



RESEARCH PAPER

Effect of green manure intercropping with different levels of fertilizer on growth attributes of rice

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Abstract : Green manuring is an age old practice and its value is known to the farmers for several centuries ago. Greenmanuring to rice crop improve the soil fertility and productivity. The greenmanure application to the soil promotes the activities of soil microorganisms through which CO₂ is liberated, the chemical reactions in the soil are speeded up and more plant nutrient is made available to rice crop. Organic acids produced during the decomposition of greenmanure helps to release phosphates and made them available to the crop. The greenmanure crop withdraws plant nutrients from the lower layers of soil and concentrates them to the surface, when ploughed in and this assists the succeeding or associating crop. For sustainable crop production, Pathak and Ghose (1996) emphasized that application of greenmanure, complementary use of N through organic manures and improved composted manures and crop residue utilization are important. *In situ* incorporation of *Sesbania aculeata* @ 12 t ha⁻¹ recorded higher grain yield and higher cooking time of rice due to the increased hardness of grain (Hemalatha *et al.*, 2000).

Key Words : Green manure intercropping, Different levels, Fertilizer, Growth attributes, Rice

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INTRODUCTION

Field experiments were conducted at the Agricultural College and Research Institute; Killikulam to evaluate the suitable rice based greenmanure intercropping system under different nutrient management in wetseeded condition. The experiment was laid out in Randomized Block Design replicated thrice with 14 treatments. The treatments were four levels of NPK *i.e.*, 0, 50, 75 and 100 per cent of recommended dose and with two greenmanure crop *viz.*, *Sesbania aculeata* and *Sesbania speciosa* intercropping and incorporation as well as green leaf manuring with and

without 100 per cent recommended NPK. Green manures and rice crops were sown simultaneously with the help of drum seeder. Greenmanure intercrops were raised and incorporated at 30 days after sowing. Inorganic fertilizer were applied in three split doses *i.e.*, basal, maximum tillering and at panicle initiation stage. Greenmanure intercrops on incorporation were beneficial in terms of securing better biomass and dry matter production.

MATERIAL AND METHODS

Rice variety ASD 16 and green manures *Sesbania*

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aculeata and *Sesbania speciosa* obtained from the central farm of Agricultural College and Research Institute, Killikulam. The rice variety ASD 16 is a short bold grain type with the duration of 110–115 days. It is a variety evolved by crossing between ADT 31 and CO 39 with the yield potential of 5600 kg ha⁻¹. The green leaf manure *Glyricidia maculata* raised in farm bunds were cut and applied. The experiment was laid out in Randomized Block Design replicated thrice with 14 treatments. The treatments were four levels of NPK i.e., 0, 50, 75 and 100 per cent of recommended dose and with two greenmanure crop viz., *Sesbania aculeata* and *Sesbania speciosa* intercropping and incorporation as well as green leaf manuring with and without 100 per cent recommended NPK. Green manures and rice crops were sown simultaneously with the help of drum seeder developed by TNAU. Green manure intercrops were raised and incorporated at 30 days after sowing by using cono weeder. *Sesbania aculeata* and *Sesbania speciosa* green manure crops were raised as intercrops in between the rows of rice sown with drum seeder at 1:1 ratio.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads :

Plant height :

During *Kar* season, the plant height at harvest was ranged from 84.93 to 96.83 cm. The highest plant height was recorded with *S. aculeata* intercropping and incorporation with 100 per cent recommended NPK (96.83 cm), and was followed by *S. speciosa* with same level of NPK (93.77 cm). The control treatment recorded lowest plant height of 84.93 cm. The same trend was also noticed in *Pishanam* season and the plant height was 95.67 cm with 100 per cent recommended NPK and intercropped and incorporation with *S. aculeata*, which was followed by 91.17 cm with *S. speciosa* with 100 per cent recommended NPK. The lowest plant height was recorded by the control plot (84.10 cm).

Tiller production :

The total number of tillers at harvest also varied significantly due to treatments. During *Kar* season, the higher tiller production was recorded by *S. aculeata* intercropping and incorporation with 100 per cent NPK (531m⁻²) and is superior to other treatments and was followed by *S. speciosa* with same dose of NPK (521 m⁻²) while the lowest number of tillers (462 m⁻²) was recorded by the control plot. In *Pishanam* season also the same trend was noticed, where in *S. aculeata* with 100 per cent NPK recorded the highest tiller production

Table 1 : Effect of green manure intercropping with different levels on fertilizer on growth attributes of rice

Treatments	Plant height at harvest (cm)		No. of tillers at harvest		Leaf area index (flowering stage)	
	Kar	Pishanam	Kar	Pishanam	Kar	Pishanam
<i>S. a.</i> + 100% NPK	96.83	95.67	531	506	5.97	5.93
<i>S. a.</i> + 75% NPK	92.30	90.43	508	482	5.18	5.36
<i>S. a.</i> + 50% NPK	91.40	89.50	500	469	4.83	5.30
<i>S. a.</i> alone	90.23	89.30	476	448	4.27	5.10
<i>S. s.</i> + 100% NPK	93.77	91.17	521	500	5.42	5.10
<i>S. s.</i> + 75% NPK	92.00	90.27	510	473	5.03	4.97
<i>S. s.</i> + 50% NPK	91.07	89.53	495	462	4.57	4.67
<i>S. s.</i> alone	89.20	88.13	471	434	4.47	4.43
GLM + 100% NPK	93.07	91.10	515	492	5.73	4.60
GLM alone	89.73	88.20	468	427	4.30	4.43
NPK 100%	92.17	90.30	511	482	5.23	4.50
NPK 75%	91.00	89.30	487	452	4.53	4.50
NPK 50%	90.27	88.13	483	445	4.43	4.30
Control	84.93	84.10	462	422	4.17	4.23
S.E.±	0.22	0.24	3.06	2.66	0.27	0.22
C.D. (P = 0.05)	0.44	0.50	6.28	5.46	0.55	0.46

S.a – *Sesbania aculeata*; S.s – *Sesbania speciosa*; GLM – Green leaf manure

of 506 m² and was followed by *S. speciosa* with same dose of NPK (500 m²). The lowest number of tiller production recorded by the control plot (with out fertilizer and green manuring) was 422 m².

Leaf area index (LAI) :

LAI decreased with decrease in levels of NPK during flowering stage. Among the treatment combinations, green manuring with higher level of NPK recorded the highest LAI in both seasons. During *Kar* season, the 5.97 LAI was recorded in plots intercropped with *S. aculeata* with 100 per cent recommended NPK and was comparable with 5.73 recorded by the plots were raised with green leaf manure + 100 per cent recommended NPK. The lowest LAI of 4.17 recorded in unmanured treatments. During *Pishanam* season also, the maximum LAI was recorded by *S. aculeata* intercropping with 100 per cent recommended NPK (5.93) and was comparable with same dose NPK with *S. speciosa* intercropping (5.77). The lowest LAI were recorded on the control plot which recorded 4.23.

The growth characters of rice such as plant height, LAI, number of tillers per hill and dry matter production were significantly influenced by incorporation of greenmanures on 30 DAS after sowing. The basal application of full dose of phosphorus and potassium and 50 per cent of nitrogen was applied to wet seeded rice as basal. The effect of different levels of fertilizer upto 30 days to greenmanure crops showed that the NPK accumulation was at higher level with higher dose of fertilizer that in 100 per cent recommended NPK with *S. aculeate* than *S. speciosa* in both the seasons and the NPK accumulation by these intercrops incorporation added the NPK nutrients on decompositions and was utilized for the rice crop increased the growth of rice. Nagarajah (1988) also found that the decomposition greenmanures incorporated, released N to the soil in the first 2–3 weeks after incorporation. The initial N requirement of the rice crop could have been adequately taken care of by the intercropped green manure incorporation after 30 days of sowing along with the basal applied N. The fertilizer N top dressed during the critical physiological growth stages (maximum tillering and panicle initiation) and the decomposable N from the green manure would have met the late N requirement of the crop. This corroborates the findings of Kempu Chetty (1989). As a result of the N availability improved the growth parameters in the treatment receiving higher dose

of basal N application with green manure incorporation on 30 DAS.

The growth in turn depends on the inputs added and the environment in which the crop is grown. Conjunctive use of green manure incorporation 30 DAS with fertilizer application produced taller plants than treatments without fertilizer and green manures. The observation confirms on the pivotal role of N in enhancing the vegetative growth of rice. Similar results were reported by Siddeswaran (1992). Rice plant height was influenced by the treatments such that fertilizer dose had the dominant effect and it was supplemented by green manuring or row early the intercrop green manure was incorporated.

Adequate N supply during the early stages produced taller plants. Taller plants will provide a better ventilated canopy thereby improving the CO₂ exchange (Nova and Loomis, 1981). The beneficial effect of N and the combined effect of green leaf manure and fertilizer N on plant height was reported by Siddeswaran (1992), Prem Sekhar (1993) and Budhar (1994).

Combined use of greenmanure and fertilizer N increased the total number of tillers per hill. Incorporation of green manure 30 days after sowing and split application of N maximum tiller production. This is in accordance with the findings of Budhar (1994). Higher tiller production stage due to steady supply of N green manuring which favours more production of panicles and enhances rice yield (Srinivasalu Reddy, 1988). In the present study also the tillering due to N application at the required stages and green manure applied by growing as intercrop and incorporated on 30 DAS favoured for higher tiller production with higher doses of nitrogen. Higher N levels with green manure had favourable influence on LAI. Better utilization of N during the early stages resulted in higher leaf area and higher LAI. Increase in the level of N increases the LAI and the highest was with 120 kg ha⁻¹ N. This corroborates with the finding of Panda and Rao (1991) with higher LAI, plants become photosynthetically more active there by enhancing the yield (Sharma and Mittra, 1988). Similar results were also reported by Yoshida (1981) and Budhar (1994). Increased N both by applied fertilizer and greenmanure resulted with larger LAI and height with vertical manner resulted in increased productivity.

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