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Effect of biophos and phosphate levels on growth and yield of groundnut and available nutrient status of the soil

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A field experiment was conducted to study the effect of biophos and phosphate levels on plant growth, yield of groundnut and availability of nutrients in Sawargaon soil series. The highest pod, haulm yield, 100 kernel weight, shelling percentage and protein content in kernel of groundnut was obtained in treatment 100 %RD of $P_2 0_5$+ Biophos 2.50 kg ha^{-1}.The yield and yield contributing characters were gradually increased with increase in levels of phosphorus with and without biophos inoculation.There was significant increase in available nitrogen and phosphorus whereas potassium was gradually increased with increase in levels of phosphorus and biophos. The available phosphorus and potassium decreased with advance growth period of the crop; whereas the nitrogen content was not decreased in the soil at harvest.

Key words : Pod, Haulm, Protein, Available N, P, K, Biophos culture

INTRODUCTION

INDIA is the largest groundnut growing country in the world and second largest producer of groundnut next to china. The groundnut being a legume, require higher quantity of phosphorous for root development, better tillering, essential for many metabolic processes and small quantity of nitrogen.Phosphatic fertilizers added to soil, the part of phosphorus is utilized by the plants and remainining phosphorus is fixed in the form of insoluble phosphorus.The phosphate solubilizing bacteria and fungi solubilze the insoluble phosphorus to soluble form and makes it available to plants, Wani. et. al.(1979).Groundnut crop showed better response to phosphorus management, Jana et.al.(1990).The present investigation, was , therefore, undertaken to study the effect of biophos (phosphate solubilizing micro organisms) and phosphate levels on growth and yield of groundnut and available nutrient status of the soil.

MATERIAL AND METHODS

A field experiment was conducted during Kharif 1994 at Rahuri on Sawargaon soil series having available N-205 Kg ha^{-1}, P-5.48 Kg ha^{-1} and K-308 Kg ha^{-1}. Twelve treatments combinations were tested with three replications in randomized block design consisting of three levels of biophos culture (0, 1.25 and 2.50 Kg ha^{-1}) and four levels of phosphorus (0, 50, 75 and 100 % of recommened dose of 50 kg $P_2 0_5$ ha^{-1}). Uniform basal applications of N @ 25 Kg ha^{-1} through urea and phosphate through single super phosphate (SSP) as per treatment was applied at the time of sowing. Groundnut seeds (JL-24) were inoculated with PSM. The net plot size was 3.8 x 3.0 m and dibbling of seed was done at a distance of 30 X 10 cm. The soil samples (15 cm depth) from each plot at flowering, pod formation and harvest stage were colleced, air dried and passed through 2mm sieve and used for estimation of available N by alkaline $KmnO_4$ method (Sahrawat and Burdford, 1982), P by 0.5M $NaHCo_3$ at pH 8.5asorbic acid method (Watanbe and Olsen, 1965) and K by 1N NH_4OAc at pH 7.0 method (Jackson, 1973). The dry matter yield, haulm yield,dry pod yield, shelling percentage and100 kernel weight were recorded.The N content in diacid ($H_2 0_2$:$HClO_4$) extract of kernel was estimated by following standard method.The treatment details are as follows

RESULTS AND DISCUSSION

The data revealed that the haulm and pod yield of groundnut was not influenced significantly (Table 1).However, the haulm and pod yield of groundnut increased with the biophos inoculation to seed over control (uninoculted). The haulm and pod yield gradually increased with the increase in the levels of phosphorus with and without biophos inoculation over treament T_1.The highest haulm and pod yield was recorded in 100 % recommended dose of $P_2 0_5$ alongwith biophos inoculation@ 2.5 Kg ha^{-1}(T_{12}).There was increase in haulm and pod yield by was 3.53 and 7.51 per cent respectively in the treatment T_{12} over treatment T_6 . Ahmad and Jha (1977) observed that Bacillus megaterium was more efficient in releasing native p or p from single super phosphate.

The shelling percent and protein content in groundnut kernelwas significantly influenced by different treatments. The highest shelling percent (73.97) was recorded in the treatment T_{12}; where as 100 kernel weight was non significant. The protein content in kernel gradually increased with increase in levels of biophos and phosphate over control. The highest shelling percent, protein content and 100 kernel weight was recorded 100 % recommened dose of $P_2 0_5$ alongwith biophos inoculation@ 2.5 Kg ha^{-1} . Wani. et. al. (1988) reported that 100 kernel weight increased with increase in levels of single super phosphate as well as boronated super phosphate.The increase in crude protein content with p application and its availablity might be due to its role in protein synthesis. Increase in crude protein by increasing phosphorus level was also reported by Singh and Ahuja (1985).

It is seen that the available N and P in the soil was significantly inflenced by different treatments at all growth stages; whereas K was non significantly(Table 2).The available N content in soil increased with the levels of phosphorus and biophos over control .The highest available N was recorded in treatment T_{12} which was on par with treatments T_{11} and T_6 at flowering stage and T_{10},T_{11} and T_6 at pod formation and harvest stage.The available N decreased upto pod formation, it might be due to higher uptake of nitrogen and increased availability at harvest stage due to fixation of nitrogen by groundnut crop. The influence of phosphorus levels on nitrogen fixation may be attributed to the increased supply of photosynthates (Graham and Rosas 1979).

The available phosphorus content in the soil at flowering was significantly higher under biophos @ 1.25 and 2.5 Kg ha^{-1} in treatments T_2, T_3 and non significant at pod formation and harvest stage. This might be due to mineralisation and solubilization of inorganically fixed soil phosphorus by organism (Gerretsen, 1948 and Sundara Rao and Sinha 1963). The significant difference in available phosphorus was noticed in the treatments T_4 , T_5, T_6. Whereas the T_6 was on par with 75 %

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Table 1 : Rising water table in canal commands

Sr.No.	Irrigation commands	Rise of water tables (m annum^{-1})
1	Mahi right bank canal command (MRBC)Gujarat	0.28
2	Rajastan canal command (IGNP) Rajastan	0.29- 0.88
3	Western Jamuna and Bhakra canal command Haryana	0.30 – 1.00
4	Sirhand canal command Punjab	0.10 – 1.00
5	Sharda shayak canal command (U.P)	0.68
6	Malaprabha canal command, Karnataka	0.60 -1.2
7	Nagarjna sagar irrigation project Andhra Pradesh	0.32
8	Sriram sagar irrigation project Andhra Pradesh	0.26

Table 2 : Effect of levels of biophos and phosphate on available nutrient content at different growth stages of Groundnut

Treatment	Available Nitrogen (Kg ha^{-1})			Available Phosphorus (Kg ha^{-1})			Available Potassium (Kg ha^{-1})		
	Flowering	Pod formation	Harvest	Flowering	Pod formation	Harvest	Flowering	Pod formation	Harvest
T_1	201	199	201	7.99	5.96	4.47	270	262	234
T_2	204	201	202	9.26	6.56	4.99	275	267	239
T_3	205	201	203	9.71	6.79	5.23	276	268	240
T_4	206	201	204	10.08	7.09	5.74	275	267	239
T_5	208	203	207	11.87	9.26	7.16	280	272	248
T_6	210	205	209	14.03	10.60	9.26	284	276	253
T_7	207	201	204	10.52	7.68	6.02	276	268	240
T_8	208	202	205	11.34	7.99	6.34	275	272	244
T_9	209	204	207	12.61	10.08	7.65	280	276	248
T_{10}	209	205	208	13.21	10.45	8.65	280	276	253
T_{11}	212	206	210	13.61	11.49	9.56	294	281	256
T_{12}	213	207	210	15.67	11.87	10.08	294	281	258
C.D.at 0.05	3.53	2.72	2.15	1.23	0.96	1.69	N.S.	N.S.	N.S.

N.S. - Non Significant

recommended dose of P_20_5 alongwith biophos inoculation@ 2.5 Kg ha $^{-1}$. The available potassium in soil decreased with the advance growth period of the crop.This might be due to extraction of potassium by plant during thecrop growth.

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