

Original Research Article

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Optimization of Groundnut (*Arachis hypogaea* L.) Production Technologies under Various Resource Constraints in Konkan Region

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ABSTRACT

Groundnut production depends on the genetic potential of the cultivar and the cultural practices to which the crop is subjected. There are several constraints in groundnut production viz. fertilizer, plant protection and weed management often pose serious problems. Therefore, present study was carried out to focus on such limiting factors individually or in combination which may cause more yield reduction under resource constraint. The study was formulated on lateritic soils of *konkan* at Agricultural Research Station, Shirgaon, Tal. Dist. Ratnagiri (MS) during *Kharif* 2011-2013 (three years) in Randomized Block Design with three replications which imposed of 8 different treatments. The results revealed that, application of full package as per recommendation recorded significantly highest pod yield (3.82 kg/ha) with 1:2.72 B:C ratio over the full package of practices excluding fertilizer, plant protection, weed management practices in alone and also in combinations of these limiting factors. The reduction in pod yield due to exclusion of plant protection, weed and fertilizer management from full package of practices as per recommendation was to the tune of 20.81%, 31.46% and 39.34%, respectively. However, the improvement in pod yield was followed by application of full package of practices excluding plant protection 3.03 t/ha and 1:2.23 B:C ratio, weed management 2.62 t/ha and 1:2.08 B:C ratio and fertilizer management 2.32 t/ha and 1:2.15 B:C ratio.

Keywords

Fertilizer,
Groundnut,
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Yield,
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Introduction

Groundnut or peanut (*Arachis hypogaea* L.) is also known as a 'King' of oilseed (Priya *et al.*, 2013). Groundnut (*Arachis hypogaea* L.) is the 6th most important oil seed crop in the world. It contains 48-50% oil, 26-28% protein and 11-27 % carbohydrate, minerals and vitamin (Mukhtar, 2009). It is cultivated in 5.31 mha area with the production of 6.96 mt and average productivity of 1.31 t/ha. The area under groundnut crop in Konkan was about 10,000 ha with 2,150 kg/ha productivity

during *rabi* 2011-12 (Anonymous, 2013). Success of any crop production largely depends on use of quality seeds and agronomic management practices. The maximization of any crop yield is affected due to the use of different crop management practices such as application of recommended dose of fertilizers, plant protection measures and weed control. Farmers are not well aware about crop management practices and 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). Not much attention was given on such aspect which should be given priority under the limited resources to minimize the yield reduction. Hence, present investigation was undertaken.

Materials and Methods

The field investigations were conducted with Groundnut cultivar *Trombay Konkan Groundnut-Bold'* (TG 19A) at Agricultural Research Station, Dr. B.S. Konkan Krishi Vidyapeeth, Shirgaon, Dist. Ratnagiri (MS) during the three consecutive *kharif* seasons from 2012 to 2014. There were eight treatments comprised of full package as per recommendation *i.e.* T₁, T₂ (T₁ – Fertilizer), T₃ (T₁ – Plant Protection), T₄ (T₁ – Weeding), T₅ (T₁ - Fertilizer + Plant Protection), T₆ (T₁ - Fertilizer + Weeding), T₇ (T₁ – Plant Protection + Weeding) and T₈ (T₁ – Fertilizer + Plant Protection + Weeding) were assessed in randomized block design replicated thrice. Experimental site was high in organic matter (1.41 %), moderately acidic in reaction (pH 6.2) with electrical conductivity of 0.045 dS/m, medium in available nitrogen (203.50 kg ha⁻¹) and high in available phosphorus (16.15 kg ha⁻¹) and available potassium (269.40 kg ha⁻¹). Groundnut was sown at 30 cm × 15 cm spacing with seed rate of 125 kg/ha. The recommended dose of fertilizer (25:50:00 NPK kg/ha) was applied through urea for nitrogen and phosphorus through single super phosphate. The 100% nitrogen and phosphorus was applied as basal dose. Weed control by use of pre emergence application of *Pendimethalin* @ 1 kg ha⁻¹ combined with one hand weeding at 30-35 days after sowing were carried out in treatments T₄ (T₁ – Weeding), T₆ (T₁ - Fertilizer + Weeding), T₇ (T₁ – Plant Protection + Weeding) and T₈ (T₁ – Fertilizer

+ Plant Protection + Weeding). However, in plant protection measures 3 spray of contact/systematic insecticide combined with systematic fungicides and 2 spray of for treatments T₃ (T₁ – Plant Protection), T₅ (T₁ - Fertilizer + Plant Protection), T₇ (T₁ – Plant Protection + Weeding) and T₈ (T₁ – Fertilizer + Plant Protection + Weeding) were followed to keep pest and disease population under control. Similarly, all these treatments were imposed as per the schedule and methodologies given above to specific plots.

Results and Discussion

Ancillary attributes

Pooled data presented in table 1 revealed that, number of branches/plant, number of pods/plant, shelling per cent and 100 kernel weight were significantly influenced under different resource constraint treatments. The application of full package noticed significantly higher ancillary traits over rest of treatments. However, height of plant did not reach to level of significance under application of various resource constraints treatments.

Yield

The data presented in table 2 revealed that the dry pod yield (kg/ha) was significantly highest (3.82 t/ha) in the treatment receiving full package as per recommendation *i.e.* 100% RDF + weeding + plant protection over all the treatments except treatment full package as per recommendation excluding plant protection *i.e.* T₁-PP (3.03 kg/ha) which was at par with each other. Full package as per recommendation treatment significantly influenced the pod yield in all the three years of experimentation and the same was reflected in the pooled analysis.

Table.1 Ancillary attributes of groundnut as influenced by different treatments (Pooled data of 3 years)

Treatments	Plant height (cm) at harvest	No. of branches/plant	Total No. of pods/plant	Shelling (%)	100 Kernel weight (g)
T ₁ - Full package as per recommendations	42.7	3.8	26.4	71.1	56.7
T ₂ - Fertilizer (F)	44.0	3.4	17.3	63.6	54.6
T ₃ - Plant Protection (PP)	42.8	3.5	23.0	71.7	54.8
T ₄ - Weeding (W)	43.9	3.6	20.3	68.4	57.3
T ₅ - (F+ PP)	42.8	3.0	13.4	69.5	54.5
T ₆ - (F + W)	44.7	2.9	11.2	67.5	56.2
T ₇ - (PP+W)	44.9	3.5	18.2	68.3	58.5
T ₈ -(F + PP + W)	43.0	2.9	9.5	68.8	52.2
Mean	43.6	3.3	17.4	68.6	55.6
SE ±	3.5	0.4	2.4	1.8	1.5
CD at 5%	NS	1.0	6.7	5.0	4.1
CV %	8.1	11.1	13.5	2.6	2.6

Table.2 Dry pod yield of groundnut as influenced by different treatments

Treatments	Dry pod yield (t/ha)				Per cent Reduction in the yield over T ₁
	Kharif 2011	Kharif 2012	Kharif 2013	Pooled mean	
T ₁ - Full package as per recommendations	4.29	3.80	3.38	3.82	--
T ₂ - Fertilizer (F)	3.02	1.91	2.03	2.32	39.34
T ₃ - Plant Protection (PP)	3.92	2.73	2.43	3.03	20.81
T ₄ - Weeding (W)	3.40	2.26	2.21	2.62	31.46
T ₅ - (F+ PP)	2.44	1.79	1.40	1.88	50.88
T ₆ - (F + W)	2.10	1.58	1.19	1.62	57.52
T ₇ - (PP+W)	3.18	1.87	1.60	2.22	42.00
T ₈ -(F + PP + W)	1.71	1.26	0.98	1.32	65.51
SE ±	0.17	0.16	0.11	0.29	--
CD at 5%	0.52	0.47	0.33	0.82	--
CV %	9.9	12.5	10	12.3	--

Table.3 Dry pod, kernel, haulm yield and input based economics of groundnut as influenced by different treatments (Pooled data of 3 years)

Treatments	Dry pod yield (t/ha)	Kernel yield (t/ha)	Dry Haulm yield (t/ha)	Gross Returns ($\times 10^3 \text{ ₹ ha}^{-1}$)	Cost of Cultivation ($\times 10^3 \text{ ₹ ha}^{-1}$)	Net Returns ($\times 10^3 \text{ ₹ ha}^{-1}$)	B:C Ratio
T ₁ - Full package as per recommendations	3.82	2.72	4.39	125.8	46.2	79.1	2.72
T ₂ - Fertilizer (F)	2.32	1.55	3.13	77.0	35.8	40.8	2.15
T ₃ - Plant Protection (PP)	3.03	2.09	3.89	103.9	44.6	54.6	2.23
T ₄ - Weeding (W)	2.62	1.80	3.75	88.8	41.8	44.7	2.08
T ₅ - (F+ PP)	1.88	1.30	3.04	66.9	33.7	28.3	1.85
T ₆ - (F + W)	1.62	1.09	2.09	57.4	34.0	19.0	1.57
T ₇ - (PP+W)	2.22	1.52	3.42	79.6	40.7	32.3	1.81
T ₈ -(F + PP + W)	1.32	0.92	2.05	46.9	30.8	12.6	1.42
S.E. ±	0.29	0.21	0.41	-	-	-	-
CD at 5%	0.82	0.59	1.16	-	-	-	-
CV (%)	12.3	12.7	12.7	-	-	-	-

Produce and input Rates:

Kharif season	Groundnut pod (Rs/kg)	Haulm (Rs/kg)	Labour (Rs./day)	N (Rs/kg)	P ₂ O ₅ (Rs/kg)	FYM (Rs/tonne)	Gr.nut Seed (Pod) (Rs/kg)
2011	30.0	0.8	120.0	10.8	21.0	800.0	50.0
2012	30.0	1.0	120.0	10.8	21.0	1000.0	63.0
2013	35.0	1.5	120.0	12.2	37.5	1000.0	63.0

The increase in pod yield with full package of practices over absolute control (full package as per recommendation excluding fertilizer + plant protection + weeding) was 65.51 per cent. Madhu Bala and Kedar Nath, 2015, reported significantly highest pod yield of groundnut by application of full package as per recommendation (100% RDF + weeding + plant protection) over full package as per recommendation excluding fertilizer + weeding + plant protection. These results are in hormone with those reported by Jagtap and Patel, 2015 while working on niger.

Three years pooled data (Table 3) insinuates that, the treatment where application of fertilizers, plant protection and weed control were excluded from full package of practices as per recommendation, gave the lowest pod, kernel and haulm yield (1.32, 0.92 and 2.05 t/ha, respectively). However, full package of practice as per recommendation was recorded significantly highest pod, kernel and haulm yield (3.82, 2.72 and 4.39 t/ha, respectively) over all other treatments. These results are in line as reported by Patil *et al.*, (2003) while working in safflower.

Groundnut growing with full package of practice as per recommendation excluding fertilizer management (T₁- Fertilizer) noticed the lowest pod yield *i.e.* 2.32 t/ha followed by full package of practice as per recommendation excluding weeding (T₁- Weeding) *i.e.* 2.62 t/ha and full package of practice as per recommendation excluding plant protection (T₁- Plant protection) *i.e.* 3.03 t/ha. Moreover, groundnut exposed to more than one resource constraints, treatment T₆ (T₁- Fertilizer +Weeding) recorded the lowest pod yield of 1.62 t/ha over all other treatments except treatment T₈ (T₁- Fertilizer +Plant protection + Weeding) which indicates that no use of fertilizer along with non following of the weed management measures proved to be crucial role in reducing the pod yield in groundnut crop.

Economics

Most of farmers are unable to afford costly agro inputs to grow the groundnut crop. Therefore, present investigation was aimed to minimized the expensive 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 3). The highest gross monetary return of Rs 1,25,848/ ha was observed in full package of practice as per recommendation which includes 100% RDF + weeding + plant protection measures, which was followed by the treatment full package of practice as per recommendation excluding the plant protection (T₁ - PP) *i.e.* Rs. 1,03,895/ ha which suggest that increase in GMR due to integration of all resources used during cultivation, whereas increase in net monetary returns due to increase in gross monetary returns (Patil *et al.*, 2003; Dwiwedi and Rawat, 2013).

The highest net monetary returns was obtained with full package of practice as per recommendation (Rs.79,107/ ha) over all the treatments. However, the lowest net monetary return was noticed in treatment comprising full package of practice as per recommendation excluding fertilizer +plant protection + weeding (T₁- Fertilizer +Plant protection + Weeding) *i.e.* Rs. 12,635/ ha. Such kinds of results are also observed by Jagtap *et al.*, (2014) in niger crop. Benefit cost ratio refers to monetary gain over each rupee of investment under the particular treatment. The treatment full package of practice as per recommendation remained topped in rank with maximum profitability *i.e.* B:C ratio of 1:2.72 followed by treatment full package of practice excluding plant protection (1:2.23). These results are in conformity with findings of Madhubala and Kedar Nath (2015), Yadav *et al.*, (2008) and Sharma and Kewat (1994).

It was concluded from the present investigation, for an optimum productivity and profitability from *kharif* groundnut under lateritic soils of *Konkan*, give first preference to fertilizer management followed by weed management and plant protection measures, respectively under the resource constraints.

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