

Performance, sizing and total solids of nine onion (*Allium cepa*) cultivars¹

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ABSTRACT

Onion cultivars Granex 33, Granex 429, Texas Grano 502, Texas Grano 1025 Y, Texas Grano 1105 Y, FMX-225, Texas Grano 1030 Y, Texas Early Grano 502 and Texas Grano 1015 Y were evaluated at the Fortuna Agricultural Experiment Substation in Juana Díaz, P. R. from late November 1985 to early April 1986. Granex 33 and Granex 429 gave highest marketable yields: 33,075 and 32,194 kg/ha, respectively. These yields were significantly higher than yields of other cultivars except Texas Grano 502. These cultivars were also the best in terms of size classification. There were no significant differences in average bulb weight among most of the cultivars. Granex 33 had the highest density and Texas Grano 1030 Y had the highest percentage of total solids.

RESUMEN

Producción, tamaño y porcentaje de sólidos totales de nueve variedades de cebolla (*Allium cepa*)

Se evaluaron las variedades de cebolla Granex 33, Granex 429, Texas Grano 502, Texas Grano 1025 Y, Texas Grano 1105 Y, FMX-225, Texas Grano 1030 Y, Texas Early Grano 502 y Texas Grano 1015 Y en la subestación de Fortuna en Juana Díaz, P. R. desde fines de noviembre de 1985 hasta principios de abril de 1986. Los rendimientos de las cultivares Granex 33 y Granex 429 fueron significativamente mayores (33,075 y 32,194 kg./ha.) que los de las otras variedades, excepto Texas Grano 502. Estas tres variedades produjeron bulbos de mejor tamaño y aceptables comercialmente. No hubo diferencia entre variedades en cuanto al peso medio del bulbo. Los bulbos de las variedades Granex 33 y Texas Grano 1030 Y fueron los de mayor densidad y mayor porcentaje de sólidos totales.

INTRODUCTION

In 1986, Puerto Rico imported \$157 million worth of fresh and processed vegetables from the United States and \$20 million from other countries. The Vegetable Program on the south coast of Puerto Rico produced \$21 million worth of vegetable crops. Thus, the deficit in the vegetable industry was approximately \$156 million (1, 4).

Onions are an important item of consumption in Puerto Rico. Annual per capita consumption of onions increased from 4.08 kg in 1974-75 to

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5.75 kg in 1985-86. In 1985-86 the 40.65 ha planted to onions produced 1,015 metric tons (4). The same year, 18,882 metric tons were imported to supply the local demand.

Expansion of commercial onion production requires high yielding, good quality, well-adapted, short-day onion cultivars (6). This requirement demands continuous testing for performance and product quality of promising commercial cultivars available mainly from seed companies in the United States.

This paper presents the results of a trial conducted to evaluate the performance, size and total solids of a group of onion (hybrids and open pollinated) cultivars.

MATERIALS AND METHODS

The study herein reported was conducted at the Fortuna agricultural experiment substation in Juana Díaz, on the south coast of Puerto Rico. The soil is classified as a San Antón clay loam, a Mollisol (Cumulic Haplustolls, fine-loamy, mixed, isohyperthermic) with pH 7.9. Rainfall and temperature data were recorded during the growing season.

Table 1 gives information on the characteristics and sources of the cultivars tested. They were all yellow or straw yellow, which is the color preferred by local consumers. According to seed sources, days to matur-

TABLE 1.—*Characteristics and source of the onion cultivars included in the 1985-86 variety trial at the Fortuna agricultural experiment substation¹*

Cultivar ²	Source	Relative days to maturity	Type ³	Color
Granex 33 ¹	Asgrow	162	F ₁	Yellow
Granex 419	Asgrow	165	F ₁	Yellow
Texas Grano 502 ¹	Asgrow	168	O.P.	Straw
Texas Grano 1025 Y	Asgrow	182	O.P.	Straw Yellow
Texas Grano 1105 Y	Dr. L. M. Pike			
	Texas A&M Univ.	180	O.P.	Yellow
FMX - 225	Ferry Morse	170	F ₁	Straw Yellow
Texas Grano 1030 Y	Dr. L. M. Pike			
	Texas A&M Univ.	180	O.P.	Yellow
Texas Early				
Grano 502	Ferry Morse	170	O.P.	Straw
Texas Grano 1015 Y	Asgrow	168	O.P.	Straw Yellow

¹As described by seed sources.

²All cultivars were pink rot resistant.

³O.P. = Open pollinated; F₁ = hybrids.

⁴Control cultivars for comparison purposes.

ity range from 162 in Granex 33 to 180 in Texas Grano 1105 Y and Texas Grano 1015 Y for an average of 170. However, this study reveals that a good commercial onion crop can be obtained in southern Puerto Rico in less than 130 days.

Seeds of the nine onion cultivars were sown in the field 21 November 1985, in double-row plots, 366 cm (12 ft) long with plants spaced 8 cm (3 in) within rows, and at 31 cm (12 in) between rows. The trial was arranged in a balanced lattice design with four replications.

The experiment was fertilized at a rate of 227.3, 227.3, and 181.8 kg/ha (200, 200 and 160 lb/acre) of N, P₂O₅ and K₂O, respectively. Fifty percent of the total amount of fertilizer was applied before planting; the rest was applied 45 days after planting. Sprinkler irrigation was applied twice a week for the first 2 weeks at the rate of 1 inch, and once a week thereafter up to 30 days before harvest.

Dacthal W-175 was applied immediately after planting at the rate of 15.8 kg/ha (14 lb./acre) as a preemergent herbicide. Six weeks later, Fusilade and Goal were applied at the rate of 0.42 kg ai/ha (0.37 lb ai/acre) and 0.28 kg ai/ha (0.25 lb. ai/acre), respectively, as postemergent herbicides.

A preventive weekly spraying program was scheduled to control insects and diseases (2, 3). Diazinon AG 500 and Nudrin 90 were applied at the rate of 0.55 L ai/ha (0.47 pt ai/acre) and 1.7 kg ai/ha (1.5 lb ai/acre), respectively, to control insects. Dithane M-45 and Ridomil MZ-58 were used at the rate of 1.60 kg ai/ha (1.4 lb ai/acre) and 0.93 kg ai/ha (0.82 lb ai/acre), respectively, to control fungi.

Bulbs were harvested when the green tops weakened just above the bulb and fell over (5, 7, 8). Onions were harvested 17 March, 25 March and 4 April 1986 (table 3). After 10-day curing, bulbs were counted, weighed and classified as to size. Also, total marketable yields were calculated. A sample of 20 dry bulbs per plot was analyzed at the Food Technology Laboratory for total solids, size distribution, volume and density. Onions were classified under USDA bulb size classes, 1 to 19, based upon bulb diameter from 4.75 to 1.00 inch. The Archimedes principle (water displacement) was used to determine average bulb density.

RESULTS AND DISCUSSION

Table 2 presents data on weather conditions during the crop cycle. Total rainfall amounted to 153 mm. Monthly distribution ranged from 2 mm in December 1985 to 72 mm in April 1986. Variations in mean average and mean maximum daily temperature were negligible. Mean maximum temperature was 17.6° C in February 1986 and rose to 20.4 in April. Climatic conditions apparently favored bulb formation. The increased decay observed towards the end of the growing cycle could be attributed to the April rains.

TABLE 2.—*Weather conditions during the 1985-86 crop cycle November 1985 through April 1986.*

Month	Average daily temperature (C)			Rainfall mm
	Max.	Min.	Mean	
November 1985	30.8	19.8	25.3	38
December 1985	30.3	18.7	24.5	2
January 1986	29.7	18.2	23.9	8
February 1986	29.2	17.6	23.4	28
March 1986	30.3	18.7	24.5	5
April 1986	30.3	20.4	25.3	72

Total marketable yield of cultivars Granex 33 (33,075 kg/ha) and Granex 429 (32,194 kg/ha) was significantly higher ($P = 0.05$) than that of the other cultivars tested except Texas Grano 502 (table 3). Cultivars Texas Grano 502 and Texas Grano 1025 Y outyielded the remainder in terms of marketable yield. Mean production of these four cultivars was close to 30,000 kg/ha. The mean production of all other cultivars pooled together was around 20,500 kg/ha. Texas Grano 1015 Y (15,525 kg/ha) yielded lowest. The poor performance of this cultivar was mostly attributable to decay. No significant differences were observed in average bulb weight among most of the cultivars. Furthermore, there were no significant differences in number of bulbs per hectare among most of the cultivars, but Texas Grano 1015 Y produced the fewest bulbs.

The percentage of total solids ranged from 7.59 to 8.67. Texas Grano 1030 Y and Granex 429 showed the highest percentage of total solids, whereas Granex 33 (7.54) and Texas Grano 1105 Y (7.57) showed the lowest.

As to bulb density, there were almost no differences among cultivars, but Granex 33 and Texas Grano 502 had the highest (2.11 g/cm³), whereas density of Texas Grano 502 was only 2.00 g/cm³.

Granex 33, Granex 429 and Texas Grano 502 produced the highest percentage of bulbs 7.5 cm (3) or larger in diameter (table 4). Texas Early Grano 502 and Texas Grano 1015 Y produced more bulbs smaller than 7.5 cm (3 in). Overall, the diameter of the bulbs of the majority of the cultivars measured 7.0 (2.75 in) to 8.9 cm (3.50 in).

In terms of trial marketable yield, cultivars Granex 33 and 429 must be preferred for commercial plantings on the south coast of Puerto Rico. However, there might be other criteria to be considered when recommending a new variety for commercial production.

TABLE 3.—Performance of nine onion cultivars during the 1985-86 season¹

Cultivar	Harvest date	Total marketable yield	Total no. of bulbs per ha	Average weight	Total solids	Density
		<i>kg/ha</i>		<i>g/bulb</i>	%	<i>g/cm³</i>
Granex 33	3-17-86	33,075a ²	250,221a	132a	7.54	2.11
Granex 429	3-17-86	32,194a	241,753a	134a	8.28	2.09
Texas Grano 502	3-17-86	29,367ab	217,843a	135a	8.12	2.00
Texas Grano 1025 Y	4-04-86	24,926bc	238,266a	104abc	8.11	2.09
Texas Grano 1105 Y	4-04-86	22,107c	235,775a	95bc	7.57	2.10
FMC-225	3-25-86	21,625c	181,647ab	125ab	8.05	2.07
Texas Grano 1030 Y	4-04-86	21,009c	250,221a	85c	8.67	2.10
Texas Early Grano 502	3-25-86	20,842c	194,598ab	110abc	8.21	2.11
Texas Grano 1015 Y	4-04-86	15,252d	139,805b	113abc	8.22	2.04

¹Planting date: 21 November 1985.

²Values in columns followed by one or more letters in common do not differ at the P = .05 level using Duncan's Multiple Range test.

TABLE 4.—Sizing (%) of nine onion cultivars during the 1985-86 season¹

USDA bulb size classes	Granex 33	Granex 429	Texas Grano 502	Texas Grano 1025 Y	Texas Grano 1105 Y	FMX-225	Texas Grano 1030 Y	Texas Early Grano 502	Texas Grano 1015 Y
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-
6	2.50	-	-	-	-	-	1.25	-	-
7	3.75	3.75	2.50	2.50	-	-	1.25	2.17	1.67
8	23.75	8.75	6.25	5.00	6.33	-	2.50	6.52	6.67
9	27.50	22.50	25.00	22.50	18.99	15.00	16.25	23.91	8.33
10	35.00	43.75	42.50	37.50	36.71	62.50	33.75	32.61	16.67
11	7.50	18.75	18.75	28.75	29.11	17.50	26.25	32.61	35.00
12	-	2.50	5.00	2.50	5.06	5.00	10.00	21.74	21.67
13	-	-	-	1.25	3.80	-	7.50	8.70	6.67
14	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-

¹ USDA bulb size classes, 1 to 19 are based upon bulb diameter of 4.75, 4.50, 4.25, 4.1875, 4.125, 4.00, 3.75, 3.50, 3.25, 3.00, 2.75, 2.50, 2.25, 2.00, 1.75, 1.50, 1.25, 1.10 and 1.00 inch, respectively.

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