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AGRONOMICAL ASPECTS OF PIGEON PEA IN MARIE-GALANTE

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Marie-Galante is a small island (37,000 acres) near Guadeloupe. The culture of pigeon pea is traditional on its dark clay soils derived from limestone.

We shall examine successively:

(1) The usual agronomic practices of the culture.

(2) The results of first experiments dealing with:

Evaluation of yields and its problems.

Some factors of the productivity acting upon yields:

time of sowing;

fertilizing;

relative importance of successive yields during the cropping season;

comparison of some different varieties.

(3) Perspectives of work about this pulse.

I. THE USUAL AGRONOMIC PRACTICES OF THE CULTURE

Agronomic practices of growing pigeon pea in Marie-Galante are fairly traditional: Land preparation consists of light ploughing by draught animal. On hill slopes this work is done by hand. Sowing (2 to 3 seeds per hole) occurs usually in June, at the beginning of the rainy season and after the end of sugarcane harvesting. All growers use their own seeds, harvested as dry pods from February to April. No particular work is done after sowing except occasional hoe cleaning; fertilizers are never used. The crop always remains for two years, the second year crop giving a 50% reduction in yield Pigeon pea is not grown in crop rotation: at the very most, it is grown with food crops on the less fertile soils (others being occupied by sugarcane) and it may be found before or after a grazing fallow.

In the island, 9,500 acres (3.800 Ha) are under cultivation with the following principal crops:

Sugarcane	: 80%
Pigeon pea	: 10%
Miscellaneous	: 10%

(miscellaneous are principally sweet-potato; cassava; plantain and banana; pangola grass; gardens)

In dark-clay soils deeper than 15 inches, the pigeon pea is grown intercropped with either sweet-potato or maize or other root-crops; in poorer stony shallow soils it is grown in pure stand (60% of the surface occupied by the crop). Every farmer (there are 2,500 in Marie-Galante) grows pigeon pea; the size of pea fields does not exceed 0.6 acre (25 ares), the medium being between 0.1 and 0.6. The plant number per acre, range from 3,400 to 5,000 (8,000 to 10,000 per hectare).

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The first green pods may be harvested as early as two weeks before Christmas (pigeon pea being used as a traditional feast meal) and this first-blooming harvest goes on until February. A second-blooming in March/April gives a 30–40% reduction in yield.

Pigeon peas are sold as green pods or dry seeds (essentially exported to Guadeloupe) but the larger part,-2/3-, is retained for use at home; dry seeds can hardly be stored longer than July. These points explain that an expansion of the crop would only be possible with the setting up of a canning industry.

The average annual green pod yields obtained by this traditional two years cultivation is very low: 1,000 to 1,500 pounds/acre. In the local markets, peas are sold, unshelled at prices from about 0.80 to 4.00 francs/kg (approx. 7 to 35 U.S. cents/pound) according to the season, higher prices being obtained on a few days at Christmas time.

2. RESULTS OF FIRST EXPERIMENTS

Evaluation of yields

The weight and quality of a pulse is difficult to determine. It does not necessarily require the same kind of precision as in experimental work or commercial aims, Variation in dry matter content for green pods harvested from the same plot, can occur. This may range from 25% dry matter content, in very early stages, to 45% or more as the season goes; and some pods can reach 65%. Results of green pod yield should, therefore, include data on their dry matter per cent (table 1). Results expressed as dry matter in seed yields are better for experimental comparisons (table 2).

In addition to the interest of growing a crop to be harvested over a short time, a better quality could be obtained by having:

pods at approximately the same stage of maturity (or same dry matter per cent);
in the same pod, seeds at the same stage of maturity;
uniform seed size distribution.

On the other hand, the average number of seeds per pod and also the weight ratio seed/pod are important points and it is of interest to know how different factors of growth affect them. Actually seed number per pod can vary from 2 to 6, and seed/pod ratio from 0.5 to 0.80.

Generally, mean yields reported are low: in Trinidad, more than 80 per cent of the growers obtained less than 2,000 lb/acre (4); in Puerto Rico (7) mean yields are about 1,800 lb/acre. Other mean yields reported can vary from 3,000 to 4,500 lb/acre (3;7;10). Maximum yields were obtained on experimental work: about 7,000 lb/acre for Kaki selection in Puerto Rico (7); in our experiments we obtained 6,500 to 7000, with "Kaki"; 8,000 to 13,000 with G 1 54/3 dwarf selection from Trinidad and 5,200 to 11,000 with a Marie-Galante local strain (table 1). The number of plants per acre was 4,000 but it is known to have not a marked effect on yields (1;2;3;7).

Time of Sowing

The influences of time of sowing were emphasized by several workers (2;7); in Marie-Galante. Using successive sowing times (June 24th, July 12th, July 25th),

we obtained marked effects in reducing yields for the firstblooming-crop of the local strain. On the other hand, for "Kaki" selection we did not get any effect on yields (fig. 1).

Fertilizing

In the Caribbean, fertilizers are not used (1;3;4;7) and in Puerto Rico they were found to have no effects; but response to phosphate was obtained in Hawaii (3) and in India (4).

In Marie-Galante experiments, a P–K supply (100 lb $P_2 0_5$ and 120 lb $K_2 0$ per acre) was used. Effects on yields of Marie-Galante local strain and more especially for early sowing times and first blooming yields; were obtained. Average yield was augmented by 35% to 45%. No effect was found with the Puerto-Rican "Kaki selection" (tables 1 & 2).

Further work will be developed including Trinidad selections, principally with phosphorus (which may give higher P% in the seeds) and effects on leaf composition.

SUCCESSIVE YIELDS DURING THE CROPPING SEASON

Generally, two successive bloomings give two successive yields: the first one from December to February, the second one in March–April. Relative importance of these two yields is analysed in table 3. Second blooming yields are lower for "Kaki" selection than for local strain and, for the latter, it depends on sowing time: for late sowing times, second blooming yields are better and balance lower first blooming yields.

The first blooming yield is harvested several times during some weeks, the greater part being available on the two first weeks: 53% for G1 54/3 Trinidad selection (table 4).

COMPARISON OF VARIETIES AND DISCUSSION

It is difficult to give definitive comparison when considering only annual yields: Precocity, length of cropping season, relative importance of successive yields, allow a better knowledge of the possibility of pigeon pea culture (2; 8; 9). First results, summarized in fig. 1 and tables 1, 2, 3, 4, show some aspects of agronomical comparisons.

Chemical composition of seeds and shells shows significant differences between varieties for nitrogen and phosphorons (table 5). The G 1 54/3 Trinidad selection shows particular higher contents for N,P.K. and lower for Ca and Mg.

This Trinidad selection clearly appeared better for potential yields than the two other experimented ones. But the more important problem in Marie-Galante is its greater sensibility to *Heliothis virescens** attacks: Some pods, completely bored, cannot be sold (representing a 25% loss), furthermore many peas in the non-climinated pods are also attached and the total loss may be as high as 45%. Of course, other varieties are attacked by Heliothis, but to a lesser extent, and resulting losses may not exceed 20%–25%.

Variety selection is of particular interest in that sowing dates can be varied and yields may be obtained over a longer period or at best throughout the year (2). In the

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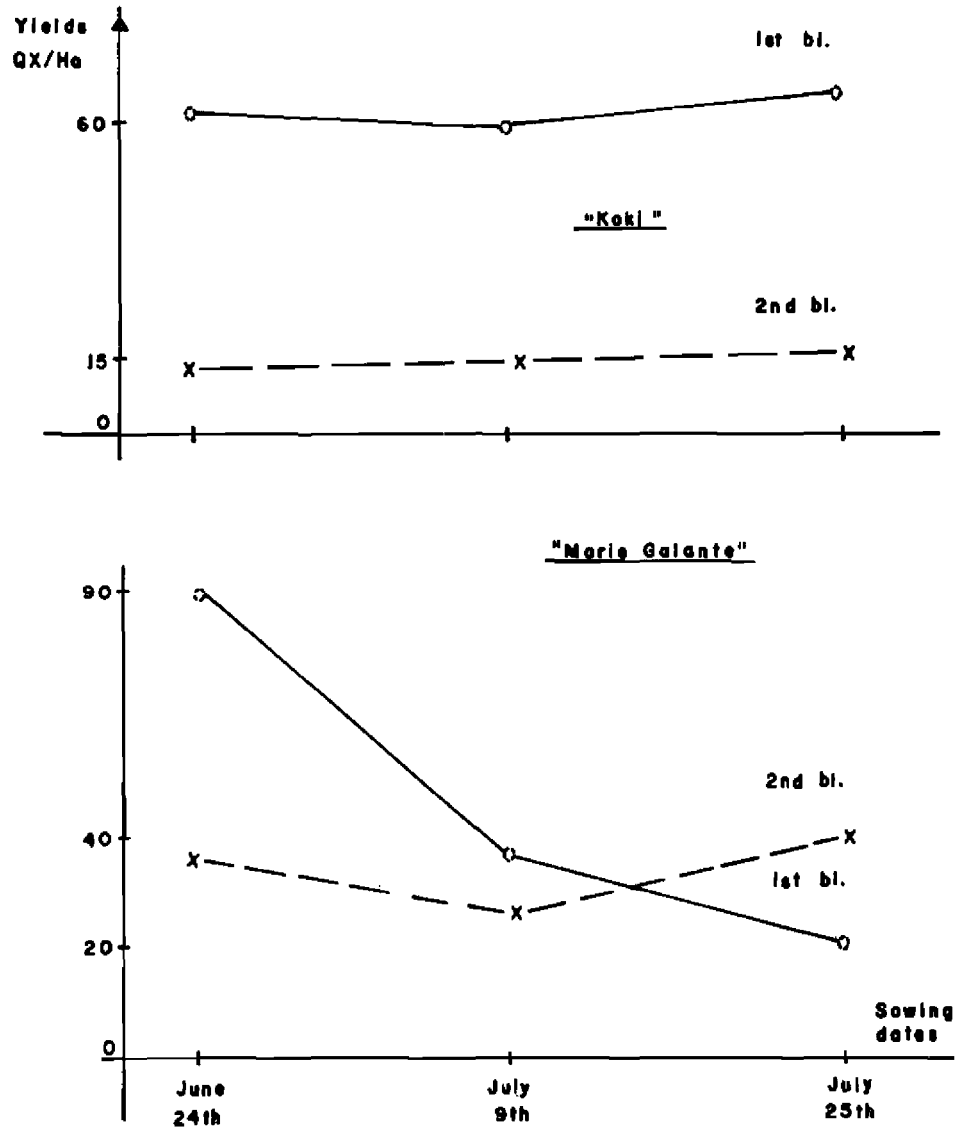

Figure 1 Influence of time of sowing on yields of Marie-Galante local strain, and Koki selection; yields corresponding to 1st blooming and 2nd blooming; fertilized plots.

Caribbean, ecological differences with particular reference to day length may give interest for further systematic studies in this way.

3. PERSPECTIVES OF WORK AND CONCLUSION

Work on pigeon pea will be developed in the perspective of canning industries and improvement and increase of fresh peas.

General quality tests include a good appreciation of yield and improvement of uniformity between different plants or pods or seeds; factors acting on maturity stages must be studied thoroughly, including effects of fertilizers (mineral exportation by pods of a high yielding crop can reach 35 lb P_2O_5 and 80 lb K_2O per acre). Uniformity quality of peas is related to different possible picking systems (9,10) and should be studied according to different varieties, stage of maturity and time of harvest. Uniformity of colour (relative importance of yellow and green peas) or size is a good test for canning peas and also for fresh ones; a hardness test might also be of interest.

Essential quality tests particular to canning purposes (10) are high shelling possibilities (efficiency of shelling operations), good colour of brines, per cent starch and alcohol in soluble solids: It will be of interest to relate these quality tests to agronomical conditions in order to improve a better knowledge of quality and yields and a better possibility of payment for peas.

TABLE 1

Yields for three varieties of pigeon pea: Qx/Ha green pods—35% dry matter—(to obtain pounds per acre multiply by 89.3). For the G 1 54/3 variety, the first data is related to possible obtainable yields including borer attacked pods; the figures in brackets are referring to real yields, after the attacked pods: have been eliminated.

Date of sowing	1st blooming yields			2nd blooming yields			Total yields/year		
	June 24th	July 9th	Mean	June 24th	July 9th	Mean	June 24th	July 9th	Mean
"Marie-Galante" local strain									
Fertilized	90	39	65	34	28	31	124	67	96
Unfertilized	62	27	45	20	31	25	82	58	70
"Kaki" selection									
Fertilized	62	59	60	13	14	13	75	73	74
Unfertilized	65	52	59	14	10	12	79	62	71
"Dwarf G 1 54/3" ...	June 12th			June 12th			June 12th		
Unfertilized	105	—	—	45	—	—	150	—	—
	(79)	—	—	(34)	—	—	(113)	—	—

TABLE 2

Yields for three varieties of pigeon pea; Dry matter of seeds (kgs/Ha: to obtain pounds per acre multiply by 0.893).

For the G 1 54/3 variety the first data is related to possible obtainable yields including borer attacked seeds; the figures in brackets are referring to real yields, after the attacked seeds have been eliminated.

Date of Sowing	1st blooming yields			2nd blooming yields			Total yields/year		
	June 24th	July 9th	mean	June 24th	July 9th	mean	June 24th	July 9th	mean
"Marie-Galante" local strain									
Fertilized	1850	800	1320	700	620	660	2500	1420	1980
Unfertilized	1300	560	930	430	630	530	1730	1190	1460
"Kaki" selection									
Fertilized	1340	1400	1370	350	360	355	1690	1760	1725
Unfertilized	1400	1100	1250	320	240	280	1720	1360	1530
Dwarf G 154/3	June 12th			June 12th			June 12th		
Unfertilized	1700 (930)	— —	— —	750 (410)	— —	— —	2450 (1340)	— —	— —

TABLE 3

Relative importance of yields corresponding to 1st and 2nd bloomings: these figures represent the mean ratio 2nd/1st blooming yield.

Variety	Dwarf G 1 54/3	Marie-Galante	Kaki
Dates of sowing			
June, 12th	.44	—	—
June, 24th	—	.36	.23
July, 9th	—	.90	.25
July, 25th	—	1.90	.24

TABLE 4

Relative importance of yield (1st blooming crop harvested at 4 successive times) for the G 1 54/3 selection. Sown June 12th.

Yields	1st blooming yield				Total 1st	2nd blooming yield	Total 1st + 2nd
Harvesting Dates	Jan. 12	Jan. 25	Feb. 2	Feb. 12		March 29	
Green pods yields (Qx/Ha)*	56	17	20	12	105	45	150
Per cent % 1st blooming yield	53%	16%	19%	12%	100%	—	—
Per cent % total yield...	37%	11%	13%	9%	70%	30%	100%
Seeds	960	230	350	160	1700	750	2450
Dry matter yields (kg/ha)†							

*To obtain pounds per acre multiply by 89.3

†To obtain pounds per acre multiply by 0.893

TABLE 5

Mean mineral composition of pods for three varieties of pigeon pea: one of the local strains of Marie-Galante; kaki selection from Puerto-Rico; G 1 54/3 selection from Trinidad. Effect of fertilizers gave no significant differences on mineral composition but significant differences were found between varieties

% element (dry matter basis)	N	P	K	Ca	Mg
1) SHELLS					
"Marie-Galante"	1.39*	.05	.74	.67	.38
Kaki	.76*	.05	.80	.68	.38
(G 1 54/3)	1.93*	.21*	1.39*	.07*	.22*
2) SEEDS					
"Marie-Galante"	3.59	.34*	1.61	lower than .01	.13
Kaki	3.13*	.25*	1.52	do.	.14
(G 1 54/3)	3.87	.43*	1.70	do.	.13

(*Figures, for a variety, significatively different of each from two others.)

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