ADVNACE RESEARCH JOURNAL OF CROP IMPROVEMENT
Volume 1 Issue 2 (December, 2010) Page : 106-110

Received : *July, 2010;* ***Accepted :*** *September, 2010*

Research Paper

Influence of phosphatic fertilizers, gypsum and sulphur on growth contributing characters of groundnut (*Arachis hypogaea* L.)

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ABSTRACT

Field experiments were conducted at Agronomy farm, College of Agriculture, Pune during *Kharif* 2006 and 2007 to investigate the influence of phosphatic fertilizers, gypsum and sulphur on growth contributing characters of groundnut. Trials were conducted in a randomized block design with four replications and six treatments *viz,* Absolute Control (T_1) , Single super phosphate + 5 t FYM/ha (T_2) , Diammonium phosphate + 5 t FYM/ha(T_3) , Rock phosphate + 5 t FYM/ha (T_4) , RDF + gypsum @ 500 kg/ha (250 kg gypsum/ha at the time of sowing and 250 kg gypsum/ha at the time of peg formation) + 5 t FYM/ha (T_5) and RDF + elemental sulphur @ 30kg /ha + 5 t FYM/ha (T_6). The results revealed that the growth contributing characters like plant height, plant spread, number of branches/plant,dry matter/plant and number of nodules/ plant were significantly superior by the application of RDF + gypsum@ 500 kg/ha (250 kg gypsum/ha at the time of sowing and 250 kg gypsum/ha at the time of peg formation) + 5t FYM/ha.

Salke, S.R., Shaikh, A.A. and Dalavi, N.D. (2010). Influence of phosphatic fertilizers, gypsum and sulphur on growth contributing characters of groundnut (*Arachis hypogaea* L.), *Adv. Res. J. Crop Improv.,* **1** (2) : 106-111.

Key words : Phosphatic fertilizers, Gypsum, Sulphur, Groundut

INTRODUCTION

Groundnut is grown on a large scale in almost all the tropical and subtropical countries of the world. The most important groundnut growing countries are India, China, Nigeria, Sudan and U.S.A. In India its cultivation is mostly confined to the southern Indian states, *viz.*,Gujarat, Andhra Pradesh, Karnataka, Tamilnadu and Maharashtra. The other important states where it is grown are Madhya Pradesh, Rajasthan, Uttar Pradesh and Panjab. Major groundnut growing districts in Maharashtra are Dhule, Nasik, Jalgaon, Ahmednagar, Parbhani, Pune, Satara and Kolhapur.

Groundnut kernels are rich in vitamins A, B_1, B_2 and E. Oil content in kernels is 43 to 49 per cent and protein content is 28 to 29.31 per cent. Groundnut cake is rich in protein content (46%) and is the best source of organic manure. The creepers are used as cattle feed and shells as fuel. Groundnut is not only used as edible oil but also used in manufacture of soap, hydrogenated vegetable oil, toilet requisites and used for culinary purpose as well. Therefore, groundnut crop plays an important role and has got immense importance in the national economy of our country. With increase in population in geometric progression, the demand for vegetable oil in India has been steadily increasing more than 4% per annum where the rate of increase in production is only 2% per annum. Every year the gap between demand and supply of edible oil is going on increasing. Very meager information is available on calcium and sulphur requirement in groundnut hence, emphasis is given to nutrient management in groundnut.

MATERIALS AND METHODS

The experiments were conducted during *Kharif* 2006 and 2007 at Agronomy farm, College of Agriculture, Pune (M.S.) The soils of experimental area were grouped under inceptisol order. The soil of the experimental area was medium black with 60-90cm depth, dominant type of clay mineral having high swell- shrink properties.

The experiments were conducted in Randomized Block Design with four replications. Phule Pragati (JL-24) variety was used. There were six treatments consisting phosphatic fertilizers, gypsum and sulphur. The treatments

consisting of Absolute control (T_1), Single super phosphate + 5 t FYM/ha (T_2), Diammonium phosphate + 5 t FYM/ha(T_3), Rock phosphate + 5 t FYM/ha (T_4), RDF +gypsum @ 500 kg/ha (250 kg gypsum/ha at the time of sowing and 250 kg gypsum/ha at the time of peg formation) + 5 t FYM/ha(T_5) and RDF + elemental sulphur @ 30kg/ha + 5 t FYM/ha (T_6). The gross and net plot sizes were 4.00 x 3.00 and 3.60 x 2.40 m^2, respectively. The groundnut was dibbled at 30 x 10 cm^2.

RESULTS AND DISCUSSION

The results obtained from the present investigation have been discussed in the following sub heads :

Plant height:

The data regarding mean plant height (cm) as affected periodically by different treatments are presented in Table1. The mean plant height was 36.82 cm at harvest.

The periodical plant height of groundnut was significantly influenced by phosphatic fertilizer,gypsum and sulphur nutrition. An integration of RDF + gypsum @ 500 kg /ha (250 kg gypsum/ha at the time of sowing and 250 kg gypsum /ha at the time of peg formation) +5 t FYM/ha significantly increased the groundnut plant height at 98 DAS (41.1cm). It was at par with RDF + elemental sulphur @ 30 kg/ha + 5t FYM/ha(40.35 cm).

The phosphorus nutrition to groundnut through single super phosphate, diammonium phosphate alongwith 5 t FYM/ha were found at par with each other at 98 DAS. This might be because of addition of gypsum, FYM and sulphur to groundnut supplied an adequate amount of sulphur. It might have essentially utilized for the chlorophyll synthesis and maintaining the N/S ratio, Ca/S ratio. This might have increased the photosynthetic activity and assimilation of organic constituent in groundnut. This resulted in increased plant height of groundnut. These results are similar to those observed by Chaubey *et al*. (2000).

Plant spread:

The mean periodical plant spread of groundnut as influenced by phosphatic fertilizers, gypsum and elemental sulphur are presented in Table 1.

The phosphorus, gypsum and sulphur nutrition to groundnut significantly influenced the periodical plant spread from 14 to 98 DAS. The magnitude of spread was more up to 70 DAS irrespective treatments. However, it was significantly higher in groundnut nutrition with RDF + Gypsum @ 500 kg /ha (250 kg gypsum /ha at the time of sowing and 250 kg gypsum /ha at the time of peg formation)+5 t FYM/ha (16.45 cm) and was at par with RDF + elemental sulphur @ 30 kg/ha+ 5 t FYM/ha (15.62 cm) at 28 DAS. Similar trend was observed at 42 DAS. The plant spread at 56, 70, 84 and 98 DAS were found at par with each other by the treatment RDF + gypsum @ 500 kg/ha (250 kg gypsum/ha at the time of sowing and 250 kg gypsum/ha at the time of peg formation)+ 5 t FYM/ha and was at par with RDF + elemental sulphur @ 30 kg /ha + 5 t FYM/ha. This might be because of gypsum, single superphosphate and elemental sulphur along with 5 t FYM/ha supplied adequate and balanced nutrient supply to groundnut crop. This may also have balanced the Ca/S, S/N as well as phosphorus ratio in plant which resulted in more periodical spread of groundnut. Similar results were reported by Ramesh and Sabale (2001). Thus, phosphatic fertilizers, gypsum and elemental sulphur alongwith 5 t FYM/ha to groundnut are beneficial for their spread.

Number of branches per plant:

The data pertaining to the mean number of branches per plant are presented in Table 1. It is observed that the total number of branches increased with advancement of age and influenced significantly by various treatments. The mean number of branches of groundnut was significantly influenced by the application of single super phosphate, diammonium phosphate, rock phosphate along with 5 t FYM /ha, RDF + gypsum @ 500 kg /ha (250 kg gypsum / ha at the time of sowing and 250 kg gypsum /haat the time of peg formation) +5 t FYM/ha and was at par with RDF + elemental sulphur @ 30 kg /ha + 5 t FYM/ha. It was significantly higher in treatment number 5 at 28 DAS. However, it was at par with each other at 42, 56, 70, 84 and 98 DAS except control. The application of RDF + gypsum @ 500 kg/ha (250 kg gypsum /ha at the time of sowing and 250 kg gypsum/ha at the time of peg formation)+5t FYM/ha recorded higher number of branches/plant than the rest of the treatments.

The phosphorus, calcium and sulphur nutrition to groundnut through single super phosphate, diammonium phosphate, gypsum and sulphur alongwith 5 t FYM /ha were beneficial for enhancing the number of branches throughout their growth period. Similar results were reported by Chaubey *et al*. (2000).

Leaf area (dm^2) per plant:

The data on periodic leaf area (dm^2) per plant as influenced by different treatments are presented in Table 1. The data clearly indicate that there was significant influence of different treatments on leaf area (dm^2) throughout the phases of growth. The mean leaf area at harvest was 25.11 dm^2.

Table 1: Influence of phosphatic fertilizers, gypsum and sulphur on growth contributing characters of groundnut (Pooled over two seasons)

Treatments	Plant height (cm)						Plant spread (cm)						Number of branches / Plant					
	28 DAS	42 DAS	56 DAS	70 DAS	84 DAS	98 DAS	28 DAS	42 DAS	56 DAS	70 DAS	84 DAS	98 DAS	28 DAS	42 DAS	56 DAS	70 DAS	84 DAS	98 DAS
Control	3.92	6.67	14.32	17.35	23.80	29.35	9.27	14.45	19.90	28.20	36.27	39.05	4.20	4.67	5.05	5.37	5.75	6.20
Single super phosphate + 5 t FYM /ha	5.05	10.80	17.62	21.50	28.34	38.10	15.22	21.87	28.05	34.95	41.27	44.07	4.80	5.33	5.85	6.47	7.40	7.65
Diammonium phosphate + 5 t FYM /ha	4.98	10.65	17.50	20.22	27.07	37.75	13.80	19.57	24.67	33.82	40.82	43.35	4.64	5.37	5.70	6.35	6.82	6.42
Rock phosphate + 5 t FYM /ha	4.82	10.55	17.46	19.85	26.85	34.32	12.85	18.87	23.20	30.79	40.72	42.57	4.60	5.26	5.60	6.32	6.77	6.32
RDF + Gypsum @ 500kg /ha + 5 t FYM /ha	5.35	15.67	19.72	23.00	30.22	41.10	16.45	23.97	31.57	37.52	45.65	49.85	5.20	5.75	6.35	7.00	8.00	8.25
RDF + Elemental sulphur 30kg /ha + 5 t FYM /ha	5.05	15.07	18.45	22.29	29.07	40.35	15.62	22.67	29.89	35.40	42.82	44.95	4.80	5.45	6.00	6.70	7.32	7.92
S.E.	0.30	0.65	0.98	0.81	0.77	1.13	0.59	0.59	0.43	0.84	1.46	1.38	0.13	0.18	0.17	0.26	0.19	0.40
C.D. (P=0.005)	0.91	1.98	2.97	2.45	2.33	3.42	1.80	1.80	1.32	2.53	4.41	4.17	0.37	0.56	0.52	0.79	0.57	1.21
General Mean	4.69	11.56	16.89	20.83	27.72	36.82	13.87	20.22	26.21	33.42	40.86	44.3	4.58	5.19	5.66	6.37	7.01	7.14

Contd... Table 1

Table 1 contd...

Treatments	Leaf area / plant (dm^2)						Dry matter / plant (g)						Number of nodules/ plant at 42 DAS	Days to 50% flowering
	28 DAS	42 DAS	56 DAS	70 DAS	84 DAS	98 DAS	28 DAS	42 DAS	56 DAS	70 DAS	84 DAS	98 DAS		
Control	1.17	7.45	10.55	17.85	19.60	20.05	0.77	6.50	11.50	13.52	19.80	25.17	13.66	27.00
Single super phosphate + 5 t FYM /ha	1.82	11.65	14.57	22.25	23.22	24.67	1.57	10.37	14.62	18.25	27.00	33.12	17.30	30.50
Diammonium phosphate + 5 t FYM /ha	1.65	10.67	13.72	21.25	23.22	24.67	1.55	9.62	13.87	17.75	26.50	29.27	16.49	29.25
Rock phosphate + 5 t FYM /ha	1.62	10.32	12.72	21.05	22.57	23.03	1.54	9.00	13.37	17.00	24.00	28.72	16.62	28.75
RDF + Gypsum @ 500kg /ha + 5 t FYM /ha	2.37	14.55	16.60	25.00	27.50	29.10	2.35	12.17	17.72	22.48	31.75	36.42	19.69	29.25
RDF + Elemental sulphur 30kg /ha + 5 t FYM /ha	1.75	12.32	14.92	23.52	25.30	26.57	1.77	11.50	15.25	20.32	29.50	34.77	17.48	30.75
S.E.	0.12	0.60	0.62	1.01	0.61	0.72	0.23	0.75	0.57	1.15	1.66	0.57	0.66	0.48
C.D. (P=0.005)	0.38	1.81	1.88	3.05	1.84	2.17	0.70	2.26	1.74	3.46	5.00	1.72	1.98	1.44
General Mean	1.69	11.16	13.85	22.02	24.12	25.11	1.54	10.2	14.39	18.24	26.41	31.25	16.87	29.41

The mean periodical leaf area of groundnut plant was significantly influenced by the SSP, DAP, rock phosphate, RDF + gypsum and RDF + elemental sulphur alongwith 5 t FYM/ha. The magnitude of leaf area was increased with an increased age of crop. However, fertilizer application to groundnut through RDF + gypsum @ 500 kg/ha (250 kg gypsum /ha at the time of sowing and 250 kg gypsum/ ha at the time of peg formation)+ 5 t FYM/ha significantly influenced the leaf area over rest of the treatments at all the growth stages of crop period except at 28 DAS. At 28 DAS the maximum leaf area of (2.37 dm^2) was recorded by the treatment RDF + gypsum @ 500 kg/ha (250 kg gypsum /ha at the time of sowing and 250 kg gypsum /ha at the time of peg formation)+ 5 t FYM/ha which was significantly superior over control (1.17 dm^2). This might be because of addition of calcium and sulphur through gypsum and micronutrients through FYM in addition to RDF probably balanced the Calcium : boron ratio, Calcium : nitrogen ratio and balanced nutrition. Similarly, the sulphur nutrition accelerated the chlorophyll synthesis and photosynthesis. These plant processes might have reflected in increased leaf area.

Number of nodules per plant:

The data pertaining to mean number of nodules per plant as influenced by different treatments are presented in Table 1.The data indicate that there was significant influence of various treatments on number of nodules per plant. The mean number of nodules at 42 DAS was significantly increased by the application RDF + gypsum @ 500 kg /ha (250 kg gypsum/ha at the time of sowing and 250 kg gypsum /ha at the time of peg formation)+ 5 t FYM/ha and at harvest were (19.67 and 62.35, respectively) over the remaining treatments. However, the groundnut nutrition with SSP, DAP, Rock phosphate and RDF + elemental sulphur @ 30kg /ha + 5 t FYM/ha were at par with each other.The control treatment recorded significantly lower number of root nodules (13.66).Thus, phosphatic fertilizers, gypsum and elemental sulphur @ 30 kg /ha +5 t FYM/ha were beneficial for root nodules of groundnut crop. This might be due to the combine effect of calcium and sulphur present in gypsum and single super phosphate. These results are similar to those obtained by Tripathi and Hazra (2003).

Dry matter per plant (g):

The data regarding mean dry matter per plant are presented in Table 1. It could be seen from Table1 that the dry matter accumulation was increased up to harvest. The mean dry matter per plant recorded was 31.25 g at harvest. The data clearly indicated that there was a significant difference amongst various treatments on dry matter accumulation per plant.

The periodical dry matter of groundnut crop was significantly increased by the application of RDF + gypsum @ 500 kg/ha(250 kg gypsum/ha at the time of sowing and 250 kg gypsum/ha at the time of peg formation)+ 5 t FYM/ ha at 28, 42, 56, 70, 84 and 98 DAS (2.35,12.17, 17.72, 22.47,31.75and 36.42 g $plant^{-1}$,respectively). It was at par with RDF + elemental sulphur @ 30 kg /ha + 5 t FYM/ha (1.77, 11.50, 15.25, 20.32, 29.50 and 34.77g /plant, respectively).

The increased dry matter might be associated with addition of calcium and sulphur through gypsum and elemental sulphur which might have enhanced the metabolic activity of groundnut crop which are reflected in assimilation of biomass. The groundnut nutrition as SSP (33.12 g), DAP (29.27g), and rock phosphate (28.72 g) with + 5 t FYM/ha were at par with each other for their periodical dry matter accumulation. Whereas, control treatment recorded the least amount of dry matter at all the days of observation (0.77, 6.50, 11.50, 13.52, 19.80 and 25.17 g/plant, respectively). These results are similar to those obtained by Maity *et al.* (2003)

Conclusion:

The results revealed that the growth contributing characters like plant height, plant spread, number of branches/plant, dry matter/plant and number of nodules/ plant were significantly superior by the application of RDF + gypsum@ 500 kg/ha (250 kg gypsum/ha at the time of sowing and 250 kg gypsum/ha at the time of peg formation) + 5t FYM/ha.

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