Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5141

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 997-1002 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Potassium, Zinc and Fym on Content and Uptake of Nutrients of Summer Green Gram (*Vigna radiata* L.) at Different Growth Stages under South Saurashtra Region of Gujarat

Ranpariya, V. S.* and Polara, K. B.

Department of Agricultural Chemistry and Soil Science,

Junagadh Agricultural University, Junagadh 362-001 (Gujarat), India

*Corresponding Author E-mail: rvpatel7694@gmail.com

Received: 5.07.2017 | Revised: 14.08.2017 | Accepted: 20.08.2017

ABSTRACT

An field experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during summer season of 2016 to evaluate soil application of potassium, zinc and FYM and effect on nutrient content and uptake of green gram (Vigna radiata L.) under south Saurashtra region of Gujarat. The experiment comprising of Three levels of potassium viz., 0, 40, and 60 kg K_2O ha^{-1}, zinc sulphate viz., 0 and 10 kg $ZnSO_4$ ha^{-1} and FYM viz., 0 and 5 t ha^{-1} and experiment was laid out in Factorial Randomized Block Design and replicated thrice. The results revealed that the content and uptake of nutrients were significantly influenced by the various levels of potassium, zinc and FYM . The application of potassium 40 and 60 kg K_2O ha^{-1}, zinc sulphate 10 kg $ZnSO_4$ ha^{-1} and 5 t ha^{-1} FYM significantly increased the N, P, K, S and Zn content and uptake of all nutrients.

Key words: *Vigna radiata, Potassium, Zinc sulphate*

INTRODUCTION

India is one of the major pulses growing country of the world, accounting roughly for one third of total world area under pulse cultivation and one fourth of total world production. Pulses occupy a key position in Indian diet and meet about 30 per cent of the daily protein requirement. Green gram commonly known as “mung” or “mung bean” is the most important crop of the South-East Asia and particularly the Indian sub-continent. This popular and ancient crop is specially recognized as an excellent source of protein. It also plays an important role in maintaining and improving the fertility of soil through its ability to fix atmospheric nitrogen in the soil by root nodules.

Potassium is one of the essential nutrient for plant growth and vital for sustaining modern high yield agriculture. Plant needs large quantities of potassium which not only improves the crop yield, but crop quality also. Hence potassium fertilization results in higher value product and therefore in a greater return to farmers. It is a prime factor for deciding the market price of green gram grown, which improve the income of farmers just by improving the quality of produce[4].

Cite this article: Ranpariya, V.S. and Polara, K.B., Effect of Potassium, Zinc and Fym on Content and Uptake of Nutrients of Summer Green Gram (*Vigna radiata* L.) at Different Growth Stages under South Saurashtra Region of Gujarat, *Int. J. Pure App. Biosci.* **6(1):** 997-1002 (2018). doi: http://dx.doi.org/10.18782/2320-7051.5141

Among the micronutrients, zinc plays vital role in plant growth and development. Zinc also catalyses the biosynthesis of indol acetic acid, acting as metal activator of the enzyme, there by ultimately increasing crop yield. Moreover, it controls the equilibrium between CO2, water and carbonic acid in plant metabolism and helps in synthesis of nucleic acids, proteins and stimulates seed formation. Its deficiency retards photosynthesis and nitrogen metabolism. The end result is lower yield; poor produce quality and sub optimal nutrient use efficiency. Mungbean also respond to zinc application[7].

Organic manures like farm yard manures and compost have been traditionally used as input for improving soil physical, chemical and biological properties as well as maintain soil fertility which has resulted in yield stability. Guar *et al*[3]., reported that organic nitrogen is slowly mineralized and about 30 percentage N, 60 to 70 percentage P2O5 and 75 percentages K2O is likely become available to the first crop and rest of the nutrients to succeeding crops. Therefore, an experiment planned to know the effect of potassium and zinc with FYM on yield and quality of green gram.

MATERIAL AND METHODS

The experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *Summer* season of 2015-16. The soil of the experimental field was clayey in texture and alkaline in reaction (pH of 8.0 and EC of 0.56 dS m^{-1}). The soil was low in available nitrogen (225 kg ha^{-1}), medium in available phosphorus (36 kg ha^{-1}), medium in available potassium (185 kg ha^{-1}), medium in available sulphur (15.64 ppm), medium in iron (5.26 ppm), high in zinc (0.50 ppm), high in manganese (16.77 ppm) and high in copper (2.07 ppm). The experiment comprised of total twelve treatment combinations in which three levels of potassium (0, 40 and 60 K_2O kg ha^{-1}), two levels of zinc (0 and 10 $ZnSO_4$ kg ha^{-1}) and two levels of FYM (0 and 5 t ha^{-1}) were laid out in Randomized Block Design having factorial concept with three replications. The fertilizer application was done with fixed doses of nitrogen at 20 kg ha^{-1} and phosphorus at 40 kg ha^{-1}. Potassium, zinc and FYM application was done according to the treatments. The nutrients of N, P, K and Zn were applied by using sources of Urea, DAP, MOP and zinc sulphate (WG 35% Zn), respectively. The Green gram variety "Gujarat Mung - 4" was planted in third week of January with spacing of 30 m × 10 m and seed rate of 25 kg ha^{-1}. The crop was raised with all the standard package of practices and protection measures also timely carried out as they required. The experimental data recorded for growth parameters, yield attributes and yield parameters were statistically analyzed for level of significance.

RESULTS AND DISCUSSION

Nutrient content and uptake

Effect of potassium

Concentration of all nutrients in plant decreased with increasing crop age. However, at 30, 60 DAS and at harvest, the treatment differences were found non-significant in content of N, S and micro nutrients in straw. The data revealed that maximum content of K (1.82, 1.16 and 0.98 %) was observed under K_{60} treatment which was at statically at par with K_{40} treatment. The significantly, higher P content in straw at harvest (0.19 %) was observed under K_{40} treatment which was at par with K_{60} treatment. While, the treatment difference was found non-significant in content of P at 30 and 60 DAS. The P content in straw was decreased during later growth stages. There was a decrease in root activity and increasing in dry weight of plants. This might cause considerable reduction of nutrients status in plant due to decreased

absorption and dilution effect. Yeasmin[12] reported that the application of K significantly increased K concentration in green gram. Baldha[1] was also found that the higher concentration and uptake of K in plant significantly influenced due to K application.

The uptake of nitrogen, phosphorus, potassium, sulphur and micro-nutrient by straw was increased with increasing in potassium level at 30, 60 DAS and at harvest. The application of potassium @ 40 kg K_2O ha^{-1} showed significantly higher value of nitrogen (5.39, 10.44 and 22.33kg ha^{-1}) and phosphorus (0.96, 1.40 and 3.19kg ha^{-1}) uptake by straw at 30, 60 and at harvest, respectively. The application of potassium @ 60 kg K_2O ha^{-1}(K_3) showed significantly highest value of potassium (4.20, 6.75 and 16.30kg ha^{-1}) and sulphur (1.61, 2.74 and 4.69 kg ha^{-1}) uptake by straw at 30, 60 and at harvest, respectively. Similar trend was observed for the uptake of micro-nutrient like iron (198, 425 and 1020 g ha^{-1}), manganese (21.09, 39.91 and 83.07 g ha^{-1}) zinc (16.29, 31.53 and 59.99g ha^{-1}) and copper (12.62, 26.73 and 64.13 g ha^{-1}) by straw with the application of 60 kg K_2O ha^{-1}. These results are in agreement with those of Sarker *et al*[9]., and Singh *et al*[10].

Effect of Zinc

The concentration of zinc recorded significantly highest in straw at 30, 60 DAS and at harvest with the values of 91.21, 57.19 and 37.62 mg kg^{-1}at zinc applied @ 10 kg $ZnSO_4$ ha^{-1} respectively. The concentration of N and S recorded significantly highest in seed with values of 3.63% and 0.81% at zinc applied @ 10 kg $ZnSO_4$ ha^{-1} at harvest. The concentration of S recorded significantly highest in straw at 30, 60 DAS and at harvest with values of 0.74 %, 0.49 % and 0.29 % at zinc applied @ 10 kg $ZnSO_4$ ha^{-1} respectively. The concentration of nitrogen, phosphorus, potassium and micro-nutrient in straw at different growth stages did not influenced by zinc application.

The uptake of nitrogen, phosphorus, potassium, sulphur and micro-nutrient by straw was increased with application of zinc at 30, 60 DAS and at harvest. The application of zinc @ 10 kg $ZnSO_4$ ha^{-1} showed significantly highest value of nitrogen (5.32, 10.50 and 22.54kg ha^{-1}), phosphorus (0.94, 1.35 and 3.22kg ha^{-1}), potassium (3.89, 6.62 and 15.41kg ha^{-1}) and sulphur (1.62, 2.77 and 4.68 kg ha^{-1}) uptake by straw at 30, 60 and at harvest, respectively. Similar trend was observed for the uptake of micro-nutrient like iron (196, 426 and 997 g ha^{-1}), manganese (20.82, 39.29 and 80.79 g ha^{-1}) zinc (17.21, 32.73 and 61.40g ha^{-1}) and copper (12.86, 27.24 and 62.27g ha^{-1}) uptake by straw with the application of 10 kg $ZnSO_4$ ha^{-1}. The results are in close confirmation with the findings of Manivasagaperumal *et al*[5]., Goswami[2], and Roy *et al*[8].

Effect of FYM

The concentration of N, P and Zn recorded significantly highest in straw at harvest with values of 1.39 %, 0.18% and 37.14 mg kg^{-1} at FYM applied @ 5 t ha^{-1} at harvest. The concentration of potassium, sulphur and micro-nutrient in straw at different growth stages did not influenced by FYM application.

The uptake of nitrogen, phosphorus, potassium, sulphur and micro-nutrient by seed were increased with FYM application. The application of FYM @ 5 t ha^{-1}showed significantly higher value of nitrogen (43.95 kg ha^{-1}), phosphorus (6.07 kg ha^{-1}), potassium (8.92 kg ha^{-1}) and sulphur (3.69 kg ha^{-1}) uptake by seed. Similar trend was observed for the uptake of micro-nutrient like iron (749 g ha^{-1}), manganese (74.35 g ha^{-1}), zinc (64.26 g ha^{-1}) and copper (64.98 g ha^{-1}) uptake by seed with the application of FYM @ 5 t ha^{-1}. These results are in agreement with those of Meena[6] and Sulbha[11].

Table 1: Effect of potassium, zinc and FYM on contain of macro nutrients (N, P, K and S) in summer green gram at different growth stages

Treatments	N Content (%)			P Content (%)			K Content (%)			S Content (%)		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Potassium levels (kg K_2O ha^{-1})												
K_0 – 0	3.42	2.38	1.28	0.34	0.20	0.15	1.46	1.09	0.82	0.68	0.46	0.27
K_{40} – 40	3.59	2.53	1.37	0.39	0.24	0.19	1.65	1.15	0.92	0.70	0.46	0.27
K_{60} – 60	3.55	2.52	1.34	0.35	0.21	0.16	1.82	1.16	0.98	0.70	0.47	0.28
S. Em ±	0.06	0.10	0.03	0.02	0.01	0.01	0.073	0.020	0.027	0.011	0.009	0.011
C.D. at 5%	NS	NS	NS	NS	NS	0.03	0.214	0.060	0.080	NS	NS	NS
Zinc sulphate levels (kg $ZnSO_4$ ha^{-1})												
Z_0 – 0	3.44	2.35	1.28	0.33	0.20	0.16	1.59	1.11	0.87	0.65	0.44	0.25
Z_{10} – 10	3.59	2.60	1.38	0.38	0.23	0.18	1.69	1.15	0.94	0.74	0.49	0.29
S. Em ±	0.05	0.08	0.02	0.017	0.009	0.008	0.059	0.016	0.022	0.009	0.008	0.009
C.D. at 5%	NS	NS	0.08	NS	NS	NS	NS	NS	0.066	0.026	0.023	0.027
FYM levels (t ha^{-1})												
F_0 – 0	3.46	2.42	3.46	0.34	0.21	0.15	1.55	1.11	0.88	0.68	0.45	0.27
F_5 – 5	3.58	2.53	3.58	0.38	0.23	0.18	1.73	1.16	0.93	0.71	0.47	0.28
S. Em ±	0.05	0.08	0.05	0.017	0.009	0.008	0.059	0.016	0.022	0.009	0.008	0.009
C.D. at 5%	NS	NS	NS	NS	NS	0.026	NS	NS	NS	NS	NS	NS
C.V. %	6.43	14.95	6.43	16.21	18.36	21.71	15.38	6.32	10.40	5.52	7.32	14.12

Table 2: Effect of potassium, zinc and FYM on contain of micro nutrients (Fe, Mn, Zn and Cu) in summer green gram at different growth stages

Treatments	Fe Content (mg kg^{-1})			Mn Content (mg kg^{-1})			Zn Content (mg kg^{-1})			Cu Content (mg kg^{-1})		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Potassium levels (kg K_2O ha^{-1})												
K_0 – 0	1139	764	578	83.47	62.42	43.84	82.56	52.33	33.43	52.57	43.56	33.07
K_{40} – 40	1180	758	598	90.84	68.25	48.36	85.51	54.34	35.78	56.84	47.67	37.34
K_{60} – 60	1210	787	612	91.32	68.57	49.94	85.49	54.16	36.03	54.72	45.93	38.50
S. Em ±	29	48	13	2.40	1.89	1.72	2.46	1.41	1.01	2.18	1.81	1.56
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Zinc sulphate levels (kg $ZnSO_4$ ha^{-1})												
Z_0 – 0	1145	731	581	86.10	64.29	45.34	78.83	50.02	32.53	53.17	43.92	34.57
Z_{10} – 10	1208	809	611	90.99	68.54	49.42	91.21	57.19	37.62	56.25	47.53	38.04
S. Em ±	24	39	10	1.96	1.54	1.40	2.00	1.15	0.82	1.78	1.48	1.27
C.D. at 5%	NS	NS	NS	NS	NS	NS	5.89	3.38	2.42	NS	NS	NS
FYM levels (t ha^{-1})												
F_0 – 0	1144	739	580	85.86	64.16	45.51	81.67	51.95	33.02	52.88	43.92	34.46
F_5 – 5	1209	800	612	91.22	68.66	49.25	87.37	55.27	37.14	56.55	47.52	38.14
S. Em ±	24	39	10	1.96	1.54	1.40	2.00	1.15	0.82	1.78	1.48	1.27
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	2.42	NS	NS	NS
C.V. %	8.71	15.03	7.73	9.40	9.86	12.59	10.08	9.14	10.01	13.85	13.77	14.88

Table 3: Effect of potassium, zinc and FYM on uptake of macro nutrients (N, P, K and S) in summer green gram at different growth stages

Treatments	N Uptake (kg ha^{-1})			P Uptake (kg ha^{-1})			K Uptake (kg ha^{-1})			S Uptake (kg ha^{-1})		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Potassium levels (kg K_2O ha^{-1})												
K_0 – 0	4.69	8.53	18.69	0.76	1.07	2.55	3.18	5.69	12.10	1.470	2.420	4.041
K_{40} – 40	5.29	10.44	22.33	0.96	1.40	3.19	3.77	6.58	14.94	1.591	2.662	4.497
K_{60} – 60	5.26	10.13	22.31	0.82	1.26	2.80	4.20	6.75	16.30	1.613	2.741	4.693
S. Em ±	0.16	0.53	0.66	0.04	0.06	0.10	0.170	0.150	0.588	0.031	0.072	0.211
C.D. at 5%	0.47	1.55	1.93	0.13	0.19	0.30	0.51	0.450	1.726	0.09	0.21	NS
Zinc sulphate levels (kg $ZnSO_4$ ha^{-1})												
Z_0 – 0	4.84	8.90	19.68	0.75	1.14	2.47	3.54	6.06	13.48	1.461	2.391	3.959
Z_{10} – 10	5.32	10.50	22.54	0.94	1.35	3.22	3.89	6.62	15.41	1.662	2.833	4.862
S. Em ±	0.13	0.43	0.53	0.03	0.05	0.085	0.130	0.122	0.480	0.023	0.062	0.172
C.D. at 5%	0.38	1.27	1.58	0.11	0.15	0.24	NS	0.37	1.410	0.072	0.171	0.506
FYM levels (t ha^{-1})												
F_0 – 0	4.82	8.93	19.03	0.77	1.14	2.51	3.43	5.94	13.32	1.501	2.452	4.140
F_5 – 5	5.34	10.47	23.20	0.92	1.35	3.18	4.00	6.74	15.58	1.622	2.770	4.680
S. Em ±	0.13	0.43	0.53	0.03	0.05	0.085	0.13	0.12	0.480	0.021	0.063	0.172
C.D. at 5%	0.38	1.27	1.58	0.110	0.150	0.249	0.40	0.37	1.41	0.073	0.179	0.506
C.V. %	10.99	18.94	10.83	18.93	18.23	12.67	15.91	8.50	14.11	6.95	9.74	16.59

Table 4: Effect of potassium, zinc and FYM on uptake of micro nutrients (Fe, Mn, Zn and Cu) in summer green gram at different growth stages

Treatments	Fe Uptake (g ha^{-1})			Mn Uptake (g ha^{-1})			Zn Uptake (g ha^{-1})			Cu Uptake (g ha^{-1})		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Potassium levels (kg K_2O ha^{-1})												
K_0 – 0	171	366	843	18.12	32.65	63.90	14.72	27.49	49.06	11.41	22.73	48.22
K_{40} – 40	189	414	969	20.71	38.91	78.40	16.09	30.97	58.11	12.97	26.73	60.63
K_{60} – 60	198	425	1020	21.09	39.91	83.07	16.29	31.53	59.99	12.62	27.12	64.13
S. Em ±	7	25	27	0.61	1.35	3.18	0.61	1.00	1.99	0.54	1.17	2.87
C.D. at 5%	21	NS	79	1.80	3.96	9.33	NS	2.95	5.84	NS	3.46	8.41
Zinc sulphate levels (kg $ZnSO_4$ ha^{-1})												
Z_0 – 0	176	378	891	19.13	35.02	69.46	14.19	27.27	50.04	11.81	23.86	53.05
Z_{10} – 10	196	426	997	20.82	39.29	80.79	17.21	32.73	61.40	12.86	27.24	62.27
S. Em ±	6	20	22	0.50	1.10	2.59	0.49	0.82	1.62	0.44	0.96	2.34
C.D. at 5%	17	NS	65	1.47	3.23	7.62	1.46	2.41	4.77	NS	2.82	6.87
FYM levels (t ha^{-1})												
F_0 – 0	174	372	869	18.90	34.39	68.47	14.68	27.82	49.65	11.63	23.48	51.81
F_5 – 5	198	432	1019	21.05	39.92	81.78	16.72	32.17	61.80	13.04	27.64	63.51
S. Em ±	6	20	22	0.50	1.10	2.59	0.49	0.82	1.62	0.44	0.96	2.34
C.D. at 5%	17	NS	65	1.47	3.23	7.62	1.46	2.41	4.77	1.29	2.82	6.87
C.V. %	13.41	18.27	9.96	10.69	12.58	14.68	13.46	11.64	12.39	15.18	15.98	17.24

CONCLUSION

It can be concluded that application of potassium @ 40 kg ha^{-1}, zinc sulphate @ 10 kg ha^{-1} along with 5 t ha^{-1} FYM significantly increase the nutrient content and uptake of green gram at different growth stages in medium black calcareous soils of South Saurashtra region of Gujarat.

REFERENCES

1. Baldha. B.B., Effect of potassium and zinc on growth and yield of black gram under *rainfed* condition. M.Sc (Agri.), thesis submitted to J.A.U.,Junagadh (2009).
2. Goswami, P., Effect of phosphorus, sulphur, zinc and Bio-inoculants on growth and yield of *summer*mungbean [*vignaradiata*(L.)]. Ph.D.(Agri.),thesis submitted to Banaras Hindu University, Varanasi (2013).
3. Guar, A.C., Neelketan, S. and Dargan, K.S., *Organic manures*. ICAR, New Delhi. Pp. 3 (1900).
4. Krishna, S., Mineral Nutrition of Plants: Principles and perspectives. *Better CropsVol*., **82(3):** 155-160 (1995).
5. Manivasagaperumal, R., Vijayarengan, P., Balamurugan, S. and Thiyagarajan, G. Effect of zinc on growth, dry matter yield and nutrient content of green gram.*International J. of Recent Scientific Res.*, **3(8):** 687-692 (2012).
6. Meena, R.S., Response to Different Nutrient Sources on Green gram [*Vignaradiata*(L.) Wilczeck] Productivity. *Indian J. Ecol.*, **40(2):** 324-326 (2013).
7. Quah, S.C. Hashim, N.F., Kusnan, M. and Bujang, I., Effect of Zn on nodulation in Mungbean Second National Congress on Genetics, 13-15 Nov. 1996, Genetic Society of Malaysia (1996).
8. Roy, D.P., Narwal, R.P., Malik, R.S., Saha, B.N. and Kumar, S., Impact of zinc application on green gram productivity and grain zinc fortication. *J. of enviro. Biology*, **35:** 851-854 (2013).
9. Sarker, M.J.U., Siddiky, M.A., Jahiruddin, M., Mian, M.H. and Islam, M.S., Uptake of different nutrients elements by legumes crops in wheat-legume- T. Aman cropping pattern. *BangladeshJ. Agril. Res*., **36(2):** 247-253 (2011).
10. Singh, A.K., Choudhary, R.K. and Sharma, R.P.R., Effect of inoculation and fertilizer levels on yield, yield attributes and nutrient uptake of green gram and black gram. *Indian J. of Agron.*, **38(4):** 663-665 (1993).
11. Sulbha, B.A., Integrated nutrient management in summer green gram. M.Sc (Agri) 2015 thesis summited to J.A.U., Junagadh (2015).
12. Yeasmin, M.I.,.Effect of nitrogen and potassium on growth and yield of BARI Mashkalai-1 (*Vigna mungo* L.). M.Sc (Thesis) (2015).