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THE PERFORMANCE OF TROPICAL SOYABEAN CULTIVARS IN TRINIDAD*

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ABSTRACT

Four tropical soyabean cultivars (TGX 849-294, TGX 536-02, TGX 539-5E and TGX 306-036) from the International Institute of Tropical Agriculture were evaluated in a series of field trials on the University Field Station and cooperative farmer plots. In the planting date study the cultivars gave seed yields ranging from 1,800 to 3,800 kg/ha but exhibited slight response to photoperiod. They flowered in 40 to 70 days and matured in 97 to 138 days after planting with plant heights at harvest ranging from 50 to 90 cm. In the soyabean/cassava intercrop study, sole crop yield of TGX 849-294 averaged 2,878 kg/ha as against 1,170 kg/ha in the intercrop. The cassava yield of 23,000 kg/ha compensated for the lower soyabean yield in the intercrop. In all trials the four cultivars were confirmed as promiscuous nodulators and generally performed better than the American cultivar, Jupiter. The tropical cultivars did not succumb to any serious pest or disease problem, showed excellent shatter resistance, rapid leaf senescence at maturity and improved seed viability. Cultivar TGX 849-294 which matured the earliest and produced the best yields of excellent quality yellow seeds with protein contents of 40 % and oil content of 20 % was identified as the cultivar best suited for cultivation under local conditions.

Keywords : soyabean cultivars ; seed yield , cassava.

RESUME

LES PERFORMANCES DE QUATRE CULTIVARS DE SOJA TROPICAL A TRINIDAD

Des cultivars de Soja (TGX 849-249 ; TGX 536-02 ; TGX 539-5E et TGX 306-036) en provenance de l'Institut International d'Agriculture Tropicale

sont évalués dans une série d'essais à la station expérimentale de l'Université et chez l'agriculteur. L'étude dates de plantation montre que les cultivars ont donné des rendements allant de 1 800 à 3 800 kg/ha mais présentent une certaine sensibilité à la photopériode. Ils fleurissent après 40-70 jours et mûrissent après 97-138 jours avec des tailles de 50 à 90 cm. Dans l'association soja/manioc, le cultivar TGX 849-294 donne 1 170 Kg/ha contre 2 878 Kg/ha en monoculture. Le rendement en manioc de 23 000 Kg/ha compense le faible rendement en soja. Dans tous les essais les quatres cultivars présentent

une nodulation hétérogène mais se révèlent être plus performants que le cultivar américain, Jupiter. Ils n'ont succombé à aucun ravageur revieux ni à aucun problème de maladieet présentent une rapide sénescence foliaire à la maturité et une viabilité accrue des graines.Le cultivar TGX 849-294 qui est le plus précoce et le plus productif en graines jaunes d'excellente qualité, avec des teneurs en protéines de 40 % et en huile de 20 % a été identifié comme le cultivar le mieux adapté aux conditions locales.

INTRODUCTION

Larges quantities of soyabean and its by-products are imported into Trinidad and Tobago and other Caribbean countries mainly for the manufacture of edible oil, animal feed or to be used directly as human food. In 1988, Trinidad imported 30.8 million kilograms of soyabean valued at TT$69.2 million (C.S.O Overseas Trade, 1988). This large quantity of soyabean imported each year causes a significant loss in foreign exchange.

It was against this background that a soyabean research programme was initiated at the University of the West Indies, St. Augustine in 1965. Results from experiments conducted led to the identification of two American cultivars - Jupiter and Acadian, (Radley, 1968 and Brathwaite, 1972) - which produced acceptable yields. Radley (1968) estimated that under large scale production yields of 1760 Kg/ha could be obtained from Jupiter.

Based primarily on these experimental results the Chaguaramas Agricultural Development Project (CADP), a joint venture between the Government of Trinidad and Tobago and the Federal Republic of Germany, was initiated to examine the commercial feasibility of corn/soyabean production. However, this project was unsuccessful (CADP, 1974) mainly because of the variable performance of the American cultivars to the local conditions. These cultivars had poor viability and nodulation, and in general produced low

yields (950 Kg/ha) primarily because of the shorter daylengths.

In the early 1970 "s breeding work conducted at the International Institute of Tropical Agriculture (IITA) led to the development of several cultivars that were adapted to the tropics. Four of these cultivars were brought back from IITA by one of us (RAIB) for evaluation in our research programme.

Cultivars characteristics

The four IITA cultivars are «promiscuous nodulators», that is, they form symbiotic relationship indiscriminately with diverse rhizobia strains. This is important because most developing countries lack inoculant industries and extension systems to distribute inoculants to small farmers. These cultivars also exhibit improved storeability and germinating power even when

kept under ambient conditions in the humid tropics (IITA, 1983). Other beneficial characteristics include high yield potential (>2,500 Kg/ha), shatter and lodging resistance and rapid leaf senescence at maturity fo facilitate harvesting.

The four IITA cultivars are classified into three maturity groups (IITA, 1984) ; cv. TGX 849-294 early maturing, cvs. TGX 536-02 and TGX 539-5E medium maturing and cv. TGX 306-036 late maturing. Although cultivar TGX 849-294 is early maturing, it is a vigorous cultivar with very high yield potential. Cultivars TGX 306-036 is the latest and produces low but stable yields compared to the other cultivars.

Table 1 shows some other cultivar characteristics ; the number of seeds per pod varied from 2.0-2.5, whilst seed weight ranged from 10.0-12.0 gram per 100 seeds. Cultivars Jupiter had the largest seeds, this may be responsible for its poor storeability. Seeds of cultivar TGX 536-02 has both green and cream testa, TGX 539-5E testa is black.

The above qualities are essential if soyabean growing is to be done commercially. It is for this reason that four IITA soyabean cultivars, TGX 849-294, TGX 536-02, TGX 539-5E and TGX 306-036 were evaluated to determine their potential under field conditions in Trinidad. Their performance were normally compared to that of the American cultivar, Jupiter.

Planting date study

The four cultivars were planted in the first week of the months of March, June, September and December during 1987-1988 at the University Field Station ; at a density of 101,000 plants per hectare (50 X 20cm) normally used by farmers for erect Vigna. Results showed that the cultivars exhibited similar characteristics under local conditions, as reported at IITA in Nigeria. However, planting dates significantly affected the growth and yield of these cultivars.

Soyabean is photoperiodic and under the shorter daylengths of the tropics, the period to maturity is hastened. Although the daylength varies slightly in Trinidad, October to February averaging 11.7 hours and March to September averaging 12.5 hours, (table 2) the responses of the various cultivars differ with planting dates. Table 3 presents data on the effect of planting dates on the plant height at maturity, the number of days to harvest and seed yield, respectively. March and June plantings, because of the almost uniform daylengths produced plants with similar maturity dates. The same was true for the September and December plantings.

Cultivar TGX 849-294 was the earliest at all planting dates but produced the highest yield. Plant growth analysis of this cultivar showed that is was more vigorous than the others, producing the largest number of pods and number of effective primary branches per plant. This cultivar was the second tallest after cultivar TGX 306-036.

The yield variation between planting dates can be accounted for by the difference in response to changes in daylength. The daylengths during the growth period of the March and June plantings were longer and plants responded by producing increased vegetative growth, delayed flowering and increased yield (Radley, 1968 ; Samuels, 1969 and Brathwaite, 1972). In the September and December plantings, because of the shorter daylengths, plants were forced into the reproductive phase with insufficient vegetative growth, consequently resulting in low yields compared to the other two dates.

As a result of the success of this study cultivar TGX 849-294 was used in several other experiments. Farmers were also given seeds, their plots were monitored and yield data collected.

Table 1 : Seed number per pod, seedweight (14% moisture) and seed colour

CULTIVAR	NO. OF SEEDS/POD	100 SEED WEIGHT (G)	SEED COLOUR
TGX 849-294	2,5	12	Yellow
TGX 536-02	2,4	11,8	Yellow/green
TGX 539-5E	2,1	11,8	Black
TGX 306-036	2,5	10,9	Yellow
Jupiter	2	18,6	Yellow

Table 2 : Mean values of daylength (hours), rainfall (mm) and maximum and minimum temperature (°C) taken over the study period at the University Field Station°

MONTH	DAYLENGTH	RAINFALL (MM)		MAX.TEMP. (°C)		MIN. TEMP. (°C)	
		1987	1988	1987	1988	1987	1988
January	11,6	7.4	26.4	30.9	31.2	20.5	20.8
February	11,8	10.7	39.6	31.0	31.4	20.9	19.7
March	12,1	0.3	13.1	32.1	31.6	21.4	21.0
April	12,4	8.2	3.6	32.4	32.7	22.2	21.6
May	12,6	104.4	33.5	32.2	33.2	22.4	23.0
June	12,7	180.2	265.6	31.7	32.3	22.2	22.5
July	12,7	248.3	316.3	31	31.8	21,8	22.0
August	12,5	190.9	357.2	32.1	32.2	21.9	21.8
September	12,2	102.0	273.9	32.1	31.8	21.6	22.1
October	11,9	176.3	564.1	32.6	32.3	22.9	22.4
November	11,7	180.3	263.6	31.7	31.4	22.1	22.2
December	11,5	114.3	124.1	31.9	30.7	21.9	21.4

° Meteorological data recorded at the University Meteorological, Station, Champ Fleurs, Trinidad

Soyabean/cassava, intercropping experiment

Cassava, unlike soyabean is grown as an intercrop or sole crop by a large number of small farmers in Trinidad and Tobago. However, the quantity produced is insufficient to meet local demands and some is imported. This experiment evaluated the performance of soyabean in intercropped situation ; it serves the purpose of introducing a relatively new crop (soyabean) with a traditional crop (cassava).

Intercropping represents a more efficient utilisation of land and other resources (Willey, 1979), since soyabean is a legume, soil fertility and cassava growth would be expected to benefit from intercropping. Also, soyabean seeds are highly nutritious and can be used in the farm or sold to bring in additional income.

Two soyabean cultivars, the early maturing TGX 849-294 and late maturing TGX 306-036 and two cassava varieties (M.Col 22, an early maturing improved variety developed by Centro International de Agricultura Tropical (CIAT) Cali, Colombia and Maracas Black Stick (MBS), a traditional variety grown by local farmers were evaluated at the University Field Station in a June, 1987 planting. Results indicated (Table 4) that cv. TGX 849-294 was the higher yielding of the two soyabean cultivars in both the sole and intercrop, averaging 2,878 Kg/ha and 1,170 Kg/ha, respectively. The cassava variety , M.Col. 22, yielded better, averaging 34,500 Kg/ha and 23,000 Kg/ha for the sole and intercrop, respectively. Full details of this study are reported in Fletcher and Brathwaite (1988).

Nodulation study

Nodulation studies with these tropical cultivars conducted at the University Field Station (Boodoosingh, unpub., 1988) showed them to be far superior to the American cultivar Jupiter (Table 5). The nodulation scores indicate the potential of these tropical cultivars to form nodules with indigenous soil bacterium. Improved nodulation would enhance the fixation of atmospheric nitrogen thus making available more nutrients for plant growth and yield.

Multilocationaw<l studies

Table 6 shows the mean yield of cv. TGX 849-294 planted at various locations. The yields obtained are consistent for this cultivar at the various planting dates. Cultivar TGX 849-294 also exhibited promiscuous nodulation

Table 3 : the effect of planting dates on plant height at maturity the number of days to harvest and seed yield

PLANTING DATE	CULTIVAR	PLANT HEIGHT AT MATURITY (cm)	NUMBER OF DAYS TO HARVEST	YIELD (Kg/ha)
March	TGX849-294	74,8	111	2833
	TGX536-02	58	121	3147
	TGX539-5E	59,2	131	2271
	TGX306-036	78	138	1683
	Jupiter	35	130	2522
June	TGX849-294	82,6	112	3782
	TGX536-02	76,5	120	3716
	TGX539-5E	78,3	122	3598
	TGX306-036	90,9	136	2295
	Jupiter	63	134	1966
September	TGX849-294	50,2	97	2167
	TGX536-02	49,5	99	2183
	TGX539-5E	52,2	105	2079
	TGX306-036	57,8	120	1609
	Jupiter	44,3	106	1683
December	TGX849-294	66,6	98	2984
	TGX536-02	58,1	102	2084
	TGX539-5E	58,5	103	2668
	TGX306-036	72,8	127	2092
	Jupiter	32,9	109	1719
	S. E (+)	3,5	1,3	292

at all the locations suggesting its adaptability to a wide range of soil type.

Seed composition studies

Chemical analysis of seeds performed for oil and protein determination showed that these cultivars contained an average of 40 p.cent protein and 20 p.cent oil in agreement with reports from IITA.

CONCLUSION

The numerous studies showed that soyabean growing can be advantageous especially with the advent of these IITA tropical cultivars. Some of these advantages include :

1. It is a highly nutritious crop with seeds containing on average 40 p.cent protein and 20 p.cent soil.

2. Few disease and insect problems.

3. A legume that fixes its own nitrogen and gives good yield without the use of N.-fertiliser or inoculum.

4. An excellent rotation or intercrop for cereals and root crops because the yield of these crops improve when planted after or with soyabean.

These tropical cultivars are characterised by high yielding ability, promiscuous nodulation, shatter resistance, improved seed viability, rapid leaf senescence at maturity and can be grown at anytime of the year. However, since soyabean is photoperiodic the yield would vary with planting dates. Cultivar TGX 849-294 performed better in most of the trials suggesting that it is better adapted for local production. With the technical information on soyabean growing available, cv. TGX 849-294 and the other cultivars, to a lesser extent, have the potential for cultivation by both large scale commercial producers and small farmers in Trinidad.

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Table 4 : Effect of row arrangements and intercropping on yield of soyabean and cassava*

Treatment	Soyabean yield (KG/HA)	Cassavayield (KG/HA)
So	1, 804	-
S1	2, 878	-
CO	-	19,816
C1	-	34, 540
So Co Ro	355	25, 928
So Co Ro	487	19, 909
So C 1 Ro	663	22, 039
So C1 R1	604	28, 891
So Co Ro	1, 089	22, 872
S1 Co R1	1, 166	18, 751
S1 C1 Ro	1, 244	26, 854
S1 C1 RO	1, 203	27, 873
C.V. (%)	14, 4 %	

* Plant population/ha : Soyabean (So, S1) sole crop = 38, 889

Cassava (Co, C1) sole crop = 11, 111

Intercrop (Ro) soyabean = 23, 333 cassava = 7, 444

Intercrop (R1) soyabean = 7, 778 cassava = 8, 889

So = TGX306-036 Co = Maracas Black Stick Ro = 1 : 1 row arrangement

S1 = TGX849-294 C1 = M. COL 22 Ro = 2 : 1 row arrangement

Table 5 : Nodulation scores obtained without rhizobial inoculation

CULTIVAR	MODULATION SCORE °
TGX 849-294	4
TGX 536-02	3
TGX 539-5E	3,5
TGX 306-036	4
Jupiter	2,5

° 1 = no nodules , 3 = good nodulation,
5 = excellent nodulation

Table 6 : Mean yield performance of cultivar TGX 849-294 from multilocational planting studies

TRIAL/LOCATION	SOIL TYPE	PLANTING DATE	YIELD (Kg/ha)
Weed study (St Augustine)	Loam	June	3, 860
Cultivar evaluation (Orange Grove)	Clay loam	November	2, 000
Cultivar evaluation (Bejucal)	Heavy clay	December	2, 600
Cooperative Farmer (Talparo)	Heavy clay	Various	2, 500

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