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Utilization of Eupatorium (*Chromoleana odorata*), an obnoxious weed as green leaf manure in enhancing rice productivity

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Abstract: *A field experiment was conducted during kharif seasons of 2002 and 2003 at Agricultural Research Station (Paddy), Sirsi to know the effect of eupatorium as green leaf manure in combination with graded levels of inorganic fertilizers on rice yield and profitability. On an average over two years, application of 100 % recommended dose of fertilizer (RDF) recorded maximum grain yield, straw yield and net returns followed by 50% RDF and no fertilizer which were differing significantly from one another. The grain yield recorded with application of eupatorium @ 10 t/ha (6735 kg/ha) was found to be on par with that of 20 t/ha (6929 kg/ha) and 15 t/ha (6915 kg/ha). The trend in net returns was almost similar to that of grain yield. Whereas, the straw yield recorded with eupatorium @ 10 t/ha (6205 kg/ha) was found to be on par with that of 15 t/ha (6130 kg/ha) only. The data on interaction indicates that the grain yield and net returns recorded with combination of eupatorium @ 20 t/ha + 100% RDF, eupatorium @ 15 t/ha + 100% RDF, eupatorium @ 10 t/ha + 100% RDF, eupatorium @ 10 t/ha + 50% RDF and eupatorium @ 15 t/ha + 50% RDF.*

Key Words: *Eupatorium, fertilizer, grain yield, straw yield, returns,*

I. Introduction

Eupatorium (*Chromoleana odorata*) an obnoxious weed found in abundance in the North Kanara district of Karnataka has become a menace in younger plantations, waste lands and along road sides. This weed is also known to cause diseases in animals and human beings [1]. Considering its adverse impact on the environment, several attempts have been made to control this weed by adopting various methods. But, none of the methods showed great promise in controlling this weed. Under this juncture, few efforts were made to find out alternate ways for controlling/minimizing this weed menace. One of the environmentally friendly ways to eradicate this weed would be its utilization for productive purposes in agriculture. One of the ways of using eupatorium is as green leaf manure before its seed setting [2]. Further, the N, P and K content of eupatorium is quite comparable to other conventional green manure crops like sunnhemp, and glyricidia [3]. Hence an effort has been made in this investigation to find out the effect of eupatorium as green leaf manure on rice productivity.

II. Materials and Methods

A field experiment was conducted during kharif seasons of 2002-03 and 2003-04 at Agricultural Research Station (Paddy), Sirsi to know the effect of eupatorium as green leaf manure in conjunction with inorganic fertilizers on productivity of paddy. The experiment was laid out in split plot design with three replications. The different levels of eupatorium (no eupatorium, eupatorium @ 5, 10, 15 and 20 t/ha) were allotted to main plot treatments and the levels of inorganic fertilizers (no fertilizer, 50% and 100% RDF) to sub plots. The recommended dose of fertilizer (RDF) used for paddy was 75:75:87.5 kg N, P_2O_5 and K_2O per ha. The fresh and succulent eupatorium was incorporated into the soil two weeks before planting as per the treatments. Before incorporation, the eupatorium was chopped into 2-3 pieces by using sickle. 25 days old seedlings of ruling rice variety Abhilash with duration of about 150-155 days were used for planting. The crop was grown as rainfed transplanted rice. In treatments having inorganic fertilizer levels, 50 per cent each of N and K and entire dose of P was applied as basal dose at the time of transplanting. The first top dressing was done with 25 per cent of N and remaining 50 per cent of K at 25 days after transplanting. The crop was second top dressed with remaining 25 per cent of N at 50 days after transplanting. The crop was harvested when it attained maturity and yield per ha was calculated based on the net plot yield. Based on the prevailing market prices, gross and net returns were worked out. The individual years and as well as pooled data was analyzed statistically as per the split plot design under M-STAT-C programme.

III. Results and Discussion

3.1 Effect of inorganic fertilizers on grain and straw yield

The grain and straw yields were influenced significantly by the application of different inorganic fertilizer levels during the both the years as well as in pooled data. During 2003 and in pooled data, application of 100% RDF recorded significantly higher grain yield (7507 and 7147 kg/ha, respectively) when compared to 50% RDF

(6626 and 6644 kg/ha, respectively) and no fertilizer (5614 and 5653 kg/ha). The results are in conformity with Katyal and Gangwar [4]. Whereas, in 2002, the grain yield recorded with 100% RDF (6788 kg/ha) and 50% RDF (6661 kg/ha) were on par but significantly superior over no fertilizer (5691 kg/ha). The straw yield was maximum with application of 100% RDF followed by 50% RDF and no fertilizer during both the years as well as in pooled data (Table 1). The net returns realized with 100% RDF and 50% RDF were on par with each other but significantly superior over no fertilizer in individual years (Table 3). Whereas, in pooled data, these treatments are differing significantly from one another. This clearly indicates that the rice responds for higher level of fertilizer application.

1.2 Effect of eupatorium on grain and straw yield

The grain and straw yields were also influenced significantly by the application of different levels of eupatorium during both the years as well as in pooled data (Table 1). The grain yields recorded with application of eupatorium at 10 t/ha (6569, 6900 and 6735 kg/ha, respectively), 15 t/ha (6651, 7180 and 66915 kg/ha, respectively) and 20 t/ha (6487, 7370 and 6929 kg/ha, respectively) were found to be on par with each other during 2002, 2003 and in pooled data. The response of rice in terms of straw yield to application of eupatorium was different in different years. During both the years as well as in pooled data, the maximum straw yield was recorded with eupatorium @ 20 t/ha. However, the straw yield recorded with this level (eupatorium @ 20 t/ha) was found to be on par with that of eupatorium at 10 t/ha (6132 kg/ha) during 2002 and with both 10 t/ha (6280 kg/ha) and 15 t/ha (6130 kg/ha) during 2003. The trend in net returns realized with application of eupatorium was almost similar to that of grain yield (Table 3). This data clearly indicated that the response of rice was maximum up to 10 tonnes per ha of eupatorium. Thereafter, there was not much influence of eupatorium in increasing rice grain yield.

3.3 Interaction effect of inorganic fertilizers and eupatorium

The 'F' test indicates that the interaction effect of eupatorium levels and chemical fertilizers was found to be non significant with respect to grain and straw yield as well as gross and net returns. Similar results were obtained by Chandra and Pareek [5]. However, the DMRT test clearly indicates that there was significant difference in these parameters recorded with different combinations of inorganic fertilizer and eupatorium levels. On an average over two years, the maximum grain yield was recorded with combination of eupatorium @ 20 t/ha + 100% RDF (7582 kg/ha) and was found to be on par with that of eupatorium @ 15 t/ha + 100% RDF (7555 kg/ha), eupatorium @ 10 t/ha + 100% RDF (7327 kg/ha), eupatorium @ 10 t/ha + 50% RDF (7043 kg/ha) and eupatorium @ 15 t/ha + 50% RDF (7030 kg/ha) (Table 2). Similarly, the net returns realized with eupatorium @ 15 t/ha + 100% RDF (Rs. 33977/ha), eupatorium @ 20 t/ha + 100% RDF (Rs. 33346/ha), eupatorium @ 10 t/ha + 100% RDF (Rs. 32708/ha), eupatorium @ 10 t/ha + 50% RDF (Rs. 31448/ha) and eupatorium @ 15 t/ha + 50% RDF (Rs. 30547/ha) were found to be on par with each other. This clearly indicates that inorganic fertilizers can be restricted to 50% if eupatorium is used as green manure even at 10 t/ha in combination with inorganic fertilizers. Salik Ram and Sanjoy Saha [6] recorded higher grain yield, straw yield, gross return and net return per rupee investment when different types of organics (farm yard manure, green manure and poultry manure) were applied with chemical fertilizer in 50:50 ratio compared to fertilizer alone. At Palampur, pooled analysis of rice over years indicated that 100% dose of recommended NPK through fertilizers was on par with 50% RDF plus 50% nitrogen through green manure [7]. Raju and Reddy [8] recorded similar results on rice with the application of sesbania green leaf manure.

IV. Conclusions

Escalating costs of inorganic fertilizers on one hand and their undesirable impacts on soil health on the other hand call for immediate inclusion of organic sources in crop production. At this juncture, the present study showed that eupatorium (*Chromolaena odorata*), an obnoxious weed found in abundance all along roadsides, waste lands and in forest area can be used as green leaf manure in rice cultivation as it was found to increase yield of rice.

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Table 1: Effect of different levels of eupatorium and inorganic fertilizers on grain and straw yield of rice

Treatments	Grain Yield (kg/ha)			Straw yield(kg/ha		
	2002	2003	Pooled	2002	2003	Pooled
Inorganic Fertilizer levels						
No Fertilizer	5691	5614	5653	5061	4746	4903
50% RDF	6661	6626	6644	5770	5727	5748
100% RDF	6788	7507	7147	6585	7001	6793
S.Em±	**95**	**199**	**110**	**160**	**210**	**132**
C.D. at 5%	**373**	**780**	**359**	**628**	**824**	**430**
Organic Manures						
No eupatorium	5958	5457	5707	4716	4584	4650
Eupatorium @ 5t/ha	6235	6005	6120	5470	4983	5227
Eupatorium @ 10t/ha	6569	6900	6735	6132	6280	6206
Eupatorium @ 15t/ha	6651	7180	6915	5989	6271	6130
Eupatorium @ 20t/ha	6487	7370	6929	6719	7005	6862
S.Em±	**133**	**177**	**111**	**213**	**284**	**178**
C.D. at 5%	**388**	**516**	**315**	**622**	**830**	**505**

Table 2: Interaction effect of eupatorium levels and inorganic fertilizers on grain and straw yield of rice (Average of two years; pooled)

Organic Manures / Inorganic fertilizer levels	Grain Yield (kg/ha)			Straw yield(kg/ha		
	No Fertilizer	50% RDF	100% RDF	No Fertilizer	50% RDF	100% RDF
No eupatorium	4780	5883	6459	3924	4500	5525
Eupatorium @5t/ha	5229	6316	6814	4352	5365	5963
Eupatorium @10t/ha	5834	7043	7327	5076	6300	7243
Eupatorium @15t/ha	6161	7030	7555	4992	5643	7754
Eupatorium @20t/ha	6258	6946	7582	6172	6932	7481
S.Em±	**192**			**308**		
C.D. at 5%	**NS**			**NS**		

Table 3: Effect of different levels of eupatorium and inorganic fertilizers on economics of rice

Treatments	Gross returns (Rs./ha)			Net returns (Rs./ha)		
	2002	2003	Pooled	2002	2003	Pooled
Inorganic Fertilizer levels						
No Fertilizer	36397	35625	36012	24053	23281	23667
50% RDF	42404	42172	42288	28815	28583	28699
100% RDF	43920	48287	46103	29087	33454	31271
S.Em±	**436**	**1242**	**658**	**436**	**1242**	**658**
C.D. at 5%	**1712**	**4875**	**2146**	**1712**	**4875**	**2146**
Organic Manures						
No eupatorium	37544	34596	36071	24955	22008	23482
Eupatorium @ 5t/ha	39761	38008	38885	26672	24920	25796
Eupatorium @ 10t/ha	42262	44232	43247	28674	30643	29659
Eupatorium @ 15t/ha	42569	45763	44165	28480	31674	30077
Eupatorium @ 20t/ha	42400	47539	44969	27811	32950	30381
S.Em±	**877**	**1150**	**723**	**877**	**1150**	**723**
C.D. at 5%	**2560**	**3357**	**2055**	**2560**	**3357**	**2055**

Table 4: Interaction effect of eupatorium levels and inorganic fertilizers on economics of rice (Average of two years; pooled)

Organic Manures / Inorganic fertilizer levels	Gross returns (Rs./ha)			Net returns (Rs./ha)		
	No Fertilizer	50% RDF	100% RDF	No Fertilizer	50% RDF	100% RDF
No eupatorium	30306	36855	41050	18962	24265	27217
Eupatorium @5t/ha	33112	40105	43438	21268	27016	29105
Eupatorium @10t/ha	37163	45037	47541	24819	31448	32708
Eupatorium @15t/ha	38880	44307	49310	26037	30218	33977
Eupatorium @20t/ha	40592	45136	49180	27248	30547	33346
S.Em±	**1252**			**1252**		
C.D. at 5%						