

## PERFORMANCE OF PULSES IN PULSE-FINGER MILLET RELAY CROPPING SYSTEMS AS INFLUENCED BY ESTABLISHMENT TIMES OF RELAYED MILLET AND N LEVELS TO LEGUMES

S. PURUSHOTHAM\* AND K. SHIVASHANKAR

Department of Agronomy, Agricultural College,  
University of Agricultural Sciences, GKVK Campus, Bangalore-560065

### ABSTRACT

A field experiment was conducted at Agricultural Research Station, Chintamani (Karnataka State) during 1982 and 1983 under dry land conditions to study the performance of three legumes (soyabean, cowpea and field beans) as early crops at three N levels (0, 12.5 and 25 kg N/ha) and with establishment of finger millet at two times (30 and 60 days after sowing of legumes). The pooled grain and haulm yields of soybean were significantly higher at later establishment (718 and 618 kg/ha) than at early establishment (388 and 510 kg/ha). Yield differences of cowpea and field beans were non-significant due to establishment times. The total N uptake by soybean was significantly higher in later establishment (61.8 kg N/ha) as compared to early establishment of millet (37.3 kg N/ha) in second year. In cowpea and field beans, the total N uptake was relatively higher in the later establishment. Soybean and cowpea can be preferred as early crops as these are short in stature and mature earlier than field beans and that legumes in the relay cropping system need not be fertilized with N.

### INTRODUCTION

Relay cropping is an alternative to double cropping under dryland conditions where the monsoon is not extended for growing two crops in succession but it is more than sufficient for growing a single crop. Even in an intercropping situation, De et al. (1978) and Anjaneyulu et al. (1982) observed increased yield of mung beans by delaying the establishment of pearl millet. In Karnataka, finger millet (*Eleusine coracana* (L) Gaertn) is a staple food crop. Double cropping of cowpea-finger millet has been recommended for red soil region in the years of extended rainfall spreading from April/May to November months. Alternatively in area where rainfall is ill distributed and inadequate, there is a need for finger millet based relay cropping systems where millet is predominantly grown. Therefore, a study was undertaken under dry land condition to search for a pulse-finger millet relay cropping system for the red soils of southern Karnataka.

---

\* Agronomist (Forage Crops), Regional Research Station Tiptur-572202 (Karnataka)

## MATERIAL AND METHODS

The three legumes tested were soybean (Cv. Hardee), cowpea (Cv. C-152) and fields beans (Cv. Local Mani Avare) at three N levels (0, 12.5 and 25 kg/ha) and sown as early crops in the relay cropping system. Finger millet (Cv. Indaf-8) was relayed at two times, viz., 30 and 60 days after sowing of pulses in the system making in all eighteen treatment combinations. The experiment was conducted in a Randomised Block Design with three replications at the Agricultural Research Station, Chintamani (Kolar District) of Karnataka during *Kharif* 1982 and 1983. The soil was sandy loam with 0.46% organic carbon and 419, 30 and 350 kg/ha respectively of available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O in first year and with 0.65%, 433, 34 and 435 kg/ha in the second year. A row spacing of 45 cm to legume was followed while finger millet was sown as a relay crop in between two rows of legumes as per treatment. Soybean and cowpea were sown at 10 cm between plants with in the row and fields bean at 45 cm. The seeds of pulses were dibbled while the relay crop finger millet was sown as per treatment. However, due to lack of rains during both the years the establishment of finger millet in first relay was achieved with either pre or post sowing irrigation through a farm pond.

## RESULTS AND DISCUSSION

The grain yield of soybean was significantly higher at later establishment of finger millet (543 and 892 kg/ha) than early establishment (273 and 503 kg/ha) of finger millet during both the years. The pooled grain yield of soybean also followed a similar trend as in the individual years as regards the effect of establishment time of finger millet (Table 1). The grain yield of cowpea and field beans were not significantly influenced by establishment times of finger millet in both the years. However, in pooled data, the grain yields were slightly higher with later establishment of finger millet (426 and 931 kg/ha in cowpea and field beans) than early establishment of finger millet (400 and 856 kg/ha respectively). There was no difference in the haulms yield of legumes except in case of soybean due to establishment time of finger millet in the system. In pooled analysis, the haulms yield of soybean at later establishment of finger millet (618 kg/ha) was significantly superior than early establishment of finger millet (510 kg/ha).

The N uptake by soybean grain was significantly higher at later establishment of finger millet (33.3 and 52.7 kg/ha in the first and second years respectively) than early establishment of finger millet (18.5 and 40.8 kg/ha in the corresponding years). However, there was no difference in N uptake through the grain of cowpea and field beans as well as through haulms of all the legumes due to different establishment times of finger millet in the relay cropping system (Table 2). The total N uptake by soybean was significantly higher at later establishment of finger millet (61.8 kg/ha) as compared to early establishment (37.3 kg N/ha) during 1983. In case of cowpea and

Table 1 Effect of establishment time and N levels in Pulse - finger millet relay cropping system on pulse yields

Treatments	Soybean						Cowpea						Field beans												
	Grain		Haulms		Total		Grain		Haulms		Total		Grain		Haulms		Total		Grain		Haulms		Total		
	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	
Establishment times of finger millet																									
I Relay (Early)	272	503	388	541	478	510	357	444	400	320	660	490	432	1280	856	1631	3086	2359							
II Relay (Late)	543	892	718	546	690	618	415	426	426	227	667	447	578	1285	931	2019	3439	2729							
CD 5%	210	263	160	—	—	103	—	—	—	—	—	—	—	—	—	—	—	—							
Nitrogen levels (kg/ha)																									
0	471	714	593	597	623	610	424	388	406	312	640	476	435	1430	933	1587	3372	2480							
12.5	360	609	485	511	526	519	292	459	376	258	749	503	532	1196	864	2050	3042	2546							
25.0	392	769	581	524	603	563	440	472	456	251	602	427	549	1222	886	1838	3373	2606							

Table 2. Effect of establishment time and N levels in pulse finger millet-relay cropping on N up take (kg/ha) by pulses.

Treatments	Soybean						Cowpea						Field beans													
	Grain		Haulms		Total		Grain		Haulms		Total		Grain		Stalk		Total		Grain		Stalk		Total			
	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean	1982	1983	Mean		
Establishment times of finger millet																										
I. Relay (Early)	18.5	30.8	24.6	7.5	6.4	7.0	13.9	17.1	15.5	4.9	10.2	7.6	18.9	27.3	23.1	14.9	45.7	30.3	19.4	34.5	27.0	19.4	34.5	27.0	34.3	80.1
II. Relay (Late)	33.3	52.7	43.0	7.1	9.0	8.1	18.2	18.3	18.3	3.7	10.7	7.2	22.0	29.0	25.5	19.8	45.0	32.4	24.6	40.7	32.7	24.6	40.7	32.7	44.5	89.5
Nitrogen levels (kg/ha)																										
0	29.8	44.1	37.0	7.6	7.8	7.7	17.2	14.7	16.0	4.8	9.6	7.2	22.1	24.3	23.2	14.8	50.4	32.6	19.6	40.7	30.2	19.6	40.7	30.2	34.4	91.2
12.5	23.0	36.7	29.9	7.1	7.1	7.1	12.4	18.9	15.7	4.3	11.8	8.1	16.7	33.8	25.3	17.9	41.9	29.9	22.6	36.0	29.3	22.6	36.0	29.3	41.5	83.5
25.0	24.8	44.4	34.6	7.2	8.2	7.7	18.6	19.5	19.1	3.9	10.0	7.0	22.5	29.5	26.0	19.4	43.6	31.5	22.9	36.1	29.5	22.9	36.1	29.5	42.3	79.8

field beans also the total uptake of N was higher at later establishment of finger millet but was not significant during both years.

The grain and haulms yield of legumes as well as N uptake through grain, haulms and by the crop in all the legumes was not significantly influenced by N levels as well as its interaction with the establishment times of finger millet during the course of study.

In general, the grain yield of legumes were superior during 1983 as compared to 1982. This was mainly because of better expression of yield components due to good distribution of rain fall during 1983 (32 rainy days from June to Sept.) as compared to 1982 (21 rainy days in the same period). The mean N uptake in second relay by soybean through grains (43 kg N/ha) and the entire plant (51.1 kg/ha) was higher as compared to first relay (24.7 and 31.7 kg N/ha, respectively by grain and entire plant). The total N uptake in cowpea and field beans at later establishment of finger millet was also higher than with early establishment of finger millet. Further, the total N uptake was higher in all the legumes during 1983 than during 1982. These differences in N uptake caused for differences yield attributes and in yields in general. The better performance of all three legumes more particularly soybean in second relay has to be viewed from the point of competition free period available for the legume crops to establish themselves in the first instance and to complete major requirements of nutrient uptake from the soil in the second instance. In the current studies, flowering and pod initiation were over in soybean and cowpea before finger millet in second relay was established so that there was least competition between the legumes and later established millet crop. Field beans, competed with the main crop of finger millet without getting itself smothered. These results are in agreement with those of Crookstan and Kent (1976) who opined that planting of short statured crop in advance and tall crop little later provides some competition free period to the short statured crop. Further, De et al. (1978) observed that the yield of mung in an intercropping system with pearl millet was considerably increased by delaying the planting of millet. Anjaneyulu et al. (1982) obtained 31 to 41 per cent increase in mung bean yields by delaying the establishment of pearl millet by 14 days and 63 per cent increase in yields by delaying 28 days. Establishment of finger millet crop by 30 days after sowing of legumes might have affected the normal growth including nodulation process of legumes in general but in soybean particular. The N levels did not significantly influence yields of legumes during the studies. Similarly the N uptake also was not influenced by nitrogen levels given to the legumes. Thus, the yields were in agreement with total N uptake by legumes.

From these studies, it can be inferred that soybean as well as cowpea can be grown as early crops when finger millet has to be taken as a relay crop since these legumes are short statured and mature early as compared to field beans. The early crop of field beans realises more yields but suppresses the growth of finger millet due to its

longer duration. The study also suggests that application of nitrogen to the legume is not required in pulse-finger millet relay cropping system.

#### REFERENCES

- Anjaneyulu, V.R. ., Singh, S.P. and Pal, M. 1982, Effect of competition free period and technique and pattern of pearl millet planting on growth and yield of mung bean and total productivity in solid pearl millet and pearl millet/mung bean intercropping system. *Indian Journal of Agronomy* 27 : 219-226.
- Crookstan, R.K. and Kente, R. 1976, Intercropping a new version of an old idea. *Crop and Soils* 28 : 7-9.
- De, R., Gupta, R.S., Singh, S.P., Pal, M., Singh, S.N., Sharma, R.N. and Kaushik, S. K. 1978. Interplanting maize, sorghum and pearl millet with short duration grain legumes. *Indian Journal of Agricultural Science* 48 : 132-37.