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Influence of Weeds as Nutrient Source on Paddy Yield, Residual Soil Properties and Economics

R. Krishnamurthy*
Department of Soil Science and Agricultural Chemistry,
College of Agriculture, UAS (B), V.C. Farm, Mandya- 571 405, Karnataka, India

To evaluate the effect of recommended dose of fertilizers and *Parthenium* and *Chromolaena* as green manures and their compost incorporation on paddy yield and its nutrition, field experiment was conducted during *kharif* 2006 in sandy soil at Chickmagalur district of Karnataka state in farmers field. The field experiment was laid out in random complete block design with three replication and ten treatment combinations. Combined application of recommended dose of fertilizer in combination with *chromolaena* compost @ 7.5 t/ha recorded significantly higher grain yield as compared to rest of the treatments. The increase in the grain yield is by about 88.42 per cent over control. Significant differences in all the chemical properties of post harvest soil were observed due to application of recommended dose of fertilizers and different levels of organic manures. The net return and benefit cost ratio due to application of recommended dose of fertilizer in combination with chromolaena compost @ 7.5 t/ha was Rs.39957 and 2.29 respectively and recommended dose of fertilizer in combination with *Parthenium* compost @ 7.5 t/ha Rs.38274 and 2.22 respectively.

Key words: Paddy, *Chromolaena, Parthenium*, compost, yield, nutrient, economics.

Integrated nutrient management is an efficient way of management of fertility of the soil and supply of nutrient to crops. Integrated nutrient management aims in achieving harmony in the conjoint use of all resources - chemical fertilizers, organic manures, green manures, biofertilizers and crop residue. The escalating cost of fertilizers on one hand and their undesirable effect on the physical condition of the soil on the other call for inclusion of adequate quantities of organic sources to soil. On the other hand, many waste plants are growing which has potential to supply abundant biomass which can be exploited for soil improvement and economic crop production. Among these plants *Parthenium* (*Parthenium hysterophorus*) and *Chromolaena* (*Chromolaena odorata*) are fast growing which come up in abundance in fallow lands, road sides and gomal (range) lands. Besides having high content of N and P, they have succulent biomass and could be used to help substantially in N and P economy of crops if incorporated in the soil. Keeping this in view, an experiment was conducted to find out the effect of *Parthenium* and *Chromolaena* as green manure and their compost in combination with recommended dose of fertilizer on paddy yield, post harvest soil properties and cost benefit ratio.

Materials and Methods

A field experiment was conducted during *kharif* 2006 to study the agronomic efficiency of recommended dose of fertilizer (RDF) in combination with *Chromolaena* and *Parthenium* as green manure and their composts. The soil of the experimental site was sandy, pH 5.38, EC 0.04 dSm^{-1}, total organic carbon 0.98 %, NH_4^+- N 61.10 mg kg^{-1}, NO_3- N 10.0 mg kg^{-1}, Olsen P 6.71 mg kg^{-1} and NH_4OAc-K 68.91 mg kg^{-1}. The experiment was laid out in a randomized complete block design with 3 replications. The rice variety used was sharavathi and the treatments were T_1:Control, T_2: Recommended dose of fertilizer (RDF), T_3: RDF + *Parthenium* as green manure @ 5.0 t/ha (RDF + PG1), T_4: RDF + *Parthenium* as green manure @ 7.5 t/ha (RDF + PG2), T_5:RDF + *Parthenium* compost @ 5.0 t/ha (RDF + PC1), T_6:RDF + *Parthenium* compost @ 7.5 t/ha (RDF + PC2), T_7:RDF + *Chromolaena* as green manure @ 5.0 t/ha (RDF + CG1), T_8:RDF + *Chromolaena* as green manure @ 7.5 t/ha (RDF + CG1), T_9:RDF + *Chromolaena* compost @ 5.0 t/ha (RDF + CC1), T_{10}:RDF + *Chromolaena* compost @ 7.5 t/ha (RDF + CC2). Top portion of *Parthenium* and *Chromolaena* were chopped in to small pieces and mixed thoroughly with upper 15 cm of soil of respective plot. At the same time composting was done using *Parthenium* and *Chromolaena* separately with the organic additives viz, cow dung at @ 20 per cent and inorganic additives viz, rock phosphate @ 5 per cent and *Phanerochaete chrysosporium*, *Pleurotus sajorcaju, Trichoderma harzianum* were used as microbial inoculum (20 g). Nitrogen, phosphorus and potassium content of *Parthenium* and *Chromolaena* were 1.6, 0.63, 0.98 and 1.90, 0.69,

*Corresponding author email: srkmurthyssac@gmail.com

1.08 per cent respectively. Nutrient composition of *Parthenium* and *Chromolaena* compost was 0.94 and 1.32 per cent nitrogen, 1.03 and 1.93 per cent phosphorus and 1.46 and 1.89 per cent potassium respectively.

The soil of each plot were irrigated to field capacity after the incorporation of *Parthenium* and *Chromolaena* as green manure and their compost and kept as such for 20 days before transplanting of paddy so as to give sufficient time for their decomposition. After 20th day the soil of each plot was dug and again mixed thoroughly. The recommended dose of fertilizer (100:50:50) was applied through urea, DAP, muriate of potash. The N was applied in two splits while P and K were applied at transplanting. At maturity, the grain and straw were separated and their dry weights were recorded. After the harvesting of the crop, the residual properties of the soils were estimated using standard procedures. The cost benefit ratio was calculated.

Results and Discussion

Grain and straw yield

In the present experiment, treatment T_{10}: RDF + CC2 improved the grain yield better than organic sources (Table 1). The yield increase is due to conjunctive application of RDF and organic manures which could be due to the increased availability of nitrogen, phosphorus and potassium in soil and the resultant in increase in the number of tillers, panicle and other growth attributes as a result of better uptake of nutrients from soil as reported by many workers (Basavaraja, 2001; Kenchaiah, 1997; Paraye, 2002; and Meelu and Morris, 1988).

Table 1. Effect of recommended dose of fertilizer in combination with varying levels of organic manures on grain and straw yield of rice

Treatment	Grain yield (q/ha)	Per cent increase over control	Straw yield (q/ha)	Per cent increase over control
T_1: Control	25.77	-	31.90	-
T_2: RDF	39.40	52.85	46.80	46.70
T_3: RDF+PG 1	41.66	61.67	48.06	50.66
T_4: RDF+PG 2	45.13	75.13	52.14	63.45
T_5: RDF+PC 1	45.06	74.85	53.10	66.46
T_6: RDF+PC 2	47.11	82.81	55.24	73.17
T_7: RDF+CG 1	45.02	74.70	53.98	69.22
T_8: RDF+CG 2	45.91	78.15	52.96	66.02
T_9: RDF+CC 1	46.42	80.13	53.91	64.93
T_{10}: RDF+CC 2	48.66	88.82	55.63	74.39
SEm ±	0.97		0.93	
LSD (P = 0.05)	2.90		2.78	

Straw yield also followed the similar trend as that of grain yield. Increase in straw yield was due to the influence of fertilizer with different levels of organic manures, which was mainly due to more number of tillers and plant height. The results are in close conformity with the findings of other workers with the use of green manures in rice production (Meelu and Morris, 1988 and Ramtete *et al.,* 1998).

Effect on soil properties

Application of recommended dose of fertilizers in combination with organic manures had favourable effect on soil chemical properties. The soil pH differed significantly in soil after harvest due to treatments. The incorporation of organic manures helps in stabilizing pH and resists fluctuation in pH due to management practices. The EC values differed significantly among treatments, which may be due to varying degrees of soluble salts in compost (Table 2).

There was a significant increase in the OC content of the soil and was due to different levels of organic manures application. The OC content of soil changed in accordance with chemical composition of the organic manures. Organic carbon content of the soil was higher in the treatment which received both RDF + *Chromolaena* compost @ 7.5 t ha^{-1}(T_{10}: RDF + CC2). Increased organic carbon status with application of eupatorium was also reported by Manjappa (1999) and Vinod Kumar *et al.* (1998). Application of higher amount of green biomass produced higher values of organic carbon, available P_2O_5 and K_2O in soil compared to lower level of its application (Bouldin, 1988).

There was a significant increase in the available N, P_2O_5 and K_2O content of the post harvest soil in treatments T_{10}: RDF + *Chromolaena* compost @ 7.5 t/ha, T_4: RDF + *Parthenium* green manure @ 7.5 t/ha, T_5: RDF + *Parthenium* compost @ 5.0 t/ha and T_6: RDF + *Parthenium* compost @ 7.5 t/ha. This might be due to the mineralization of N from the compost during decomposition and also the application of recommended dose of fertilizer. This is in agreement with the findings of Manjappa (1999). The increased available P_2O_5 in post harvest soil was due to the release of P from compost enriched with rock phosphate. Similar results were reported by Budhar *et al.* (1990), Chaphale *et al.* (2000) and Sharma and Verma (2000). The increase in available K_2O with conjunctive use of RDF + organic manures was reported by Bouldin (1988). Higher availability of K_2O might be due to less involvement in organic fractions of green manure which helped for its faster release during decomposition.

There was significant differences between treatments with respect to exchangeable Ca and Mg content of the post harvest soil. The available S content of the soil recorded higher values in T_{10}: RDF + *Chromolaena* compost @ 7.5 t/ha, T_9: RDF + *Chromolaena* compost @ 5.0 t/ha, T_5: RDF + *Parthenium* compost @ 5.0 t/ha and T_6: RDF + *Parthenium* compost @ 7.5 t/ha treatments over initial S content of soil. The increase in available S in compost treatment could be attributed to the

Table 2. Chemical properties of the post harvest soil as affected by recommended dose of fertilizer in combination with various levels of organic manures

Treatment	pH	EC (dSm^{-1})	OC (%)	Av N (kg ha^{-1})	Av P_2O_5 (kg ha^{-1})	AV. K_2O (kg ha^{-1})	Ex Ca (c mol $(p+)kg^{1}$)	Ex Mg (c mol $(p+)kg^{1}$)	Av. S (ppm)	DTPA-Zn (ppm)	DTPA-Cu(ppm)	DTPA-Fe (ppm)	DTPA-Mn (ppm)
T_1: Control	5.40	0.06	0.78	93.11	13.63	97.81	1.50	0.90	2.71	1.88	1.36	69.31	1.63
T_2: RDF	5.41	0.11	0.81	153.48	15.97	124.36	1.41	0.90	2.73	1.96	1.36	70.00	1.67
T_3: RDF+PG 1	6.43	0.31	1.12	196.73	22.63	137.80	1.71	0.91	2.81	1.97	1.47	71.34	1.71
T_4: RDF+PG 2	6.47	0.36	1.21	213.74	28.73	153.16	1.73	0.93	2.84	2.01	1.48	72.00	1.83
T_5: RDF+PC 1	6.56	0.40	1.26	236.63	32.60	168.26	1.75	0.95	2.93	2.13	1.53	73.64	1.89
T_6: RDF+PC 2	6.68	0.46	0.96	163.78	36.71	182.10	1.81	0.98	3.00	2.19	1.51	74.11	1.98
T_7: RDF+CG 1	6.59	0.33	1.18	218.18	26.69	142.20	1.73	0.92	2.92	2.08	1.08	72.09	1.78
T_8: RDF+CG 2	6.70	0.38	1.26	238.60	31.44	161.28	1.76	0.96	2.99	2.14	1.56	73.10	1.89
T_9: RDF+CC 1	6.74	0.44	1.28	241.78	37.76	173.63	1.80	0.99	3.06	2.20	1.60	74.13	1.93
T10: RDF+CC 2	6.90	0.50	1.39	276.10	44.63	213.74	1.99	1.06	3.12	2.34	1.73	74.98	2.03
SEm ±	0.01	0.01	0.12	1.38	0.50	0.59	0.11	0.11	0.01	0.01	0.01	0.25	0.01
LSD (P =0.05)	0.03	0.03	0.36	4.00	1.43	1.73	0.29	0.33	0.04	0.03	0.04	0.61	0.04

release of organic bound S and native S through mineralization process. Similar results were obtained by Tester and Parr, (1983).

DTPA extractable micronutrients of the post harvest soil showed an increase in all the treatments. The organic manures which are good reservoir of micronutrients and it is observed that soil which receives continuous application of organic manures seldom show an increase in micronutrient status.

Economics

The cost of cultivation was higher with the use of recommended dose of fertilizer in combination with various levels of organic manures when compared to the use of only organic manures (Table 3).

Analysis of economics reveled that the net return and benefit cost ratio obtained with the application of recommended dose of fertilizer in combination with *Chromolaena* compost @ 7.5 t/ha (T_{10}: RDF + CC2) (Rs.39, 957 and 2.29) and recommended dose of fertilizer in combination with *Parthenium* compost @ 7.5 t/ha (T_6: RDF + PC2) (Rs.38.274 and 2.22), respectively were similar. This suggested that both *Parthenium* and *Chromolaena* can be used advantageously as a source of nutrients for the soil. T_7: RDF + CG1 and T_8: RDF + CG2 reveled B:C ratio of 4.31 and 4.28 respectively where as T_{10}: RDF + CC2 records 2.29. This suggests that the application of *Chromolaena* as green manure to paddy field records better income compared to their compost, preparation of compost was not economical but it gives better yield.

Table 3. Cost of cultivation, gross return, net return and cost benefit ratio as influenced by recommended dose of fertilizer in combination with various levels of organic manures

Treatment	Yield (q/ha)		Revenue (Rs/ha)		Gross return (Rs)	Cost of cultivation (Rs)	Net return (Rs)	B:C ratio.
	Grain	Straw	Grain	Straw				
T_1: Control	25.77	31.90	16750	14355	31105	7170	23935	3.33
T_2: RDF	39.40	46.80	25610	21060	46670	9705	36965	3.81
T_3: RDF+PG 1	41.66	48.06	27079	21627	48706	10080	38626	3.83
T_4: RDF+PG 2	45.13	52.14	29334	23463	52795	10147	42650	4.20
T_5: RDF+PC 1	45.06	53.10	29289	23895	53184	14705	38479	2.61
T_6: RDF+PC 2	47.11	55.24	30621	24858	55479	17205	38274	2.22
T_7: RDF+CG 1	45.02	53.98	29263	24291	53554	10080	43474	4.31
T_8: RDF+CG 2	45.91	52.96	29841	23832	53763	10147	43526	4.28
T_9: RDF+CC 1	46.92	53.91	30173	24259	54432	14705	39727	2.70
T_{10}: RDF+CC 2	48.66	55.63	31629	25033	56662	17205	39957	2.29

Mehla and Panwar (2000), obtained higher gross return (Rs.45,425 ha^{-1}) with conjunctive use of FYM and nitrogen in rice as compared to FYM alone (Rs.36, 225 ha^{-1})

Combined application of organics and fertilizers sustained the grain yield at higher levels due to improvement in physical, chemical and biological properties of soil (Yadvinder Singh *et al.,* 1991). The available weeds such as *Parthenium* and *Chromolaena* in agricultural field we can use it as green manures and also compost can be made using the weeds. Weeds and their composts contain good source of nutrients. Therefore, the combined use of recommended dose of fertilizer with *Chromolaena* and *Parthenium* as green manure and also their compost give better yield.

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