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Integrated Nutrient Management in Transplanted Rice Genotypes

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Abstract

Investigation was carried out during *Kharif* 1999 to 2001 at Regional Research Station, Mudigere with an objective of utilizing waste weed *Chromolaena odorata* as a green manure in paddy field. Treatment consisted of different nutrient management practices (Compost, Chromolaena, recommended NPK and recommended package) for five genotypes (Puttabatta, Intan, IET-7191, KHP-2 and Hemavathi). The performance of *Chromolaena* was found to be at par with that of compost application in respect of organic carbon content, available N status of soil and yield components, which resulted in significantly higher grain yield (35.92 and 34.73 q/ha respectively) compared to control (24.47 q/ha). However, recommended package of compost with full dose of inorganic fertilizers recorded significantly highest yield (48.78 q/ha). Among the different varieties, Puttabatta yielded significantly highest grain (42.44 q/ha) and straw (48.6 q/ha) yield.

Key words : Chromolaena, Nitrogen, Puttabatta, Rice, Yield.

Organic farming entails the use of composts, FYM, crop residues, crop rotation, mixtures and bio-fertilizers to enrich soil organic carbon. Estimates indicate that use of residues can provide 7m tons of NPK (1) thereby reducing the gap of required nutrients to 5 m tons. Proper recycling of these residues in INM will provide sustainable crop production with less pollution, judicious use of inorganic fertilizers and better food quality. For the hill tract, biomass regeneration and utilization as a source of organic input has been a feasible approach in upgrading the productivity of land. *Chromolaena odorata* (L.) King and Robinson is an introduced ornamental plant to India from central and tropical south America. Now a day, it has become a serious weed of plantations, grazing lands, edges of the cultivated lands, forests and roads all along the western ghats in Karnataka, Tamilnadu and Kerala. It can be utilized as mulch, composting and green mannure in plantation and other crops to contain further spread. From the point of maintenance of soil fertility, the manurial value of the weed can be exploited better in rice fields, as it produces more biomass due to prolific growth (2). The present study aims at feasibility of using *Chromolaena* as a green mannure in paddy fields with a possible replacement for traditional FYM.

Methods

The field experiment was conducted for three years (1999 to 2001) during *Kharif* season at Regional Research Station, Mudigere. The soil of the experimental site was red sandy loam, slightly acidic in nature (pH 5.9) , medium in organic carbon (0.48 to 0.62%), low in phosphorus (24 kg/ha) and potassium (112 kg/ha) status. The experiment was laid out on a split plot design replicated three times. The main treatments consisted of different organic (compost and *Chromolaena*) and inorganic (recommended NPK and recommended package)source of application, while the five varieties (Puttabatta, Intan, IET-7191,KHP-2 and Hemavathi) were sub-treatments. Among the varieties, Puttabatta, Intan and Hemavathi have long duration (>160 days) while IET 7191 and KHP-2 are medium duration (around 150 days). Uniform plant population was maintained for each sub-plot, which had 20 × 10 cm spacing with a plot size of 3.2 × 1.2 m.*Chromolaena* had an average N content of 0.64% (both leaves and stem), while FYM used in the experiment had 0.55% N content. On the nutrient basis, *Chromolaena* and FYM supplied about 52 and 55 kg N, per ha respectively. Non-flowered succulent young *Chromolaena* plants were selected and chopped appropriately and incorporated a day prior to transplant-

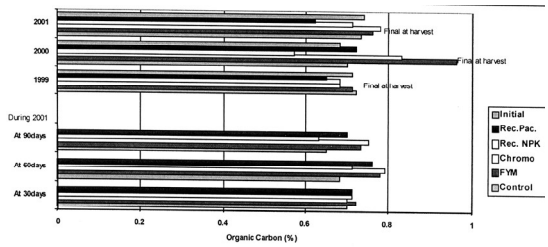

Figure 1. Effect of nutrient management on organic carbon (%) of the soil.

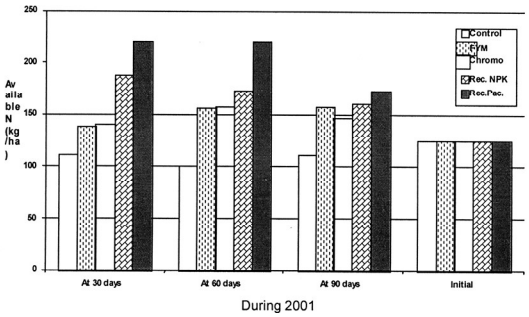

Figure 2. Effect of nutrient management on available nitrogen (kg/ha) of the soil.

ing into the soil. Except for the treatments, remaining recommended package of practices (3) were followed for growing the crop. After ascertaining the response in two years (1999 and 2000), detailed study was undertaken during 2001. Observations on growth parameters and yield components were recorded apart from soil organic carbon and N status. The data obtained were statistically analyzed and were tested at 5% level of significance to interpret the treatment differences.

Results and Discussion

The effect of different nutrient management on organic carbon status is shown in Figure 1. The data showed that the difference between initial and final organic carbon content of soil varied in each year of study. During 2000 and 2001, the final content showed a little higher value for compost and *Chromolaena* application compared to initial value. During 2001, the organic C status at 30, 60 and 90 days after transplanting was determined. At 30 days, no change was noticed. *Chromolaena* applied plots did not vary probably because of N-immobilization. Both at 60 and 90 days after transplanting where the crop need for the nutrients is at maximum, increasing trend of organic carbon was recorded wherever compost and *Chromolaena* was applied. Malonki et al. (4) reported significant change in physico-chemical properties of soil with better release of nutrients upon green manure application of *Chromolaena at 5 t/ha.* Available N status was determined at 60 and 90 days after transplanting and is presented in Figure 2. The data indicated that inorganic N applied plots maintained higher N status than rest of treatments. It implied for better growth of the crop compared to control. Both FYM and *Chromolaena* applied plots maintained moderate level of N at this stage. Kamegne et al. (5) from Cameroon reported that Chromolaena odorata when

Table 1. Effect of nutrient management practices on paddy yield.

Treatments	Grain yield (q/ha) 1999	2000	2001	Mean	Straw yield (t/ha) 1999	2000	2001	Mean
1. NPK 75 : 75 : 90 kg/ha + Compost 10 t/ha	46.07	50.89	49.19	48.78	5.42	5.11	5.86	5.46
2. NPK 75 : 75 : 90 kg/ha	40.86	46.78	44.74	44.13	4.72	4.11	5.08	4.64
3. Chromolaena 8 t/ha	32.19	39.78	35.78	35.92	3.89	3.67	4.47	4.01
4. Compost 10 t/ha	29.87	41.03	33.30	34.73	3.38	4.17	4.23	3.93
5. Control	24.82	23.72	24.87	24.47	2.87	2.11	2.91	2.63
CD 0.05	2.06	4.01	1.56	1.87	0.19	1.04	0.12	0.43
1. Puttabatta	36.43	44.69	46.20	42.44	4.46	4.83	5.28	4.86
2. Intan	34.06	40.56	40.22	38.53	3.98	3.67	4.81	4.15
3. IET-7191	33.88	40.78	38.57	38.00	3.90	3.33	4.74	4.01
4. KHP-2	34.64	38.72	30.35	34.38	3.94	3.45	3.78	3.73
5. Hemavthy	34.82	37.47	32.52	34.62	3.99	3.89	3.94	3.91
CD (.05)	0.86	1.81	1.18	0.7	0.15	0.44	0.10	0.18
CV (%)	5.1	6.3	7.2	5.1	5.1	15.9	2.98	8.9

Table 2. Effect of nutrient management practices on growth and yield components during 2001.

	Treatment	Plant height (cm)	Panicle length (cm)	Productive tillers (no.)	Grain number	Grain weight
1.	NPK 75 : 75 : 90 kg/ha + Compost 10 t/ha	72.67	20.32	5.77	510.13	16.67
2.	NPK 75 : 75 : 90 kg/ha	70.52	20.76	5.28	489.60	15.09
3.	Chromolaena 8 t/ha	71.87	20.33	5.44	482.87	14.14
4.	Compost 10 t/ha	68.25	19.64	4.95	473.07	14.38
5.	Control	67.27	19.42	3.88	374.33	12.97
	CD (0.05)	3.15	0.79	0.46	23.62	0.92
1.	Puttabatta	89.52	20.97	5.67	541.2	18.99
2.	Intan	77.13	19.76	4.99	461.13	12.12
3.	IET-7191	52.15	19.64	4.49	404.33	11.44
4.	KHP-2	72.76	19.77	5.27	467.60	16.05
5.	Hemavathy	59.01	20.33	4.91	455.73	14.06
	CD (0.05)	3.16	0.95	0.27	31.26	0.56
	CV (%)	5.87	6.17	6.98	9.03	5.01

used, degrades faster contributing to the build up of soil organic nitrogen.

The effect of nutrient management on grain yield is presented in Table 1. Different applications of organic and inorganic had significant influence. Control plot recorded lowest grain yield (24.47 q/ha) during both the years. On the contrary, the package recommendation recorded significantly highest yield in all the years with a mean value of 48.78 q/ha. In presence of recommended nutrient supply, growth was optimum yield components were higher (Table 2) resulting in good performance. Only organic applied plots yielded significantly higher than control. Compost at 10 t/ha and *Chromolaena* at 8t/ha achieved 42% (34.73 q/ha)and 46% (35.92 q/ha) higher yield respectively compared to control (24.47 q/ha). The sustenance of relatively higher organic carbon and available N at peak plant nutrient need by these plots resulted to perform better. Bahr et al. (6) reported similarities in *kharif* rice yield and nitrogen availability with the application of pre-digested manures of *Sesbania aculeata, Chromolaena odorata* and *Ipomea cornea.* In this study, there was no difference in grain yield obtained between the organic sources, which indicates the possible replacement for compost by *Chromolaena.* Comparison between recommended NPK alone to that of recommended package showed that application of compost along with NPK resulted in 10% more yield (48.78 q/ha) than recommended NPK alone (44.74 q/ha). The compost applied plot maintained better organic carbon and available N-status and in combination with recommended NPK yielded better indicating the supportive role of compost to enhance yields. Application of green manure of *Chromolaena* at 5 t/ha in rice-mustard system was found to be equivalent to that of FYM and *Sesbania* with regard to yields (7, 8).

With respect to straw yield, package recommendation resulted significantly highest average yield (5.46 t/ha) compared to other treatments. It was followed by inorganic application of NPK. Application of either compost (3.93 t/ha) or *Chrmolaena* (4.01 t/ha) recorded better straw yield than control (2.63 t/ha.)

Among the different paddy genotypes tested, Puttabatta, a local variety performed better in all the years of study. It performed with an average yield of 42.44 q/ha followed by Intan (38.53 q/ha) and IET-7191 (38.00 q/ha). The performance is related to their growth habits and yield components recorded. KHP-2 (34.38 q/ha) and Hemavathi (34.02q/ha) did not differ between themselves and recorded lowest grain yields. Similar trend was noticed in respect of straw yield also.

Correlation studies (Table 3) between yield and its components (Plant height, panicle height, productive tillers, grain number and weight) turned out to be significant. The regressed yield as given in the multiple regression indicated that nearly 43% of the varia-

Table 3. Correlation and regression studies on yield. $Y = -2039.65 - 3.05 X_1 + 6.95X_2 + 4.62X_3 + 5.48X_4 - 2.05X_5$. ($R^2 = 0.427$).

	Plant height (X_1)	Panicle height (X_2)	Productive tillers (X_3)	Grain number (X_4)	Grain weight (X_5)
Correlation Coefficient	0.366*	0.367*	0.626**	0.620**	0.460*
Intercept	1790.19	–2221.93	–94.70	–409.60	1398.63
Slope	27.80	296.65	757.10	8.90	159.70
Covariance	5448.8	514.6	584.5	48842.6	1497.7

tion in yield is attributed to these factors.

Conclusion

The experimental results are encouraging to utilize the *Chromolaena* as a manure in paddy fields and can replace compost application.

References

1. Gaur A. C. and G. Singh. 1994. Organic and biological plant nutrient sources. *In* Integrated plant nutrient systems. FAO Fert. and Pl. Nutr. Bull.12 : 85—112.
2. Syed Anwarulla M. 1998. Integrated nutrient (NPK) management for green mannured rice-soyabean sequential cropping to hill zone of Karnataka. Doctoral thesis, Dr. B. R. Ambedkar Univ. Agra, UP, India.
3. Anonymous. 1999. Package of practices for high yielding crops. Univ. Agric. Sci. Bangalore, India.
4. Malonki R., M. Bernard, E. Padonon and G. Renard 1998. Soil fertility management in West African land use system. Proc. Reg. Works. Uni. Bohenneim, ICRISAT Saheliaun center and INRAN, Niamey, Niger, Mar 4—8, 1997-98, pp. 187–191.
5. Kamegne J., B. Dugrme, J. Henrot and N. O. Siriman. 1999. Soil fertility enhancement by planted tree fallow species in humid low land of Cameroon. Agro-For. Systems 46 : 239—49.
6. Bahr J. V., B. N. Sarmah and S. R. Baroova. 1997. Effect of bio-digested organic mannures on nitrogen availability in *kharif* rice. J. Agric. Sci. 10 : 186—192.
7. Dutta S. C., J. Deka and S. R. Baroova. 1994. Effect of green mannure and N levels in productivity of rice based relay cropping systems. J. Agric. Sci. 7 : 177—179.
8. Baruah N., J. Deka and A. C. Thakur. 1996. Effect of plant biomass and tillage practices on productivity of rice-mustard sequence. J. Agric. Sci. 9 : 209—211.