

# PERFORMANCE OF FINGER MILLET RELAY CROPPED WITH LEGUMES AS INFLUENCED BY ESTABLISHMENT TIMES AND N LEVELS

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## ABSTRACT

Performance of finger millet as a relay crop was studied with early crops of soybean, cowpea and field beans at three N levels (0, 12.5 and 25 kg/ha). Finger millet was sown at 30 and 60 days after sowing of legumes. The yield components, N uptake and yield of finger millet were significantly influenced by different early legumes and establishment times of finger millet but not by N levels applied to the legume. Relays with soybean and cowpea gave significantly higher yields than with field beans. Early establishment of finger millet gave significantly higher yields than late establishment. The study suggests soybean and cowpea to be preferred as early crops with an early establishment of finger millet in the system, without requiring applied nitrogen.

## INTRODUCTION

Double cropping of cowpea-finger millet system, though recommended for red soils of Karnataka under dryland conditions is not practised by many farmers due to the lack of time for getting the lands prepared for both the crops. Relay cropping of legume-finger millet system is more likely than double cropping by overcoming post-kharif land preparation problems and by utilizing the residual moisture or extended rainfall periods and nutrients left over by kharif crop. Hence, study was undertaken to find out a suitable early legume crop, time of establishment of finger millet as a relay crop and nitrogen requirement in the legume-finger millet relay cropping system.

## MATERIAL AND METHODS

A field experiment was conducted at Agricultural Research Station, Chintamani (Karnataka) under rainfed conditions during kharif 1982 and 1983. The treat-

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Part of Ph.D. thesis submitted by the senior author to the Univ. of Agril. Sciences, Bangalore

ments consisted of three legumes (soybean cv 'Hardee', cowpea cv 'C-152' and field beans cv 'Mani Avare local') sown early with three nitrogen levels (0, 12.5 and 25 kg N/ha). Relay crop of finger millet (cv 'Indaf-8') was sown in two batches i. e. 30 and 60 days after sowing of legumes in the interspace of two (45 cm apart) rows of the early sown grain legume. Thus, in all, there were 18 treatment combinations in a Randomised Block Design with three replications. The soil of the experimental site was sandy loam and acidic, with 0.46% organic carbon and 419, 13.2 and 291 kg per ha of available N, P and K, respectively, in the first year; and 0.65% organic carbon and 433, 15 and 361 kg of N, P and K per ha in the second year. The rainfall received during the crop growing period in the two years was 519 and 489 mm. respectively, less than the normal (616 mm); the distribution of rainfall was better in 1983 than in 1982.

A plant spacing of 10 cm in soybean and cowpea while, 45 cm in the field beans, was followed. Standard fertilizer doses of 25, 22 and 21 kg/ha of N, P and K for soybean and cowpea crops; 25, 22 and 0 kg/ha for field beans and 25, 16.5, and 0 kg/ha for finger millet crop were used except where applied nitrogen was reduced to half (12.5 kg/ha) or nil. Entire dose of NPK was applied at the time of sowing to legumes, while for finger millet, 50% N and entire P was the rest of N was given as top dressing at 45-50 days after sowing, based on the soil moisture conditions. The seeds of legumes were dibbled, while finger millet as relay crop was sown as per treatment. However, the establishment of finger millet in the first relay was achieved by a pre- or post-sowing irrigation from the farm pond during both the years.

## RESULTS AND DISCUSSION

The grain and straw yields of finger millet, when relayed with cowpea, were significantly higher (1795 and 2217 kg/ha, respectively) than in relay with soybean (1336 and 1557 kg/ha) during 1982. Further, these were significantly higher than in relay with field beans. In 1983, the yields of finger millet with soybean and cowpea were on a par but significantly higher than the relay with field beans (Table 1). This differential response was due to less rainfall and its poorer distribution in 1982 than in 1983.

In pooled analysis, grain and straw yields of finger millet in relay with cowpea and soybean were similar and significantly better than relay with field beans. The higher yield of finger millet's relay with soybean and cowpea than with field beans was due to better yield components like ears/plant, grain yield/plant, ear length, fingers/ear and 1000 - grain weight (Table 2) and higher N uptake in grain and straw of finger millet in both the years (Table 3). However in 1982, there was marginal superiority of yield components like ears/plant, grain weight/

Table 1. Yields (kg/ha) of finger millet as influenced by nitrogen levels to the pulse crops and establishment times of finger millet in pulse-finger millet relay cropping systems during 1982 and 1983

Treatments	1982		1983		mean	
	Grain	Straw	Grain	Straw	Grain	Straw
<b>Cropping systems</b>						
Soybean-Finger millet	1336	1557	1522	4212	1429	2884
Cowpea-Finger millet	1795	2217	1519	3951	1657	3084
Field beans-Finger millet	374	430	179	389	277	410
SE $\pm$	88	127	72	122	81	220
CD (P=0.05)	252	363	206	353	244	656
<b>Establishment times</b>						
I (Early)	1290	1572	1244	3232	1267	2402
II (Late)	1048	1231	923	2470	986	1851
(F test significant for both)						
<b>Nitrogen levels (kg/ha)</b>						
0	1139	1317	936	2570	1037	1944
12.5	1155	1556	1160	2940	1158	2248
25	1212	1332	1124	2998	1168	2165
	88	127	72	122	81	220

plant and number of fingers/ear in cowpea-finger millet relay. Further, poor growth of cowpea caused yield superiority of finger millet over soybean-finger millet relay. Added to this, N-uptake in grain and straw of finger millet was relatively higher in cowpea-finger millet relay than in soybean-finger millet relay (Table 3). Among pulses, soybean and cowpea, being short in duration, offered less competition to finger millet compared to field beans which showed stiff competition. The vegetative growth of field beans smothered finger millet which, in turn, flowered yield components, N-uptake and ultimately yields. Reddy et al. (1983) also observed lesser adverse effect of soybean and cowpea on finger millet than of redgram and field beans.

Early establishment of finger millet gave significantly higher grain, straw and biological yield of this millet than with later establishment at 60 days after sowing of legumes in both the years (Table 1). Better yields in early establishment of finger millet were due to less competition offered by legumes which, in turn gave significantly more grain weight/plant, ear length, fingers/ear (Table 2) and N-uptake in grain and straw of finger millet (Table 3). As observed in the present study, Anjaneyulu et al. (1982) obtained greater grain yields from pearl millet established at 14 days rather than at 28 days in early sown mung bean crop. Added to initial suppression by legumes to establishing finger millet, continued competition was observed for a period of lesser duration in cowpea and soybean than in field beans.

Table 2. Yield components of finger millet in pulse-finger millet relay cropping systems as influenced by establishment times of finger millet and nitrogen levels during 1982 and 1983

Treatments	1982					1983				
	Ears/ plant (no.)	Grain wt (g)/ plant	Ear length (cm)	Fingers ear (no.)	1000 grain wt (g)	Ears/ plant (no.)	Grain wt (g)/ plant	Ear length (cm)	Fingers/ ear (no.)	1000 grain wt (g)
<b>Relay cropping with</b>										
Soybean	1.0	5.4	9.4	6.6	2.39	1.6	7.6	10.1	7.5	2.61
Cowpea	1.1	5.7	8.8	7.9	2.40	1.4	7.6	10.2	7.5	26.5
Field beans	0.5	3.3	7.9	5.3	2.21	0.7	1.9	7.6	4.8	2.24
SEM $\pm$	0.1	0.3	0.2	0.2	0.05	0.1	0.5	0.3	0.2	0.05
CD (P=0.05)	0.2	0.8	0.6	0.6	0.14	0.3	1.4	0.8	0.7	0.15
<b>Establishment times</b>										
I (Early)	0.9	5.6	9.0	7.5	2.31	1.3	6.3	9.6	7.1	2.51
II (Late)	0.8	4.0	8.4	5.7	2.35	1.2	5.1	9.6	6.1	2.49
SEM $\pm$	0.1	0.2	0.2	0.2	0.04	0.1	0.4	0.2	0.2	0.04
CD (P=0.05)	ns	0.7	0.5	0.5	ns	ns	1.2	0.6	0.5	ns
<b>Nitrogen levels (kg/ha)</b>										
0	0.8	5.0	8.7	7.0	2.35	1.2	5.2	9.0	6.6	2.46
12.5	0.9	4.8	8.6	6.4	2.31	1.2	5.1	9.4	6.7	2.53
25.	0.9	4.6	8.7	6.4	2.34	1.4	6.9	9.5	6.5	2.52
SEM $\pm$	0.1	0.3	0.2	0.2	0.05	0.1	0.5	0.3	0.2	0.05
CD (P=0.05)	ns	ns	ns	ns	ns	ns	1.4	ns	ns	ns
General Mean	0.87	4.8	8.7	6.6	2.33	1.2	5.7	9.32	6.60	2.50

Table 3. Nitrogen uptake (kg/ha) through grain and straw of finger millet relay cropping systems as influenced by establishment times and nitrogen levels during 1982 and 1983

Treatments	Grain		Straw		Total	
	1982	1983	1982	1983	1982	1983
<b>Relay cropping with</b>						
Soybean	21.93	23.66	10.30	27.73	32.25	51.39
Cowpea	24.63	23.29	15.09	25.64	39.72	48.83
Field beans	5.77	2.50	2.60	2.16	8.37	4.66
SEm $\pm$	1.51	1.25	0.70	1.04	1.92	1.80
CD (P=0.05)	4.34	3.59	2.00	2.88	5.53	5.16
<b>Establishment time</b>						
I Relay	19.71	18.76	9.19	21.20	28.90	39.96
II Relay	15.18	14.14	9.02	15.85	24.20	29.97
<b>Nitrogen levels (kg/ha)</b>						
0	16.42	14.89	8.73	16.60	25.15	31.46
12.5	18.18	16.82	9.95	19.71	28.13	36.53
25	17.73	17.64	9.33	19.23	27.06	36.87
SEm $\pm$	1.51	1.25	0.70	1.15	1.92	1.80

Grain and straw yields of finger millet did not differ due to N-levels applied to the early sown legumes in both years as well as in pooled analysis (Table 1). However, total biological yield (grain + straw) of finger millet with nitrogen was significantly higher than with no N application in 1983 only.

The interaction between relay cropping systems and establishment times of finger millet in influencing the grain yield of finger millet was significant in 1982 (Table 4). In case of cowpea-finger millet relay system, grain yield of finger millet did not differ due to establishment times of finger millet. However, finger millet relayed with soybean and field beans gave significantly higher grain yield at early establishment. At both the establishment periods, grain yield of finger millet was significantly higher when relayed with soybean and cowpea than its relay with field beans. Further, under late establishment yield of finger millet was significantly higher of in relay with cowpea than with soybean in 1982.

Table 4. Grain, straw and total yields (kg/ha) of finger millet as influenced by cropping systems and establishment times during 1982 and 1983 (data only significant presented)

Finga millet with	Grain yield (1982)		Straw yield (1983)		Total yield (1983)	
	Early	Late	Early	Late	Early	Late
Soybean	1570	1104	4626	3800	6380	5089
Cowpea	1742	1849	4595	3305	6301	4649
Field beans	559	191	474	303	686	451
SEm $\pm$		124		174		226
CD (P=0.05)		356		499		649

Thus on red soils, under rainfed conditions, soybean and cowpea as early legumes and subsequently relayed with finger millet after 30 days of legume-sowing gave higher yields of finger millet with less competition. Better yield components and N-uptake were observed in finger millet under these relay systems.

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