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EFFECT OF *IN SITU* GREEN MANURING ON WEEDS IN RICE

The major problem faced by the semi-dry rice (*Oryza sativa* L.) crop is the occurrence of weeds, which leads to a crop loss ranging from 78 to 91 per cent (Ali and Sankaran, 1984; Ravichandran, 1993). Therefore, the success of such a system mainly depends on the management practices that can effectively check the growth and development of weeds. Intercropping has been reported to minimize the need for weed control in many crops (Bansal and Bhan, 1993). In this context, the present study was undertaken to understand the effect of simultaneous *in situ* green manuring on the reduction of weeds in semi-dry rice.

A field experiment was conducted at the Agricultural Research Station, Mannuthy, Trichur during the kharif season of 1993 under the semi-dry system, using the rice variety Jyothi and green manure cowpea variety Kanakamony. The soil was sandy clay loam in texture with medium fertility and acidic in reaction. The treatments consisted of four levels of nitrogen (0, 35, 70, and 105 kg N ha^{-1}), two levels of phosphorus (0 and 35 kg P_2O_5 ha^{-1}), two seed rates for cowpea (15 and 30 kg seed ha^{-1}) and a control treatment following the recommendations of the Kerala Agricultural University (KAU, 1993) without *in situ* intercropping. The experiment was laid out in randomized block design with three replications in plots of 20 m^2. Rice seeds were dibbled in the second week of May, at a spacing of 15 cm x 15 cm and cowpea seeds, on the same day, in between the two rows of rice, with four and eight seeds per metre row length in the 15 and 30 kg seed rate levels, respectively. Phosphorus was applied fully as basal while nitrogen was given in three equal split doses as per the recommendations of KAU (1993). One hand-weeding was given at 20 days after sowing (DAS). By about 50 DAS, the growth of cowpea ceased and it got decomposed due to water stagnation, towards the

Table 1. Effect of treatment levels on weed count and dry matter production

Treatments	Weed count per m^2						Dry matter production, kg ha^{-1}	
	20 DAS			40 DAS			20 DAS	40 DAS
	Grasses	Sedges	Dicots	Grasses	Sedges	Dicots		
N (kg ha^{-1})								
0	34.0	28.7	31.7	30.3	10.0	30.7	516	64
35	31.7	10.7	26.3	27.7	5.0	25.3	294	103
70	21.3	10.0	31.0	21.8	6.0	17.7	359	94
105	20.7	8.7	24.3	15.3	4.0	16.3	263	128
SEm ±	3.8	5.6	5.2	2.1	4.3	4.5	20.2	3.7
CD (0.05)	7.7	11.4	NS	4.3	NS	9.2	41.1	7.4
P_2O_5 (kg ha^{-1})								
0	27.0	13.0	27.5	25.4	6.5	22.0	292	98
35	26.8	16.0	29.2	22.2	6.0	23.0	423	97
SEm ±	2.6	3.9	3.7	1.5	1.6	3.2	14.3	2.6
CD (0.05)	NS	NS	NS	NS	NS	NS	29.0	NS
Cowpea seed rate (kg ha^{-1})								
15	28.5	16.8	27.3	23.9	8.0	22.0	361	117
30	25.3	12.2	39.3	23.7	4.5	23.0	355	78
SEm±	2.6	3.3	3.7	1.5	1.6	3.2	14.3	2.6
CD (0.05)	NS	NS	NS	NS	3.3	NS	NS	5.3
Mean for seed rates	26.9	14.5	28.3	23.8	6.2	22.5	358	97.5
Control	29.3	9.3	46.7	20.0	5.0	29.0	646	36.0
SEm ±	7.5	11.1	10.5	4.2	4.6	9.0	40.3	7.3
CD (0.05)	NS	NS	21.3	NS	NS	NS	82.2	14.9

end of June. Observations were taken at 20 and 40 DAS on the count of grasses, sedges and broad-leaf weeds per m^2. Samples were taken to find out the dry matter production of weeds and the data were analyzed statistically (Panse and Sukhatme, 1985).

Table 2. Rainfall data during the crop period

Weeks	Rainfall (mm)
Apr 30-6	3.0
May 7-13	1.4
May 14-20	31.9
May 21-27	6.0
May 28-3	103.8
June 4-10	236.6
June 11-17	237.9
June 18-24	85.5
Jun 25-1	186.4
July 2-8	188.9
July 9-15	167.8
July 16-22	128.1
July 23-29	101.0
Jul 30-5	96.4
August 6-12	54.9
August 13-19	66.3
August 20-26	61.9
Aug 27-2	33.6
Sept 3-9	23.7
10-16	11.5
17-23	23.2
Sep24-30	14.9

The weed flora of the experimental site included grasses, viz., *Dactyloctenium aegyptium* (L.) P. Beauv., *Echinochloa colonum* (L.) Link, *Eleusine indica* Gaertn., *Digitaria ciliaris* (Retz.) Koeler, *Panicum repens* L. and *Saccolepis interrupta* Stapf., sedges viz., *Cyperus rotundus* L. and broad-leaf weeds viz., *Melochia corchorifolia* L., *Cleome viscosa* L., *Celosia argentea* L., *Euphorbia hirta* L., *Abutilon indicum* G. Don., *Phyllanthus niruri* Auct. etc.

It was observed that an inverse relationship existed between the levels of application of nitrogen and the count of weeds (Table 1). At 20 DAS the count of grasses and sedges decreased significantly while that of broad-leaf weeds was not affected with increasing levels of nitrogen. It was further seen that the count of weeds decreased by 40th day also and the effect of higher levels of nitrogen was more apparent in the case of broad-leaf weeds. The reduction in weed count with increasing levels of nitrogen application was associated with a corresponding reduction in the weed biomass. This tendency of lower weed count and biomass at higher N levels may be because of the effect of fertilizer nitrogen. Nair (1968) has reported that basal dressing of increased nitrogen levels would affect the plants deleteriously through the effect of salt index. Similar results were reported in wheat by Yadav *et al.* (1995) who attributed the reason as the suppression of weed growth by the increased vigour of wheat plants.

Though not significant, variation in the seed rate of cowpea for simultaneous *in situ* green manuring caused difference in the weed count showing a lower count at higher seed rate. The dry matter production of weeds also followed the same trend. Though variation in the seed rates of cowpea could not influence the dry matter production by weeds in the initial stages, a higher seed rate significantly reduced the weed dry matter at 40 DAS and the reduction worked out to 33 per cent.

The reduction in weed growth due to simultaneous *in situ* green manuring evidently is due to the successful smothering effect of cowpea. Cowpea with its broader leaves and early rapid growth might have blocked the light from reaching the ground. Increase in weed count and biomass was observed when the cowpea seed rate was lower where the blocking of light had been less effective. Shetty and Rao (1991), Prusty *et al.* (1990) and Kar *et al.* (1993) have also attributed the lower weed growth to the smothering effect caused by the well-developed crop canopy. The magnitude of weed control by the cowpea intercrop at 20 DAS was worked out to 27 per cent, while Thakur (1993) has reported the magnitude of weed control due to intercropping as 35-40 per cent.

The inability of cowpea intercropping to affect the weed control at 40 DAS was mainly due to the fact that all the weeds had been removed by 20th day and that the observation at 40 DAS related to the second flush of weeds which was lower due to the advancement in the growth of the crop. At this stage, however, the weeds that further emerged would have benefited from nutrients added by cowpea. Tisdale *et al.* (1985) have pointed out that concurrent plants benefit from the sloughed-off roots and root excretions of legumes.

Another interesting observation in the present study is an apparent differential influence of cowpea on different group of weeds. Compared with the normal system of rice culture, cowpea intercropping significantly reduced the count of broad-leaf weeds and though not significant, tended to increase sedges, while it had virtually little effect on grassy weeds at 20 DAS. The same trend was observed on the 40th day also. Bhargavi and Reddy (1993) have observed maximum number of weed species belonging to C_4 type of plants in semi-dry rice crop and attributed to under semi-dry conditions, moisture stress occurred during early stage of crop leading to the partial closure of stomata by the plants. In this condition, for the same amount of stomatal opening, uptake of carbon dioxide might be higher in C_4 weeds than C_3 rice as the carboxylating enzyme of C_4 plants is phosphoenol pyruvic acid which has high affinity for carbon dioxide. The increase in the count of sedges compared to other weeds under the intercropping system might be because of the C_4 nature of sedges. The data presented in Table 2 show that in the first 40 days of crop growth, only 382.7 mm rainfall was received as against 994.6 mm in the next 40 days.

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