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SHORT NOTE

Effect of harvest methods on the second flush yield of short-duration pigeonpea (*Cajanus cajan*)

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Short-duration pigeonpea can give up to three harvests in environments with mild winters (e.g. minimum temperature above 10 °C) such as those prevailing in peninsular India (Sharma, Saxena & Green, 1978; Chauhan, Venkataratnam & Sheldrake, 1984). This is mainly due to the short time (about 120 days) taken to produce the first flush, and the strong perennial character of pigeonpea. The seed yield of short-duration pigeonpea in this multiple-harvest system may reach 5·2 t/ha (Chauhan *et al.* 1984).

Venkataratnam & Sheldrake (1985) found that the yield of the second harvest of medium-duration pigeonpea was significantly influenced by the method of harvesting of the first flush. The lower the plants were cut, the smaller were the second-harvest yields. A positive relationship between the height at which the stem was cut and success of ratooning was also reported by Suarez & Herreara (1971). Tayo (1985), however, found that in the lowland tropics, plants of a dwarf pigeonpea variety ratooned at 0·3 m had better growth and yield than hand-picked plants; ratooning at 0·6 m height was intermediate. Information on the effect of different harvest methods on yield of short-duration pigeonpea in subtropical, semi-arid environments is not available. The objective of this study was to obtain this information.

MATERIALS AND METHODS

The experiments were conducted on an alfisol (Udic Rhodustalf) and a vertisol (Typic Pellustert) at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Centre (17 °N, 78 °E, 545 m elevation) in 1984–5. The alfisols generally hold less than 100 mm plant-available water, and the vertisols about 250 mm. A basal dose of 100 kg/ha of diammonium phosphate (18% N and 20% P) was applied on both soils just prior to sowing.

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On both soils two short-duration pigeonpea genotypes, ICPL 81 (indeterminate) and ICPL 87 (determinate), were sown on 15 June 1984 on both sides of 0·6 m ridges at a spacing of 0·3 × 0·1 m. At first-flush maturity the following three harvest methods were applied to the crop which had grown about 1 m tall: (1) cutting off the shoots 0·6 m above ground level (ratooning), (2) hand picking the mature pods on the plant, and (3) no harvest (single-harvest only at the second-flush maturity). The experimental treatments of harvest methods and genotypes were laid out in a randomized-block design. There were four replications on each soil and the plot size was 6 × 4 m. On both soils, about 19 m^2 per plot was harvested for yield estimation. The experiment on the alfisol was irrigated 10 and 20 weeks after sowing (WAS) and that on the vertisol at 11 and 21 WAS. Labour records were kept during the first harvest. In all the treatments, at the second-flush maturity, all pods of plants were harvested by cutting the stems at ground level. All harvested material was threshed by machine and the seed was sun-dried to a moisture content of 8–9% before weighing. The pods that dropped off, mainly during the second flush and its harvest, were also carefully collected and threshed, and their seed yield was included in the second-flush yield of the ratooning and hand picking treatment, and in the total yield of the single-harvest treatment.

RESULTS AND DISCUSSION

For ICPL 81, the first flush of flowering commenced 10 WAS and the pods matured at 16 WAS. For ICPL 87, flowering commenced at 11 WAS and pods matured at 17 WAS. In all treatments a second flush of pods was produced. Although little rain was received 17 WAS (Fig. 1), the second flush of flowers was supported by stored soil moisture and one irrigation. The second flush of ICPL 81 matured 27 WAS and of ICPL 87 28 WAS in both hand picking and single-harvest treatments. However, the second flush in the ratooning treatment reached maturity

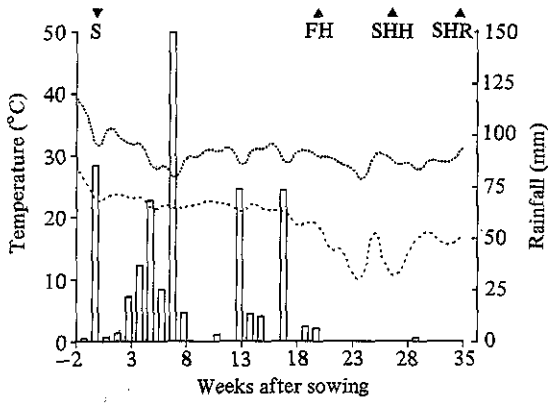

Fig. 1. Meteorological data for the growing season of short-duration pigeonpea genotypes at ICRISAT Center, 1984–5. □, Rainfall (mm); ------, maximum temperature (°C); ···, minimum temperature (°C). Time of sowing (S), first-flush harvest (FH), second-flush harvest in hand picking (SHH), and ratooning (SHR) treatments are also shown.

31 WAS in both genotypes. This delay can be attributed to the fact that the flowers in the ratooning treatments developed on new shoots, whereas on intact plants, flowering began on existing shoots soon after the maturity of the first flush.

The error variances for effect of harvest method on yield of first and second flush, total yield, total dry matter at the second flush maturity, and the yield loss due to pod dropping on both the alfisol and the vertisol were homogeneous, so data for both soils were analysed together. The interaction between soil type and harvest method was not significant for these variables. The mean values for the two soils are therefore presented in Table 1. The first-harvest yield of ICPL 81 was significantly lower than that for ICPL 87. The poor yield of ICPL 81 may be due to its poor emergence, which was 57% on the vertisol and 32% on the alfisol, compared with 80% of ICPL 87 on both soils. Nevertheless, the first-harvest yield of ICPL 81 did not differ significantly between the two soils; this may be due to its plasticity. In an experiment using different plant population densities, seed yield increase of only 5% was observed in ICPL 81 when its density was increased from 16 to 42 plants/m^2 (Chauhan *et al.* 1984). In both genotypes, the first-harvest yield was similar for both ratooning and hand picking. For the second-harvest yield, the interaction between the harvest method and genotype was highly significant. The second-harvest yield of ICPL 87 was significantly lower when harvested by ratooning than by hand picking, whereas for ICPL 81 there was no significant difference between first-flush harvest methods (Table 1). ICPL 87 has a greater leaf area than ICPL 81 at maturity of the first flush (unpublished results) and may have consequently suffered more from the ratooning.

Tayo (1985) reported the opposite results in a study of the effects of ratooning and hand picking on the second-harvest yield of a dwarf pigeonpea variety in the lowland tropical environment of Ibadan, Nigeria. Here, under non-limiting moisture conditions, ratooned plants grew better and yielded more than intact plants from which pods were hand picked. The higher yield of the ratooned plants was attributed to the greater physiological efficiency of leaves on the new shoots as compared with older leaves on intact plants. The fact that in the lowland tropical environment a longer period of regrowth, about 23 weeks, was available for the realization of this vigour compared with 13 weeks at ICRISAT Center, may partly explain the different responses to ratooning in the two environments. The regrowth period at ICRISAT Center, which is in an essentially semi-arid tropical environment, was perhaps insufficient for the compensatory regrowth of the ratooned plants. This was reflected in the lower dry matter of ratooned plants at the second-flush maturity than plants in the hand-picking treatment (Table 1). Whether a longer regrowth period would enable higher yields in ratooned plants than in hand-picked plants in a semi-arid tropical environment is not known. However, it seems important to examine this, particularly since ratooning was much less labour intensive than hand picking. In the present study, the labour requirement (number of man

Table 1. *Mean seed yields in ratooning (R), hand picking (H), and single-harvest (S) treatments of two short-duration pigeonpea genotypes*

	ICPL 81			ICPL 87			
	R	H	S	R	H	S	S.E.
First-flush yield (t/ha)	1·33	1·35	NH	2·19	2·03	NH	0·052
Second-flush yield (t/ha)	0·55	0·67	NH	0·78	1·47	NH	0·050
Total yield (t/ha)	1·87	2·00	2·06	2·97	3·50	3·52	0·078
Total dry matter (t/ha)	2·67	3·25	5·65	3·89	5·28	7·66	0·162
Yield loss (%)	0·40	1·30	4·70	0·90	2·30	7·30	0·430

NH, not harvested separately.

days/ha) for harvesting the first flush by ratooning was 31 for ICPL 81 and 56 for ICPL 87, as compared with a hand picking requirement of 243 for ICPL 81 and 211 for ICPL 87.

In the treatment where harvesting of the first flush of pods was delayed until the second flush of pods had matured, in both genotypes the total yield obtained in the single harvest was similar to the yield of two separate harvests in the hand picking treatment (Table 1). In ICPL 87 it was significantly more than the total yield of the ratooning treatment. This suggests that presence of mature first-flush pods does not affect the formation of pods in the second flush. This harvest method, therefore, had an advantage over hand picking and ratooning, as the yield was not lowered, while there was no labour requirement for a first-flush harvest. Thus, unless one wants to harvest the crop earlier, both flushes may be harvested together. However, in the single-harvest treatment there was a slightly greater yield loss in the form of increased dropping of pods (Table 1). There is also a possibility of rain, diseases, and insects damaging the crop when mature pods are left on the plants.

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