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Effect of crop residue management of early season legumes on th succeeding rainfed finger millet

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Abstract: **Field experiments were conducted at the Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu during *kharif* and *rabi* seasons of 2000-2003 under rainfed condition. The treatments included raising greengram or cowpea for vegetable / grain purpose and utilization of haulms as fodder as well for incorporation alongwith fallow (no pulse crop). For the second season crop of finger millet, the above treatments were kept as main plot treatments with the subplot treatments of either transplanting or direct sowing of finger millet with and without phosphorus. Results of the study revealed that maximum green fodder production and yield were obtained in cowpea as compared to greengram. In succeeding finger millet crop, higher grain and straw yield and net return were obtained when cowpea was incorporated in the early season followed by transplanting of finger millet with P application.**

Key words : Legumes, Finger millet, Relay cropping, Phosphorus, Yield, Net return, B:C ratio.

Introduction

Many legumes *viz.* cowpea, blackgram, greengram and horsegram invariably find a place in finger millet based cropping systems. These crops are taken either as a preceding crop or as an intercrop or as relay crop in the system depending upon the rainfall distribution and soil type. Many high yielding short duration varieties of these crops have been evolved in recent years for increasing cropping intensity. Hence, the feasibility of double cropping/ inter cropping and relay cropping is to be explored wherever bimodal rainfall is a common feature. Seth and Balyan (1989) reported that inclusion of legumes in cropping system improves the nitrogen status of soil and increases the yield of succeeding cereal crops. Mehrotra and Ali (1970) stated that the legume after meeting their own nitrogen, can supply a part of the nitrogen that is fixed to another non-legume crop during the growth period and partly through the legume death through ploughing of nodules which gradually degenerate and release the N into the soil. Hence, the present study was mooted with an objective to findout the effect of preceding early season legumes on growth and yield of finger millet (Co 11).

Materials and Methods

Field experiments were conducted at drylan farm of Department of Agronomy, Tamil Nad Agricultural University, Coimbatore, Tamil Nadu India during *kharif* and *rabi* seasons of 200 2003. Cowpea CO 2 and greengram (Pusaba were raised during *kharif* (I season) unde randomized block design with five treatmen and three replications. The experimental treatmen are as follows :

I Season (Main plot)

M_1 Cowpea for fodder after harvest fo vegetable purpose

M_2 Cowpea for incorporation after harve for vegetable purpose

M_3 Greengram for fodder after harvest fo grain purpose

M_4 Greengram for incorporation after harve for grain purpose

M_5 Fallow

II Season (Sub plot)

S_1 Transplanting of finger millet with

S_2 Transplanting of finger millet without

S_3 Direct sowing of finger millet with

S_4 Direct sowing of finger millet without

Table 1. Growth attributes of early season cowpea and greengram

Treatments	Plant height (cm)				Green Fodder yield (kg ha^{-1})			
	2000-01	2001-02	2002-03	Mean	2000-01	2001-02	2002-03	Mean
M_1	81	72	76	76.3	21978	17958	18241	19392
M_2	85	74	78	79.0	22099	18249	19320	19889
M_3	76	65	70	70.3	8318	7758	8540	8205
M_4	79	68	72	73.0	8526	7994	9210	8576
M_5	-	-	-	-	-	-	-	-
CD (P=0.05)	1.7	1.4	1.9	-	263	297	289	-

Table 2. Vegetable and grain yield of early season cowpea and greengram.

Treatments	Vegetable yield (kg ha^{-1})				Grain yield (kg ha^{-1})			
	2000-01	2001-02	2002-03	Mean	2000-01	2001-02	2002-03	Mean
M_1	4009	4065	3973	4019	-	-	-	-
M_2	3725	4250	4166	4047	-	-	-	-
M_3	-	-	-	-	602	705	852	719
M_4	-	-	-	-	630	748	842	740
M_5	-	-	-	-	-	-	-	-

Table 3. Effect of early season legumes on soil fertility status

Treat-ments	Available nitrogen (kg ha^{-1})			Available phosphorus (kg ha^{-1})			Available potassium (kg ha^{-1})		
	2001-02	2002-03	Mean	2001-02	2002-03	Mean	2001-02	2002-03	Mean
M_1	193	194	194	9.6	9.6	9.6	552	555	554
M_2	198	193	196	9.7	9.6	9.7	558	554	556
M_3	190	182	186	9.3	9.3	9.3	552	548	550
M_4	190	184	187	9.4	9.3	9.4	551	555	553
M_5	180	179	180	9.0	8.8	8.9	539	538	539
CD (5%)	4.9	5.6	-	NS	NS	-	11.9	13.5	-

The second season experiment on finger millet was laid out in split plot design with three replications. 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 (185 kg ha^{-1}), medium available phosphorus (9 kg ha^{-1}) and high potassium (538 kg ha^{-1}). N and K fertilizers were applied at 40 and 20 kg ha^{-1}, respectively and P fertilizer was applied based on the treatment schedule. A total rainfall of 504, 342 and 402mm was received in 30, 25 and 27 rainy days during the respective years. In the second year (2001-02), the succeeding finger millet crop did not establish well due to scarcity of rainfall. Observations with regard to growth, yield parameters and yield of legumes and finger millet were recorded. Economics of the system was also worked out.

Results and Discussion

The results revealed that, in the first crop of legumes, significantly higher plant height and drymatter production (DMP) at harvest were recorded in cowpea crop compared to greengram. Among the treatments, significantly higher plant height and green fodder production were recorded in the treatment cowpea for incorporation after harvest for vegetable purpose (M_2) which recorded plant height of 79 cm and green fodder production of 19889 kg ha^{-1} as compared to greengram.

In the succeeding crop of finger millet, significantly higher plant height, yield attributes and yield were recorded when preceding either cowpea or greengram was grown (M_1-M_4) compared to when the field was left fallow. Among the main plot treatments, cowpea incorporation after harvest for vegetable purpose (M_2) recorded significantly higher plant height, yield attributes and yield of the succeeding finger millet crop (2640 kg ha^{-1}). With respect to sub plot treatments transplanting finger millet (S_1 and S_2) recorded significantly higher growth and yield attributes and yield compared to direct sown finger millet (S_3 and S_4). Application of P significantly increased the finger millet yield compared to witho P. Transplanting finger millet with P (S_1) record higher finger millet grain and straw yields 2390 and 5334 kg ha^{-1}, respectively. Increa in finger millet yield might be attributed the effect of legume cowpea, which might ha provided an additional N to succeeding fing millet through biological N fixation a mineralisation of root biomass. Similar resu were reported by Balyan (1997).

In general, growth, yield attributes a yield of finger millet were markedly high when it was sown after incorporation of precedi cowpea into the soil than it was removed fr the field for fodder. Incorporation of cowp produced the maximum effect, which m be due to maximum contribution of nitro to the soil through this crop. These res are in close agreement with Seth and Bal (1985) and Velayudham and Seth (1986)

The economics showed that cowp incorporated in the early season followed transplanting of finger millet with P and with P registered higher net returns and B:C ra compared to other treatments.

Table 4. Effect of short duration legumes on plant height and yield attributes of succeeding finger millet.

Treatments	Plant height (cm)			No. of tillers $hill^{-1}$			No. of productive tillers pla		
	2000-01	2002-03	Mean	2000-01	2002-03	Mean	2000-01	2002-03	Mea
M_1	99	98	98	8.6	8.2	8.4	6.0	4.6	5.3
M_2	104	105	104	9.4	9.3	9.4	7.1	5.7	6.4
M_3	99	100	99	8.4	8.0	8.2	6.6	4.4	5.5
M_4	102	103	102	8.0	9.2	8.6	5.8	5.3	5.6
M_5	87	84	85	7.7	7.6	7.7	4.7	4.0	4.4
CD (P=0.05)	4.7	7.1	-	0.5	0.71	-	0.39	0.33	-
S_1	104	106	105	9.7	9.6	9.6	7.6	7.4	7.5
S_2	98	101	99	8.9	8.8	8.8	6.1	6.8	6.5
S_3	97	98	97	7.9	7.9	7.9	5.8	2.6	4.2
S_4	93	94	93	7.1	7.2	7.2	4.6	2.4	3.5
CD (P=0.05)	3.6	4.3	-	0.38	0.44	-	0.65	0.68	-
M at S									
CD (P=0.05)	5.6	7.3	-	0.63	0.69	-	0.48	0.42	-
S at M									
CD (P=0.05)	4.3	4.8	-	0.47	0.59	-	0.30	0.44	-

Table 5. Effect of short duration legumes on yield and economics of succeeding finger millet

Treatment	Grain yield (kg ha^{-1})			Straw yield (kg ha^{-1})			Net return (Rs ha^{-1})			B:C ratio		
	2000-01	2002-03	Mean	2000-01	2002-03	Mean	2000-01	2002-03	Mean	2000-01	2002-03	Mean
M_1	2367	2263	2315	4802	2991	3897	7984	6787	7386	2.91	2.16	2.54
M_2	2677	2603	2640	5415	3121	4268	9074	8825	8950	3.17	2.50	2.84
M_3	2302	2238	2270	4940	2880	3910	7125	6514	6820	2.70	2.08	2.39
M_4	2465	2395	2430	5007	3095	4051	7611	8029	7820	2.82	2.46	2.64
M_5	1746	1614	1680	3804	2847	3339	5821	5807	5807	2.36	2.24	2.30
CD (P=0.05)	248	239	-	279	294	-	-	-	-	-	-	-
S_1	1885	2895	2390	5107	5561	5334	7582	10864	10864	2.60	2.90	2.75
S_2	1833	2865	2349	5076	5518	5297	7516	10549	10549	2.67	2.85	2.59
S_3	1710	1450	1580	4750	468	4715	7152	5778	6465	2.07	1.67	1.87
S_4	1625	1300	1463	4242	422	4231	7042	5672	6357	2.01	1.50	1.76
CD (P=0.05)	189	174	-	269	301	-	-	-	-	-	-	-
M at S	130	120	-	158	162	-	-	-	-	-	-	-
CD (P=0.05)	246	249	-	219	319	-	-	-	-	-	-	-
S at M	124	118	-	138	140	-	-	-	-	-	-	-
CD (P=0.05)	248	242	-	275	287	-	-	-	-	-	-	-

With regard to soil fertility status, higher available nitrogen (196 kg ha^{-1}) available phosphorus (9.7 kg ha^{-1}) and available potassium were registered with cowpea (CO 2) for incorporation after harvest for vegetable purpose. Similar results were reported by Mehrotra and Ali (1976).

In conclusion, cowpea raised in the early season for incorporation after harvest for vegetable purpose followed by transplanting finger millet in the second season with basal application of P registered higher grain yield with increased net returns and B:C ratio under rainfed condition.

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