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Enhancing the Yield of Kharif Groundnut (*Arachis hypogaea* L.) and Quality in Entisol through Different Levels of Potassium

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A B S T R A C T

A experiment was conducted at Post Graduate Research Farm, College of Agriculture, Kolhapur during *kharif* season of 2017 to study the effect of levels and time of potassium application on yield, quality of *kharif* groundnut (*Arachis hypogaea* L.) in Entisol. The experiment was laid out in Factorial Randomized Block Design with two replications comprising of four levels (0, 20, 30,40 kg K_2O ha^{-1}) and five time of application (Sowing, flowering, pegging) of potassium. The results revealed that successive increase in levels of potassium showed significant effect on yield and yield attributes of groundnut crop, along with quality. Significantly highest dry pod, kernel and haulm of groundnut were increased significantly with increasing levels of potassium and highest yield (30.08, 21.20, 36.51 q ha^{-1}, respectively) was recorded by application of 40 kg ha $^{-1}$ K_2O. The oil content and oil yield of groundnut was significantly highest (49.40 %) and (1047.33 kg ha^{-1}) with application of 40 kg K_2O ha^{-1}. Effect of time of potassium application and interactions in respect of yield of dry pod, kernel, haulm, oil content, oil yield of groundnut were found non-significant. The shelling percentage ranged 67-70 % but the effect of various treatments on shelling percentage was non-significant.

Introduction

Oilseed constitutes the principal commercial crops of India and occupies an important place in Indian economy, as it directly involves in food and industrial needs. Among the oilseed crops grown in India, groundnut crop plays a predominant role in oilseed production. Groundnut is a heavy feeder of potassium and an adequate supply of this nutrient is indispensable to harvest a good crop of groundnut. As regards the nutritional value of groundnut its seed contains about 40-50 per cent oil, 20-30 per cent protein and 10-20 per cent carbohydrates (Okello *et al.*, 2010).

Potassium is one of the 3 main pillers of balanced fertilizer use, along with nitrogen (N) and phosphorus (P). The major functions are enzymes involved in photosynthesis, stomatal activity (water use), transport of sugars, water and nutrient synthesis of protein, translocation of carbohydrate. Also improve the crop quality, kernel size of groundnut, test weight and shelling percentage (Bhosle *et al.*, 2011; Rathore *et al.*, 2014). Out of large

percentage of area in India, very little or no potassium (K) fertilizers are being applied and therefore it mainly comes from potassium reserves of the soil. Potassium fertilizers are one commodity for which country depends solely on import. Application of required quantity of nutrients at right time by adopting proper method enhances the groundnut pod yield and quality. Since the growth of groundnut is intensive from 30 DAS to 70 DAS, appropriate time of fertilizer application in required quantity is extremely critical to match the nutrient supply with demand prevailing the critical stages of groundnut.

Most research data showed that basal and split application of potassium is equally good, but some recent studies conducted on oilseed crop showed beneficial effects of splits doses of potassium over basal doses, due to fixation and leaching loses in intensively cropped area. Therefore, keeping this in view of the effect of varying levels and time of potassium application on yield and quality of groundnut were studied in present investigation.

Materials and Methods

The field experiment was conducted during the *kharif* season of 2017-18 at Post Graduate Research Farm, College of Agriculture, Kolhapur ($16^0$42' N latitude, $74^0$14' E longitude and 548 m AMSL) in sandy clay loam soil (52.92 % sand, 15.26 % silt and 31.82 % clay) containing available N (158.36 kg ha^{-1}), moderately high P (22.17 kg ha^{-1}) and K (246.40 kg ha^{-1}). The status of organic carbon content (0.44 %) was moderate and moderately calcareous with 4.5 per cent $CaCO_3$ equivalent. The pH, EC values were 7.6 and 0.26 dS m^{-1}, respectively. The weekly mean maximum and minimum temperature during crop growth period ranged between 25^0C to 34^0C and 16^0C to 23^0C, respectively. The weekly mean relative humidity during the morning and evening ranged between 86 to 92 per cent and 53 to 81 per cent, respectively. The weekly mean rainfall received during the experimental period ranged between 0.3 mm to 25mm. The weekly mean evapotranspiration (mm hr^{-1}) ranged between 0.8 mm hr^{-1} to 9.7 mm hr^{-1}. The experiment was laid out in the factorial randomized block design. The treatments consisted of four levels of potassium *viz*.0, 20, 30 and 40 kg ha^{-1} which were supplied through five different time of potassium application *viz* Sowing, flowering, pegging. Groundnut was sown on 28.06.2016 with a spacing 30 cm x 15 cm. All the recommended agronomic practices were adopted. Recommended dose of N and P_2O_5 (25:50 kg ha^{-1}) was applied to all treatments through Urea and Single super phosphate and potassium through MOP as per treatments. Oil content was determined by Soxhlet Ether Extract method (A.O.A.C.2016).

Results and Discussion

Effect on dry pod, kernel and haulm yield of groundnut

The yield of dry pod, kernel and haulm of groundnut were increased significantly with increasing levels of potassium and highest yield (30.08, 21.20, 36.51 q ha^{-1}, respectively) were recorded by application of 40 kg K_2O ha^{-1}. While, Interaction effects of potassium levels and time of potassium application were found non-significant in relation to dry pod, kernel, haulm yield of groundnut. Potassium play vital role in maintaining balance in enzymatic, stomatal activity (water use), transport of sugars, water and nutrients and synthesis of protein, starch and photosynthesis, carbohydrate metabolism, translocation of carbohydrate thus K application increased growth and yield attributes in groundnut. The results are in close conformity with the observations recorded by Rathore *et al.,* (2014), Borah *et al.,* (2017) and Vinod Kumar *et al.,* (2000)

Effect on yield attributes of groundnut

In general, the yield attributes viz., number of filled and unfilled pods and shelling percentage were influenced by different levels and sources of potassium applications. Significantly highest number of filled pods plant^{-1} (40.06) were recorded by application of 40 kg K_2O ha^{-1} and significantly lowest unfilled pods plant^{-1} were recorded with L_4-40 kg K_2O ha^{-1} (8.42). However, Effect of time of potassium application and interaction was found non-significant in relation to number of filled and unfilled pods plant^{-1}. The results are in close agreement with the findings reported by Reddy *et al.*, (2011) who also reported superior performance of groundnut to various levels of potassium (Table 1).

Table.1 Yield and Yield attributes of groundnut influenced by different potassic levels and time of application

Treatments	Dry pod yield (q ha^{-1})	Kernel yield (q ha^{-1})	haulm yield (q ha^{-1})	Shelling %	Filled pods Plant^{-1}	Unfilled pods Plant^{-1}
Levels of potassium (kg ha^{-1})						
L_1 (0)	21.22	14.22	30.41	67.06	24.27	9.48
L_2(20)	25.05	17.57	34.82	68.43	32.08	9.02
L_3(30)	28.75	19.11	35.52	69.49	36.56	8.56
L_4(40)	30.08	21.20	36.51	69.50	40.06	8.42
S.E.±	0.54	0.43	0.93	0.37	0.68	0.13
CD at 5%	1.62	1.28	2.78	1.11	2.03	0.40
Time of potassium application						
T_1	27.19	18.87	35.57	69.25	32.85	9.20
T_2	26.30	18.25	34.52	69.41	33.05	8.79
T_3	26.19	17.91	34.21	69.39	33.05	8.65
T_4	25.92	17.64	33.72	68.07	33.20	8.86
T5	25.76	17.47	33.56	67.99	33.70	8.85
S.E.±	0.61	0.48	1.05	0.42	0.77	0.15
CD at 5%	NS	NS	NS	NS	NS	NS
Interaction (L x T)						
S.E.±	1.22	0.96	2.10	0.84	1.54	0.30
CD at 5%	NS	NS	NS	NS	NS	NS

Table.2 Effect of potassium levels and time of application on oil content and yield of groundnut

Treatments	Oil content %	Oil yield (kg ha^{-1})
Levels of potassium (kg ha^{-1})		
L_1 (0)	45.98	**653.56**
L_2 (20)	47.10	**827.32**
L_3 (30)	48.65	**930.21**
L_4 (40)	49.40	**1047.33**
S.E.±	0.23	**22.35**
CD at 5%	0.69	**66.15**
Time of potassium application		
T_1	47.22	**892.71**
T_2	47.44	**869.61**
T_3	47.88	**861.47**
T_4	48.03	**850.71**
T_5	48.33	**848.54**
S.E.±	0.26	**24.98**
CD at 5%	NS	**NS**
Interaction (L x T)		
S.E.±	0.52	**49.97**
CD at 5%	**NS**	**NS**

The shelling percentage was not much more influenced by the different levels and sources of potassium and it was found non-significant. The highest shelling percentage was recorded in L_4- 40 kg K_2O ha^{-1} (69.50 %). While, Effect of time of potassium application and interaction were found non-significant in relation to shelling percentage Similar findings have been reported by Borah *et al.*, (2017) and Nadia Hemeid (2015).

Effect on oil content, oil yield of groundnut

The oil content of groundnut improve significantly with the graded doses of potassium application. Significantly highest (49.40 %) oil content of groundnut kernel was reported with application of 40 kg K_2O ha^{-1} but effect of time of potassium application and interactions were found non-significant (Table 2). The results indicated that, significantly highest oil yield (1047.33 kg ha^{-1}) was recorded by application of L_4 (40 kg K_2O ha^{-1}) which was significantly superior over rest of K_2O levels. Balanced use of nutrients might have improved the yield attributing characteristics like root and plant growth, nutrient uptake, physical, chemical and biological activities which ultimately results in higher kernel and oil yield. Umar *et al.*, (1999), Rathore *et al.*, (2014), Gupta *et al.*, (2011) and Borah *et al.*, (2017) have reported similar findings in relation to oil content and oil yield of groundnut. The result from the present study revealed that, Pod, kernel and haulm yield, oil content and oil yield of groundnut was significantly increased due to the application of increasing levels of potassium i.e. 40 kg K_2O ha^{-1} over control and there is no significant difference observed with time of potassium application.

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