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Yield and economics of groundnut as influenced by levels and ratios of nitrogen and phosphorus application in Northern Transition Zone of Karnataka , India

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ABSTRACT

The groundnut cultivar JL 24 was tried during 2012 with eleven ratios of nitrogen (N) and phosphorus (P_2O_5) fertilizers with potassium level as constant (25 kg K_2O ha^{-1}) at UAS, Dharwad. The yield attributing characteristics, dry pod yield and economics were increased due to increasing N/P fertilizer ratios from 0.00 to 1.00. The treatment receiving N/P fertilizer ratio of 0.50 (30 kg N, 60 kg P_2O_5, 25 kg K_2O ha^{-1}) produced significantly higher dry pod yield (3310 kg ha^{-1}), 100 kernel weight (38.50 g). Maximum gross monetary returns and net monetary returns (Rs. 1,25,780 ha^{-1} and Rs 1,01,426 ha^{-1}) and highest B : C ratio of 4.16 in the treatment receiving N/P fertilizer ratio of 0.50 (30 kg N, 60 kg P_2O_5, 25 kg K_2O ha^{-1}) produced higher kernel yield (2441 kg ha^{-1}). as compared to all other treatments and control (Rs 83,372 ha^{-1} and Rs 62,904 ha^{-1}) B: C ratio was recorded is lowest (3.07).

Keywords: Groundnut, N/P fertilizer ratios, Dry pod yield, kernel weight, Economics, B: C ratio.

INTRODUCTION

Groundnut (*Arachis hypogaea* L) is an annual legume native to South America. It is now grown in most tropical, sub-tropical and warm temperate regions of the World. In the world the crop is grown in an area of 26.62 million with an annual production of 35.66 million tonnes with a productivity of 1348 kg ha^{-1}. In India, it is grown in an area of 5.3 million ha with a production of 6.93 million tonnes with the average productivity of 1348 kg ha^{-1}. In Karnataka, it is grown in an area of 0.70 million ha with a production of 0.50 million tonnes and a productivity of 705 kg ha^{-1} (Anon., 2012).

Further, inadequate and/or imbalanced use of fertilizers has been identified as one of the critical constraints in groundnut production under rainfed farming situation. Groundnut experiments at ICRISAT centre showed that excess or insufficient soil moisture reduced N_2 fixation and a 40 % reduction in light intensity, which is generally observed in monsoon season (cloudy weather) considerably reduced the rate of N fixation. However, to meet the nitrogen requirement during early growth stages, it is applied as starter dose. Basal application of N (10 to 75 kg ha^{-1}) in the form of mineral nitrogen fertilizers has improved groundnut yield in some trials (Shimshi *et al*., 1967).

MATERIAL AND METHODS

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during rainy season of 2012. The soil is texturally clay, neutral in pH (7.53), medium in available nitrogen (229 kg Nha^{-1}), phosphorus content (32.10 kg P_2O_5 ha^{-1}), high in available potassium (386 kg K_2O ha^{-1}) and medium in organic carbon (0.49 %) content, and normal in salt content (0.36 dSm^{-1}). The experiment was laid out in randomized complete block design with three replications. The experiment consisted of 11 N/P fertilizer levels and ratios *viz.*, 0.00 (control), 0.00 (0 kg N, 0 kg P_2O_5 and 25 kg K_2O ha^{-1}), 0.83 (25 kg N, 30 kg P_2O_5 and 25 kg K_2O ha^{-1}), 0.56 (25 kg N, 45 kg P_2O_5 and 25 kg K_2O ha^{-1}), 0.50 (25 kg N, 50 kg P_2O_5 and 25 kg K_2O ha^{-1}), 0.42 (25

kg N, 60 kg P_2O_5 and 25 kg K_2O ha^{-1}), 0.33 (25 kg N, 75 kg P_2O_5 and 25 kg K_2O ha^{-1}), 1.00 (30 kg N, 30 kg P_2O_5 and 25 kg K_2O ha^{-1}), 0.67 (30 kg N, 45 kg P_2O_5 and 25 kg K_2O ha^{-1}), 0.50 (30 kg N, 60 kg P_2O_5 and 25 kg K_2O ha^{-1}) and 0.40 (30 kg N, 75 kg P_2O_5 and 25 kg K_2O ha^{-1}). The groundnut cultivar JL 24 was used for sowing at 30 cm × 10 cm spacing.

The observations on yield and yield attributes were recorded at harvest. The economics were calculated on the basis of prevailing market price. The analysis and interpretation of data were studied by using the Fischer's method of analysis of variance technique as described by Gomez and Gomez (1984). Wherever 'F' test were significant, treatments mean were compared by LSD.

RESULTS AND DISCUSSION

Application of different levels and ratios of nitrogen and phosphorus fertilizers had significant difference with respect to 100 kernel weight, kernel yield, dry pod yield.

Dry pod yield (3310 kg ha^{-1}) and kernel yield (2441 kg ha^{-1}) were significantly higher with the treatment involving N/P fertilizer ratio of 0.50 *i.e.*, basal application of 30 kg N, 60 kg P_2O_5, 25 kg K_2O ha^{-1} with 3177 kg ha^{-1} and when compared to recommended dose of fertilizer for assured rainfall situations *i.e.*, N/P fertilizer ratio of 0.33 (25 kg N, 75 kg P_2O_5 and 25 kg K_2O ha^{-1}) with 2344 kg ha^{-1} and recommended dose of fertilizer for rainfed groundnut *i.e.*, N/P fertilizer ratio of 0.50 (25 kg N, 50 kg P_2O_5 and 25 kg K_2O ha^{-1}) (3019 and 2213 kg ha^{-1}, respectively). Haulm yield recording 2932 to 3654 kg ha^{-1} in different treatments differ significantly with respect to application of different levels and ratios of nitrogen and phosphorus fertilizers (Table 4). Similar results were obtained by Shinde *et al.* (2001) and Kandil *et al.* (2007) where in N/P fertilizer ratio of > 0.50 produced higher dry pod yield and kernel yield of groundnut.

The main factors which have direct bearing on dry pod yield are total number of pods $plant^{-1}$, dry pod weight $plant^{-1}$, 100 kernel weight and shelling percentage. Further growth attributes like dry matter production $plant^{-1}$ and its distribution in to various plant parts had indirect influence on dry pod yield. Among the yield components, dry pod weight $plant^{-1}$ was more closely associated with the dry pod yield ha^{-1}. The treatment receiving N/P fertilizer ratio of 0.56 (25 kg N, 45 kg P_2O_5, 25 kg K_2O ha^{-1}) produced higher dry pod weight $plant^{-1}$ (15.82 g) as compared to N/P fertilizer ratio of 0.33 and 0.50 (13.61g and 13.12 g, respectively). Similar trend was reported earlier by Kandil *et al.* 2007.

The economic analysis of different treatments receiving nitrogen and phosphorus fertilization indicated that maximum gross monetary returns and net monetary returns (` 1,25,780 $ha^{-1}$ and ` 1,01,426 ha^{-1}) were obtained with the treatment receiving N/P fertilizer ratio of 0.50 (30 kg N, 60 kg P_2O_5, 25 kg K_2O ha^{-1}) as compared to all other treatments (` 1,04,994 $ha^{-1}$ to ` 1,20,726 ha^{-1} and ` 83,792 $ha^{-1}$ to ` 1,01,426 ha^{-1}, respectively) and control (` 83,372 $ha^{-1}$ and ` 62,904 ha^{-1}). Highest B: C ratio of 4.16 was realized in the treatment receiving N/P fertilizer ratio of 0.50 (30 kg N, 60 kg P_2O_5 and 25 kg K_2O ha^{-1}) among the different fertilizer ratio and lowest B: C ratio was recorded in the control (3.07).

Table 1: Dry pod yield (kg ha^{-1}), kernel yield (kg ha^{-1}), haulm yield (kg ha^{-1}), 100 kernel weight (g) of groundnut as influenced by nitrogen and phosphorus levels and ratios of fertilizers

Treatments	Quantity of nutrients (kg ha^{-1}) Basal application			N/P Ratio	Dry pod yield (kg ha^{-1})		Kernel yield (kg ha^{-1})		Haulm yield (kg ha^{-1})		100 kernel weight (g)	
	N	P_2O_5	K_2O									
T_1	0	0	0	**0.00**	2194	**c**	1660	**c**	2932	**b**	39.49	**a**
T_2	0	0	25	**0.00**	2763	**b**	2045	**b**	3223	**ab**	39.26	**a**
T_3	25	30	25	**0.83**	3042	**ab**	2255	**ab**	3422	**a**	39.86	**a**
T_4	25	45	25	**0.56**	2851	**ab**	2091	**b**	3439	**a**	38.40	**a**
T_5	25	50	25	**0.50**	3019	**ab**	2213	**ab**	3401	**a**	39.53	**a**
T_6	25	60	25	**0.42**	3079	**ab**	2264	**ab**	3614	**a**	38.43	**a**
T_7	25	75	25	**0.33**	3177	**ab**	2344	**ab**	3455	**a**	39.02	**a**
T_8	30	30	25	**1.00**	2690	**b**	2019	**b**	3418	**a**	39.29	**a**
T_9	30	45	25	**0.67**	3156	**ab**	2335	**ab**	3496	**a**	39.68	**a**
T_{10}	30	60	25	**0.50**	3310	**a**	2441	**a**	3651	**a**	38.50	**a**
T_{11}	30	75	25	**0.40**	3062	**ab**	2267	**ab**	3654	**a**	38.60	**a**
Mean					**2940**		**2176**		**3428**		**38.98**	
S. Em ±					154.65		102.36		145.87		1.14	

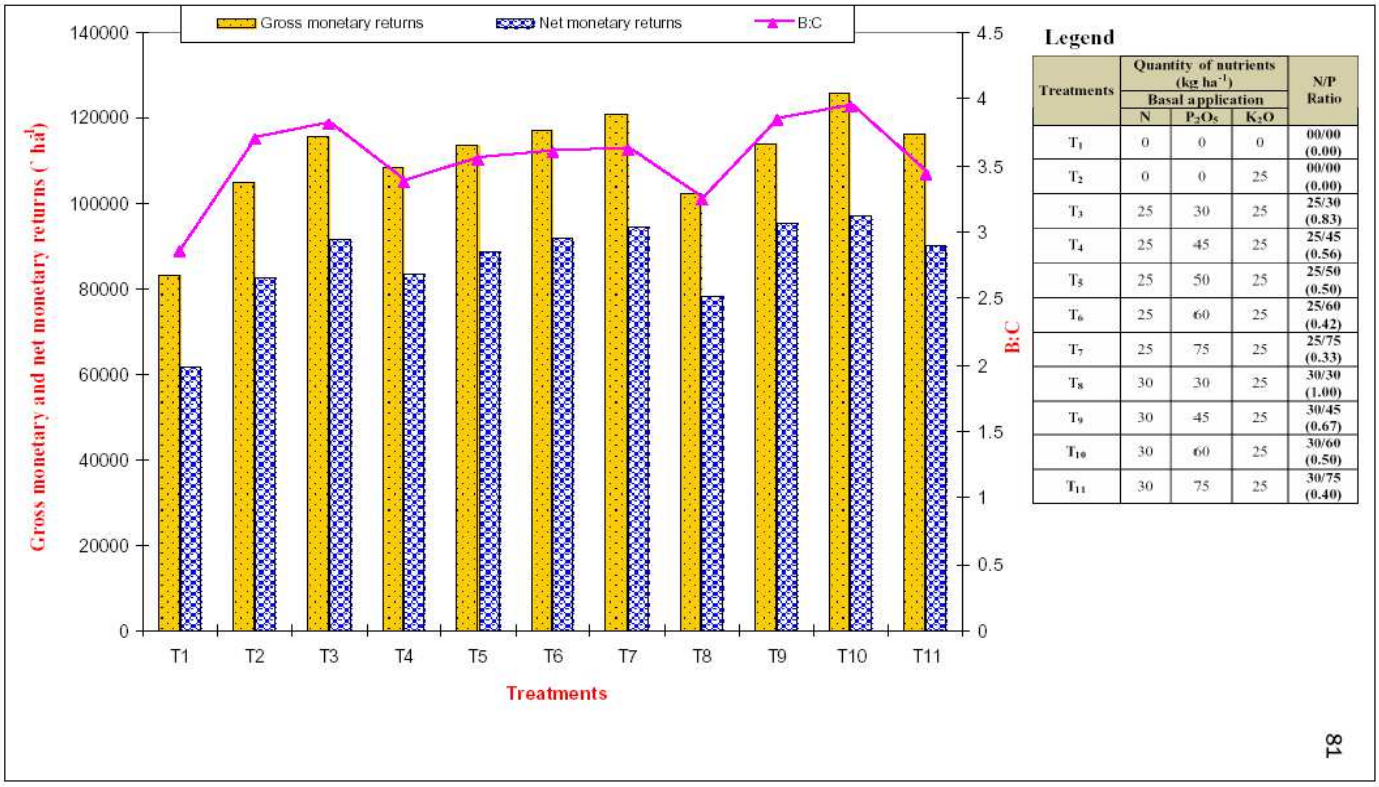
***Note**: In a column mean values followed by the common letter are not significantly different at p=0.05 level (DMRT at 5 % level) DAS: Days after sowing*

Table 2: Economics of groundnut as influenced by nitrogen and phosphorus levels and ratios of fertilizers

Treatments	Quantity of nutrients (kg ha^{-1}) Basal application			N/P Ratio	Cost of cultivation (` ha)	Gross monetary return (` ha)		Net monetary returns (` ha)		B:C	
	N	P_2O_5	K_2O								
T_1	0	0	0	**0.00**	20468	83372	**c**	62904	**g**	3.07	**d**
T_2	0	0	25	**0.00**	21202	104994	**b**	83792	**e**	3.95	**a-c**
T_3	25	30	25	**0.83**	22903	115596	**ab**	92693	**cd**	4.05	**ab**
T_4	25	45	25	**0.56**	23597	108338	**ab**	84741	**e**	3.59	**bc**
T_5	25	50	25	**0.50**	23828	113468	**ab**	89640	**d**	3.76	**a-c**
T_6	25	60	25	**0.42**	24291	117002	**ab**	92711	**cd**	3.82	**a-c**
T_7	25	75	25	**0.33**	24984	120726	**ab**	95742	**bc**	3.83	**a-c**
T_8	30	30	25	**1.00**	22966	102220	**b**	79254	**f**	3.45	**cd**
T_9	30	45	25	**0.67**	23660	113928	**ab**	96268	**b**	4.07	**ab**
T_{10}	30	60	25	**0.50**	24354	125780	**a**	101426	**a**	4.16	**a**
T_{11}	30	75	25	**0.40**	25048	116356	**ab**	91308	**d**	3.65	**a-c**
Mean					**23391**	**111070**		**88225**		**3.76**	
S. Em ±						1258		1097		0.16	

***Note**: In a column mean values followed by the common letter are not significantly different at p=0.05 level (DMRT at 5 % level)*

***DAS**: Days after sowing*



CONCLUSION

Based on the results from the present investigation it could be concluded that higher dry pod yield (3310 kg ha^{-1}) and maximum gross monetary returns and net monetary returns (` 1,25,780 ha$^{-1}$ and ` 1,01,426 ha^{-1}) and B: C ratio of 4.16 of groundnut was obtained with fertilizer management practices involving basal application of 30 kg N, 60 kg P_2O_5 and 25 kg K_2O ha^{-1} (N/P fertilizer ratio of 0.50) in Northern Transition Zone (Zone 8) of Karnataka during rainy season under rainfed situations.

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