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Utilization of *Chromolaenaodorata* as a source of nutrientsin groundnut

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Abstract

The Chromolaenaodorataweed poses a great threat to the fragile biodiversity of the Western Ghats, eco-tourism, forestry, watershed management and sustainable farm management, where it is competitively replacing the existing indigenous rich flora, thereby creating ecological imbalance. This weed has assumed much importance due to its alarmingly increasing intensity day by day. Field study was planned under this content at Main Research Station, Hebbal, University of Agricultural Sciences, Bengaluru. The treatments comprised of various combinations of Chromolaena's compost with recommended dose of fertilizer (RDF), RDF+ farm yard manure (FYM), RDF alone and unfertilized control. The results revealed that combined application of compost of Chromolaenaodorata(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7. 5 t ha^{-1} along with 100% RDF was superior and recorded higher pod yield by 8.0% and higher net income of Rs 20,916 ha^{-1} than RDF + FYM 7.5 t ha^{-1} (17,549 kg ha^{-1}) in groundnut. Further, application of compost of Chromolaenaodorata(2/3) + FYM (1/3) @ 7.5 t ha^{-1} + RDF was the next best treatments in terms of higher pod yield and net income in groundnut, besides substantially increasing the fertility status of the soil by increasing the available soil nitrogen, phosphorus and potassium.

Keywords: Chromolaenaodorata, Groundnut, Compost, Economics

I. INTRODUCTION

To-day around the world, in many countries biodiversity is under threat due to establishment of invasive species like *Chromolaena*.In India, it has become a serious threat to afforestation programmes especially in the states of Assam, Nagaland, West Bengal, Orissa, Tamil Nadu, Kerala, Karnataka and Goa. In Karnataka, the weed is occurring in high density in high rainfall areas covering hilly, coastal and southern transition zones. The Forest Department of Karnataka spends several lakhs of rupees annually to clear this weed in nurseries and young plantations, but the problem has remained unsolved (Mogali*etal*., 1989; Anon, 2004). It is estimated that the weed has covered 23,000 sq. km. in Western ghats (Doddamani*etal*., 2001).Looking into all these problems created by this weed and producing biomass of 3 t ha^{-1} in a span of 3 months after occurrence of rains in March and April months, the utility of green biomass as compost or green leaf manure in agriculture has known to improve soil physical, chemical and biological properties and favour better crop growth which might suppress the weeds in standing crops (Ramachandra Prasad *et al*., 2003). Thus weed utilization will perhaps serves as alternate strategy for managing weeds substantially, minimize spread and hazardousness of these weeds to human beings and animals and finally improves the aesthetic value of the locality.The use of the compost of *Chromolaenaodorata*in field crops has not been attempted adequately elsewhere. Hence the possibility on the use of *Chromolaena*in combination with fertilizers in relation to other compost is explored in groundnut crop.

II. MATERIALS AND METHODS

A field experiment was conducted at Main Research Station, Hebbal, University of Agricultural Sciences, Bangalore, consisting of eleven treatments on fixed site during *Kharif* 2014 with groundnut. The experiment was laid out in randomized block design with three replications. The soil was sandy loam in texture and medium fertility with respect to N, P and K status and had OC 0.34%. The treatments comprised various combinations of *Chromolaena's*compost with recommended dose of fertilizer (RDF), RDF+ farm yard manure (FYM), RDF alone and unfertilized control. The green biomass of *Chromolaena*collected from nearby locality was chopped into small pieces. As per the treatments, organics viz, cow dung slurry, microbial culture, forest soil, leaf litter etc, were prepared compost and obtained in 3 months, which was black, light in weight and friable.

III. RESULTS AND DISCUSSION

Effect of *Chromolaena* composts on crop growth

Incorporation of *Chromolaena's*compost along with other organic sources and in combination with fertilizer had pronounced effect on growth characters at all the growth stages.

Total dry matter per plant was significantly lower in unfertilized control as compared to all other treatments except RDF alone and compost of *Lantana camara*(30%)+ *Glyricidiamaculata*- leaves (30%) + cow dung (10%) + leaf litter (30%) @ 7.5 t ha^{-1} + RDF (T8). This poor growth of crop was result of lack of sufficient nutrients supply to the crop from the soil reserve, as external application was not done. Further, mere application of RDF alone treatments resulted in significantly lower total dry matter per plant as compared to various combinations of *Chromolaena's*compost except compost of*Chromolaenaodorata*+ forest soil (2 layers of 2 cm) + microbial consortium @ 7.5 t ha^{-1} + RDF (T6), compost of*Chromolaenaodorata*(50%) + leaf litter (50%) + vermi compost @ 7.5 t ha^{-1} + RDF (T7) and compost of *Lantana camara*(30%) + *Glyricidiamaculata*- leaves (30%) + cow dung (10%) + leaf litter (30%) @ 7.5 t ha^{-1} + RDF (T8) at 30 DAS (Table 1).

Plot receiving unfertilized control (22.9 g/ plant) resulted in significantly lower total dry matter production per plant than RDF alone (35.3 g/ plant) as a result of poor nutrient supply, Further, total dry matter per plant was significantly improved due to application of compost of*Chromolaenaodorata* (50%) + leaf litter (50%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T4),*Chromolaenaodorata* (90%) + cow dung slurry (10%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T2),*Chromolaenaodorata*(2/3) + FYM (1/3) @ 7.5 t ha^{-1} + RDF (T5) and compost of*Chromolaenaodorata*(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7.5 t ha^{-1} + RDF (T3) (60.7 to 71.3 g/ plant) (Table 1). In these treatments, better crop growth of groundnut was due to the increase in plant height, number of leaves and leaf area and cumulative effective of all these parameters. It was also observed significantly lower leaf area per plant in unfertilized control than all treatments. As leaf area and dry matter are inter- dependent, as opined by Thakur and Singh (1987), Kiran Kumar *et al.* (2002) observed similar increase in dry matter production with application of chemical fertilizer along with green manure, confirming the present study.

This higher dry matter of plant was supported by higher dry matter accumulation in leaf, stem and pods due to use of weed composts with RDF and FYM + RDF. In the present study, use of compost of*Chromolaenaodorata*(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7.5 t ha^{-1} + RDF (T3), showed significantly higher plant height, number of leaves per plant, number of branches per plant and leaf area per plant. All these attributes were higher which favoured in increasing dry weight of plants and more accumulation in pods. Various combinations of *Chromolaena's* compost with RDF and combined application of FYM + RDF have helped in uniform availability of nutrients at all the stages coupled with better microbial activity and improved uptake of nutrients, in groundnut. Ramachandra Prasad *et al*. (1991) at Bangalore. An adequate supply of plant nutrients is necessary for enhanced metabolic activity. These results are in conformity with earlier studies at Bangalore, byKiran Kumar *et al.* (2002) in finger millet- groundnut cropping system.

Effect of *Chromolaena* composts on yield

Pod yield was significantly lower inunfertilized control (T11) as compared to RDF. Control had significantly lower yield owing to poor growth and yield components as a result of poor availability of nutrients from soil pool, as external supply was not done. Application of combinations of *Chromolaena's* compost along with RDF significantly improved pod yield, which was found to be 55 per cent higher over RDF alone (1301 kg/ha). Among the combinations of compost,*Chromolaenaodorata*(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7.5 t ha^{-1} + RDF (T3), followed by*Chromolaenaodorata*(2/3) + FYM (1/3) @ 7.5 t ha^{-1} + RDF (T5),*Chromolaenaodorata* (90%) + cow dung slurry (10%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T2) produced significantly higher pod yield and 29.5 per cent increase over vermi compost + *Chromolaenaodorata* (50%) + leaf litter (50%) @ 7.5 t ha^{-1} + RDF (T7) and compost of *Lantana camara*(30%)+ *Glyricidiamaculata*- leaves (30%) + cow dung (10%) + leaf litter (30%) @ 7.5 t ha^{-1} + RDF (T8) (Table 2). This higher pod yield of groundnut with conjunctive use of organic and inorganic nutrient sources were attributed to the higher growth parameters *viz*., plant height, number of leaves per plant, LAI which favoured increased light interception by the canopy. This higher LAI and more light interception perhaps favoured the production of higher dry matter accumulation in leaf, stem and pod dry weight. Whereas, haulm yielddid not differ significantly among the treatments.

Among various combinations, *Chromolaena's* compost,*Chromolaenaodorata*(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7.5 t ha^{-1} + RDF (T3) produced relatively higher pod yield of groundnut (2896 kg ha^{-1}) which was found to be 122.5 per cent higher as compared to RDF alone (1301 kg ha^{-1}). Further, use of RDF + FYM (2682 kg ha^{-1}) gave 106.1 per cent higher over RDF alone (1301 kg ha^{-1}). All these facts emphasize that better plant growth could be ascribed to benefits of combination *Chromolaena's* compost which supplies major nutrients in available forms in addition to micronutrients to the plants through biological decomposition and also indirectly improving the soil biota, as indicated by Ramachandra Prasad (2009) in finger millet -groundnut and Denesh (2008) in maize – sunflower system.

Economics

Total cost of cultivation of groundnut in unfertilized control was ` 8,689 ha$^{-1}$ as against ` 11,377 ha^{-1} in RDF alone. Addition of FYM along with RDF increased the total cost of cultivation to ` 14,725 ha$^{-1}$ as compared to various combinations of *Chromolaena's*compost along with RDF, in which total cost of cultivation ranged from ` 13,557 ha^{-1} in*Chromolaenaodorata*(90%) + cow dung slurry (10%) @7.5 t ha^{-1} + RDF (T1) to ` 14,407 ha$^{-1}$*Chromolaenaodorata*(2/3) + FYM (1/3) @ 7.5 t ha$^{-1}$ + RDF (T5) (Table 3). However, total cost of cultivation was higher with addition of compost / FYM. Combinations with *Chromolaena's*compost was cheaper than FYM due to higher cost of FYM (` 14,725 ha^{-1}) more than weed compost, as also stated by Denesh (2008) with use of weed composts in maize- sunflower system.

Unlike observed in total cost of cultivation, gross returns were higher in treatments receiving compost of*Chromolaenaodorata*(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7.5 t ha^{-1} + RDF (T3),*Chromolaenaodorata* (90%) + cow dung slurry (10%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T2),*Chromolaenaodorata*(2/3) + FYM (1/3) @ 7.5 t ha^{-1} + RDF (T5) (` 34,752 to 33,612 $ha^{-1}$) as compared to rest of the treatments but slightly better than RDF + FYM (` 32,184 ha^{-1}) (Table 3). Mere addition of ` 2,000 to 3,000 $ha^{-1}$ of compost value doubled the gross returns (` 34,752 ha^{-1}) as compared to RDF alone (` 15,612 $ha^{-1}$) while unfertilized control had considerably lower gross returns per hectare. The present, study suggested that the use of *Chromolaena's* compost saves sizeable cost (` 2,568 ha^{-1}) on its usage as compared to FYM. Weeds occurring everywhere and producing huge biomass can be composted and nutrient contents of those composts become available to the crop upon application, as suggested by Manjappa and Koppada (2002), Ramachandra Prasad (2009) and earlier studies at Bangalore (Anon., 2004) with *Chromolaena.*

Net returns was considerably lower in RDF and unfertilized control (` 4,235 to 4,307 ha^{-1}) as compared to RDF + FYM or various combinations of *Chromolaena's*compost as a result of lower yields. Addition of FYM along with RDF improved the net returns by 2 to 5 folds as compared to RDF alone (T10). The treatments receiving vermi compost + *Chromolaenaodorata* (50%) + leaf litter (50%) @ 7.5 t ha^{-1} + RDF (T7) and compost of *Lantana camara*(30%)+ *Glyricidiamaculata*- leaves (30%) + cow dung (10%) + leaf litter (30%) @ 7.5 t ha^{-1} + RDF (T8) had relatively lower net returns (Table 3) as compared to other *Chromolaena's* compost and RDF + FYM (` 17,459 ha^{-1}). Further, treatments receiving RDF with composts of *Chromolaenaodorata*(2/3) + FYM (1/3) @ 7.5 t ha^{-1} + RDF (T5),*Chromolaenaodorata* (50%) + leaf litter (50%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T4),*Chromolaenaodorata* (90%) + cow dung slurry (10%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T2) and*Chromolaenaodorata*(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7.5 t ha^{-1} + RDF (T3), gave higher net returns (` 19,205 to 20,916 ha^{-1}) than RDF + FYM, indicating the superiority of weeds' composts due to low cost of preparation of the compost. Similarly, earlier studies at Bangalore, have indicated that weeds' compost resulted in better net returns than FYM (Anon., 2004) in maize- sunflower system (Denesh, 2008).

Addition of FYM or various combinations of *Chromolaena's*compost increased the B: C ratio by 2 to 4 times over the B: C ratio obtained in RDF alone (Table 48). In treatments receiving compost of*Chromolaenaodorata*(2/3) + FYM (1/3) @ 7.5 t ha^{-1} + RDF (T5), compost of*Chromolaenaodorata* (50%) + leaf litter (50%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T4),*Chromolaenaodorata* (90%) + cow dung slurry (10%) + microbial consortium @ 7.5 t ha^{-1} + RDF (T2) and*Chromolaenaodorata*(90%) + cow dung slurry (10%) + microbial consortium + rock phosphate (2.5% of P) @ 7.5 t ha^{-1} + RDF (T3), B: C ratio was pretty higher (1.33 to 1.51) as compared to RDF + FYM (1.18). This suggested that use of weeds' compost particularly *Chromolaena* can be used in place of FYM, as it resulted in similar yield, gross returns and net returns comparable to FYM, which is becoming costly and not available easily. As observed in the present study, Manjappa and Koppada (2002) also observed similar returns by use of weeds' compost in rice crop, while in sprouted rice (Anonymous, 2004), aerobic rice (Denesh, 2008), transplanted rice, finger millet at Karnataka (Anon., 2004), *Chromolaena* weed as green manure have resulted in higher productivity and returns.

IV. CONCLUSION

This study indicated the utility of weeds' bio -mass, which are easily accessible, as compost, which could be alternative to FYM and save cost of nutrients. In addition *Chromolaena's* compost along with fertilizer dose gave slightly superior benefits in terms of groundnut crops' yield and monetary benefits as compared to use of traditional FYM in the present study.

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Table. 1. Effect of combinations of *Chromolaena's* compost along with recommended dose of fertilizer on total dry matter production/plant (g) in groundnut at different stages.

	Treatments	Stages			
		30 DAS	60 DAS	90 DAS	At harvest
T1	Compost of*Chromolaenaodorata*(90%) + Cow dung slurry (10%) @ 7.5 t ha^{-1}+RDF.	3.7	16.3	30.5	57.6
T2	Compost of*Chromolaenaodorata* (90%) + Cow dung slurry (10%) + Microbial consortium @ 7.5 t ha^{-1}+ RDF.	5.7	21.0	36.0	61.9
T3	Compost of*Chromolaenaodorata*(90%) + Cow dung slurry (10%) + Microbial consortium +Rock phosphate (2.5% of P) @ 7.5 t ha^{-1}+RDF.	6.6	26.6	44.6	71.3
T4	Compost of*Chromolaenaodorata* (50%) + Leaf litter (50%) +Microbial consortium @ 7.5 t ha^{-1}+RDF.	4.9	21.4	35.1	60.7
T5	Compost of*Chromolaenaodorata*(2/3) +FYM (1/3) @ 7.5 t ha^{-1}+RDF.	5.9	21.8	39.5	67.6
T6	Compost of*Chromolaenaodorata*+ Forest soil (2 layers of 2 cm) + Microbial consortium @ 7.5 t ha^{-1}+ RDF.	3.0	16.8	31.2	55.9
T7	Vermi compost +*Chromolaenaodorata*(50%) + Leaf litter (50%) @ 7. 5 t.ha^{-1}+ RDF.	3.0	14.8	23.7	45.3
T8	Compost of *Lantana camara*(30%)+ *Glyricidiamaculata*- leaf (30%) + Cow dung (10%) + Leaf litter (30%) @ 7.5 t ha^{-1}+RDF.	2.7	15.5	27.8	53.7
T9	RDF + FYM 7. 5 t ha^{-1}	4.3	16.9	31.6	56.7
T10	RDF alone (25 N : 75 P_2O_5 : 37.5 K_2O kg ha^{-1})	1.6	14.1	22.3	35.3
T11	Unfertilized control (absolute control)	1.1	8.83	13.9	22.9
	" F" test	*	*	*	*
	S .Em ±	0.58	1.81	2.81	3.5
	CD ($P \leq 0.05$)	1.72	5.34	9.33	11.63

RDF = Recommended dose of fertilizer, 25 N : 75 P_2O_5 : 37.5 K_2O kg ha^{-1}
DAS = Days after sowing

Table. 2. Effect of combinations of *Chromolaena's* compost along with recommended dose of fertilizer on pod yield (kg ha^{-1}), haulm yield (kg ha^{-1}), and harvest index in groundnut.

Treatments		Pod yield (kg/ha)	Haulm yield (kg/ha)	Harvest index
T1	Compost of *Chromolaena odorata* (90%) + Cow dung slurry (10%) @ 7.5 t ha^{-1} +RDF.	2516	2658	0.48
T2	Compost of *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial consortium @ 7.5 t ha^{-1} + RDF.	2777	2753	0.50
T3	Compost of *Chromolaena odorata* (90%) + Cow dung slurry (10%) + Microbial consortium +Rock phosphate (2.5% of P) @ 7.5 t ha^{-1} +RDF.	2896	2990	0.49
T4	Compost of *Chromolaena odorata* (50%) + Leaf litter (50%) +Microbial consortium @ 7.5 t ha^{-1} +RDF.	2777	2890	0.48
T5	Compost of *Chromolaena odorata* (2/3) +FYM (1/3) @ 7.5 t ha^{-1} +RDF.	2801	2896	0.49
T6	Compost of *Chromolaena odorata* + Forest soil (2 layers of 2 cm) + Microbial consortium @ 7.5 t ha^{-1} + RDF.	2326	2539	0.47
T7	Vermi compost + *Chromolaena odorata* (50%) + Leaf litter (50%) @ 7. 5 t ha^{-1} + RDF.	2041	2397	0.45
T8	Compost of *Lantana camara* (30%) + *Glyricidia maculata* - leaf (30%) + Cow dung (10%) + Leaf litter (30%) @ 7.5 t ha^{-1} +RDF.	2041	2468	0.45
T9	RDF + FYM 7. 5 t ha^{-1}	2682	2805	0.48
T10	RDF alone (25 N : 75 P_2O_5 : 37.5 K_2O kg ha^{-1})	1301	2014	0.39
T11	Unfertilized control (absolute control)	1083	1764	0.38
	"F" test	*	*	*
	S.Em ±	240	504	0.01
	CD ($P \leq 0.05$)	534	1120	0.02

RDF = Recommended dose of fertilizer, 25 N : 75 P_2O_5 : 37.5 K_2O kg ha^{-1}

DAS = Days after sowing

Table. 3. Economics of groundnut as influenced by various combinations of *Chromolaena's* compost and fertilizer.

Treatments		Total cost of cultivation ` ha^{-1}	Gross returns ` ha^{-1}	Net returns ` ha^{-1}	B:C ratio
T1	Compost of*Chromolaenaodorata*(90%) + Cow dung slurry (10%) @ 7.5 t ha^{-1}+RDF.	13,557	30,192	16,635	1.22
T2	Compost of*Chromolaenaodorata* (90%) + Cow dung slurry (10%) + Microbial consortium @ 7.5 t ha^{-1}+ RDF.	13,653	33,324	19,671	1.44
T3	Compost of*Chromolaenaodorata*(90%) + Cow dung slurry (10%) + Microbial consortium +Rock phosphate (2.5% of P) @ 7.5 t ha^{-1}+RDF.	13,836	34,752	20,916	1.51
T4	Compost of*Chromolaenaodorata* (50%) + Leaf litter (50%) +Microbial consortium @ 7.5 t ha^{-1}+RDF.	13,657	33,324	19,667	1.44
T5	Compost of*Chromolaenaodorata*(2/3) +FYM (1/3) @ 7.5 t ha^{-1}+RDF.	14,407	33,612	19,205	1.33
T6	Compost of*Chromolaenaodorata*+ Forest soil (2 layers of 2 cm) + Microbial consortium @ 7.5 t ha^{-1}+ RDF.	13,667	27,912	14,245	1.04
T7	Vermi compost +*Chromolaenaodorata*(50%) + Leaf litter (50%) @ 7. 5 t.ha^{-1}+ RDF.	13,757	24,492	10,735	0.78
T8	Compost of *Lantana camara*(30%)+ *Glyricidiamaculata*-leaf (30%) + Cow dung (10%) + Leaf litter (30%) @ 7.5 t ha^{-1}+RDF.	13,774	24,492	10,718	0.77
T9	RDF + FYM 7. 5 t ha^{-1}	14,725	32,184	17,459	1.18
T10	RDF alone (25 N : 75 P_2O_5 : 37.5 K_2O kg ha^{-1})	11,377	15,612	4,235	0.37
T11	Unfertilized control (absolute control)	8,689	12,996	4,307	0.49

Data are averaged over replications and not analysedstasticaly

