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Effect of various tillage and nutrient management practices on growth and yield attributes of groundnut (*Arachis hypogaea* L.)

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ABSTRACT

A field study was conducted during *Kharif* season of 2007 to study the effect of various tillage and nutrient management practices on growth and yield attributes of groundnut (*Arachis hypogaea* L.) under rainfed condition. Three tillage and four nutrient management practices were tried. Among tillage practices, mechanical tillage + two intercultivations registered significantly higher growth and yield attributes and pod and haulm yield (1307 and 2733 kg ha^{-1}, respectively) compared to conventional tillage practices. Amongst the nutrient management practices, combined application of 50 per cent organics + 50 per cent inorganics registered higher pod and haulm yield (1282 and 2729 kg ha^{-1}, respectively) compared to 100 per cent inorganics and 100 per cent organics. Net return with B:C ratio was maximum in mechanical tillage + two intercultivations with combined application of 50 per cent organic manure with 50 per cent inorganic fertilizer (Rs. 12,903 and 1.86 ha^{-1}, respectively).

Key words : Conventional tillage, Mechanical tillage, Intercultivation, Nutrients, Groundnut

INTRODUCTION

Groundnut (*Arachis hypogaea* L.), king of oilseeds belongs to the family Leguminosae. The groundnut seed is valued both for its oil and protein content. The seeds contain about 40-45 per cent oil, 25 per cent protein and 18 per cent carbohydrates in addition to minerals and vitamins. Groundnut is grown in an area of 26.4 million hectares with a total production of 36.1 million metric tons and an average productivity of 1.4 metric tons ha^{-1} in the world (Anonymous, 2007). Karnataka stands fourth with an area of 10.4 lakh hectares with annual production of 6.71 lakh tonnes and average productivity of 679 kg ha^{-1}. Tillage helps to improve looseness, oxygen supplies and water intake among other things (Donahue *et al*., 1987). Integrated use of both chemical fertilizers and organic manures is needed to check the depletion of soil and enhance the yield levels. The importance of organic manures in promoting soil health and better plant nutrition has started receiving much recognition in the world as a whole in recent years. The supplementary and complementary use of organic manures along with chemical fertilizers, besides improving physico-chemical properties also improves the use efficiency of applied fertilizers. Farmyard manure (FYM) is one of the important organic manures that improves the soil physico-chemical properties and use efficiency of applied fertilizers. Keeping these points in view, the present investigation was undertaken to study the effect of various tillage and nutrient management practices on growth and yield attributes of groundnut (*Arachis hypogaea* L.) under rainfed condition

MATERIALS AND METHODS

Field experiment was conducted at Agronomy field unit, University of Agricultural Sciences, GKVK, Bangalore during *Kharif* season in 2007. The soil of the experimental field was red sandy loam, having pH 6.6 and EC 0.15 dS m^{1}, available N (189.6 kg ha^{1}), available P_2O_5 (29.3 kg ha^{1}), available K_2O (202.8 kg ha^{-1}) and organic carbon (0.56%). The experiment was laid out in a Split Plot Design with four replications. The twelve treatment combinations comprised of four tillage practices *viz.,* T_1: Conventional tillage (bullock drawn desi plough twice + bullock drawn cultivator twice) + one intercultivation at 25 days after sowing (DAS), T_2: Conventional tillage + two intercultivations at 25 and 40 DAS, T_3: Mechanical tillage (tractor drawn disc plough once + tractor drawn cultivator twice) + one intercultivation at 25 DAS and T_4: Mechanical tillage + two intercultivations at 25 and 40 DAS in main plots and three nutrient management practices *viz.*, F_1: 100% organics (FYM at 25 kg N equivalent), F_2: 100% inorganics (25:50:25 kg N, P_2O_5, K_2O ha^{-1}) and F_3: 50% organics (FYM at 12.5 kg N equivalent) + 50% inorganics (12.5:25:12.5 kg N, P_2O_5, K_2O ha^{-1}) in sub-plots. Groundnut cultivar TMV-2, was sown in last week of July, 2007 by hand dibbling by adopting a spacing of 30 cm x 15 cm.

All agronomic practices were carried out as per schedule to raise the crop growth attributes such as plant

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height and number of primary branches plant^{-1} at harvest and leaf area index (LAI) at 90 DAS and peg to flower ratio were measured. Yield attributes *viz.*, number of pod plant^{-1}, shelling per cent, pod yield plant^{-1} and pod and haulm yield ha^{-1} at harvest were measured. The data recorded on various characters during the course of investigation were subjected to Fisher's method of analysis of variance and interpretation of data was made as per the procedure given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Growth attributes :

Observation on plant height and number of primary branches recorded at harvest and LAI at 90 DAS and peg to flower ratio were significantly influenced by various tillage and nutrient management practices (Table 1). Among tillage practices, significantly higher plant height of 34.04 cm and branches plant^{-1} (5.1) and LAI at 90 DAS (3.61) and peg to flower ratio (0.68) were observed with mechanical tillage + two intercultivations as compared to other tillage practices. These results are in conformity with the findings of Panda *et al.* (1996). Among nutrient management practices, application of 100 per cent inorganics recorded significantly higher plant height (32.7 cm), primary branches plant^{-1} (4.9) and LAI at 90 DAS (3.45) and which was at par with that of 50 per cent organics + 50 per cent inorganics treatment. However, significantly higher peg to flower ratio (0.64) was recorded with application of 50 per cent organics + 50 per cent inorganics.

Yield and yield attributes :

The observation on yield and yield attributes varied significantly due to various tillage and nutrient management practices (Table 2). The results indicated that, significantly higher pod and haulm yield of groundnut (1307 and 2733 kg ha^{-1}, respectively) was noticed with mechanical tillage + two intercultivations than all other tillage practices. The higher pod yield attributed to higher number of matured pods plant^{-1} (21.6), shelling percentage (66.3%) and pod yield plant^{-1} (7.95 g). These results are in conformity with Vijay Kumar *et al.* (1999). The integrated use of organic and inorganic nutrient sources (50 per cent organics + 50 per cent inorganics) produced significantly higher pod yield of groundnut (1282 kg ha^{-1}) than 100 per cent inorganics (1196 kg ha^{-1}) and 100 per cent organics (1089 kg ha^{-1}). However, haulm yield was significantly higher in 100 per cent inorganics (2889 kg ha^{-1}). Significantly higher pod yield with conjunctive use of 50 per cent organic and 50 per cent inorganic nutrients sources was attributed to higher yield attributes like more number of matured pods plant^{-1}, shelling percentage and pod yield plant^{-1} (20.9, 65.4% and 7.71 g, respectively). Similar results were obtained by Subramanian *et al.* (2000). This could be ascribed to the slow and steady rate of N release into soil solution to match the required absorption pattern of groundnut. These results are in conformity with the findings of Seshadri Reddy *et al.* (2005).

The increase in growth and yields of groundnut under

Table 1 : Effect of various tillage and nutrient management practices on growth attributes of groundnut

Treatments	Plant height (cm)	Primary branches plant^{-1}	LAI at 90 DAS	Peg to flower ratio
Tillage Practices (T)				
T_1 : Conventional tillage + one intercultivation	27.13	3.9	2.79	0.55
T_2 : Conventional tillage + two intercultivations	29.93	4.2	3.07	0.62
T_3 : Mechanical tillage + one intercultivation	31.98	4.8	3.34	0.63
T_4: Mechanical tillage + two intercultivations	34.04	5.1	3.61	0.68
S.E.±	0.44	0.10	0.07	0.007
C.D. (P= 0.05)	1.53	0.36	0.24	0.026
Nutrient management practices (F)				
F_1: 100% organics	27.75	3.7	2.76	0.62
F_2: 100% inorganics	32.70	4.9	3.45	0.60
F_3: 50% organics + 50% inorganics	31.87	4.8	3.40	0.64
S.E. ±	0.42	0.06	0.03	0.005
C.D. (P: 0.05)	1.26	0.17	0.08	0.016
Interaction (TxF)	NS	NS	NS	NS

NS = Non significant, DAS: Days after sowing

Table 2 : Effect of various tillage and nutrient management practices on yield and yield attributes of groundnut

Treatments	No. of pods plant^{-1}	Shelling %	Pod yield plant^{-1} (g)	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
Tillage Practices (T)					
T_1 : Conventional tillage + one intercultivation	15.1	61.8	5.88	1081	2538
T_2 : Conventional tillage + two intercultivations	17.1	63.4	6.67	1153	2594
T_3 : Mechanical tillage + one intercultivation	19.4	64.8	7.07	1215	2693
T_4: Mechanical tillage + two intercultivations	21.6	66.3	7.95	1307	2733
S.E. ±	0.27	0.30	0.06	6.9	20.1
C.D. (P= 0.05)	0.93	1.03	0.20	23.9	69.7
Nutrient management practices (F)					
F_1: 100% organics	15.0	62.3	5.72	1089	2301
F_2: 100% inorganics	19.1	64.6	7.24	1196	2889
F_3: 50% organics + 50% inorganics	20.9	65.4	7.71	1282	2729
S.E. ±	0.18	0.21	0.04	7.0	13.0
C.D. (P= 0.05)	0.55	0.64	0.13	21.0	39.0
Interaction (TxF)	NS	NS	NS	NS	NS

NS = Non significant

mechanical tillage treatment was mainly due to deep tillage with tractor drawn implements which facilitate deep penetration of roots thereby extracts more water and nutrients from deeper layer (Anonymous, 2006) and application of inorganic N fertilizer with organic sources is known to reduce the C:N ratio and stimulate the mineralization of organic N (Malligawad *et al.,* 2000).

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