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OPTIMIZATION OF *KHARIF* GROUNDNUT PRODUCTION UNDER RESOURCE CONSTRAINTS

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Abstract

A field experiment was conducted to optimization of *kharif* groundnut production under resource constraints in groundnut (*Arachis hypogaea* L.) for consecutive three *kharif* seasons in 2010, 2011 and 2012 at Breeder Seed Production Farm of Orissa University of Agriculture and Technology, Bhubaneswar with 8 treatments in three replications. The use of full package of practices *viz*. fertilizer 20 : 40 : 40 kg N : P_2O_5 : K_2O/ha + 10 kg Borax/ha applied to soil produced significantly higher pod yield of 2078 kg/ha than other treatments tried. The same treatment recorded 28.5,40.4 and 6.1 per cent higher pod yield than $\mathbf{T_2}$, $\mathbf{T_3}$, and $\mathbf{T_4}$ indicating contribution of fertilizer, plant protection and weeding alone towards production of pod yield. But the contribution of combined use of weeding with either plant protection or fertilizer was 33.0 and 36.0 per cent, respectively towards expression of pod yield of groundnut compared to use of no package of practices.

Key words : Optimization, production, groundnut, resource constraints and *kharif*.

Introduction

Groundnut (*Arachis hypogaea* L.) is an important major oilseed crop of India. Among the nine oilseeds, namely, groundnut, rapeseed-mustard, soybean, sunflower, safflower, sesame, niger, castor and linseed, groundnut is the second largest oilseed in India in terms of production and area (Thamaraikannan *et al*., 2009). Groundnut contributes about 40 per cent to the total oilseeds production in the country. At this level of contribution the projected demand for groundnut by 2020 AD will be about 14 million tonnes with the present production level of around 8.2 million tonnes. Therefore, a gap of about 5.8 million tonnes needs to be bridged. This calls for a growth rate of about 2.2 per cent annum^{-1} in production. This growth has to come mainly from the increase in productivity. At present, average yield in the *kharif* is around 900 kg ha^{-1} and the *rabi* is around 1500 kg ha^{-1}. A fair projection for enhanced productivity with sustainability by 2020 AD will be about 1100 kg ha^{-1} (about 22% increase) for *kharif* groundnut and 2000 kg ha^{-1} (about 25% increase) for *rabi* groundnut (CRIDA, 2004). But both production and productivity especially of *kharif* groundnut have shown highly fluctuating trends. Walia *et al*. (2007) reported that there is an urgent need to explore the possibilities for increasing the productivity through better understanding of the constraints in production of oilseed crops especially in groundnut.

The declining trend in groundnut was contributed by several constraints including biotic and abiotic stress besides, low or no use of plant nutrients were the major factors that hinders in increasing oilseed productivity. With hardly 17 per cent of the area under irrigation, oilseeds are subjected to vagaries of monsoon resulting in lower yields coupled with continuous cultivation of oilseed without crop rotation has led to the depletion in soil nutrients as well as increase in pest and disease incidences. Farmers are neglecting the application of fertilizers, use of plant protection measure and weed control due to paucity of funds and lack of knowledge (Patil *et al*., 2003). Low level of management adopted by small and marginal farmers, poor post harvest technology and inadequate support besides weak technology transfer contributed to the low level of productivity. Pest and disease incidence are the major thread in groundnut production which causing more than 25 per cent of yield loss Seed is the crucial input for groundnut, which costing 25 per cent of the total variable cost in groundnut cultivation, hence farmers mostly used own seed to minimize the expenditure on purchased input and not able to realize the potential yield of varieties due to the decline in varietal purity while continuous use of own seeds.

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Materials and Methods

The experiment was conducted at Breeder Seed Production Farm of Orissa University of Agriculture and Technology, Bhubaneswar for three consecutive *Kharif* seasons of the years 2010, 2011 and 2012 in randomized block design with 8 treatments replicated four times. The experimental site was located at 20.15^0 N latitudes and 85.53^0 E longitudes with average annual rainfall of 1520 mm. The soil of experimental field was medium deep with pH 5.9, available N 280 kg/ha, P_2O_5 14.0 kg/ha and K_2O 175 kg/ha. The details of treatments are given in table 1. Bold and healthy seeds of groundnut were selected and treated with captan at the rate of 2 g kg^{-1} of seed. Groundnut variety *'Smruti'* was sown in first fortnight of July during all the experimental years with plant spacing of 30 x 10 cm^2 on flat beds. Nitrogen, phosphorous and potassium were applied at the rate of 20 : 40 : 40 kg N, P_2O_5, and K_2O ha^{-1} in the form of urea, single super phosphate and muriate of potash respectively as per treatments. Gypsum @ 250 kg ha^{-1} were applied. The entire quantity of fertilizer was applied at the time of sowing in the furrows opened 5 cm away from the seed line and later furrows were covered with soil except Gypsum, which was applied at 21 DAS. Randomly five plants were selected from each plot and regular biometric observations of crop parameters were recorded from 40 DAS up to harvest. For economic study, prevailing market price was used for different outputs and inputs. All the data were subjected to analysis of variance (ANOVA) as per the standard procedure.

Results and Discussion

Growth analysis

The use of full package of practices *viz*. fertilizer 20:40:40 kg N:P_2O_5 : K_2O/ha + 10 kg Borax/ha applied to soil produced significantly higher number of root nodules per plant at 40(16.1) and 80(20.1) DAS than other treatments tried. The same treatment recorded root nodule number by 22.9, 9.5 and 36.4 per cent higher at 40 DAS and by 20.9, 10.0 and 32.0 per cent higher at 80 DAS than $\mathbf{T_2}$, $\mathbf{T_3}$ and $\mathbf{T_4}$ indicating contribution of fertilizer, plant protection and weeding alone towards production of root nodule number. The lowest number of root nodules per plant both at 40 and 80 DAS were observed under treatment where fertilizer, weeding and plant protection practices were withheld from full package of practices (table 1). These results are in conformity with findings of Yadav *et al*. (2008) and Sharma and Kewat (1994).

Yield and yield attributes

The use of full package of practices *viz*. fertilizer 20:40:40 kg N:P_2O_5 :K_2O/ha + 10 kg Borax/ha applied to soil produced significantly higher pod yield of 2078 kg/ha than other treatments tried. The same treatment recorded 28.5, 40.4 and 6.1 per cent higher pod yield than $\mathbf{T_2}$, $\mathbf{T_3}$, and $\mathbf{T_4}$ indicating contribution of fertilizer, plant protection and weeding alone towards production of pod yield. But the contribution of combined use of weeding with either plant protection or fertilizer was 33.0 and 36.0 per cent, respectively towards expression of pod yield of groundnut compared to control. Similar results were observed by Reddy *et al*. (1986) and Patil (1987), in safflower and also by Saini and Dhillon (1985) in groundnut.

Return

The data presented in table 2 revealed that the highest gross monetary return of Rs. 51958 ha^{-1} was observed in full package treatment ($\mathbf{T_1}$) followed by the treatment $\mathbf{T_3}$ (T1-PP). However, lowest gross return was recorded in treatment $\mathbf{T_8}$ *i.e*. Rs. 24936 ha^{-1}. The present investigation was aimed to minimized the expensive

Table 1 : Yield attributes of groundnut at harvest as influenced by different treatments under rain fed conditions (*Kharif* 2011, *Kharif* 2012, *Kharif* 2013 and pooled).

	Treatments	Dry pod yield (kg./ha.)				Percent decrease	Dry haulm yield (kg./ha.)			
		2011	2012	2013	Pooled		2011	2012	2013	Pooled
$\mathbf{T_1}$	Full package as per recommendation	1533	2622	2621	2259	-	2439	4006	3950	3465
$\mathbf{T_2}$	$\mathbf{T_1}$-Fertilizer	1495	1732	1785	1671	26.0	2389	2585	2428	2471
$\mathbf{T_3}$	$\mathbf{T_1}$-Plant Protection	1452	2457	2416	2108	6.7	2358	3690	3391	3146
$\mathbf{T_4}$	$\mathbf{T_1}$-Weeding	1361	1599	1639	1533	32.1	2267	2367	2391	2312
$\mathbf{T_5}$	$\mathbf{T_1}$-(F+PP)	1274	1311	1364	1316	41.7	2180	2133	2213	2176
$\mathbf{T_6}$	$\mathbf{T_1}$-(F+W)	1207	1604	1644	1485	34.2	2113	2443	2403	2320
$\mathbf{T_7}$	$\mathbf{T_1}$-(PP+W)	1048	1727	1754	1510	33.2	1954	2675	2600	2410
$\mathbf{T_8}$	$\mathbf{T_1}$-(F+PP+W)	921	1153	1178	1084	52.0	2099	1902	2209	2070
	LSD (0.05)	99.6	45.9	70.0	40.0	274.5	69.0	363	215.0	

Table 2 : Yield attributes of groundnut at harvest as influenced by different treatments under rain fed conditions (pooled).

	Treatments	Number of pods/plant	No. of root nodules/plant at 40 DAS	No. of root nodules/ plant at 80 DAS	Shelling percent	Hundred kernel weight (g)	Gross monetary return (Rs./ha.)	Net monetary return (Rs./ha.)	B:C Ratio
T_1	Full package as per recommendation	20.2	16.1	23.1	67.2	36.7	51958	29066	2.24
T_2	T_1-Fertilizer	15.7	13.1	19.1	64.3	35.4	38419	18489	1.93
T_3	T_1-Plant Protection	17.5	14.7	21.0	65.4	35.6	48494	25509	2.09
T_4	T_1-Weeding	13.7	11.8	17.5	61.1	34.4	35267	14970	1.74
T_5	T_1-(F+PP)	14.1	12.4	17.5	60.6	33.6	30274	9910	1.49
T_6	T_1-(F+W)	14.2	12.3	18.1	60.9	33.6	34163	13997	1.70
T_7	T_1-(PP+W)	15.8	13.9	20.2	63.0	33.6	34720	15270	1.81
T_8	T_1-(F+PP+W)	12.4	11.3	16.4	58.3	31.8	24936	6020	1.32
	LSD (0.05)	0.7	1.1	0.8	0.8	1.1	910	658	0.04

cultivation practices and find out the most appropriate treatment combination. The economic status of each treatment was determined by considering the cost of inputs used and gross returns (table 2). The treatment T_1, which includes all the improved cultivation practices recorded highest gross monetary returns (GMR Rs. 51958 ha^{-1}) followed by T_3 (Rs. 48494) and T_2 (Rs. 38419), which suggest increase in GMR due to integration of all resources used during cultivation whereas increase in net monetary return (NMR) is due to increase in GMR (Patil *et al*., 2003 and Dwiwedi and Rawat, 2013). Significantly highest net monetary return was obtained by practice of full package (Rs. 29066) over all treatments. Lowest net monetary return Rs. 6020 ha^{-1} was recorded by treatment T_8. Similar results were observed by Jagtap *et al*. (2014) in niger. Benefit cost ratio refers to monetary gain over each rupee of investment under the particular treatment. The treatment T_1 was recorded maximum profitability (2.24) followed by T_1 (3.08), T_3 (2.09) and T_2 (1.93), respectively. These results are in conformity with findings of Yadav *et al*. (2008) and Sharma and Kewat (1994).

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