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EFFECT OF ORGANIC AND INORGANIC SOURCES OF NUTRIENTS ON GROWTH CHARACTERS OF GROUNDNUT IN TWO DIFFERENT TEXTURED SOILS

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ABSTRACT:

Field experiments were carried out in a farmer's field at Chinnathanakuppam and Ayeekuppam villages, Cuddalore District during December, 2008 and March, 2009 to study the effect of combined use of organic and inorganic sources of nutrients on growth characters of groundnut in two different textured soils. The experimental soil at Chinnathanakuppam belongs to vadalapakkam series (Typic haplustalf) with loam texture having pH- 7.8 and EC – 0.36 dSm^{-1}, organic carbon status 3.4 g kg^{-1}, 285 kg ha^{-1} of alkaline $KMnO_4$ –N, 11 kg ha^{-1} of Olsen–P and 190 kg ha^{-1} of NH_4OAC- K. The experimental soil at Ayeekuppam belongs to vadalapakkam series (Typic haplustalf) with sandy in texture, having pH- 8.1 and EC – 0.41 $dSm^{-1.}$ The soil was low in OC (2.8 g kg^{-1}), low in available N (230 kg ha^{-1}) and P (9.0 kg ha^{-1}) and medium in available K (160 kg ha^{-1}). The experiment was conducted with 16 treatment combinations (Refer table). The treatments consisted of different levels of NPK viz., 100%, 75% and 50% RDF and different sources of nutrients viz., farm yard manure @ 12.5 t ha^{-1}, fly ash @ 10 t ha^{-1} and humic acid @ 20 kg ha^{-1} along with micronutrients boron @ 10 kg ha^{-1} and zinc sulphate @ 25 kg ha^{-1}. The experiment was laid out in randomized block design (RBD) with three replications and tested with groundnut crop var.JL- 11.

The results of the experiment clearly indicated the usefulness of various sources of nutrients and NPK application in promoting the growth of groundnut. Among the levels of NPK, application of 100% RDF+ $ZnSO_4$ @ 25 kg ha^{-1} + boron @ 10 kg ha^{-1} and farm yard manure @ 12.5 t ha^{-1} (T_8) recorded the highest plant height in loam (24.50 cm at flowering, 35.0 cm at peg formation and 52.07 cm at harvest) and sandy (20.55 cm at flowering, 25.04 cm at peg formation and 43.25 cm at harvest) soils. Similarly, the dry matter production of groundnut was the highest in the above said treatments. The loam soil registered a DMP of 1152 kg ha^{-1} at flowering and 2041 kg ha^{-1} at peg formation stage. The sandy soil recorded a DMP of 520 kg ha^{-1} at flowering and 1220 kg ha^{-1} at peg formation stage. In the treatment T_{12}

- 75% RDF + $ZnSO_4$+ boron+ humic acid the values of growth were on par with T_8 values in both loam and sandy soils. With regard to 50% RDF along with different sources of nutrients registered lowest plant height and DMP in both soils.

Among added organic sources FYM gave better result (T_8) which on par with 75% RDF plus humic acid @ 20 kg ha^{-1}. This trend followed on T_4, T_6, T_7, T_{10} and T_{11}. 100% RDF+ $ZnSO_4$ @ 25 kg ha^{-1} + boron @ 10 kg ha^{-1} and farm yard manure @ 12.5 t ha^{-1} (T_8). Among the sources tried, FYM was superior in the performance of growth parameters. The humic acid was the next best source. The micronutrient sources zinc sulphate and borax was relatively better in their performance but fly ash showed poor performance. Thus the result revealed that 75% RDF + $ZnSO_4$ @ 25 kg ha^{-1} + Boron @ 10 kg ha^{-1} and humic acid @ 20 kg ha^{-1} which resulted in better growth characters in both the soils could be the best treatment.

KEY WORD: *Effect, Organic, Inorganic, Nutrients, Groundnut, Soils.*

INTRODUCTION:

Groundnut (*Arachis hypogaea* L.) is a unique and important oilseed crop of India. In India, groundnut is cultivated in 5.48 m ha with a production of 5.43 m t and productivity of 991 kg ha^{-1} (2009-10). Tamilnadu ranks 3rd in the country both in area (6.03 lakh ha^{-1} contributing 8.45 %) and production (9.89 m t contributing 14.32 %) with an average productivity of 1.64 t ha^{-1} (Directorate of economics and statistics, Department of Agriculture and Cooperation, 2009-10). The low level of its productivity has been ascribed to several constraints. Among them, low organic matter content, poor fertility status, imbalanced use of high analysis chemical fertilizers accompanied by restricted use of organic manures that made the soils not only deficient in secondary and micronutrients, but also deteriorated the soil health (Akbari *et al*., 2011).

Due to prohibitive cost of chemical fertilizers, farmers do not apply the recommended doses of nutrients to this energy-rich legume crops. Indigenously available organic sources of nutrients have enhanced the efficiency and reduced the requirements of chemical fertilizers (Bhat *et al*., 2007). Hence, it is necessary to integrate different sources of nutrients to meet the crop requirement. Sustainable yields in groundnut can be achieved through the conjunctive use of organic and inorganic fertilizers (Singh *et al*., 1990). Organic manures improved the soil physical, chemical and biological properties and also increase the efficiency of the applied nutrients especially in light soils (Pandey *et al*., 2007).

Groundnut crop is mostly grown in light soils and this crop broadly embraces the rain fed tract of Tamilnadu. In view of the vagaries of rainfall and soil fertility problems, groundnut crop needs efficient nutrient management practices with an integrated approach of exploring all possible nutrient resources, not only to augment the nutrient supply system, but also to improve the physical, chemical and biological properties of soil, so as to overcome the limitations of groundnut cultivation in light soils. Such integrated approach with special emphasis on combined application of inorganic fertilizers with organic manures would sound well in oilseed crops like groundnut grown under aberrated climatic conditions. Therefore, an experiment was conducted to study the effect of integrated use of organic and inorganic sources of nutrients on groundnut in loam and sandy soils.

MATERIALS AND METHODS:

The field experiments were conducted in farmer's field at Chinnathanakuppam and at Ayeekuppam village during December, 2008 to March, 2009 . The experimental soil at Chinnathanakuppam belongs to vadalapakkam series (Typic Haplustalf) with loam texture having pH- 7.8 and EC – 0.36 dSm^{-1}, organic carbon status 3.4 g kg^{-1}, 285 kg ha^{-1} of alkaline $KMnO_4$ –N, 11 kg ha^{-1} of Olsen–P and 190 kg ha^{-1} of NH_4OAC- K. The experimental soil at Ayeekuppam belongs to vadalapakkam series (Typic Haplustalf) with sandy in texture, having pH- 8.1 and EC – 0.41 dSm^{-1} . The soil was low in OC (2.8 g kg^{-1}), low in available N (230 kg ha^{-1}) and P (9.0 kg ha^{-1}) and medium in available K (160 kg ha^{-1}). The experiments were conducted with 16 treatment combinations (Refer table). The treatments consisted of different levels of NPK viz., 100%, 75% and 50% RDF and different sources of nutrients viz., farm yard manure @ 12.5 t ha^{-1}, fly ash (FA) @ 10 t ha^{-1} and humic acid (HA) @ 20 kg ha^{-1} along with micronutrients boron @ 10 kg ha^{-1} and zinc sulphate @ 25 kg ha^{-1}. The experiments were laid out in randomized block design (RBD) with three replications and tested with groundnut crop var.JL- 11. Required quantities of nutrient sources as per the treatment schedule were incorporated. Calculated amount of fertilizer doses of 17:34:54 kg N: P_2O_5:K_2O ha^{-1} was applied in both soils as per the treatment schedule. At flowering and peg formation stages the growth characters viz., plant height and DMP and at harvest pod and haulm yields were recorded.

RESULTS AND DISCUSSION:

Growth characters

All the inorganic, organic and micronutrients evaluated with different levels of NPK fertilizers significantly increased the growth characters of groundnut in both the soils.

Among treatments tried, application of 100% RDF + FYM + Boron + $ZnSO_4$ (T_8) registered the maximum plant height and DMP at all critical stages of groundnut in both the soils. The maximum plant height was 24.50 and 20.55 cm (Flowering stage), 35.00 and 25.04 cm (Peg formation stage) and 52.07 and 43.25 cm (Harvest) in both loam and sandy soils, respectively. Similarly, the dry matter production of groundnut was the highest in above said critical stages in loam (1152 and 2041 kg ha^{-1}) and sandy (520 and 1220 kg ha^{-1}) soils. However, it was on par with 75% NPK + $ZnSO_4$ @ 25 kg ha^{-1} + Boron @ 10 kg ha^{-1} along with humic acid @ 20 kg ha^{-1} (T_{12}) treatment. When both micronutrients were combined with RDF, the treatment T_4 (100% NPK + $ZnSO_4$ @ 25 kg ha^{-1} + Boron @ 10 kg ha^{-1}) recorded maximum plant height of 22.71, 24.34 and 44.34 cm in loam soil and 16.24, 20.39 and 37.06 cm in sandy soil at flowering, peg formation and harvest stages respectively. The dry matter production of groundnut was also the highest in the above said treatment in both loam (799 kg ha^{-1} at flowering and 1450 kg ha^{-1} at peg formation stage) and sandy soils (422 kg ha^{-1} at flowering and 1012 kg ha^{-1} at peg formation stage) and it was followed by T_7 and T_6 treatments received application of boron or $ZnSO_4$ alone with 100% NPK + FYM. This was significantly followed by the treatment T_{11} (75% RDF + Boron + Humic acid), T_{10} (75% RDF + $ZnSO_4$ + Humic acid) and T_{16} (50% RDF + $ZnSO_4$ + Boron + Fly ash) which were equally efficient in influencing the growth characters of groundnut.

Application of 100% RDF + FYM @ 12.5 t ha^{-1} (T_5), RDF + Boron @ 10 kg ha^{-1} (T_3) and 75% RDF + Humic acid @ 20 kg ha^{-1} (T_9) rated equally efficient in increasing the growth characters of groundnut. Among these treatments T_5 - 100% RDF+ FYM recorded the maximum plant height at flowering (23.07 and16.24 cm), peg formation (28.72 and 20.04 cm) and at harvest (43.65 and 37.11cm) stages and the dry matter production was also maximum at flowering (799 and 430 kg ha^{-1}) and at harvest (1450 and 1008 kg ha^{-1}) stages in loam and sandy soils respectively.. However, it was comparable with the treatment T_3 and T_9. The treatments 50% RDF + Fly ash (T_{13}), 50 % RDF + $ZnSO_4$ + Fly ash (T_{14}) and 50% RDF + Boron + $ZnSO_4$ + Fly ash (T_{15}) recorded the lowest values in growth characters of groundnut. The increased value in growth characters might be due to the combined effect of organic and inorganic fertilizers on the increased nutrient availability and microbial activity resulting in better nutrient absorption and growth of crops. These results are in conformity with the finding of Babhulkar (2000).

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Table.1. Effect of organic and inorganic sources of nutrients on growth characters of groundnut

Treatments	Loam soil					Sandy soil				
	Plant height (cm)			DMP (kg ha^{-1})		Plant height (cm)			DMP (kg ha^{-1})	
	FS	PFS	HS	FS	PFS	FS	PFS	HS	FS	PFS
T_1- RDF	15.80	20.17	35.07	810	1221	14.10	17.68	30.33	351	790
T_2- RDF+ $ZnSO_4$	20.63	23.04	38.58	847	1394	15.77	19.20	33.42	376	1000
T_3- RDF + Boron	20.11	22.88	36.62	812	1356	15.02	18.79	32.99	368	987
T_4- RDF+ $ZnSO_4$+ Boron	22.71	24.34	44.34	859	1423	16.24	20.39	37.06	422	1012
T_5 – RDF + FYM	23.07	28.72	43.65	799	1450	16.69	20.04	37.11	430	1008
T_6 - RDF+ $ZnSO_4$ + FYM	23.41	32.41	48.67	1050	1857	18.67	22.49	40.55	487	1132
T_7 - RDF + Boron + FYM	23.37	31.04	46.32	1022	1809	18.31	22.34	38.97	471	1120
T_8 - RDF+ $ZnSO_4$+ Boron + FYM	24.50	35.00	52.07	1152	2041	20.55	25.04	43.25	520	1220
T_9 – 75% RDF + HA.	19.33	23.07	44.36	798	1398	16.11	19.69	30.79	350	802
T_{10} -75% RDF + $ZnSO_4$+ HA.	23.41	26.97	47.32	1001	1759	16.99	21.97	36.25	399	1094
T_{11} -75% RDF + Boron+ HA.	23.02	26.01	44.08	917	1746	16.44	21.07	34.39	372	1072
T_{12} - 75% RDF + $ZnSO_4$+ Boron+ HA.	23.45	33.26	50.13	1115	1979	19.67	23.82	41.36	510	1201
T_{13} – 50% RDF + FA	14.32	17.65	33.21	750	1150	13.62	15.36	29.16	337	690
T_{14} - 50% RDF + $ZnSO_4$ + FA	17.28	20.25	34.19	797	1197	13.99	16.95	30.01	347	957
T_{15} -50% RDF + Boron + FA	16.32	19.37	33.14	785	1185	13.78	16.29	29.76	342	940
T_{16} -50% RDF + $ZnSO_4$ +Boron +FA	17.01	21.09	35.89	806	1206	14.36	17.35	31.04	353	992
SED	**2.44**	**3.50**	**5.20**	**79.8**	**139.8**	**2.09**	**2.50**	**4.32**	**52**	**122**
CD (P=0.05)	**1.22**	**1.75**	**2.60**	**39.90**	**69.91**	**1.02**	**1.25**	**2.16**	**26**	**61**