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Yield Gap Analysis of *Kharif* Groundnut Cultivation Through Front Line Demonstration in Plateau Ecosystem

S.K. Nath* and K.C. Barik
Krishi Vigyan Kendra, Orissa University of Agriculture and Technology, Deogarh - 768 119, Orissa.

This study was undertaken in Deogarh district of Orissa coming under North-Western plateau agro climatic zone. Front Line Demonstration on groundnut was taken by Krishi Vigyan Kendra, Deogarh during *kharif* season from 2007-08 to 2010-11 for fifty farmers. Timely sowing, interculture with integrated nutrient management (INM) practices like application of Paper Mill Sludge (PMS) 5q ha^{-1}, gypsum 2.5q ha^{-1} and recommended dose of fertiliser were found the factors behind the average yield gap of 3.9q ha^{-1}. It was observed that the BC ratio was 1.76 for farmers' practice and was 2.14 for recommended practice during 2010-11. Farmers perceived the variety and time of sowing were the major factors contributing to yield gap.

Key words: Groundnut, Yield gap, Net return, Sustainability, BC ratio

India has the fourth largest edible oil economy of the world after United States, China and Brazil. The per capita consumption of edible oil of every Indian was 14.5 kg per annum (2008-09) which was double than that of early nineties. During 2009-10 India imported about 8 million tonnes of edible oil worth 25000 crores. Though India's status in oilseed production has been increased after the launch of Technology Mission on Oilseeds in 1986, yet the productivity as a whole could not be able to meet the growing demand (Hegde, 2010).

Groundnut, mustard, sesamum, niger, sunflower, safflower, linseed are the major oilseed crops cultivated in Orissa. Groundnut, as the principal oilseed crop, contributes 1.41% of net cultivated area of the state, i.e. 83 thousand ha (2008-09) with an average yield of 11.56q ha^{-1} (Anonymous, 2008-09). It is cultivated in *kharif* and post *rabi* seasons of the year. Lack of assured irrigation facility in uplands has influenced the adoption of *kharif* groundnut cultivation in plateau eco-system. Deogarh district, present in North Western plateau agro-climatic zone of Orissa (21^0 31' 53'' N and 84^0 43' 2'' E) has 33% of cultivated area irrigated. 1060 ha of the district is covered by *kharif* groundnut whereas only 320 ha during *rabi* season (2009-10). The majority of the *kharif* groundnut growers belong to the class of 83% of farming community that are under small and marginal category. With the paucity of resources and lack of awareness on improved cropping practices among them, the farmers' productivity is below than the recommended practices which are popularised through frontline demonstrations. Keeping this in view, the present study was under taken with an objective of investigating the yield gap in *kharif* groundnut production technology.

*Corresponding author email: nathsk@rediffmail.com

Materials and Methods

The study was conducted in the *kharif* FLD (oilseed) groundnut programme of Krishi Vigyan Kendra (KVK), Deogarh from the consecutive years of 2007-08 to 2010-11 in the low elevation, high rainfall plateau agro-ecological situation. The programme was taken in Balirui, Asatnali, Akshyarasila and Aksyarapat villages of Deogarh district. During these four years, the FLD programmes were conducted for fifty farmers in twenty hactares of land. For conducting the FLD programme, one pre-FLD training on scientific groundnut cultivation mentioning the critical inputs and interventions to be taken, was organised by the KVK. The soil of the study area was acidic, sandy loam with a pH range of 5.4 to 6.2. Various parameters related to crop growth and yield were recorded from both the farmers practice (FP) and demonstrated recommended practice (RP). Yield, cost of cultivation, gross return and net return of individual farmers were recorded and yield gap and BC ratio were calculated. Sustainability index (SI) was worked out (Singh *et al*., 1990) as follows:

$$\text{Sustainability index (SI)} = \frac{Y_{mean} - SD}{Y_{max}} \times 100$$

Where Y_{mean} = mean seed yield (q/ha) over the years Y_{max} = maximum seed yield (q/ha) recorded in the years of study

SD = standard deviation

SI = Sustainability index expressed in percentage and the values less than 33per cent indicates technology is not promising; from 33% to 66%

indicates moderately sustainable; 66% and above indicates the technology is highly promising, sustainable and recommended for adoption.

Results and Discussion

The Front Line Demonstration on *kharif* groundnut cultivation has the objective to increase the productivity of the crop by critical interventions. The basic differences between the package of practices of *kharif* groundnut cultivation of the FLD and farmers practice are enumerated below in Table 1.

From Table 1 it can be summarised that the differences in management practices followed in groundnut cultivation makes the difference in yield reported in Table 2. From Table 2 it is observed that the demonstration yield was 9.6q ha^{-1} (2007-08) which was 23% more than the control (7.8q ha^{-1}). The highest yield was recorded during 2009-10 i.e. 16.6q ha^{-1} with the highest yield gap of 7.4q ha^{-1}. It may be concluded that timely sowing, interculture with INM practices like application of PMS 5q ha^{-1}, gypsum 2.5q ha^{-1} and recommended dose of fertiliser are the factors behind the yield gap. Sustainability index(SI) was 66.6% which clearly indicates that the technology demonstrated for increasing the productivity of groundnut is highly promising and more sustainable in its yield in the prevailing climatic condition. It can be found that the yield of the control plot also increased from 7.8q ha^{-1} (2007-08) to 10.7 q ha^{-1} (2010-11) during the study period. Increasing awareness on production technology of groundnut cultivation may be attributed for the cause.

Table 1. A comparison between FP and RP in FLD programme of *kharif* 2010-11

Particulars	Farmers' practice	Recommended practice
Variety	AK 12-24	TAG-24
Time of sowing	3rd week of July	1st week of July
Seed rate	150 kg ha^{-1}	125 kg ha^{-1}
Application of PMS	-	500 kg ha^{-1}
Application of gypsum	-	250 kg ha^{-1}
Application of fertiliser	20:10:10 NPK kg ha^{-1}	20:40:40 NPK kg ha^{-1}
Seed treatment	-	2g *vitavax power* kg^{-1} of seeds
Interculture	35 DAS	25 DAS
Plant protection measures	*Dithane-M-45*@ 3gm lit^{-1} once	Need based application of pesticides

Table 3 indicates the economic analysis in FLD plots in comparison to control plots .The average cost of production and returns were calculated on the prices of the prevailing period.

Table 2. Performance of *kharif* groundnut under FLD programme (cv: TAG-24)

Year	Area (ha)	No. of demonstrations	Yield(q ha^{-1})		% Increase in yield	Yield gap (q ha^{-1})	Sustainability index (%)
			Demonstration	Control			
2007-08	05	15	9.6	7.8	23.0	1.8	66.6
2008-09	05	10	12.1	9.8	23.5	2.3	
2009-10	05	10	16.6	9.2	80.0	7.4	
2010-11	05	15	15.1	10.7	41.1	4.4	
Mean			13.3	9.4	41.5	3.9	

The above Table indicates that there is increase in cost of cultivation from 2007-08 to 2010-11 both in FLD programmes as well as in farmers' practice. During 2007-08 it was Rs. 15000/ha whereas it was Rs 17600/ha during 2010-11 in FLD plots. The same trend was also observed in the average gross return and average net return. The average net return found

Table 3. Economics of FLD and Control plots (cv: TAG-24)

Year	Area (ha)	Average cost of cultivation (Rs/ha)		Average gross return (Rs/ha)		Average net return(Rs/ha)		BC ratio	
		FP	RP	FP	RP	FP	RP	FP	RP
2007-08	05	14000	15000	16800	24000	2800	9000	1.2	1.6
2008-09	05	15750	17500	24500	30750	8750	12750	1.55	1.73
2009-10	05	14950	17200	24550	35500	9600	18350	1.75	2.06
2010-11	05	15200	17600	26750	37750	11550	20150	1.76	2.14

increased 2.24 times from 2007-08 to 2010-11. The average gross return during *kharif* 2010-11 was Rs 37750 ha^{-1} in the FLD plots which was Rs11000 ha^{-1} more than the farmers' practice. The BC ratio during 2007-08 in FLD plots was 1.6 in comparison to 1.2 in control. It was increased to 2.14 and 1.76 respectively during 2010-11. Thus it may be concluded that adoption of scientific recommended practices in *kharif* groundnut cultivation has increased the pod yield. Further it may be noted that the profit in *kharif* groundnut cultivation has also been increased during the study period.

Perception of farmers about the factors attributing the higher yield of *kharif* groundnut was collected and mentioned in Table 4.

Table 4. Perception of farmers about the yield of FLD (N=50)

Parameters	Total score	Mean score	Rank
Variety	86	1.72	I
Seed treatment with seed treating chemicals	34	0.68	X
Rhizobium culture inoculation	15	0.3	XI
Time of sowing	68	1.36	II
Application of PMS	44	0.88	VIII
Recommended dose of fertiliser application	45	0.90	VII
Plant density	53	1.06	IV
Time of interculture	55	1.1	III
Application of gypsum during interculture	46	0.92	VI
Weed management	49	0.98	V
Plant protection measures	40	0.8	IX

From the Table 4 it can be concluded that farmers perceived the introduction of variety TAG-24 was instrumental in increasing the yield in the demonstration over their local variety AK 12-24.They perceived time of sowing also plays a major role for promotion of productivity. It secured second rank among the factors attributing yield. Time of interculture secured third highest mean score followed by plant density and weed management in the rank analysis. Application of gypsum during interculture, RDF and application of PMS contributed approximately equally to the yield according to farmers' perception. It was found from the discussion that incidence of the major disease, *tikka* in AK 12-24 found absent in TAG-24 variety. It secured the ninth position among the eleven factors. It is observed from the above table that seed treatment and *rhizobium* inoculation still came last in the farmers' perception about higher yield in *kharif* groundnut. This conclusion resembles the previous studies of Singh and Satpathy (1994) who had reported that farmers in general appear to possess very little knowledge about the *Rhizobium* culture.

From the above study it was found out that intervention in FLD *kharif* groundnut programme has been fruitful in increasing the yield and BC ratio. Adoption of scientific practices can reduce the yield gap. The yield gap can also be termed as extension gap as extension agencies of the district like the agriculture department and Krishi Vigyan Kendra can play a pivotal role in bridging this gap.

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