. Leaf sheaths with an abundant vestiture of short suberect, rather weak, pallid hairs, strongly glaucous, pallid greenish purplish at base within; throat dark brown, densely lannate and with a fringe of long hairs behind the ligule and at the sides; collar conspicuous, reaching the midrib, dark brown, reddish brown when young, glaucous but not lannate; ligule medium; ligular processes none or short and inconspicuous. Leaf blades spreading, light green flat, 5 to 6 cm. wide, minutely but distantly serrulate, the base ciliate

This cane was so highly endorsed on its introduction and presented such a good appearance wherever grown that it seems very strange that it has been so little planted. Apparently it is better adapted to *vega* lands than to the hills, thus being complementary to the last which was clearly a hill-land cane. It is reported as a sweet, good milling cane but no analyses are available. It has proved to be quite susceptible to mosaic but its reactions to root disease and gum disease have not been determined. It is clearly worthy of a much more extended trial than has ever been given it in this Island. It is one of the old, well-known varieties with a long history in the literature. It is usually considered as = Penang but it is absolutely distinct from the kind so named here.

#### Salangor Rayada.

This name is used by Stahl, and López Tuero seems to = Rayada though of this it is impossible to be fully certain. A variant of the above variety was, however, observed in the fields at Central Coloso which may properly be called Salangor Rayada. It has faint white and green stripings on the stalks. It has been brought into the Station cultures under this name.

#### Salangor Rojo.

As used by Stahl and López Tuero, this name clearly stands for what is here called Cavengerie Rojo, which see. The cane brought in from Bayaney, under this name has, as already stated, proved to be what is here called Rosa Morada.

#### Sarangola.

A local name occasionally heard in Porto Rico. Sometimes it is applied to Cristalina and once we have found it applied to Rosa Morada. It does not occur in the literature.

**Sealey Seedling.**

Introduced by Mr. Sewall from Antigua in 1909. At various times it has been considerably planted at both Central Fajardo and Guánica. Occasionally found in mixed plantings in other parts of the Island. As grown here it is scarcely distinguishable from B-3412. In the former paper on cane varieties by the present writer it was considered as identical, but perhaps the point is not fully proven.

Erect or at length decumbent, vigorous, free stooling, arrowing only in certain localities. Stalks long, slender, usually  $2\frac{1}{2}$  to 3 cm., though sometimes thicker, green with a strong reddish flush when fully exposed, bloom light but usually evident. Internodes medium to long, often slightly staggered, compressed laterally, furrow well marked. Nodes slightly constricted, oblique; growth ring inconspicuous, usually slightly sunken, 2 to 3 mm. wide, concolorous; root band oblique, 6 to 10 mm., concolorous, rudimentary roots slightly sunken, inconspicuous with very small, purplish center, in 3 to 4 rows; leaf scar glabrous, appressed behind; glaucous band conspicuous, 8 to 10 mm., scarcely constricted. Buds rather large, ovate, rather obtuse, about  $13 \times 13$  mm., exceeding the growth ring by one-third of length. Margin broader below but not shouldered, about 1 to  $1\frac{1}{2}$  mm., germination apical, the base with places of heavy crisped hairs, margin and apex bearded. Leaf sheaths with heavy vestiture of short, stiff, assurgent hairs, green, not much glaucous; throat lannate and with long hairs behind the ligule; collar broad, rather conspicuous, glaucous but not lannate, ligule, 3 to 4 mm. at center tapering to 1 mm. at ends, the edge fimbriate; ligular processes none. Leaf blades spreading, more or less in two ranks, crowded, narrow, usually averaging but little more than 5 cm., bright green, minutely but sharply serrulate, the base nearly even.

As here described this differs from B-3412 in the more strongly lannate throat and from B-3405 in the glaucous collar. The leaves, too, seem to average a little narrower, but it is by no means certain that these differences are constant. The material we have under these three names is scarcely distinguishable either by cultural or taxonomic characters. We have no real proof that these names are authentic, or if by chance only one kind has really reached us under these three names which one of the three is really represented.

Whatever these facts may be it is a vigorous, strong-ratooning cane which gives heavy tonnage under a variety of soil conditions. It is late in maturing and should only be planted as *gran cultura*, since when immature it is very low in sugar. For the same reason it is best planted on uplands, for on low, wet soils it seldom really matures. At 15 to 16 months, if fully ripened by 6 to 8 weeks of dry weather it develops a high degree of sucrose and purity. Com-

paratively few analyses are available under this name, but the following will illustrate what may be expected when green and when fairly well matured:

Kind	Date	Age	Extr.	Brix.	Sucro.	Red. Sug.	Purity	Fiber
Sealey S. ....	1-12-12..	.....	.....	14.8	10.6	3.2	71.6	.....
Sealey S. ....	12-15-20.	Rat. 11 Mo.	69.6	14.59	11.59	2.49	79.76	13.5
Cristalina ..	12-15-20.	Rat. 14 Mo.	70.0	17.53	15.53	0.28	88.74	9.60
Sealey S. * ..	1-24-21..	Rat. 15 Mo.	70.1	14.47	10.87	1.88	75.47	13.1
Cristalina ..	1-24-21..	Rat. 15 Mo.	70.3	17.85	16.14	0.33	90.42	10.6
Sealey S. † ..	2-25-21..	.....	.....	19.70	17.85	.....	90.60	.....

\* Still green.

† Getting ripe.

This is a kind that may give very profitable results if planted in pure cultures and harvested with good judgment, but it is clearly unwise to let it become mixed with other kinds where it is likely to be cut while only containing 10 or 11 per cent of sugar in the juice.

Its strong resistance to root disease and good ratooning powers are its chief advantages. It is quite susceptible to mosaic and suffers badly when attacked. Its reaction to gum disease has not been determined. Its further planting is recommended to those who will study its peculiarities. Those who will not had better leave it alone.

#### Tamarin.

Introduced by Dr. Grivot Grand-Court, probably from Guadalupe prior to 1879. The name originated in Mauritius. The cane is said to come from New Caledonia. Found sparingly in mixed plantings in the hills between Arecibo and Lares. Not seen elsewhere.

Erect at length decumbent, of medium vigor, arrowing not observed. Stalks of medium length and diameter, dark purple, with moderate bloom. Internodes medium length, barrel shaped, furrow none. Nodes strongly constricted; growth ring wide, 3 to 4 mm. somewhat sunken, yellow then concolorous or darker; root band about 8 mm., concolorous, rudimentary roots with dark purple centers, in 3 to 4 rows; leaf scar glabrous, appressed behind; glaucous band constricted, about 8 mm., conspicuous. Buds ovate, 8 to 9 × 10 mm. somewhat exceeding the growth ring, margin medium width, uniform germination subapical, basal places of crisped hairs extending onto the margins, apex glabrous. Leaf sheaths with medium vestiture glaucous, tinted, the base within stained purple; throat nearly glabrous with a few long marginal hairs; collar broad, pallid, not reaching the midrib, glaucous; ligule broad, 5 mm., fimbriate; ligular processes on only one side, broad and short, the edge fimbriate. Lea.

blades spreading, bright green,  $5\frac{1}{2}$  to  $6\frac{1}{2}$  cm. wide, very minutely serrulate, the base ciliate.

Only seen on hill lands, where it is of only moderate vigor. It is susceptible to mosaic; behavior to other diseases not observed. It is a soft cane and reported to be very sweet, being much sought by the laborers for chewing. No analyses are available. Its agricultural value is problematical.

#### Tanna.

Canes called Black Tanna were cultivated on the Station grounds in 1913. The seed was brought in from nearby fields. From the descriptions on file they seem to have been the self-colored forms of Cavengerie, here called respectively Cavengerie Roja and Cavengerie Negra.

In the spring of 1920 seeds of striped Tanna were sent to this Station by Director May of the Federal Station, who imported them from Guadalupe. Unfortunately, they failed to grow. The variety is, however, growing in the plots of that Station at Mayagüez.

#### Uba.

(=Kavangire.) Imported from the Argentine by D. W. May, Director of the Federal Station at Mayagüez in 1917. A further importation of 10 tons of seed was made from the Argentine in 1920 by the United States Department of Agriculture as an aid in combating the outbreak of cane mosaic in Porto Rico. It is now widely disseminated and is being grown in an experimental way in many parts of the Island but more particularly on the west coast.

Erect, very vigorous, stools tremendously, arrows early and very freely. Stalks very tall, slender, average about 2 cm. in diameter, green, often with lilac tint, medium heavy bloom. Internodes long, 10 or 12 to 16 or 18 cm. cylindrical or slightly larger below, furrow none. Nodes normally of same diameter as internode, occasionally the lower ones enlarged; growth ring rather wide, 3 to 4 mm., even or slightly sunken, concolorous or nearly so: root band slightly oblique, 7 to 9 mm., concolorous or yellowish, usually even, occasionally swollen on the lower nodes: rudimentary roots large, crowded, yellowish, in about 3 rows; glaucous band indistinct, blending with the bloom of the internode, circle of hairs below bud present but scanty and soon deciduous. Buds ovate, obtuse, about  $10 \times 14$  mm., exceeding the growth ring by one-fourth of length. Margin narrow, uniform, about  $1\frac{1}{2}$  mm., germination apical, glabrate below, but with inconspicuous appressed hairs on the margins. Leaf sheaths soon glabrate, greenish, scarcely glaucous; throat sub-glabrous, the vestiture reduced to a few short hairs on the shoulders; collar narrow,

reaching the midrib, glaucous; ligule with an abrupt triangular widening at center, where it reaches 4 to 5 mm. the ends 1 to 2 mm., margin irregular; ligular processes none. Leaf blades numerous, spreading, narrow 3 to 5 cm., minutely but closely serrulate to the base.

This cane came originally from India at an early day to Brazil. From there it was carried in 1869 to Mauritius under the name of Uba. Later it went from Brazil to Argentina, this time under the name of Kavangire, and from the Argentine it has now come to Porto Rico. It is today practically the only cane planted in Natal and other parts of South Africa. It is not extensively planted in Argentina on account of danger from frost, since there it is considered late in maturing although in favorable seasons it gives very heavy yields. It is a typical representative of the Ganna<sup>1</sup> canes of North India some of which have also gone to Japan where they are extensively cultivated. The close resemblance of the Uba to these Japanese canes has led to its being also called a Japanese cane, but to the best of our knowledge it has never been grown in Japan. This class of canes are very distinct from those in general cultivation. They have such vigor and such great stooling power that they yield very heavy tonnage, notwithstanding their slender diameter. They grow well on a great variety of soils and are exceedingly resistant to root disease in all of its forms. Their preeminent characteristic is, however, their complete immunity to mosaic. It is this, of course that is attracting such wide attention to these canes in Porto Rico. Their reaction to gum disease has not been determined, but it is highly probable that they will prove to be resistant. These canes have been considered to be poor in sucrose and late in maturity. In Natal they are not considered to be at their best under 19 months. The results obtained here so far have been unexpectedly favorable. Uba seems to be decidedly better than either of the other two canes of this class so far tested (Biloxi and Zwinga). As will be seen by the following analyses it has more than once given more sucrose than Cristalina from the same field. This was certainly not expected and especially so early in the season. It must be noted however, that these high analyses all came from hill lands where canes tend to mature early. The canes that have not arrowed, too seem much slower in maturing. It is too early yet to predict what place the Uba will ultimately take in commercial production in

<sup>1</sup> Since the above was written a letter from Mr. C. A. Barber, the authority on Indian canes, informs me that Uba belongs to the Pansahi group of North Indian canes.

Porto Rico. In any event its introduction and testing on so large a scale constitutes one of the most interesting incidents in recent sugar-cane history, and this Island owes a debt of gratitude to the Federal Department of Agriculture for its prompt initiative in importing this seed. It seems certain that the serious outbreak of mosaic disease on the west coast can be easily and quickly dominated by the use of this variety. Once this is accomplished its cultivation can be discontinued if other varieties prove more profitable:

## Analyses, Station Cane, Red Hill Lands.

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	Red. S.	Purity	Fiber
Uba .....	12-6-20	Rat. 18 mo.	Yes	60.4	18.01	15.04	1.38	83.55	12.80
Cheribon* .....			No			13.60	1.67	85.88	12.29
Uba .....	1-10-21	Rat. 14 mo.	Yes	62.5	18.25	16.16	0.82	89.54	13.50
Cristalina .....	1-10-21	Rat. 14 mo.	No	71.4	17.30	15.34	0.64	86.67	12.01
Uba .....	1-5-21	Plant 15 mo.	Yes	64.0	18.91	16.82	0.73	89.47	13.66
Cristalina .....	1-5-21	Plant 15 mo.	No	65.6	16.96	15.35	0.56	90.54	11.35
Uba .....	12-24-20	Plant 15 mo.	Yes	69.0	16.28	13.43	0.71	82.59	15.20
Cristalina .....	12-24-20	Plant 15 mo.	No	65.7	18.88	17.08	0.52	90.65	13.72
Uba .....	2-7-21	Plant 17 mo.	Yes	61.1	17.18	15.83	0.40	89.93	14.00
Uba .....	2-7-21	Plant 17 mo.	No	63.8	15.15	13.16	0.95	84.90	13.03
Cristalina .....	2-7-21	Plant 17 mo.	Yes	65.2	18.40	17.27	0.67	93.85	11.83
Cristalina .....	2-7-21	Plant 17 mo.	No	68.6	17.90	16.14	0.805	90.16	12.81
Uba .....	2-23-21	Plant 17 mo.	No	68.5	17.50	15.93	0.399	90.02	13.86
Uba .....	2-23-21	Plant 17 mo.	Yes	64.1	17.90	16.26	0.43	90.83	14.36
Uba .....	4-4-21	Plant 18 mo.	No	64.5	18.30	18.53	1.06	84.86	12.67

\* Average 5 lots cane.

## Analyses, Other Localities.

Mayagüez Station* .....	1-1919	Plant 16 Mo.				12.2		81.23	
Central Guánica† .....	12-18-20	Plant .....		78.42	13.17	10.59	1.76	77.31	
Central Guánica D-117‡ .....	12-18-20	Plant .....			15.72	13.24		84.22	
Hatillo Fruit Co. ....	1-28-21	Plant 15 Mo.	No	66.6	14.05	13.74	0.79	83.61	13.96
Hill land .....									
Central Yannina .....									
Hill land .....	1-22-21	Plant 15 Mo.			19.25	17.19		89.09	
Hill land .....	2-4-21	Plant 16 Mo.	No	65.3	18.20	15.89	0.95	87.30	13.88
Bayamón .....	2-9-21				15.65	11.89	0.99	75.97	
Mayagüez .....	2-10-21			62.59	16.15	13.85	0.466	85.75	
Utüado .....	2-19-21				17.00	12.32		72.47	
Arecibo .....	2-18-21	Plant 10 Mo.	No		14.5	9.32	2.52	64.27	

\* Yield estimated at 83.56 tons per acre.

† Tons per acre, 44.75; tons sugar, 3.716.

‡ Tons sugar per acre, 5.509.

Verde Zic-zac.

Stahl, p. 137:

"I will so call a certain green cane whose joints form a zig-zag until I know its true name. It is superior in sweetness to many other varieties."

This is the sum total of our knowledge of this kind which is very probably the same that was mentioned by Deerr in the article previously quoted (p. 37) as having been introduced into Jamaica

by Captain Bligh in 1793, together with his introduction of Otaheite. No cane clearly referable to this variety has been found by the writer in Porto Rico, though Mr. Deerr has informed him verbally of having seen such a cane at some of the loading stations in the western part of the Island at the time of his recent visit (Jan. 1920).

White Transparent.

See Cristalina.

Yellow Caledonia.

First introduced by D. W. May, Director of the Federal Station at Mayagüez, in December 1904, from Audubon Park, Louisiana under the name of Rose Bamboo. Later, in 1909, reintroduced from Eva Plantation, Hawaii, by Mr. E. E. Olding, then administrator of Central San Cristóbal, Naguabo. First extensively grown and disseminated by Mr. Sewall of Naguabo (see letters of May and Sewall, pp. 35, 36). At present extensively planted in nearly all parts of the Island, but especially on the northern and western coasts. Probably third in total acreage, only exceeded by Rayada and Cristalina and being extended more rapidly than any other variety.

Strictly erect, very vigorous, strong stooling, very seldom arrowing. Stalks medium stout, green, with heavy reddish flush where exposed, usually marked with brown lines, bloom none or very faint. Internodes medium length, straight, cylindrical, furrow none. Nodes not constricted; growth ring rather broad, 2 to 4 mm., even or a little sunken, usually light green; root band narrow, somewhat oblique, 6 to 10 mm., greenish; rudimentary roots small, dark purple, in 3 to 4 rows; leaf scar glabrous, nearly perpendicular, narrow, appressed behind; glaucous band conspicuous, about 8 mm. Buds broadly ovate or nearly orbicular, small, often purplish, about  $10 \times 10$  mm., usually reaching but not exceeding the growth ring, margin uniform, very narrow, germination long delayed, subapical, nearly glabrous except for heavy apical tuft which reaches 4 mm. Leaf sheaths glabrous, green or sometimes tinted below, glaucous, conspicuously stained with purple within, especially at base; throat wide, dark brown, densely lannate, a circle of sparse rather short hairs behind the ligule, especially toward the margins and extending unto the shoulders; collar broad, dark brown, extending to the midrib, densely lannate, ligule tapering toward the ends, 2 to 4 mm., margin uneven somewhat fimbriate; ligular processes none. Leaf blades erect with the tips declined, flat, broad, 7 to 8 cm., dark green, very minutely serrulate, the margin even below or sometimes scantily ciliate.

The extensive planting of this cane has led to many heated discussions between mill owners and *colonos*, the former wishing

to restrict its planting on account of its low average sucrose while the latter insist on planting it because of its high tonnage. This trouble has largely come because the nature of the variety is not well understood. If cut green at 11 to 12 months, and especially if rains are frequent it will have very little sucrose and be high in reducing sugars, making the yield so small that it does not pay to grind it. It is a late-maturing cane, requiring age and at least 4 to 6 weeks of dry weather in which to ripen. It should never be cut before April when, though never as rich as *Cristalina*, it will give a very satisfactory yield. If handled in this way, on old compacted lands, it will give a much larger output of sugar per acre than either *Rayada* or *Cristalina*. It is preeminently a low-land cane, thriving only moderately on dry hills. It should not be planted on lands that still give a satisfactory tonnage of these better kinds. It is especially indicated for those old and compacted maritime *vega* lands where *Rayada* and *Cristalina* now fail from root disease. In such localities it will give much greater tonnage and will ratoon for many more cuttings. If allowed to fully ripen the yield of sugar will be highly satisfactory. It would not be possible to run a central at a profit if all of its fields were planted to this cane, since all would mature so late as to make too short a grinding season. It is simply folly to cut this cane green and rush it to the mill before it has developed any sugar.

Yellow Caledonia is very resistant to the ordinary forms of root disease and it is a strong ratooner. As it almost never arrows it can be safely carried over as "long crop" or *caña quedada*, as is so extensively done with it in Hawaii. In some soils in Porto Rico, however, it tends to become hollow and dry if carried over to the second year. It proves, however, to be rather susceptible to the vascular-bundle fungus, fields having been occasionally seen that were seriously injured from this cause. It is very susceptible to mosaic, or at least it is very seriously injured by it when attacked, the growth being immediately dwarfed and the plant often actually dying within a few months. In some instances it seems to contract the disease less readily than some other kinds. Diseased plants are so easily recognized that roguing is made easy. It is probable that more attention has been paid to cleaning up fields of this kind in order to secure a supply of clean seed than with any other variety. It is very resistant indeed if not fully immune, to gum disease, which at the present moment is a matter of great importance.

The following selected analyses will serve to give an idea of what

may be expected of this kind under different conditions of ripeness and immaturity. For a fuller discussion of its chemical qualities and analyses from other parts of the Island see Circular 33, by Director E. D. Colón, who has made a comprehensive study of this variety under Porto Rican conditions:

Kind	Date	Age	Extr.	Brix.	Suc.	R. S.	Puri	Fiber
Y. Cal.....	2-1912	Plant.....	.....	15.2	11.3	2.6	74.3	.....
Y. Cal.....	12-8-20	Rat. 10 Mo.	72.4	13.01	8.60	3.16	66.15	9.9
Cristalina ...	12-8-20	Rat. 10 Mo.	73.0	16.63	13.41	1.78	85.76	10.8
Y. Cal.....	1-24-21	Rat. 15 Mo.	67.4	16.60	13.37	1.51	80.54	13.4
Cristalina ...	1-24-21	Rat. 15 Mo.	70.3	17.85	16.14	0.33	90.42	11.2
Y. Cal.....	2-4-21	Pl. 16 Mo...	61.5	18.90	17.70	0.69	93.65	13.8
Cristalina ...	2-4-21	Pl. 16 Mo...	65.2	18.40	17.27	0.85	93.85	11.8

This last is the only case in our records where Yellow Caledonia has fully equaled Cristalina grown under the same conditions. It was from a dry hill top where the cane was fully mature, but it illustrates the folly of cutting this kind when it only contains 10 or 12 per cent sucrose.

#### Zwinga.

(= Japanese Fodder.) Introduced from Louisiana by the Federal Station at Mayagüez. Date of introduction not known. It is now also in the plots at the Insular Station but has not been seen elsewhere in the Island. In the fall of 1919 the Federal Station brought some seed cane from St. Croix under the name of Kavangire. It was observed by the present writer to be distinct from the Kavangire brought from the Argentine and was thought to be Zwinga. This now seems doubtful. This St. Croix cane seems to more nearly resemble what is here called Biloxi than it does either Uba or Zwinga. Whatever its identity, small lots of it were somewhat widely distributed. It seems to be slower in ripening and poorer in sugar than the Uba.

Erect, very vigorous, heavy stooler, arrows infrequently. Stalks long, very slender, about 2 cm., green or ash-colored from the light bloom. Internodes long, 13 to 15 cm., straight, nearly cylindrical but usually larger below, furrow slight or none; nodes abruptly and conspicuously swollen; growth ring slightly sunken, 2 to 3 mm. broad, yellowish-green, conspicuous; root band abruptly swollen, 10 to 12 mm. wide, concolorous; rudimentary roots large, crowded becoming prominent, concolorous, in 3 to 4 rows; leaf scar glabrous closely appressed behind; glaucous band tapering rapidly, its lowest part being the narrowest part of the stalk. The circle of hairs below the bud is strongly developed. Buds ovate, about 10 × 12 mm. exceeding the growth ring by one-fourth of length, margin uniform

medium narrow, germination apical, basal places of hairs poorly developed, abundant, long, appressed marginal hairs. Leaf sheaths with a distinct but short and somewhat deciduous vestiture which is usually more abundant on the sides than on the back, green, little or no bloom; throat minutely lannate but with no long hairs or sometimes scant marginal tufts; collar pale, indistinct, glaucous; ligule wide and with an abrupt triangular widening at the center where it reaches 5 to 6 mm., the edge fimbriate; ligular processes none. Leaf blades numerous spreading narrow  $4\frac{1}{2}$  to 5 cm., bright green, very minutely serrulate.

This cane very closely resembles the Uba but may be distinguished by the more abundant vestiture on the leaf sheaths and the abruptly swollen nodes. In Uba nodes and internodes are normally of the same diameter. The buds are flat and germinate apically as in Uba. This serves to distinguish it from "Biloxi" which has plumper buds that germinate subapically or nearly subdorsally.

Like the Uba it is completely immune to mosaic and is exceedingly resistant to all forms of root disease. Its reaction to gum disease is not known, but it is probably immune.

This cane is extensively grown in the Southern States as a forage for cattle and it is considerably used there for syrup making. It probably has but little value for sugar making on account of its late maturity and low sucrose content. A few analyses are given:

Kind	Date	Age	Ext.	Brix.	Sucr.	Red. Sug.	Purity	Fiber
Zwinga.....	12-30-20	Pl. 13 Mo. ...	66.6	15.13	11.78	1.96	77.85	9.35
Y. Cal.....	12-30-20	.....	67.9	15.73	11.35	2.00	78.51	13.48

A number of other unknown canes have been picked up in mixed plantings in different parts of the Island and are being grown as "X" numbers in the Station collections. It has so far been impossible to identify them and they are reserved for future study. Presumably they represent old varieties but there is always the possibility of some unknown Barbados or Demerara seedling having gone astray. Besides, it is necessary to bear in mind the two hundred lost seedlings that were more or less distributed by the Federal Station. All of these factors add to the difficulty of satisfactorily determining an unknown cane.

Having thus completed the list of named varieties that have been reported as occurring in Porto Rico, it will be next in order to take up alphabetically the lists of imported seedlings and finally

the discussion of such of the Porto Rican Seedlings as have become somewhat widely disseminated.

#### THE BARBADOS SEEDLINGS.

Of the vast number of seedlings bred by Mr. J. R. Bovell in Barbados only a comparatively small number have reached Porto Rico. Most of these belong to the earlier series that was designated simply by the initial B. All of these that we have here are good canes but none of them have proved to be superlatively good. Most of them have been rather widely disseminated but only a few have been planted on a large scale. Such facts as have been gathered concerning each of them will be found below.

##### B-88.

A cane under this number was found growing at Río Grande. There is no record of the introduction of this kind. Its identity has not been determined.

##### B-109.

Parentage unknown. Introduced from Antigua by Sewall in 1909. Cultivated at this Station since 1911 from seed sent by Sewall, and to some extent at Humacao and other parts of the east coast. It was in cultivation at Guánica in 1912, but has been abandoned there. It is still cultivated at Fajardo though the acreage is smaller than formerly.

Erect or at length declined, stooling only moderate, arrows rather freely. Stalks long, medium stout, green, then yellowish, no flush, little or no bloom. Internodes medium length, straight or very slightly staggered, cylindrical, furrow very slight or none. Nodes not constricted; growth ring narrow, about 2 mm., somewhat swollen, concolorous; root band narrow 6 to 8 mm., slightly swollen; rudimentary roots small, crowded, pallid, in 2 to 3 rows; leaf scar glabrous; glaucous band well marked, not constricted. Buds obovate, broader than long with an apiculate apex, about  $9 \times 10$  mm., not exceeding the growth ring, margin narrow, uniform, germination subdorsal, nearly glabrous but with short scanty basal places of crisped hairs and a short scanty apical tuft from the under side of the bud. Leaf sheaths glabrous, green, but little bloom; throat with abundant vestiture of course hairs, densely lannate; collar broad, dark brown, reaching the midrib, densely lannate; ligule medium short, entire; ligular processes unequal, usually only one developed, sometimes wanting. Leaf blades spreading, rather broad 7 to 8 cm., minutely but sharply serrulate, the base ciliate.

This cane is usually reputed to be low in sucrose. As in so

many other cases this comes from failure to understand its characteristics. It is a cane of considerable vigor and continues its growth late in the season. On low lands it is therefore slow in maturing and is usually cut before it is ripe. On hill lands it ripens as early as *Cristalina* and frequently develops even more sucrose. Up to February 4 it had given the highest sucrose of any kind analysed this year. It seems to have more vigor and resistance to unfavorable conditions than *Rayada* and *Cristalina* and will usually give at least equal tonnage. Its greatest weakness is that it is not a very free stooler, usually giving comparatively few stalks to the hill. It can be recommended for fall planting in the red shale hills.

B-109 is rather unusually resistant to root disease and it stands high in resistance to mosaic (see Bull. 19). Its reaction to gum disease has not been determined.

The following selected analyses show its sugar-producing qualities:

	Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	Red S.	Purity	Fiber
Low land	B-109 .....	1913....	.....	.....	.....	16.14	13.88	.....	86.0	.....
	B-109 .....	12-20-20	Rat. 14 Mo.	No....	72.0	17.0	13.59	1.29	79.98	10.64
	<i>Cristalina</i> ..	12-20-20	Rat. 14 Mo.	No....	70.0	17.5	13.53	0.28	88.74	9.60
Hill land	B-109 .....	12-21-20	Pl. 15 Mo.	Yes....	65.3	18.78	16.51	1.04	87.91	12.94
	<i>Cristalina</i> ..	12-21-20	Pl. 15 Mo.	No....	65.7	18.88	17.08	0.52	90.65	13.72
	B-109 .....	2-4-21	Pl. 16 Mo.	No....	67.3	20.7	19.09	0.55	92.07	10.78
	B-109 .....	2-4-21	Pl. 16 Mo.	Yes....	64.2	20.55	19.05	0.39	92.70	10.71
	<i>Cristalina</i> ..	2-4-21	Pl. 16 Mo.	Yes....	65.2	18.40	17.27	0.65	93.85	11.83

#### B-114.

Included in the variety experiment at Carmen, Central Aguirre, Mr. Crawley's notes say "a green, long-jointed cane." When cut January 31, 1911, this plot gave the following results: tons cane, 68.59; brix, 16.90; sucrose, 13.25; purity, 78.4; tons sugar, 6.42.

We have no other records of this cane. Not seen.

#### B-147.

Introduced from Antigua in 1909 by Mr. Sewall, but he remarks that it was previously grown at Mayagüez. He notes that it is good as both plant and ratoon but that it is hard to establish. In November 1910 Mr. Murphy notes that it was growing slowly at Guánica, and in January 1913 that it had been abandoned as it did not seem to succeed. Not seen.

#### B-156.

Introduced from Antigua in 1909 by Mr. Sewall. He notes that it was easy to establish and was rich in sugar but not heavy in

tonnage. It does not seem to have been planted elsewhere. Not seen.

**B-208.**

Parentage unknown. Introduced from Antigua by Sewall in 1909 but he notes that it had been previously grown at Mayagüez. A large field of it in good condition was noted at Central Fortune by Mr. Crawley in August 1910. Included by Murphy in a list of best canes for Guánica December 28, 1910. Mentioned by McConnie among the best canes for Fajardo, June 24, 1913. Frequently seen in all parts of the Island but particularly on the south and east coasts, where considerable fields of it are still cultivated.

Erect or at length declined, vigorous, medium stooling, seldom arrows. Stalks medium length, medium stout to stout, green, usually no flush, somewhat glaucous. Internodes short, tumid, usually abruptly enlarged below at the back, furrow evident but shallow. Nodes narrow, strongly constricted; growth ring narrow, at first yellow, then concolorous and inconspicuous; root band narrow, oblique 5 to 8 mm.; leaf scar glabrous; glaucous band narrow, strongly constricted, well defined. Buds subhemispheric but broader than long, about  $12 \times 10$  mm., not exceeding the growth ring, margin narrow but distinctly shouldered, germination subdorsal, soon developing on the standing stalk, with a scanty apical tuft of long hairs. Leaf sheaths with a dense vestiture of long erect pallid hairs, green or somewhat tinted, rather glaucous, stained with purple at base within; throat lannate, and with an abundant vestiture of long soft hairs; collar conspicuous, reaching the midrib, the center densely glaucous, the margins lannate with short white hairs; ligule medium width, about 3 mm., edge fimbriate; ligular processes usually none. Leaf blades semi-erect, not numerous, broad, reaching 8 to 9 cm., rather short and abruptly pointed, sharply serrulate, the base a little ciliate.

This was the first of the Barbados seedlings to attract widespread attention. It has been carried all over the world and has been tested wherever cane is grown on a commercial scale. At times it gives splendid results both in tonnage and sucrose, but its behavior has been too uneven to be fully satisfactory. It is by no means a general-purpose cane, being confined to a rather narrow range of soil conditions. It requires a rich, moist but porous and well-drained soil. In fact its requirements are much the same as those of the Otaheite but it is even more intolerant of drouth. In Porto Rico it does well on "semi-poyals" and alluvial *vegas*, especially where irrigation is available. In such localities it ratoons much

better than Otaheite and it is to be strongly recommended, especially for late spring planting, since it matures fairly early. It is not adapted to hard, dry, exhausted soils.

On suitable soils it is fairly resistant to root disease, as shown by its good ratooning power, but it is very susceptible to mosaic, taking the disease easily and suffering seriously when attacked. It is, too, somewhat susceptible to the gum disease and should not be planted where that is prevalent.

Its great reputation for unusual sweetness is hardly sustained by our records. With all of the conditions fully favorable it will doubtless sometimes exceed Cristalina in the per cent of sucrose, but as seen from the following selected analyses it frequently falls below that standard kind when taken under comparable conditions.

Kind	Date	Age	Extr.	Brix.	Sucr.	Red. Sug.	Purity	Fiber
B-208	Feb. 1912	Pl.		17.1	13.9	1.2	81.3	
B-208	1913	Rat.		19.95	15.63		93.6	
B-208 <sup>1</sup>	3-12-18	Pl.		17.3	14.71		85.02	
B-208 <sup>2</sup>	1-5-20	Rat. 14 Mo.	66.4	18.98	16.99		89.50	
B-208	12-6-20	Rat. 13 Mo.	62.7	15.0	12.07	1.99	81.66	10.27
Average of 5 Cheribon canes	12-6-20	Rat. 13 Mo.			13.69	1.67	85.88	12.29
B-208	12-15-20	Rat. 14 Mo.	70.1	18.15	15.37	0.89	87.43	9.56
Cristalina	12-15-20	Rat. 14 Mo.	70.0	17.50	15.33	0.28	87.50	9.68
B-208	1-24-21	Rat. 15 Mo.	62.9	17.70	15.05	0.85	87.50	11.85
Cristalina	1-24-21	Rat. 15 Mo.	70.3	17.85	16.14	0.33	90.42	10.69
B-208	2-9-21	Pl. 16 Mo.	61.0	18.00	15.73	1.03	87.22	11.52
Cristalina	2-9-21	Pl. 16 Mo.	68.7	16.20	13.85	0.95	85.40	11.20
B-208 <sup>3</sup>	Apr. 1913	Pl.			18.08		98.6	
B-208 <sup>4</sup>	3-18-11	(Sewall Naguabo)		22.40	22.0		98.20	
B-208	Mar. 1912	(Guánica Reports)		18.6	15.7		81.9	
Otaheite	Mar. 1912	(Guánica Reports)		17.3	14.3		79.7	
B-208	Mar. 1912	(Guánica Reports)		18.2	15.2		81.4	
Otaheite	Mar. 1912	(Guánica Reports)		17.7	14.9		82.2	
B-208	Mar. 1913	(Guánica Reports)		20.4	26.6		81.4	
Otaheite	Mar. 1913	(Guánica Reports)		18.7	14.9		79.8	
B-376	Mar. 1913	(Guánica Reports)		19.4	16.1		82.8	

<sup>1</sup> Was seventh in sucrose in a lot of 20 kinds.

<sup>2</sup> Was fifth in sucrose out of 37 kinds. Cristalina average of 3 plots, 17.27 per cent; B-376, 18.18 per cent; B-1809, 17.42 per cent; P. R.-208, 17.54 per cent.

<sup>3</sup> Highest for the year in sucrose.—Cowgill.

<sup>4</sup> The highest analyses found in our records for any cane.

### B-306.

Introduced from Antigua in 1909 by Mr. Sewall, who remarks "already grown at Mayagüez as No. 347." It seems to have been grown on the Station grounds as B-306 up to 1913, since that date it has been called B-347. It has been impossible to determine which is really the correct name for this cane.<sup>1</sup>

<sup>1</sup> Brief notes in Proc. Agric. Soc. Trinidad, Tob. 9: 102, 1909, indicate that B-306 is a yellow cane not unlike Otaheite while B-347 is called a dingy purple cane of heavy growth. If this is correct, our cane is B-306 and not B-347.

B-347.

Parentage unknown. Introduced from Audubon Park, Louisiana, by D. W. May in 1904. Reintroduced by Mr. Sewall (see above) as B-306. Still planted at both Centrals Fajardo and Guánica but on a less scale than formerly. Frequently seen in mixed cultures, especially on the south and east coasts. It is quite abundant in the fields at Central Fortuna.

Erect or at length decumbent, good vigor, medium stooling, arrows occasionally. Stalks long, medium diameter, green, yellow on maturity, no flush, little or no bloom. Internodes medium to long, slightly flattened, strongly staggered, often marked with whitish blotches, furrow slight or sometimes none. Nodes slightly constricted; growth ring narrow slightly sunken, concolorous; root band strongly oblique, 6 to 10 mm., concolorous; rudimentary roots large but inconspicuous, concolorous, in about 3 rows; leaf scar at first conspicuously ciliate, later often glabrate, prominent, not appressed behind; glaucous band broad, well marked. Buds large, oval, obtuse, often reddish, 10 to 12  $\times$  15 mm., margin uniform rather wide, usually exceeding the growth ring, germination subapical, basal plaes an apical tuft and lines of hairs on the sides. Leaf sheaths with a dense vestiture of pallid hairs, green or very slightly tinted, somewhat glaucous, slightly stained, with purple at base within; throat dark brown, densely lannate and with a circle of short dark hairs behind the ligule; collar dark, rather broad, reaching the midrib, lannate; ligule medium width, about 3 mm., margin even; ligular processes none. Leaf blades numerous, somewhat two ranked, strictly erect. plicate and revolute, bright green, 7 to 8 cm. wide, very minutely serrulate, the base even, not ciliate.

This is a thoroughly good, medium season, general-purpose cane. It perhaps has nothing to specifically recommend it in preference to Cristalina and Rayada, though on some soils it will quite certainly outyield these kinds and will probably ratoon longer. It prefers moist rather than dry land. When immature it has less sugar than Cristalina in the same condition, but when fully ripe it is equally as good. It is a soft cane and is often badly damaged by rats. It may be planted either in fall or spring.

It resists root disease rather better than Cristalina. It is probably susceptible to mosaic but it was accidentally omitted from the immunity test at Santa Rita and we have no positive observations.

Neither has its reaction to gum disease been tested.

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	Red. S.	Purity	Fiber
B-347 .....	12-28-20	Rat. 9 Mo.	No	74.06	14.89	12.03	2.12	80.77	8.12
B-347 .....	12-28-20	Rat. 9 Mo.	Yes	72.7	17.09	14.81	1.49	86.65	8.75
B-347 .....	12-10-20	Rat. 10 Mo.	No	71.7	13.33	10.37	2.93	74.44	7.77
Rayada .....	12-10-20	Rat. 10 Mo.	No	71.1	15.82	13.45	1.78	84.96	8.08
B-347 .....	1-5-21	Pl. 15 Mo.	No	71.1	16.06	14.90	1.12	87.85	11.56
Cristalina .....	1-5-21	Pl. 15 Mo.	No	66.6	16.96	15.35	0.56	90.56	11.35
B-347 .....	2-0-21	Pl. 16 Mo.	No	62.9	18.50	16.90	0.68	91.35	11.87
Cristalina .....	2-5-21	Pl. 16 Mo.	No	68.7	18.20	13.85	0.95	85.49	11.20
B-347 .....	1-26-2	Rat. 15 Mo.	No	68.7	19.05	17.20	0.52	90.81	11.26
B-347 .....	1-26-2	Rat. 15 Mo.	Yes	71.1	18.05	15.85	0.67	87.81	12.27
Cristalina .....	1-26-2	Rat. 15 Mo.	No	70.2	17.85	16.14	0.33	90.42	10.69

This cane was included in the Aguirre test plots in 1911 when it gave tons cane, 61.878; brix, 17.33; sucrose, 13.95; purity, 80.5; tons sugar, 6.08.

#### B-376.

Parentage unknown. Seems to have been introduced by Mr. Murphey from Barbados. It is mentioned in his reports under date of November 1910, and in October 1911 he reports 10 to 12 acres of it under cultivation at Central Guánica. It is still grown on a considerable scale at Central Fajardo, where 91 acres of it were harvested in 1917, and 66 acres in 1919.

The description of Cristalina will fit this cane word for word except that in B-376 the collar is glaucous or very slightly lannate on the extreme margins while in Cristalina it is lanuate throughout.

In cultural characters also it is almost the exact equivalent of Cristalina, though usually seeming a little more vigorous and often giving rather heavier tonnage. In one of the Fajardo reports it is noted as doing well on salty *poyals*.

In its behavior toward root disease and mosaic it is exactly equal to Cristalina. Its reaction to gum disease has not been determined, but doubtless like Cristalina it will be more or less susceptible.

As seen from the following selected analyses, it is the equivalent of Cristalina as a sugar producer. In fact, for all practical purposes it may be considered as a rather unusually vigorous strain of that standard kind and as such it has a very considerable value.

Kind	Date	Age	Extr.	Brix.	Sucr.	Red S.	Purity	Fiber
B-376 * .....	1-5-20	Rat. 14 mo.	68.0	20.05	13.18	.....	90.4	.....
B-376 .....	12-28-20	Rat. 9 mo.	68.0	16.33	14.67	1.04	88.1	8.98
B-376 .....	12-20-12	Rat. 14 mo.	70.5	16.43	14.67	0.35	89.4	10.58
Cristalina .....	12-20-12	Rat. 14 mo.	70.0	17.50	15.53	0.28	88.2	9.60
B-376 .....	1-26-21	Rat. 15 mo.	64.2	16.65	15.21	0.59	91.3	11.45
Cristalina .....	1-26-21	Rat. 15 mo.	70.3	17.85	16.14	0.33	90.4	10.69
B-376 .....	12-24-20	Pl. 15 mo.	62.6	18.48	17.0	0.37	91.9	10.19
Cristalina .....	12-24-20	Pl. 15 mo.	65.7	18.88	17.08	0.52	90.6	13.72
B-376 .....	2-7-21	Pl. 16 mo.	60.7	19.10	16.90	0.36	88.9	11.70
Cristalina .....	2-7-21	Pl. 16 mo.	68.6	17.90	16.14	0.80	90.1	13.81

\* The highest in sucrose out of 37 kinds. Cristalina average, 3 plots, 17.27; highest, 18.10.

## B-1030.

When imported and by whom unknown. There were  $27\frac{3}{4}$  acres of it at Central Mercedita, Ponce, in 1916 and it is still being grown there. It has also been grown on a small scale at Fajardo.

Soon decumbent, vigorous, a strong stooler, arrowing not noted. Stalks medium length and diameter, green with a dull, brownish-purple flush when exposed, a little bloom. Internodes medium length, somewhat barrel shaped, a little staggered, furrow none. Nodes constricted, oblique; growth ring rather wide, even, bright green, then concolorous; root band narrow, very oblique, 5 to 8 mm., concolorous; rudimentary roots inconspicuous, in 2 or 3 rows; leaf scar glabrous, appressed behind; glaucous band narrow, strongly constricted. Buds large, broadly ovate, obtuse, broader than long, 12 to  $14 \times 10$  to 12 mm., exceeding the growth ring, margin broad, shouldered, germination subdorsal, premature, the buds soon sprouting, vestiture scanty, indistinct basal places and an apical tuft. Leaf sheaths with dense vestiture of suberect tawney hairs, green or faintly tinted, glaucous; throat glaucous, with a few scattered medium long hairs; collar broad, pallid, glaucous or slightly lannate on the margins; ligule medium length, fimbriate; ligular processes none. Leaf blades erect, two-ranked, flat, broad, 9 cm., glaucous-green, minutely serrulate, the base slightly ciliate.

This cane germinates quickly, grows vigorously and stools unusually well. It has not been sufficiently tested to express a final judgment as to its value, but it promises to be very useful on account of its early maturity. It had more sucrose than any cane analysed during the first half of December. This is very important, for most of our heavy-tonnage canes are late in maturing and we are greatly in need of early kinds for grinding during the first part of the crop. Apparently this cane will serve also for late spring planting. Its greatest weakness seems to be its unusually strong tendency for the buds to sprout prematurely.

It was not included in the immunity experiment at Santa Rita. At Mercedita it is said to be about medium in its susceptibility to mosaic. It seems to ratoon well and promises to be fairly resistant to root disease. Its reaction to gum disease is not known.

Kind	Date	Age	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
B-1030, .....	12-6-20	Pl. 13 mo.	.....	17.88	15.10	1.53	84.44	9.90
Ave. of 5								
Cheribon..	12-6-20	Pl. 14 mo.	.....	.....	13.69	1.67	85.88	12.5
B-1030, .....	3-9-21	Pl. 16 mo.	66.00	19.70	18.45	0.42	93.64	12.5
Cristalina ...	3-9-21	Pl. 16 mo.	69.40	19.09	17.20	0.39	90.52	11.0

## B-1355.

Mr. Sewall received this cane from the Federal Station at Mayagüez, according to a note by Cowgill, but date is not given. It was growing at this Station in 1911 and 1913 from seed sent by Mr. Sewall but had disappeared from the collections until seed was brought from Central Mercedita in September 1919. Over ninety acres of it were grown at that Central in 1916 and it has been grown to some extent at Fajardo.

Soon decumbent, good vigor and stooling, arrowing not noted, stalks long, medium diameter, green with dull red flush, no bloom. Internodes, medium length, somewhat staggered, abruptly shouldered below at back, furrow none. Nodes constricted; growth ring very broad, 4 to 6 mm., even but encircling the shoulder of the internode, concolorous but often bordered with reddish; root band narrow, oblique, sharply constricted; rudimentary roots obscure, in about 2 rows; leaf scar strongly ciliate with stiff hairs 5 to 6 mm. long, appressed behind; glaucous band narrow, about 6 mm., strongly constricted. Buds ovate triangular, acute,  $10 \times 10$  to  $12 \times 12$  mm., exceeding the growth ring, margin broad, somewhat shouldered, germination apical, vestiture scanty at apex and margin, basal places well developed. Leaf sheaths with medium vestiture of soft appressed hairs, greenish, glaucous; throat sparingly lannate with some long hairs on the margins; collar pallid, reaching the midrib, sparingly lannate; ligule rather broad, 5 mm., edge fimbriate; ligular processes usually poorly developed. Leaf blades spreading, flat, rather narrow, about 6 cm., light green, margin closely but minutely serrulate, the base ciliate.

This seems to be a cane of only medium value, but not enough is known regarding its characteristic to express a positive opinion.

In the immunity experiment at Santa Rita it made a slightly better showing as regard root disease than the Rayada but fell in the same class in susceptibility to mosaic. Its reaction to gum disease is not known.

Its record at the Station as published in Circular 8 was rather low in total tonnage for the three crops, medium in sucrose and high in purity, the figures being, total tons, 3 crops, 56.75; brix, 16.81; average sucrose 15.71; purity, 93.3. Recent analyses are as follows:

Kind	Date	Age	Extr.	Brix.	Sucr.	Red. S.	Purity	Fiber
B-1355 .....	12-2-20	Pl. 13 mo.	67.3	15.3	12.54	3.06	81.96	11.77
Average of 5								
Cheribon ..	12-2-29	Pl. 13 mo.	.....	.....	13.69	1.67	85.88	12.29
B-1355 .....	3-9-21	Pl. 16 mo.	72.4	18.4	17.32	0.396	93.62	12.44
Cristalina ...	3-9-21	Pl. 16 mo.	69.4	19.4	17.20	0.20	90.52	11.01

**B-1356.**

Noted by Cowgill as having been received by Mr. Sewall from the Mayagüez Station. It was in cultivation at this Station in 1911 from seed sent by Mr. Sewall, Cowgill noting that it is scarcely distinguishable from B-1355. Its record in Circular 8 is total tons in 3 crops, 49.86; brix, 17.86; sucrose, 17.01; purity, 95.2, being the highest purity in the 24 kinds but next to the lowest tonnage. Not seen.

**B-1376.**

Noted as received from the Mayagüez Station by Mr. Sewall, from whom seed came to this Station in 1911, Mr. Murphey reports on it at Guánica in 1911. Was planted at Central Lafayette in 1914. Cowgill says "seems to be identical with Cristalina in appearance." Its record at this Station as published in Circular 8 was plant cane, 41.8 tons, total 3 crops, 67.6 tons, brix, 18.59; sucrose, 1820; purity, 94.8. The highest sucrose out of 24 kinds and next to the highest purity.

Not seen.

**B-1529.**

Introduced by Mr. Sewall from Antigua in 1911. Apparently never planted elsewhere.

Not seen.

**B-1566.**

This seems to have been introduced from Barbados by Mr. Murphey. It figures frequently in his reports from Guánica during 1911, 1912 and 1913 and seems to have attracted his very favorable attention. It is said to have decidedly outyielded Otaheite and to ratoon well and be free from rot. There were 4 acres at Guánica in 1915. It does not seem to have been planted elsewhere.

Not seen.

**B-1753.**

Noted by Mr. Sewall as received from the Mayagüez Station. Grown in considerable quantity at Guánica during 1910-1913, where it is frequently mentioned in Mr. Murphey's reports. He considered it as a very promising kind and frequently calls attention to the fact that it is strongly resistant to lime chlorosis. There were 81 acres of it at Guánica in 1915 but it is no longer cultivated there. It was included in the variety experiment at Aguirre in 1911 and was grown at Central Lafayette in 1914-1916. It was formerly considerably cultivated at this Station, seed having been brought

from Guánica in 1911, and although it produced the highest sugar per acre out of 24 kinds in the three-year tests reported in Circular 8 it is no longer found here and two recent attempts to bring in seed and reestablish it have failed. It has only been seen on the grounds of Central Mercedita at Ponce.

Strictly erect, vigorous, a strong stooler, arrowing not noted. Stalks slender,  $2\frac{1}{2}$  to 3 cm., green, yellow when mature, no flush and no bloom. Internodes medium long, straight, cylindrical, furrow usually evident but slight. Nodes scarcely constricted; growth ring narrow, inconspicuous, concolorous; root band narrow, 6 to 8 mm., yellow; rudimentary roots small, indistinct, in 3 to 4 rows; leaf scar glabrous; glaucous band narrow, 6 to 7 mm., conspicuous. Buds rather small, oval-ovate, with rounded narrowed base and acute point, about  $8 \times 10$  mm., exceeds the growth ring, margin very narrow, germination apical, base sides and apex with appressed hairs. Leaf sheaths subglabrate but with short brown hairs mixed with the bloom, glaucous. Leaf blades erect, narrow, light green.

This is an unusual cane and one clearly having many excellent qualities. It seems to have been dropped from cultivation solely because of its slender diameter, most planters having a strong but unfounded preference for stout canes. In the Aguirre plots in 1911 this kind gave tons cane, 59.165; brix, 17.97; sucrose, 13.80; purity, 76.8; tons sugar, 5.6. At Central Lafayette in 1914 as plant cane it gave, brix, 21.0; sucrose, 18.5; purity, 88.3. Cane grown at La Muda between Río Piedras and Caguas analyzed April 1917 as plant cane at 14 months gave, brix, 21.05; sucrose, 19.40; purity, 92.40. It was the highest in tonnage out of six kinds. Its record at the Station as published in Circular 8 is, plant cane, 50.22 tons; total, 3 crops, 105.72 tons; average brix, 17.42; sucrose, 15.58; purity, 89.4. It was exceeded in tonnage by D-625, Cavengerie, Sealy Seedling, and B-4596, but figured by the formula now used by Central Vannina in buying cane by sucrose content this gave the highest sugar per acre of any of the 24 kinds tested, averaging 4.09 tons sugar per acre for each of the three crops. It is hard to understand why, with such a record as this, this cane should have been abandoned.

It was not included in the immunity experiment at Santa Rita. At Central Mercedita, the only place where it is now grown, it is reported to be very seldom attacked by mosaic. Its ratooning power shows it to be fairly resistant to root disease. It has not been tested with gum disease. Its unusual resistance to lime chlorosis has already been noted.

## B-1809.

Parentage unknown. Introduced by this Station from Barbados in 1911. It is now in cultivation at Fajardo but has not been seen elsewhere.

Strictly erect, good vigor, medium stooling, seldom arrows. Stalks long, medium to medium stout, green, a slight reddish flush when fully exposed, only light bloom. Internodes rather long a little flattened, usually abruptly shouldered below on side opposite to bud furrow broad and rather deep. Nodes prominent, not constricted growth ring broad, prominently enlarged; root band prominent, enlarged above to meet the swollen growth ring; rudimentary roots in 2 or 3 rows; leaf scar glabrous; glaucous band slightly constricted well defined. Buds large, triangular-lanceolate, acute, 12 to 15 × 12 to 20 mm., exceeding the growth ring by one-half the length, margin narrow but shouldered; germination apical, apex bearded. Leaf sheaths with a scanty vestiture on the back which is soon deciduous becoming glabrate, green, glaucous; throat lannate and with a medium vestiture of hairs; collar broad, dark brown, reaching the midrib, glaucous, the margins sparingly lannate; ligule medium length, edge even; ligular processes none, or poorly developed. Leaf blades erect except the tips, medium width, 6 to 7 cm., bright green minutely but closely serrulate to the base.

This is a good, heavy-tonnage, general-purpose cane which matures fairly early. It may be safely planted as "Primavera." It is best adapted to *vega* lands but also grows well in the red shale hills. In 1915 it stood second in tonnage out of 20 kinds at this Station giving 9 tons more than Cristalina.

It was not included in the immunity experiment at Santa Rita but it has contracted mosaic on the Station grounds, being apparently in about the same class in regard to resistance as Rayada and Cristalina. Its reaction to gum disease is not known.

As seen from the following selected analyses, it is of about the same sucrose value as Cristalina:

Kind	Date	Age	Extr.	Brix.	Suer.	Red S.	Purity	Fiber
B-1809*.....	1915	Pl.....	.....	17.34	15.98	.....	89.3	.....
Cristalina.....	1915	Pl.....	.....	17.98	16.55	.....	92.0	.....
B-1809.....	May, 1916	Rat.....	.....	18.50	17.2	.....	92.98	.....
Cristalina.....	May, 1916	Rat.....	.....	18.80	17.8	.....	94.14	.....
B-1809.....	1-8-20	Rat. 14 mo.	63.2	19.15	17.52	.....	90.96	.....
B-1809.....	12-13-20	Rat. 10 mo.	69.4	17.36	14.61	1.90	84.0	12.2
Rayada.....	12-13-20	Rat. 10 mo.	71.1	15.83	13.45	1.76	84.96	8.0
B-1809.....	12-15-20	Rat. 14 mo.	70.8	16.63	14.23	2.02	85.56	11.6
Cristalina.....	12-15-20	Rat. 14 mo.	70.0	17.50	15.53	0.28	88.74	9.6
B-1809.....	2-2-21	Rat. 16 mo.	66.6	18.35	16.92	0.31	92.2	12.6
Cristalina.....	2-2-21	Rat. 16 mo.	70.3	17.85	16.15	0.33	90.42	10.6
B-1809.....	4-11-21	Pl. 17 mo.	64.50	18.80	17.40	0.531	92.55	11.5
Cristalina.....	4-11-21	Pl. 17 mo.	70.10	18.10	16.92	0.265	92.48	10.4

\* Fourth in sucrose out of 37 kinds. Cristalina average, 3 plots, sucrose, 17.27; highest, 18.18; P. R.-208, 17.59; B-376, 18.18.

B-3289.

Noted by Mr. Sewall that the seed came from the Mayagüez Station. Grown at this Station during 1912 and 1913 from seed received from Mr. Sewall. It was grown in a small way at Fajardo up to 1917 but its record there was poor, being twenty-second in tons sugar per acre out of 25 kinds. It was lowest in tons sugar per acre among the kinds tested at Aguirre in 1911, where its record was as follows: Tons cane, 59.702; brix, 16.47; sucrose, 12.89; purity, 78.3; tons sugar, 5.34. At this Station in 1913 it gave, tons cane, 34.05; sucrose, 16.58; purity, 89.9.

Not seen.

B-3390.

Said to be a seedling of D-95. Probably introduced from Barbados by Mr. Murphey. At least he reports on it as in cultivation at Guánica in 1911, at which date seed was brought to this Station from there. It was at Fajardo as early as 1914. Brought to this Station from Fajardo in November 1919.

Soon prostrate, medium vigor and stooling, arrows freely. Stalks long, medium slender, dull green with red flush, light bloom. Internodes long, somewhat enlarged below, straight or nearly so, furrow evident but shallow. Nodes scarcely constricted, oblique, growth ring broad, 3 to 5 mm., nearly even, bright green; root band strongly oblique, concolorous, rudimentary roots rather crowded, in 3 or sometimes 4 rows; leaf scar glabrous, closely appressed behind; glaucous band narrow, somewhat constricted. Buds triangular-lanceolate, very long, 10 to 11  $\times$  15 to 20 mm., exceeding the growth ring by half or more of the length, margin medium, shouldered below, germination apical; basal places and scanty vestiture on sides and apex. Leaf sheaths glabrous, green scarcely glaucous; throat broad, densely lanate, very few long hairs; collar broad reaching the midrib, lanate; ligule very narrow, about 2 mm., somewhat fimbriate; ligular processes none. Leaf blades spreading, somewhat plicate rather narrow, about 6 cm., light green, very sparingly serrulate nearly even, base not ciliate.

But little is known as to the agricultural value of this cane. It has a good record on red lands in Barbados.

It was included in the immunity experiment at Santa Rita but was in the small list that failed to contract the mosaic. Nothing is known as to its resistance to either of the three serious diseases.

The only available analyses are the following:

Kind	Date	Age	Extr.	Brix.	Sucr.	Red. S.	Purity	Fiber
B-3390 .....	1915	.....	.....	18.0	16.45	.....	91.5	.....
Cristalina .....	1915	.....	.....	17.98	16.55	.....	92.0	.....
B-3390 .....	May 1916	Rat .....	.....	18.4	17.2	.....	93.47	.....
B-3390 .....	1-14-21	Pl. 14 mo. ....	60.6	15.10	12.05	1.69	79.80	12.60
Cristalina .....	1-14-21	Pl. 15 mo. ....	70.0	17.25	15.96	0.37	92.52	9.60
B 3390 .....	4-8-21	Pl. 17 mo. ....	69.7	18.30	16.18	0.653	88.41	10.50

#### B-3405.

A seedling of D-74. Probably introduced by Mr. Murphey from Barbados. It is mentioned in his Guánica reports for 1911. It first came to this Station from Guánica in 1911. It was reported from Fajardo in 1913 and is still cultivated there. The first record at this Station is in 1911. Seed cane has been distributed to planters in many parts of the Island.

The description given under Sealey Seedling fits this cane in every particular except that the collar is lannate while in the former it is glaucous or only slightly lannate on the extreme margins. This cane is also usually a little stouter and the leaves average a little broader, but these differences can hardly be exactly defined.<sup>1</sup>

This is a vigorous cane of heavy tonnage and is an especially strong ratooner. It is adapted to either high or low lands. It can be safely recommended for general planting on lands where Rayada and Cristalina are beginning to fail. It is however, rather late in maturing and should be planted in the fall as *grand cultura*, or if planted in the late spring it should be held over until the second year. If cut too green this cane is very poor in sugar, but when fully matured it develops a very satisfactory percentage of sucrose and purity.

It is quite resistant to root disease, as shown by its great ratooning power. It was not included in the immunity experiment at Santa Rita, so its behavior toward mosaic has not been fully tested. Some plots at Central Coloso of what was believed to be this cane were showing rather unusual resistance to it. Its reaction to gum disease has not been determined.

<sup>1</sup> From brief descriptions of Sealey Seedling, B-3405 and B-3412 recently published in Rept. Imp. Dept. of Agric. West Indies, Sugar Cane Experiment in Leeward Islands, Antigua and St. Kitts—Nevis, 1918-19 (issued 1921) pp. 4-5, it seems probable that all of the material we have here in Porto Rico under these three names really belongs under B-3412. That is described as "erect, narrow, light-green leaves, medium-sized cane, slightly zig-zag. Internodes cylindrical, fairly long and slender, well-defined channel. Color greenish brown. Buds conical, long and pointed. Arrows sparsely." This fits our cane in every particular. Sealey Seedling differs in color, being brownish green to brownish yellow, and in arrowing very freely. B-3405 is described as a russet-brown cane with broad, flat, adhering buds. We have no cane in Porto Rico which fits this description.

A few selected analyses follow:

Kind	Date	Age	Extr.	Brix.	Sucr.	Red. S.	Purity	Fiber
B-3405	1915	Plant.	.....	17.17	15.19	.....	88.4	.....
Cristalina	1915	Plant.	.....	17.98	16.35	.....	92.0	.....
B-3405	May 1916	Rat.	.....	18.6	17.1	.....	91.98	.....
Cristalina *	May 1916	Rat.	.....	18.8	17.8	.....	94.14	.....
B-3405	12-8-20	Rat. 10 mo.	77.0	13.21	9.17	3.27	68.66	10.12
Cristalina	12-8-20	Rat. 10 mo.	73.0	15.63	13.41	1.78	85.76	10.80
B-3405	12-12-20	Rat. 14 mo.	70.9m	15.13	12.15	2.36	80.30	9.32
Cristalina	12-12-20	Rat. 14 mo.	70.0	17.50	15.53	0.28	88.74	9.60
B-3405	2-2-21	Rat. 16 mo.	65.7	17.10	15.17	0.988	88.12	12.37
Cristalina	2-2-21	Rat. 16 mo.	70.3	17.85	16.84	0.39	90.42	10.69
B-3405	4-12-21	Pl. 18	70.4	18.70	17.73	0.533	91.60	11.84

\* Third in tonnage both as plant and ratoon out of 20 kinds

### B-3412.

Seedling of D-74. Presumably introduced from Barbados by Mr. Murphey. It figures prominently in his Guánica reports for 1910, 1911 and 1912. It is still one of the principal canes planted there, especially on hill lands. Seed was brought to this Station from Guánica in 1911. It has also been largely planted at Fajardo, but is being abandoned there as it is considered too low in sugar. It is to be seen in all parts of the Island and is probably more widely planted than any of the other Barbados seedlings.

For description see Sealey Seedling (and note under B-3405), from which it can be distinguished, if at all, only by the less lannate throat. It perhaps averages a little stouter than the form we have as Sealey Seedling, but it varies greatly in diameter according to vigor and condition of growth.

In agricultural value it seems to resemble B-3405 and Sealey Seedling as closely as in taxonomic characters. It has been much more widely planted than either of them, especially at Central Guánica, but it is hard to see on what grounds it can be separated from them. It grows best on low, moist lands but in such localities it is difficult to ripen it enough to develop much sucrose. It is therefore usually planted as a hill-land cane. It is to be recommended for lands where Rayada and Cristalina fail, but great care should be taken not to cut it green. When really mature it makes a good yield of sugar and it can be depended on for better tonnage than Cristalina.

This kind has good resistance to root disease and always ratoons well. It is usually considerably troubled with leaf spot, sometimes enough so to interfere with growth, especially when young. It is noted in some of the Guánica reports that it resists the lime chlorosis as well as B-1753. Its behavior toward mosaic is peculiar in that

it takes the disease less readily than some other kinds, but when once attacked it suffers severely, turning quite yellow and being conspicuously dwarfed. Its reaction to gum disease has not been determined.

The following selected analyses indicate how poor it is in sugar when green but that it sweetens up well at full maturity.

Kind	Date	Age	Extr.	Brix.	Sucr.	Red. S.	Purity	Fiber
B-3412 .....	4-17-17	Pl. 14 mo.	.....	20.40	18.50	.....	90.70	.....
B-3412 .....	2-12-17	Pl. 16 mo.	.....	15.50	12.54	.....	80.90	.....
B-3412 .....	12-15-20	Rat. 14 mo.	73.40	12.51	8.30	3.42	66.34	10.60
Cristalina ...	12-15-20	Rat. 14 mo	70.0	17.50	15.53	0.28	88.74	9.60
B-3412 .....	1-26-21	Rat. 15 mo	70.8	14.15	10.74	2.006	70.89	11.06
Cristalina ...	1-26-21	Rat. 15 mo.	70.3	17.85	16.14	0.33	90.42	10.69
B-3412 .....	4-11-21	Pl. 18 mo.	71.2*	17.70	16.02	0.53	90.55	12.67
B-3412 .....	2-7-21	Pl. 16 mo.	72.1	16.80	14.64	1.30	87.27	10.37
Cristalina ...	2-7-21	Pl. 16 mo.	68.6	17.90	16.14	0.803	90.16	13.01

#### B-3578.

No data as to introduction. It was included among the canes sent from Fajardo for the immunity test at Santa Rita. Seed was also brought to this Station from Fajardo in November 1919. There is no other record of its occurrence in the Island.

It is so little cultivated that a description is omitted.

It failed to contract the mosaic in the Santa Rita experiment. It seemed to resist root disease unusually well and came through to the end of the experiment in good general condition and vigor.

#### B-3675.

Mentioned in Mr. Murphey's notes from Guánica in 1912. It seems to have been in cultivation at this Station in 1913 but the record is not clear.

Not seen.

#### B-3696.

Mr. Sewall's notes show that he obtained seed of this kind from the Federal Station at Mayagüez. Seed from him was planted at this Station in 1911. It does not seem to have been grown at Guánica but was included in the variety test at Aguirre in 1911. It is grown on a small scale only at Fajardo. Seed was again brought to this Station in November 1919, this time from Fajardo. This is now the principal cane planted on the farm of the Hatillo Fruit Company near Río Piedras. Some seed was obtained by them at this Station some years ago that was labeled B-3747. As it seemed to give good results the planting was extended from time to time and it was not noted until the spring of 1920 that two kinds of cane

were represented. The greater part was of this kind as described below but a small portion was clearly different having a conspicuously ciliate leaf scar. This temporarily led to further confusion, as from this character it was carelessly considered to be B-3922. It now appears that this is the true B-3747 while the greater part of the planting is B-3696.

Erect, seldom decumbent, good vigor, free stooling, seldom arrows. Stalks long, medium diameter, dull green with a red flush when exposed, medium bloom. Internodes medium to long, laterally compressed, somewhat inequilateral, the front straight and the back somewhat convex, conspicuously staggered, furrow well developed. Nodes but little constricted, oblique; growth ring medium width, slightly depressed, bright green; root band oblique, 6 to 8 mm., slightly elevated, concolorous; rudimentary roots crowded, small, inconspicuous, in 3 or 4 rows; leaf scar glabrous, appressed behind; glaucous band well marked, slightly constricted. Buds ovate, obtuse  $12 \times 15$  mm., exceeding the growth ring by one-half, margin rather broad, uniform, germination apical, basal plane and a marginal vestiture of white hairs. Leaf sheaths with sparse vestiture of short hairs soon glabrate, green, not glaucous; throat lannate and with tufts of long hairs at the margins; collar narrow, not reaching the midrib, glaucous, the margins lannate; ligule about 3 mm., the margin even; ligular processes small, poorly developed. Leaf blades spreading, flat, rather narrow, about 6 cm., light green, very minutely serrulate, the base even, not ciliate.

This seems to be a good general-purpose cane yielding a fairly good tonnage. It does not ripen quite as early as *Cristalina* but at full maturity it develops high sucrose and purity.

It was included in the Santa Rita immunity experiment, but a very poor stand was secured and the few plants which survived failed to take the mosaic. It has contracted it, however, at the Hatillo Fruit Company farm, seeming to suffer about like the *Rayada*. Its reaction to gum disease has not been determined.

In the Aguirre test plots in January 1911 it gave: tons cane, 70.305; brix, 17.65; sucrose, 14.77; purity, 83.7; tons sugar, 7.47.

This is a fine record, though the cane was evidently still green when cut. Its best record is for a car from the Hatillo Fruit Company ground at Central Vannina June 11, 1920, which gave; brix, 22.2, sucrose, 20.35; purity, 91.67. It was sold on the basis of sucrose content and under the prevailing terms brought 9.89 per cent to the grower in sugar on the total weight of cane. A cane

capable of such a record is certainly worth further trial. Some recent analyses of immature cane are as follows:

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Puri	Fiber
B-3696 .....	1-12-21	Pl. 15 mo.	No	72.7	14.95	11.66	2.09	77.99	9.82
Cristalina .....	1-12-21	Pl. 15 mo.	No	70.0	17.25	15.96	0.87	92.51	9.60
B-3696 .....	2-11-21	Pl. 16 mo.	No	72.9	16.65	13.59	1.92	81.62	11.92
Rayada .....	2-11-21	Pl. 16 mo.	No	63.6	17.15	15.25	0.81	88.92	12.37
B-3696 .....	4-11-21	Pl. 18 mo.	No	71.6	17.60	15.85	0.77	90.05	11.36

#### B-3708.

Mr. Sewall notes having received this cane from the Mayagüez Station. This Station received it from Mr. Sewall in 1911. Ratoons in 1913 gave: tons, 27.87; brix, 18.88; sucrose, 17.88; purity, 94.7. Its record in Circular 8 is, total tons for 3 crops, 47.81; brix, 18.44; sucrose, 17.27; purity, 93.6. The lowest in tonnage out of 25 kinds.

Not seen.

#### B-3747.

This kind was included in the plantings made at this Station in 1911. Seed from Central Guánica. In 1915 as plant cane it gave: tons cane, 27.42; brix, 19.19; sucrose, 17.81; purity, 92.8. Cristalina from same field gave, tons, 22.10; brix, 17.98; sucrose, 16.55; purity, 92.0. There is no other record of this cane in Porto Rico except the planting on the farm of the Hatillo Fruit Company already noted. Where recently sorted out and planted in pure culture it is making a good growth and promises a heavy yield. An analysis made June 24, 1920, gave: brix, 21.12; sucrose, 19.07; purity, 90.29. Figuring according to the Vannina contracts at 65 per cent of the yield of sugar this would give 9.28 per cent to the grower. It closely resembles B-3922 but the cilia on the leaf scar are even longer and more abundant and the bud is a little longer and more acute.

#### B-3750.

Introduced by this Station in 1911 from Barbados. No records of results.

Not seen.

#### B-3819.

Probably introduced by Mr. Murphey from Barbados. It figures frequently in his reports from Guánica during 1911, 1912 and 1913, as much as 26½ acres of it was grown at Guánica in 1915. No record of its being planted elsewhere.

Not seen.

## B-3859.

Introduced by this Station in 1911 from Barbados. There is now a considerable acreage of it at the Hatillo Fruit Company's farm near Río Piedras from seed obtained here. Seed was sent from Fajardo for the immunity experiment at Santa Rita, where it seemed strongly resistant to mosaic. It is not grown on a field scale at Fajardo and does not seem to have been planted elsewhere in the Island. Seed was again brought to the Station in the fall of 1919 from the Hatillo Fruit Company farm.

It is a strong-growing dark-purple cane but it has not been sufficiently tested to venture an opinion as to its real value. In 1915 as plant cane it gave: tons, 26.10; brix, 16.63; sucrose, 14.56; purity, 87.5. On January 14, 1921, as plant cane at 15 months it only gave, brix, 14.10; sucrose, 10.84; purity, 76.87; showing that it is rather late in maturing.

## 3-3922.

Seedling of B-647. Probably introduced from Barbados by Mr. Murphey. It is frequently mentioned in his reports at Guánica during 1911 and 1912. Seed was brought here from Guánica in 1911. It was being very extensively planted at Guánica up to the mosaic outbreak in 1919. Since then it has been less planted, since it suffers seriously from this disease. It was in cultivation at this Station in 1911 and 1912. It has been somewhat cultivated at Fajardo but with less satisfactory results than at Guánica. Not seen in other parts of the Island.

Erect but at length declined, vigorous, a good stooler, seldom arrowing. Stalks long, medium diameter, green with a reddish flush, light bloom. Internodes medium to long, nearly cylindrical but a little flattened, sometimes shouldered below, straight or a little staggered, sometimes checking in lines, furrow slight but evident. Nodes slightly constricted, oblique; growth ring poorly defined, often purplish; root band oblique, narrow, 5 to 8 mm., concolorous, rudimentary roots small, crowded, in about 3 rows; leaf scar conspicuously ciliate with white, erect hairs about 3 mm. long; glaucous band well marked, about 8 mm., somewhat constricted. Buds usually tinted, broadly triangular-ovate, obtuse, often broader than long, 10 to 12 × 10 mm., slightly exceeding the growth ring, margin medium width, uniform, germination apical or subapical, with basal places and scanty marginal vestiture. Leaf sheaths with short scanty vestiture, green, little or no bloom; throat narrow, pallid, sparingly lanate, and with a circle of scattered, rather stout hairs, especially on the margins; collar narrow, pallid, scarcely reaching the midrib, minutely lanate; ligule about 3 mm., minutely fimbriate; ligular

processes none or poorly developed. Leaf blades spreading or somewhat erect, about 6 cm., light green, minutely serrulate, the base somewhat ciliate.

In the Guánica district, where it usually planted as *gran cultura*, this cane gives a heavy tonnage and very satisfactory sucrose. It has not been sufficiently tested elsewhere.

It is fairly resistant to root disease and ratoons well but it suffers seriously from mosaic, being rather more susceptible than Rayada and Cristalina. Its resistance to gum disease has not been tested. It is a soft cane and is often eaten badly by rats.

In January 1914 one plot at Guánica gave: tons cane, 60.81; sucrose, 14.7; purity, 82.8. The remainder of the field in other varieties gave only 42.82 tons. In February 1914 another field gave: tons cane, 62.84; sucrose, 15.6; purity, 85.9; tons sugar, 7.66. Fajardo in 1916 reports: tons cane, 21.55; sucrose in cane, 12.6; purity, 89.4; tons sugar, 2.71. Other reports are still lower. The few available late analyses follow.

Kind	Date	Age	Extr.	Brix.	Sucr.	Red S.	Purity	Fiber
B-3922 .....	12-15-20	Rat. 14 mo.	70.9	14.33	10.39	2.70	72.50	11.45
Cristalina ...	12-15-20	Rat. 14 mo.	70.0	17.50	15.53	0.28	88.74	9.60
B-3922 .....	2-11-21	Pl. 16 mo.	71.8	17.05	15.35	0.91	90.02	12.40
Rayada, .....	2-11-21	Pl. 16 mo.	63.6	17.15	15.25	0.81	88.92	12.37

#### B-4028.

Seed of this kind was brought to this Station from Guánica in 1911. It is growing in the Fajardo Experimental plots but it does not seem to have been extended on a field scale. Seed was brought from Fajardo to this Station in November 1919. It was also sent from Fajardo for the immunity test at Santa Rita but it failed to germinate.

#### B-4507.

Introduced from Antigua by Mr. Sewall in 1911. It does not seem to have been planted elsewhere.

Not seen.

#### B-4578.

This kind was planted at this Station in 1911 with seed brought from Central Guánica. Only very poor yields are recorded. It does not seem to have been planted elsewhere.

Not seen.

B-4596.

Seedling of B-521. Introduced from Antigua by Mr. Sewall in 1909. Mentioned in Mr. Murphey's reports from Guánica in 1910 but seems to have been very little planted there. It has been planted in a small way at Fajardo for a number of years, 13.55 acres being harvested in 1919. It was tested at Central Lafayette, 1914-1916. It has been considerably planted at this Station, seed being obtained from Mr. Sewall in 1911, and seed has been widely distributed on account of supposed disease resistance.

Erect, or at length decumbent, vigorous, a free stooler, arrows frequently. Stalks long, medium to medium small diameter, green with dull reddish flush, usually checking in lines, but little bloom. Internodes medium length, flattened, slightly tumid, nearly straight, furrow fairly well marked. Nodes constricted, oblique, growth ring narrow, inconspicuous even, concolorous; root band narrow, oblique 5 to 8 mm., bright green; rudimentary roots large, yellowish, crowded, in 2 or 3 rows; leaf scar glabrous, appressed behind; glaucous band, narrow, 7 to 8 mm., sharply constricted, conspicuous. Buds large, broadly ovate, obtuse, 12 to 13  $\times$  12 to 13 mm., exceeding the growth ring, margin broad 2 mm. or more slightly shouldered, germination subapical, nearly glabrous apical and marginal hairs short and scanty. Leaf sheaths glabrous, green, glaucous; throat lannate and with a sparing vestiture of medium hairs on the margins; collar broad, pallid, reaching the midrib, glaucous the margins lannate; ligule about 4 mm., the margin undulate and slightly fimbriate; ligular processes none. Leaf blades spreading, abundant, flat, somewhat 2 ranked, 6 cm., light green, minutely serrulate, the base even, not ciliate.

The agricultural value of this cane is still uncertain. It is adapted to low, wet, compacted lands where Rayada begins to fail and in such localities it gives heavy tonnage and ratoons well. It makes a poor growth in dry hill lands. It is very late in maturing and when green gives the lowest sucrose and purity of any kind tested. Our records are far from complete but they fail to show that it ever develops more than a very ordinary degree of sweetness.

This cane is undoubtedly very resistant to root disease but this seems to be its only virtue. It was among the very few kinds which developed no top rot whatever in the Santa Rita immunity test. At one time it was recommended as having great resistance to mosaic, but this claim has not been substantiated. It perhaps takes the disease a little less readily than some other kinds, but when attacked it suffers nearly as much as the Rayada. Its resist-

ance to gum disease has not been determined. As a cane for low compacted lands it seems to have no advantage over yellow Caladonia, and in our tests it invariably falls below this kind in sucrose and purity. It should only be planted for some special object and with these facts in mind.

In Circular 8 its record is third in tonnage out of 25 kinds total tons, 3 crops, 108.5; brix, 15.03; sucrose, 12.73; purity, 84.2 or an average yield of 3.31 of sugar. The Fajardo reports indicate an average of 3.38 tons sugar per acre in 1916-17 and 2.72 tons in 1918-19. At Central Lafayette as plant cane in 1914 it gave, brix 19.8; sucrose, 17.6; purity, 88.8, which is the highest analysis in our records. Other analyses follow:

Kind	Date	Age	Extr.	Brix.	Sucr.	Red S.	Purity	Fiber
B-4596 .....	1-5-20	Rat. 14 mo.	65.0	13.27	10.15	.....	76.50	.....
B-4596 .....	12-20-20	Rat. 14 mo.	71.0	13.30	9.34	2.34	70.22	11.6
Cristalina .....	12-20-20	Rat. 14 mo.	70.0	17.50	15.53	0.28	88.74	9.6
B-4596 * .....	1-14-21	Pl. 15 mo.	68.7	13.10	9.64	2.41	73.58	10.6
Cristalina .....	1-14-21	Pl. 15 mo.	70.0	17.25	15.96	0.87	92.52	9.6
B-4596 .....	4-13-21	Pl. 18 mo.	68.4	16.00	13.65	1.46	85.31	12.6

\* Lowest in sucrose out of 40 kinds.

#### B-4934.

Was in cultivation at this Station from 1911 to 1916. The seed came from Central Guánica. It does not seem to have been cultivated elsewhere.

Not seen.

#### B-6032.

Probably imported from Barbados by Central Mercedita of Ponce Seed was brought to this Station from that Central in fall of 1919. It has been badly attacked by mosaic at Mercedita.

#### B-6048.

Mr. Sewall notes that this kind came from the Mayagüez Station. It was in cultivation at this Station 1911 to 1916 with seed sent by Mr. Sewall but had disappeared. It is in the experimental plots at Fajardo and seed was again obtained there in November 1919. In the Santa Rita immunity experiment it was strongly resistant to root disease and developed no top rot but is was quite susceptible to mosaic.

#### B-6292.

A seedling of T-24. This kind was imported by this Station from Barbados in 1911. It does not figure in the available reports from either Guánica or Fajardo.

Erect or tardily decumbent, vigorous, good stooler, arrows occasionally. Stalks long, medium to medium slender, green with a dull red flush, but little bloom. Internodes medium length, somewhat compressed, inequilateral, slightly tumid on side opposite bud, furrow shallow but evident. Nodes slightly constricted, oblique; growth ring medium width, often slightly elevated, greenish; root band oblique, 6 to 10 mm., greenish; rudimentary roots crowded, whitish, in 3 or 4 rows; leaf scar glabrous, appressed behind; glaucous band slightly constricted, 8 to 10 mm., well marked. Buds broadly ovate, obtuse, sometimes broader than long, about  $14 \times 14$  mm., exceeding the growth ring by one-third, margin broad, about 2 mm., uniform, germination apical or subapical, usually soon developing, with heavy basal plates and abundant marginal and apical vestiture. Leaf sheaths with rather scanty but long and coarse vestiture, green or sometimes a little tinted below, not glaucous; throat often crinkled, lannate, and with scanty marginal hairs; collar reddish brown, glaucous, the margins lannate; ligule about 4 mm., the edge uneven and fimbriate; ligular processes none or small and poorly developed. Leaf blades abundant, flat, spreading, 5 to 6 cm., light green, minutely serrulate, the base even, not ciliate.

This is a valuable kind, especially for *vega* lands. It is not so well adapted to dry hills. It should be planted in the fall as *gran cultura*, since it is slow in maturing. It is adapted to the same conditions as Yellow Caledonia and it may be expected to make equally as good tonnage and at full maturity to yield a larger per cent of sucrose.

In the Santa Rita immunity experiment it proved to be about equal to Rayada in root-disease resistance and to be rather more susceptible to mosaic. Its resistance to gum disease has not been determined.

The following items are from the Station records:

Kind	Date	Age	Tonnage	Brix.	Sucr.	Purity
B-6292 *	1915	Plant	37.10	16.33	14.75	90.8
Cristalina	1915	Plant	22.10	17.98	16.65	92.0
B-6292 †	May 1916	Rat.	25.60	18.00	17.2	92.45
Cristalina	May 1916	Rat.	18.80	18.8	17.8	94.14

\* First in tonnage out of 20 kinds.

† Second in tonnage out of 20 kinds both as ratoon and for two crops.

Recent analyses are as follows:

Kind	Date	Age	Extr.	Brix.	Sucr.	Red S.	Purity	Fiber
B-6292	12-15-20	Rat. 14 mo.	70.0	14.93	11.25	2.55	78.70	10.80
Cristalina	12-15-20	Rat. 14 mo.	70.0	17.60	15.63	0.28	88.78	9.60
B-6292	1-24-20	Rat. 16 mo.	70.9	13.60	10.45	1.52	76.89	11.64
Cristalina	1-24-20	Rat. 16 mo.	70.3	17.85	16.14	0.33	90.42	10.60
B-6292	2-7-21	Pl. 16 mo.	68.5	17.45	15.76	0.65	90.31	12.06
Cristalina	2-7-21	Pl. 16 mo.	68.6	17.90	16.14	0.803	90.16	13.81
B-6292	4-11-21	Pl. 18 mo.	68.5	18.50	17.24	0.60	93.18	11.34

B-6408.

This seems to have been introduced by Central Mercedita o Ponce. Seed was brought from there to this Station in November 1919. But little attacked by mosaic at Mercedita. It promises heavy tonnage.

B-6341.

Was imported by this Station from Barbados in 1911. It was the lowest in tonnage cut of 20 kinds in 1915 but one of the highest in sucrose.

Not seen.

B-6346.

Noted by Cowgill December 3, 1913, as seen in Mr. Sewall's collection at Naguabo. There is no other reference to this cane. [Is it possible that B-6436 was intended?]

B-6388.

This cane was in cultivation at this Station from 1911 to 1914 from seed brought Central Guánica. Its record was poor.

Not seen.

B-6436.

Introduced from Antigua in 1911 by Mr. Sewall. No other record of this cane has been found.

Not seen.

B-6450.

A seedling of T-24. It seems to have been introduced from Barbados by Mr. Murphey. It was not mentioned in his report from Guánica during 1910, but occurs frequently in his 1911 and 1912 reports. It is still planted at both Guánica and Fajardo and at Central Mercedita, Ponce. It has been sent out from this Station quite widely to different parts of the Island.

Soon decumbent, vigorous, good stooling, arrows infrequently. Stalks long, medium diameter, green, yellowing on maturity, little or no flush, sometimes checking in lines, some bloom. Internodes medium to long, somewhat tumid, usually enlarged below, more or less staggered, furrow broad but shallow. Nodes constricted, oblique growth ring broad, elevated, concolorous; root band oblique, 6 to 1 mm., concolorous; rudimentary roots large, closely crowded, whitish in about 3 rows; leaf scar glabrous, appressed behind; glaucous band, constricted, narrow, 6 to 8 mm., well marked. Buds large, ovate or ovate-lanceolate, acute, 11 to 12  $\times$  16 to 18 mm., exceeding the growth ring by one-half or more, margin narrow, uniform, germination apical, short rather scanty basal plates and scanty margins.

vestiture of long hairs. Leaf sheaths with a scanty vestiture of short appressed hairs, green or slightly tinted below, not glaucous; throat narrow, lannate, with scanty marginal hairs; collar narrow, pallid, glaucous, the margins lannate; ligule broad at center, reaching 5 mm., the ends tapering rapidly, fimbriate; ligular processes absent or poorly developed. Leaf blades abundant, flat, suberect, 6 to 6½ cm. wide, bright rather dark green, minutely serrulate to the base, scarcely ciliate.

This is a good general-purpose cane that should be more widely planted. It succeeds on a variety of soils and as it matures about with *Cristalina* it may be planted either in fall or spring.

It is decidedly more resistant to both root disease and mosaic than *Rayada* and *Cristalina*. Its resistance to gum disease has not been determined.

This cane was noted as one of the three best at Fajardo in 1914 the others being *Yellow Caledonia* and *D-117* but its record as a sugar producer has been only medium at both Fajardo and Guánica. At Guánica it was included by Mr. Murphey in a list of best canes for 1911. In some variety plots at Central Mercedita. Yabucoa on rich cow-penned land. Cut February 1920 as plant cane at 17 months, it gave, without irrigation, tons per acre, 65.6; brix, 16.30; sucrose, 13.82; purity, 84.8, being second in tonnage but first in sucrose out of 8 kinds. This would represent 6.527 tons sugar per acre. Recent analyses are as follows:

Kind	Date	Age	Extr.	Brix	Sucr.	Red S.	Purity	Fiber
B-6450 .....	12-2-20	Pl. 13 mo.	70.4	15.80	13.87	2.56	87.78	10.60
Ave. of 5								
Cheribon ..	12-2-20	Pl. 13 mo.	.....	.....	13.68	1.67	85.88	12.29
B-6450 ..	12-20-20	Rat. 14 mo.	70.2	16.52	14.23	0.21	86.08	8.31
Cristalina ...	12-20-20	Rat. 14 mo.	70.0	17.80	15.52	0.28	88.74	9.60
B-6450 .....	2-2-21	Rat. 16 mo.	71.6	17.05	16.03	0.56	88.15	9.08
B-6450 .....	2-2-21	Rat. 16 mo.	72.4	15.60	13.48	1.80	86.09	10.64
Cristalina ...	2-2-21	Rat. 16 mo.	70.3	17.85	16.14	0.33	90.42	10.69
B-6450 .....	2-7-21	Pl. 16 mo.	70.5	17.25	15.89	0.75	89.21	11.80
Cristalina ...	2-7-21	Pl. 16 mo.	68.6	17.90	16.14	0.803	90.16	12.81

#### B-6536.

This variety was in cultivation at this Station from 1911 to 1916, from seed brought from Central Guánica. It also occurs in the experimental plots at Central Fajardo and seed from there was again brought to this Station in November 1919. It was included in the Santa Rita immunity experiment where it showed medium resistance to root disease and rather strong resistance to mosaic. It is of only moderate vigor and medium sucrose content.

B-6835.

This was introduced from Barbados by this Station in 1911. It gave poor tonnage but good sucrose.

Not seen.

B-7169.

Introduced by this Station from Barbados in 1911. It occurs in the experimental plots at Fajardo and seed was again brought from there in November 1919. It is of medium vigor and sucrose content.

B-7245.

Introduced by this Station from Barbados in 1911. It does not seem to have been grown elsewhere on the Island.

Strictly erect, vigorous, medium stooler, no arrows. Stalks medium length and diameter, green, becoming yellow, with a red flush, little or no bloom. Internodes medium length, nearly cylindrical but abruptly shouldered below on side opposite bud, straight, furrow none. Nodes slightly constricted, oblique, growth ring narrow, usually elevated, brownish; root band narrow, oblique, 5 to 8 mm., constricted, concolorous or lighter; rudimentary roots pallid, crowded, in about 4 rows; leaf scar glabrous, usually about equally prominent behind; glaucous band narrow, 5 to 8 mm., well marked, but little constricted. Buds small, broadly ovate, obtuse, about 8 to 9  $\times$  8 to 9 mm., not exceeding the growth ring, margin narrow, uniform, usually purplish, germination apical, not developing on the standing stalks, short basal plac and sparse vestiture of white hairs on sides and apex. Leaf sheaths with a coarse abundant vestiture of strongly asurgent hairs, green, not glaucous; throat lannate and with a sparing vestiture of rather short white hairs; collar narrow, pallid, reaching the midrib, glaucous and more or less lannate throughout; ligule short, 3 mm. nearly even; ligular processes none. Leaf blades spreading, somewhat 2 ranked, flat, 6 to 7 cm. wide, bright green, minutely serrulate, the base sparingly ciliate.

This is a cane with usually good keeping qualities in the field. It never arrows, almost never falls down and the buds do not sprout, making it unusually well adapted to holding over as *caña quedada* or long-season cane. It grows late in the season and consequently is a little late in maturing but is really nearly average in this respect. It is better adapted to *vega* lands.

Its reactions to the different disease have not been determined. It is ratooning well and so must be fairly resistant to root disease.

Its early record at the Station is as follows:

Kind	Date	Age	Tons.	Brix.	Sucr.	Purity
B-7245 *	1915	Plant	30.0	18.64	17.30	92.8
Cristalina	1915	Plant	22.10	17.98	16.55	92.0
B-7245 †	May 1916	Rat.	37.80	19.1	18.0	94.24
Cristalina	May 1916	Rat.	18.80	18.8	17.8	94.14
B-7245	4-30-19	Rat. 11 Mo.		20.0	18.32	91.61
B-7245	Apr. 1920	2nd Rat. 12 Mo.		20.7	18.23	88.88
B-7245	5-18-20	2nd Rat. 13 Mo.		21.75	19.60	89.65
B-7245	1-13-20	2nd Rat. 8 Mo.		14.82	11.19	75.55
Cristalina	1-13-20	2nd Rat. 8 Mo.			16.35	.....

\* Fourth in tons out of 20.

† First in tons out of 20.

The latest analyses are as follows:

Kind	Date	Age	Extr.	Brix.	Sucr.	Red S	Purity	Fiber
B-7245	1-19-21	Pl. 15 mo.	70.0	17.55	15.44	0.95	87.97	10.80
Cristalina	1-19-21	Pl. 15 mo.	70.0	17.25	15.96	0.37	92.52	9.60
B-7245	2-14-21	Pl. 16 mo.	66.6	15.85	12.93	1.27	81.57	12.02
Rayada	2-14-21	Pl. 16 mo.	63.6	17.15	15.25	0.81	88.92	12.37
B-7245	2- 2-21	Pl. 20 mo.	70.1	18.55	16.73	0.71	90.18	13.15
B-7245	4-13-21	Pl. 18 mo.	70.7	17.30	16.87	0.509	92.18	10.44

#### B-8660.

Introduced by this Station from Barbados in 1911. Its record was medium both as to tonnage and sucrose.

Not seen.

#### Ba-6032.

And Ba-7924 were imported by Central Guánica from Barbados in the Fall of 1919. The latter is also in cultivation at this Station from seed of this importation. Not yet sufficiently tested to form an opinion.

#### BH-10(12).

Imported by Central Guánica from Barbados in the fall of 1919. Part of this seed also sent to this Station. It also seems to have been imported independently by Central Mercedita of Ponce.

Erect, or at length somewhat declined, vigorous, a strong stooler, seldom arrows. Stalks long, medium to medium slender, greenish but soon flushing to a uniform dull pink, marked with lines, often blotched, considerable bloom. Internodes medium length, staggered, somewhat compressed, larger below and shouldered on side opposite bud. Nodes constricted, oblique; growth ring rather broad but indistinct, enlarged on the shoulder behind; root band oblique, 6 to 10 mm., concolorous but paler, tapering downward, rudimentary roots small, purplish, in 3 or 4 rows; leaf scar glabrous, appressed behind; glaucous band slightly constricted, about 8 mm., somewhat obscured by the bloom of the internode. Buds nearly orbicular, 10 to 11 × 10 to 11 mm.,

only slightly exceeding growth ring, margin narrow, uniform, often purplish, germination subapical, basal places, and sparse marginal and apical vestiture. Leaf sheaths with a sparse vestiture of short appressed hairs, green or a little tinted, somewhat glaucous; throat narrow, lannate with a sparse marginal vestiture of long hairs; collar narrow, scarcely reaching the midrib, glaucous; ligule, about 3 mm., margin undulate, not fimbriate; ligular processes small and poorly developed or none. Leaf blades, suberect, the tips declined, flat, about 6 cm., widest above the middle, light green, minutely serrulate the base even, not ciliate.

This famous Barbados hybrid is making a very favorable showing. It seems to be adapted to a wide range of conditions but is doing especially well on the red shale hills. It is a good germinator and ripens sufficiently early to be used either for fall or spring planting. So far it is ratooning very strong. It has every promise of being an unusually good general-purpose cane.

Its resistance to root disease is evidently good. It has contracted the mosaic at Central Mercedita but how seriously it was effected was not ascertained. Nothing is known as to its resistance to gum disease.

A small field of this cane at Central Mercedita cut early in the present crop as plant cane of 11 months gave over 6 tons of sugar per acre, which is an unusually good showing for such young cane. Recent analyses are as follows.

Kind	Date	Age	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
BH 10 (12)...	12-2-20	Rat. 13 mo.	65.9	16.53	13.93	1.38	84.2	10.2'
Ave. 5 Che- Bribon.....	12-2-20	Rat. 13 mo.	.....	.....	13.69	1.67	85.88	12.24
H 10 (12)...	1-10-21	Rat. 14 mo.	63.1	17.40	15.64	0.58	89.88	10.31
Crist.....	1-10-21	Rat. 14 mo.	71.4	17.30	15.34	0.64	86.67	12.01
BH 10 (12)...	2-23-21	Rat. 15 mo.	66.6	17.10	15.03	1.01	87.89	11.31
Crist.....	2-23-21	Rat. 15 mo.	71.4	18.90	17.40	0.30	92.06	12.54
BH 10 (12)...	2-11-21	Pl. 16 mo. ..	70.7	18.00	15.17	1.42	84.27	11.71
Rayada.....	2-11-21	Pl. 16 mo. ..	63.6	17.15	15.25	0.81	88.92	12.37
BH 10 (12)...	4-13-21	Pl. 18 mo. ..	70.3	18.50	16.71	0.82	90.32	11.84

BSF 12 (34), BSF (45) BSF (13) (8) and BSF 13 (14) were all introduced from Barbados by Central Guánica in the fall of 1919 and are being tested at their Reparada estate near Ponce.

This ends the list of Barbados seedling canes that have been introduced into Porto Rico according to existing records.

#### THE DEMERARA SEEDLING CANES.

The number of Seedlings introduced from Demerara is very much less than from Barbados. Most of them have made a good record and some are among our most important kinds.

## D-74.

Imported by Mr. May of the Mayagüez Station from Audubon Park Louisiana in 1904. Reimported from Antigua by Mr. Sewall in 1909. It was included in the variety experiment at Aguirre in 1911. It was in cultivation at this Station from 1911 to 1916. Not here now and not seen in Porto Rico.

It seems very remarkable that this very valuable cane after having made so good a record has been completely abandoned and lost. Unfortunately, two recent attempts by the present writer to reintroduce it have failed. One of the greatest needs of Porto Rico today is for an early maturing cane of good tonnage and high sucrose to balance up the many good late canes now in cultivation and to serve for furnishing the mills with mature cane for the first month of the grinding. This need would be better filled by D-74 than by any other known variety. It would be a serious mistake to depend on this kind for the entire crop, but if about one-fourth of the acreage was of this kind it would add an average of 2 per cent or more to the average sucrose for the first month's grinding. In the writers experience in Cuba this kind usually gave 3 per cent more sucrose than Cristalina in December when the crop usually begins there but by February or March Cristalina would be better than D-74. This cane arrows so freely it should all be cut early in the season. It ratoons well and on average soils will give a tonnage about equal to Cristalina. It has suffered seriously from mosaic in Louisiana.

In the Aguirre experiments this kind came out second in tons sugar per acre, the record being, tons cane, 66.362; brix, 18.55; sucrose, 15.68; purity, 84.5; tons sugar, 7.53. The following record at this Station follows:

Kind	Date	Age	Tons.	Brix.	Sucr.	Glue.	Purity
D-74 *	Feb. 1912	Plant...		18.7	16.8	0.8	89.8
D-74	1915	Plant...	14.9	17.90	15.39		91.2
Crist	1915	Plant...	22.1	17.98	16.55		92.0
D-74	May 1916	Rat....	10.6	18.4	16.9		91.83
Othello	May 1916	Rat....	12.2	18.3	17.0		92.89

## D-95.

Imported from Audubon Park, Louisiana, in 1904 by Mr. May of the Mayagüez Station. Mr. Sewall notes having received seed from Mayagüez. In the crop of 1910 it stood highest in his tests

\* Highest in sucrose and purity out of 25 kinds.

in both brix, sucrose and purity as follows: brix, 18.4; sucrose, 17.8; purity, 96.70. It was cultivated at Guánica in 1910 and 1911 where Mr. Murphey notes that it was troubled by a leaf spot. It was included in the variety plots at Aguirre in 1911 where it stood first in tons sugar per acre. Its record follows: tons cane, 68.31; brix, 18.45; sucrose, 15.78; purity, 83.7; tons sugar, 7.84. It does not seem to have been cultivated at this Station. Not seen in Porto Rico.

The remarks made under D-74 may be repeated here. This is another valuable early-maturing kind that after making an exceptionally good record here has been completely abandoned and lost. A fact that is hard to understand.

#### D-109.

Introduced from Antigua by Mr. Sewall in 1909. It was probably also included in the direct importation from Demerara made by Central Canóvanas, though this was not so understood by Mr. Sewall. It is planted extensively in Eastern Porto Rico, especially in the districts about Canóvanas, Rio Piedras, Fajardo and Naguabo. Since the outbreak of mosaic in the western part of the Island, seed cane from this eastern region has been in strong demand and this variety has been widely disseminated. It is now probably planted more largely than any other of the seedling canes. It was first noted in the Guánica reports in 1913. In 1915 there were 9 acres of it there but it has attracted no attention in that district. It has been in continuous cultivation at this Station since 1911 and seed of it has been sent to many planters.

Usually soon decumbent, good vigor and stooling, arrows freely. Stalks long, medium diameter, red or reddish purple, heavy bloom. Internodes medium to long, somewhat barrel-shaped, or sometimes subcylindrical and enlarged below, furrow shallow, often wanting. Nodes strongly constricted; growth ring broad, usually 4 to 6 mm., even or nearly so, at first yellowish then dark purple or brownish purple; root band narrow, 6 to 7 mm., strongly constricted, at first yellowish but at length darker than the internode; rudimentary roots small, crowded, in about 3 rows; leaf scar glabrous, appressed behind; glaucous band narrow, 6 to 7 mm., constricted. Buds small, oval-ovate, obtuse, 8 to 9  $\times$  8 to 9 mm., exceeding the root band but seldom exceeding the growth ring, margin very narrow, germination apical, inconspicuous basal places and scanty marginal and apical vestiture, sometimes sub-glabrate. Leaf sheaths with a short scanty vestiture which is usually deciduous, leaving the mature sheath glabrate, strongly tinted, glaucous; throat lannate with a scanty vestiture of longer hairs on the margins; collar well marked, reaching

the midrib, often with purplish tints, glaucous or the margins sparingly lannate; ligule short, 2 to 3 mm., nearly even; ligular processes irregular or wanting, sometimes one well developed. Leaf blades spreading, flat, about 6 cm., rather dark green, the midrib sometimes purplish with age, minutely serrulate, the base even and sparingly ciliate.

This is a good general-purpose cane well adapted for general planting. It closely resembles Rayada and Crystalina in cultural characters and requirements but seems a little better able to withstand unfavorable soil conditions. It seems to be especially well adapted to the red shale hills. It ripens a little later than Crystalina but develops equally good sucrose at maturity. It may be planted either in fall or spring, but on account of its free arrowing should not be held over as *caña quedada*.

It seems to be a little more resistant to root disease than Crystalina but it is perhaps even more susceptible to mosaic. Recent observations in the Trujillo Alto district indicate that it is strongly resistant or perhaps immune to gum diseases. If this proves to be true it will add greatly to its value.

Its record as a sugar producer is only moderately good at Fajardo, averaging about  $2\frac{1}{2}$  tons per acre. It is largely planted there especially in hill lands. Our highest record comes from Central Lafayette on the south coast, first in sucrose as plant cane and second as ratoons out of 7 kinds tested as follows:

Kind	Date	Age	Brix.	Sucr.	Purity
D-109 .....	Apr. 1914	Plant. ....	21.8	20.3	93.5
D-109 .....	Feb. 1916	2nd. Rat. ..	21.7	19.5	89.8

As reported in Circular 8, it stood: plant cane, 36 to 56 tons; total for 3 crops, 78.72 tons; brix, 18.42; sucrose, 14.98; purity, 87.0. This would indicate an average yield of 2.89 tons sugar per acre for each of the three crops. Other analyses follow:

Kind	Date	Age	Arr.	Extr.	Brix	Sucr.	R. S.	Purity	Fiber
D 109 .....	12-10-20	Rat. 10 mo....	No....	73.3	14.23	9.93	3.22	69.78	8.54
Rayada .....	12-10-20	Rat. 10 mo....	No....	71.1	15.83	13.45	1.76	84.96	8.08
D-109 .....	12-30-20	Rat. 9 mo....	No....	70.0	18.94	16.38	0.91	86.58	10.80
D-109 .....	12-30-20	Rat. 9 mo....	Yes...	67.3	20.04	17.85	1.15	89.70	13.08
D-109 .....	12-24-20	Pl. 14 mo. ....	Yes...	61.1	19.58	17.46	0.67	89.17	14.0
Crist. ....	12-24-20	Pl. 14 mo. ....	No....	65.7	18.88	17.08	0.52	90.65	13.72
D-109 .....	2-4-21	Pl. 16 mo. ....	No....	65.2	18.0	16.33	0.59	90.72	11.13
D-109 .....	2-4-21	Pl. 16 mo. ....	Yes...	64.0	17.5	15.34	0.62	87.65	12.24
Crist. ....	2-4-21	Pl. 16 mo. ....	Yes...	65.2	18.40	17.27	0.65	93.85	11.03

D-116.

Introduced by Central Canóvanas. As planted in Porto Rico this is the same as D-625, which see. There is some doubt as to which of these kinds is really represented here.

D-117.

Imported from Audubon Park, Louisiana, in 1904 by Mr. May of the Mayagüez Station. It was mentioned in the Guánica reports for 1910 as among the best canes for that district and is today more widely planted there than any other kind. It was included in the variety test at Aguirre in 1911. Fajardo reports for 1913 mention it as among the three best canes for that district but at present it is less planted there than formerly. It has been sent out from here very widely. It is probably more widely planted in Porto Rico than any other seedling except D-109.

Strictly erect, good vigor and stooling, arrows freely. Stalks long, medium diameter, green then yellowish, flush none or very slight, little or no bloom. Internodes medium to long, straight or somewhat staggered, cylindrical or sometimes larger below, furrow slight or none. Nodes scarcely constricted, somewhat oblique; growth ring narrow, brownish, prominent, the widest part of the stalk; root band oblique, 8 to 10 mm., light green, tapering downward; rudimentary roots crowded in about 4 rows, leaf scar glabrous, appressed behind; glaucous band slightly constricted, about 8 mm., conspicuous. Buds large, ovate, obtuse, about  $14 \times 14$  mm., exceeding the growth ring by one-fourth, margin narrow, uniform, germination apical or subapical, often developing, with short basal plaes and scanty short marginal and apical vestiture. Leaf sheaths with scanty short appressed vestiture often becoming nearly glabrate, green, somewhat glaucous; stained with purple at base within; throat densely lannate and with a conspicuous vestiture of long hairs on the margins and behind the ligule; collar conspicuous, dark brown, reaching the midrib, lannate on the margins; ligule short, 2 to 3 mm., nearly even; ligular processes unequal, one usually strongly developed often 2 cm. long, acute, the other usually wanting. Leaf blades suberect, crowded, flat, somewhat two ranked, dark green, 6 to 7 cm. wide, very minutely serrulate, the base even, not ciliate.

This is the one of the best canes for general planting in Porto Rico. It thrives on a great variety of soils. On the low compacted *vegas* it will give a tonnage almost or quite equal to Yellow Caledonia. In the red shale hills it will decidedly exceed that kind. It is, however, late in maturing and should always be planted in the fall as *gran cultura*. It arrows too freely to be held over as *caña quedada*, or long crop.

It is decidedly more resistant to both root disease and mosaic than *Cristalina* and *Rayada* and it is usually a good ratooner. Its resistance to gum disease is not fully determined but it seems to be good. At least no diseased canes of this kind have been found, although it occurs in mixed plantings where the *Otaheite* is heavily infected by gumming.

Early in the season it is poor in sucrose, especially in the stalks that have not arrowed. When fully mature it develops about the same per cent of sucrose as *Cristalina*. It should never be planted in mixed plantings where it is likely to be cut too green. Its record at Aguirre in 1911 was as follows: tons cane, 69.821; brix, 17.09; sucrose, 13.52; purity, 79.01; tons sugar, 6.59. It was third in tonnage among the kinds tested, but these plots were cut in January and this cane was evidently still too green to have developed its best sucrose. Mr. Sewall reports that in 1910 this cane stood second in sucrose and purity by mill test at Naguabo. Its record was: brix, 16.7; sucrose, 15.70; purity, 94.0. The Fajardo reports have usually been low, seldom averaging more than 3 tons sugar per acre. At Central Lafayette, April 1914, as plant cane it gave: brix, 21.1; sucrose, 18.6; purity, 88.1. As second ratoon in February 1916, it gave: brix, 20.4; sucrose, 18.0; purity, 88.2. In Guánica, December 1920, a field of 12.85 acres of *gran cultura* gave, tons cane, 49.715; brix, 15.27; sucrose, 13.24; purity, 84.22; tons sugar, 5.23. Here again the cane was evidently too green. At this Station, as reported in Circular 8, it stood second in tons cane as plant cane but fell to sixth place in total tons for three crops. The record follows: tons cane as plant, 57.53; total for 3 crops, 99.55; brix, 17.50; sucrose, 15.92; purity, 90.9. *Cristalina* record in these tests was: tons plant cane, 43.87; total for 3 crops, 77.52; brix, 16.60; sucrose, 15.02; purity, 90.5. This would figure an average of 3.972 tons sugar for each of the three crops for D-117 and 2.91 tons for *Cristalina*. Some recent analyses are:

Kind	Date	Age	Arr.	Extr.	Lrix.	Sucr.	R. S.	Purity	Fiber
D-117	12-30-20	Rat. 9 mo.	No	69.13	15.13	12.15	1.69	80.30	11.58
D-117	12-30-20	Rat. 9 mo.	Yes.	67.2	16.53	13.66	1.71	82.52	11.80
D-117	12-20-20	Rat. 14 mo.	No	67.6	16.30	13.78	0.72	84.54	10.36
D-117	12-20-20	Rat. 14 mo.	Yes.	68.7	17.20	15.03	0.21	87.38	10.60
Crist.	12-20-20	Rat. 14 mo.	No	70.0	17.50	15.53	0.28	88.74	9.60
D-117	1-26-21	Rat. 15 mo.	No	67.5	15.55	12.94	1.17	83.21	10.40
D-117	1-26-21	Rat. 15 mo.	Yes.	67.6	18.20	15.82	0.76	86.44	11.00
Crist.	1-26-21	Rat. 15 mo.	No	70.3	17.85	16.14	0.33	90.42	11.22
D-117	2-4-21	Pl. 16 mo.	No	64.7	17.20	14.71	1.50	85.52	12.60
D-117	2-4-21	Pl. 16 mo.	Yes.	61.5	17.50	15.20	1.13	86.85	12.32
Crist.	2-4-21	Pl. 16 mo.	Yes.	65.2	18.40	17.27	0.65	93.85	11.83
D-117	4-6-21	Pl. 18 mo.	Yes.	68.0	19.45	18.02	0.265	93.48	10.47

D-147.

This kind is present in the experimental plots at Fajardo. Seed was brought to this Station in November 1919 but it failed to germinate. Not seen elsewhere. We find no record of its introduction.

D-355.

Noted by Cowgill as occurring at Dolores, Río Grande, July 15, 1912. No other record of this cane.

Not seen.

D-357.

This cane figured in Cowgill's notes as occurring at Fajardo in 1913. We have no record of its introduction. Seed was brought from Fajardo to this Station in November 1919. It was included in the Santa Rita immunity experiment where it suffered considerably from root disease and top rot and was severely attacked by mosaic. It seems to have no special value.

D-433.

We have no record of the introduction of this cane. In Mr. Crawley's notes under date of June 24, 1913, it is mentioned in a list of the best canes for the Fajardo district given him by McConney. It is now being planted at Fajardo more largely than any other variety and it is giving heavier average tonnage and more sugar per acre. Seed was brought from Fajardo to this Station in 1918. It is doing well here but apparently no better than D-117. It has not been seen elsewhere excepting in the Santa Rita immunity experiment, where seed was sent from Fajardo.

Erect or at length declined, good vigor and stooling, seldom arrows. Stalks long, medium to medium stout, green with a slight pink flush, completely covered by a dense gray bloom. Internodes long cylindrical or somewhat enlarged below, staggered, furrow none. Nodes constricted, oblique; growth ring narrow, even or a little sunken, greenish; root band about 8 mm., concolorous; rudimentary roots large but indistinct, in about 3 rows; leaf scar glabrous, appressed behind; glaucous band almost completely obscured by heavy bloom of the internode. Buds broadly ovate, obtuse, about 12 to 14 × 12 to 14 mm., exceeding the growth ring by one-fourth, margin medium width, uniform, germination subdorsal, basal plac short, marginal vestiture heavy, ending in a pronounced apical tuft and extending down the back of the bud to the germinating point. Leaf sheaths with a moderate vestiture of long stiff assurgent hairs, greenish, densely glaucous; throat lannate and with a sparse vestiture of long hairs on the margins and behind the ligule; collar narrow, reaching the midrib, pallid, glaucous, slightly lannate on the margins;

ligule about 3 mm., margin fimbriate-ciliate; ligular processes none. Leaf blades erect the tips declined, broad, flat or the margins slightly revolute, reaching 8 cm. or more, dull blue-green, serrulate to the sparingly ciliate base.

This cane seems to be particularly adapted to the low, compact maritime *vegas* and the yellow clay alluviums where Rayada and Cristalina are beginning to fail so badly. It grows fairly well on the red shale hills but seems to have no advantage there over a number of other canes. It could be used to advantage wherever Yellow Caledonia is being planted for it will yield equal tonnage and give better sucrose. It is best planted in the fall as *gran cultura*, though it can be used for spring planting. It arrows so little that it would probably stand over well for long crop or *caña quedada*, but this has not been tested.

It was included in the Santa Rita immunity tests but the results were not conclusive. It seemed, however, to have good resistance to mosaic and it certainly resists root disease and ratoons well, especially on low compact lands.

At Fajardo it has given the following average results in tons of sugar per acre. In 1915, 3.73 tons; 1916, 3.47 tons; 1917, 3.44 tons, and in 1919, 3.75 tons. Recent analyses here as follows:

Kind	Date	Age	Extr.	Brix	Sucr.	R. S.	Purity	Fiber
D-433 .....	11-29-20	Rat. 13 mo.	67.0	16.67	12.56	2.48	75.66	10.18
Ave. 5 Chevron .....	11-29-20	Rat. 13 mo			13.69	1.67	87.88	12.29
D-433 .....	1-10-21	Rat. 14 mo.	65.9	15.10	13.03	1.81	86.29	10.91
Crist. ....	1-10-21	Rat. 14 mo.	71.4	17.30	15.34	0.64	86.67	12.01
D-433 .....	2-23-21	Rat. 16 mo.	72.2	18.20	15.46	1.49	86.36	11.12
Crist. ....	2-23-21	Rat. 16 mo.	71.4	18.90	17.40	0.30	92.66	12.58
D-433 .....	4-6-21	Pl. 18 mo..	67.1	19.60	18.18	0.53	92.24	11.84

#### D-448.

This cane has been considerably planted at Fajardo but we have no data concerning its introduction. It seems to have been first planted at this Station in the spring of 1918, presumably with seed from Fajardo. It has not been seen elsewhere.

Erect or at length somewhat decumbent, good vigor and stooling, arrows frequently. Stalks long, medium stout, dull purple fading to dirty brown on maturity, heavy bloom. Internodes medium length, straight or nearly so, cylindrical, or enlarged below, furrow none. Nodes scarcely constricted, somewhat oblique; growth ring broad, a little sunken, greenish or yellowish; root band 8 to 10 mm., greenish: rudimentary roots small, obscure, purplish, crowded, in 4 or 5 rows: leaf scar glabrous, appressed behind; glaucous band 8 to 10 mm.,

scarcely constricted, not conspicuous. Buds broader than long, obtuse, plump, about 14 to 15 × 12 mm., not exceeding the growth ring; margin narrow, uniform, germination dorsal, basal plac, moderate, marginal vestiture of medium length hairs and lines of short, white, appressed hairs along all of the vascular bundles of the bud scales. Leaf sheaths with a short, scanty appressed vestiture when young, usually glabrate with age, glaucous, strongly tinted; throat lannate and with a vestiture of rather short whitish hairs; collar reaching the midrib, pallid, lannate with short white hairs; ligule 3 to 4 mm. even; ligular processes none. Leaf blades suberect the tips drooping, flat, about 7 cm. wide, medium dull green, serrulate to the base, not ciliate.

This cane is not being extended at Fajardo where it is not considered fully satisfactory. Here it is very promising, especially on hill lands. Apparently it needs open, porous soils. It should be tried on the red coral lands. It seems to mature early and promises to be useful for spring planting.

It was not included in the Santa Rita immunity experiments and but little is known regarding its disease resistance.

At Fajardo its record in sugar production is poor, being only 1.61 tons per acre in 1916, 1.87 tons in 1917 and 2.69 tons average on an area of 23 acres in 1919. Recent analyses here are as follows. Its promise of tonnage is better than the average:

Kind	Date	Age	Arr.	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
D-448 .....	1-5-21....	Pl. 15 mo....	Yes...	65.6	18.53	15.96	1.39	86.13	12.38
Crist .....	1-5-21....	Pl. 15 mo....	No....	66.6	16.96	15.35	0.56	90.56	11.35
D-448 .....	2-9-21....	Pl. 16 mo....	No....	65.6	18.40	16.51	0.87	89.72	13.07
Crist .....	2-9-21....	Pl. 16 mo....	No....	68.7	16.20	13.85	0.95	85.49	11.20
D-448 .....	4-6-21....	Pl. 18 mo....	No....	69.4	17.30	15.14	0.65	90.40	12.24

#### D-504.

This kind occurs in the variety plots at Fajardo but there is no record as to its introduction; seed was brought from there to the Station in November 1919. A thirty-acre field of it was found at Río Grande under the name of Java 133 and it also occurs at Humacao as Java 101. Not seen elsewhere. A very similar but distinct cane occurs at Central Fortuna, Ponce which is known as "Caña de Vino."

Erect, or at length decumbent, vigorous, good stooler, seldom arrows. Stalks medium length, stout, purple fading to olive, light bloom. Internodes short to medium, stout, strongly enlarged below, subconic, furrow none. Nodes constricted, oblique; growth ring medium to broad, conspicuously elevated, brownish then olive; root band 6 to 8 mm., greenish, tapering downward; rudimentary roots large, brownish, in about 3 rows; leaf scar glabrous, appressed

behind; glaucous band constricted, about 8 mm., well marked. Buds small, broader than long, obtuse, plump, about  $9 \times 8$  mm., not reaching the growth ring, margin medium, uniform, germination dorsal, short basal places, and scanty marginal and apical vestiture. Leaf sheaths with abundant, coarse, assurgent vestiture, glaucous, purplish, usually splitting, throat densely lannate and with longer whitish hairs on margins and behind ligule; collar broad reaching the midrib, pallid but with reddish tinge, glaucous, the margins faintly lannate; ligule long, reaching 5 mm. at center, minutely fimbriate; ligular processes none. Leaf blades suberect, flat broad, 7 to 9 cm., dull bluish-green, the midrib often purplish with age, sharply serrulate to the base, sparingly ciliate.

This is a very promising cane but it has not been sufficiently tested to warrant a positive opinion. It has attracted no attention except at the one farm at Río Grande where it is being rapidly extended. On the Station grounds it has done especially well on the red shale hills but it has also been satisfactory in low lands. It grows late and has the appearance of a late cane but the analyses show thta it develops sugar early. It is certainly worthy of careful study.

It was in the Santa Rita immunity experiment but a poor stand was secured and it was in the short list of those which did not contract the mosaic. Nothing is therefore really known as to its disease resistance.

The following is its only record for sucrose:

Kind	Date	Age	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
D-504 .....	12-12-20	Pl. 14 mo ..	69.2	16 13	13.84	1 88	84.2	7.39
Ave. 5 Cheribon .....	12-12-20	Pl. 14 mo....			13.69	1 67	85 88	12 29
D-504 .....	2-9-21	Pl. 16 mo....	60.1	20 10	18.25	0 77	90.79	11.60
Crist .....	2-9-21	Pl. 16 mo....	68.7	16 20	13.85	0 95	85.49	11.20
D-504 .....	4-8-21	Pl. 18 mo....	66.6	20 10	18 93	0 408	94.17	12.02

#### D-625.

Introduced from Antigua in 1909 by Mr. Sewall. Probably previously introduced by Mr. Marr of Canóvanas as D-116. Nowhere now grown in pure cultures but abundantly present in mixed plantings in all parts of the Island, but especially in the eastern districts. It was in cultivation at this Station from 1911 to 1916 but had disappeared from the collections until brought in from various sources during 1919.

Erect or at length decumbent, very vigorous, a strong stooler, arrows freely. Stalks long, medium stout, green then yellow no flush, little or no bloom. Internodes medium long, cylindrical, straight or

nearly so, furrow slight or none. Nodes not constricted; growth ring broad, 3 to 6 mm., swollen, brownish, usually very conspicuous; root band narrow, 6 to 8 mm., whitish then concolorous; rudimentary roots large, scattered, in about 3 rows; leaf scar glabrous, broad and prominent in front, appressed behind; glaucous band narrow, about 8 mm., well marked. Buds broadly triangular-ovate, 12 to 14  $\times$  12 to 14 mm., scarcely exceeding the growth ring, margin narrow uniform, germination apical, basal plates heavy, sides and apex with an abundant vestiture of long brownish hairs. Leaf sheaths glabrate, but with some hairs on medium line when young, green, glaucous; throat narrow, pale brown, densely lannate; collar narrow, not reaching the midrib, pale brown, glaucous; ligule broad reaching 6 mm. even; ligular processes none. Leaf blades spreading, the margins somewhat revolute, 6 to 7 cm. wide, dull green, minutely but sharply serrulate, the base nearly even and sparingly ciliate.

This is one of the most vigorous canes seen in Porto Rico and is probably capable of yielding a higher tonnage than any other one now grown in the Island. It is considered, however, to be so low in sucrose that many of the mills refuse to accept it and its planting in pure cultures has been abandoned. On account of its high tonnage many *colonos* still mix as much of it in their fields as they think will pass unnoticed at the mills. Recent analyses indicate that this cane has been entirely misunderstood and that when properly ripened it develops a very satisfactory degree of sucrose. This must be so, since it still furnishes by far the greater part of the sugar made in Demerara. It needs to be studied anew, but the present indications are that it is a most valuable cane for the red shale hills and probably for the red coral lands or for any other locations where it can be made to mature. It should not be allowed in mixed plantings.

It was not included in the immunity experiment at Santa Rita and but little is known concerning its disease resistance. Stalks of it attacked by gum disease have been seen in the Trujillo Alto district.

As reported by McConny (*Revista* 1:17, 1918), this kind was second in total sugar at Fajardo as an average of two crops, average cane, 38.48; sucrose, 10.3; purity, 78.7; tons sugar, 3.99. This is a good showing, but the cane was evidently green. At this Station, as reported in Circular 8, where it appears both as D-116 and D-625, it took first place in tonnage both as plant cane and total per 3 crops. It seems to have been cut green here also and so only took second place in total sugar, being exceeded by B-1753. The average of the two lots follows: Plant cane, 59.93 tons; three crops, 139.26; brix,

15.26; sucrose, 11.54; purity, 73.1. This would give an average of 3.431 tons sugar per acre for each of the three crops. Recent analyses follow:

Kind	Date	Age	Arr.	Extr.	Brix.	Sucr	R. S.	Purity	Fiber
D-625	11-29-20	Pl. 13 mo. ....	No....	60.3	16.97	13.78	2.23	81.26	12.70
Ave. 5 Cheri-									
bon.....	11-28-20	Pl. 13 mo. ....	No....			13.69	1.67	85.88	12.29
D-625	1-5-21	Pl. 15 mo. ....	No....	65.8	16.76	13.85	1.80	82.87	9.57
Crist.....	1-5-21	Pl. 15 mo. ....	No....	66.6	16.96	15.35	0.56	90.85	11.35
D-625	1-10-21	Rat. 14 mo. ....	Yes..	70.2	18.95	16.92	1.06	86.10	12.52
Crist.....	1-10-21	Rat. 14 mo. ....	No....	71.4	17.30	15.34	0.64	86.67	12.01
D-625	1-19-21	Pl. 15 mo. ....	No....	65.0	17.85	14.94	1.70	83.69	12.92
Crist.....	1-19-21	Pl. 15 mo. ....	No....	70.0	17.25	15.96	0.37	92.52	9.60
D-625	2-9-21	Pl. 16 mo. ....	No....	63.4	17.50	14.80	1.78	81.57	13.17
Crist.....	2-9-21	Pl. 16 mo. ....	No....	68.6	16.20	13.85	0.95	85.49	11.20
D-625	2-23-21	Pl. 16 mo. ....	No....	72.6	17.90	15.50	1.59	86.59	12.05
Crist.....	2-23-21	Pl. 16 mo. ....	No....	71.4	18.90	17.40	0.30	92.06	12.58
D-625	4-4-21	Pl. 18 mo. ....	No....	72.4	21.45	19.55	0.59	91.14	11.04

#### D-848.

Introduced from Antigua by Mr. Sewall in 1911. It does not seem to have been planted elsewhere.

Not seen.

#### D-1111.

Introduced from Antigua by Mr. Sewall in 1911. It is mentioned in the Fajardo monthly reports for 1914. This cane seems to have attracted no attention excepting on one farm near Naguabo where it is being planted on a large scale. It is on hill land and is doing much better than Rayada or any other kind planted there. It is a clean-growing, upright, brownish cane. Seed brought to this Station in anuary 1921. It is making a good germination.

#### D-1135.

Introduced from the Hawaiian Islands via Washington, by this Station in January 1921. It is making a good germination.

#### D-1170.

A cane grown under this number was seen at Central Coloso in August 1919. Not seen elsewhere and we have no knowledge of its origin.

#### D-4393.

A cane under this number was noted by Cowgill, July 1913, at Dolores, Río Grande. We have no other knowledge of this kind.

#### Diamond 185.

The Diamond seedlings were produced at a plantation of that name in Demerara. This one was imported by this Station from

Barbados in 1911. Its record was nearly equal to Cristalina, both in tonnage and sucrose.

Not seen.

#### **The Fajardo Seedlings.**

A very considerable number of seedling canes have been and are still being propagated and tested by the Central Fajardo. They are numbered under the initials "F. C." Some of them are now being extended there on a large scale. Sixty of them were included in the immunity test at Santa Rita. A number of these proved strongly resistant to both root disease and mosaic. They have none of them been disseminated over the Island and none of them are in cultivation at this Station. A detailed consideration of them can not be attempted at this time.

#### **The Fortuna Seedlings.**

At one time seedling canes were grown at Central Fortuna near Ponce, which is now one of the Guánica properties. This work was soon discontinued and most of the seedlings have been lost. Only one was included in the immunity experiment at Santa Rita where it made a very good record in resistance to both root disease and mosaic.

Not seen elsewhere.

#### **The Guánica Seedlings.**

The growing of seedling canes was begun at Central Guánica about 1908 and is still continued. They are numbered under the initials "G. C." These numbers now reach nearly two thousand. Numbers 493, 701, 888 and some others are now grown on a large scale on the various Guánica properties. Two of the "G. C." varieties are in cultivation at Fajardo and three are in the collections at this Station. They have not been otherwise disseminated. They will not be discussed at this time.

#### **The Java Seedlings.**

Of the immense number of seedling produced in Java very few have found their way to this Island. In Mr. May's letter (see p. 35) he mentions having made direct importations from Java but gave no data nor does he mention the kinds imported. In 1917 Mr. May received from the Argentine Sugar Station at Tucumán, together with the Uba or Kavangire, three of Kobus' cross-bred Java seedlings which are indicated by the letters "P. O. J." following the numbers. These canes are all infected by mosaic but they are so

resistant to its effect that it does not check their growth. It is for this reason that they have not been brought to this Station and only partial data can be given concerning them. The name "Java" is popularly applied to various canes in Porto Rico. Thus "Java Green" at Central Fortuna seems to be D-117 and Java 101 at Humacao and Java 133 at Río Grande both prove to be D-504.

**Java 36-P. O. J.**

(By an error first recorded as Java 56.) Parents, Chunnee X Black Cheribon. Imported from the Argentine in 1917 by the Mayagüez Station. Sent out by them to various parts of western Porto Rico. Included in the Santa Rita immunity experiment where it took the highest rank in resistance to both root disease and mosaic. It is a strong ratooner and gives heavy tonnage but hardly equal to Uba in this respect. In the Argentine it matures earlier than Uba and is now one of their two chief commercial canes.

Erect or at length somewhat declined, very vigorous, a strong stooler, arrows frequently. Stalks long, slender, usually less than  $2\frac{1}{2}$  cm., brownish purple, little bloom. Internodes long, straight, cylindrical, furrow scarcely evident. Nodes broad, prominent, not constricted; growth ring narrow, conspicuous, greenish; root band broad; rudimentary roots inconspicuous; purplish, in about 3 rows; leaf scar glabrous; glaucous band conspicuous, not constricted. Buds large, broader than long, obtuse, margin broad uniform. Leaf sheaths glabrate, purplish, throat minutely lannate and with a scanty vestiture of long hairs; collar narrow, inconspicuous, not reaching the midrib; ligule abruptly broadest at the center (as in Uba); ligular processes none. Leaf blades spreading, narrow, long acuminate, weakly serrulate to the base.

No analyses of this cane can be given but it has a good reputation as a sugar producer. Its planting is strongly recommended in those districts that are completely invaded by mosaic, since it is not injured by that disease. It should never be planted in the neighborhood of healthy cane for it all has mosaic and it serves as an active source of infection.

**Java 100.**

According to Cowgill's notes, such a cane was in the Fajardo collections in 1914. It is not to be found there now and there is nothing to indicate whether it was 100-B or 100-P. O. J. It probably came in the direct importation mentioned by Mr. May.

Not seen.

Java 101.

See D-504.

Java 105-P. O. J.

(Also known as Egyptian cane.) Parents Chunnee X Black Cheribon. Probably included in the importation from Egypt mentioned by Mr. May (see letter p. 35). This cane was first seen by the writer in the fall of 1918 at Central Córscica in western Porto Rico. It was growing vigorously, notwithstanding a complete infection with mosaic, and presented a striking contrast to the Rayad and other kinds which were all seriously injured by mosaic. It was called "Egyptian cane" and seed was said to have come from the Mayagüez Station some five years before. Later the same cane was seen in the outskirts of Mayagüez, where it was being called "Pesante cane" after the owner of the farm where it occurred. This cane is attracting much attention and is being widely planted in the extreme western districts. From the full description published by Fawcett (Rev. Indust. y Agric. de Tucuman, 9:142, 1919) it seems quite certain that this is 105-P. O. J. It came to the Argentine from Egypt and is known there as Ambar de Egypto. A note in our files shows that on October 24, 1914, six varieties of Egyptian canes were received from the Mayagüez Station, but there is no data as to what became of them. This one can not be traced among them.

Erect, vigorous, strong stooler, arrows, freely. Stalks tall, slender, usually less than  $2\frac{1}{2}$  cm., brownish, very heavy bloom. Internodes long, cylindrical or a little compressed, furrow evident. Node prominent, enlarged; growth ring broad, even, yellowish; root band broad; rudimentary roots inconspicuous, purplish, in about 3 rows equal on all sides, not compressed behind, the widest part of stalk glaucous band indistinct, obscured by the bloom of the internode. Buds large triangular margin wide, strongly shouldered (as in *Cristallina*), nearly glabrous. Leaf sheaths glabrous, tinted; throat slightly lanate, with scanty tufts of hairs on the margins; collar glaucous ligule broad, broadest at center; ligular processes none. Leaf blade suberect but tips declined, long, narrow, bright green, scarcely serrate, nearly even.

Like the other P. O. J. hybrids this cane is very resistant to both root disease and mosaic. It is in no sense immune to the latter disease like the Uba, since every stalk seen of it is infected, but it does not stop its growth. It can be strongly recommended for the heavily infected western districts where it is being extended very rapidly. In the Argentine it is considered to be late in maturing. Here its sucrose content is considered satisfactory, but there is little detail.

information concerning it. Only one analysis is available, that of 14 months plant cane brought from Rincón, December 1, 1920; arrows, yes; extr., 68.4; brix, 16.50; sucrose, 13.11; R. S., 2.72; purity, 79.45; fiber, 13.27. This is not bad, compared with other canes at this early date, but the large amount of reducing sugars and the low purity show that the cane was still very green.

Java 133.

See D-504.

Java 213-P. O. J.

Imported from the Argentine by this Station in January 1921. Not tested.

Java 228-P. O. J.

Parents Chunnee X Black Cheribon. Imported from the Argentine by the Mayagüez Station in 1917. Somewhat distributed in western Porto Rico.

Erect, fairly vigorous, good stooling. Stalks slender, purplish with heavy bloom. Internodes long, cylindrical, straight, furrow scarcely evident. Nodes broad, prominent; growth ring broad elevated, yellow then dark brown; root band pallid; rudimentary roots in 3 or 4 rows; leaf scar glabrous, appressed behind; glaucous band swollen, larger than the internode. Buds obovate, broad, margin wide shouldered above, vestiture at base and apex. Leaf sheaths glabrate; throat lannate and with a sparse vestiture of hairs; collar inconspicuous, glaucous; ligule broad, fimbriate. Leaf blades erect, the tips declined, narrow minutely but distinctly serrulate.

In the Santa Rita immunity tests and in the experimental plots at Mayagüez this kind showed less resistance to root disease and mosaic than 36-P. O. J. There seems no reason why it should be further cultivated.

Java 234-P. O. J.

Parents Chunnee X Black Cheribon. Introduced from the Argentine by the Mayagüez Station in 1917. Somewhat distributed on the west coast.

Erect or at length somewhat declined, very vigorous, heavy stooler. Stalks long, slender, usually less than  $2\frac{1}{2}$  cm., dull greenish with red flush. Internodes long, cylindrical or slightly larger below, straight, furrow scarcely evident. Nodes broad, enlarged; growth ring broad, yellowish, even; root band enlarged; rudimentary roots obscure, scarcely evident; leaf scar glabrous, narrow, appressed behind; glaucous band clearly marked, not constricted. Buds small,

orbicular, becoming hemispheric, glabrous. Leaf sheaths glabrous; throat lannate and with scanty vestiture of hairs; collar inconspicuous, glaucous; ligule very broad, minutely fimbriate. Leaf blades spreading, numerous, narrow, hanging long on the stalk, slightly serrulate.

This seems to be closely similar to 36-P. O. J. in cultural characters and to be equally valuable as grown here, though in the Argentine it has not attracted the same attention. It can be strongly recommended for the districts that are completely invaded by mosaic, but it should not be planted elsewhere for every stalk on the Island is infected. While the disease does not injure the growth of this kind it would be an active center of infection if planted among healthy cane. No analytical data is available.

#### L-511.

Imported from Louisiana by Central Guánica in October 1920 and part of the seed was sent to this Station where it is making a satisfactory growth. This is the only one of the Louisiana seedlings so far imported. It is supposed to be an even better early cane than D-74. If so, it will be exceedingly useful here, where early canes are so badly needed for use at the beginning of the crop and for late spring planting.

#### Sta. Cruz 12(4).

Imported by the Mayagüez Station. Seed from Mayagüez was planted at this Station in the spring of 1919. It has been considerably distributed by the Mayagüez Station. Central Mercedita, Ponce, now has 30 acres.

Erect, good vigor, fair stooler. Stalks long, medium diameter, green with reddish flush, light bloom. Internodes medium to long, cylindrical or a little compressed, staggered, furrow slight or none. Nodes somewhat constricted, strongly oblique; growth ring broad but rather poorly defined, even or somewhat elevated, yellowish; root band strongly oblique, 5 to 10 mm., concolorous or paler; rudimentary roots crowded, in about 4 rows; leaf scar glabrous, broad and prominent in front, appressed behind; glaucous band constrictly, poorly defined. Buds large, lance-ovate, about  $12 \times 16$  mm., exceeding the growth ring by one-third to one-half, margin broad uniform, germination apical, heavy basal plates, abundant marginal vestiture ending in a conspicuous apical tuft. Leaf sheaths with dense vestiture along the back, the sides glabrate, greenish or slightly tinted, somewhat glaucous, the base slightly stained purple within; throat lannate, and with an abundant vestiture of hairs; collar medium width, reaching the midrib, glaucous the margins slightly lannate; ligule about 4

mm., minutely fimbriate; ligular processes none. Leaf blades erect, usually even to the tips, flat, 7 cm. or more wide, dull green, minutely and sparingly serrulate, the bases even, not ciliate.

This cane has not been sufficiently tested for a final opinion but it seems very promising. It is said to resist drouth unusually well and it matures early, making it available for spring planting. It was not in the Santa Rita immunity experiment but at Mayagüez it is resisting mosaie decidedly better than most kinds. Its sucrose quality seems very good, although but few analyses are available.

Kind	Date	Age	Arr.	Extr.	Brix.	Sucr.	R. S.	Purity	Fibe
St. C. 12 <sup>(4)</sup> .....	12-6-20	Pl. 13 mo. ....	No.....	62.0	16.89	14.81	1.47	87.68	10.72
Av. 5 Cheribon	12-6-20	Pl. 13 mo. ....	No.....	63.9	21.80	13.69	1.67	85.88	12.29
St. C. 12 <sup>(4)</sup> .....	3-9-21	Pl. 16 mo. ....	Yes....	69.4	19.00	19.63	0.392	89.63	12.99
Cristalina .....	3-9-21	Pl. 16 mo. ....	No.....	69.4	19.00	17.20	0.39	90.52	11.01

#### Sta. Cruz 12(11).

Probably imported by the Mayagüez Station. Central Mercedita planted 3 acres in the fall of 1920.

Not seen.

#### St. Kitts Seedlings.

Imported by Mr. Sewall from Antigua in 1911. Said to be a sport from B-208. Mr. Sewall notes that here it reverts to that kind.

Not seen.

#### T-77.

Imported from Audubon Park, Louisiana, in 1904 by the Mayagüez Station. This cane was considerably planted at Guánica, 1910 to 1912 and was tested by Sewall at Naguabo, who got his seed from the Mayagüez Station. It was in cultivation at this Station from 1911 to 1913. In the Aguirre variety tests in 1911 it gave, tons cane, 61.42; brix, 19.19; sucrose, 15.85; purity, 82.6; tons sugar, 6.95. In 1912 at this Station it gave, brix, 17.2; sucrose, 14.6; glucose, 1.4; purity, 84.9, and in 1913 ratoon 12 months, brix, 17.01; sucrose, 15.07; purity, 88.6. Mr. Sewall reports February 25, 1912, brix, 17.10; sucrose, 15.70; purtiy, 91.8. It is described as a rather slender red cane.

Not seen.

This completes the list of the canes that have been imported into Porto Rico in so far as it has been possible to trace them. It remains to discuss the Porto Rico seedlings that are numbered under the initials "P. R." As has been elsewhere stated, numbers 1 to 200 were

bred at the Mayagüez Station between 1906 and 1911, when on the establishment of what is now the Insular Station at Río Piedras this work was abandoned at Mayagüez.<sup>1</sup> These kinds seem to have all been lost. One of them, P. R.-68, turned up in the first Santa Rita immunity experiment, where it made a poor record. It has not since been seen. Sixteen of the three hundred and twenty or more kinds produced at this Station during 1912 have been selected and kept in continuous cultivation here since that time, and they have been considerably disseminated throughout the Island. They will be described and discussed in the following pages. These are all good canes. It is probable that each of them under conditions favorable to it will produce greater tonnage and rather more sugar per acre Cristalina and Rayada. It cannot be claimed, however, that any of them are of surpassing merit. They will average about like the best of the Barbados and Demerara canes that have been tested here. Among the large number of seedlings produced each year from 1913 to 1918 there are a number that are very promising. They have not been fully tested and have not been disseminated. They will not be discussed at this time. No seedlings have been produced at this Station since 1918. Facilities were hardly sufficient for the proper testing of those already in hand.

#### THE PORTO RICO SEEDLINGS PRODUCED IN 1912.

P. R.-202.

Parentage unknown.

Erect, vigorous, good stooling, arrows occasionally. Stalks long medium stout, green, little or no flush, heavy bloom. Internodes long cylindrical, but enlarged below, staggered, furrow none. Node scarcely constricted, oblique; growth ring broad, 3 to 4 mm., swollen the widest part of the stalk, conspicuous, yellowish-brown; root band oblique, 6 to 10 mm., tapering downward, concolorous; leaf sheath glabrous, appressed behind; glaucous band scarcely constricted, partially obscured by the bloom of the internode. Buds subhemispherical plump, about 12 × 12 mm., not exceeding the growth ring, margin narrow, uniform, germination subapical, basal parts well developed marginal and apical vestiture of long hairs and a short appressed pubescence extending well up on the sides of the bud. Leaf sheath with a short vestiture when young, becoming glabrate, green, somewhat glaucous; throat narrow, densely lannate and with a sparse vestiture of short hairs on the margins; collar narrow, not reaching the midrib, dark brown, glaucous, the margins lannate; ligule short 2 to 3 mm. minutely fimbriate; ligular processes none. Leaf blade

<sup>1</sup> The production of seedling varieties was resumed at the Mayagüez Station about four years ago. These canes are numbered under the letters "M. P. R."

erect except the tips, conspicuously plicate and revolute, broad, 9 cm. or more, minutely but sharply serrulate to the base, not ciliate.

This is a vigorous, heavy-tonnage cane that is adapted to either low or hill lands. It does not mature quite as early as the *Cristalina*, still it may be used for either fall or spring planting. It usually ratoons well but its disease resistance has not been fully tested. It was not included in the Santa Rita immunity experiment.

The following selected analyses show about how it ranks as a sugar producer.

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 202	4-25-17	Rat. ....	.....	.....	22.75	20.90	.....	91.86	.....
P. R. 202	Apr. 1918	Pl. 11 mo. ....	.....	.....	19.98	17.73	.....	88.96	.....
P. R. 202	4-28-19	Rat. 11 mo. ....	.....	.....	19.60	17.68	.....	90.63	.....
P. R. 202	1-13-20	Rat. 8 mo. ....	.....	61.90	14.42	10.77	.....	74.68	.....
Crist.	1-13-20	Rat. 8 mo. ....	.....	.....	.....	16.35	.....	.....	.....
P. R. 202	1-13-20	Pl. 10 mo. ....	.....	64.58	18.66	16.73	.....	89.65	.....
P. R. 202	12-8-20	Rat. 10 mo. ....	No	71.1	13.13	10.27	2.10	72.68	8.0
Rayada	12-8-20	Rat. 10 mo. ....	No	71.1	15.83	13.45	1.76	84.96	8.08
P. R. 202	2-2-21	Rat. 10 mo. ....	No	67.5	17.75	15.71	0.95	88.5	11.70
P. R. 202	2-2-21	Rat. 10 mo. ....	Yes	67.3	19.15	16.77	0.79	87.57	11.77
P. R. 202	2-7-21	Pl. 16 mo. ....	No	62.5	18.10	16.26	0.71	89.57	11.56
Crist.	2-7-21	Pl. 16 mo. ....	No	68.6	17.90	16.14	0.803	90.16	13.81
P. R. 202	4-29-21	Pl. 18 mo. ....	No	60.7	20.10	18.37	0.168	92.38	.....

#### P. R.-207.

Parent, B-306 (=B347).

Erect, good medium in vigor and stooling, arrows frequently. Stalks medium length and diameter, green at length with faint pink flush, light bloom. Internodes medium length, somewhat larger below, nearly straight, furrow none. Nodes somewhat constricted, only slightly oblique; growth ring medium width, elevated, concolorous; root band narrow. 6 to 8 mm., concolorous; rudimentary roots large, crowded, whitish, in 3 rows; leaf scar glabrous, narrow, appressed behind; glaucous band a little constricted, poorly defined. Buds oval-ovate, obtuse, about  $9 \times 12$  mm., exceeding the growth ring, margin narrow, equal, germination subapical, basal places short and inconspicuous, marginal vestiture scanty. Leaf sheaths with a short appressed vestiture, sometimes becoming glabrate, green or slightly tinted, glaucous; throat densely lannate, vestiture of long hairs, scanty, mostly on the margins; collar well marked, reaching the midrib, glaucous, the margins lannate; ligule narrow, 2 to 3 mm., even; ligular processes rather short and broad, obtuse, on one side only. Leaf blades erect, the tips declined, flat, 6 to 7 cm., dark green, serrulate to the base, not ciliate.

This cane grows less rapidly at first than some of the others, but it ultimately makes a good tonnage and ratoons well. It is a medium-season cane, not maturing quite as early as *Cristalina*, still it may be used for spring planting. Although it arrows freely if

planted early, spring plantings seldom arrow and may be carried at the Station planted in May 1918 was not cut till April 1920 23 months old. It was in perfectly good condition showing very few rotten canes. It is best planted in *vega* lands but does fair well in the hills. Its disease resistance has not been fully tested.

As seen from the following analyses, it develops very satisfactory sucrose and purity:

K nd	Date	Age	Arr.	Extr.	Brix.	Sucr.	R. S.	Puri y	Fib
P. R. 207	4-24-13	Pl.			19.1	17.55		91.8	
P. R. 207	Apr. 1918				19.50	16.79		85.84	
P. R. 207	6-1-18	Rat.			18.36	16.30		88.92	
P. R. 207	4-29-19	Rat.			20.0	18.80		90.40	
P. R. 207	1-13-20	Rat. 8 mo.		61.90	16.09	12.59		78.24	
Crist.	1-13-20	Rat. 8 mo.				16.35			
P. R. 207	1-13-20	Pl. 10 mo.				14.51		84.26	
P. R. 207	Apr. 1920	Rat.		64.47	17.22	14.51		88.39	
P. R. 207	1-14-20	Pl. 20 mo.		60.0	21.54	19.04		91.70	
P. R. 207	1-14-20	Pl. 20 mo.		62.88	18.68	17.13		91.23	
Crist.	1-14-20	Pl. 20 mo.		60.22	17.46	15.93		91.23	
P. R. 207	1-21-21	Pl. 15 mo.	No.	67.10	16.8	14.28	1.26	85.0	12
Crist.	1-21-21	Pl. 15 mo.	No.	70.0	17.25	15.96	0.37	92.52	9
P. R. 207	2-14-21	Pl. 16 mo.	No.	72.4	18.30	15.84	1.08	86.55	13
Rayada	2-14-21	Pl. 16 mo.	No.	63.6	17.15	15.25	0.81	88.92	12
P. R. 207	4-29-21	Pl. 18 mo.	No.	62.9	17.70	16.06	0.485	90.53	

#### P. R.-208.

Parentage unknown.

Erect, but at length declined, medium vigor and stooling, seldom arrows. Stalks of medium length and diameter, green then yellowish with a pronounced red flush, light bloom. Internodes medium length enlarged below and somewhat shouldered on side opposite bud, furrow well marked. Nodes constricted, but slightly oblique; growth ring narrow, often sunken, greenish; root band narrow, 6 to 8 cm., tapering downward, darker green; rudimentary roots small, crowded, brownish, in 3 or sometimes 4 rows; leaf scar glabrous, appressed behind glaucous band constricted, about 8 mm., well defined. Buds triangular-ovate, apex narrow but obtuse, about  $12 \times 14$  mm., exceeding the growth ring by one-third or one-half, margin medium width, little wider below but not shouldered, germination apical, basal plate well developed, and with sparse marginal and apical vestiture. Leaf sheaths with a dense but rather short assurgent vestiture, green or slightly tinted, glaucous, somewhat stained with purple at base within throat densely lannate, and with an abundant vestiture of medium short hairs on the margins and behind the ligule, conspicuous, pouched and wrinkled; collar conspicuous, dark brown, reaching to midrib, glaucous and lannate nearly to the middle; ligule abruptly wider at center, reaching 4 or 5 mm., the ends narrow, nearly ever ligular processes none or poorly developed. Leaf blades suberect the tips declined, broad, flat, reaching 8 cm., dark green, minutely serrate late to the base, not ciliate.

This averages the richest in sucrose of any of the Porto Rico seedlings but it can not be recommended for general planting since

it does poorly on poor, dry lands, where it suffers considerably from root disease. It is a desirable cane for rich, moist lands and responds readily to increased applications of fertilizers. It develops sucrose fairly early but continues to make growth for a long season. It has not been tested as a long-crop cane but from its general habit it should be well adapted to holding over. It may be planted either in fall or spring.

In the Santa Rita tests it proved to be rather more resistant to mosaic than the Rayada. It has not been tested for gum disease. It is sometimes badly eaten by rats.

In a variety test at Central Mercedita, Yabucoa, on rich cow-penned land, cut February 1920 as plant cane of 17 months, this gave: tons per acre, 57.35; brix, 15.7; sucrose, 13.58; purity, 86.3. It was evidently still immature.

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 208.....	4-24-13	Pl.....	.....	*	19.3	18.44	.....	95.5	.....
P. R. 208.....	5-4-16	.....	.....	.....	19.4	18.44	.....	95.05	.....
P. R. 208.....	4-25-17	.....	.....	.....	24.80	23.10	.....	93.41	.....
P. R. 208.....	2-12-18	Pl.....	.....	.....	15.70	12.59	.....	80.19	.....
P. R. 208.....	1-8-20	Rat. 14 mo.	.....	58.13	17.12	14.71	.....	85.62	.....
P. R. 208.....	12-10-20	Rat. 10 mo.	No.....	75.0	14.43	11.04	2.58	76.43	8.0
Rayada.....	12-10-20	Rat. 10 mo.	No.....	71.1	15.83	13.45	1.76	84.96	8.08
P. R. 208.....	12-22-20	Rat. 14 mo.	No.....	72.0	17.63	15.57	0.89	87.97	7.84
Cristalina.....	12-22-20	Rat. 14 mo.	No.....	70.0	17.60	15.53	0.28	88.74	9.60
P. R. 208.....	1-28-21	Rat. 15 mo.	No.....	72.7	18.15	16.43	0.71	90.18	13.15
Cristalina.....	1-28-21	Rat. 15 mo.	No.....	68.6	17.90	16.14	0.803	90.16	13.81
P. R. 208.....	1-19-21	Pl. 15 mo.	No.....	70.2	20.35	18.52	0.31	91.0	9.53
Cristalina.....	1-19-21	Pl. 15 mo.	No.....	70.0	17.25	15.96	0.37	82.62	9.60
P. R. 208.....	2-14-21	Pl. 16 mo.	No.....	70.2	18.75	17.0	0.71	90.66	10.36
Rayada.....	2-14-21	Pl. 16 mo.	No.....	63.6	17.15	15.25	0.81	88.92	12.37
P. R. 208.....	4-29-21	Pl. 18 mo.	No.....	65.6	21.26	19.90	0.168	93.50	.....
Cristalina.....	4-29-21	Pl. 18 mo.	No.....	65.1	19.55	18.93	0.241	96.82	.....

#### P. R.—209.

Parentage unknown:

Erect, or sometimes tardily decumbent, good vigor, medium stooling, sometimes arrows. Stalks long, medium diameter, green, then yellow, with faint reddish flush, no bloom. Internodes medium to short, slightly compressed, strongly staggered, furrow none. Nodes prominent, scarcely constricted, oblique; growth ring broad, 2 to 4 mm., elevated, concolorous then brownish; root band oblique, 6 to 10 mm., concolorous; rudimentary roots large, crowded, yellowish, in about 3 rows; leaf scar minutely appressed ciliate then glabrate, appressed behind; glaucous band about 8 mm., scarcely constricted, well defined. Buds broadly ovate or subhemispheric, obtusely rounded, about 12 to 14 × 12 to 14 mm., exceeding the growth ring by one-fourth to one-third, margin narrow but shouldered, germination dorsal, often germinating prominently on the standing stalk, basal plac well developed, marginal vestiture scanty but ending in a conspicuous apical tuft. Leaf sheaths with heavy vestiture of ap-

pressed white hairs, green, glaucous, faintly stained with purple at the base within; throat densely lannate and with an abundant vestiture of long hairs on margins and behind ligule; collar broad, reaching the midrib, lannate; ligule medium, about 3 mm., even; ligular processes sometimes present, often poorly developed. Leaf blade erect except the tips, somewhat two ranked, flat, broad, 9 or 10 cm dark green, minutely serrulate, the base even and ciliate.

This is another cane that can only be recommended for moist rich soils. It is a failure on poor hill land. Where conditions are favorable it makes heavy tonnage and develops a good degree of sucrose. It responds to heavy applications of fertilizers on moist lands.

It is better for fall than for spring planting. In the Saint Rita experiment it suffered more than Rayada from both root diseases and mosaic. It has not been tested for gum disease.

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 209	4-24-13	Pl.			17.4	15.44		88.7	
P. R. 209	5-4-16				16.4	14.50		88.41	
P. R. 209	4-15-17				22.38	10.50		91.60	
P. R. 209	Apr. 1918	Pl.			16.30	13.55		81.80	
P. R. 209	4-28-19	Rat.		55.0	19.20	17.4		90.63	
P. R. 209	1-13-20	Rat. 8 mo.		63.33	13.38	9.72		72.64	
Crist.	1-13-20	Rat. 8 mo.				16.35			
P. R. 209	Apr. 1920	Rat. 11 mo.		68.91	19.41	17.31		88.25	
P. R. 209	12-13-20	Rat. 10 mo.	No.	71.60	14.79	11.71	2.11	79.1	10.5
Rayada	12-13-20	Rat. 10 mo.	No.	71.10	15.83	13.45	1.76	84.96	8.0
P. R. 209	1-21-21	Pl. 15 mo.	Yes.	64.3	17.80	15.02	1.15	86.82	12.8
Crist.	1-21-21	Pl. 15 mo.	No.	70.0	17.25	15.96	0.37	92.52	9.0
P. R. 209	2-14-21	Pl. 16 mo.	No.	68.0	18.75	17.05	0.62	90.93	12.3
Rayada	2-14-21	Pl. 16 mo.	No.	63.6	17.15	15.26	0.81	88.92	12.3
P. R. 209	4-30-21	Pl. 18 mo.	No.	62.7	17.45	16.47	0.751	91.75	
P. R. 209	4-30-21	Pl. 18 mo.	Yes.	65.7	18.50	16.98	0.628	91.78	

#### P. R.-210.

Parentage unknown.

Strictly erect, medium vigor and stooling, seldom arrows. Stalk medium diameter, green then yellowish, with a red flush, no bloom. Internodes medium length, cylindrical, straight, furrow none. Node not constricted, scarcely oblique; growth ring narrow, 1 to 2 mm nearly even, usually concolorous or sometimes brownish; root band narrow, 6 to 8 mm., concolorous or darker; rudimentary roots small crowded, in about 3 rows; leaf scar glabrous, appressed behind glaucous band about 8 mm., well marked. Buds suborbicular, often slightly wider than long, 9 to 10 × 8 to 9 mm., very slightly exceeding growth ring, margin medium, somewhat shouldered, germination sub apical, basal places short, marginal and apical vestiture scanty but with more or less short pubescence well up on sides. Leaf sheath with a moderate vestiture, green, not glaucous; throat dark brown strongly lannate, with an abundant vestiture of hairs on the margins collar dark brown, glaucous, the margins densely lannate; ligule

about 4 mm., the margin fimbriate and ciliate; ligular processes, one usually well developed about 12 mm. acute. Leaf blades strictly erect, narrow, 5 or 6 cm., flat, somewhat two ranked, medium green, sharply serrulate to the base, not ciliate.

This is another good cane that can hardly be recommended for general planting. It requires rich land and good treatment when it yields a heavy tonnage. It does not mature quite as early as *Cristalina*, still it can be used for spring planting. It grows so strictly erect that it should be planted closer than other kinds. It stands up well and is seldom damaged by rats. It should be tested for the alluvial irrigated lands of the south coast.

In the Santa Rita Experiment it made a good showing, being decidedly more resistant to mosaic than *Rayada*. On poor lands, however, it often suffers from root disease. It has not been tested for gum disease.

In the variety experiment at Central Mercedita, Yabucoa, on rich cowpened land this cane made a fine showing being third in tonnage. Its record was, February 1920, plant cane 17 months, tons per acre, 57.55; brix, 15.80; sucrose, 13.12; purity, 83.0. This would indicate 5.399 tons sugar per acre. Other records follow:

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 210.....	4-25-13	Pl.....	.....	.....	19.4	17.54	.....	90.4	.....
P. R. 210.....	5-4-16	.....	.....	.....	17.6	16.17	.....	91.87	.....
P. R. 210*.....	4-25-17	.....	.....	.....	23.38	21.30	.....	91.10	.....
P. R. 210.....	12-8-50	Rat. 10 mo	No	71.4	14.93	11.81	2.71	79.10	9.15
Crist.....	12-8-20	Rat. 10 mo	No	73.0	15.63	13.41	1.78	85.75	10.60
P. R. 210.....	1-21-21	Pl. 15 mo	No	70.9	16.90	14.22	1.77	84.14	11.64
Crist.....	1-21-21	Pl. 15 mo	No	70.0	17.25	16.96	0.37	92.82	9.60
P. R. 210.....	3-3-21	Pl. 16 mo	No	69.7	18.20	16.62	0.39	91.31	12.72
Rayada.....	3-3-21	Pl. 16 mo	No	72.7	18.25	16.50	0.71	89.31	12.00
P. R. 210.....	4-30-21	Pl. 18 mo	No	66.6	19.50	18.06	0.491	92.11	.....

\* Sixth in tons cane out of 47 kinds.

#### P. R.--219.

Parent, D-117:

Erect, or finally decumbent, good vigor, medium stooling, arrows freely. Stalks long, medium diameter, green with a slight red flush, light bloom. Internodes medium to long, enlarged but hardly shouldered below, slightly staggered, furrow none. Nodes slightly constricted, somewhat oblique, growth ring about 2 mm., somewhat elevated, constituting the thickest part of the stalk, brownish-green; root band 7 to 10 mm., concolorous or rather brighter green, tapering downward; rudimentary roots small, crowded, pale brownish, in 4 or sometimes 5 rows; leaf scar glabrous, appressed behind; glaucous band about 8 mm., slightly constricted, well defined. Buds broadly ovate, subacute, about 10 to 14 × 10 to 14 mm., slightly exceeding

the growth ring, margin narrow, uniform, germination subapical, basal places short but well developed, marginal and apical vestiture medium. Leaf sheaths with a sparing vestiture of short hairs on the back, at length sometimes glabrate, green or slightly tinted, somewhat glaucous, stained with purple at base within; throat densely lannate and with an abundant vestiture of hairs on the margins and behind the ligule; collar narrow, reaching the midrib, glaucous, the margin lannate; ligule about 3 mm., even; ligular processes sometimes one strongly developed reaching 25 to 30 mm., acute, sometimes wanting. Leaf blades erect except the tips, rather narrow especially at the base, reaching 6 cm. above the middle, flat or somewhat plicate, medium green, minutely serrulate, not ciliate above the throat. (Hardly distinguishable from D-117.)

This cane grows vigorously but it does not seem to last well in the field after arrowing, usually showing considerable top rot and rind disease. In some fields it has suffered seriously from root disease. It is known to contract mosaic but how badly it is injured has not been determined. It should probably be abandoned as there are many other equally good canes without these faults. Its sucrose record follows:

Kind	Date	Age	Arr.	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 219.....	2-22-13	Plant.....			17.4	14.54		83.5	
P. R. 219.....	5-4-16	Plant.....			17.1	15.13		88.7	
P. R. 219*.....	4-25-17	Plant.....			21.45	19.9		92.77	
P. R. 219.....	4-2-19	Rat. 11 mo.....		50.06	19.7	18.0		91.36	
P. R. 219.....	Apr. 1918	Pl. 11 mo.....			18.85	16.4		85.09	
P. R. 219.....	1-13-20	Rat. 8 mo.....		59.52	16.46	13.84		84.08	
Crist.....	1-13-29	Rat. 8 mo.....				16.35			
P. R. 219.....	Apr. 1920	Rat. 11 mo.....		66.63	20.14	18.10		89.87	
P. R. 219.....	12-8-20	Rat. 10 mo.....	No	73.5	13.83	9.70		70.13	7.42
Rayada.....	12-8-20	Rat. 10 mo.....	No	71.1	17.83	13.45	1.76	84.96	8.08
P. R. 219†.....	1-21-21	Pl. 15 mo.....	Yes	67.2	19.10	16.82	0.94	88.06	11.15
Crist.....	1-21-21	Pl. 15 mo.....	No	70.0	17.25	15.96	0.37	92.52	9.60

\* Second in tons cane out of 47 kinds.

† Third in sucrose out of 40 kinds to date.

#### P. R.-230.

Parentage unknown:

Erect, or at length decumbent, vigorous, good stooler, arrows freely. Stalks medium length and diameter, green then yellow, little or no flush, no bloom. Internodes medium to long, at first cylindrical then tumid on side behind the bud, somewhat staggered, furrow usually none. Nodes slightly constricted, somewhat oblique; growth ring broad, often 3 or more mm., somewhat elevated, brownish; root band 8 to 10 mm., somewhat constricted, nearly concolorous; rudimentary roots large, crowded, yellowish brown, in about 3 rows; leaf scar glabrous, appressed behind; glaucous band narrow, 6 or 7 mm., slightly constricted, well defined. Buds ovate, obtuse, at first about 10 × 10 mm., often soon expanding, usually stained purplish, exceed-

ing the growth ring, margin rather broad, uniform, germination sub-apical, basal places short and scanty, margins nearly glabrate, a scanty apical tuft from behind the bud. Leaf sheaths at first with a moderate vestiture, becoming glabrate, green, somewhat glaucous; throat lannate, with a sparing vestiture of short hairs on the margins and behind the ligule; collar narrow, reaching the midrib, glaucous or the margins slightly lannate; ligule about 3 mm., the margin fimbriate and ciliate; ligular processes usually one moderately developed. Leaf blades suberect the tips declined, flat, about 6 or 7 cm. wide, bright green, minutely serrulate, the base even and slightly ciliate.

This cane somewhat closely resembles D-117 but the foliage is lighter in color, the buds are more nearly glabrate and the collar is less lannate.

It is a rather promising cane, especially for the red shale hills where it ratoons strongly. It does not mature quite as early as Cristalina but may be used for either fall or spring planting.

It has good resistance to root disease as shown by its good ratooning power. Its resistance to mosaic and gum disease has not been determined.

Its record for sucrose follows:

Kind	Date	Age	Arr.	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 230.....	4-25-13	Pl.....	.....	.....	15.8	12.42	.....	78.6	.....
P. R. 230.....	5-4-16	.....	.....	.....	20.5	17.01	.....	83.12	.....
P. R. 230*.....	4-25-17	.....	.....	.....	22.51	20.70	.....	91.96	.....
P. R. 230.....	Apr. 1918	Pl. 11 mo.....	.....	.....	21.50	19.10	.....	88.83	.....
P. R. 230.....	4-28-19	Rat. 12 mo.....	.....	59.0	20.50	18.38	.....	89.63	.....
P. R. 230.....	1-13-20	Rat. 8 mo.....	.....	61.91	17.80	15.00	.....	84.55	.....
Crist.....	1-13-20	Rat. 8 mo.....	.....	.....	.....	16.35	.....	.....	.....
P. R. 230.....	Apr. 1920	Rat. 11 mo.....	.....	61.90	22.01	20.23	.....	91.91	.....
P. R. 230.....	12-8-20	Rat. 10 mo.....	No.....	75.0	12.53	8.02	3.65	64.0	9.0
Rayada.....	12-8-20	Rat. 10 mo.....	No.....	71.1	15.83	13.45	1.76	81.96	8.08
P. R. 230.....	1-21-21	Pl. 15 mo.....	yes.....	67.2	18.30	15.38	1.31	81.04	12.46
Crist.....	1-21-21	Pl. 15 mo*.....	No.....	76.0	17.25	15.96	0.37	92.52	9.60
P. R. 230.....	2-14-21	Pl. 16 mo.....	No.....	69.5	17.85	15.58	1.07	86.70	12.20
Rayada.....	2-14-21	Pl. 16 mo.....	No.....	65.6	17.15	15.25	0.81	88.92	12.37

\* Third in tons cane out of 47 kinds.

P. R.-260.

Parentage unknown:

Erect, vigorous, medium stooling, arrows freely. Stalks long, medium diameter, green, then yellow, with a faint flush, medium heavy bloom. Internodes medium to long, cylindrical, slightly staggered, furrow usually evident for full length of internode. Nodes scarcely constricted, somewhat oblique; growth ring narrow, even, concolorous; root band 8 to 10 mm., concolorous; rudimentary roots large, indistinct, in about 3 rows; leaf-scar glabrous, constricted behind. Buds narrowly ovate, acute, about  $10 \times 14$  mm. but often soon considerably elongated, exceeding the growth ring by one-third to one-half, margin medium width, uniform, germination apical, basal places heavy with a

conspicuous tuft on shoulders, margin glabrate, but a sparse, apical tuft. Leaf sheaths with a heavy stiff vestiture, green a little glaucous; stained with purple at base within; throat lannate, with a vestiture of rather short hairs on the margins; collar reaching the midrib, lannate; ligule about 3 mm., fimbriate; ligular processes one usually developed, about 14 mm., obtuse. Leaf blades erect except the tips, flat, about 7 cm. wide, medium green, minutely but sharply serrulate, the base not ciliate.

This is one of the best canes in this series. It does fairly well on hills but is best on rich *vega* land. It matures rather late and so is best planted in the fall. On suitable soils it gives a very heavy tonnage and ratoons well. Its planting is being considerably extended in the Guánica district.

In the Santa Rita immunity experiment it proved to be rather unusually resistant to mosaic and its seedlings, a number of which have been grown at the Mayagüez Station, seem to quite uniformly inherit this characteristic. It has not been tested for gum disease.

In a variety test on rich cow-penned land at Central Mercedita, Yabucoa, it made the highest tonnage of any cane tested. Cut February 1920 as plant cane at 17 months it gave: tons cane per acre, 78.82; brix, 14.55; sucrose, 11.18; purity, 74.8; tons sugar per acre, 6.313. Clearly this cane was still green or the yield of sugar would have been much higher. Other analyses follow:

Kind	Date	Age	Arr.	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 260.....	4-24-13	Pl. ....	.....	.....	18.2	17.7	.....	93.2	.....
P. R. 260.....	5-4-16	.....	.....	.....	18.5	17.68	.....	95.56	.....
P. R. 260.....	4-25-17	.....	.....	.....	20.61	18.50	.....	89.76	.....
P. R. 260.....	2-12-17	Pl. ....	.....	.....	17.70	14.73	.....	83.22	.....
P. R. 260.....	2-1-18	Rat. 12 mo. ....	.....	.....	14.60	12.50	.....	85.61	.....
P. R. 260.....	12-8-20	Rat. 10 mo. ....	.....	73.0	14.43	10.52	2.85	72.90	7.56
P. R. 260.....	12-8-20	Rat. 10 mo. ....	.....	73.0	15.63	13.61	1.78	85.76	10.80
Crist.....	12-22-20	Rat. 14 mo. ....	No. ....	69.2	15.40	12.45	1.47	80.84	12.44
P. R. 260.....	12-22-20	Rat. 14 mo. ....	Yes. ....	65.0	17.00	14.81	0.61	87.11	14.00
P. R. 260.....	12-22-20	Rat. 14 mo. ....	No. ....	70.3	17.85	16.14	0.33	90.42	10.69
P. R. 260.....	1-21-21	Pl. 15 mo. ....	Yes. ....	67.2	18.10	15.50	0.77	85.63	11.80
Crist.....	1-21-21	Pl. 15 mo. ....	No. ....	70.0	17.25	15.96	0.37	92.52	9.60
P. R. 260.....	2-28-21	Pl. 16 mo. ....	No. ....	64.2	17.85	15.90	0.62	89.07	12.88
P. R. 260.....	2-28-21	Pl. 16 mo. ....	Yes. ....	65.1	17.95	15.73	0.75	87.47	13.96
Rayada.....	2-28-21	Pl. 16 mo. ....	No. ....	63.6	17.15	15.25	0.81	88.92	12.37
P. R. 260.....	5-3-21	Pl. 18 mo. ....	Yes. ....	66.1	19.70	18.18	0.333	92.28	.....

#### P. R. 270.

Parentage unknown.

Soon decumbent and prostrate, vigorous, medium stooler, arrows frequently. Stalks long, medium diameter, bright green, sometimes with pink flush, no bloom. Internodes medium length, cylindrical, somewhat staggered, furrow none or evident on the lower internodes. Nodes scarcely constricted, oblique; growth ring broad but indistinct, even, concolorous; root band 8 to 10 mm., concolorous; rudimentary

roots crowded, pallid, in 3 or 4 rows; leaf scar glabrous, narrow, appressed behind; glaucous band wide, 10 mm., slightly constricted, well defined. Buds oval, 7 to 10  $\times$  8 to 12 mm., not exceeding the growth ring, margin rather broad, uniform, germination subapical or subdorsal, basal places short, margins nearly glabrate but with a few scattered hairs, a sparse apical tuft from behind the bud. Leaf sheaths with heavy stiff vestiture, green, scarcely glaucous; throat densely lannate and with scanty marginal vestiture; collar reaching the midrib, glaucous, the margins lannate; ligule short, 2 or 3 mm., even; ligular processes when present reduced to a blunt lateral protuberance. Leaf blades erect except the tips, somewhat plicate and inrolled, 7 to 7½ cm., sharply serrulate to the base, not ciliate.

This is a good vigorous cane but with nothing to particularly recommend it. It is rather late in maturing. In the immunity tests at Santa Rita it made a poor showing, being badly injured by root disease and top rot and suffering seriously from mosaic.

It develops good sucrose but only when fully mature:

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 270.....	4-24-13	Pl.....	.....	.....	19.3	17.28	.....	89.5	.....
P. R. 270.....	5-4-16	.....	.....	.....	18.2	16.44	.....	90.32	.....
P. R. 270.....	4-25-17	.....	.....	.....	22.20	20.50	.....	92.34	.....
P. R. 270.....	Apr. 1918	Pl. 11 mo.....	.....	.....	18.05	15.59	.....	85.20	.....
P. R. 270.....	4-28-19	Rat. 12 mo.....	.....	58.60	20.00	18.25	.....	91.25	.....
P. R. 270.....	1-14-20	Rat. 12 mo.....	.....	63.04	15.72	13.31	.....	84.06	.....
Crist.....	1-14-20	Rat. 12 mo.....	.....	60.22	17.46	15.93	.....	91.23	.....
P. R. 270.....	4-5-20	Pl. 13 mo.....	.....	60.00	21.39	18.35	.....	90.46	.....
P. R. 270.....	12-10-20	Rat. 10 mo.....	No.....	69.00	14.33	10.69	3.00	74.59	7.44
Rayada.....	12-10-20	Rat. 10 mo.....	No.....	71.10	15.83	13.45	1.76	81.96	8.08
P. R. 270.....	2-2-21	Rat. 10 mo.....	No.....	67.80	17.40	14.97	1.19	86.03	12.42
P. R. 270.....	2-2-21	Rat. 10 mo.....	Yes.....	70.90	17.55	15.20	0.95	86.60	12.80
P. R. 270.....	2-28-21	Pl. 16 mo.....	No.....	61.9	17.75	15.68	0.62	90.02	12.22
P. R. 270.....	2-28-21	Pl. 16 mo.....	Yes.....	66.6	17.20	16.56	0.64	98.14	12.48
Rayada.....	2-28-21	Pl. 16 mo.....	No.....	63.6	17.15	15.25	0.81	81.92	12.37

#### P. R. 271.

Parentage unknown.

Erect or at length declined, vigorous, moderate stooling, arrows frequently. Stalks long, medium to medium stout, green then yellow, often a slight purplish flush, heavy bloom. Internodes medium length, cylindrical, staggered, furrow usually none. Nodes scarcely constricted, somewhat oblique; growth ring rather broad but indistinct, greenish or brownish; root band narrow, 6 to 8 mm., concolorous; rudimentary roots large but indistinct, in 2 or 3 rows; leaf scar glabrous, narrow, appressed behind; glaucous band broad 10 to 12 mm., very slightly constricted, not well defined. Buds triangular-ovate, 11 to 12  $\times$  11 to 12 mm., slightly exceeding the growth ring, margin rather broad, a little wider below but not shouldered, germination apical or subapical, heavy basal places, moderate marginal vestiture extending well up on sides of bud and a conspicuous apical tuft. Leaf sheaths with dense harsh vestiture, green, a little glau-

cous; throat densely lannate, and with a heavy vestiture of medium short hairs on the margins and behind the ligule; collar reaching the midrib, lannate; ligule about 3 mm., even; ligular processes usually none. Leaf blades erect almost to the tips, somewhat plicate, two ranked, broad 8 or 9 cm., sharply serrulate to the base, not ciliate.

This is one of the best general-purpose canes in this series but it is a little late in maturing and so should be used for fall planting. It succeeds well on either high or low land.

It is known to be attacked by mosaic but it was not included in the Santa Rita experiment, so its disease resistance has not been fully tested.

When immature it is very low in sucrose but develops a good percentage at maturity.

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 271.....	4-25-13	Pl. ....	.....	.....	19.50	17.91	.....	91.8	.....
P. R. 271.....	5-4-16	.....	.....	.....	20.50	19.52	.....	95.21	.....
P. R. 271.....	4-25-17	.....	.....	.....	22.85	21.00	.....	91.90	.....
P. R. 271.....	4-5-18	Pl. 11 mo.....	.....	.....	20.15	17.83	.....	88.48	.....
P. R. 271.....	4-29-19	Rat. 12 mo.....	.....	58.2	20.30	18.47	.....	91.0	.....
P. R. 271.....	1-13-20	Rat. 8 mo.....	.....	63.46	16.19	13.50	.....	83.38	.....
Crist.....	1-13-20	Rat. 8 mo.....	.....	.....	.....	16.35	.....	.....	.....
P. R. 271.....	Apr. 1919	Rat. 11 mo.....	.....	66.66	20.44	18.67	.....	91.63	.....
P. R. 271.....	2-28-20	Pl. 16 mo.....	No.....	71.60	18.55	16.92	0.65	91.21	12.49
Rayada.....	2-28-20	Pl. 16 mo.....	No.....	63.60	17.15	15.27	0.81	88.92	12.57
P. R. 271.....	5-4-21	Pl. 18 mo.....	Yes.....	67.2	19.60	18.30	0.475	93.36	.....

#### P. R. 272.

Parentage unknown.

Erect or at length decumbent, moderate vigor and stooling, seldom arrows. Stalks medium length and diameter, green or yellowish usually with pink flush, no bloom. Internodes medium length, cylindrical or somewhat larger below, straight, furrow none. Nodes scarcely constricted, nearly rectangular; growth ring 2 or 3 mm., usually elevated, rather inconspicuous; root band about 8 mm., the base constricted, tapering downward, concolorous, rudimentary roots large, whitish, in 2 or 3 rows; leaf scar at first somewhat ciliate below the bud, then glabrate, appressed behind; glaucous band about 6 mm., poorly defined. Buds broadly oval, usually reddish, about  $9 \times 10$  mm., not exceeding the growth ring, margin narrow, uniform, germination subdorsal, almost glabrate, basal places greatly reduced and very scanty marginal vestiture. Leaf sheaths with vestiture of soft hairs at length often nearly glabrate, green but somewhat tinted, somewhat glaucous, hanging long on the stalk; slightly stained purple at base within; throat lannate and with an abundant vestiture of hairs on margins and behind ligule; collar broad, deeply wrinkled, reaching the midrib, glaucous or slightly lannate, on margins; ligule abruptly widened at center, reaching 5 mm., fimbriate and ciliate; ligular processes on one side only, short, obtuse. Leaf blades spread-

ing, strongly revolute, about 7 cm., light green, minutely serrulate, the base not ciliate.

This cane is not desirable for general planting since it is lacking in vigor on poor hill lands. It is adapted to moist *vegas*. It ripens fairly early and develops high sucrose at full maturity. Its disease resistance has not been fully tested.

It made a good record in the rich cow-penned land in the variety tests at Central Mercedita, Yabucoa, where as cut in February 1920 as plant cane at 16 months it gave: tons cane, 59.46; brix, 14.90; sucrose, 12.81; purity, 85.3. It was evidently not fully matured, since as seen in the following analyses the sucrose should go much higher:

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 272.....	4-24-13	Pl.....	.....	.....	18.6	17.05	.....	91.6	.....
P. R. 272.....	5-4-16	.....	.....	.....	21.3	20.97	.....	98.45	.....
P. R. 272.....	4-25-17	.....	.....	.....	22.58	20.50	.....	90.70	.....
P. R. 272.....	2-4-18	Pl.....	.....	.....	12.87	10.00	.....	77.70	.....
P. R. 272.....	1-7-20	Rat. 14 mo.....	.....	59.61	17.07	14.76	.....	86.46	.....
P. R. 272.....	12-13-20	Rat. 10 mo.....	.....	71.1	15.43	12.81	1.74	81.20	9.21
Cryst.....	12-13-20	Rat. 10 mo.....	No.....	.....	.....	13.41	1.78	85.76	10.80
P. R. 272.....	12-18-20	Rat. 14 mo.....	No.....	69.1	17.50	15.17	1.01	86.86	9.88
Cryst.....	12-18-20	Rat. 14 mo.....	No.....	70.0	17.50	15.52	0.28	88.74	9.60
P. R. 272.....	2-23-21	Pl. 16 mo.....	No.....	66.6	19.90	18.34	0.72	92.16	11.35
Rayada.....	2-23-21	Pl. 16 mo.....	No.....	63.6	17.15	15.25	0.81	78.92	12.47
P. R. 272.....	5-4-21	Pl. 18 mo.....	No.....	60.9	20.55	18.35	0.265	93.91	.....

#### P. R. 292.

Parent, D-117.

Erect, or at length somewhat declined, vigorous, good stooler, arrows freely. Stalks long, medium diameter, green with strong red flush, heavy bloom. Internodes long, enlarged below, staggered, furrow none. Nodes constricted, oblique; growth ring about 2 mm., brownish, somewhat elevated; root band 6 or 8 mm., tapering downwards the base constricted, concolorous; rudimentary roots obscure, in about 3 rows; leaf scar glabrous, narrow, not much compressed behind; glaucous band constricted, 8 to 10 mm. wide, poorly defined. Buds broadly triangular-ovate but seeming obovate from the flaring margin, about 10 × 10 mm., scarcely exceeding the growth ring margin very wide and with long shoulders reaching almost to the emarginate tip, germination subapical, basal places scanty but extending half way up on the shoulders, marginal vestiture above the places very scanty, apex glabrous. Leaf sheaths with short appressed vestiture, green, somewhat tinted, slightly glaucous, stained, with purple at the base within; throat densely lannate and with a vestiture of rather short hairs on the margins and behind the ligule; collar reaching the midrib, glaucous, the margins minutely lannate; ligule short, about 2 mm., fimbriate; ligular processes reduced to a scarcely noticeable lateral protuberance on one side. Leaf blades erect except

the tips, somewhat plicate, or nearly flat, 7 or 8 cm. wide, dark green, minutely serrulate, the base even, sometimes slightly ciliate.

This is a good general-purpose cane. It can be especially recommended for the red shale hills where it gives heavy tonnage and ratoons remarkable well. It does not ripen quite as early as Cristalina, still it may be used for either fall or spring planting. It arrows too freely to be held over as long crop or *caña quedada*.

It made a good record in the Santa Rita immunity tests being rather more resistant than Rayada to both rooth disease and mosaic. It has not been tested for gum disease.

Kind.	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 292.....	4-23-13	Pl.....	.....	.....	17.94	15.70	.....	87.5	.....
P. R. 292.....	5-5-16	.....	.....	.....	19.10	16.70	.....	86.91	.....
P. R. 292.....	4-25-17	.....	.....	.....	22.55	21.50	.....	95.34	.....
P. R. 292.....	2-4-18	Pl.....	.....	.....	16.50	14.10	.....	85.4	.....
P. R. 292.....	1-18-20	Rat. 14 mo.....	.....	59.49	15.32	12.96	.....	84.59	.....
P. R. 292.....	12-10-20	Rat. 10 mo.....	No.....	72.70	15.23	12.10	2.47	79.44	8.73
Rayada.....	12-10-20	Rat. 10 mo.....	No.....	71.10	15.83	13.45	1.76	84.96	8.08
P. R. 292.....	12-18-20	Rat. 14 mo.....	No.....	67.20	16.63	14.28	0.86	85.86	9.84
P. R. 292.....	12-18-20	Rat. 14 mo.....	Yes.....	65.60	17.03	14.79	0.63	86.86	11.69
Crist.....	12-18-20	Rat. 14 mo.....	No.....	70.00	17.50	15.55	0.28	88.74	9.60
P. R. 292.....	2-7-21	Pl. 16 mo.....	No.....	66.6	18.50	16.8	0.65	90.81	.....
P. R. 292.....	2-7-21	Pl. 16 mo.....	Yes.....	61.9	18.20	16.45	0.55	90.38	12.95
Crist.....	2-7-21	Pl. 16 mo.....	No.....	68.6	17.90	16.14	0.803	90.16	13.81
P. R. 292.....	2-28-21	Pl. 16 mo.....	No.....	69.4	19.60	18.11	0.41	92.59	12.24
P. R. 292.....	2-28-21	Pl. 16 mo.....	Yes.....	67.9	19.25	17.28	0.49	89.76	12.84
Rayada.....	2-28-21	Pl. 16 mo.....	No.....	63.6	17.15	15.25	0.81	88.92	12.37
P. R. 292.....	5-4-21	Pl. 18 mo.....	No.....	60.0	19.20	17.97	0.289	93.95	.....
P. R. 292.....	5-4-21	Pl. 18 mo.....	Yes.....	72.4	20.00	18.57	0.601	92.85	.....

#### P. R. 308.

Parents unknown.

Erect or at length procumbent, good vigor and stooling, arrows occasionally. Staks long, medium diameter, green with a strong reddish flush, little bloom. Internodes medium length, conspicuously enlarged below, only slightly staggered, furrow usually none. Nodes scarcely constricted, oblique; growth ring broad, 2 to 4 mm., elevated but with a depressed line in center, dark green; root band strongly oblique, 6 to 10 mm. tapering downward the base constricted, concolorous; rudimentary roots large but inconspicuous, in about 3 rows; leaf scar glabrous, appressed behind; glaucous band 8 or 9 mm., not constricted, well defined. Buds broadly ovate or semi-orbicular but a little broader than long, about  $12 \times 10$  mm., scarcely exceeding the growth ring, margin broad, broader below but hardly shouldered, germination subdorsal, basal plac short, with a scanty marginal but usually rather pronounced apical vestiture. Leaf sheaths with a heavy vestiture of long, coarse hairs, green or slightly tinted, glaucous, stained with purple at base within; throat densely lannate, extending in lines up the base of the leaf blade, and with an abundant vestiture of medium short hairs on the margins and behind the ligule; collar narrow reaching the midrib, glaucous the

margins heavily lannate; ligule short, 2 or 3 mm., the margin jagged and somewhat ciliate; ligular processes one, usually developed but small and obtuse. Leaf blades erect except the tips, somewhat plicate and revolute, broad, 8 or 9 cm. dark green, sharply serrulate to the base, not ciliate.

This is a good vigorous high-tonnage cane but it should only be planted in low lands. It does not do well on the red shale hills. It is rather late in ripening so is best planted in the fall but it may be planted in the spring if not cut under 12 or 13 months. It can be carried over successfully for long crop or *caña quedada* as it keeps well in the field and is not much eaten by rats. Its disease resistance has not been fully tested.

It is low in sucrose when green but develops a good percentage at full maturity. The last analysis given is the highest sucrose found in any variety so far this year.

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 308	4-23-13	Pl.			18.9	17.41		92.1	
P. R. 308	5-5-16				21.5	20.00		93.02	
P. R. 308	4-25-17				20.75	19.50		91.56	
P. R. 308	Apr. 1918	Pl. 11 mo.			16.40	13.01		79.32	
P. R. 308	6-1-18	Pl. 13 mo.			18.90	17.06		93.12	
P. R. 308	4-29-19	Rat. 11 mo.		56.0	19.70	18.21		92.43	
P. R. 308	1-8-20	Rat. 14 mo.		62.92	17.42	15.15		86.96	
P. R. 308	Apr. 1920	Rat. 11 mo.		63.46	20.31	18.06		88.92	
P. R. 308	1-8-20	Rat. 8 mo.		65.85	13.59	9.71		89.90	
P. R. 308	12-13-20	Rat. 10 mo.		75.0	13.73	11.78		82.95	9.00
Rayada	12-13-20	Rat. 10 mo.	No.	71.1	15.83	13.45	1.76	84.56	8.08
P. R. 308	2-28-21	Pl. 16 mo.	No.	70.3	17.90	15.80	0.88	88.26	12.84
Rayada	2-28-21	Pl. 16 mo.	No.	63.6	17.15	15.25	0.81	88.92	12.37
P. R. 308	5-5-21	Pl. 18 mo.	No.	60.7	21.0	19.94	0.191	94.95	

#### P. R. 309.

Parent unknown.

Erect, then declined, vigorous, medium stooler, seldom arrows. Stalks long, medium diameter, bright green, sometimes with a pink flush, no bloom. Internodes medium length, larger below, somewhat staggered, furrow slight and poorly defined or none. Nodes prominent not constricted, nearly rectangular; growth ring about 2 mm., enlarged, the thickest part of the stalk, concolorous or brownish; root band 8 to 10 mm., tapering downward, concolorous; rudimentary roots large, distant, in about 3 rows; leaf scar at first lannate below the bud, appressed behind; glaucous band about 6 to 8 mm. tapering downward. Buds, oval, small about 8 × 9 mm., not exceeding the root band, margin narrow, uniform, germination dorsal or subdorsal, nearly glabrous, basal places greatly reduced but extending well up on the sides. Leaf sheaths with a dense vestiture of long, stiff, assurgent hairs, green or tinted, slightly glaucous, stained with purple at base within; throat densely lannate and with an abundant vestiture of medium long hairs on margins and behind

ligule; collar narrow, reaching the midrib, lannate; ligule narrow, 2 or 3 mm., entire; ligular processes none. Leaf blades erect except the tips, flat, about 7 cm., dark green, minutely serrulate, the base nearly even, not ciliate.

A vigorous cane of high tonnage but best adapted to low lands. It is late in maturing and should only be planted in the fall. Its disease resistance has not been determined.

Its late maturity is indicated by the following analyses. It should be tested for long crop or *caña quedada*:

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 309.....	4-25-13	Pl.....	.....	.....	15.5	12.61	.....	81.3	.....
P. R. 309.....	5-5-16	.....	.....	.....	17.0	14.60	.....	85.88	.....
P. K. 309.....	4-25-17	.....	.....	.....	18.55	16.00	.....	86.25	.....
P. R. 309.....	4-15-18	Pl. 11 mo. ....	.....	.....	16.85	13.12	.....	77.81	.....
P. R. 309.....	4-30-19	Rat. 12 mo. ....	.....	57.6	17.90	15.30	.....	85.47	.....
P. R. 309.....	4-15-20	Rat. 11 mo. ....	.....	71.42	17.59	14.51	.....	82.49	.....
P. R. 309*	1-8-20	Rat. 14 mo. ....	.....	66.03	13.05	9.24	.....	70.80	.....
P. R. 309.....	12-13-20	Rat. 10 mo. ....	.....	72.40	15.09	11.93	2.15	79.05	7.72
Rayada.....	12-13-20	Rat. 10 mo. ....	No.....	71.10	15.83	13.45	1.76	84.96	8.08
P. R. 309.....	2-28-21	Pl. 16 mo. ....	No.....	65.30	20.60	19.41	0.72	94.22	12.49
Rayada.....	2-28-21	Pl. 16 mo. ....	No.....	63.60	17.15	15.25	0.81	88.92	12.37

\* Lowest in sucrose out of 37 kinds.

#### P. R. 317.

Parent unknown.

Erect, at length declined, vigorous; good stooler, arrows frequently. Stalks long, medium diameter, green then yellowish with a reddish flush, little or no bloom. Internodes long, at first cylindrical, then somewhat ventricose on side opposite bud, somewhat staggered, furrow usually evident. Nodes somewhat constricted, more or less oblique; growth ring poorly defined, about 2 mm. concolorous or dull brownish; root band, 9 to 12 mm., concolorous; rudimentary roots small, crowded, in 4 to 6 rows; leaf scar glabrous, appressed behind; glaucous band broad, 10 to 12 mm. somewhat constricted. Buds large, flat, narrowly ovate, pointed but not acute, about 12 × 15 mm., exceeding growth ring by one-third to one-half; margin broad uniform, germination apical, basal places well developed and extending up onto the shoulders, marginal vestiture scanty. Leaf sheaths with a dense, coarse, strongly assurgent vestiture, green or tinted, glaucous, stained with purple at the base within; throat lannate and with a rather scanty vestiture of medium short hairs on the margins and behind the ligule; collar reaching the midrib, glaucous, the margins lannate; ligule rather narrow, abruptly widened to 4 mm., at center, minutely fimbriate; ligular processes one usually developed, small obtuse. Leaf blades erect except the tips, somewhat plicate and revolute, about 7 cm. wide, minutely serrulate, the base even not ciliate.

A sport with pink stripes has been found and is being cultivated as X-64.

This is a good, vigorous, general-purpose cane adapted to either high or low land but does best on the *vegas*. It matures late and is best planted in the fall.

In the Santa Rita immunity experiment it proved more resistant than Rayada to root disease but rather more susceptible to mosaic. It has not been tested for gum disease.

In the variety test on rich cow-penned land at Central Mercedita, Yabucoa, it made a good record, cut February 1920, as plant cane of 17 months: tons cane per acre, 54.87; brix, 16.10; sucrose, 13.12; purity, 81.5; tons sugar, 5.089.

Kind	Date	Age	Arrows	Extr	Brix	Sucr.	R. S.	Purity	Fiber
P. R. 317.....	4-24-13	Pl.....	.....	.....	17.6	15.10	.....	85.8	.....
P. R. 317.....	5-5-16	.....	.....	.....	18.1	15.61	.....	86.24	.....
P. R. 317.....	1-15-17	.....	.....	.....	20.05	18.40	.....	91.77	.....
P. R. 317.....	2-12-18	Pl. 15 mo.	.....	.....	11.70	8.21	.....	70.17	.....
P. R. 317.....	1-7-20	Rat. 14 mo.	.....	61.53	17.17	14.76	.....	85.96	.....
Crist.....	1-7-20	Rat. 16 mo.	.....	.....	.....	17.27	.....	.....	.....
P. R. 317.....	12-13-20	Rat. 10 mo.	No.....	72.10	13.43	9.15	2.01	72.5	9.08
Crist.....	12-13-20	Rat. 10 mo.	No.....	.....	.....	13.41	1.78	85.76	10.80
P. R. 317.....	12-22-20	Rat. 14 mo.	No.....	65.80	16.60	12.89	1.74	82.62	9.36
P. R. 317.....	12-22-20	Rat. 14 mo.	Yes.....	74.0	16.23	13.65	1.31	84.10	11.62
Crist.....	12-22-20	Rat. 14 mo.	No.....	70.0	17.50	13.53	0.28	88.70	9.60
P. R. 317.....	3-3-21	Pl. 16 mo.	No.....	71.4	16.85	13.35	1.04	79.22	11.44
Rayada.....	3-3-21	Pl. 16 mo.	No.....	72.7	18.25	16.30	0.71	89.31	12.00
P. R. 317.....	5-5-21	Pl. 18 mo.	No.....	64.8	20.60	18.81	0.433	94.60	.....

#### P. R. 318.

Parents unknown.

Erect, at length declined, medium vigor and stooling, seldom arrows. Stalk medium stout, green then yellowish with a purplish-red flush, considerable bloom. Internodes medium to short, somewhat barrel shaped, staggered, furrow usually none. Nodes constricted, somewhat oblique; growth ring about 2 mm., usually a little elevated, yellowish brown then dark green; root band 6 to 9 mm., constricted, green; rudimentary roots medium size, crowded, greenish; leaf scar glabrous, appressed behind; glaucous band 10 mm., slightly constricted, well defined. Buds triangular-ovate, obtuse, often reddish, about 12 × 12 mm., slightly exceeding the growth ring, margin medium width broader below but scarcely shouldered, germination sub-apical, basal plac well developed and extending up onto the shoulders, marginal and apical vestiture scanty. Leaf sheaths glabrous or nearly so, green or tinted, somewhat glaucous, stained with purple at base within; throat densely lannate and with abundant vestiture on margins and behind ligule; densely lannate throughout; ligule about 3 mm., fimbriate; ligular processes usually one developed, short 6 to 8 mm., obtuse. Leaf blades erect except the tips, flat, broad, 8 or 9 cm., serrulate to the base, not ciliate.

A good cane on moist rich lands but not suited to the hills. It may be planted either in fall or spring. It does not mature quite as early as *Cristalina* but ultimately develops high sucrose.

In the Santa Rita immunity experiment its record was fair, being a little better than *Rayada* as regards root disease and about the same in susceptibility to mosaic. It has not been tested for gum disease.

In the variety tests on cow-penned land at Central Mercedita Yabucoa, it gave the poorest tonnage out of the eight kinds tested tons cane per acre, 30.73; brix, 17.10; sucrose, 13.74; purity, 82.6

Kind	Date	Age	Arrows	Extr.	Brix.	Sucr.	R. S.	Purity	Fiber
P. R. 318.....	4-25-13	Pl.....	.....	.....	19.4	17.64	.....	80.9	.....
P. R. 318.....	5-5-16	.....	.....	.....	18.7	17.02	.....	91.01	.....
P. R. 318.....	4-25-17	.....	.....	.....	22.15	20.60	.....	93.00	.....
P. R. 318*.....	2-12-18	Pl. 16 mo.....	.....	.....	19.70	17.80	.....	90.31	.....
P. R. 318.....	12-13-20	Rat. 10 mo.....	No.....	71.1	15.66	12.22	2.32	78.03	8.0
<i>Rayada</i> .....	12-13-20	Rat. 10 mo.....	No.....	71.1	15.83	13.45	1.76	84.96	8.0
P. R. 318.....	12-22-20	Rat. 14 mo.....	No.....	69.0	17.73	15.85	0.84	89.39	12.4
<i>Crist</i> .....	12-22-20	Rat. 14 mo.....	No.....	70.0	17.50	15.53	0.28	88.74	9.6
P. R. 318.....	1-26-21	Rat. 15 mo.....	No.....	70.5	17.95	15.85	0.73	88.30	12.9
<i>Crist</i> .....	1-26-21	Rat. 15 mo.....	No.....	70.3	17.85	16.14	0.33	90.42	10.6
P. R. 318.....	5-5-21	Pl.....	No.....	67.1	19.10	17.73	0.70	92.82	.....

\* First in sucrose out of 20 kinds.

This concludes the list of the canes that it seems advisable to attempt to discuss at the present time, although it comprises only a small proportion of those actually existing in the Island. Of these very few have been sufficiently tested and under sufficiently widely varying conditions to make possible the formation of a final judgment as to their value. The discussions given above must be regarded as tentative only and as representing the best judgment that it has been possible to form up to this time. We are greatly in need of additional tonnage tests made under plantation conditions and of endurance tests to determine how long the different kinds will continue in profitable production under different soil and cultural conditions.

A careful consideration of the many analyses given in the above pages of many kinds at different stages of maturity makes it very clear that nearly all varieties of cane will give a very satisfactory percentage of sucrose and purity when they have really reached a state of maturity. The trouble is that the great majority of the kinds now most grown in Porto Rico are late in maturing and that as usually planted in mixed cultures they are usually cut and rushed to the mill while still too green to have developed much sugar. This

custom is causing the needless loss of millions of dollars annually. It will be quickly corrected if all of the mills will adopt the plan of buying on the basis of available sucrose and not tonnage as is now being done so successfully by a few of them. There is no question of greater moment before the sugar planters of Porto Rico today than that of so arranging their business as to allow their canes to fully mature before harvesting them.

Since there is some doubt as to the identity of some of the canes discussed in this paper it has seemed best to prepare herbarium specimens of each of them, showing the buds, the leaf sheaths and sections of the leaf blades in order that they may be preserved for further study and to make it possible for future investigators to make certain as to just what canes are really discussed in this paper. One set of these specimens will be deposited in the herbarium of this Station, and another will be forwarded to the New York Botanical Garden where they will be accessible to anyone who cares to examine them. Leaving a permanent record of this kind will serve to avoid future errors.

The following short lists of canes for special purposes is given as a kind of summary of the valuation of varieties as given under the foregoing discussions:

#### CANES FOR GENERAL PLANTING.

The kinds in this list are adapted to any kind of good cane land. Except where specially noted they may be planted in either fall or spring. They are good general-purpose canes for the main crop:

Cristalina.	B-6450.
Rayada.	BH-10(12) (Not yet widely tested).
B-376 (Almost indistinguishable from Cristalina).	D-109.
B-1809.	D-117 (Fall planting only).

#### CANES FOR MOIST, WELL-DRAINED ALLUVIAL SOILS AND SEMI-POYALS.

These canes are well adapted to these conditions but should not be planted on hard, dry lands. They may be planted either in fall or spring.

B-208.	P. R.-308.
P. R.-208.	P. R.-318.
P. R.-260.	

CANES FOR COMPACT, POORLY DRAINED MARITIME SOILS AND CLAY,  
ALLUVIUMS.

These are all late canes and should only be planted in the fall.

Yellow Caledonia.  
D-433.

B-6292.

## CANES FOR RED HILL LANDS.

Cavangerie and its variants (Fall planting only). B-3412 (Fall planting only).  
P. R.-202.

Rosa Morada.

P. R.-230.

Uba.

P. R.-292.

B-109.

Santa Cruz 10(4) (not fully tested)

B-3405.

## CANES FOR LANDS WITH LIME SUBSOIL.

B-1753.

B-3412 (Fall plant only).

## CANES FOR SALTY LANDS.

Uba (In India canes of this class are much more resistant to salt than the thick canes. In the other West Indies Uba has proved resistant to salt. Not tried here.)

## VERY EARLY MATURING CANES.

B-1030.

D-95 (Not now in Porto Rico).

D-74 (Not now in Porto Rico).

## CANES TO HOLD OVER FOR LONG CROP.

Yellow Caledonia.

B-7245.

P. R.-207.

P. R.-309.

## CANES TO PLANT IN DISTRICTS INFECTED WITH MOSAIC.

Uba.

remembered that all of these late

Biloxi.

three are infected, and they should

Java 36-P. O. J.

not be planted in districts where

Java 105-P. O. J. (Egyptian).

the attempt is being made

Java 234-P. O. J. (It would be re-

eradicate the mosaic).

## A KEY TO THE VARIETIES DESCRIBED IN THIS PAPER.

1. Stalks slender, average less than  $2\frac{1}{2}$  cm.; leaf blades narrow, average less than 5 cm.; peduncles and rachis strongly pubescent. *Saccharum spontaneum*-----  
Stalks stouter, average more than  $2\frac{1}{2}$  cm.; leaf blades broader, average more than 5 cm.; peduncles and rachis usually glabrous. *Saccharum officinarum*-----  
(*Saccharum Spontaneum*.)
2. Leaf blades strictly erect, or the tips declined---Creole  
(Arrows have not been examined.)  
Leaf blades spreading-----

- |  |    |
|--|----|
| 3. Buds with sterile margin uniform or nearly so -----                   | 4  |
| Buds with sterile margin shouldered -----                                | 7  |
| 4. Buds ovate, obtuse -----  | 5  |
| Buds orbicular, small; stalks green with red flush.                      |    |
| Java 234-P. O. J.  |    |
| Buds broader than long; stalks brownish purple.                          |    |
| Java 36-P. O. J.   |    |
| 5. Buds plump, germination subapical or subdorsal_Biloxi                 |    |
| Buds flat, germination apical -----                                      | 6  |
| 6. Nodes usually not swollen, same diameter as internode;                |    |
| sheaths glabrate ----- Uba   |    |
| Nodes abruptly enlarged; sheaths with scanty vestiture                   |    |
| Zwinga   |    |
| 7. Buds triangular ovate (Cristalina-like); stalk brownish               |    |
| Java 105-P. O. J.  |    |
| Buds broad, obovate; stalks purplish_Java 228-P. O. J.                   |    |
| ( <i>Saccharum officinarum</i> .)  |    |
| 8. Buds lanceolate or lance-ovate ( $1\frac{1}{2}$ times as long as wide |    |
| or more (see also under 25) -----  | 9  |
| Buds ovate (1 to $1\frac{1}{3}$ times as long as broad; sometimes        |    |
| broader than long.) -----  | 12 |
| Buds oval (longer than broad, both ends rounded.) -----                  | 48 |
| Buds orbicular or nearly so -----  | 52 |
| Buds broader than long, obtuse -----                                     | 55 |
| 9. Buds with uniform margin; sheaths with vestiture -----                | 10 |
| Buds with shouldered margin; sheaths glabrous; stalks                    |    |
| green with flush ----- B-3390  |    |
| 10. Buds with scanty marginal and apical vestiture -----                 | 11 |
| Buds with abundant marginal vestiture and pronounced                     |    |
| apical tuft; stalks green with red flush                                 |    |
| Sta. Cruz 10 (4)   |    |
| 11. Vestiture of sheaths scanty, short, appressed; margin of             |    |
| buds narrow; stalks green, little or no flush_B-6450                     |    |
| Vestiture of sheaths dense, long, stiff, assurgent; margin               |    |
| of buds broad; stalks green with red flush_P. R.-317                     |    |
| 12. Buds with the sterile margin uniform in width or nearly              |    |
| so -----   | 13 |
| Buds with the sterile margin shouldered -----                            | 40 |
| 13. Leaf sheaths glabrous, or with scanty hairs on the median            |    |
| line -----   | 14 |
| Leaf sheaths with an affused vestiture at least when young               |    |
| (Sheaths glabrous.)  | 16 |
| 14. Buds with abundant marginal vestiture; growth ring                   |    |
| broad, conspicuous, brown; stalks green, then yellow, no                 |    |
| flush ----- D-625  |    |
| Buds with scanty marginal vestiture; growth ring green-                  |    |
| ish; stalks green with red flush -----                                   | 15 |
| 15. Buds triangular-ovate, $12 \times 12$ mm., nodes constricted;        |    |
| no lines in stalk ----- P. R.-318  |    |

Buds broadly ovate, nearly orbicular,  $10 \times 10$  mm., nodes not constricted; brown lines on stalk.

Yellow Caledonia

(Sheaths with vestiture or "cane itch.")

16. Leaf scar ciliate; stalks green with flush (see also B-3747)

B-3922

Leaf scar glabrous-----

17

17. Stalks with green and white (sometimes pinkish) stripes-----

18

Stalks with green and red or purple stripes-----

19

Stalks red with a bronze stripe; sheaths with white stripes,

Cavangerie

Stalks uniform red or purple-----

21

Stalks green, at least at first-----

25

18. Nodes enlarged, not constricted; buds with scanty marginal vestiture-----

Bambú Rayada

Nodes constricted; buds with abundant marginal vestiture,

Calancana

19. Buds longer than broad, apex glabrate; striping faint,

Salangor Rayada

Buds about as broad as long; striping pronounced-----

20

20. Buds nearly glabrous; nodes scarcely constricted

Cavangerie Rayada

Buds with conspicuous apical tuft; nodes constricted

Rosa Rayada

(Stalks red or purple.)

21. Nodes scarcely constricted; no bloom-----

22

Nodes constricted-----

23

22. Stalks claret red-----

Cavangerie Roja

Stalks dark reddish brown-----

Cavangerie Negra

23. Buds large 12 mm. with apical tuft-----

Rosa Morada

Buds small, about 10 mm.; apex glabrate-----

24

24. Bud with medium margin exceeding growth ring; ligule

5 mm., long, fimbriate-----

Tamarin

Bud with very narrow margin not exceeding growth ring;

ligule 2-3 mm., even-----

D-109

(Stalks greenish.)

25. Buds decidedly longer than wide, reaching 14-15 mm.

(might go under 8); heavy bloom-----

26

Buds but little longer than broad-----

27

26. Internodes cylindrical; nodes scarcely constricted

P. R.-260

Internodes barrel shape; nodes strongly constricted

Salangor

27. Stalks medium slender, not averaging more than 3 cm.,

leaves rather narrow, averaging less than 6 cm.-----

28

Stalks medium to medium stout, averaging over 3 cm., leaves

broader, averaging over 6 cm.-----

30

28. Leaf blades erect; stalks green then yellow, no flush, no

bloom-----

B-1753

Leaf blades spreading; stalks green with red flush and light bloom-----	29
29. Buds with margin uniformly 2 mm. wide-----	B-6292
Buds with margin wider below but not shouldered, 1-1½ mm.-----	{Sealey seedling
	{B-3405
	{B-3412
(As grown here cannot distinguish these three.)	
30. Buds at first not exceeding or scarcely exceeding the growth ring (sometimes increase in length before germination)-----	31
Buds from the first exceeding the growth ring usually by from one-fourth to one-third of length-----	33
31. Buds acute; nodes enlarged not constricted.	
	Bambú Blanca
Buds obtuse; nodes somewhat constricted-----	32
32. Buds with narrow margin; sheaths green, not glaucous	
	B-7245
Buds with medium margin; sheaths lilac tinted, glaucous	
	Penang
33. Buds elliptic-ovate, the base narrowed, margins with conspicuous vestiture-----	Otaheite
Buds broadly ovate or triangular-ovate, the base broad-----	34
34. Furrow on internodes well marked-----	35
Furrow none, or very slight on lower internodes-----	37
35. Internodes cylindrical but larger and somewhat shouldered below; buds triangular-ovate-----	P. R.-208
Internodes laterally compressed, unequilateral, tumid on side opposite bud (might be confused with kinds under 27.)-----	36
36. Internodes marked with brown lines, little bloom-----	B-4596
Internodes not marked with lines, medium bloom-----	B-3696
37. Stalks with light bloom or none-----	38
Stalks with heavy bloom-----	39
38. Margin of bud wide; internodes inequilateral, somewhat tumid behind-----	P. R.-230
Margin of bud narrow; internodes cylindrical but larger below-----	{D-117
	{P. R.-219
(P. R. 219 can scarcely be distinguished from its parent D-117)	
39. Bloom very heavy on both stalks and sheaths; buds germinating subdorsally-----	D-433
Bloom moderately heavy on stalk, only a little on sheaths; buds germinating apically-----	P. R.-271
(Buds with shouldered margins.)	
40. Leaf sheaths glabrous or with scanty hairs on median line.	41
Leaf sheaths with an effused vestiture, at least when young.	43

41. Stalks with green and purple stripes; heavy bloom  
     Rayada  
     Stalks uniform dark purple; heavy bloom-----Morada  
     Stalks green with heavy pink flush; heavy bloom-----42
42. Collar of leaf sheaths lannate-----Cristalina  
     Collar of leaf sheath glabrous or the extreme margin only  
     minutely lannate-----B-376  
     (Sheaths with vestiture; stalks green with flush.)
43. Shoulders of bud margin extended well on top of bud al-  
     most to emarginate apex; heavy bloom-----P. R.-292  
     Shoulders at base of sterile margin (Cristalina-like)-----44
44. Leaf scar ciliate-----B-1355  
     Leaf scar glabrous-----45
45. Furrow evident-----46  
     Furrow none or very slight on lower internodes only-----47
46. Nodes constricted; heavy bloom; buds broader than long  
     B-208  
     Nodes not constricted; little bloom, buds longer than  
     broad-----B-1809
47. Nodes constricted; internodes somewhat barrel shaped  
     B-1030  
     Nodes not constricted; internodes latterally compressed  
     P. R.-209  
     (Buds oval, both base and apex rounded, margin uniform;  
     sheaths with vestiture.)
48. Margin of bud broad-----49  
     Margin of bud narrow-----50
49. Leaf scar ciliate when young then glabrate; stalks green  
     then yellow, no flush, no bloom-----B-347  
     Leaf scar glabrous from the first; stalks green with pink  
     flush, no bloom-----P. R.-270
50. Buds exceeding the growth ring-----P. R.-207  
     Buds not exceeding growth ring-----51
51. Ligule short 2 to 3 mm., entire; sheaths falling freely  
     P. R.-309  
     Ligule abruptly widened at center, 5 mm., fimbriate-ciliate;  
     leaf sheaths hanging long on stalk-----P. R.-272  
     (Buds orbicular or nearly so; sheaths with vestiture.)
52. Bud-margins with a pronounced apical protuberance or  
     shoulder; stalk stout, purplish, heavy bloom-----Elephant  
     Buds with a uniform margin-----53
53. Stalks dull pink, marked with lines-----BH-10 (12)  
     Stalks green or with a slight flush-----54
54. Stalks with a heavy bloom-----P. R.-202  
     Stalks with no bloom, erect; leaves narrow, strictly erect  
     P. R.-210  
     (Buds broader than long. Buds ovate in outline not in-  
     cluded even when broader than long; margins uniform.)

55. Leaf sheaths glabrous; stalk green-----	B-109	
Leaf sheaths with an effused vestiture-----		56
56. Stalks purplish -----		57
Stalks green with red flush, little bloom-----	P. R.-308	
57. Internodes long, cylindrical; nodes scarcely constricted	D-448	
Internodes short, strongly enlarged below; nodes constricted-----	D-504	

## HOW TO USE THE KEY.

In the above key the contrasted characters will be found grouped under the same guide number on the left side of the page. At the right of each group character is another guide number which shows where in the key this group is further discussed. Thus under guide No. 1 there are two groups, one with very slender stalks and narrow leaves, the other with stouter stalks and broader leaves. If it is decided that the specimen in hand belongs in the first group we are referred to guide No. 2, which will be found repeated on the left side of the page where the group is further divided according to the character of the margin of the bud, whether uniform or shouldered, the guide number for one group being 3, and for the other 6. If on the other hand the cane under examination is stout and with broad leaves we are referred to 8. Looking down the left side we find guide No. 8, and under it five groups divided according to the shape of the buds, each with a guide number on the right which shows where to look next. Thus if the cane has a bud decidedly broader than long we must pass to the last group under No. 55, almost at the end of the Key.

Supposing that a cane of the Cristalina variety is being examined; we would find as follow: Under No. 1 we take the second group, since it is more than  $2\frac{1}{2}$  cm. (= 1 in.) in diameter and the leaves are more than 5 cm. (= 2 in.) wide. This leads to No. 8. Under No. 8 we find that the buds are triangular-ovate, being broader at the base than at the tip and about as long as broad. This indicates No. 12. Turning to No. 12, we have to decide regarding the margin of the bud whether it is uniform in width or shouldered, Cristalina has a shouldered bud, hence we must go to No. 40 (all between No. 13 and No. 39 have uniform, margined buds). Turning to No. 40 at the left we find two groups, one with the leaf sheaths smooth and glabrous, the other with an effused covering or vestiture of sharp hair or prickles, often known as "cane itch." Cristalina has a smooth leaf sheath with no "cane itch," so we go to No. 41. Here,

we find one kind with green and purple stripes, the Rayada, another uniform dark-purple the Morada, and a third group with green stalks with a pink flush. This agrees with Cristalina, so we pass to No. 42, where the lannate collar leads us to Cristalina.

This explanation as to the manner of using the key is inserted for the benefit of those cane growers who are not botanists. All botanists, at least those of the older generation who grew up with Wood's Class Book under one arm and Gray's Manual under the other, will know without telling how to use either the present "bifurcated" key of Wood or the "idented" key of Gray. Personally, the writer greatly prefers the former.

#### GLOSSARY: TERMS USED IN DESCRIBING CANES.

Acuminate: ending in a long, drawn-out, slender point.

Acute: ending in a sharp point.

Apical: at the apex or point.

Arrow: the flower of the cane, including the panicle and its stalk.

Basal plac: the dense mass of short, appressed, usually crisped hairs found at the base of the buds.

Bloom: a coating of wax on the stalks and leaf sheaths.

Ciliate: fringed with long, wavy hairs.

Cm.: centimeter; one hundredth of a meter ( $2\frac{1}{2}$  cm. = 1 inch).

Collar: the outside angle at the joining of the leaf blade and leaf sheath.

Concolorous: of the same color.

Dorsal: on the back.

Fimbriate: margin uneven, with minute points; fringed.

Flush: the change in color of a green cane to pink, red or purple when exposed to light.

Furrow: a groove in the internode extending up from the bud.

Glabrate: nearly glabrous, almost smooth.

Glabrous: smooth, no coating of any kind.

Glaucous: covered with a thin, waxy coating, bloom. coated with wax.

Growth ring: a narrow circle where the root band of the node joins the internode above. The tissue of this ring remains long in a condition of active growth. If the stalk falls over, the growth of this tissue enables the top to again become erect.

Habit: the general appearance and mode of growth.

Internode: that part of the stalk between the nodes. The word "joint" is sometimes popularly used for the internode, but again it may mean the node.

Lanceolate: long and pointed but broader below, like the head of a lance.

Lannate: woolly, covered with short, more or less felted hairs.

Leaf blade: the free green part of the leaf.

Leaf scar: the base of the leaf sheath which remains on the stalk when the leaf falls.

Leaf sheath: the base of the leaf which encircles the stalk.

Ligular process: protuberance at the top of the leaf sheath at the points where the ligule ends.

Ligule: a short, horny membrane pressed against the stalk at the throat where the leaf blade joins the sheath.

Margin (of bud): a flat, sterile fold of the outer bud scales. It may be narrow or broad, uniform in width or shouldered.

Mm: millimeter; one-tenth of a centimeter or the one-thousandth part of a meter.

Node: that part of the cane where the bud is situated. It includes the growth ring, the root band, the leaf scar, and the glaucous band.

Obovate: egg-shaped; broadest above.

Obtuse: blunt; not sharp pointed.

Orbicular: nearly circular in outline.

Oval: broadest in middle with ends equal and rounded.

Ovate: egg-shaped; broader below.

Peduncle: the stalk of the arrow; the flower stalk.

Plicate: folded like a fan.

Rachis: the central axis of the flower panicle; really a prolongation of the peduncle.

Root band: that region of the node above the bud where the ends of the rudimentary roots may be seen ready to protrude and grow when the cane is planted.

Serrate: with the margin cut into sharp notches like saw teeth.

Serrulate: the margin with very small teeth.

Staggered: zig-zag; internodes not in a straight line.

Stooling: the comparative number of stalk in a hill; suckering; tillering.

Throat: the inner angle where the leaf blade joins the sheath.

Triangular-ovate: the base broad and rounded but the sides straight and ending in a point.

Tumid: irregularly swollen or enlarged.

Undulate: wavy.

Vestiture: a coating of hairs.

#### BIBLIOGRAPHY OF PAPERS DEALING WITH CANE VARIETIES IN PORTO RICO.

ANON.—An unsigned editorial in *Revista de Agricultura, Industria y Comercio*, San Juan, 1887, p. 174. Gives an account of Dr. Agustín Stahl and his work in introducing cane varieties with a price list of those being propagated by him at Bayamón.

COLÓN, E. D.—Ann. Rept. Insular Expt. Station 1918. Gives a resumé of work done at this Station with cane varieties.

COLL Y TOSTE, C.—Boletín Histórico de Puerto Rico. Publicación bimestral (1914—).

COWGILL, H. B.—Informe del Perito en Plantas de Semillero para 1913-14. 3d Ann. Rept. Board of Comm. of Agri. Brief notes only.

Report of the Plant Breeder. 4th Rept. Board of Comm. of Agri. 1915.

Report of the Plant Breeder. 5th Rept. Board of Comm. of Agri. 1916.

Report of the Plant Breeder. Ann. Rept. Insular Expt. Sta. 1917.

Distribución de Caña para Semilla, Insular Expt. Sta. Cir. 8, 1917.

A method of Identification and Description of Sugar Cane Varieties and its Application to Types grown in Porto Rico. Jour. Dept. of Agr. Porto Rico 1 (3), 1917.

Studies in Inheritance in Sugar Cane. Jour. Dept. Agr. Porto Rico 2 (1), 1918.

Ann. Rept. Insular Expt. Sta. 1918. Report of the Division of Agronomy and Plant Breeding, pp. 78-95.

CRAWLEY, J. W.—1st. Ann. Río Piedras, 1911.

Brief notes on Otaheite, Cristalina and Rayada.

2nd Ann. Rept. Expt. Sta. Río Piedras, 1912. List of 17 varieties from Central Guánica, 10 varieties imported direct from Barbados and 6 kinds from various sources. Reports on field tests with 4 kinds.

3rd Ann. Rept. Expt. Sta. Río Piedras, 1913. Tonnage tests and analyses of 24 kinds are reported for one year and two year test for 4 kinds.

EARLE, F. S.—The Resistance of Cane Varieties to the Yellow Stripe or Mosaic Disease. Bull. Insular Sta. 19, 1919.

Varieties of Sugar Cane in Porto Rico. Jour. Dept. of Agri. Porto Rico, 3 (2) April, 1919.

Variedades de Caña. Cir. Insular Sta. 23, Apr. 1920.

Sugar Cane Root Disease Investigations. Jour. Dept. Agri. Porto Rico, 4 (1), 1920. (Issued Oct. 1920.) Varietal resistance to root disease is discussed.

GRIVOT GRAND-COURT, AGUSTIN STAHL and JOSÉ JULIAN ACOSTA.—Informe sobre la Enfermedad de la Caña de Azúcar, 1878. (Reprinted by Dr. Stahl in La Enfermedad de la Caña in Porto Rico, 1880.)

LÓPEZ TUERO, FERNANDO.—Caña de Azúcar. San Juan, 1895. A practical treatise on Sugar-Cane Culture in which twenty-two varieties are discussed.

MAY, D. W.—Federal Expt. Sta. Mayagüez, Bull 9, 1910.

MCCONNIE, R. C.—Nuevas Variedades de Caña de Azúcar. Revista de Agricultura, Puerto Rico 1:12-17, 1917.

QUINONES, ANTONIO RUÍZ.—Memoria Sobre la Enfermedad de la Caña de Azúcar, Aug. 1877. (Reprinted by Dr. Stahl in La Enfermedad de la Caña 1880.)

STAHL, DR. AGUSTÍN.—Estudios Prácticos Sobre la Enfermedad de la Caña. La Prensa, Apr. 5, May 2, 1878. (Reprinted in La Enfermedad de la Caña, 1880.)

La Enfermedad de la Caña de Azúcar en Puerto Rico. San Juan, 1880. In this important paper Dr. Stahl brings together all the various reports that had been published regarding the cane epidemic of 1872. He gives 23 kinds of cane known to occur in Porto Rico with notes on their disease resistance.