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Influence of Green Manuring on the Yield and Economics of Paddy

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ABSTRACT

Green manuring is an inexpensive, eco-friendly, effective technology in economizing the agricultural production system ensuring productive capacity of soil under mounting prices of fertilizers. Keeping this in view, Front Line Demonstrations were conducted in six different villages of Warangal district of Telangana state during kharif seasons of 2011, 2012 and 2013. The yield and net returns of paddy with Green manuring were calculated and compared with the corresponding farmer's practices (without green manuring). Dhaincha was grown and ploughed back as green manuring in paddy fields. Paddy fields with Green manuring recorded higher yields i.e. 69.6 q/ha , 68.7 q/ha and 68.9 q/ha continuously in all growing seasons 2011, 2012 and 2013 as compared to farmer's practices i.e. 59.6, 58.1 and 58.9 q/ha. The average yield increase was 17.4 per cent. In spite of increase in yield of paddy, technology gap, extension gap and technology index existed. The improved technology gave not only higher gross return (1, 02,660, 93,432 and 97149 Rs. /ha), but also higher net returns (63,634, 54,653 and 58,252 Rs. /ha), consequently benefit cost ratio was also higher (2.6, 2.4 and 2.4) as compared to farmer's practices. The reasons for low yields and net returns were attributed to the adoption of unscientific practices, lack of awareness about best technology available and poor socio economic condition of the farmer. This study revealed that maximised net returns through increased yields can be maintained on sustainable mode with the organisation of FLDs in farmer's fields as these FLDs will bring change in farmers attitude, skill and knowledge of improved package and practices of like green manuring.

Key words*: Economics of paddy, Green manuring and Yield.*

The modern agriculture concentrates only on maximisation of output but overlooks input efficiency as a result of which it has not been sustainable. Rice is staple food not only for India but also for South Asia (Singh *et al*. 2013). The declining trend in the productivity of rice crop has become the major concern for the farmers which is mainly due to decline in soil health (Singh *et al*. 2014). The loss of nutrients from the soils is mainly due to exhaustive cropping systems like rice-oilseeds or rice-maize. Recommended dose of NPK fertilizers alone does not sustain soil productivity under continuous intensive cropping (Kumar et al. 2009) where as inclusion of organic manures improve soil fertility and crop yields (Mogle 2014) and biological status of soil (Batra 2004). However integrated use of organics and in organics may improve the soil productivity and can sustain the desired yields of important exhaustive crops like rice. The use of organic sources like FYM is important source of nutrition to the agricultural crops but its availability is quite inadequate due to its alternative use as a fuel.As an alternative, green manure crops like Sunhemp (Crotoleria Juncea), dahaincha (Sesbania acculata) and Robinia (Robinia pseudoacacia) have advantage and proven ability to enhance the productivity of major cropping systems (Singh and Kumar, 2009). Keeping in view the constraints, DAATT Centre Warangal conducted front line demonstrations in paddy crop with dahaincha (*Sesbania acculata*) as Green manuring in under puddled condition.

MATERIAL AND METHODS

Front line demonstrations (FLDs) in paddy with Green manuring (Dahaincha) were conducted by DAATT centre, Warangal, during the period of 2011, 2012 and 2013 in six villages of Warangal district. In general soils of the area under study were sandy loam with low to medium fertility status. The components (Table1**)** in demonstration of technology in paddy comprised of adoption of improved variety released from university, green manuring with dahincha, proper land preparation, optimum seed rate and balance dose of NPK fertilizer (120:60:40 kg ha^{1}), proper irrigation, and timely management. The green manure crop (dahincha) sown @ 12 kg/acre during the first week

of June and ploughed back in soil at the time of flowering (45 days) stage with rotavator.

The total 09 ha area was covered in three consecutive years. In the demonstration, one control plot was also kept where farmers practices was carried out. The FLDs were conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The technology gap, extension gap and technological index (%) were calculated by using following formula as given below (Samui *et al.* 2000).

$$\text{Percent increase yield} = \frac{\text{Demonstration yield- farmers yield}}{\text{Farmers yield}} \times 100$$

$$\text{Technology gap} = \text{Potential yield-Demonstrated yield}$$

$$\text{Extension gap} = \text{Demonstrated yield} - \text{Yield under existing practice}$$

$$\text{Technology index} = \frac{\text{Potential yield - Demonstrated yield}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

The average yield and productive tillers of paddy in demonstration plots in three years (69.6, 68.7, 68.9 q/ha and 280, 273, 276 and tillers/m^2) respectively, were much higher than average yield and productive tillers of farmers practices (59.6, 58.1, 58.9 q/ha and 210, 241, 243 tillers/m^2). The average percentage increase in yield over farmer's practices was 16.7, 18.2 and 16.9 respectively in three years (Table 2). The results indicated that the front line demonstrations have given a good impact over the farming community of Warangal district as they were motivated by the new agricultural technologies applied in the FLD plots. This finding is in colloboration with the findings of Lal Singh *et al.* (2015).

Economics of frontline demonstrations

The input and output prices of commodities prevailed during the study were taken for calculating gross returns, cost of cultivation, net returns and benefit: cost ratio (Table 3). The cultivation of paddy under green manuring with dahincha gave higher net returns of Rs. average 58,846/- per hectare, as compared to farmer's practices Rs average 34,678/- per hectare. The benefit cost ratios of paddy under green manuring were 2.4 as compared to 1.6 under farmer's practices. This may be due to higher yields obtained under green manuring compared to local check (farmers practice). Farmer can also reduce the cost of cultivation by decreasing chemical application like fertilizers and insecticides with green manuring practice. This finding is in corroboration with the findings of Lekha *et al.* (1990) and Lal Singh *et al.* (2015).

Extension gap

Extension gap of 10, 10.6 and10 q/ha was observed during 2011, 2012 and 2013 respectively (Table- 4). On an average extension gap was observed 10.2q/ha which emphasized the need to educate the farmers through various extension means *i.e.* front line demonstrations for adoption of improved production and protection technologies, to reduce extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap. This finding is in corroboration with the findings of Dhananjai Singh *et al.* (2016).

Technology gap

The technology gap, the differences between potential yield and yield of demonstration plots were 10.4, 11.3 and 11.1 q/ha during 2011, 2012 and 2013 respectively (Table 4). On an average technology gap under three year FLDs programme was 10.9 q/ha. The technology gap observed may be attributed to decreased soil fertility status, lack of awareness about improved agricultural practices and unfavourable local climatic situation.

Technology index

The technology index shows the feasibility of the technology to be demonstrated at the farmers field. The technology index varied from 13, 14.1 and13.8 per cent (Table 4). Average technology index observed was 13.6 per cent during the study period, which shows the efficacy or good performance of technical interventions. This will

Table1. Differences between farmers' practices and technological intervention for paddy crop.

Particulars	Demonstration	Farmers' Practice
Variety	Improved seed of university	Seed from private company
Land preparation	Tractor with four wheel drive with rotavator used	Heavy tractor with cage wheel used
Greenmanuring	Dahincha 12 kg /acre	-
Fertilizer dose(kg/ha)	120:60:40 kg ha^1	140:70:20 kg ha^1
Visual observation	healthy growth noticed	Sick appearance
Nutrient details	No micronutrient deficiency were observed	Severe Zinc deficiency was noticed
Irrigation	Rotational irrigation was given Up to tillering later water depth 3-5cm maintained.	Water depth 5cm from the date of transplanting maintained.
Weed management	Initially weedicides were used, one manual weeding with 3 labour	Twice manual weeding @ 8 labour every time.

Table 2. Yield and yield attributing character of paddy under farmers' practice and front line demonstration.

Year	Trial (No.)	Area of each demonstration (ha)	Average yield (q/ha)		Per cent increase in yield	Productive tillers /m^2	
			Trial	Farmers practice		Trial	Farmers practice
2010 -11	6	0.5	69.6	59.6	16.7	280	210
2011 -12	6	0.5	68.7	58.1	18.2	273	241
2012-13	6	0.5	68.9	58.9	16.9	276	243
Total/Average	6	0.5	69.1	58.9	17.2	276	231

Table 3. Economics of frontline demonstrations (rounded to nearest rupee).

Variables		Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
Farmers Practices	2010 -11	48,906	87,910	39,004	1.7
	2011 -12	48,535	79,016	30,481	1.6
	2012-13	48499	83049	34550	1.7
	Average	48647	83325	34678	1.6
Trial	2010 -11	39,026	1,02,660	63,634	2.6
	2011 -12	38,779	93,432	54,653	2.4
	2012-13	38897	97149	58252	2.4
	Average	38900	97747	58846	2.4

Price of paddy in 2011= Rs1475/-, In 2012- Rs 1360/- and In 2013- Rs 1410/-

Table 4. Technology & Extension gap and Technological Index of cotton under FLDs.

Year	Trial (No.)	Area (ha)	Technology gap (q/ha)	Extension gap (q/ha)	Technological index (%)
2010 -11	6	0.5	10.4	10	13
2011 -12	6	0.5	11.3	10.6	14.1
2012-13	6	0.5	11.1	10	13.8
Total/Average	6	0.5	10.9	10.2	13.6

accelerate the adoption of demonstrated technical intervention to increase the yield and net returns of paddy.

CONCLUSION:

Thus from the above FLD it was concluded that adopting Green manuring with dahaincha (*Sesbania acculata*) in paddy fields will not only maintain soil health on sustainable manner but also increase paddy yields and net returns to farmer. This practise will also reduce the load of chemicals in paddy cultivation which in turn minimise soil and environment pollution and reduce cost of cultivation.

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