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EFFECT OF ORGANIC MANURES, CHEMICAL AND BIOFERTILIZERS ON POTASSIUM USE EFFICIENCY IN GROUNDNUT

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ABSTRACT

A field experiment was conducted on sandy clay loam soils at Wetland farm, ANGRAU, S.V. Agricultural College, Tirupati during *rabi* 2023-2024 in groundnut crop to study the effect of application of organic manure, chemical fertilizers and biofertilizer of potassium on potassium use efficiency in groundnut. The experimental results revealed that application of 75 per cent RDK through FYM + seed treatment with KRB @ 10 ml kg^{-1} seed + spraying of Multi K @1 per cent at 45 DAS (T_4), being statistically at par with application of 75 per cent RDK through MOP + soil application with KRB @ 1.25 L ha^{-1}+ spraying of Multi K @1 per cent at pod development (T_7) and 50 per cent RDK through FYM and MOP each + soil application with KRB @ 1.25 L ha^{-1}(T_{10})significantly promoted higher growth parameters viz., plant height, leaf area, dry matter production at all stages of crop, yield attributes viz., number of filled pods per plant, number of illfilled pods per plant, hundred pod weight, hundred kernel weight, shelling per cent age,pod yield(1690 kg ha^{-1}) and haulm yield (3102 kg ha^{-1}).

KEYWORDS: Potassium Use Efficiency, growth parameters and yield attributes.

INTRODUCTION

In terms of acreage and output, groundnut dominates all oilseed crops in the nation, accounting for more than 40–50 per cent. Groundnut oil cake is an useful organic manure that is produced after oil extraction and includes 7-8 per cent N, 1.5 per cent P_2O_5, and 1.5 per cent K_2O. It also works well as a cover crop for areas at risk due to soil erosion. India leads world in groundnut cultivation area, covering 54.21 lakh hectares annually and is the second largest producer with a production of 101 lakh tonnes and productivity of 1863 kg ha^{-1} in the year 2021-2022. Similarly in Andhra Pradesh, the groundnut production is of about 5.19 lakh tonnes on an area of 8.23 lakh hectares.

In the recent times due to inadequate information there is heavy and indiscriminate use of fertilizers which led to nutrient loss during application and sometimes plants are unable to absorb nutrients from the applied organic and inorganic fertilizers, in such cases biofertilizers are used as substitute because they increase the plant growth, yield and they even improve water holding capacity, structure and bulk density of soil.

It is proven that microbial soil community is able to influence soil fertility through soil processes *viz*. decomposition, mineralization, and storage/release of nutrients (Parmar and Sindhu, 2013). Among these microorganisms, K mobilizing bacteria (KMB) have attracted the attention of agriculturists as soil inoculum to promote the plant growth and yield.

MATERIAL AND METHODS

A field experiment was carried out during *rabi* season of 2023-2024 at the Wetland farm, S. V. Agricultural College, ANGRAU, Tirupati, Andhra Pradesh.The experimental soil was slightly alkaline in reaction, non saline, low in organic carbon and nitrogen and medium in available phosphorus and potassium.The experimental was laid out in Randomized Block Design (RBD) with 10 treatments and 3 replications.The treatments involved combination of organic manure (FYM), potassium fertilizers (MOP and Multi-K) and biofertilizer (liquid KRB) are :Control (T_1), T_1 + seed treatment with KRB @ 10 ml kg^{-1} seed + Spraying of Multi K @1 per cent at 30 DAS and 60 DAS (T_2), 100 per cent RDK through FYM (T_3), 75 per cent RDK through FYM + seed treatment with KRB @ 10 ml kg^{-1} seed + spraying of Multi K @1 per cent at 45 DAS (T_4), 50 per cent RDK through FYM + seed treatment with KRB @ 10 ml kg^{-1} seed + spraying of Multi K @1 per cent at 45 DAS (T_5), 100 per cent RDK through MOP (T_6), 75 per cent RDK through MOP + soil application with KRB @ 1.25 L ha^{-1} + spraying of Multi K @ 1 per cent at pod development (T_7), 50 per cent RDK through MOP + soil application with KRB @ 1.25 L ha^{-1} + spraying of Multi K @1 per cent at pod development (T_8), 50 per cent RDK through FYM and MOP each (T_9)and 50 per cent RDK through FYM and MOP each + soil application with KRB @ 1.25 L ha^{-1} (T_{10}).FYM, chemical fertilizers MOP and Multi-K were applied based on per cent of potassium content.

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Table 1. Effect of potassium application through different organic, inorganic sources and biofertilizers of potassium on plant height (cm), leaf area (cm^2), dry matter production (kg ha^{-1}) of groundnut crop at different crop intervals

Treatment	Plant height (cm)			Leaf area (cm^2)			Dry matter production (kg ha^{-1})		
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
T_1	8.9	25.5	35.1	187.8	536.4	369.6	948	2177	4224
T_2	9.3	25.6	35.2	188.8	548.3	389.9	1072	2193	4248
T_3	11.0	26.5	39.9	189.7	563.4	396.1	1056	2413	4806
T_4	**12.5**	**31.3**	**48.8**	225.6	635.5	452.6	**1156**	**3147**	**5573**
T_5	11.3	28.7	44.4	204.7	583.4	399.6	1039	2790	4945
T_6	9.9	26.2	38.6	208.3	587.2	416.3	994	2355	4765
T_7	12.3	30.9	48.5	221.8	**651.7**	459.1	1124	3115	5477
T_8	10.1	26.7	40.2	217.8	635.5	399.8	1016	2390	4770
T_9	11.1	28.5	43.9	193.4	623.2	435.9	1023	2786	4837
T_{10}	12.2	30.5	48.2	**235.4**	650.7	**469.0**	1060	3073	5424
S.Em±	0.61	1.69	1.88	7.82	14.02	8.72	23.80	25.49	34.55
CD @ 5%	1.80	NS	5.58	23.24	41.70	25.90	70.80	75.74	102.65

Table 2. Effect of potassium application through different organic, inorganic sources and biofertilizers of potassium on Yield attributes of groundnut

Treatments	No. of filled pods $plant^{-1}$	No. of illfilled pods $plant^{-1}$	Hundred pod weight (g)	Hundred kernel weight (g)	Shelling percentage (%)
T_1	9.7	4.3	95.2	41.9	67.1
T_2	10.0	3.7	97.9	42.3	68.7
T_3	12.0	5.3	106.2	44.2	70.5
T_4	**15.7**	**2.3**	**117.8**	**49.7**	**74.2**
T_5	13.0	2.7	110.2	46.1	72.9
T_6	11.3	5.0	105.1	43.2	69.7
T_7	15.0	3.0	111.4	47.7	74.1
T_8	11.7	4.3	106.0	43.9	70.2
T_9	12.3	3.0	108.8	45.9	71.0
T_{10}	14.0	3.7	111.3	46.7	73.3
S.Em±	0.76	0.49	3.63	2.33	2.79
CD @ 5%	2.26	1.47	10.8	NS	NS

Table 3. Effect of potassium application through different organic, inorganic sources and biofertilizers of potassium on pod and haulm yield (kg ha^{-1}) of groundnut crop

Treatment details	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
T_1 : Control	1173	2423
T_2 : Seed treatment with KRB @ 10 ml kg^{-1} seed + Multi K @ 1% at 30 DAS and 60 DAS	1296	2562
T_3 : 100% RDK through FYM	1535	2870
T_4 : 75% RDK through FYM + Seed treatment with KRB @ 10 ml kg^{-1} seed + spraying of Multi K @ 1% at 45 DAS	**1690**	**3102**
T_5 : 50% RDK through FYM + Seed treatment with KRB @ 10 ml kg^{-1} seed + spraying of Multi K @ 1% at 45 DAS	1566	3040
T_6 : 100% RDK through MOP	1427	2793
T_7 : 75% RDK through MOP + Soil application with KRB @ 1.25 L ha^{-1} + Spraying of Multi K @ 1% at pod development	1682	3056
T_8 : 50% RDK through MOP + Soil application with KRB @ 1.25 L ha^{-1} + Spraying of Multi K @ 1% at pod development	1520	2855
T_9 : 50% RDK through FYM and MOP each	1551	2932
T_{10} : 50% RDK through FYM and MOP each + Soil application with KRB @ 1.25 L ha^{-1}	1628	3048
S.Em±	57.32	57.32
CD @ 5%	170.32	170.32

FYM contains 0.5 per cent K_2O, MOP contains 60 per cent K_2O, and Multi-K contains 46 per cent K_2O.The test variety used in the present experiment was dharani variety by adopting a spacing of 22.5 cm × 10 cm.

For soil application KRB was applied to FYM before 5 days of sowingand applied to the soil, Multi-K is applied as foliar application at the time of sowing along with MOP as basal application as per treatment details. The recommended dose of N and P was applied commonly to all treatments (Recommended dose of fertilizer 30-40-50 N- P_2O_5-K_2O kg ha^{-1}).

Sampling was done at different phenological growth stages of crop after recording plant height. Five plants from each plot were dug out with roots. The plants were thoroughly washed to free from dirt and surface dried with blotting paper. Different plant parts were dried in hot air oven at 100°C for 15 minutes and then at 80°C for 48 hours until they attained constant weights. Leaf area and dry matter was estimated in five plants in each plot at different growth stages of crop. After separation of leaves from the plant, leaf area was estimated using leaf area meter (Li- COR model LI 3100) and expressed as cm^2.

RESULTS AND DISCUSSION

Effect of FYM and liquid KRB on growth parameters and yield attributes of groundnut

Combined application of RDK and KRB significantly improved all growth parameters of groundnut *viz.,* plant height, leaf area, and dry matter production at all stages of crop growth. This is due to effect of KRB that helps in increasing the available nutrients in soil and thus increasing N, P and K content and uptake by plant haulm and kernels. (Table 1) [Jat *et al*. (2013) and Bagyalakshmi *et al*. (2012)].

Effect of FYM and liquid KRB on yield attributes of groundnut

Application of RDK and KRB improved the yield attributes due to slow mineralisation and availability of nutrient along with increased moisture holding capacity of soil [Sarade *et al*., (2016) and Sultana *et al*., (2012)]. Among the treatments application of 75 per cent RDK through FYM + seed treatment with KRB @ 10 ml kg^{-1} seed + spraying of Multi K @ 1 per cent at 45 DAS (T_4) recorded higher yield attributes *i.e.,* No. of pods per plant, hundred pod weight, hundred kernel weight, shelling per cent age (Table 2) due to supply of N, P, K, secondary and micronutrients thus improving the soil fertility.

Effect of FYM, potassium fertilizers and liquid KRB on groundnut yield

Pod and haulm yield were significantly enhanced with application of RDK and KRB. Significantly highest pod yield (1690 kg ha^{-1}) and haulm yield (3102 kg ha^{-1}) was recorded with application of 75 per cent RDK through FYM + seed treatment with KRB @ 10ml kg^{-1}seed + spraying of Multi K @ 1 per cent at 45 DAS (T_4) (Table 3). The results are in conformity with findings of Ola *et al.* (2013).

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