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Strip and intercropping of rainfed finger millet with grain and vegetable legumes for sustaining productivity and soil health

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Abstract: Field experiments were conducted at the Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during *kharif* and *rabi* season of 2000-2003 under rainfed condition to study the effect of strip and intercropping of legumes on finger millet productivity. The treatments included the base crop of finger millet (CO 13) with strip and intercropping of pigeon pea, grain cowpea, green gram and vegetable cowpea and compared with farmers practice of broad casting finger millet in the 1.5 m space and two rows of pigeon pea. The results revealed that the higher finger millet grain yield of 2015 kg ha^{-1} and straw yield of 6135 kg ha^{-1} were recorded with intercropping of finger millet (CO 13) with vegetable cowpea (CO 4) at 8:2 ratio. Highest net return (Rs.15984 ha^{-1}) and B:C ratio (4.18) was recorded with inter cropping of finger millet (CO 13) with pigeon pea CO 5. Legumes under strip cropping recorded higher vegetable yield than under intercropping systems.

Key words : Finger millet, legumes, strip cropping, intercropping, yield, grain equivalent yield, economics.

Introduction

Mixed cropping or intercropping has been an important practice in many parts of India. It wa considered as part of subsistence farming designed to meet diverse domestic requirements. Under rainfed conditions, growing of several crops as mixtures with finger millet is a rule rather than exception. With the available rain water, it is possible to augment pulse production by adopting suitable inter, double, relay cropping and rotations. In rainfed intercropping risk of failure in any particular crop due to adverse weather is avoided, resources are better utilized and finally the prospects of obtaining good yields of each crop component involved are expected (Gill and Patil, 1983). However, with adoption of improved management practices, traditional mixed intercropping systems are found to be non remunerative. In cereal - legume competition, legumes exert poor competition for growing below ground resource as compared to cereals and millets (Haynes, 1980). Purushotham, (1987) reported that it is advantageous to choose a ragi-pulse relay cropping system with normal sowings of ragi followed by cowpea for fodder purpose around 45 days after establishment of ragi. Mehrotra and Ali (1970) earlier stated that the legume after meeting their own nitrogen, can supply a part of the nitrogen that is fixed, to another non-legume during the growth period and partly through the legume death though the nodules which gradually decelerate and release the N into the soil. In this context, the present experiment was conducted with an objective to study the influence of strip cropping and inter cropping different legumes on the finger millet productivity and its economics.

Materials and Methods

Field experiments were conducted at Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India during *kharif* and *rabi* seasons (June to December) of 2000 to 2003 in a randomized block design with three replications under rainfed conditions. The soil of the experimental site was clay loam in texture, with pH 8.0 and EC 0.85 dSm^{-1}. The soil had low available nitrogen

Table 1. Effect of treatments on growth and yield attributes of finger millet (2000-01 to 2002-03)

Treatments	Plant height (cm)				No. of tillers / hill				No. of productive tillers/plant			
	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean
T1	101	100	102	101.0	11.2	9.4	10.4	10.3	8	5.3	6.5	6.6
T2	104	103	103	103.0	11.5	9.6	10.6	10.6	7	5.9	7.4	6.8
T3	109	104	107	106.5	12.0	9.6	10.7	10.8	4	5.8	6.5	5.4
T4	98	95	96	96.5	12.2	9.7	11.1	11.0	6	5.9	7.2	6.4
T5	111	105	108	108.0	11.3	11.6	11.6	11.5	9	7.4	6.4	7.6
T6	101	108	105	104.6	1.9	10.9	11.0	10.9	7	8.0	6.8	7.3
T7	105	104	104	104.0	11.7	11.1	11.5	11.4	8	7.5	6.5	7.3
T8	108	107	112	109.0	12.1	11.4	11.8	11.8	9	8.8	6.4	8.1
T9	100	98	99	99.0	11.0	8.0	9.5	9.5	7	2.8	6.3	5.4
SEd	0.95	0.85	0.82	-	0.81	0.32	0.29	-	0.58	0.53	0.82	-
CD (P=0.05)	2.01	1.79	1.73	-	1.72	0.69	0.61	-	1.7	1.4	NS	-

Table 2. Effect of treatments on growth and yield attributes and yield of pulses (2000-01 to 2002-03)

Treatments	Plant height (cm)				No. of pods/plant				No.of seeds/pod				Yield (Vegetable/Grain) kg ha^{-1}			
	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean
T1	69.5	71.4	71.0	70.6	118	107	112	112.5	4.2	4.5	3.8	4.2	895	562	295	584
T2	63.3	54.3	57.2	58.3	65	51	56	58.0	8.3	8.0	12.5	936	640	581	215	479
T3	68.1	34.1	51.0	51.1	68	45	57	56.5	8.7	8.3	8.7	9.8	580	526	178	428
T4	67.9	58.4	62.7	63.0	12	27	20	19.5	6.3	6.7	8.9	7.3	1750*	1856*	928*	1511*
T5	62.5	70.8	66.6	66.7	102	94	98	98.0	3.9	4.1	3.8	3.9	327	308	127	254
T6	59.3	50.7	55.6	55.2	9	48	29	28.5	5.4	7.4	11.6	8.1	380	344	117	280
T7	61.1	31.4	46.2	46.3	49	33	42	41.0	6.8	8.0	8.6	7.8	358	272	106	245
T8	60.9	55.6	61.0	61.1	11	15	13	13.0	7.4	6.5	8.2	7.4	1440*	910*	658*	1003*
T9	60.2	61.3	61.0	60.8	98	85	92	91.5	3.6	3.4	3.5	3.5	241	198	99	179
SEd	2.24	2.82	2.43	-	3.08	3.21	4.01	-	0.92	0.81	1.10	-	-	-	-	-
CD (P=0.05)	5.06	6.21	5.34	-	8.10	8.34	10.39	-	2.07	1.78	2.31	-	-	-	-	-

* Vegetable yield of CO 2 cowpea

Table 3. Effect of treatments on yield and Grain Equivalent Yield of finger millet (2000-01 to 2002-03)

Treatments	Grain yield (kg ha^{-1})				Straw yield (kg ha^{-1})				GEY (kg ha^{-1})			
	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean
T1	1526	1422	2115	1688	4858	4981	3507	4449	1750	1563	2189	1834
T2	1571	1609	2237	1806	5207	5772	3765	4915	1891	1900	2477	2089
T3	1447	1446	2108	1667	4224	4981	3428	4211	1640	1621	2251	1837
T4	1393	1512	2317	1741	4267	5547	3549	4454	3143	3368	3245	3252
T5	1675	2011	2102	1929	5681	6636	3330	5216	1832	2113	2199	2048
T6	1546	2051	2113	1903	4495	7492	3526	5171	1736	2223	2253	2071
T7	1649	1958	2109	1905	6951	7344	3321	5872	1768	2049	2191	2003
T8	1702	2141	2202	2015	7207	7694	3505	6135	3142	3280	2860	3094
T9	1294	1358	2105	1586	3952	4249	3219	3807	1654	1483	2275	1804
SEd	8.72	19.14	45.17	-	18.45	82.43	68.82	-	20.65	46.17	53.61	-
CD (P=0.05)	19.01	40.20	94.91	-	41.47	171.13	144.59	-	41.31	95.20	112.21	-

Table 4. Effect of treatments on economics (2000-01 to 2002-03)

Treatments	Net Return (Rs. ha^{-1})				B:C Ratio			
	2000-01	01-02	02-03	Mean	2000-01	01-02	02-03	Mean
T1	23277	4399	14501	14059	5.90	1.93	3.23	3.68
T2	12267	3469	11163	8966	3.67	1.75	2.72	2.71
T3	16426	3412	10638	10159	4.50	1.72	2.64	2.95
T4	11042	5966	13003	10004	3.37	2.28	3.00	2.88
T5	22976	14792	10184	15984	5.87	4.11	2.57	4.18
T6	11375	10593	8882	10283	3.47	3.30	2.37	3.05
T7	17144	10639	9198	12327	4.78	3.26	2.42	3.48
T8	13303	16724	10946	13658	3.86	4.60	2.68	3.71
T9	14854	13100	9664	12539	4.30	3.91	2.53	3.58

Cost of pigeonpea : Rs. 20/kg
Cost of green gram : Rs.15/kg
Cost of cowpea grain : Rs. 10/kg
Cost of field bean : Rs.15/kg
Cost of Vegetable cowpea : Rs.5/kg
Cost of finger millet : Rs.5/kg

(185 kg ha^{-1}), medium available phosphorus (9 kg ha^{-1}) and high available potassium (538 kg ha^{-1}). The treatments included were strip cropping of finger millet (CO 13) with pigeon pea (CO 5), grain cowpea (COCP 702), green gram (Pusa Bold) and vegetable cowpea (CO 4) in one third of the area, intercropping of the finger millet (CO 13) with above legumes at 8:2 row ratio and compared with farmers practice of broad casting finger millet in the 1.5 m space with two rows of pigeon pea. In strip cropping systems the rotations followed in the experimentaiton is furnished here under.

Strip cropping system (on rotation basis)

	Strip I	Strip II	Strip III
I Year	Finger millet	Finger millet	Legume
II Year	Finger millet	Legume	Finger millet
III Year	Legume	Finger millet	Finger millet

Treatments details are as follows

T_1 - Strip cropping of finger millet (CO 13) + Pigeon pea (CO 5)

T_2 - Strip cropping of finger millet (CO 13) + Grain cowpea (COCP 702)

T_3 - Strip cropping of finger millet (CO 13) + Green gram (Pusa bold)

T_4 - Strip cropping of finger millet (CO 13) + Vegetable cowpea (CO 4)

T_5 - Intercropping of finger millet (CO 13) + pigeon pea (CO 5)

T_6 - Intercropping of finger millet (CO 13) + grain cowpea (COCP 702)

T_7 - Intercropping of finger millet (CO 13) + Green gram (Pusa bold)

T_8 - Intercropping of finger millet (CO 13) + Vegetable cowpea (CO 4)

T_9 - Farmers practice of broad casting finger millet in the 1.5 m space and two rows of pigeon pea.

A total rainfall of 504, 342 and 40 mm was received in 30, 25 and 27 rainy day during the respective years. Observations wi regard to growth and yield parameters of finge millet and yield of pulse crops were recorde Parameters like grain equivalent yield an economics and available soil nutrients of differe systems were worked out and presented.

Results and Discussion

The results revealed that, with regar to finger millet, the plant height was highe with intercropping of finger millet (CO 13 + pigeon pea (8:2 ratio) followed by finge millet (CO 13) intercropped with vegetable cowpe (8:2 ratio). Higher number of tillers and productiv tillers per hill were recorded with finger mill intercropped with vegetable cowpea 8:2 rat and it was on per with finger millet intercroppi with pigeon pea. In intercropping system, so extra nitrogen was perhaps made available the finger millet by the companion legum resulting in better plant growth. Singh (198 also reported similar results in sorghum - legum intercropping system.

The grain and straw yield (2015 k ha^{-1} and 6135 kg ha^{-1}, respectively of finge millet was the highest with intercropping o finger millet (CO 13) with vegetable cowpe (CO 4) at 8:2 ratio. This was followed b intercropping of finger millet (CO 13) wit pigeon pea (8:2 ratio). This was compare with all strip cropping systems. The yield o finger millet was much higher in all intercroppin systems when compared with strip croppin of finger millet. Such increase was also du to increase in plant stand compared with tha of strip cropping of finger millet. This wa in line with the findings of Singh and Ary (1999) and Siddeswaran et al. (1987) in finge millet based intercropping systems.

With regard to strip / intercropping c legumes, vegetable / grain yield of legume in the system was higher under strip croppin

Table 5. Effect of treatments on soil fertility status (kg ha^{-1}) (2001-2002 to 2002-2003)

Treatments	Available nitrogen			Available phosphorus			Available potassium		
	2001-02	02-03	Mean	2001-02	02-03	Mean	2001-02	02-03	Mean
T1	195	198.0	197.0	9.8	9.1	9.5	546	537.0	542
T2	200	215.0	208.0	9.5	10.4	10.0	554	562.0	558
T3	197	207.5	202.0	9.7	9.5	9.6	545	548.0	547
T4	198	212.7	205.0	9.6	10.2	9.9	548	555.0	551
T5	194	189.4	192.0	9.5	8.4	9.0	544	533.0	539
T6	198	202.2	200.0	9.4	9.2	9.3	542.	546.0	541
T7	192	192.3	192.0	9.4	8.7	9.1	543	536.0	540
T8	196	195.8	196.0	9.3	8.7	9.0	544	541.0	543
T9	185	184.3	185.0	9.2	8.2	8.7	537	529.0	533
SEd	-3.19	7.66	-	0.61	0.56	-	2.83	9.73	-
CD (P=0.05)	6.7	16.08	-	NS	1.18	-	5.91	20.45	-

system as compared to intercropping systems (Table 2). This was mainly due to more land surface occupied by legumes in strip cropping system.

Strip cropping of finger millet (CO 13) + Vegetable cowpea (CO 4) (T4) recorded highest GEY of 3252 kg ha^{-1} which was due to high price ratio of vegetable cowpea to finger millet and also higher yield of vegetable cowpea in strip cropping system. Similar results was also reported by Gadhia *et al.* (1993) in rainfed pearl millet based cropping system. Intercropping of finger millet with pigeon pea (CO 5) recorded the highest net return (4.18) which was followed by the intercropping of finger millet with vegetable cowpea (CO 4).

Strip cropping of finger millet with vegetable cowpea (CO 4) recorded the highest vegetable yield (1511 kg ha^{-1}) than same treatment combination under intercropping (1003 kg ha^{-1}).

Strip cropping of finger millet (CO 13) + Grain cowpea (COCP 702) recorded significantly higher available nitrogen (208 kg ha^{-1}), phosphorus (10 kg ha^{-1}) and potash (558 kg ha^{-1}) as compared to the farmers practice by broad casting finger millet in the 1.5 m space and two rows of pigeon pea.

In conclusion, higher finger millet grain yield of 2015 kg ha^{-1} and straw yield of 6135 kg ha^{-1} were recorded with intercropping of finger millet (CO 13) with vegetable cowpea (CO 4) at 8:2 ratio. Highest net return (Rs. 15984 ha^{-1}) and B:C ratio (4.18) was recorded with inter cropping of finger millet (CO 13) with pigeon pea CO 5. Legumes under strip cropping recorded higher vegetable yield than under intercropping systems.

References

Gadhia, D.S., Khanpara, V.D. and Patel, J.C. (1993). Production potential and economic returns of pearl millet (*Pennisetum glaucum*) - based intercropping system with different grain legumes and oilseed crop under rainfed condition. *Indian J. Agron* **38**: 282-283.

Gill, A.S. and Patil, B.D. (1983). Intercropping pays in Rabi fodder crops. *Indian Frng* **32**: 32.

Haynes, R.J. (1980). Competitive aspects of grass legumes association. *Adv. Agron.* **33:** 227-261.

Mehrotra, O.N. and Ali, A.S. (1970). Mixed cropping a scientific analysis, *Sci. Cult.* **36:** 196-199.

Purushotham, S. (1987). Relay and intercropping systems with grain and fodder legumes in ragi, Ph.D. thesis, UAS, Bangalore.

Siddeswaran, K., Ramaswamy, C. and Moraghan, Y.B. (1989). Nutrient uptake of finger millet as influenced by intercrops, border crops and N fertilization. *Madras Agricultural Journal.* **76:** 361-365.

Singh, R.V. and Arya, M.P.S. (1999). Nitrogen requirement of finger millet (Eleusine coracana) + pulse intercropping system. Indian Journal + pulse intercropping system. *Indian Journal of Agronomy.* **44:** 47-50.

Singh, S.P. (1981). Studies on spatial arrangement in sorghum - legume intercropping system. *J. Agric. Sci., Camb.* **97:** 655-661.

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