

Effect of green-manuring on nitrogen management in lowland rice (*Oryza sativa*)

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ABSTRACT

An experiment was conducted at Vyara (Gujarat) during the rainy (*kharif*) season of 1988–91 on rice (*Oryza sativa* L.). Variety 'GR 3' grown after the incorporation of green-manure crops, viz. sunnhemp (*Crotalaria juncea* L.), clusterbean or guar [*Cyamopsis tetragonoloba* (L.) Taubert] and cowpea [*Vigna unguiculata* (L.) Walp.], with 100, 80 and 60% of recommended dose of nitrogen. No green-manuring + 100% recommended N was kept as the control. The highest rice yield (6.1 tonnes/ha) was obtained under sunnhemp + 100% recommended N, while no green-manuring + 100% recommended N recorded the lowest grain yield (4.3 tonnes/ha). Among the green-manure crops, sunnhemp gave the best results. The treatments of green-manuring + 60% of recommended dose of N were at par with no green-manuring + 100% recommended N, indicating that 40% (32 kg N/ha) inorganic nitrogen could be saved through green-manuring.

Green-manuring has been successfully adopted to improve the soil productivity, especially the available soil nitrogen. It can partially substitutes the nitrogen fertilizer requirement of the subsequent crop (Meelu and Singh, 1991). The amount of N contributed differs not only from one green-manure crop to another but also from region to region, depending upon the soil type, environmental conditions and management practices.

Rice (*Oryza sativa* L.) is an important crop of South Gujarat Heavy Rainfall Zone (Dang, Valsad and parts of Surat districts) but practice of green-manuring in rice field is not adopted in agro-ecological situation III. As the quantitative information about the advantages of green-manuring in rice is lacking, the present investigation was carried out.

MATERIALS AND METHODS

The field experiment was conducted dur-

ing rainy season for 3 years from 1988 at the Regional Rice Research Station, Vyara (Gujarat). The mean annual rainfall during the experimental period was 1,466 mm. The soil was Typic Ustochrepts fine-textured and medium in organic carbon (0.46%) content, with pH 7.6 and electrical conductivity 0.10 dS/m. Ten treatments consisted of 3 green-manure crops, viz. sunnhemp (*Crotalaria juncea* L.), cowpea [*Vigna unguiculata* (L.) Walp.] and clusterbean or guar [*Cyamopsis tetragonoloba* (L.) Taubert], with 100, 80 and 60% of recommended nitrogen dose (RDN) and no green-manure + 100% RDN as the control. The experiment was laid out in randomized block design with 4 replications. The green-manure crops were sown on 12, 22 and 16 May and incorporated on 4, 6 and 8 July during 1988, 1989 and 1990 respectively. The fresh green weight incorporated was 40, 17 and 14 tonnes/ha of sunnhemp, cowpea and guar respectively. The early rice cultivar 'GR 3' was trans-

Table 1. Effect of green-manuring on grain and straw yields, panicles/plant, plant height, panicle length and economics in lowland rice (pooled mean of 1988–90)

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Panicles/plant	Plant height (cm)	Panicle length (cm)	Benefit: cost ratio
No GM + 100% RDN	43.08	48.18	9.67	105.33	27.67	
GM sunnhemp + 100% RDN	61.00	65.63	10.33	107.33	28.00	10.54
GM guar + 100% RDN	57.86	63.84	10.00	103.67	27.00	4.67
GM cowpea + 100% RDN	53.30	59.88	9.00	104.33	27.67	2.67
GM sunnhemp + 80% RDN	55.07	63.41	9.67	103.00	27.33	11.10
GM guar + 80% RDN	52.27	59.89	10.00	100.67	27.33	3.56
GM cowpea + 80% RDN	50.81	55.96	9.33	102.00	28.00	2.38
GM sunnhemp + 60% RDN	50.08	58.78	10.00	104.33	27.67	13.31
GM guar + 60% RDN	46.31	53.24	9.00	101.67	27.67	1.62
GM cowpea + 60% RDN	46.73	55.02	10.33	101.33	27.33	1.37
CD (P = 0.05)	8.38	7.48				

GM, Green-manure; RDN, recommended dose of nitrogen

planted in second week of July every year. A basal dose of 50 kg/ha each of P_2O_5 and K_2O was given to all plots. The dose of nitrogen for 60, 80 and 100% recommended dose of N (RDN) worked out to 48, 64 and 80 kg/ha respectively.

RESULTS AND DISCUSSION

There was a significant effect of green-manure crops and nitrogen doses on the growth and yield of rice in the individual years as well as in pooled data (Tables 1, 2). The green-manuring of sunnhemp + 100% RDN with a yield of 6.1 tonnes/ha ranked first and gave 1.8 tonnes/ha more yield over no green-manuring + 100% RDN (control). It was at par with the treatments of green-manuring of guar and cowpea with 100% RDN and green-manuring of sunnhemp + 80% RDN and significantly superior to the rest of the treatments including the control. The data further revealed that the treatment of green-manuring + 60% RDN was at par with no green-manuring + 100% RDN. It is thus apparent that 40% inorganic nitrogen

can be saved by green-manuring. It confirms the finding of Meelu and Singh (1991), who reported saving of 60 kg N/ha through green-manuring in rice. The straw yield followed the similar trend. The plant height, panicle length and number of panicles plant were maximum under sunnhemp + 100% RDN, which resulted in higher rice yield under this treatment.

Based on the pooled mean, sunnhemp

Table 2. Effect of green-manuring and N application on grain yield (q/ha) in lowland rice (pooled mean of 1988–90)

Nitrogen (%)	Green-manure crop			
	Sunnhemp	Guar	Cowpea	Mean
100% RDN	61.00	57.86	53.30	57.38
80% RDN	55.07	52.26	50.86	52.71
60% RDN	50.08	46.31	46.73	47.71
Mean	55.38	52.14	50.27	
CD (P = 0.05)				
Green-manure crops		1.09		
N levels		1.09		
Green-manure crops x N		1.89		

was found the best green-manure crop, followed by *guar* and cowpea (Table 2). Grewal and Kolar (1991) also made similar observations. Among the fertilizer doses, 100% RDN gave significantly maximum grain yield compared with 80 and 60% RDN respectively. The interaction between green-manuring and nitrogen levels was also found significant in 1 out of 3 years and in pooled data. Green-manuring of sunnhemp with 100% RDN gave significantly highest grain yield, followed by *guar* + 100% RDN and sunnhemp + 80% RDN. The lowest grain yield was obtained under *guar* + 60% RDN.

Economics

Among the 3 green-manure crops tested, the sunnhemp combinations recorded the higher benefit : cost ratios, maximum being

in sunnhemp + 60% RDN (13.31).

On the basis of our results, it could be concluded that incorporation of green-manure over and above the recommended dose of nitrogen (80 kg N/ha) markedly increased the rice yield. Among the different green-manure crops, sunnhemp was distinctly superior and more remunerative to *guar* and cowpea. The results further show that green-manuring may substitute up to 32 kg N/ha (40% of 80 kg N/ha).

REFERENCES

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