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COMPARATIVE RESPONSE OF DIVERSE RICE VARIETIES TO GREEN MANURING (*Sesbania aculeata*)

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Abstract: An experiment to evaluate the effect of green manuring (*Sesbania aculeata*) on the yield of three cultivars (IR-6, KSK-282 and Basmati-370) of rice was conducted at the farm of Faculty of Agriculture, Gomal University Dera Ismail Khan, Pakistan. The green manuring significantly has increased paddy yield of fine variety of rice Basmati -370 while paddy yield of coarse varieties, IR- and KSK-282 was nonsignificant over control. Agro-economical analysis of paddy yield data of three rice varieties indicate that green manuring is economical only for fine rice varieties in intensive cropping system of rice-wheat in rice growing areas.

Keywords: Green manure, paddy yield, rice varieties, *Sesbania aculeata*.

INTRODUCTION

Rice (Oryza sativa L.) attains second place among cereal crop, both for acreage and production in the world. It is an important cereal next to wheat for domestic demands and it can be an effective weapon for increasing the foreign exchange however, its yield is low in Pakistan as compared to other countries [Khalid *et al.* 2003]. Paddy soils are usually deficient in organic matter because of high temperature and moisture, which causes rapid decomposition of organic matter. Green manures enhance organic matter as a benefit derived from the various benefits credited to green manure. The positive effect of green manure on paddy yield has been reported by Bhatti *et al*. [1983]. He reported that *Sesbania* green manuring substantially improved grain yield up to 72%. Intensive use of soil for crop production, increased use of chemical fertilizers, increased use of mechanical cultivation, burning of farm waste and crop residues unavailability of farm yard manure has caused shortage of organic matter in soils. This situation leads to deterioration of physical conditions of soils in rice belt. Sethi [1952] reported that green manuring increased the paddy yield and was the cheapest means of increasing yield of paddy. Efforts are required to improve soil conditions and increase low yield of rice per unit area to meet food requirements of ever increasing population of the world. Keeping in view the above facts, the present study was carried-out to determine the comparative response of green manuring on the yield of course and fine varieties of rice under the irrigated condition of NWFP, Pakistan.

MATERIALS AND METHODS

The experiment was conducted at the Farm of Faculty of Agriculture, Gomal University, Dera Ismail Khan, NWFP, Pakistan. The soil of the farm is clay loam and tube well irrigated. The climate of the area is arid. The rainfall during cropping season was 37 mm, 53 % average relative humidity, 25 °C average minimum temperature and 37 °C average maximum temperate. It was laid out in a Split plot Block Design having four replications with a net plot size of 4 m x 6 m for each treatment. Treatments comprised of green manuring (T) and no green manuring for three varieties viz. IR-6 KSK-282 & Basmati-370. Dhaincha (*Sesbania aculeata*) was sown as a green manure crop immediately after harvesting of wheat crop by single row drill with a seed rate of 32 kg ha^{-1}, which raised and buried 50 days after emergence but one day before transplanting the seedlings of rice. Nursery was sown in 25th May, 1987 and was transplanted on 25th June, 1987. A basal dose of 120 kg N, 90 kg P and 60 kg K ha^{-1} to coarse rice varieties i.e. IR-6 and KSK-282; and for fine rice variety a basal dose of 90 kg N and 60 kg P ha^{-1} was applied in the form of urea, single super phosphate & potassium sulfate. All the phosphorus and potash fertilizer and half dose of nitrogen was applied by broadcast before transplanting and remaining half dose of nitrogen was applied after one month. One-month-old seedlings were transplanted in standing water one seedling per hill. Normal cultural practices were applied to all the treatments equally. Ten plants in each treatment were randomly selected for recording the plant height, normal kernel percentage and 1000-grain weight. The IR-6 variety was harvested on 15 September, KSK-282 on Ist October and Basmate-370 on 15th October 1987. The green manuring has effect on date of harvesting it data was not in plan therefore it was not recorded. To observe the occurrence of sterility and normal kernels, a “Rice Kernel Quality Analyser” and seed working board were used. The kernels were then differentiated into various categories after getting ten randomly selected panicles from each treatment and sketching them using the standard method [Nagato and Chaudhry 1969]. The only means of sterility and normal kernel percentage from analysis of quality of kernel has been reported to summaries the result and discussion. The data were analyzed by ‘T test’ statistical package of Minitab at 5% probability level on each parameter of each variety of rice.

RESULTS AND DISCUSSION

Results presented in Table 1 show that green manuring has significant effect on plant height in IR-6 and KSK-282 while non-significant effect on Basmati-370. All varieties showed non-significant of green manuring on panicle per square meter, sterility percentage, 1000-grain weight and straw yield however normal kernel percentage and paddy yield in Basmati-370 was significantly increased over control. Green manuring

increased paddy yield over control (6.83 to 6.30 t ha^{-1}) 530 kg ha^{-1}, (6.92 to 6.30 t ha^{-1}) 620 kg ha^{-1} and (3.59 to 2.66 t ha^{-1}) 930 kg ha^{-1} of IR-6, KS-282 and Basmati-370, respectively. The improvement in paddy yield in Basmati-370 was higher than other two varieties. Percent increase in yield is less than the earlier reported by Bhatti *et al.* [1983]. While greater improvement in yield were noted in Basmati-370 than percentage recorded by Staker [1958]. Who reported 19.4% improvement with green manuring. Duhan *et al.* [2001] conducted a field experiment to study the effect of green manuring and nitrogen application on the yield and potassium nutrition under submerged rice cultivation. The highest rice grain yield (5.5 t ha^{-1}) was recorded with the combination of sunhemp as green manure (GM)+120 kg N ha^{-1}, whereas highest husk (2.4 t ha^{-1}) and straw (8.0 t ha^{-1}) yields were recorded with dhaincha as (GM)+120 kg N ha^{-1}. Application of GM, in general, increased the K uptake from 2.9 to 4.6 kg ha^{-1} in rice grain, and from 2.4 to 3.9 kg ha^{-1} in straw. Application of N also increased the K uptake by rice grain, husk and straw from 4.6 to 8.9, 3.9 to 6.8 and from 62.8 to 98.2 kg ha^{-1}, respectively. The yield obtained by this experiment is much higher than reported by Khalid *et al*. [2003] and Amin *et al.* [2004]. The past studies in this regard state that green manuring increased the paddy yield and was recorded cheapest means of increasing yield of paddy [Sethi 1952]. Azeez and Shafi [1964] reported that *Sesabiana aculeata* is the best green manure in the Kalar tract. They also reported that the combination of ammonium sulphate with Dhaincha was found better than green manuring or nitrogen alone. Moreover, they also reported that besides improving the yield, green manuring improved the nutritive value of rice and increased rice to paddy ratio. Chen and Chai [1972] observed in pot experiments, rice was grown on alluvial soils and the effect of applying various rates of rice straw and green manuring (soy bean stems), ammonium sulphate and changing the C:N ratio of soils were investigated. Rice yields decreased when 1% straw was applied. Application of green manure increased yield. Dargan *et al*. [1975] conducted an experiment on sodic soil having pH 9.2, by the application of nitrogen levels varying from 40-120 kg ha^{-1}. They observed that average rice grain yield improved considerably by nitrogen application on green manured plots compared to fallow plots, revealing increased nitrogen utilizes efficiency with *Sesbania aculeata* green manuring. Swarup [1986] conducted a field experiment in split plot design to evaluate the effect of 0, 1 and 2 week field sub-emergence before transplanting with and without green manure on yield and soil improvement, on a highly sodic soil with a plot size of 40 square metre. Gypsum was applied @ 10 tons ha^{-1} to all plots. *Sesbania aculeata* was grown as green manure and was incorporated 50 day after emergence. Urea @ 150 kg N ha^{-1} and Zinc sulphate @ 40 kg ha^{-1} were applied to all plots. The green manuring significantly enhanced yield with a yield of 7 tons ha^{-1} as compared to control yield 5 i.e tons ha^{-1}.

Table 1: Effect of green manuring on growth and yield components of rice varieties IR-6, KSK-282 and Basmati-370.

Components	Green Manure Treatments	VARIETIES IR-6	KSK-282	Basmati-370
Plant height (cm)	T	94.5 a	93.7 a	143.9 NS
	T_0	82.7 b	81.5 b	129.1 NS
Panicle m^{-2}	T	384.2 NS	361.0 NS	242.5 NS
	T_0	373.2 NS	376.0 NS	217.7 NS
Sterility (%)	T	10.8 NS	11.9 NS	11.0 NS
	T_0	13.4 NS	13.6 NS	15.4 NS
Normal Kernel (%)	T	91.0 NS	89.4 NS	93.1 a
	T_0	87.4 NS	84.6 NS	90.1 b
1000 grain wt. (g)	T	21.4 NS	21.2 NS	15.7 NS
	T_0	20.9 NS	20.8 NS	15.2 NS
Grain yield (t ha^{-1})	T	6.83 NS	6.92 NS	3.59 a
	T_0	6.30 NS	6.53 NS	2.66 b
Straw yield (t ha^{-1})	T	14.9 NS	13.1 NS	7.6 NS
	T_0	12.5 NS	12.3 NS	7.6 NS

1) Means not sharing a letter differ significantly at 5% level in a column.
2) NS means non significant difference at 5% level.

Table 2: Expenditure and Income by Green Manuring

(a) Extra expenditure per hectare for green manuring

	Rupees
1- Seed bed preparation	
i- Two ploughings	200/-
ii- labour	50/-
2- Sesbania seed 32kg/ha @ Rs.3/-	96/-
3- Labour charges for irrigation	75/-
4- Irrigation charges	300/-
5- Rotavation charges	200/-
Total Expenditure	921/-

(b) Profit and Loss per hectare with green manuring

1- Income from paddy yield.	
i. Coarse varieties.	
(IR-6)	
(6830-6300 kg) @ 1.35 per kg	715/-
Extra cost of green manuring	921/-
Loss	206/-
(KSK-282)	
(6920-6530 kg) @ 1.35	526/-
Extra cost of green manuring	921/-
Loss	394/-
ii- Fine variety (Basmati-370)	
(3590 –2660 kg) @ 2.55	2371/-
Extra cost of green manuring	921/-
Profit	1450/-

Singh [1982] reported that alkali soil (pH 10.4) were reclaimed by applying the 3 t gypsum ha in 1976 and ploughing in *Sesbania aculeate* grown as green manure crop in the summer season of 1977. The paddy grain yield of rice-wheat-rice grown with NPK and Zn were obtained in 1977-78. Rice cv IET2970, Saje and Jaya of medium duration and Saket-4, IET 1444 and Anupama of short duration gave high yields. In the present study short and medium varieties showed increased yield but was not significant at 5% level however long duration fine variety Basmati-370 showed significant increase in paddy yield which was economical and profitable as calculated below.

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