

Original Research Article

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## Yield and Gap Analysis of Groundnut (*Arachis hypogaea* L.) Productivity through Frontline Demonstration in District Chittorgarh of Rajasthan, India

Ratan Lal Solanki<sup>1\*</sup> and K.C. Nagar<sup>2</sup>

<sup>1</sup>KVK, Chittorgarh, <sup>2</sup>KVK, Bhilwara, Maharana Pratap University of Agriculture and  
Technology, Udaipur (Rajasthan), India

\*Corresponding author

### ABSTRACT

Groundnut had played a pivotal role in socio-economic transformation of majority of small and marginal farming community of central India and continued to contribute significantly to the oil economy of India. A study therefore was carried out by Krishi Vigyan Kendra, Chittorgarh (Rajasthan) to know the yield gaps between improved package and practices under front line demonstration (FLD) and farmer's practice (FP) of groundnut crop under rainfed conditions. Front line demonstrations (FLDs) were conducted on total 84 farmer's fields each year to demonstrate the impact of improved agro-techniques on production and economic benefits under rainfed conditions of Chittorgarh in Zone 1V A Sub humid Southern and Plain Arawalli Hills region during Kharif seasons of two consecutive years i.e. 2016-17 to 2017-18. The technologies demonstrated in FLDs recorded additional yield over farmer's practice. Under FLDs the mean grain yield of groundnut was increased by 21.11 per cent over FP. The mean extension gap, technology gap and technology index were calculated as 296 kg ha<sup>-1</sup>, 311 kg ha<sup>-1</sup> and 15.53 per cent, respectively. Adoption of improved package of practices in groundnut cultivation recorded higher mean B: C ratio (2.55) as compared to FP (2.33). Yield enhancement and higher net returns observed under FLDs of improved technologies in groundnut. Thus, the productivity of groundnut could be increased with the adoption of recommended improved package of practices. The study resulted to convincing the farming community for higher productivity and returns.

### Keywords

Economics,  
Extension gap,  
FLD, Technology  
gap, Technology  
index, Groundnut  
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### Introduction

Groundnut (*Arachis hypogaea* L.) is a self pollinated, annual, herbaceous, autotetraploid legume with 2n = 40 chromosomes belonging to the family leguminosae (Fabaceae). Groundnut is recognized as golden or miracle bean due to its high nutritive value and various usage viz., for feed, oil and soy food products. It is rich in protein (38-42%) and

contains 18- 22 per cent edible oil. It is known by various names as "wondernut", "Poor man's Cashew nut", "Peanut" "Monkey nut", "Earth nut" or "King of Oilseeds". It is the thirteenth most important food crop of the world; fourth most important source of edible oil and the third most important source of vegetable protein (Sorrensen *et al.*, 2004; Taru *et al.*, 2008). This crop has own importance due to high edible oil content

and nutritional value of kernel as human food, and haulm as rich feed for animals. Peanut is very important source of oil (40.45%), protein (26%), carbohydrates (25%), minerals (Phosphorus, calcium and iron) and vitamins (vitamin B complex like thiamine, riboflavin, niacin and vitamin E) in addition to higher proportion of unsaturated fatty acids, including essential fatty acids like linolenic and linoleic acids (Rajbal *et al.*, 2020). Groundnut continues to be number one oilseed crop in India occupying 04.91 million ha area with production of 09.18 million tonnes and productivity 1868 Kg ha<sup>-1</sup>. Out of which large area of groundnut production is in Rajasthan i.e. 0.64 million ha and 1.26 million tonnes production with 1966 kg ha<sup>-1</sup> productivity (Anonymous, 2018). The acreage of groundnut in Chittorgarh district was 18344 ha and 30990 metric tonnes production with 1966 kg ha<sup>-1</sup> productivity (Anonymous, 2017-18), respectively. This district has greater potential of groundnut production due to favourable climatic and soil condition. As an exceptional crop among oilseeds, groundnut attained an unparalleled glory of its horizontal expansion in very short span of nearly four decades (Dupare *et al.*, 2012). The adoption of recommended production technology among farmers is not very encouraging. The reason may be that either the promising technologies have not yet reached the farmer's fields or farmers are unable to use improved technology due to various socio-economic reasons. Hence, an efficient technology transfer system is advocated and conducting frontline demonstration on farmer fields have proved as an effective means for creating awareness and acceptance of improved technologies. Keeping this in view, the present study was carried out to find out the yield and gap analysis of groundnut (*Arachis hypogaea* L.) productivity through frontline demonstration in district Chittorgarh of Rajasthan and effect of technological interventions on groundnut productivity and

economics. Groundnut production has to be increased by adopting improved production practices. There are several constraints of low productivity of groundnut in India, out of which poor extension of improved agronomic practices is on the top. Moreover, poor agronomic practices such as higher seed rate, unsuitable new varieties, faulty nutrient management as well as negligence of plant protection measures of crop from insect-pest and wild animals are also responsible for low productivity of groundnut. Frontline demonstration is the modern concept with the objective to demonstrate newly released crop production and protection technologies and its management practices at farmer's fields under different farming situations. While demonstrating the technologies in the farmer's fields, the scientists are required to study the various factors contributing higher crop yield, constraints in field production and thereby generate production data and feedback information. Keeping these in view, FLDs of improved production technology on groundnut were conducted to enhance the productivity and economic returns and also convincing the farmers for adoption of improved production technologies in groundnut crop.

## **Materials and Methods**

The present study was carried out by Krishi Vigyan Kendra and demonstrations were conducted in its adopted village's viz. Godhakeri, Bhutkera Kherpura, Nahargarh, Laxmipura Ram nagar, *etc.*, district Chittorgarh (Rajasthan) in Kharif season of 2016-17 and 2017-18 on the selected farmers' fields. Each demo was conducted in 0.4 ha (one acre) and thus, 84 demonstrations were conducted 2016-17 and 2017-18 year. For the adoption of villages PRA technique and for the selection of farmers the purposive sampling design from frequently organized group meetings was exercised in each village.

The soils of the farmer fields were rainfed and Silt clay loam in texture and low to medium in NPK. FLD plots were kept for assigning farmers practices. Prior to conducting FLDs, group meeting and specific skill training was given to the selected farmers regarding package of practices of groundnut crop. To popularize the improved groundnut agro techniques for enhancing the production, constraints in groundnut production were identified through participatory approach. Preferential ranking technique was utilized to identify the constraints faced by the respondent farmers in groundnut production. Farmers were also asked to rank the constraints they perceive as limiting factor for groundnut cultivation in order of preference. Based on top rank of farmer's problems identified, front line demonstrations were planned and conducted at the farmer's fields. The improved production-techniques selected for FLDs given in (Table 1). The groundnut crop was sown at 30 cm (row-row) apart in line using seed rate of 100 kg ha<sup>-1</sup> in month of last June and First week of July during the years, respectively. The average yield of FLD and farmer practice has been taken in the years for interpretation of the results. The extension gap, technology gap and technology index were calculated using the following formula as suggested by Samui *et al.*, (2003).

Extension gap (Kg ha<sup>-1</sup>) = Demonstration yield (Kg ha<sup>-1</sup>) – Yield of local check (Kg ha<sup>-1</sup>)

Technology gap (Kg ha<sup>-1</sup>) = Potential yield (Kg ha<sup>-1</sup>) – Demonstration yield (Kg ha<sup>-1</sup>)

Technology index % =

$$\frac{(\text{Potential yield} - \text{Demonstration yield}) \times 100}{\text{Potential yield}}$$

The data on yield were recorded and analysed for interpretation of the results.

The economic-parameters (gross return, net return and B: C ratio) were worked out on the

basis of prevailing market prices of inputs and minimum support prices of outputs.

## Results and Discussion

The gap between the existing and recommended technologies of groundnut in Doongla and Begun block district Chittorgarh was presented in (Table 1). Full gap was observed in case of plant protection measure, HYVs, and seed treatment and 50% gap was observed in case of fertilizer management and weed management whereas, partial gap was observed in use of seed, land preparation, and, which definitely was the reason of not achieving potential yield. Farmers were not aware about recommended technologies. In general, farmers used local or age old varieties instead of the recommended high yielding and disease resistant varieties. Unavailability of seed in time and lack of awareness were the main reasons.

### Groundnut yield

The data on groundnut yield (Table 2) indicated that the FLDs given a good impact on the farming community of Chittorgarh district as they were motivated by the new agricultural technologies adopted in the demonstrations. Average groundnut yield under front line demonstrations was observed as 1690 Kg ha<sup>-1</sup> which was higher by 21.11% over the prevailing farmers practice (1394 Kg ha<sup>-1</sup>). The results clearly indicated that the yield of groundnut could be increased over the yield obtained under farmer's practices by accelerating the adoption of recommended production technology for the Chittorgarh districts. Singh *et al.*, (2014), Sharma *et al.*, (2016) and Solanki *et al.*, (2020) also found similar findings. The yield level of control plot was low due to use of low yielding local varieties, improper fertilizers and improper plant population measures. However, in case of demonstration plot, the factors leads to enhance the yield of crop were timely sowing,

use of new recommended varieties, balanced nutrient management, earthing up seed treatment and plant protection measures.

### **Extension gap**

More and more use of latest production technologies with high yielding varieties will subsequently change different this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinuance of old varieties with the new technology. From these results the extension gap 254 kg ha<sup>-1</sup> in year in 2016-17, 337 kg ha<sup>-1</sup> in 2017-18 and average 296 kg ha<sup>-1</sup> was reported (Table 2). During the period of study which emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. The technology gap observed may be attributed to the dissimilarity in the soil fertility status and weather conditions. Hence, variety wise location specific recommendation appears to be necessary to minimize the technology gap for yield level in different situations. These finding of studies were in agreement with Singh *et al.*, (2014) Mahadik and Talathi, (2016) and Solanki *et al.*, (2020).

### **Technology gap**

Data presented in (Table 2) revealed that the maximum technology gap was found in the year 2016-17 (407 kg ha<sup>-1</sup>) and lowest in the year 2017-18 (214 kg ha<sup>-1</sup>). However, overall average technology gap in the study was 311 kg ha<sup>-1</sup>. It was further reported that the technology gap was reduced with respect to succeeding years of experimentation and observed 407 kg ha<sup>-1</sup> in year 2016-17 and 214 kg ha<sup>-1</sup> in 2017-18 respectively. It may be attributed to difference in the soil fertility status, agricultural practices, local climate conditions, rainfed agriculture and timeliness

of availability of inputs. Hence, variety wise location specific recommendation appears to be necessary to minimize the technology gap for yield level in different farming situations. Hence, location specific recommendations are necessary to bridge the gap. These results are in agreement with Solanki *et al.*, (2013) and Singh *et al.*, (2014).

### **Technology index**

The technology index indicates the feasibility of evolved technology at the farmer's field. The lower the value of technology index more is the feasibility of the technology. Result of study depicted in (Table 2) revealed that the technology index value was 20.35 per cent in year 2016-17 and 10.70 per cent in 2017-18. On the basis of two years study, the overall technology index 15.53 per cent was recorded, whereas highest technology 20.35 per cent was recorded during 2016-17 and lowest (10.70%) during 2017-18. Hence, it can be inferred that awareness and adoption of improved varieties with the recommended scientific package of practices have increased during the advancement of the study period. These results are corroborating with the findings of Solanki *et al.*, (2013) and Sharma *et al.*, (2016).

### **Economic analysis**

The mean higher cost of cultivation Rs. 28700 ha<sup>-1</sup> involved in FLDs as compared to Rs. 25900 ha<sup>-1</sup> under farmers practice (Table 3). The FLDs plots fetched higher mean gross returns (Rs. 73351 ha<sup>-1</sup>) and net returns Rs. 44651 ha<sup>-1</sup> with higher benefit: cost ratio 2.55 as compared to gross returns Rs. 60493.5 ha<sup>-1</sup>, net returns Rs. 34593.5 ha<sup>-1</sup> and benefit: cost ratio 2.33 with farmers practice. Solanki *et al.*, (2020) also reported higher net returns and B: C ratio in the FLDs on improved technologies compared to the farmers practices and are at par with results of the

present study which also resulted in higher net returns through FLDs on improved technologies. Similar findings were reported by Solanki *et al.*, (2020).

**Table.1** Comparison between technological intervention under FLDs and local check on groundnut

S.No.	Particulars	FLDs	FP	Gap
1.	Farming situation	Rainfed	Rainfed	No gap
2.	Variety	Improved quality seed bunch variety UG-5	Old variety GG-2	Gap (50 %)
3.	Land preparation	Summer deep ploughing followed by rotavator	Summer deep ploughing followed by rotavator	No gap
4.	Time of sowing	Mid June to July	Mid June to July	No gap
5.	Seed rate	Use optimum seed rate (100 kg ha <sup>-1</sup> )	Higher seed rate (125 kg ha <sup>-1</sup> )	10-20% more than recommendation
6.	Seed treatment	Seed treatment with trichoderma 8 gram kg <sup>-1</sup> and bio-fertilizer culture (Rhizobium and PBB)	No proper seed treatment	Full gap (100 %)
7.	Method of sowing	Line sowing	Line sowing	No gap
8.	Fertilizers Management	Apply SSP fertilizer (250 kg ha <sup>-1</sup> ) and 25 kg urea ha <sup>-1</sup> at the time of sowing (10kgN +40kg P <sub>2</sub> O <sub>5</sub> +30kg S ha <sup>-1</sup> )	Generally DAP fertilizer are applied (100kg ha <sup>-1</sup> )	Gap (50%)
9.	Weed Management	Use of herbicides Imazethapyr 10EC 100gram ha <sup>-1</sup> at 10-15 DAS	Manual weeding	Gap (100%)
10.	Plant protection Measure	Plant protection measures judiciously followed that is Carbendazim 50WP 2.0 kg against Tikka disease	Plant protection measure not practices	Gap (100%)

**Table.2** Yield performance of groundnut under FLDs

Years	No. of demonstrations	Area (ha)	Yield (kg ha <sup>-1</sup> )		%Yield increase over FP	Extension gap (kg ha <sup>-1</sup> )	Technological gap (kg ha <sup>-1</sup> )	Technology index (%)
			FLD	FP				
2016-17	24	9.6	1593	1339	18.96	254	407	20.35
2017-18	60	24.5	1786	1449	23.26	337	214	10.70
<b>Mean</b>	<b>84</b>	<b>34.1</b>	<b>1690</b>	<b>1394</b>	<b>21.11</b>	<b>2.96</b>	<b>311</b>	<b>15.53</b>

**Table.3** Economics, additional cost and returns in groundnut under frontline demonstrations (FLDs) vs. farmers practice (FP)

Years	Cost of cultivation (Rs ha <sup>-1</sup> )		Gross returns (Rs. ha <sup>-1</sup> )		Net returns (Rs ha <sup>-1</sup> )		Additional cost of cultivation (Rs ha <sup>-1</sup> in FLD)	Additional returns (Rs ha <sup>-1</sup> in FLD)	B: C Ratio	
	FLD	FP	FLD	FP	FLD	FP			FLD	FP
2016-17	27200	25400	67225	56506	40025	31106	1800	27200	2.47	2.22
2017-18	30200	26400	79427	64481	49217	38081	3800	30200	2.63	2.44
<b>Mean</b>	<b>28700</b>	<b>25900</b>	<b>73351</b>	<b>60493.5</b>	<b>44651</b>	<b>34593.5</b>	<b>2800</b>	<b>28700</b>	<b>2.55</b>	<b>2.33</b>

### Additional cost of cultivation and returns

Data (Table 3) revealed that the average additional cost of cultivation (Rs. 2800 ha<sup>-1</sup>) under integrated crop management demonstrations and has yielded additional net returns of Rs. 28700 ha<sup>-1</sup>. The results suggest that higher profitability and economic viability of groundnut demonstrations under local agro-ecological situation.

Thus, it may be concluded that the yield and returns in groundnut crop increased substantially with the improved production technologies. However, the yield level under FLDs was better than the farmer practice and performance of these varieties UG-5 could be further improved by adopting recommended production technologies. So, there is need to disseminate the improved technologies among the farmers with effective extension methods like training and field demonstrations. The farmers should be encouraged to adopt the recommended agro-techniques for getting maximum returns in specific locations and use varieties developed by Maharana Pratap

University of Agriculture and Technology, Udaipur (Rajasthan), India have higher yield potential on farmer's field. Thus, it was clearly showed that the demonstration of groundnut with full package was better to farmer's practices. The results indicated that the frontline demonstration has given a good impact on the farming community of the district Chittorgarh (Rajasthan) as they were motivated by the new agricultural technology applied in the FLD plots. Similar findings were reported by Joshi *et al.*, (2014).

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