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Yam protection II. Anthracnose, yield, and profit of monocultures and interplantings[1]

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ABSTRACT

In experimental plantings in Corozal, Puerto Rico, anthracnose (*Colletotrichum gloeosporioides*) was first observed on susceptible *Dioscorea alata* cv. Florido yams in June 1982 and again in July 1983. By October of both years, incidence had reached 100% with foliar necrosis exceeding 60%. High negative correlations (r = –0.93) were found between severity ratings from September to November and total tuber yield in both seasons. Higher and more stable yields of Guinea Blanco yam (*D. rotundata*) were associated with anthracnose resistance and higher yield potential. Florido yams interplanted with Guinea Blanco yams showed later occurrence and lower severity of anthracnose and higher and less variable yield of larger sized tubers than the same cultivar in monoculture. Interplantings showed notable stability in tuber numbers among years. Economic returns of mixed plantings always exceeded those of Florido monoculture. One to one interplanting of Florido and Guinea Blanco equaled or outgrossed Guinea Blanco in monoculture when Guinea Blanco was valued at $0.55/kg and Florido at $1.10 and $0.99/kg for the 1982 and 1983 seasons, respectively. Species mixtures appear valuable for stabilizing yam production by reducing anthracnose.**

INTRODUCTION

Yams (*Dioscorea* spp.) are an important dietary staple for the people of the humid tropics. In the Caribbean islands, yam is a well-liked food demanding premium prices.

In Puerto Rico, domestic yam production was valued at 6.3 million dollars in 1983-84. Local demand for yams exceeds local production and large quantities (14,000 cwts) are imported yearly. Besides in an unsatu-

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rated local market, yams are also popular and bring attractive prices among Caribbean people in the large cities of the United States. Because of the existing local and export markets, prospects of increased local production are economically attractive.

Traditionally, two yam cultivars, Florido (*D. alata*) and Guinea Blanco, also known as Habanero (*D. rotundata*), are principally grown in Puerto Rico. Guinea Blanco has increasingly been favored by farmers for its higher yield potential and its resistance to anthracnose. Nevertheless, many consumers prefer Florido, but its scarcity has nearly doubled its price over that of Guinea Blanco. Farmers are reluctant to cultivate Florido because of the substantial losses due to anthracnose (7,9,12,13). Local farmers produce yams mostly on small plots with intensive labor over a long season (10 months).

Anthracnose is threatening the disappearance of Florido yams in Puerto Rico. It is causing a shift to more fields planted to *D. rotundata*. Necrosis of newly formed leaves and vines with a burned appearance characterize this disease. In some varieties defoliation leaves only the naked darkened vines. The underside of leaves show the characteristic anthracnose symptom of vein necrosis and darkening. Yam anthracnose is caused by *Colletotrichum gloeosporioides*. In Puerto Rico an anthracnose epidemic in Florido yams can reduce yield by 50 to 90% (6,7,9,14). We have found that anthracnose significantly decreased the number of surviving plants by 58%, the number of tubers by 61%, tuber weight per plant by 58%, and number of marketable tubers by 61%. Whereas Guinea Blanco is resistant to anthracnose, and produces higher yield than Florido, it is more susceptible to virus, nematodes and storage decay than Florido.

Anthracnose of yams can be partially controlled by fungicide applications (6,7,12,13). However small scale farmers will not readily accept this practice because of greatly increased labor and production costs. These farmers, however, are often willing to interplant crops to reduce pest losses.

Plant diseases are often favored by intensified plantings of uniformly susceptible cultivars (1,2,3,15,17,18). Workers in corn (*Zea mays* L.) observed that leaf blight increased substantially when genetically uniform hybrids replaced open-pollinated mixed populations and plant density was increased. Moreover, the dispersion of airborne and waterborne pathogen propagules have an inverse relation to distance from the inoculum source. This relationship is based on area and not on linear distance (5). For this reason, infection probability at 2 meters from a source may be less than one fourth of that at one meter. As probability of infection decreases, it takes longer for chance infections to occur on wider spaced plantings. This reduces both initial outbreaks and subsequent progress of aerial disease. On the basis of this reasoning, multiline cereal grains were developed for controlling rust and powdery mildew (2). In the Tropics, small farmers who do not require a high degree of product uniformity use interspecific plantings to reduce pests and diseases. However, usually interplanting and its beneficial effect on disease control is neither appreciated nor tested for use in modern production systems. Fostering increased genetic diversity of commercial planting may be wise since it promotes a more stable production, increases profitability, and reduces production vulnerability (13,15).

Despite Florido's price advantage, increasing or even maintaining production depends on successfully controlling anthracnose. For the last 10 years, because of anthracnose, more fields have been planted to Guinea Blanco. However, this fact seems to have caused an increase in diseases and losses (4,8,10,11,12,13,16) in this species. Pathogen populations of *Curvularia* leaf spot (16), nematodes (9,11,15) and tuber decay (4,8,10,11) cause more damage to Guinea Blanco than to Florido. It is expected that increased Florido production would lessen pest pressure and losses on Guinea Blanco.

With this information in mind, interspecific yam plantings were tested as a possible means of sustaining Florido production in an environment conducive to anthracnose development in Puerto Rico.

MATERIALS AND METHODS

This study was conducted at the Corozal Substation, Agricultural Experiment Station, University of Puerto Rico in the 1982-83 and 1983-84 growing seasons. The substation is located in the north central hills at about 200 m above sea level. The soil is a Corozal clay, Aquic Tropudults, Ultisol. The environment is generally humid, with about 1.6 m of rainfall per year. The experimental plots had, as means, 5.1 pH, 2% organic matter, 1 meq/100 aluminum, 24 p/m P, 303 p/m K, 1,463 p/m Ca, 121 p/m Mg, 32 p/m Mn and 1.6 p/m Fe. Daily temperature generally ranged from 20 to 30° C. The environment was consistently found favorable for severe anthracnose development in 1982-84, and before the experiment from 1978 to 1982.

Yams were planted in mid-April and harvested in early January of both growing seasons. Plots in the same field both years consisted of four 6-m long hills (rows) with 1.67 m between hills, and 0.67 m hill height, and 20 plants per row. Seed pieces were set every 30 cm. Before being planted, seed pieces of about 0.1 kg were immersed in an aqueous solution of 2,000 p/m a.i. thiabendazole (Mertect 340^{RT})[3] immediately after tuber

[3]Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment of materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

sectioning. Healing of cut surface occurred at 90% RH and 30° C for 48 hours.

Treatment comparisons consisted of a) alternating rows of Florido and Guinea Blanco; b) alternating seed pieces of Florido and Guinea Blanco on each row; c) alternating 1 seedpiece of Florido for every 3 seed pieces of Guinea Blanco on each row; d) alternating 3 seed pieces of Florido for every seed piece of Guinea Blanco on each row; e) Florido monoculture (solid planting); and f) Guinea Blanco monoculture. Treatments were arranged in a randomized complete block design with 4 replications.

At harvest, tubers were separately counted and weighed on a per plant basis for each cultivar. Yield data was statistically analyzed. To determine possible benefits of interplanting over those of monocultures, expected (E) yields were calculated with proportions of the interplanting yield; then these were compared to actually observed (0) interplanting yield. This was calculated in percentage by the formula: interplanting advantage $= \frac{0-E}{E} \times 100.$ Variability of yield for each treatment within and among years was evaluated by comparing coefficients of variability ($\sigma/\bar{X}$ 100). High variability is associated with high numerical values of the coefficient. Gross returns were compared with average yields and variable price ratios for Florido and Guinea Blanco yams.

RESULTS

The first anthracnose symptoms were observed on monocultures of Florido (F) in June 1982 and July 1983. Detailed observations on incidence were taken in 1982 (table 1). From June to August incidence appeared to double each month. By October, in both seasons, all susceptible plants were infected. Florido in monoculture showed 38% incidence in

TABLE 1.—*Yam anthracnose incidence in monocultures and mixed plantings Florido and Guinea Blanco during the development of a severe epidemic of anthracnose in Corozal, P. R. in 1982*

Type of planting[1]	Percentage of Florido plants with anthracnose				
	Month/day				
	6/9	7/7	8/9	9/1	10/21
Guinea Blanco monoculture	0.0	0.0	0.0	0.0	0.0
Florido monoculture	7.3	19.6	38.2	88.3	100.0
Alternate rows (1 GB:1 F)	0.0	11.9	18.4	35.6	100.0
Within rows (1 GB:1 F)	2.4	11.7	17.0	33.6	100.0
Within rows (3 GB:1 F)	1.6	10.3	12.2	28.2	100.0
Within rows (3 F:1 GB)	8.0	12.3	16.1	30.5	100.0

[1]Guinea Blanco (GB) and Florido (F) are consistently resistant and high susceptible, respectively, to yam anthracnose in Puerto Rico.

TABLE 2.—*Anthracnose severity in monocultures and interplantings of susceptible Florido and resistant Guinea Blanco during the 1982-83 and 1983-84 growing season*

Type of planting	Anthracnose severity (%)[1]									
	1982-83						1983-84			
	6/8	7/7	8/4	9/1	10/1	11/3	7/10	8/9	9/9	10/21
Guinea Blanco monoculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Florido monoculture	0.1	0.3	8.0	32.6	68.8	77.5	10.5	21.1	43.8	100.0
Alternate rows (1 GB:1 F)	0.0	0.1	0.8	5.3	50.0	66.3	11.5	20.0	35.0	100.0
Within rows (1 GB:1 F)	0.1	0.1	0.4	1.4	21.3	26.3	2.0	5.5	18.0	92.5
Within rows (3 GB:1 F)	0.1	0.1	0.4	1.0	24.0	25.0	5.0	10.3	8.3	71.5
Within rows	0.1	0.1	0.6	2.1	37.5	62.5	7.0	17.3	27.5	100.0

[1]Anthracnose disease severity = estimated proportion of disease foliage expressed as % of the total foliar surface.

August, whereas the same variety when interplanted did not approach the same level until September. In both seasons, no anthracnose was observed on Guinea Blanco (GB).

Anthracnose severity, estimated by foliar necrosis, reached high levels in both seasons (table 2). In 1982, monoculture Florido showed over 30% necrosis by September; similar levels were not reached by interplanted Florido until October. Less difference in anthracnose sever-

TABLE 3.—*Comparison of anthracnose severity rate and initial disease of Florido between monoculture and interplantings of* Dioscorea *spp. during 1982-83 and 1983-84 growing season*

Type of plantiing	1982-83		1983-84	
	Initial disease[1]	Epidemic rate[2]	Initial Disease	Epidemic rate
Monoculture (Florido)	-6.82	0.06	-5.95	0.09
Alternate rows	-8.73	0.07	-5.94	0.09
Within rows (1 GB:1 F)	-7.79	0.05	-6.28	0.06
Within rows (3 GB:1 F)	-7.81	0.05	-4.38	0.04
Within rows	-7.95	0.06	-6.56	0.09

[1]Initial disease—This value is calculated by finding the intercept of the line of the y axis based on the equation y = mb + b, where b is the intercept, y is disease severity, x is time.

[2]Rate = is the proportion of disease increase over time or speed of the epidemic progress. It is calculated according to the equation: $r = \frac{1}{t_2 - t_1}(\text{logit } X_2 - \text{logit } X_1)$, where X is disease severity and t is time after first appearance of disease symptoms.

ity between monoculture and mixed interplantings was observed in 1983. Although by October 1982, all Florido plants showed 4 anthracnose symptoms, monocultures had the highest severity levels (69%), whereas interplantings averaged 33% anthracnose severity (tables 1 and 2).

Anthracnose development was highly variable in the field from one year to the next (table 3). Initial disease in 1983-84 was higher than in the previous year. Higher rates of disease increase were registered for monoculture, 1 GB:1 F in alternate rows and the 3 F:1 GB within each row in 1982-83. The same behavior occurred in the 1983-84 growing season, although disease rates were even higher. In both growing seasons, within row combinations of either 1:1 or 3 GB:1 F had the lowest rates of disease increase.

Florido monoculture yields were associated with levels of anthracnose severity (table 4). Anthracnose severity from September to November was highly correlated with yield ($r= -0.93^{**}$). In October or November, each percentage unit of disease severity was associated with a reduction of 170 to 177 kg of yams per hectare (table 4). Optimum Florido production was estimated at up to 24,708 kg/ha, if plants were free from anthracnose.

Interplanting of yams assured higher Florido yield with additional production from Guinea Blanco (table 5), compared with the yield of Florido monoculture. Total yield in the interplanting always exceeded that of the Florido monoculture, but was less than that obtained from Guinea Blanco monoculture. Total tuber number and mean tuber weight of interplantings of Florido and Guinea Blanco resembled those of Guinea Blanco much more than Florido's (table 6).

TABLE 4.—*The observed relationships of anthracnose disease severity (x) to yam tuber yields (y) in susceptible Florido grown under monoculture in anthracnose conducive environment at Corozal during the 1982-83 and 1983-84 growing seasons*

Anthracnose rating dates	Disease severity(x)[1]	Tuber yield (y) in kg/h[2]	Association coefficients[4] r[3]	$r^{2,3}$
Oct. 1, 1982	68.8	y =–170.4 x + 21,363.0	–.97**[4]	.94
Nov. 3, 1982	77.5	y =–170.4 x + 23,231.2	–.95**	.90
Sept. 9, 1983	43.8	y = –93.2 x + 14,722.6	–.98**	.96
Oct. 21, 1983	100.0	y =–177.2 x + 24,708.0	–.93*	.86

[1]Anthracnose disease severity rating (x) = visually estimated diseased foliage proportion expressed in percentage of the total foliar surface.

[2]Tuber yield (y) = weight of harvested tuber in pounds per 40 m^2 plot.

[3]r = linear correlation coefficient determines the degree of linear association between anthracnose levels and yam yield. $r^{2,3}$ = coefficient of determination indicates the proportion in yield loss that could be attributed to anthracnose.

[4]* and ** denote statistical significance or value at P = 0.05 and P = 0.01, respectively.

TABLE 5.—*Individual and total yields of Florido and Guinea Blanco in interplantings and monocultures during 2 growing seasons*

Treatment	Mean tuber yield (kgx10³/ha)					
	1982 - 1983			1983 - 1984		
	F[1]	GB[2]	Total	F	GB	Total
Alternate row (1 F:1 GB)	10.1	13.2	23.3	3.8	17.5	21.3
Within rows (1 F:1 GB)	8.9	18.2	27.1	5.6	12.3	17.9
Within rows (3 GB:1 F)	2.4	21.2	23.5	3.1	18.2	21.3
Within rows (3 F:1 GB)	6.4	10.8	17.2	5.2	7.7	12.9
Florido monoculture	9.4	–	9.4	10.1	–	10.1
Guinea Blanco monoculture	–	33.7	33.7	–	28.2	29.2

[1]F = Florido (*Dioscorea alata*).
[2]GB = Guinea Blanco (*Dioscorea rotundata*).

Florido monoculture produced yams of 0.47 kg, Guinea Blanco monoculture produced 1.2 kg yams, whereas interplantings produced 1.0-kg yams (table 6). Interplanting yields and tuber sizes were greater than the expected mean from monoculture (table 7). Intercropping benefit was correlated with the delayed occurrence and lower severity of anthracnose on interplanted Florido yam (table 4).

Greatest variability of yam production was associated with Florido in monoculture (table 8). Interplantings of Guinea Blanco and Florido reduced variability in tuber numbers and yield. Interplanting yields resembled Guinea Blanco production in within-year tuber number and yield stability. They differed in showing a greater among-year stability in these parameters than the same Guinea Blanco monoculture.

TABLE 6.—*Pooled yield components for interplantings and monocultures of Florido and Guinea Blanco during two growing seasons*

Treatment		1982-83		1983-84		
		Tuber no. (1000/ha)	Tuber weight	Tuber no. (1000/ha)	Tuber weight	Combined mean weight[1]
			kg		*kg*	*kg*
Alternate rows (1 F:1 GB)		10.0	1.06	10.1	0.95	1.00
Within rows (1 F:1 GB)		11.7	1.05	10.5	0.80	0.92
Within rows (3 GB:1 F)		9.5	1.12	9.5	1.02	1.07
Within rows (3 F:1 GB)		9.4	0.83	8.7	0.68	0.75
Florido monoculture		7.8	0.54	11.8	0.39	0.47
Guinea Blanco monoculture		12.3	1.24	.5	1.20	1.22
	FLSD .05	2.4	0.18	1.8	0.19	0.14
	.01	3.3	0.25	2.4	0.26	0.19

[1]Combined = mean weight of '82-83 and '83-84 growing seasons. Tuber numbers were not presented because of significant year by year interaction.

TABLE 7.—*Comparisons between the observed and expected values for mean tuber yield and mean tuber weight of interplantings of Guinea Blanco and Florido for two growing seasons*

Treatment	Mean tuber yield (kg × 10³/ha)					
	1982-83			1983-84		
	Observed[1]	Expected[2]	% Difference[3]	Observed	Expected	% Difference
Alternate rows (1 F:1 GB)	23.2	21.6	7.8	2.3	16.3	30.4
Within rows (1 F:1 GB)	27.1	21.6	25.6	17.9	16.3	9.7
Within rows (3 GB:1 F)	23.5	27.7	-14.8	21.3	19.5	9.5
Within rows (3 F:1 GB)	17.2	15.5	11.0	12.9	13.2	-2.0
Treatment	**Mean tuber weight (kg/tuber)**					
	1982-83			1983-84		
	Observed	Expected	% Difference	Observed	Expected	% Difference
Alternate rows (1 F:1 GB)	1.06	0.89	18.3	0.95	0.79	20.0
Within rows (1 F:1 GB)	1.05	0.89	17.3	0.80	0.79	1.1
Within rows (3 GB:1 F)	1.12	1.07	4.7	1.02	1.00	2.2
Within rows (3 F:1 GB)	0.83	0.72	14.5	0.68	0.56	13.7

[1]Observed = mean yields (kg x 10³/ha) as found experimentally.

[2]Expected = interplantings yield calculated as a mean of monoculture yields based on the real proportion of each cultivar in each mixture.

[3]Percent difference = (Observed-Expected ÷ Expected) (100).

Table 9 shows the calculated gross income associated with Florido and Guinea Blanco monocultures and interplantings for the 2 years. These calculations were based on a variable pricing of Florido from $0.77 to $1.10 per kg and a fixed price of $0.55 per kilogram for Guinea Blanco. One-to-one interplanting combinations were always better than the Florido monoculture when Florido prices were $1.10 and $0.99 per kg in 1982-83 and 1983-84, respectively. Florido prices fluctuate because of its scarcity as a result of anthracnose losses and preference by consumers.

TABLE 8.—*Stability of tuber yield and tuber number of monocultures and interplantings of Guinea Blanco and Florido among and within two growing seasons*

Treatment	Coefficients of variation (σ n-1/$\sqrt{\bar{x}}$)[1]					
	Tuber number			Tuber yield		
	82-83	83-84	Among seasons	82-83	83-84	Among seasons
Alternate rows (1 F:1 GB)	14.8	13.9	1.2	33.7	3.2	6.2
Within rows (1 F:1 GB)	20.8	18.5	7.7	37.3	26.5	28.7
Within rows (3 F:1 GB)	14.2	4.6	0.5	16.4	8.9	7.1
Within rows (3 F:1 GB)	8.9	20.0	5.8	24.9	18.6	19.9
Florido monoculture	36.8	25.9	28.4	77.0	31.2	5.0
Guinea Blanco monoculture	17.2	6.3	25.8	27.3	9.0	28.0

[1]High variability is associated with numerical values of this coefficient.

TABLE 9.—*Gross economic returns ($ × 10³/ha) in monocultures and interplantings of* Florido and Guinea Blanco at a fixed price of $0.55/kg for Guinea Blanco and a variable price from $0.77 to $1.10/kg for Florido calculated from experimental yields at Corozal, Puerto Rico, during two seasons

		Gross income ($ × 10³/ha)					
		1982-83			1983-84		
Type of planting	Variable price of Florido ($/kg)	Florido	Guinea Blanco at $0.55	Total	Florido	Guinea Blanco at $0.55	Total
Alternate Row	0.77	7.75	7.25	15.00	2.93	9.63	12.56
	0.88	8.88	7.25	16.13	3.35	9.63	12.98
	0.99	9.98	7.25	17.23	3.78	9.63	13.41
	1.10	11.10	7.25	18.35	4.20	9.63	13.83
Within Rows (1F:1GB)	0.77	6.88	10.00	16.88	4.35	6.78	11.13
	0.88	7.85	10.00	17.85	4.95	6.78	11.73
	0.99	8.83	10.00	18.83	5.58	6.78	12.36
	1.10	9.83	10.00	19.83	6.20	6.78	12.98
Within Rows (3GB:1F)	0.77	1.68	11.70	13.38	2.38	10.05	12.43
	0.88	1.90	11.70	13.60	2.70	10.05	12.75
	0.99	2.15	11.70	13.85	3.05	10.05	13.10
	1.10	2.38	11.70	14.08	3.38	10.05	13.43
Within Rows (3F:1GB)	0.77	4.95	5.90	10.85	3.95	4.28	8.23
	0.88	5.65	5.90	11.55	4.53	4.28	8.81
	0.99	6.38	5.90	12.38	5.75	4.28	9.43
	1.10	7.08	5.90	12.98	5.73	4.28	10.01
Monoculture Florido	0.77	7.23	–	7.23	7.75	–	7.75
	0.88	8.25	–	8.25	8.80	–	8.80
	0.99	9.28	–	9.28	10.00	–	10.00
	1.10	10.33	–	10.33	11.10	–	11.10
Monoculture Guinea Blanco	–	–	18.58	18.58	–	12.43	12.43

DISCUSSION

Interplanting Florido and Guinea Blanco delayed anthracnose onset and reduced severity. In this study, natural occurrence of inoculum was apparently higher in the 1983-84 season than in the 1982-83 season. This could represent the effect of planting the same field where yams had been planted the previous year.

This helped build up inoculum on crop residue. Moreover, we have found yam anthracnose tuber-borne (14) and seed-tubers harvested from the previous experimental plots could have also contributed to the higher initial disease levels (table 3). Because of the nature of this disease and since interplantings gave better results on disease control and yield, the importance of integrating rotation with other crops and seed-tuber fungicidal treatment to reduce initial disease levels should be considered.

In interplantings, Florido yield often approached that of a pure culture. Guinea Blanco yield increased the profitability per area more than monoculture of Florido. In cases where Florido yams were nearly double the value ($) of Guinea Blanco, 1:1 interplantings produced greater income than Guinea Blanco monocultures.

Besides the potential economic advantages of interplantings compared to the best monocultures, interplantings showed better year-to-year stability. Greater stability assures more sustainable profits and a lower risk level (3,17).

Alternate rows of Florido and Guinea Blanco can be as efficiently managed as the monocultures of each. Within row interplantings of yams would need extra attention in harvesting and sorting the tubers. Another advantage of alternate rows is the efficient control of cultivar specific pests, eliminating applications to the resistant cultivar. This reduces costs, and increases yield. Specific fungicides (14) could be employed for anthracnose control on *D. alata* and for other diseases only on the susceptible cultivar. Interplanting of these two species of yams appears to foster a more stable agroecosystem and a profitable long-term production of yams.

RESUMEN

El ñame: antracnosis, rendimiento y ganancia en siembras en monocultivo e intercaladas

En las parcelas exlperimentales, los primeros síntomas de la antracnosis, causada por *Colletotrichum gloeosporioides*, se detectaron en la variedad susceptible Florido (*Dioscorea alata*) en junio de 1982 y julio de 1983 en Corozal, Puerto Rico. Ya en octubre de ambos años, la incidencia de antracnosis había alcanzado el 100% de las plantas con una severidad mayor de 60% de tejido necrótico. Se encontró una correlación negativa alta (r = –0.93) entre la intensidad de antracnosis y el rendimiento en ambos años. Una producción mayor y más estable en la variedad Guinea Blanco (*D. rotundata*) se asoció con su resistencia a la antracnosis y con su mayor potencial de rendimiento. Plantas de Florido intercaladas con Guinea Blanco se enfermaron con antracnosis más tardíamente y en menor grado que el Florido sembrado en monocultivo. El Florido intercalado tuvo un rendimiento más alto con tubérculos de mayor tamaño y menos variable que cuando se sembró en monocultivo. Siembras intercaladas de las dos especies acusaron una notable estabilidad con respecto a la cantidad de tubérculos producidos en ambos años. La ganancia bruta que se obtuvo de estas siembras intercaladas excedió a la que se obtuvo de Florido en monocultivo. Siembras intercaladas de 1:1 (Florido: Guinea Blanco) igualaron o excedieron la ganancia bruta de Guinea Blanco en monocultivo cuando éste costaba $0.55/kg. y el Florido se valoró a $1.10 y 10.99/kg. durante 1982 y 1983, respectivamente.**

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