Original Research Article

"Effect of potassium and zinc on growth, yield and economics of Cluster bean (*Cyamopsis tetragonoloba* L.)"

ABSTRACT

The field experiment was ~~conduct~~ in CRF in the department of agronomy during the ~~*kK*~~*harif* season of 2022 ~~on~~ cluster bean crops. The treatment consisted of three levels of K (15, 20 and 25 kg/ha) Zn (10, 15 and 20 kg/ha) and control. The experiment was layout in Randomized Block Design (RBD) with 10 treatments and replicated thrice. Application of K (25 kg/ha) and Zn (20 kg/ha) produces higher plant height (139.20cm), the maximum number of branches per plant (5.86), nodules/plant (49.45) and higher dry weight (21.53g), the maximum number of pods/plant (73.13), the maximum number of grains/pod (9.13), higher seed yield (1363.56kg/ha), straw yield (3208.91kg/ha).

However, the maximum gross return (77405.66INR/ha), maximum net return (54121.66INR/ha) and maximum benefit cost-ratio (2.32) ~~was~~ obtained with the same treatment- 9 (K 25kg/ha + $ZnSO_4$ 20kg/ha).

Keywords: N, P, K, Zn doses, Growth, Yield, Quality, Cluster beans and economics.

Introduction

Cluster bean (*Cyamopsis tetragonoloba L. Taub.)* popularly known as guar, is a deep rooted legume crop grown for feed, fodder, and green manure. It belongs to the family *Leguminaceae* and is known to improve soil fertility. It is generally 100-140 cm tall and bears 4 to 8 branches (branch type). India leads among the major guar-producing countries of the world, contributing around 75 to 80% to the world's total production (1.5 m tonnes) **(Annonymous, 2021)**. It is an important cash crop of Rajasthan, Haryana, Punjab, U.P. Utter Pradesh largest producer of cluster beans having an area of 3140.2 m ha, with a production of 1.5 mt and productivity of 484kg/ha which is the maximum in the country **(Annonymous, 2022)**. The ~~arangment~~ on cluster bean is 8.10 g moisture, 10.8 g carbohydrate, 23% protein, 1.4 g fat, 1.4 g minerals, 0.09 mg thiamine,

Commented [YA1]: provide an introductory summary

Commented [YA2]: Research purposes ?

Commented [YA3]: Conclusion ?

Commented [YA4]: conducted

Commented [YA5]: were

Commented [YA6]: The abstract should include a brief introduction, objective, methods, results, discussion, and conclusion. Please improve it.

Commented [YA7]: do not use anonymous citations

Commented [YA8]: do not use anonymous citations

Commented [YA9]: arrangement

0.03 mg riboflavin, 47 I.U. vitamin C, 316 I.U, vitamin A (per 100 g of edible portion). The potential yield of most of the varieties ranges from 12-15 q/ha but the average yield productivity of the country ~~are~~ less than the potential average. This may be ascribed to many reasons but soil type and imbalanced fertilization is the major factor. ~~The~~ Potassium fertilizer is the third most important essential nutrient after nitrogen and phosphorus. The potassium activates more than 60 enzymes and enzymatic catalyzes the system involved in photosynthesis, metabolism, and translocation of carbohydrates and proteins, membrane permeability, stomatal regulation, and water utilization. Other benefits ascribed to K include the resistance of plants against pests, disease, and stress caused by drought, frost, salinity, and sodicity in assuring improved crop quality characteristics **(Kherawat *et al* 2013)**. zinc is said to activate several enzymes, play a role in auxin synthesis and increase meristematic activities. Most of the work done on the nutrition of this crop has been related ~~with~~ major elements whereas the significance of micronutrients is still ignored. In the plant system, zinc is important for ~~a number of~~ enzymatic and physiological processes. Additionally, many enzymatic reactions are activated by zinc, which is a key nutrient in the construction of several enzymes like alcohol dehydrogenase, carbonic anhydrase, and superoxide dismutase. Zinc is also necessary for the synthesis of enzymes in plants **(Pedler *et al* 2000)**. The work undertaken on these aspects in cluster bean is very ~~meagre~~. Therefore, keeping this in view a study was conducted on the effect of potassium and zinc on the growth and yields of cluster bean.

Commented [YA10]: is

Commented [YA11]: to

Commented [YA12]: several

Commented [YA13]: references of more than 10 years, replace the most recent references

Commented [YA14]: meager

2. MATERIALS AND METHODS

This experiment was laid out during the *Kharif* season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The crop research farm is situated at 25.570N latitude, 87.190 E longitude, and at an altitude of 98 m above mean sea level. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 8.0), low in organic carbon (0.40 %), available N (225 kg/ha), available P (38.2 kg/ha) and available K (240.7 kg/ha). The experiment was laid out in randomized block design and comprised of levels of potassium and zinc with ten treatments and each ~~were~~ replicated thrice *viz*. T_1 - 15kg/ha potassium + 10kg/ha zinc, T_2 -15 kg/ha potassium + 15 kg/ha zinc, T_3 -15kg/ha potassium + 20kg/ha zinc, T_4 - 20kg/ha potassium + 10kg/ha zinc, T_5 -20kg/ha potassium + 15kg/ha zinc, T_6 - 20kg/ha

Commented [YA15]: was

potassium + 20kg/ha zinc, T_7 - 25kg/ha potassium + 10kg/ha zinc, T_8 - 25kg/ha potassium + 15kg/ha zinc, T_9 -25kg/ha potassium + 20kg/ha zinc, T10 - Control (RDF 20:40:20).The observations were recorded on different growth parameters viz. Plant height,number of branch, number of nodules, dry weight, number of pod/plant, number of seeds/pod, seed yield, stover yield . Maximum net returns, gross returns, and benefit cost ratio.

RESULT AND DISSCUSSION:

Growth parameters

Plant height (cm)

At 80 DAS, a significantly ~~and~~ higher plant height (139.20cm) was recorded in treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)]. However, ~~the~~ treatment 8 [Potassium (25kg/ha) + Zinc (15kg/ha)], treatment 7 [Potassium (25kg/ha) + Zinc (10kg/ha)], treatment 6 [Potassium (20kg/ha) + Zinc (20kg/ha)] were found to be statistically at par with treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)].

The significant and higher plant height ~~was~~ with the application of potassium (25 kg/ha) might be due to ~~with~~ increased levels of K function in most of the physiological and metabolic processes resulting in increased growth and development, resulting in higher plant~~s hieght~~. ~~Similar~~ result was also reported by **Singh *et* al. (2016).**

Commented [YA16]: height

Commented [YA17]: A similar

Number of branches/plant

At 80 DAS, a significant and maximum number of branches/plant (5.86) was recorded with treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)]. However, ~~the~~ treatment 8 [Potassium (25kg/ha) + Zinc (15kg/ha)], treatment 7 [Potassium (25kg/ha) + Zinc (10kg/ha)], treatment 6 [Potassium (20kg/ha) + Zinc (20kg/ha)] were found to be statistically at par with treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)]. The significant and maximum number of branches/plants ~~was~~ observed with the application of zinc(20kg/ha) might be due to Zn function in the production of indole acetic acid, a growth hormone, and tryptophan, a precursor of auxin. ~~The~~ A similar result was also reported by **Sharma et al. (2004), Kuniya et al. (2018).**

Number of nodules/plant

At 80 DAS, a significant and maximum number of nodules/plant (49.45) was recorded with treatment 9[Potassium (25kg/ha) + Zinc (20kg/ha)]. However, ~~the~~ treatment 8[Potassium (25kg/ha) + Zinc (15kg/ha)] was found to be statistically at par with treatment 9 [Potassium (25kg/ha) +Zinc (20kg/ha)]. The significant and maximum

number of nodules/plants ~~was~~ observed with the application of Potassium (25kg/ha) might be due to increased levels of Potassium ~~activates~~ more than 60 enzyme systems, including the nitrogenous enzyme which is essential for N_2 -fixation. Potassium is also essential to generate carbohydrates by photosynthesis which provides the energy needed by bacteria in nodules to fix atmospheric N_2 and contributes to good root growth providing a proper "home" for the nodules in which N is fixed resulting maximum number of nodule/plant. ~~The~~ A similar result was also reported by **Patil *et al*. (2019).** Further increase in the number of nodule/plant observed with the application of zinc(20kg/ha) might be due to Zn function in N fixation through nodule formation and Zn play a major role in leg ~~haemoglobin~~ synthesis. ~~The~~ A similar result was also reported by **Kuniya *at* el. (2018).**

Commented [YA18]: hat activate

Commented [YA19]: hemoglobi

Plant dry weight

At 80 DAS, significant and maximum plant dry weight (21.50g) was recorded in treatment 9 [Potassium (25kg/ha) +Zinc (20kg/ha)]. However, ~~the~~ treatment 8 [Potassium (25kg/ha) +Zinc (15kg/ha)], treatment 7 [Potassium (25kg/ha) +Zinc (15kg/ha)], treatment 6 [Potassium (20kg/ha) +Zinc (20kg/ha)], were statistically at par with treatment 9 [Potassium (25kg/ha) +Zinc (20kg/ha)]. The significant and higher plant dry weight (g) ~~was~~ observed with the application of Potassium (25kg/ha) might be due increase levels of K function of protein yield is the ~~resultant~~ of dry matter yield and protein content because it balances photosynthesis and respiration due to potassium application because of an increase in dry matter yield. Similar results were reported by **Tomar *et* al. (2001).** Further increase in dry weight observed with the application of zinc (20kg/ha) might be due to Zinc application ~~created~~ a balanced nutritional environment which enhanced metabolic activities and photosynthetic rate, resulting in improvement and ultimately accumulation of plant dry matter. Similar types of results were reported by **Meena *et* al. (2006).**

Commented [YA20]: result

Commented [YA21]: creating

Number of pods/ plant

At harvest, Treatment 9 [Potassium (25kg/ha)+Zinc (20kg/ha)] was recorded a significant and maximum number of pods/ plant (73.13) which ~~was~~ superior over all other treatments. However, the treatment 8 [Potassium (25kg/ha) + Zinc (15kg/ha)] and treatment 7 [Potassium (25kg/ha) + Zinc (10kg/ha)] was found to be statistically at par with the treatment 9[Potassium (25kg/ha) + Zinc (20kg/ha)].

The significant and maximum number of pods/plant ~~was~~ observed with the application of zinc (20kg/ha) might be due increase levels of Zn application to crops on

nutrient metabolism, biological activity, and growth parameters and hence which applied zinc results in taller and higher enzyme activity in pods/plants. Similar results were reported by **Yashona *et* al. (2018).**

Number of seeds/pod:

At harvest, Treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)] ~~was~~ recorded a significant and maximum number of seeds/pod (9.13) which was superior over all other treatments. However, ~~the~~ treatment 8 [Potassium (25kg/ha) + Zinc (15kg/ha) (8.53)] was found to be statistically at par with ~~the~~ treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)]. The significant and maximum number of seeds/pod ~~was~~ observed with the application of K (25kg/ha) might be due ~~increases~~ level of K application increased the transportation of photosynthates; protein synthesis from source to sink might be the main reason for the increase in ~~number of~~ seeds. Similar results were reported by **Hussain *et* al.(2011).** Further increase in dry weight observed with the application of zinc (20kg/ha) might be due increase levels of Zn application of ~~approprite~~ ~~fertilisers~~ increased assimilate production and photosynthesis efficiency of the seed filling. Similar types of results were reported by **Ali *et* al.(2004) and Yashona(2018).**

Seed Yield (kg/ha):

At harvest, Treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)] ~~was~~ recorded ~~significantly~~ maximum Seed yield (1363.56kg/ha) which was superior over all other treatments. However, ~~the~~ treatment 8 [Potassium (25kg/ha) + Zinc (15kg/ha)], treatment 7 [Potassium (25kg/ha) + Zinc (10kg/ha)] were found to be statistically at par with the and treatment 9 [Potassium (25kg/ha) + Zinc (20kg/ha)].

The significant and maximum seed yield ~~was~~ observed with the application of Potassium (25kg/ha) might be due increase levels of K application ~~to~~ may be attributed to a strong exchange mechanism in soil, greater cell division and elongation, efficient ~~nodulation~~, and CO_2 assimilation. The higher photosynthetic surface for longer duration in crops receiving K might have resulted in enhanced photosynthetic activity and thus more metabolites are directed for the development of crop increase in seed~~s~~ yield. Similar results were reported by **Borse *et* al. (2002); Begadkar *et* al.(2020).** Further increase in dry weight observed with the application of zinc (20kg/ha) might be due to Zinc application role in the biosynthesis of indole acetic acid which is responsible for the initiation of ~~primodial~~ ~~for~~ reproductive parts and partitioning of photosynthesis toward them which results in better grain yield. Similar results were reported by **Ram *et al*.(2013) and Sunil *et* al.(2017).**

Commented [YA22]: to the increased

Commented [YA23]: several

Commented [YA24]: appropriate

Commented [YA25]: fertilizers

Commented [YA26]: a significant

Commented [YA27]: modulation

Commented [YA28]: primordial

Straw yield (kg/ha):

At harvest, Treatment 9 [Potassium (25 kg/ha) + Zinc (20kg/ha)] ~~was~~ recorded ~~significantly~~ maximum Stover yield (3208.91kg/ha) which was superior over all other treatments. However, ~~the~~ treatment-8 [Potassium (25kg/ha) + Zinc (15kg/ha)] was found to be ~~stastically~~ at par with treatment-9[Potassium (25kg/ha) + Zinc (20kg/ha)]. The significant and maximum straw yield ~~was~~ observed with the application of Potassium (25kg/ha) might be due increase levels of K application to may be either direct or indirect, under different environments, in major plant processes such as photosynthesis, respiration, protein synthesis, enzyme activation, water uptake, osmoregulation straw yield of the plant. Similar results were reported by **Nellore *et* al. (2021).** Further increase in dry weight observed with the application of zinc (20kg/ha) might be due to Zinc application role decreases the pH of the soil and ~~increases~~ root absorption of minerals and ~~improves~~ ~~biosynthisis~~ of plant growth regulator IAA, carbohydrate and N metabolism which lead of straw yield. Similar results were reported by **Ali *et* al. (2004) and Yashona *et* al (2018).**

Economice

The result showed that maximum gross return (INR 77405.66/ha), net return (INR 54121.66/ha), and B:C ratio (2.32) were also recorded in treatment 9(Potassium25kg/ha + Zinc 20kg/ha). Higher gross returns, net returns, and benefit-cost ratio ~~was~~ recorded with application of zinc (20kg/ha) might be due to maximum recovery from the application of zinc with less expenditure and higher seed yield and ~~strow~~ yield obtained from ~~these~~ ~~trestment~~. These results ~~are in conformity~~ with those observed by **Sunil *et al.*(2017).**

CONCLUSION:

Based on the above findings. It can be concluded that ~~in~~ Cluster bean with the application of Potassium 25 kg/ha along with the application of Zinc 20 kg/ha (Treatment 9) was observed highest seed yield and benefit-cost ratio.

REFERENCE

Ali, H., Khan, M. A. and Randhawa, S. A. (2004). Interactive effects of seed inoculation and phosphorous application on growth and yield of chick pea (*Cicer arietinum* L) *Int. J. Agric. Biol.***6** (1)110-112.

Commented [YA29]: a significant

Commented [YA30]: statistically

Commented [YA31]: increasing

Commented [YA32]: improving

Commented [YA33]: biosynthesis

Commented [YA34]: were

Commented [YA35]: the application

Commented [YA36]: the application

Commented [YA37]: straw

Commented [YA38]: this

Commented [YA39]: treatment

Commented [YA40]: conform

Commented [YA41]: Reference of more than 10 years, replace the most recent references

Anonymous, (2021). Directorate of Economics and statistics, Department of Agricultural and Cooperation New Delhi. India, Annual progress report.

Anonymous, (2022). All India coordinated Research Project on Arid Legumes, NBPGR, New Delhi. Annual progress report.

Bagadkar, A., Hiwale, S. and Darekar, N. (2020). Effect of graded Levels of potassium on growth, yield and economics of green gram. *Journal of Pharmacognosy and Phytochemistry* **9**(4):1799-1801.

Borse, P. A., Pawar, V. S. and Tumbare, A. D. Response of greengram (*Phaseolus radiatus*) to irrigation schedul and fertilizer level. *Indian J. Agri. Sci*.**72**(7):418-420.

Hussain, F. Malik, A. U., Haji, M. A. and Malghani, A. L. (2011). Growth and yield response of two cultivars of *mungbean (Vigna radiata* L.) to different potassium levels. *J. Animal & Plant Sci*., **21**(3): 622-625.

Kherawat, B. S., Munna lal, Agarwal, M., Yadav, H. K. And Kumar, S. (2013). Effect of applied potassium and manganese on yield and uptake of nutrients by cluster bean (*Cyamopsis tetragonoloba). Journal of Agricultural Physics*, **13**:22-26.

Kuniya, N. Chaudhary, N. and Patel, S. (2018). Effect of sulphur and zinc application on growth, yield attributes, yield and quality of summer cluster bean (*Cyamopsis tetragonolobus* L.) in light textured soil. *International Journal of Chemical Studies*.**6**(1):1529-1532.

Meena, K. R., Dahama, A. K. and Reager, M. L. (2006). Effect of phosphorus and zinc fertilization on growth and quality of clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.). *Annual Agricultural Research, New Series Vol.* **27** (3*):* 224-226.

Nellore, S. S. N. R., Dawson, J. and Rina, L.(2021). Effect of potassium and zinc application on growth, yield chickpea (*Cicer arietinum* L.). *The Pharma Innovation Journal* **10**(10):1547-1551.

Patil,V.S., Rathod, B. G., Andhle, R. P., Patil, S. R., Jamdade, P.G. and Tambe, A. D. (2019). Role of potassium balanced and split of fertilizers for enhancing production and quality of soybean on inceptisol. *J. Agric. Res. Technol.*, **44**(1):023-028.

Pedler, J.F., Parker, D.R., and Crowley, D.E., (2000). Zinc deficiency-induced phytosiderophore release by the Triticaceae is not consistently expressed in solution culture. Planta, 211: 120-126.

Commented [YA42]: do not use anonymous citations

Commented [YA43]: do not use anonymous citations

Commented [YA44]: put the year of publication

Commented [YA45]: Reference of more than 10 years, replace the most recent references

Commented [YA46]: Reference of more than 10 years, replace the most recent references

Commented [YA47]: Reference of more than 10 years, replace the most recent references

Ram, S. and Katiyar, T. P. S. (2013). Effect of sulphur and zinc on the seed yield and protein content of summer mungbean under arid climate. *I. J. S. N.*, VOL. **4**(3) 2013: 563-566.

Singh, A. P., Lal, M., Kumar, A. P. and Singh, A. P. (2016). Effect of FYM, Potassium and Zinc on Yield, Quality and uptake of nutrients in fodder clusterbean in alluvial soil. *Annals of Plant and Soil Research* **18**(3):246-250.

Sharma, O.P. and Singh, G.D.(2004). Effect of sulphur and grouth substance on yield, quality and uptake of nutrients in fodder clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) *Journal of Environment and Ecology*.***22***(4):746-748.

Sunil, Dahiya, S., Bhattoo, M. S. and Khedwal, R. S. (2017). Effect of zinc and Sulphur on growth, yield and economics of clusterbeen (*Cyamopsis tetragonoloba* (L.) Taub.). *Int. J. Curr. Microbiol. App. Sci.* **6**(11): 3744-3751.

Tomar, R. S., Kanzaria, M. V. and Jain, V.K. (2001). Response of Chickpea to potassium in a calcareous soil. *Journal of Potassium Research* **18:**105-108

Yashon, D. S., Mishra, U. S. and Aher, S. B. Response of pulse crops to sole and combined mode of zinc application.*J. Soil and Crops* **28**(2)249-258.

Commented [YA48]: Reference of more than 10 years, replace the most recent references

Commented [YA49]: Reference of more than 10 years, replace the most recent references

Commented [YA50]: put the year of publication

Table 1 Effect of Potassium and Zinc on growth of Cluster bean.

S.No.	Treatment combinations	At 80 DAS			
		Plant height (cm)	Number of branches/plant	Number of nodules/plant	Dry weight (g/plant)
1.	Potassium (15kg/ha) + Zinc (10kg/ha)	118.26	4.40	39.63	17.76
2.	Potassium (15kg/ha) + Zinc (15kg/ha)	124.06	4.80	40.13	18.26
3.	Potassium (15kg/ha) + Zinc (20kg/ha)	124.10	4.83	40.66	18.30
4.	Potassium (20kg/ha) + Zinc (10kg/ha)	127.33	4.90	41.33	18.60
5.	Potassium (20kg/ha) + Zinc (15kg/ha)	127.20	4.93	42.20	18.40
6.	Potassium (20kg/ha) + Zinc (20kg/ha)	128.80	5.03	43.08	19.60
7.	Potassium (25kg/ha) + Zinc (10kg/ha)	131.40	5.33	43.13	19.61
8.	Potassium (25kg/ha) + Zinc (15kg/ha)	136.73	5.53	46.33	21.00
9.	Potassium (25kg/ha) + Zinc (20kg/ha)	139.20	5.86	49.45	21.53
10.	Control (N:P:K 20:40:20 kg/ha)	109.53	3.80	39.46	17.43
	F test	S	S	S	S
	SEm(±)	3.90	0.29	1.65	0.90
	CD (p=0.05)	11.60	0.86	4.90	2.67

Table:2 Effect of Potassium and Zinc on yield and yield attributes of Cluster bean.

S.No.	Treatment combination	Number of pods per Plants	Number of seed per pod	Test weight (g)	Seed Yield (kg/ha)	Stover Yield (kg/ha)	Harvest Index (%)
1.	Potassium (15kg/ha) + Zinc (10kg/ha)	53.80	7.53	26.13	1093.96	2662.02	29.12
2.	Potassium (15kg/ha) + Zinc (15kg/ha)	56.60	7.60	26.70	1127.85	2670.36	28.96
3.	Potassium (15kg/ha) + Zinc (20kg/ha)	58.20	7.66	26.96	1150.56	2766.89	27.79
4.	Potassium (20kg/ha) + Zinc (10kg/ha)	59.20	7.73	26.93	1164.42	2840.29	29.07
5.	Potassium (20kg/ha) + Zinc (15kg/ha)	61.73	7.86	27.33	1170.02	2910.09	28.66
6.	Potassium (20kg/ha) + Zinc (20kg/ha)	62.93	7.93	27.46	1196.44	2937.19	31.07
7.	Potassium (25kg/ha) + Zinc (10kg/ha)	69.20	8.20	27.50	1261.89	2988.80	29.48
8.	Potassium (25kg/ha) + Zinc (15kg/ha)	72.00	8.53	28.83	1266.69	3005.02	29.64
9.	Potassium (25kg/ha) + Zinc (20kg/ha)	73.13	9.13	29.53	1363.56	3208.91	29.84
10.	Control (N:P:K 20:40:20 kg/ha)	49.66	7.40	25.86	1036.69	2576.74	28.70
	F test	S	S	NS	S	S	NS
	SEm(±)	2.62	0.25	0.90	34.95	82.28	0.98
	CD (p=0.05)	7.77	0.75	-	103.83	244.42	-

Table 3 Effect of Potassium and Zinc of economics on Cluster bean.

S.No.	Treatment combinations	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C
1.	Potassium (15kg/ha) + Zinc (10kg/ha)	22080.00	62538.33	40458.33	1.83
2.	Potassium (15kg/ha) + Zinc (15kg/ha)	22580.00	64105.05	41525.05	1.84
3.	Potassium (15kg/ha) + Zinc (20kg/ha)	23080.00	65609.66	42529.66	1.84
4.	Potassium (20kg/ha) + Zinc (10kg/ha)	22176.00	66600.66	44424.66	2.00
5.	Potassium (20kg/ha) + Zinc (15kg/ha)	22676.00	67201.66	44525.66	1.96
6.	Potassium (20kg/ha) + Zinc (20kg/ha)	23176.00	68525.78	45349.78	1.95
7.	Potassium (25kg/ha) + Zinc (10kg/ha)	22284.00	717729.23	49445.23	2.21
8.	Potassium (25kg/ha) + Zinc (15kg/ha)	22784.00	72026.33	49242.33	2.16
9.	Potassium (25kg/ha) + Zinc (20kg/ha)	23284.00	77405.66	54118.66	2.32
10.	Control (N:P:K 20:40:20 kg/ha)	21176.00	59534.93	38385.93	1.81