Table 1. Growth, yield, and gross income from pigeonpea-based intercropping systems at Barkachha, Mirzapur, Uttar Pradesh, India, mean of rainy seasons, 1990 and 1991.

Treatment		Plant height of pigeonpea (cm)	No. of pods per plant in pigeonpea	Yield (kg ha^{-1})	Pigeonpea equivalent yield (kg ha^{-1})	LER	Gross income (US$ ha^{-1})[1]
Pigeonpea	(sole)	157.8	73.5	1235	1235	1.00	367.55
Sesame	(sole)	-	-	667	1216	1.00	361.89
Urdbean	(sole)	-	-	641	486	1.00	144.64
Sorghum	(sole)	-	-	1874	413	1.00	122.88
Pigeonpea	(100%)+	156.2	72.2	1212	1879	1.53	559.17
Sesame	(50%)			366		(0.98 + 0.55)	
Pigeonpea	(100%)+	156.0	72.2	1204	* 2006	1.63	596.99
Sesame	(75%)			440		(0.97 + 0.66)	
Pigeonpea	(100%)+	151.0	66.2	1130	1982	1.61	589.86
Sesame	(100%)			468		(0.91 + 0.70)	
Pigeonpea	(100%)+	156.5	72.0	1226	1466	1.49	436.29
Urd	(50%)			316		(0.99 + 0.49)	
Pigeonpea	(100%)+	157.0	72.2	1224	1507	1.57	448.48
Urd	(75%)			373		(0.99 + 0.58)	
Pigeonpea	(100%)+	156.6	72.6	1220	1578	1.73	469.60
Urd	(100%)			473		(0.99 + 0.74)	
Pigeonpea	(100%)+	152.2	70.5	1147	1382	1.50	411.30
Sorghum	(50%)			1068		(0.93 + 0.56)	
Pigeonpea	(100%)+	149.6	63.6	944	1213	1.42	360.99
Sorghum	(75%)			1222		(0.76 + 0.65)	
Pigeonpea	(100%)+	146.2	61.2	813	1072	1.29	299.84
Sorghum	(100%)			1175		(0.65 + 0.63)	
SEm		±2.06	±1.89	±18	±20	-	-
LSD (P = 0.05)		6.10	5.58	53	59	-	-

1. Rate (for 100 kg): pigeonpea, US$ 29.76; sesame, US$ 54.24; urd, US$ 22.56; and sorghum, US$ 6.56. 1US$ = Rs. 31.25.

Goyal, S.N., Patel, N.L., Patel, N.M., and **Ahlawat, R.P.S.** 1991. Intercropping studies in pigeonpea under rainfed conditions. Indian Journal of Agronomy 36(1):49–51.

Singh, R.A., and **Singh, A.K.** 1992. Comparison of pigeonpea based intercropping systems for drylands of Vindhyan red loam soils of eastern Uttar Pradesh, India. International Pigeonpea Newsletter 16:12–14.

Preliminary Evaluation of Pigeonpea Genotypes in the Brazilian Semi-Arid Tropics

C A F Santos, E A Menezes, and **F P Araujo** (Petrolina-PE, EMBRAPA-CPATSA, C.P. 23, Brazil)

Pigeonpea is a potential crop for the Brazilian semi-arid region. However, the available information about it is very limited. Brazilian Corporation for Agricultural Research (EMBRAPA), through the Agricultural and Livestock Research Center for the Brazilian Semi-Arid Tropics (CPATSA), has been carrying out a breeding program to identify suitable genotypes for grain and forage production, using introductions from other regions of the country and from abroad, especially from ICRISAT Asia Center, India.

Fifty-one pigeonpea entries of different maturity types were evaluated in 1992, in Petrolina-Pernambuco State, Brazil (9°05′OS, 40°24′W) in three trials: (1) a cropping system trial with 13 entries of different maturing types and growth habits; (2) a short-duration trial with 18 entries; and (3) an extra short duration trial with 20 entries. The trials were laid out in a randomized complete block design with three replications in a 1.0 × 0.5 m spacing, which gives a population density of 40 000 plants ha^{-1}. The total monthly rainfall and maximum and minimum mean temperatures during the study are shown in Table 1. The short-duration and extra short duration trials included material from ICRISAT's international trials.

The following agronomic characters were evaluated: days to first harvest (DH), plant height at maturity (PH), dry matter yield (DM), and grain yield in three harvests (GY).

The entry D1 Type showed promise for forage production in the cropping system trial, yielding 5.8 t ha^{-1} of dry matter (Table 2) during the most critical dry period (Sep/Oct). After more detailed studies, it will probably be released as a forage type.

Table 1. Rainfall and temperatures during the growth period of pigeonpea[1], Petrolina, Brazil, 1992.

Month	Rainfall (mm)	Temperature (°C) Maximum	Temperature (°C) Minimum
Feb	122.1	30.2	20.3
Mar	49.4	32.1	19.6
Apr	33.4	33.7	19.7
May	4.0	33.8	18.9
Jun	4.0	31.2	18.3
Jul	0.9	30.4	17.3
Aug	0.9	31.7	17.6
Sep	0.9	32.7	19.2

1. Cropping system trial sown on 26 Feb 1992, short-duration and extra short duration trials sown on 11 Mar 1992.

Table 2. Some agronomic characters of pigeonpea entries in three trials, Petrolina, Brazil, 1992.

Cropping System				Short-duration					Extra short duration				
Entry	DH[1]	DM[2]	GY[3]	Entry	DH	PH[4]	DM	GY	Entry	dh	ph	dm	gy
Control	194	3.4	39	UPAS 120	108	71.7	1.7	466	ICPL 4	89	57.7	2.4	830
Control	191	4.0	71	ICPL 85045	97	80.0	4.0	929	ICPL 83015	93	56.7	2.5	874
ICP 2376	149	3.5	386	ICPL 86015	97	83.7	2.0	839	ICPL 84023	92	54.3	1.9	473
ICP 7035	140	2.1	202	ICPL 86023	95	74.7	2.8	635	ICPL 85010	89	53.0	2.8	780
ICP 7182	115	3.8	908	ICPL 87114	92	74.3	3.0	817	ICPL 87095	89	48.3	2.2	634
ICP 7191	113	3.8	828	ICPL 87115	113	76.0	3.3	918	ICPL 88001	91	60.7	2.5	903
ICP 7623	115	3.3	1041	ICPL 88034	110	82.7	2.9	602	ICPL 88003	89	53.0	2.3	712
ICP 8859	192	3.3	118	ICPL 89007	107	61.3	2.4	735	ICPL 88007	89	47.7	1.8	538
D1 TYPE	209	5.8	152	ICPL 89018	102	65.3	2.5	574	ICPL 88009	93	78.0	2.9	750
D2 TYPE	132	3.8	700	ICPL 90043	94	73.7	2.5	751	ICPL 88015	91	51.0	1.9	546
D3 TYPE	149	2.3	719	ICPL 90044	92	76.7	3.0	839	ICPL 88017	91	43.7	2.1	601
UQ LINC	94	1.5	433	ICPL 90045	92	70.7	2.8	1055	ICPL 89020	89	53.7	2.6	1064
UW 10	99	3.3	376	ICPL 90046	103	67.3	3.1	762	ICPL 89024	90	41.3	1.8	548
				ICPL 90048	101	66.0	3.5	887	ICPL 89027	88	53.3	2.3	1057
				ICPL 90050	105	64.3	2.5	817	ICPL 90001	91	72.0	3.0	559
				ICPL 90052	92	69.3	2.4	750	ICPL 90004	93	58.7	2.3	458
				ICPL 90053	96	85.7	3.7	1011	ICPL 90005	90	51.7	2.7	528
				ICPL 90054	115	75.3	3.2	469	ICPL 90008	89	50.0	2.0	566
				ICPL 90011	92	61.3	2.6	914					
				ICPL 90012	89	53.0	2.3	510					
Mean	147	3.4	460	Mean	101	73.3	2.9	770	Mean	90	54.9	2.3	692
F Test[2]	1%	1%	1%	F Test[2]	1%	NS	NS	NS	F Test[5]	1%	1%	NS[6]	1%
CV (%)	3	25	19	CV (%)	6	12	24	30	CV (%)	2	9	25	30

1. DH = days to first harvest.
2. DM = dry matter yield (t ha^{-1}).
3. GY = grain yield from three harvests (kg ha^{-1}).
4. PH = plant height at maturity (cm).
5. Significant at 1% by F Test.
6. NS = nonsignificant by F Test at 5% level of probability.

The short-duration trial showed two superior entries for grain production, namely, ICPL 90045 and ICPL 9053, each of which yielded more than 1 t ha^{-1} of grain, was more than 70 cm tall, and matured in less than 100 days in the first harvest (Table 2).

In the extra short duration trial, early maturing types were identified but plants yielding more than 1 t ha^{-1} were less than 55 cm tall (Table 2).

Even the superior entries, yielding over 1 t ha^{-1}, do not make make pigeonpea an economically viable crop in Brazil. However, the short-duration and extra short duration types require high plant populations, varying from 10 to 66 plants m^{-2} (Chauhan 1990). These plant populations are far greater than those used in our trials (4 plants m^{-2}). This fact was taken into account in the studies on plant population on pigeonpea of different types carried out in 1994 in Petrolina-PE, Brazil.

The preliminary results of these pigeonpea trials confirm the potential of this crop for the Brazilian semi-arid region. The entry D1 Type may be released for forage production after further studies. For grain production, it is necessary to determine the optimal plant population, and identify appropriate genotypes to obtain grain yields around 2 t ha^{-1} if commercial cultivation of pigeonpea is to be an economic proposition.

References

Chauhan, Y.S. 1990. Pigeonpea: optimum agronomic management. Pages 257–258 *in* The Pigeonpea (Nene, Y.L., Hall, S.D., and Sheila, V.K. (eds.). Wallingford, Oxford, UK: CAB International.

Cut Dry Matter Productivity of Perennial Pigeonpea Genotypes on an Acrisol in Subhumid West Africa

A Böhringer[1*], **D E Leihner**[1], and **R Böcker**[2] (1. Institute of Plant Production in the Tropics and Subtropics; Present address: Universitas Bangkalan Madura, PO Box 2, Kamal, Bangkalan, Madura, Indonesia; 2. Institute of Landscape and Vegetation Ecology, University of Hohenheim, D-70593 Stuttgart, Germany)

Cajanus cajan is unique among several candidate agroforestry species in that it is a shrubby grain legume combining food production with such favorable plant characters as good adaptation in the tropics, ease of establishment, high biomass productivity, and widespread local acceptance (Boehringer and Caldwell 1989, Böhringer et al. 1994, Daniel and Ong 1990, Daniel et al. 1991). Pigeonpea has been found useful in crop rotations (Kumar Rao et al. 1983), planted fallows (Gichuru 1991), and as a fodder crop (Ong and Kumar 1989). Several perennial genotypes were recently evaluated in Hawaii (Böhringer et al. 1994) and in India (Daniel et al. 1991, Odongo et al. 1991). A local cultivar was tested in alley cropping in Bénin in West Africa, but was not very productive when cut (Ernst-Schaeben 1994). Local pigeonpea cultivars in West Africa are tall, erect, and late-maturing, and a common sight along field edges and around homesteads. Grain is sold throughout the year in local markets and consumed much like dry cowpeas (*Vigna unguiculata*).

The objective of this study was to compare cut dry matter (DM) productivity of a local West African cultivar with other introduced perennial pigeonpea entries in order to identify superior genotypes for use in agroforestry.

The study was conducted at the International Institute of Tropical Agriculture's (IITA), Bénin-substation at Calavi (6°27′N, 2°E, 20 masl) situated in the forest-savanna mosaic zone of West Africa. Average annual rainfall is 1244 mm and mean monthly temperature is 28.6°C. Rainfall distribution is bimodal with peaks from Mar to Jul and Sep to Nov. Total precipitation at the substation, from Mar 1992 to Feb 1993, was 989 mm. Soils at Calavi are derived from late eocene clayey sandstones and are classified as Ferrali-Haplic Acrisols (FAO), locally known as 'terre de barre'.

Unreplicated observational plots of 10 entries (Table 1), including a local cultivar as a control, were sown on 15 May 1992. Each plot had four rows 5.0 m long and 1.0 m apart and plants were spaced 12.5 cm within the row. Hedgerows were hand-weeded twice after sowing, and received no other inputs. They were coppiced at 1.0 m above ground at 120, 160, 390, and 420 days after sowing (DAS). Cut material from 10 representative plants from the two center rows was separated into (1) leaves petioles, and (2) stems, and weighed. Subsamples of 500 g leaves and 800 g stems from each plot were oven-dried to constant weight at 75°C.

The data on DM yields at each of the four coppicings are given in Table 1. The high DM productivity of ICP 11288 and ICP 11298 was confirmed in three other environments as well (Boehringer and Caldwell 1989, Böhringer et al. 1994), and both entries appear to be promising genotypes for alley cropping. The performance of the local Bénin cultivar was good enough, in terms of DM productivity (Table 1), to make the introduction of peren-