



Effect of green manuring on growth, yield, economics of rice production and its influence on soil fertility status of East Kameng, Arunachal Pradesh, India

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ABSTRACT

Front Line Demonstrations with introduction of green manuring crop Dhaincha (*Sesbaniastrata*) has been conducted by Krishi Vigyan Kendra, East Kameng district, Arunachal Pradesh, India. The soil was slightly acidic in reaction (pH 5.5 to 6.0), sandy loam in texture with rich in organic matter content, medium in phosphorous and potash content. *Sesbania* were sown @ 45 kg/ha. 8 weeks old green manuring crops were chopped into pieces and incorporated in the soil. With the incorporation of green manure crop, average rice yield was increased 25.5%. The average net return was recorded to be Rs. 29177, against the average net return of farmers' practice of Rs. 20863. The Organic Carbon content (%) and Available Nitrogen content (kg/ha) was increased considerably due to incorporation of green manure in rice field.

Keywords : Rice, *Sesbania*, Yielded, Available Nitrogen Content, Organic Carbon

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INTRODUCTION

Rice being one of the principal food crops, is the staple food of over half of the world's population. It is the basic food crop and being a tropical plant, it flourishes comfortably in hot and humid climate (Singhet *et al.*, 2013). India has the largest area under rice cultivation, by virtue of this; rice is the second largest producer and consumer of rice in the world. (Singh *et al.*, 2017). Rice is mainly grown in rain fed areas that receive heavy annual rainfall. That is why it is fundamentally a *kharif* crop in India, however is also grown through irrigation in those areas that receives comparatively less rainfall. Rice is one of the major cereal crops of East Kameng district of Arunachal Pradesh occupying an area of 8,968 ha with average production of 13,631 MT and average productivity is 1520 kg/ha during 2013-14 which is far below the productivity of rice growing states of India and national average productivity (Kalita *et al.*, 2015).

Poor rice productivity in the district may be due to use of age old production practices. Moreover, farmers of the district are unaware about improved package and practices released by different research institutions and not willing to use chemical fertilizer even if it is made available to them (Singh and Kumar, 2009).

After introduction of high yielding varieties it becomes essential to provide nutrients in order to enhance the productivity of rice. Front line demonstrations were conducted to demonstrate the production potential of

released proven technologies in farmer's field under real farming situation and the available technologies should reach the farmers (Mitra *et al.*, 2014). Indeed knowledge dissemination through FLD programme has increased level of knowledge among participant farmers as compared to non-participant farmers to a significant level (Singh and Sharma, 2004 and Sagar and Ganesh, 2003). This shows positive impact of front line demonstration on yield and knowledge of the farmers (Singh *et al.*, 2007).

Out of 12,229 ha of net cropped area of East Kameng district of Arunachal Pradesh maximum area i.e. 8,267 ha (2010-11) is under traditional rice, mostly cultivated as rainfed crop during *kharif* season. The productivity of rice in the district is low due to lack of adoption of high yielding varieties and other improved technology as well as due to lack of scientific know-how. With an objective to improve rice production and productivity, KVK of East Kameng district, front line demonstration (FLD) Programme has been conducted entitled "Effect of Green manuring on Grain Yield of rice" in three villages *viz.* Pampoli, Jayanti and Watte villages of Seppa in two consecutive years i.e. 2014-15 and 2015-16 in the farm land of same farm families. Impact analysis of Front Line Demonstrations (FLD's) of rice on yield, economic returns, level of knowledge and adoption of demonstrated technology has been carried out.

MATERIALS AND METHODS

The study was carried out through front line demonstrations (FLD) during *kharif* seasons of 2014-15 and 2015-16 in 3 villages of East Kameng district of Arunachal Pradesh with the active participation of farmers after different extension approaches through regular field visit and interpersonal communication made by the scientists of Krishi Vigyan Kendra, East Kameng. The soil of the study area was slightly acidic in reaction (pH 5.5 to 6.0), sandy loam in texture with

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rich in organic matter content, medium in phosphorous and potash content. Seeds of green manuring crop *Sesbania rostrata* were sown during the month of May using seed rates of 45 kg /ha 8 weeks old green manuring crops were chopped into pieces and incorporated in the soil. After that the seedlings of rice were transplanted and followed all management practices in proper times starting from land preparation to crop harvest. Observations on different yield parameters were taken and economic analysis was done. Harvest index was the relationship between economic yield and biological yield. It was calculated by using the following formula:

$$\text{Harvest index (\%)} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

The soil was analysed for organic carbon and available nitrogen at the end of each year after harvest of rice. Tabular analysis involving simple statistical tools like

1. Extension gap=Yield through demonstration - Farmers practice yield
2. Effective gain=Additional return-Additional cost
3. Technology gap= Potential yield of variety-Demonstration yield
4. Additional return=Return through FLDs - Return through Farmers practices
5. Incremental B: C ratio = Additional return/ Additional cast
6. Technology index= Demonstration yield/ Potential yield x 100

RESULTS AND DISCUSSION

Growth and Development

Knowledge level of respondent farmers on different parameters of improved rice production technologies were measured and compared by applying dependent 'T' test. The green manuring practice produced (Fig.1) higher plant height

Table 1: Effect of green manuring on yield of rice

Year	Grain yield ((t/ha)		Straw yield (t/ha)		Harvest index (%)		% of increase in grain yield
	Demo	Farmers practice	Demo	Farmers practice	Demo	Farmers practice	
2014 -15	3 .2 4	2 .68	3 .30	2 .78	49.54	49.08	20.90
2015 -16	3 .16	2 .42	3 .2 2	2 .84	49.55	46.01	30.58
Mean	3 .20	2 .55	3 .2 6	2 .81	49.54	47.57	25.49

Changes in Soil Fertility Status

The organic carbon status of the soil (Table 2) increased after the harvest of rice at the end of each year. The brown manure practice contributed to an increase of 0.25% of organic carbon content after the harvest of rice. Such an increase in organic carbon content is attributed to the accumulation of root residues and shedding of leaves by the leguminous crops

Table 2: Effect of green manuring on soil organic carbon and post-harvest available nitrogen

Year	Organic carbon content (%)			Available N content (kg/ha)		
	Initial	After harvest	Increase	Initial	After harvest	Increase (%)
2014 -15	1.2	1.4	0.2	481	543.65	13.02
2015 -16	1.3	1.6	0.3	486.38	545.29	12.11
Mean	1.25	1.5	0.25	483.69	544.47	12.57

(112.8 cm), number of tillers per hill (36), average filled grains per panicle (155) and test weight (27.2 g) in comparison to farmers practice. This was in agreement with findings of Gill and Wallia (2014). This shows positive impact of front line demonstration on knowledge of the farmers. The results so arrived might be due to the concentrated efforts made by the field functionaries.

Grain yield, straw yield and harvest index

The difference in technology gap during different years could be due to more feasibility of recommended technologies in different districts and variability in climatic conditions. Similarly, the technology index for all the demonstrations were in accordance with technology gap. Higher technology index reflected the insufficient extension services for transfer of technology. Result of front line demonstrations (Table 1) indicated that the mean yield of rice was 3.2 t/ha which was 25.49% more than that of farmer's practices. The straw yield (3.26t/ha) was also higher than the farmers practice with higher harvest index of 49.54%. This might be due to higher tillers and grain production. This might be due to higher tillers and grain production.

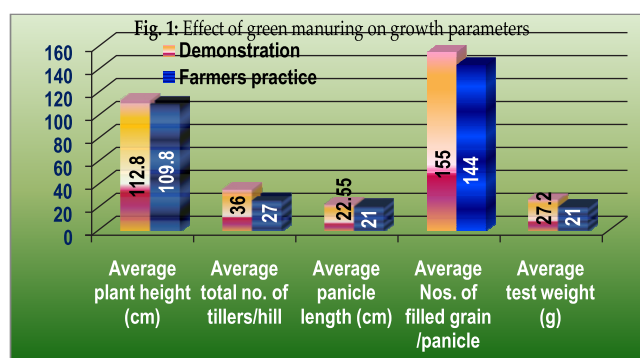


Fig. 1: Effect of green manuring on growth parameters

(Singh and Kumar, 2009). The initial available nitrogen status of the soil was 483.69 kg/ha. Progressive increase in available nitrogen status after each year was observed with incorporation of dhaincha which could sustain soil fertility. Thus the FLD might have positive impact on fertility (Mondal et al., 2005).

Economics of demonstrate Technology:

Different variables like seed, labour, bio fertilizers and pesticides were considered as cash inputs for the demonstrations as well as farmers practice. Effect of demonstration also observed in economic front too (Table 3). Higher gross return (Rs. 47569), higher net return (29177) and

higher B: C ratio (2.59) was recorded as compared to farmer's practices. The variation in net return and benefit-cost ratio may be attributed to the variation in the price of inputs and produce. These findings are also supported by the findings of [Nirmala et al., 2012](#).

Table 3: Economic performance of rice

Year	Demonstration				Farmers practice			
	Cost of cultivation	Gross return	Net return	B:C ratio	Cost of cultivation	Gross return	Net return	B:C ratio
2014 -15	17898.00	47364.00	29466.00	2.65	16897.00	39228.00	22331.00	2.32
2015 -16	18886.00	47774.00	28888.00	2.53	17567.00	36962.00	19395.00	2.10
Mean	18392.00	47569.00	29177.00	2.59	17232.00	38095.00	20863.00	2.21

Looking at the success of the technology, the farmers of the nearby villages are showing interest in green manuring especially the farmers cultivating rice. Using this technology the farmers could harvest good yield from their crop. Presently many farmers are approaching the beneficiary farmers and the KVK for seeds of Dhaincha. Thus, vertical as well as horizontal spread of the technology has been observed in the district.

CONCLUSION

Concept of FLD has been instrumental in enhancing yield to the extent of the straw yield (3.26t/ha) was also higher than the

farmers practice with higher harvest index of 49.54%. The results so arrived might be due to the concentrated efforts made by the field functionaries. FLD programme has helped in contributing to enhancement of improved rice production technology.

This can be seen as a positive indicator for formulating an objective specific and extensive FLD programme to train and educate farmers about improved rice production practices through 'working by doing' and 'doing by learning' for ensured higher rice production in the region.

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