PIGEON PEAS AND MISCELLANEOUS BEANS

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Some investigations have been carried out on pigeon peas (Cajanus cajan) at IITA from the inception of GLIP in 1971. In addition, several species of tropical grain legumes like the African yam bean (Sphenostylis stenocarpa), winged bean (Psophocarpus tetragonolobus) and velvet bean (Mucuna pruriens var utilis) have been, collected and maintained in our germplasm. Some of these species are being utilized in Farming Systems Program experiments.

PIGEON PEAS

Pigeon peas continue to demonstrate exceptional potential at Ibadan and may have the broadest range of adaptation of all grain legumes for the lowland tropics from the semi-arid to the humid zones. Their deep rooting habit, comparative freedom from pests and diseases (until flowering), high yielding potential and ability to continue growing and fruiting for 8 to 12 weeks into the dry season make them especially appropriate for the cycle of high rainfall conditions followed by a sharply defined dry season found in the low, humid tropics. Particularly promising are the short-duration, semi-dwarf, daylength insensitive strains maturing in less than five months. These can be classified into three major bush types: ovate/elliptic, spray and soytypes.

Cajanus breeding has concentrated on population improvement methods like mass selection and more elegant systems described elsewhere. Principal objectives are to develop new, more useful plant types that combine high yield potential with tolerance to population stress, broad adaptation, disease resistance and good quality seeds. These efforts have been focused mainly on short-duration, semi-dwarf bush types. Of these, the most exciting recent development is the new family of soytypes with few or no branches and profuse fruiting on the main stem, especially toward the terminal portion. They are highly determinate and basipetalous in growth habit.

Uniform Yield Trial. Six high yielding, short-duration, ovate/elliptic (OE) bush types were formed into a uniform yield trial and grown in both the First and Second seasons at IITA. They were also distributed to 28 cooperators in the tropics, 16 of which went to locations within Africa, while four of each were shipped to tropical Asia and the Americas. Results available from eight locations are presented in Tables 1 and 2. The most consistently high yielder at all eight locations was CITA-1 (3D 8111 or TUc 5543) with 1143 kg of dry seeds per ha. It was also early (106 days at IITA-S) and medium dwarf in height at 121 cm. The second and third highest yielders were CITA-4 (derived from TUc 5103) with 1072 kg/ha and 3D 8126 (derived from TUc 2432-1) with 1025 kg/ha mean yields. The strain 3D 8129 (renamed CITA-2) did not perform well in the First season plantings but it has acutely erect branching, forming an

Table 1. Some agronomic attributes of six entries in the pigeon pea uniform cultivar trial conducted at IITA during the second season, 1974.

Entry	Pedigree	Growth Habit	Plant Spread cm	Size (cm) Height	DFF*	DFRP*	Seed Size (g/100)	Threshing %
3D 8111	TUc 5543	RI 2 + 2G	55	121	73.8	107.8	7.5	68.9
3D 8104	TUc 5103	RI 33	61	118	82.5	116.0	7.8	67.5
3D 8126	TUc 2432-1	RI 22	59	113	74.0	106.3	7.7	67.5
3D 8125	TUc 838	RIe 22	51	110	74.0	105.0	8.4	68.8
3D 8127	TUc 1381-1	RE 22	46	113	72.5	111.8	7.5	70.2
3D 8129	TUc 1463-1	REe 33	42	141	75.5	114.3	9.2	68.2
TRIAL MEAN	-	-	52.5	119.2	75.4	110.3	8.0	68.5

*DFF = Days to 50 percent first flower
DFRP = Days to 50 percent first ripe pod

Table 2. Seed yields and for pigeon pea uniform cultivar trial conducted at eight locations, 1974

Entry	LOCATION*								Cultivar mean
	I-F	I-S	M	I	S	IC	P	E	
	Seed yield (kg/ha)								
3D 8111[1]	1079	1686	566	1033	684	1070	1656	1367	1143
3D 8104[2]	198	1351	683	919	1266	1346	1491	1323	1072
3D 8126	750	1463	622	945	1019	952	1233	1216	1025
3D 8125	755	1015	527	665	894	1107	1490	1260	964
3D 8127	555	1109	672	810	669	827	1487	798	866
3D 8129[3]	274	1551	911	756	641	828	1042	740	843
Location Mean	601	1362	666	855	862	1022	1400	1118	985

1 CITA-1
2 CITA-4
3 CITA-2

*Locations: I-F = IITA First season; I-S = IITA Second season; M = Mtwapa, Kenya; I = Isabela, Puerto Rico; S = Suakoko, Liberia; IC = ICRISAT, India; P = Panama; E = Ebora, Cameroons

elliptic-shaped bush that appears useful for associated cropping with cereals or cassava. 3D 8126 is an earlier, ovate bush type with reasonably good performance in both seasons at Ibadan and other locations.

Other trials at IITA. A preliminary trial comprised of six new elite lines including elliptic, ovate and soytype plants was planted on 27 August and harvested in mid-January. Growth was good due in part to two inadvertent irrigations and yields ranged from 66.2 to 201.5 g/m^2. Highest yielders were 4F 33 and 4F 61 derived from TUc Nos. 2974-1 and 5537-1, respectively. A second preliminary trial was planted but stands were poor. However, the breeding nursery was excellent and considerable yield sampling was carried out among different plant groupings. Results from the best performing 18 lines (one third of the materials sampled) are as follows:

	Soytype (11 lines)	Elliptic Bush (3 lines)	Ovate Bush (4 lines)
Plant height range (cm)	98-163	103-127	106-147
Plant spread range (cm)	40-71	48-80	66-98
Actual yield range (g/m^2)*	156-249	204-239	235-264
Actual yield mean (g/m^2)*	183.0	249.1	235.3
Calculated yield range (g/m^2)**	170-356	268-426	230-339
Calculated yield mean (g/m^2)**	272.6	325.0	324.6

* Dry seed yields based on actual row spacings.
** Dry seed yields based on foliage spread (ground covered).

WINGED, YAM AND MUCUNA BEANS

Winged Beans

Experience with winged beans at IITA indicates that the crop has potential for high yields of edible green pods, tubers and dry seeds. Moreover, some new stocks have been added to the collections that have interesting new characters including variable seed qualities, narrow leaves and long pods. Some botanical characteristics of nine strains planted on 12th July and harvested 122 to 147 days later have been examined. These indicate that dry seed yield can be up to 211.8 g/m^2, and averaging 168.5 g/m^2 for the six strains harvested for yield determination. The large dried pods measured 22.7 x 2.07 cms in length and breadth, weighed 9.6 grams, contained 15.2 locules and had 3.7g of dry seeds. The dry seeds tend to be large (28.1 g/100 as an average, ranging from 23 to 32 g/100), but threshing percent is generally low at 38.5 percent as a consequence of large pod size.

Pest and disease problems of winged beans are minimal at IITA and highly satisfactory yield levels were obtained in 1973 and 1974. Although lima beans and pigeon peas persist and grow much longer into the dry season, winged beans have continued producing for up to six weeks after the last recorded precipitation at IITA. However, no tubers were produced in 1974 in contrast with 1973 when fresh tuber yields of 572 and 1288 kg/ha were recorded for TPt 2 and 6. respectively. Highest dry seed yields in 1974 were obtained from the large seeded TPt 1 and TPt 6, which have also performed well in previous years.

African Yam Bean

The collection of germplasm comprising 63 entries was grown out in unreplicated two row plots for observations and increase. Plantings were made on 12th July and harvesting was carried out 155 days later. Growth was reasonably vigorous and good pod setting occured on all entries, although some strains appeared to have more pod withering than others. Some virus symptoms resembling the green mottling observed on cowpeas occurred in many lines, but it did not seriously affect growth and productivity compared with the unidentified yellow mosaic that severely limited seed production in 1973.

The highest yielding 16 lines (ca 25%) had mean yields of 129.0 g/m^2 and a range of 109.1 to 185.6 g/m^2 based on a harvest sampling area of 4.5 m^2. The same 16 lines has a mean threshing percent of 63.5 ranging from 54.9 to 67.0 percent. Highest performing lines were TSs Nos. 3, 45, 52, 31-2,9 and 33.

Mucuna Beans

The velvet bean (Mucuna pruriens var. utilis). and the horseye bean (Mucuna sloanei) are among the most interesting and potentially useful pulses for the more humid, lowland tropics. These two species are commonly thought of as cover, forage, green manure or medicinal crops but in many areas they are also used as pulses, especially in southern Java and sometimes in West Africa. At Ibadan the velvet bean is one of the most aggressive and rapidly growing plants; it persists even into the dry season and is normally immune to leaf diseases and insect pests. The profusely pubescent pods, some of which possess irritating hairs, are suspected to render the plant resistant to pod borers. Moreover, the dried seeds are highly resistant to storage pests owing to their hardness and presence of dopamine. The Indonesians use it to make a fermented dish similar to "tempeh" of soybeans, while the dried beans are used in soups and stews in Eastern Nigeria. In West Africa the horseye bean is frequently roasted, ground into flour and used as a soup thickener.

Thirty-two segregating lines of velvet beans were planted in short two row trellised plots on 16 May 1973 at IITA and harvested twice in January 1974. Seed setting was exceptionally good with large clusters of pods formed. Fifteen lines exceeded 300 g/m^2 unadjusted seed yields. Ten lines had mean dry seed yields of 348.4 g/m^2 from an average of 46.4 pod clusters. Yields ranged from 304.3 to 502.4 g/m^2 with a 63.4 mean threshing percent. Since seed quality - its hardness and presence of toxic elements - is a serious deterrent to expanded use of velvet beans as a pulse, a breeding program

aimed at solving this problem is needed. There is a broad range of genetic diversity in seed quality characters among land races being maintained in Indonesia and with a modicum of effort rapid improvement of quality can be predicted.

CONCLUSIONS

Progress on breeding of pigeon peas has reached a stage where several elite bush strains have been developed and have demonstrated usefulness as parental stocks and other experimental purposes. Three of these with broad adaptation and contrasting agronomic characters have been described and offered to other agricultural scientists as CITA 1 (3D 8111), CITA 2 (3D 8129) and CITA 4 (3D 8104). In addition, the new quick-maturing soytypes ranging in height from about 75-225 cm have received increasing attention during the past year and we plan to describe some of these for use as genetic stocks and in cropping systems experiments. Future work on this species may include greater emphasis on the tree/hedge types to fit long term rotations in the humid tropics.

Several viny species of tropical legumes demonstrate extraordinary yield potential in the lowland tropics when trellised and given reasonable pest protection if required. Similar results on viny Phaseolus vulgaris have been observed at CIAT in Colombia. It is therefore suggested that some of these species with better adaptability and fewer pest/disease problems should receive greater attention in the tropics.