Effects of Gibberellic Acid on Dormant Seeds and Subsequent Crops of Pigeonpeas (*Cajanus cajan*)[1]

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INTRODUCTION

Pigeonpeas (*Cajanus cajan*) is a legume crop with a high protein content, having an economic farm value in Puerto Rico of over a million dollars per year. Commercially, this is an annual crop in Puerto Rico, hence, from the breeder's standpoint, only one generation can be processed in a given year.

The experiment reported herein was performed to study the possibilities of hastening flowering and reproduction of pigeonpeas with gibberellic acid. Gibberellic acid, one of the gibberillins, has been studied extensively during the past few years by research workers on different crop plants. Reported responses tend to indicate that gibberellic acid stimulates plant growth, yield, breaking of seed dormancy, and early flowering in many crops (*1*,*2*, *3*,*4*,*5*,*6*,*7*)[3].

From previous work done on other crops it was thought that gibberellic acid might hasten the flowering period of pigeonpeas. This work was therefore initiated to determine the possible usefulness of gibberellic acid in accelerating the breeding work carried on with this crop.

MATERIALS AND METHODS

Seed of the commercial varieties Kaki, Saragateado, and Florido were soaked overnight in solutions containing 0, 20, 30, 40, and 50 p.p.m. of gibberellic acid. All varieties were sown in holes 4 feet apart, four seed per hole, and thinned to one plant per hole. A plot consisted of 10 plants per row, 8 feet between rows, giving a plot size of 40 x 8 feet or about one-hundred-thirty-sixth of an acre.

The experimental design was a split-plot one in which the three commercial varieties were studied in the whole plots. The subplots consisted of the gibberellic acid treatments and the control. All treatments were replicated four times. Data for plant height, days from sowing to flowering, and weight of shelled green peas yielded were recorded.

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[3] Italic numbers in parentheses refer to Literature Cited, pp. 26–7.

TABLE 1.—*Mean plant height (feet) of pigeonpea plants of varieties Kaki, Saragateado, and Florido, when seed were treated with different levels of gibberellic acid*

Variety	Results of treatment with indicated p.p.m. of gibberellic acid—					Mean
	0	20	30	40	50	
Florido	5.58	5.85	5.29	5.88	5.63	5.65
Kaki	5.72	5.52	5.54	5.47	5.33	5.51
Saragateado	5.19	5.19	5.28	5.40	5.50	5.31
Mean	5.50	5.52	5.37	5.58	5.48	5.49

RESULTS AND DISCUSSION

EFFECT OF GIBBERELLIC ACID ON PLANT HEIGHT OF PIGEONPEAS

Data on the plant heights of pigeonpeas varieties Kaki, Saragateado, and Florido after the seed were treated with different concentrations of gibberellic acid are presented in table 1. The standard errors and least differences for significance between mean plant heights are shown in the following tabulation:

Item	*5-percent level*	*1-percent level*
Varieties:		
Difference between highest and lowest means	0.81	1.18
Difference between 2 adjacents	.65	.98
Standard error 1.87 with 6 d.f.		
Gibberellic acid treatments:		
Highest and lowest	.35	.43
Difference between 2nd and lowest	.33	.41
Difference between 3d and lowest	.30	.38
Difference between 4th and lowest	.25	.33
Standard error 0.087 with 36 d.f.		
Between gibberellic acid treatment for same variety:		
Highest and lowest	.62	.76
Difference between 2nd and lowest	.58	.72
Difference between 3d and lowest	.53	.67
Difference between 4th and lowest	.44	.59
Standard error 0.152 with 36 d.f.		
Between any 2 varieties for same gibberellic acid treatment:		
Highest and lowest	.93	1.30
Difference between 2 adjacents	.81	1.10
Standard error 0.230		

Previous studies on the response of different crops (*1,3,4,5*) had shown that the chemical was capable of promoting growth, *i.e.*, a rapid elongation of shoots and leaves. The results with pigeonpeas showed that treating the seed with different levels of gibberellic acid did not improve the rate of

growth of this crop. No significant differences in plant heights were found between the three commercial varieties used in this trial. A lightening of the green color of the leaves was observed in all varieties treated with 50 p.p.m. of gibberellic acid. The average plant heights for Florido, Kaki, and Saragateado varieties were 5.65, 5.51, and 5.31 feet, respectively. This is in accordance with field observations in commercial and experimental work with these varieties.

Average Number of Days to Flower

The results on the mean number of days taken from sowing to flowering are presented in table 2 and figure 1.

The standard errors and least differences for significance between mean number of days from sowing to flowering are shown in the following tabulation:

Item	*5-percent level*	*1-percent level*
Varieties:		
Difference between highest and lowest means	14.13	20.57
Difference between 2 adjacents	11.26	17.06
Standard error 3.255 with 6 d. f.		
Gibberellic acid treatments:		
Highest and lowest	6.09	7.45
Difference between 2nd and lowest	5.70	7.09
Difference between 3d and lowest	5.18	6.58
Difference between 4th and lowest	4.29	5.76
Standard error 1.496 with 36 d. f.		
Between gibberellic acid treatment for same variety:		
Highest and lowest	10.54	12.90
Difference between 2nd and lowest	9.87	12.28
Difference between 3d and lowest	8.96	11.40
Difference between 4th and lowest	7.43	9.97
Standard error 2.590 with 36 d. f.		
Between any 2 varieties for same gibberellic acid treatment:		
Highest and lowest	16.14	22.66
Difference between 2 adjacents	14.07	19.10
Standard error 3.996		

Table 2 shows that there were highly significant differences in the flowering date between the three pigeonpea commercial varieties. The variety Saragateado flowered significantly later than either Florido or Kaki. This difference agrees consistently with field observations on these varieties during recent years, *i. e.*, Saragateado usually takes from 30 to 45 more days to flower than either Florido or Kaki, and Florido a few days more than Kaki.

None of the gibberellic acid treatments had any significant effect on the number of days to flower of the three pigeonpea varieties. The mean number

TABLE 2.—*Mean number of days from sowing to flowering of pigeonpea varieties Saragateado, Florido, and Kaki when seed were treated with different levels of gibberellic acid*

Variety	Results of treatment with indicated p.p.m. of gibberellic acid—					Mean
	0	20	30	40	50	
Saragateado	161.54	162.97	158.04	158.90	158.82	160.05
Florido	134.97	136.05	135.30	136.64	138.11	136.22
Kaki	124.21	127.71	124.89	128.88	124.96	126.13
Mean	140.24	142.24	139.41	141.47	140.63	140.80

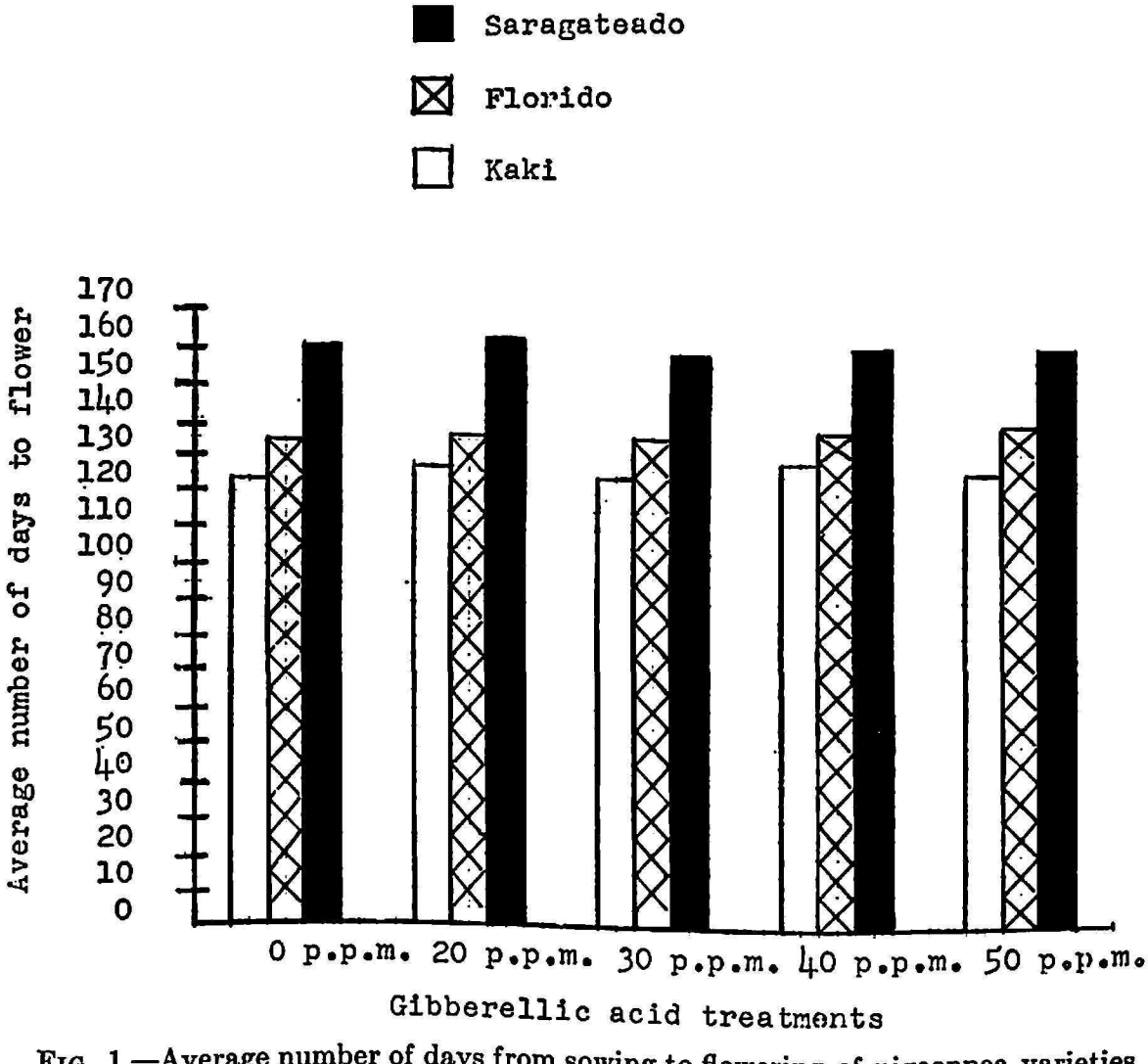

FIG. 1.—Average number of days from sowing to flowering of pigeonpea varieties Saragateado, Kaki, and Florido treated with 0, 20, 30, 40, and 50 p.p.m. of gibberellic acid.

of days from sowing to flowering for the 0, 20, 30, 40, and 50 p.p.m. of gibberellic acid treatments were 140.24, 142.24, 139.41, 141.47, and 140.63, respectively. This is presented graphically in figure 1, the dark column representing the late variety, Saragateado.

Yield Data

The results on the average green weights of shelled peas of varieties Kaki, Saragateado, and Florido, the seed of which were treated with different levels of gibberellic acid, are presented in table 3.

TABLE 3.—*Yield, in pounds per plot of shelled green peas of pigeonpea varieties Kaki, Saragateado, and Florido, when seed were treated with different levels of gibberellic acid*

Variety	Results of treatment with indicated p.p.m. of gibberellic acid—					Mean
	0	20	30	40	50	
Kaki	4.88	5.66	6.30	5.42	6.08	5.66
Saragateado	3.61	2.58	3.44	4.28	3.62	3.51
Florido	.66	.70	.91	.66	.73	.73
Mean	3.05	2.98	3.55	3.45	3.48	3.30

The standard errors and least differences for significance between mean green weights of shelled peas are shown in the following tabulation:

Item	*5-percent level*	*1-percent level*
Varieties:		
Difference between highest and lowest means	3.86	5.62
Difference between 2 adjacents	3.07	4.66
Standard error 0.889 with 6 d. f.		
Gibberellic acid treatments:		
Highest and lowest	1.10	1.34
Difference between 2nd and lowest	1.03	1.28
Difference between 3d and lowest	.93	1.19
Difference between 4th and lowest	.77	1.04
Standard error 0.270 with 36 d. f.		
Between gibberellic acid treatment for same variety:		
Highest and lowest	1.91	2.34
Difference between 2nd and lowest	1.79	2.22
Difference between 3d and lowest	1.62	2.06
Difference between 4th and lowest	1.35	1.81
Standard error 0.469 with 36 d. f.		
Between any 2 varieties for same gibberellic acid treatment:		
Highest and lowest	4.12	5.89
Difference between 2 adjacents	3.62	4.92
Standard error 0.986		

These results show significant differences in yield between varieties, the Kaki variety leading, followed by Saragateado and Florido. There were no significant differences in yield between Saragateado and Florido. Once more these results follow the pattern of production obtained in commercial and experimental work throughout the Island, *i.e.*, the Kaki variety yields best, followed by Saragateado and Florido.

There was no significant difference in yield between the gibberellic acid treatments. The mean average yields for the 0, 20, 30, 40, and 50 p.p.m. gibberellic acid treatments were as follows: 3.05, 2.98, 3.55, 3.45, and 3.48 pounds per plot, respectively.

SUMMARY

Seed of the commercial pigeonpea varieties Kaki, Saragateado, and Florido were soaked overnight in solutions of gibberellic acid containing 0, 20, 30, 40, and 50 p.p.m., in order to determine the effect of the acid on plant height, flowering period, and yield of this crop. The following results were obtained:

1. There were no significant differences in plant height between the three commercial varieties that could be attributed to the gibberellic acid treatments.
2. Varieties differed in their flowering periods, but this could not be attributed to the gibberellic acid treatments, as such differences are of genetic origin.
3. Gibberellic acid had no effect on the yield of green peas.

RESUMEN

Semillas de las variedades comerciales de gandur Kaki, Saragateado y Florido se sumergieron por 12 horas en las siguientes soluciones de ácido giberélico: 0, 20, 30, 40, y 50 partes por millón. Se observaron los efectos de estos tratamientos en relación con la altura de las plantas, número de días hasta la florecida y rendimiento en grano verde. Los resultados fueron como sigue:

1. No se encontraron diferencias en la altura de las plantas debidas a los tratamientos con ácido giberélico.
2. Hubo diferencias significativas entre las variedades en su época de florecida, pero estas diferencias no fueron causadas por los tratamientos de ácido giberélico. Las diferencias fueron de naturaleza genética.
3. El ácido giberélico no causó cambios en cuanto a los rendimientos en grano verde de las variedades estudiadas.

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