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RESEARCH PAPER

Nutrient requirement for bold seeded confectionery groundnut (*Arachis hypogaea* L.) under irrigated condition

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Abstract : A field experiment was carried out during the summer seasons of 2011-12, 2012-13 and 2013-14 at the Main Oilseeds Research Satiation, Junagadh Agriculture University, Junagadh to determine the optimum nutrient requirement for confectionery groundnut to obtain higher productivity and profitability on medium clay soil under irrigated condition. The experiment consisted of nine treatments *viz.*, two nitrogen levels, two potassium levels, two levels of sulphhur and control. Experiment was laid out in Randomized Block Design with four replications. Based on yield and yield components data, it was concluded that treatment N @ 50 kg/ha, K @ 50 kg/ha and S @ 40 kg/ha (T_8) with recommended dose of phosphorus (50 kg/ha)) gave the highest pod yield of 2770 kg/ha and haulm yield of 4557 kg/ha with net realization (Rs.85112/ha) and B:C ratio (3.34) which was closely followed by N @ 50 kg/ha, K @ 25 kg/ha and S @ 40 kg/ha (T_6). It is, therefore, suggested that these doses of NPKS fertilizer should be recommended to the farmers in order to raise a healthy and good confectionery groundnut crop and ultimately get highest yields of pods.

Key Words : Groundnut, Confectionery, Nutrients requirement, Yield

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INTRODUCTION

The use of edible groundnut kernels is generally referred as confectionery groundnut, export quality groundnut, large/bold seeded groundnut and hand picked selection (HPS) groundnut. With regard to the world consumption pattern, about 48 per cent is used for food purpose and 52 per cent for oil extraction whereas; in India it is 10, 15 and 75 per cent, respectively for food, seed and oil purposes (Bordar, 2001). Groundnut is primarily used for oil extraction; it is also consumed directly because of its high food value (Rajagopal *et al*., 2000). Confectionery groundnut with premium edible grade has great demand all over the world. India has immense potential for exporting confectionery and large seeded groundnut, however, lack of production techniques exclusive for confectionery groundnut in terms of plant density and nutrient management has restricted the scope for exports (Rahman *et al*., 1995). Till to day only limited genotypes have been bred with an aim to obtain hand picked selection (HPS) entries and such attempt was not made for the generation of production technologies for HPS groundnut. Among the various agro-techniques, the yield and quality are considerably

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influenced by the genotypes and nutrient management; hence there was a considerable scope for increasing the yield and quality by adjusting optimum level of nutrients. Considering all the facts, the present experiments was conducted to assess the quality parameters and yield of confectionery bold seeded groundnut as influenced by the different nutrients under irrigated condition.

MATERIAL AND METHODS

Field experiments were conducted during Summer 2011-12, 2012-13 and 2013-14 at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, to find out the response of confectionery groundnut to nutrients requirement for irrigated groundnut. The experiment consisted of nine treatment combinations *viz.*, two nitrogen levels, two potassium levels, two levels of sulphhur and control. Experiment was laid out in Randomized Block Design and the treatments were replicated four times with a gross plot size of 5.0m x 2.4m and a net plot size of 4.0m x 1.8m. The soils of experimental field represent the medium black type. The available nutrient status of the field was low in N (241 kg ha^{-1}), medium in phosphorus (21.4 kg ha^{-1}) and high in potash (370 kg ha^{-1}). The germination percentage of seed was more than 90 per cent and the required plant population per unit area was maintained with gap filling done within 7 days after sowing. Farm yard manure @ 10 t/ha and phosphorus of 50 kg/ha was applied commonly to all the treatments. In addition, fertilizer schedules of N, K and S as per treatments were applied. The common fertilizers used were urea (46 % nitrogen), diammonium phosphorus (18-46 NP%) and muriate of potash (60% potassium). All the NPKS fertilizers were applied basally. Each time, five plants were selected at random from the sampling rows of each plot and uprooted, made free from soils by washing with water. The pods of the sample plants of net plot area of each treatment were shelled separately. The kernel weight to the pod weight was computed and the mean for each treatment was expressed in percentage. Pods from each treatment were randomly selected and shelled. From this, a representative sample of 100 kernels was randomly picked out and weighed using an electronic balance and expressed in g/100 kernels. Hundred kernels from each treatment were randomly selected and the sound matured kernels were separated and expressed in per cent. Groundnut seed counts were indicating the number of kernels per 1 ounce (equals 28.3 g).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Yield and yield attributes :

2011-12:

The results of the present experiment showed that the pod and haulm yield of groundnut were significantly influenced by different nutrient treatments (Table 1).

Table 1 : Effect of different nutrient treatments on pod yield, haulm yield and economics of bold seeded confectionery groundnut

Tr. No	Treatments	Pod yield (kg/ha)				Haulm yield (kg/ha)				Economics(Pooled)			
		2011-12	2012--13	2013-14	Pooled	2011-12	2012-13	2013-14	Pooled	Cost of cultivation (Rs./ha)	Gross returns (Rs./ ha)	Net Returns (Rs. /ha)	B:C Ratio
T_1	$N_{25}K_{25}S_{20}$	2472	2330	2628	2477	4500	4167	3616	4094	34703	108025	73322	3.11
T_2	$N_{25}K_{25}S_{40}$	2614	2365	2771	2583	4736	4306	4122	4388	35283	113123	77840	3.21
T_3	$N_{25}K_{50}S_{20}$	2581	2389	2752	2574	4701	4375	3979	4352	35466	112646	77180	3.18
T_4	$N_{25}K_{50}S_{40}$	2613	2476	2773	2621	4708	4618	4181	4502	36046	114985	78939	3.19
T_5	$N_{50}K_{25}S_{20}$	2424	2441	2913	2593	4778	4479	4240	4499	35063	113937	78874	3.25
T_6	$N_{50}K_{25}S_{40}$	2749	2549	2965	2754	4792	4656	4392	4613	35643	120350	84707	3.38
T_7	$N_{50}K_{50}S_{20}$	2672	2566	2979	2739	4760	4583	4415	4586	35826	119687	83861	3.34
T_8	$N_{50}K_{50}S_{40}$	2648	2656	3007	2770	4833	4757	4682	4757	36406	121518	85112	3.34
T_9	Control	2152	2198	2552	2301	3361	3507	3021	3296	33145	98321	65176	2.97
	S.E.±	107	162	93	72	232	351	265	166	-	-	-	-
	C.D. (P=0.05)	313	NS	270	202	677	NS	774	468	-	-	-	-
	C.V. (%)	8.41	13.25	6.58	9.54	10.14	16.00	13.03	13.22	-	-	-	-

Market price: Groundnut pod : Rs. 37/kg and groundnut haulm:Rs. 4.0/kg , Cost of inputs (Rs./kg) : Urea -5.84, DAP- 25.18, MOP - 17.70, Gypsum-1.00
NS=Non-significant

Significantly higher pod yield (2749 kg/ha) and haulm yield (4833 kg/ha) were recorded when crop was fertilized with $N_{50}K_{25}S_{40}$ kg/ha (T_6) and $N_{50}K_{50}S_{40}$ kg/ha (T_8), respectively. But, it remained at par with treatments *viz.*, $N_{25}K_{25}S_{20}$ kg/ha (T_1), $N_{25}K_{25}S_{40}$ kg/ha (T_2),$N_{25}K_{50}S_{20}$kg/ha(T_3),$N_{25}K_{50}S_{40}$kg/ha (T_4),$N_{50}K_{50}S_{20}$ kg/ha (T_7) and $N_{50}K_{50}S_{40}$ kg/ha (T_8) in respect of pod yield and $N_{25}K_{25}S_{40}$ kg/ha (T_2), $N_{25}K_{50}S_{20}$ kg/ha (T_3), $N_{25}K_{50}S_{40}$ kg/ha (T_4), $N_{50}K_{25}S_{20}$ kg/ha (T_5), $N_{50}K_{25}S_{40}$ kg/ha (T_6) and $N_{50}K_{50}S_{20}$ kg/ha (T_7) in respect of haulm yield. Control awarded the lowest pod (2152 kg/ha) and haulm (3361 kg/ha) yield.

2012-13:

The results revealed that pod yield and haulm yield did not show significant effect due to nutrient treatments (Table 1).

2013-14 :

Data presented in Table 1 revealed that significantly the highest pod (3007 kg/ha) and haulm (4682 kg/ha) yield were recorded by $N_{50}K_{50}S_{40}$ kg/ha (T_8), which remained at par with $N_{25}K_{25}S_{40}$ kg/ha (T_2), $N_{25}K_{50}S_{20}$ kg/ha (T_3), $N_{25}K_{50}S_{40}$ kg/ha (T_4), $N_{50}K_{25}S_{20}$ kg/ha (T_5), $N_{50}K_{25}S_{40}$ kg/ha (T_6) and $N_{50}K_{50}S_{20}$ kg/ha (T_7). The control recorded lowest pod yield (2552 kg/ha) and haulm yield (3021 kg/ha).

Pooled results :

The three years' pooled results presented in Table 1 to 2 showed that all the growth and yield attributing characters were significantly influenced by the levels of nutrition. Highest values of growth and yield attributing characters *viz.*,plant height (33.0cm), number of branches per plant (5.82), number of pods per plant (24.01), shelling (71.91%),100 kernel weight (55.75g), kernel yield (1993 kg/ha), SMK (87.88%) and seed count (51.44) were recorded when nutrient applied N @ 50 kg/ha, K @ 50 kg/ha and S @ 40 kg/ha (T_8). This treatment remained at par with $N_{25}K_{25}S_{40}$ kg/ha (T_2), $N_{25}K_{50}S_{20}$ kg/ha (T_3), $N_{25}K_{50}S_{40}$ kg/ha (T_4), $N_{50}K_{25}S_{20}$ kg/ha (T_5), $N_{50}K_{25}S_{40}$ kg/ha (T_6) and $N_{50}K_{50}S_{20}$ kg/ha (T_7). While oil per cent (48.91%) and oil yield (967 kg/ha) were under the treatment $N_{50}K_{25}S_{40}$ kg/ha (T_6). This might be due to increased photosynthate and their subsequent translocation to storage organ resulted in increased plant height, number of branches and plant spread and better fills up of production. Ibrahim and Eleiwa (2008) stated that this might be due to the enhanced absorbion of nutrients from the soil solution resulting from their abundance when higher fertilization rates were applied, and hence promoted better assimilation leading to higher oil and protein content. Significant increases in protein and oil content in kernels in response to increasing K rate from 15 to 30 and 45 kg K_2O/ ha have been reported earlier by Salve and Gunjal (2011).

The pod yield (2770 kg/ha) and haulm yield (4557 kg/ha) were significantly recorded higher when applied N @ 50 kg/ha, K @ 50 kg/ha and S @ 40 kg/ha (T_8) which remained at par with the treatments *viz.*, $N_{25}K_{25}S_{40}$ kg/ha (T_2), $N_{25}K_{50}S_{20}$ kg/ha (T_3), $N_{25}K_{50}S_{40}$

Table 2 : Effect of different nutrient treatments on growth, yield attributes, quality and nutrient uptake of bold seeded confectionery groundnut (Pooled data of three years)

Treatments		Plant height (cm)	No. of branches per plant	Shelling %	100 kernel weight (g)	No. of pods per plant	Oil %	SMK %	Seed count	Oil yield (kg/ha)	Kernel yield (kg/ha)	Total uptake (kg/ha)			
												N	P	K	S
T_1	$N_{25}K_{25}S_{20}$	28.83	5.09	71.33	54.29	21.62	48.10	81.59	52.87	849	1767	136.4	11.95	32.49	10.78
T_2	$N_{25}K_{25}S_{40}$	28.92	5.33	71.66	55.04	22.68	48.31	83.73	52.18	895	1854	146.4	12.97	34.77	11.98
T_3	$N_{25}K_{50}S_{20}$	30.33	5.32	71.72	54.80	22.24	48.00	83.92	52.39	887	1848	143.5	13.11	37.48	11.42
T_4	$N_{25}K_{50}S_{40}$	32.03	5.43	71.90	55.71	22.65	48.42	87.50	51.47	912	1885	151.3	13.42	38.65	12.56
T_5	$N_{50}K_{25}S_{20}$	31.45	5.38	71.87	54.52	22.40	48.36	82.00	52.56	903	1866	153.6	13.29	35.70	11.68
T_6	$N_{50}K_{25}S_{40}$	32.06	5.70	71.79	54.87	23.86	48.91	86.11	52.25	967	1978	162.6	14.08	38.45	12.93
T_7	$N_{50}K_{50}S_{20}$	31.80	5.62	71.25	54.87	23.79	48.03	85.49	52.19	937	1952	159.5	14.22	40.08	11.91
T_8	$N_{50}K_{50}S_{40}$	33.00	5.82	71.91	55.75	24.01	48.21	87.88	51.44	962	1993	166.2	14.57	41.57	13.47
T_9	Control	27.54	4.64	69.96	52.06	19.88	47.39	77.38	55.08	763	1612	108.3	10.19	27.03	8.26
	S.E.±	1.12	0.15	0.38	0.42	0.63	0.28	1.44	0.42	26	53	3.4	0.29	0.85	0.31
	C.D. (P=0.05)	3.15	0.43	1.07	1.19	1.78	0.85	4.06	1.19	74	150	9.7	0.81	2.41	0.88
	C.V. (%)	12.61	9.79	1.83	2.67	9.68	1.38	5.93	2.77	10.14	9.87	8.07	7.64	8.17	9.20

kg/ha (T_4), $N_{50}K_{25}S_{20}$ kg/ha (T_5), $N_{50}K_{25}S_{40}$ kg/ha (T_6), and $N_{50}K_{50}S_{20}$ kg/ha (T_7). Higher pod and haulm yield were due to realization of better growth (plant height and branches/plant) and yield attributes (pods/plant, shelling %, 100 kernel weight and SMK). Saxena *et al*. (2003) reported that pod yield of groundnut could be increased with increasing levels of N and K. This is in conformity with the results of Bandopadhyay and Samui (1999); Subrahmaniyan *et al*. (2000); Mali *et al*. (2004); Munda *et al*. (2004); Sumui *et al*.(2004) and Giri (2011).

Nutrients uptake :

Total uptake of N, P, K and S (Table 2) significantly influenced by different treatments in pooled results. Significantly the highest uptake of N (166.2 kg/ha), P (14.57 kg/ha), K (41.57 kg/ha) and S (13.47 kg/ha) was recorded by $N_{50}K_{50}S_{40}$ kg/ha (T_8), which remained at par with T_6 and T_7 in respect of N and P, T_7 in respect of K and T_4 and T_6 in respect of S. The lowest total uptake of N, P, K and S were recorded with treatment T_9 (Control). Similar results also reported by Bhatol *et al*. (1994), Hussein *et al*. (2007) and Kishore *et al*. (2007).

Economics :

Gross realization, cost of cultivation, net realization and B:C ratio of different treatments were worked out on the basis of current market prices of groundnut inputs used (Table 1). The results indicated that gross realization (Rs.121518/ha), net return (Rs. 85112/ha) with B:C ratio (3.34) was recorded in N @ 50 kg/ha, K @ 50 kg/ha and S @ 40 kg/ha (T_8), which was closely followed by N @ 50 kg/ha, K @ 25 kg/ha and S @ 40 kg/ha (T_6) treatment in pooled results.

Conclusion:

From the experimental results it can be concluded that the confectionery summer groundnut could be successfully raised with application of 50-50-50 NPK kg/ha along with application of 40 sulphur kg/ha in Saurashtra region of Gujarat state.

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