Indian J. Dryland Agric. Res. & Dev. 2019 34(1) : 63-65 10.5958/2231-6701.2019.00010.1

Impact of Frontline Demonstration Technologies on Groundnut Yield in Erode District

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ABSTRACT: Groundnut (*Arachis hypogaea* L.*)* is an important oilseed crop cultivated over 20,000 ha in Erode District of Tamil Nadu. The yield was drastically reduced in the groundnut cultivable area due to the compound problems of diseases and micro nutrient deficiencies. Attempts were made by ICAR-KVK, MYRADA to manage the diseases and micronutrient deficiencies in ground nut by conducting frontline demonstrations on integrated disease and micronutrient management during 2014-15, 2015-16 and 2016-17. The technologies comprised of seed treatment with *Pseudomonas flourescens* @ 10 g kg^{-1} seed, foliar application of 10% calotropis leaf extract, need based mancozeb spray @ 1 kg ha^{-1} and groundnut rich @ 5 kg ha^{-1}. Adoption of integrated disease management practices reduces the disease incidence by 6.15% which was significantly superior to the conventional method of disease management practices as it was recorded as 16.74%. The results revealed that, foliar application of groundnut rich micronutrients resulted in increase in pod filling percent and 33.48 filled pods recorded in demonstrated plots whereas 25.75 pods recorded in the control plots. The farmers harvested an average yield of 25.82 q ha^{-1} with an yield advantage of 18.53% over the farmers' practices. The average extension gap, technology gap and technology index were 4.04 q ha^{-1}, 3.88 q ha^{-1} and 13.06%, respectively. The integrated crop management practices gave the higher benefit cost ratio of 2.16 compared to the conventional methods. The results indicated that, the adoption of integrated disease and nutrient management techniques reduces the disease incidence and increases the productivity at farmers' field level.

Key words: Groundnut, frontline demonstration, micronutrient, yield and yield gap

Introduction

Groundnut is an important monoecious, soil enriching, self pollinated legume crop cultivated widely in the world for oilseed, food and animal feed (Upadhyaya *et al.,* 2006). As a deep rooting legume enjoying symbiotic association with rhizobia and mycorrhizae, groundnut responds to starter nitrogen at earlier stages but it is able to provide for its own nitrogen needs through symbiotic nitrogen fixation. India plays a major role in global oilseeds and vegetable oil economy contributing about 16% of world's oilseed crop area, 7% of world's oilseeds production and 6.7% of vegetable oils production. However, the productivity in India is only 1148 kg ha^{-1} as compared to the world average of 2593 kg ha^{-1} (FAOSTAT, 2017). It is an annual soil enriching legume cum oil seeds crop. To meet the need of growing population expected to reach around 1.45 billion by 2025 and the increasing demand of sugar and sweeteners for internal consumption, the production and productivity of the crop needs to be increased.

Micronutrient deficiencies and the diseases are the compound factor causing yield loss in groundnut. The farmers are not aware of differentiating the micronutrient deficiencies and disease causing symptoms and adopt inappropriate methods for controlling the same. This will leads to increase in cost of cultivation and reduced yield at considerable level. Adoption levels for several components of the improved technology of the crop were low emphasizing the need for better dissemination (Kiresur *et al.,* 2001). Several biotic, abiotic and socio economic constraints inhibit exploitation of the yield potential of crops and these are needed to be addressed. The productivity of the crop could be increased by adopting the improved production technologies, management practices and suitable varieties (Ranawat *et al.,* 2011). Keeping this view in mind, ICAR-KVK, MYRADA laid out frontline demonstrations in the farmers' field to improve the production potential of groundnut by using integrated crop management technologies under the real farm situations over locally cultivated varieties in the farmers' holdings of Erode District of Tamil Nadu.

Materials and Methods

The present study was carried out in Erode District of Tamil Nadu during 2014-15, 2015-16 and 2016-17. The frontline demonstrations were designed and conducted at farmers' field. Each demonstration was conducted in an area of 0.4 ha and adjacent to the farmers' fields in which the crop was cultivated with farmers practice/variety was taken as a local check. A total of 50 frontline demonstrations conducted on integrated disease and nutrient management in groundnut at Nambiyur and Anthiyur Block of Erode District to study the production potential of the crop. Scientific interventions under frontline demonstrations were taken as mentioned in Table 1. The selected progressive farmers were trained on all scientific groundnut cultivation aspects before starting of frontline demonstrations. To study the impact of frontline demonstrations, data from FLD and farmers practices were analyzed.

Table1 : Technological interventions adopted in demonstration plots

Particulars	Demonstration	Farmer practice
Variety	CO-2	CO-2
Seed treatment	Treat the seeds with carbendazim @ 2 g kg^{-1} seed or *Pseudomonas fluorescens* @ 10 g kg^{-1} seed.	No seed treatment practices
Disease management	Spraying *of* 10% calotropis extract Spraying of mancozeb @ 1 kg ha^{-1}	Spraying of fungicides @ 15 days interval
Nutrient management	Recommended dose of fertilizer application Foliar application of 5 kg *groundnut rich/ha at the time of flowering and pod formation stage	Improper application of fertilizers

*Groundnut Rich is a combination of micronutrients developed by Tamil Nadu Agricultural University, Coimbatore, Tami l Nadu which was recommended to spray at the time of flowering and pod development stage

The yield gap analysis is a potent research technique that has been introduced in the 1970s. It was developed by the International Rice Research Institute (IRRI) and is extensively used to measure and analyze determinants of the yield gaps. It is also observed that, even though the production level has increased to a great extent in the recent past; still there exists a wide gap between the actual yield obtained by the growers and the production level actually possible with the existing modern technology.

Yield gap refers to the difference between the potential yield and actual farm yield. Potential yield refers to that which is obtained in the experiment station. The yield is considered to be the absolute maximum production of the crop possible in the given environment, which is attained by the best available methods and with the maximum inputs in trials in the experiment station in a given season. Demonstration yield is the yield obtained from the demonstration plots of the farmers' fields in the study area. The conditions on demonstration plots closely approximate the conditions on the cultivators' fields with respect to infrastructural facilities and environmental conditions. Actual yield refers to the yield realized by the farmers from their farms under their management practices. The data output were collected both in FLDs as well as control plots and finally the extension gap, technology gap, technology index (%) were worked out (Samui *et al.,* 2000) as given below in *eqns.* 1, 2 and 3.

$$\textit{Extension gap} = DY - LY \quad (1)$$

$$\textit{Technology gap} = PY - DY \quad (2)$$

$$\text{Technology Index (\%)} = \frac{(PY\text{-}DY)}{PY} \times 100 \quad (3)$$

where,

DY = Demonstration yield, q ha^{-1}

LY = Local check yield, q ha^{-1}

PY = Potential yield of variety, q ha^{-1}

Results and Discussion

The results of the trials conducted on the farmers' field are presented in Table 2. The disease incidence was reduced from 23.13 to 6.15% in the demonstrated field where as 16.74% disease incidence was recorded in the farmers practice. Significant variations were observed in disease incidence due to the adoption of integrated diseases and nutrient management practices in the demonstration plots. Table 3 indicated that, adoption of integrated disease and nutrient management technologies recorded an average of 33.48 filled pods with the highest pod filling number of 35.95. Similarly 25.75 number of filled pods observed in the farmers practices. The findings of the present study are in line with the findings of Saravanakumar (2018) and Dhaka *et al.* (2010).

Table 2 : Comparison of disease incidence %

Year	Percent Disease Incidence (Before spray)	Percent Disease Incidence (after spray)	
		Demonstration	Farmers' practice
2014-15	21.30	6.87	17.03
2015-16	24.32	6.22	16.40
2016-17	23.78	5.36	16.80
Average	**23.13**	**6.15**	**16.74**

Table 3 : Comparison of number of filled pods

Year	Number of filled pods	
	Demonstration	Farmers' practice
2014-15	35.95	25.20
2015-16	30.32	25.45
2016-17	34.17	26.60
Average	**33.48**	**25.75**

The average yield of groundnut under demonstration was 2582 kg ha^{-1} (Table 4) which was higher than the average yield of farmers practice (2178 kg ha^{-1}). The integrated crop management practices showed that 18.53% yield increase over the farmers' practice. These results indicated that the frontline demonstrations gave good impact for the farming community in Erode district as they were motivated by the adoption of integrated disease and nutrient management technologies applied in the demonstration plots. The findings of the present study are in line with Jyothi Swaroopa *et al.* (2016) and Hiremath and Nagaraju (2009).

Table 4 : Comparison of groundnut pod yield (kg ha^{-1})

Year	Yield (kg ha^{-1})		Yield increase %
	Demonstrations	Farmers' practice	
2014-15	2699	2176	24.03
2015-16	2413	2094	15.23
2016-17	2634	2264	16.34
Average	2582	2178	18.53

Technology gap and extension gap

The technology gap shows the gap between the potential yields of the crop over demonstrated yield. The technology gap was recorded as 3.88 q ha^{-1} (Table 5). The extension gap shows the gap between the demonstration yield and local yield and it was 4.04 q ha^{-1}. The observed extension gap and technology gap may be attributed due to dissimilarities in soil fertility levels, pest and disease incidence, improper usage of manures and fertilizers in this region (Mukherjee 2003). More and more use of latest production technologies will subsequently change this alarming trend. The new technologies will eventually lead to discontinue the old technologies and the adoption of new technologies by the farmers.

Table 5 : Yield, extension gap, technology gap and technology index of the demonstrations

Variables	Yield (q ha^{-1})	Extension gap (q ha^{-1})	Technology gap (q ha^{-1})	Technology Index (%)
Farmers' practice	21.78	-	-	-
Demonstrations	25.82	4.04	3.88	13.06
Potential yield	29.70	-	-	-

Technology index

Technology index shows the feasibility of the technologies at the farmers' field. The lower the value of the technology index more is the feasibility. Table 5 revealed that the technology index value was 13.06%. The findings of the present study are in line with the findings of Rai *et al.* (2015) and Hiremath and Nagaraju (2009).

Conclusion

Based on the findings, it is concluded that the scientific adoption of integrated disease and nutrient management technologies performed superior than the existing variety in all the demonstrations. Yield potential of the groundnut crop is increased over 18.53%. It is also suggested that conducting large scale adoption demonstrations and ensuring the critical inputs in time for adoption of technologies play a critical role in enhancing wheat production. This will subsequently increase the income and livelihood of the groundnut farming community. The findings also concluded that the adoption of integrated disease and nutrient management practices paved the way for improving the productivity of groundnut per unit area.

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Received: January 2019; Accepted: May 2019