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EFFECT OF GREEN MANURING *Sesbania rostrata* AND FERTILIZERS APPLICATION ON CHEMICAL PROPERTIES OF SOIL AND GRAIN YIELD IN RICE- RICE CROP SEQUENCES

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ABSTRACT

A field experiment was carried out during *kuruvai* (June - September) (South West Monsoon) and *thaladi* (October - January) (North East Monsoon) seasons of 1990-91 to evaluate the effectiveness of *Sesbania rostrata* grown as intercrop and ratoon in transplanted rice-rice sequence. Direct and residual effects of *S.rostrata* on rice yield and chemical properties of soil were studied. Grain and straw yields of rice were increased significantly due to green manuring. Fertilizer nitrogen could be saved upto 50 per cent through green manuring. Soil chemical properties *viz.*, organic carbon content, available N and K were increased significantly with green manure incorporations, particularly in ratooned ones, as compared to no green manuring. Green manuring combined with 50 kg N/ha was found to be better than pure stand of rice with 100 kg N/ha.

KEY WORDS : Rice, Crop Sequence, Green Manuring, Fertilizers, Yield, Soil Properties

Escalating cost of chemical fertilizers has forced the scientists to rely more on renewable resources through integrated nutrient supply system. Intercropping *Sesbania rostrata* in rice field under waterlogged conditions is found to be an economically feasible and viable proposition to reduce the requirement of inorganic fertilizer nitrogen for rice. The role of green manure as a component crop in rice based crop sequence has been well documented. Studies on possibility of introducing *S.rostrata* as intercrop in rice-rice sequence is limited. Hence, present investigation was carried out to study the direct and residual effect of *S.rostrata* applied from outside @ 12.5 t/ha and intercropped with rice (one row of *S.rostrata* for every 10 rows of rice) in rice rice cropping system on rice crop yield and soil chemical properties.

MATERIALS AND METHODS

Field exepriment was conducted at the Tamil Nadu Agricultural Universtiy, Coimbatore during *kuruvai* (South West Monsoon) and *thaladi* (North East Monsoon) seasons of 1990-91. The soil of the experimental field was neutral in reaction and deep clay loam in texture with organic carbon content of 0.73 per cent. The available nutrient contents were:

Table 1. Biomass production and nitrogen accumulation by *S.rostrata* (*Kuruvai* '90)

Treatments	Fresh biomass (t/ha)	B-added (kg/ha)
SR incorporated 7 DBT at 12.5 t/ha	12.5	40.0
SR incorporated at the time of transplanting	12.5	38.7
Intercropping SR and incorporated at 30 DAT	3.43	38.2
Intercropping SR and incorporated at 45 DAT	6.18	53.8
Intercropping SR and incorporated t 30 DAT and incorporated at 30 DAT and harvest	8.64	73.8
Intercropping SR ratooned at 45 DAT and incorporated at 45 DAT and harvest	10.62	82.6
Pure stand of rice	-	-

DAT : Days after transplanting ;

Table 2. Soil chemical properties as influenced by treatments (after 2 seasons)

Treatments	Organic carbon (%)	Available nutrients (kg/ha)		
		N	P	K
SR incorporated 7 DBT at 12.5 t/ha	0.74	191	28.9	476
SR incorporated at the time of transplanting	0.74	200	29.4	480
Intercropping SR and incorporated at 30 DAT	0.73	204	29.5	488
Intercropping SR and incorporated at 45 DAT	0.75	210	30.5	498
Intercropping SR ratooned at 30 DAT and incorporated at 30 DAT and harvest	0.77	220	31.7	508
Intercropping SR ratooned at 45 DAT and incorporated at 45 DAT and harvest	0.78	224	32.9	512
Pure stand of rice	0.72	173	27.9	473
SED	0.01	3.9	0.4	3.2
CD (p = 0.05)	0.03	8.6	0.7	7.1
N_0	0.71	181	27.1	477
N_{50}	0.74	201	31.0	493
N_{100}	0.81	228	32.4	503
SED	0.01	3.1	0.3	2.1
CD (p = 0.05)	0.02	6.4	0.5	4.2

DAT : Days after transplanting ; DBT : Days before transplanting ; SR : *Sesbania rostrata*

225 kg/ha of N, 29.8 kg/ha of P and 468 kg/ha of K. The experiment was laid out in randomised complete block design with three replications. The treatment schedule for *kuruvai* season rice is given in Table.1. Rice crops were fertilized with recommended dose of 50 Kg each of P_2O_5 and K_2O/ha applied during last puddling. Nitrogen was applied[2] @ 100 Kg/ha for *kuruvai* season rice in three splits (half the N basal at planting and the remaining half in two equal splits, one at active tillering and balance at panicle initiation) formed the mainplot treatment which were further divided into three to accomodate sub-plot treatments with different N levels (0.50. 100 Kg N/ha). The test varieties were IR 50 and IR 60 for *kuruvai* and *thaladi* seasons respectively. The crop was harvested at maturity and grain yield was expressed in t/ha after adjusting the moisture to 12 per cent level. Post harvest soil samples were collected for chemical analysis.

Thirty - days old *S.rostrata* seedlings were transplanted simultaneously, along with rice in main field. One row of *S.rostrata* was intercropped for 10 rows of rice, inter cropped *S.rostrata* were entirely incorportated by trampling in between rice rows during intercultural operation. Ratooning of *S.rostrata* was done by leaving 30 stem portion as ratoon and top portion was incorporated as per treatment schedule in *kuruvai* season.

RESULTS AND DISCUSSION

Soil chemical properties

Considerable soil fertility buildup was observed due to green manuring. At the end of the *kuruvai* season, soil organic carbon was higher in *S.rostrata* applied 7 days before transplanting and the time of transplanting followed by intercropping and ratooning. (Table 1). This was due to the higher biomass added in the former two treatments as compared to the later two treatments, the lowest value was recorded with no green manure plot. Even after two rice crops, there was an appreciable build up in the soil organic carbon content as compared to the initial status. Intercropping *S.rostrata* and ratooning exerted a notable residual effect. This was mainly due to the time lag in

Table 3. Grain yield as influenced by treatments (*Kuruvai* '90)

Treatments	Grain yield (t/ha)
SR incorporated 7 DBT at 12.5 t/ha	5.34
SR incorporated at the time of transplanting	5.20
Intercropping SR and incorporated at 30 DAT	4.84
Intercropping SR and incorporated at 45 DAT	4.50
Intercropping SR ratooned at 30 DAT and incorporated at 30 DAT and harvest	4.35
Intercropping SR ratooned at 45 DAT and incorporated at 45 DAT and harvest	4.14
Pure stand of rice	4.60
SED	0.08
CD (p = 0.05)	0.18

Table 4. Grain yield as influenced by *S.rostrata* and fertilizers (*Thaladi* '90)

Treatments	Grain yield (t/ha)		
	0 kg N/ha	50 kg N/ha	100 kg N/ha
SR incorporated 7 DBT at 12.5 t/ha	3.46	4.40	4.66
SR incorporated at the time of transplanting	3.48	4.48	4.81
Intercropping SR and incorporated at 30 DAT	3.64	4.77	5.19
Intercropping SR and incorporated at 45 DAT	4.04	3.35	5.46
Intercropping SR ratooned at 30 DAT and incorporated at 30 DAT and harvest	4.34	5.88	6.01
Intercropping SR ratooned at 45 DAT and incorporated at 45 DAT and harvest	4.39	6.10	6.43
Pure stand of rice	3.31	4.06	4.28

CD (p = 0.05) Green manures (G) = 0.13
Nitrogen (N) = 0.08
G at N = 0.20
N at G = 0.16

incorporation. At the end of second season, in pure stand of rice without green manure, organic carbon content decreased slightly (Table 2).

Green manuring significantly influenced the available nutrient in the soil. Available N tends to decrease after two crops. However, in green manure applied plots, available N status was maintained. Green manuring significantly improved the soil P status. The overall P showed 10 per cent increase in build up over initial P status under these treatments which received green manure incorporated before planting. Soil available K tended to increase even after two rice crops to the tune of 9 per cent over its initial level. Increasing N level had a positive influence on K availability.

K response to green manure might be due to the fact that the decomposing organic matter might have solubilising effect of native soil K (Tiwari *et al.*, 1980).

Grain yield

In *kuruvai*, grain yield was the highest when green manure was incorporated @ 12.5 t/ha, seven days prior to transplanting rice. Intercropping green manure and ratooning recorded lower yield as compared to pure stand of rice (Table 3). In *thaladi*, pronounced residual effect was observed in grain yields. Highest grain yield was under ratooning green manure on 45 days after transplanting (DAT) and incorporation at harvest in previous season, while solid stand of rice resulted in the least grain yield (Table 4). Increasing N level resulted in progressive increase in grain yield, and the highest grain yield was with 100 kg N/ha. The yield response to green manure was due to the beneficial effect on yield attributes. (Singh *et al.*, 1980) significant interaction effect between residual green manure treatment and N levels indicated that the full advantage of ratooning at 45 DAT and incorporation at harvest for the second rice with 100 kg N/ha. At all N levels, this treatment recorded higher yield. It can be concluded that, intercropping *S.rostrata* and ratooning at 45 DAT at harvest and incorporation in first season rice (*kuruvai*) had good residual effect on succeeding rice (*thaladi*) in rice - rice sequence. Direct effect of green manuring can be advantageously realised when incorporated seven days before transplanting.

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