EFFECT OF POTASSIUM LEVELS AND SPACING ON GROWTH AND YIELD OF SUMMER GROUNDNUT (*Arachis hypogaea* L.)

Comment [WU1]: Under what agro-climatic condition?

Comment [WU2]: Similarity index report?

Abstract

A field experiment was conducted during zaid season of 2021 at SHUATS Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (UP) on sandy loam type of soil so as to evaluate the effect of potassium levels and spacing on growth and yield of summer groundnut The treatment which was carried out consists of 3 levels of potassium viz., 20 kg/ha. 30 kg/ha, and 40 kg/ha soil application, with different spacing of 20 x 10 cm, 30 x 10 cm, and 40x 10 cm respectively. The experiment was laid out in randomized block design with ten treatments which were replicated thrice. Study mainly revealed that with application of K 40 kg/ha +30 x 10 cm (treatment -8) recorded maximum plant height (49.70 cm) , Maximum No. of nodules/plant (106.90), Maximum plant dry weight (22.49 g/plant),No. pods/plant (19.30), number of kernels /pod (2.70), seed index (4.50), pod yield (3.62 t/ha), Halum yield (4.65 t/ha), as compared to all theother treatment combinations.

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Comment [WU4]: Your conclusion and recommendation of study is missing.

Comment [WU5]: Keywords?

Introduction

Groundnut (*Arachis hypogaea* L.) is an important oil seed crop and a grain legume. India is the second largest producer of groundnut after China. Groundnut belonging to family Leguminaceae is the fourth most important source of edible oil also known as "The King of Oilseeds" and third most important source of vegetable protein. Groundnut is the largely produced oil seed in India; it is also an important cash crop. It contributed to sustainable agriculture being a legume and is cultivated in both kharif and zaid by farmers.Being a leguminous crop groundnut helps in maintenance of soil fertility. And being rich in protein they supply major share of protein requirement of country. Exhaustive cultivation without legumes in rotation, has transformed many regions in to barn wastelands thus inclusion of legume crop in high intensity cropping programme has shown very encouraging effect in improving physical and to certain extent the chemical properties of soil. It is also efficient cover crop for lands exposed to soil erosion.Balanced nutrition is considered as one of the basic needs to achieve the potential yield (Yadav et al, 2017). Groundnut is feeder of soil nutrients. Being a legume crop, it needs more phosphorous, Sulphur and calcium for proper shell formation and filling. Besides NPK, Sulphur is one of the essential nutrient elements which plays an important role in carbohydrate metabolism and formation of chlorophyll, glycosides, oils and many other compounds that are involved in N-fixation and photosynthesis of plants. Its nutrition to crops is vital both from quality and quantity point of view.

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Comment [WU7]: Reference?

Potassium is a multifunctional versatile nutrient, indispensable for plants. Among the three major nutrients, potassium (K) has a special position as evident by its role in increasing the crop yield by adding tolerance to various biotic and abiotic stresses (Yadav, et al., 2003 and Read, et al., 2006). The potassium application improves the kernel size of the groundnut, test weight and shelling percentage. Groundnut crop response well for potassium and play role in maintaining balance in enzymatic, stomatal activity (water use), transport of sugars, water and nutrient and synthesis of protein, photosynthesis and starch thus K application increases growth and yield attributes in groundnut (Krauss and Jiyun 2000; Rathore et al. 2014).Planting density is one of the main factors that play an important role on growth, yield and quality of peanut. Nimje (1996) reported that plant dry matter, dry weight/plant and branching were found to be maximum along with yield attributes (pod/plant, yield/plant and 1000-grain weight) when the crop is grown with proper spacing. Optimum planting geometry ensures proper growth of the aerial and underground parts of the plant through efficient utilization of solar radiation, nutrients, water, land as well air spaces (Miah et al., 1990). In densely populated crop, the inter specific competition between the plants is high. There are two general concepts to describe the relationship between plant density and seed yield. Firstly, irrespective of plant spacing within and among rows, the crop develops a canopy that is able to intercept more than 95% of the incoming solar radiation during early reproductive growth to maximize seed yield (Johnson et al., 1982). Secondly, a nearly equidistant plant arrangement minimizes inter plant competition and produces maximum seed yield (Wells, 1993). Determination of optimum plant density of a specific cultivar is necessary for successful crop production. An understanding on the yield response to planting density is required which could help in selecting management and breeding efforts needed for yield improvement.

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Materials and Methods

The experiment was carried out during zaid season of 2021 at CRF (Crop Research Farm), Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (UP). The farm is geographically situated at 25° 24' N latitude and 81° 51' Longitude. The experiment was carried out in Randomized Block Design (RBD) with ten treatments which are replicated thrice. The experiment consists of ten possible treatments combination of given factor, viz., 1) 20 kg/ha + 20 cm x 10 cm, 2) 20 kg/ha + 30 cm x 10 cm, 3) 20 kg/ha + 40 cm x 10 cm, 4) 30 kg/ha + 20 cm x 10 cm, 5) 30 kg/ha + 30 cm x 10 cm, 6) 30 kg/ha + 40 cm x 10 cm, 7) 40 kg/ha + 20 cm x 10 cm, 8) 40 kg/ha + 30 cm x 10 cm, 9) 40 kg/ha + 40 cm x 10 cm and one control plot. The mean (maximum and minimum) temperature was 37.98^{o}C and 24.21^{o}C respectively, mean (maximum and minimum) relative humidity was 82.16 percent and 45.26 percent during the crop growing season. The experimental soil was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.318%), medium in available N (70 Kg/ha), medium available P (12.50 Kg/ha) and medium available K (216.10 Kg/ha). Fertilizers were applied in the form of urea, single super phosphate and murate of potash, respectively. The furrows were opened and seed were dibbled with respective spacing and covered by soil. Shelling was done manually, seeds

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were winnowedand cleaned and seed weight per net plot was recorded on hectare basis and expressed in kg /ha. The observation regarding yield were recorded after harvesting of crop.

Comment [WU12]: Amount of water and number of irrigation?

Statistical analysis

The experimental data analyzed statistically by applying the technique of analysis of variance (ANOVA) prescribed for the design to test the significance of overall difference among treatments by the F test and conclusion were drawn at 5% probability level. Economics of treatments was also worked out (Gomez and Gomez, 1984) [6] .

Chemical analysis of soil

Composite soil samples are collected randomly before the layout of experiment was laid so as to determine the soil properties initially. The soil samples are collected from 0-15 cm depth and were dried under shade, then powdered with the help of a wooden pestle and mortar then sieved through a 2 mm sieve and was then subjected to further analysis. The physical properties of soil were evaluated by using the Bouyoucos hydrometer method outlined by Bouyoucos (1927) and for organic carbon by rapid titration method by Nelson (1975). Available nitrogen was estimated by alkaline permanganate method by Subbiah and Asia (1956), available phosphorus by Olsen's method as outlined by Jackson (1967), available potassium was determined by use of flame photometer normal ammonium acetate solution and estimating by using the flame photometer

Results and Discussions

Growth parameters

Data pertaining to growth parameters which are plant height (cm), number of nodules/plant, dry weight (g/plant) were recorded and tabulated in Table 1.

Table 1: Data pertaining to growth parameters

S.No	Treatments	Plant height (cm)	No. of Nodules/Plant	Plant dry weight (g/plant)	CGR (g/m2/day)	RGR (g/g/day)
1	K 20 kg/ha + 20 X 10 cm	44.2	95.7	17.53	11.11	0.008
2	K 20 kg/ha + 30 X 10 cm	44.9	98.8	18.99	10.49	0.007
3	K 20 kg/ha + 40 X 10 cm	46.2	103.3	20.21	10.37	0.007
4	K 30 kg/ha + 20 X 10 cm	45.7	101.7	19.44	10.37	0.007
5	K 30 kg/ha + 30 X 10 cm	46.9	106	22.21	9.28	0.006
6	K 30 kg/ha + 40 X 10 cm	47.2	103.9	21.21	10.22	0.007
7	K 40 kg/ha + 20 X 10 cm	46.3	101.9	19.55	10.74	0.007
8	K 40 kg/ha + 30 X 10 cm	49.7	106.9	22.99	9.75	0.006
9	K 40 kg/ha + 40 X 10 cm	48.3	104.6	21.55	10.12	0.007
	F-test	S	S	S	NS	NS
	SE(±)	0.54	0.64	0.28	0.36	0.003
	CD (P=0.05)	1.61	1.92	0.83	-	-

The significantly maximum plant height was recorded with application of K 40 kg/ha + 30 x 10 cm (49.70 cm)which was superior over all the treatments and are statically at par with K 40 kg/ha + 40 x 10 cm (48.30), while in case of number of nodules per plant treatment with K 40 kg/ha + 30 x 10 cmwas recorded maximum number of nodules (106.90) which is significantly superior all over the treatments and treatment with K 30 kg/ha + 30 x 10 cm(106.00) are statically at par. Data related to plant dry weight treatment with K 40 kg/ha + 30 x 10 cm(22.99 g)was recorded maximum dry weight (22.21 g) which is significantly superior all over the treatments and treatment withK 30 kg/ha + 30 x 10 cm (22.21 g), is statically at par. Maximum crop growth rate recorded in K 20 kg/ha + 20 x 10 cm(11.11) and minimum crop growth rate recorded in K 20 kg/ha + 20 x 10 cm (9.28), at the same time maximum relative growth rate recorded in K 20 kg/ha + 20 x 10 cm(0.008)and minimum relative growth rate recorded in K 40 kg/ha + 30 x 10 cm(0.006).

Comment [WU13]: Discus these results with the past review studies.

Yield parameters

Comment [WU14]: Discus these results with the past review studies.

No. of pods/plant, No. of kernels/pod, Seed index (g), seed yield (kg/ha), halum yield (kg/ha), harvest index (%) were recorded and tabulated in Table 2.

Table 2: No. of pods/plant, No. of kernels/pod, Seed index (g), seed yield (kg/ha), halum yield (kg/ha), harvest index (%)

S.No	Treatments	No. Pods/plant	No.of kernals/pod	Seed index (g)	Pod yield (g)	Halum yield (g)	Harvest index (%)
1	K 20 kg/ha + 20 X 10 cm	16.9	1.4	35.18	2.82	3.79	42.60
2	K 20 kg/ha + 30 X 10 cm	17.5	1.5	35.4	2.85	3.93	41.94
3	K 20 kg/ha + 40 X 10 cm	18	1.8	38.5	3.1	4.21	42.77
4	K 30 kg/ha + 20 X 10 cm	17.5	1.5	35.98	3.03	4.04	42.88
5	K 30 kg/ha + 30 X 10 cm	19	2.3	39.95	3.51	4.56	43.28
6	K 30 kg/ha + 40 X 10 cm	18.3	1.8	39.6	3.14	4.39	41.70
7	K 40 kg/ha + 20 X 10 cm	17.9	1.5	36.9	2.99	4.13	42.00
8	K 40 kg/ha + 30 X 10 cm	19.3	2.7	41.5	3.62	4.65	43.72
9		18.8	2	39.17	3.3	4.51	43.14
	F-test	S	S	S	S	S	NS
	SE(±)	0.21	0.06	0.58	0.07	0.05	0.82
	CD (P=0.05)	0.64	0.53	7.74	0.22	0.17	-

At harvest, data on yield attributes revealed that with the treatment of K 40 kg/ha + 30 X 10 cm (19.3) recorded maximum No. of pods per plant, which was significantly superior over all the treatmentsK 40 kg/ha + 40 X 10 cm (18.8). Treatment with K 40 kg/ha + 30 X 10 cmwas recorded maximum No. of kernels per pod (2.7) over all the treatments and the treatment with K 30 kg/ha + 30 X 10 cm (2.3) are statistically at par. Treatment with K 40 kg/ha + 30 X 10 cm (41.5 g) was recorded maximum Seed indexand the treatment with K 30 kg/ha + 30 X 10 cm (39.95) is statistically at par. The treatment with K 40 kg/ha + 30 X 10 cm (3.62) recorded maximum pod yield (g), however the treatment with K 30 kg/ha + 30 X 10 cm (3.51) is statistically at par.

Comment [WU15]: Need more discussion.

Summary

Based on the objectives under taken in the study,The results revealed that the treatment with K 40 kg/ha + 30 x 10 cm (treatment -8) recorded maximum plant height (49.70 cm) , Maximum No. of nodules/plant (106.90), Maximum plant dry weight (22.49 g/plant),No. pods/plant (19.30), number of kernels /pod (2.70), seed index (4.50), pod yield (3.62 t/ha), Halum yield (4.65 t/ha).

Conclusion

Comment [WU16]: Economic analysis or BCR will decide which treatment is better for adaptation.

It is concluded that for obtaining highest yield in Toria during *Zaid* season, application of K 40 kg/ha + 30 x 10 cm (treatment -8) recorded highest productivity. It also recorded the maximum Gross return, Net return and Benefit ratio. The finding was based on the research done in one season it may be repeated further for confirmation and recommendation.

References

Comment [WU17]: Please match all references with the text.

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