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EFFECT OF POTASSIUM ON MOONG BEAN

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ABSTRACT

Foliar application of Potassium on moong bean at the time of flowering at half and full basal fertilizer doses in different concentrations was applied and it was found that the treatment T_5 where 1.00 kg. Potassium / ha was applied as foliar spray showed best result. It enhanced almost all the vegetative and yield characteristics of moong beanat both the basam fertilizer doses. In this way a little amount of Potassium used as foliar spray at the time of flowering when the plant required maximum nutrients can enhanced the productivity and save a large amount of fertilizers.

KEYWORDS: Potassium, split plot, basal fertilizer dose

It is evident from the history of the life that food is the fundamental requirement for all living beings. To fulfill this requirement we depend on organic materials. These useful organic materials on earth are produced in plants by photosynthesis i.e. conversion of light energy into chemical energy. From very beginning of life, the man was in quest of food. Gradually the search for food compelled the whole civilization to come nearer to the agriculture.

Now a days agriculture has become the world's biggest industry, which yields a greater variety of products than that of any other industry of the world. India is an agricultural country, its 80 per cent population still lives in the villages. They depend on agriculture and agricultural related products. The green revolutions have improved the condition of our farmers and now days India produces adequate amount of cereals to export. The whole credit of green revolution goes to our Agriculture Scientists. But still we are far behind in producing pulses and oil seeds. A large quantity of pulses and oil seeds are imported every year from other countries in which a bulk of foreign reserve is expended. Therefore, the agricultural scientists pay full attention towards the production of oil seeds and pulses.

Basal fertilizer dose significantly affected the vegetative and yield characteristics. For optimum growth of the plant, the concentration of nutrients in the soil solution should be maintained at the critical value below which the growth of the plant is decreased (Mengel and Kirby, 1982). Nitrogen and phosphorus play significant role in the growth and development of the plant and occupy an important position in plant nutrition. Unlike nitrogen and phosphorus, potassium does not form stable structural part of any molecule in said plant cells. Yet surpassingly large amount of this element is needed for proper growth and development. It acts as coenzyme or activator for many enzymes. These enzymes can not act as effective catalyst for necessary metabolic reactions in its absence. Protein synthesis is one process that requires high amount of potassium because potassium deficient plants are usually low in protein content but high in aminoacid, building blocks of proteins. One of the enzymes activated by potassium is respiratory enzyme called pyruvate kinase (Salisbury and Ross, 1986).

Vigna radiata (L.) Wilczek known as mungbean is an important crop of South East Asia and Indian Sub-continent. It has been cultivated mostly during Kharif season in Northern India. Mungbean can grow best in well-drained loam or sandy loam within mean temperature ranged from 20-40^{0}C. It is erect or semi-erect, herbaceous annual, with slight tendency for twining in upper branches. Leaves are trifoliate with entire margin and long petioles. Stipules are minute and ovate. The dried beans are prepared for cooking as whole or split (Dal). It is a good source of protein (20-23 %), carbohydrates (60-62 %), water (10%), fat (1.0%), fiber (4.0%) and ash (3.0%). Mungbean protein is deficient in methionin and cystein but rich in lysine making it an excellent compliment to rice. It is a good source of mineral, pro-vitamin A, B complex and ascorbic acid. Mungbean is thus important from nutritional point of view, hence recently much attention has been paid by Plant Breeders to evolve improved varieties.

The literature indicated that a little work has been done earlier on foliar spray of potassium on moong bean.

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Some effort have been made in this direction at this centre on wheat and barley and it was noted that foliar application of nitrogen and phosphorus at the time of flowering when it required most, for the overall development and high yield of the crop plants, gave high yield of grain and grain protein content also enhanced (Qaseem, 1975; Qaseem et al., 1996; Beg, 1998). Therefore, it was decided to undertake mungbean (*Vigna radiata* (L.) Wilczek) to study the effect of foliar spray of potassium to explore the possibility of economizing on fertilizers, at the same time maintaining the high yield as well as nutritive value of the crops.

MATERIALS AND METHODS

The seeds of Mungbean (*Vigna radiata* (L.) Wilczek var. K-856) were obtained from agriculture office, Azamgarh. The healthy seeds of uniform size were tested for their per cent viability. Mercuric chloride solution (0.01%) was used for surface sterilization of seeds. The field experiments was conducted at the research field of Shibli National P.G. College, Azamgarh to study the effect of different concentration of potassium as foliar spray at the time of flowering on vegetative and yield characteristic, Nitrogen, Phosphorus and Potassium content in the leaf and grain protein content of mungbean (*Vigna radiata* (L.) Wilczek var. K-851). The experiment was carried out according to the split plot design with two main plot i.e. half basal fertilizer dose and full basal fertilizer dose applied in the soil at the time of sowing and 5 split plots. Different concentration of potassium sprayed on the leaves of mungbean was T_1 (0.2 kg K/ha), T_2 (0.4 kg K/ha), T_3 (0.6 kg K/ha), T_4 (0.8 kg K/ha) and T_5 (1 kg K/ha). The healthy and disease free seeds of uniform size were selected for experiment. After proper surface sterilization of seed, the seeds were sown in the experiment plots. Five replicates of each concentration were made. The usual "behind the plough" method of sowing was adopted. The field irrigated five times between sowing and harvesting at 7, 21, 40, 55, 70 days. After sowing weeding was done twice at interval of 30 days. Five replicates were made for each concentration of nitrogen to study vegetative characteristics, yield characteristics and NPK percentage in the leaves of mungbean and grain protein content. The growth parameters were taken at 45 60 days and all the yield parameters were taken at the time of harvesting. The flowering parameters were studied.

A. Vegetative Characteristics

1.Height of plants (cm.)
2. Length of Petiole (cm.)
3.Length of Lamina (cm.)
4.Breadth of Lamina (cm.)
5. Number of stomata per unit area
6.Length of Guard cells (μ)
7. Breadth of Guard cell (μ)
8. Length of Stomatal aperture (μ)
9.Breadth of Stomatal aperture (μ).

B. Yield Characteristics

1.Diameter of flower
2. Number of pods per plant
3. Length of pod
4. Number of seeds per pod
5. Grain yield kg/ha

C. Chemical Parameters

Grain and leaf analysis was made to test the percentage of protein in grain and percentage of nitrogen, phosphorus and potassium in the leaf.

1. Grain protein content (%)
2. Leaf nitrogen content (%)
3. Leaf phosphorus content (%)
4. Leaf potassium content (%)

OBSERVATION

Comparison of the mean values of several morphological and yield characters of mungbean between control population and the population treated with different concentration of potassium as foliar spray, at the time of flowering at half basal fertilizer dose was made. The population treated with water was taken as control (T_0). The potassium concentration used as foliar spray was 0.2 kg/ha, 0.4 kg/ha, 0.6 kg/ha, 0.8 kg/ha and 1 kg/ha as T_1, T_2, T_3, T_4 and T_5 treatments respectively. It was observed that almost all the vegetative and reproductive characters increase with

Table1: Comparison of the mean values of several vegetative and yield characters of Mungbean at half basal fertilizer dose between the control population and the population treated with different concentration of potassium as foliar spray at the time of flowering

S.N.	Characters	No. of Samples	T_0	T_1	T_2	T_3	T_4	T_5
1	Height of the plant (cm)	50	21.21 (9.4 – 30.0)	21.17 (14.5 – 39.6)	21.30 (13.5 – 39.8)	21.99 (14.3 – 38.8)	23.20 (12.3 – 41.2)	24.21 (15.3 – 36.6)
2	Length of Petiole (cm.)	50	6.07 (4.6 – 8.1)	5.81 (2.1 – 8.5)	5.23 (4.1 – 7.5)	5.52 (4.2 – 8.5)	5.68 (4.3 – 7.6)	5.54 (4.5 – 8.7)
3	Length of Lamina (cm)	50	5.45 (3.4 – 6.5)	5.14 (2.6 – 7.5)	5.18 (3.4 – 7.8)	5.43 (4.3 – 6.2)	5.82 (2.9 – 7.8)	4.91 (4.3 – 6.7)
4	Breath of Lamina (cm)	50	3.00 (2.6 – 5.4)	4.76 (2.6 – 6.1)	4.62 (2.1 – 6.1)	5.43 (4.6 – 7.5)	5.53 (4.5 – 7.2)	5.43 (2.6 – 7.5)
5	No. of stomata / unit area	50	15.74 (13.0 – 22.0)	13.24 (12.0 – 24.0)	12.72 (14.0 – 16.0)	14.84 (14.0 – 18.0)	20.30 (14.0 – 26.0)	14.82 (15.0 – 18.0)
6	Length of guard cell (µ)	50	4.64 (4.0 – 5.0)	4.36 (4.0 – 6.0)	4.52 (4.0 – 5.0)	4.54 (4.0 – 5.0)	4.58 (4.0 – 5.0)	4.58 (4.0 – 5.0)
7	Breadth of guard cell (µ)	50	2.40 (2.0 – 4.0)	2.30 (2.0 – 4.0)	2.38 (2.0 – 4.0)	2.56 (2.0 – 4.0)	2.46 (2.0 – 4.0)	2.60 (2.0 – 4.0)
8	Length of stomatal apperture (µ)	50	4.10 (2.0 – 5.0)	4.88 (2.0 – 6.0)	5.32 (2.0 – 6.0)	5.44 (2.0 – 6.0)	5.58 (2.0 – 6.0)	5.50 (2.0 – 6.0)
9	Breadth of stomatal apperture (µ)	50	2.40 (1.0 – 5.0)	2.46 (1.0 – 5.0)	2.52 (1.0 – 5.0)	2.52 (1.0 – 6.0)	2.56 (2.0 – 5.0)	2.60 (2.0 – 6.0)
10	Diameter of flower (cm)	50	1.17 (0.8 – 1.9)	1.30 (0.8 – 1.9)	1.33 (0.8 – 2.1)	1.34 (0.8 – 2.3)	1.36 (0.2 – 2.1)	1.41 (0.6 – 2.1)
11	No. of pods / plant	50	16.00 (2.0 – 22.0)	18.46 (4.0 – 20.0)	18.76 (14.0 – 21.0)	19.20 (5.0 – 22.0)	19.44 (5.0 – 25.0)	19.72 (2.0 – 26.0)
12	Length of pod (cm.)	50	3.22 (2.0 – 8.0)	3.82 (3.0 – 11.0)	4.00 (3.0 – 7.1)	4.06 (3.0 – 12.0)	4.16 (3.0 – 7.0)	4.53 (3.0 – 8.0)
13	No of seeds / pod	50	4.44 (2.0 – 8.0)	8.24 (4.0 – 10.0)	8.48 (4.0 – 11.0)	7.08 (4.0 – 10.0)	7.48 (4.0 – 10.0)	9.54 (3.0 – 12.0)
14	1000 grain weight (gm)	50	40.03	42.30	45.46	44.06	45.08	44.32

Range is given in parenthesis.,

T_0 = Control,

T_1 = 0.2 Kg K/ha as foliar spray at the time of flowering.,

T_2 = 0.4 Kg K/ha as foliar spray at the time of flowering,

T_3 = 0.6 Kg K/ha as foliar spray at the time of flowering.

T_4 = 0.8 Kg K/ha as foliar spray at the time of flowering.,

T_5 = 1.0 Kg K/ha as foliar spray at the time of flowering.

Table 2 : Comparison of the mean values of several vegetative and yield characters of Mungbean at full basal fertilizer dose between the control population and the population treated with different concentration of potassium as foliar spray at the time of flowering

S.N.	Characters	No. of Samples	T_0	T_1	T_2	T_3	T_4	T_5
1	Height of the plant (cm)	50	22.38 (9.4 – 29.9)	29.81 (14.5 – 39.6)	29.47 (13.5 – 39.8)	29.24 (14.3 – 38.8)	27.31 (12.3 – 41.2)	28.58 (15.3 – 36.6)
2	Length of Petiole (cm.)	50	6.56 (4.6 – 9.1)	6.28 (2.3 – 8.8)	5.23 (3.2 – 7.8)	6.05 (4.3 – 8.4)	6.45 (4.5 – 7.9)	6.14 (4.6 – 8.6)
3	Length of Lamina (cm)	50	5.73 (3.4 – 6.5)	5.24 (2.6 – 8.5)	4.79 (3.6 – 8.1)	5.04 (4.6 – 8.5)	5.60 (4.4 – 7.6)	5.81 (4.6 – 7.5)
4	Breath of Lamina (cm)	50	3.57 (2.6 – 5.4)	4.59 (2.7 – 6.5)	4.42 (2.3 – 6.7)	5.47 (3.5 – 7.6)	5.30 (4.6 – 7.5)	4.65 (2.7 – 7.6)
5	No. of stomata / unit area	50	16.36 (3.0 – 5.0)	21.28 (3.0 – 7.0)	20.64 (15.0 – 25.0)	22.18 (4.0 – 7.0)	21.12 (4.0 – 6.0)	20.20 (5.0 – 5.0)
6	Length of guard cell (µ)	50	4.52 (4.0 – 5.0)	4.58 (4.0 – 7.0)	4.56 (4.0 – 6.0)	4.52 (4.0 – 5.0)	4.40 (4.0 – 6.0)	4.58 (4.0 – 7.0)
7	Breadth of guard cell (µ)	50	2.80 (4.0 – 5.0)	2.40 (3.0 – 6.0)	2.64 (4.0 – 6.0)	2.48 (4.0 – 7.0)	2.62 (4.0 – 7.0)	2.62 (4.0 – 7.0)
8	Length of stomatal apperture (µ)	50	4.46 (2.0 – 6.0)	5.36 (2.0 – 6.0)	5.38 (4.0 – 6.0)	5.38 (2.0 – 3.0)	5.15 (3.0 – 6.0)	5.54 (4.0 – 6.0)
9	Breadth of stomatal apperture (µ)	50	2.58 (2.0 – 3.0)	2.52 (2.0 – 3.0)	2.56 (2.0 – 3.0)	2.50 (2.0 – 3.0)	2.70 (2.0 – 3.0)	2.58 (2.0 – 3.0)
10	Diameter of flower (cm)	50	1.24 (0.8 – 1.9)	1.33 (0.5 – 1.9)	1.37 (0.8 – 2.1)	1.35 (0.6 – 0.9)	1.33 (0.6 – 1.6)	1.46 (0.6 – 2.1)
11	No. of pods / plant	50	16.34 (2.0 – 12.0)	17.10 (3.0 – 17.0)	18.46 (5.0 – 23.0)	18.96 (4.0– 34.0)	19.72 (5.0 – 28.0)	21.44 (3.0 – 30.0)
12	Length of pod (cm.)	50	3.80 (2.0 – 8.0)	4.59 (4.0 – 10.0)	3.67 (4.0 – 11.0)	4.63 (3.0 – 13.0)	4.78 (6.0 – 12.0)	5.08 (7.0 – 14.0)
13	No of seeds / pod	50	4.46 (2.8 – 8.1)	8.60 (2.8 – 10.7)	7.54 (2.5 – 9.5)	8.12 (1.1 – 9.5)	9.44 (1.6 – 17.5)	9.04 (1.6 – 16.5)
14	1000 grain weight (gm)	50	40.60	43.50	44.35	45.06	43.83	43.02

Range is given in parenthesis.,

T_0 = Control,

T_1 = 0.2 Kg K/ha as foliar spray at the time of flowering.,

T_2 = 0.4 Kg K/ha as foliar spray at the time of flowering,

T_3 = 0.6 Kg K/ha as foliar spray at the time of flowering.

T_4 = 0.8 Kg K/ha as foliar spray at the time of flowering.,

T_5 = 1.0 Kg K/ha as foliar spray at the time of flowering.

the increases of potassium concentration (Table-1). The height of the plant increased with the foliar application of potassium and maximum increase of 14.14 per cent was recorded in T_5 treatment where plants received 1 kg K/ha as foliar spray at the time of flowering along with half basal fertilizer dose. Breadth of lamina also increased with the foliar application of potassium and this increase was 58.66, 54.00, 81.00, and 81.00 per cent over control in treatment T_1, T_2, T_3, T_4 and T_5 respectively. Maximum increase of 81 % was recorded in T_3 treatment. Number of stomata per unit area increased with potassium application and the maximum increase was recorded in T_4 treatment, it was 28.97 per cent over the control. A little increase in breadth of guard cell, length and breadth of stomatal aperture was also recorded with the application of potassium (Table-1).

The reproductive characters taken into consideration were diameter of flower, number of pod per plant, length of pod and number of seed per pod. Maximum increase in diameter of flower was recorded in T_5 treatment and it was 20.51 per cent as compared to control. Number of seed per pod also increased and maximum increase of 23.25 per cent over control was recorded in T_5 treatment. It was recorded that almost all the vegetative and yield characters increased with the foliar application of potassium at the time of flowering. In most of the cases maximum increase was recorded in T_5 treatment where plant received 1 kg K / ha in addition to usual half basal fertilizer dose (Table-1).

Comparison of the mean values of several morphological and yield characters of mungbean between control population and the population treated with different concentration of potassium as foliar spray at the time of flowering at full basal fertilizer dose was made and data are presented in table-2. The population treated with water was taken as control (T_0). The potassium concentration used as foliar spray was 0.2 kg/ha, 0.4 kg/ha, 0.6 kg/ha, 0.8 kg/ha and 1 kg/ha as T_1, T_2, T_3, T_4 and T_5 treatment respectively. It was observed that almost all the vegetative and reproductive characters increased with the increases of potassium concentration. The height of the plant increased with the foliar application of potassium and maximum increase was recorded in T_1 treatment where plants received 0.2 kg K/ha as foliar spray along with full basal fertilizer dose. This increase was 33.19 per cent over control. Length of petiole and lamina seems to unaffected with the foliar application of potassium. Breadth of lamina increased with the foliar application of potassium and this increase was 28.57, 23.80, 53.22, 48.45 and 30.25 per cent in treatment T_1, T_2, T_3, T_4 and T_5 respectively over control. Maximum increase was recorded in T_3 treatment. Number of stomata per unit area increased with potassium application and the maximum increase was recorded in T_3 treatment, it was 35.57 per cent over the control. Length of guard cell, breadth of guard cell, length and breadth of stomatal aperture were found to be unaffected with the application of potassium (Table-2).

The reproductive characters taken into consideration were diameter of flower, number of pods per plant, length of pod and number of seeds per pod. Maximum increase in diameter of flower was recorded in T_5 treatment and it was 17.74 per cent over control. Number of pods per plant increase with the application of potassium concentration and maximum increase was recorded in T_5 treatment where 1.0 kg potassium was applied as foliar spray at the time of flowering. This increase was 31.21 per cent over control. Length of pod increases maximum in T_5 treatment and it was 33.68 per cent. Number of seeds per pod also increased with the application of potassium as foliar spray and maximum increase was recorded in T_4 treatment. It was 111.65 per cent. 1000 grain weight increased with the increase of 10.98 per cent in T_3 treatment. It was observed that almost all the vegetative and yield characters increased with the foliar application of potassium at the time of flowering in most of the cases. T_5 treatment, where plant received 1 kg K / ha as foliar spray in addition to full basal fertilizer dose was found to most effective (Table-2).

RESULTS AND DISCUSSION

Potassium is also important in mineral nutrient present in the soil in the form of its various salts. It is the most mobile plant nutrient. The most important role of potassium is in ionic and osmotic regulation. Potassium also function as co-factor or activator of several enzymes involved in protein and carbohydrate metabolism. It increases the efficiency of the leaf in manufacturing sugar

and starch. Several workers like Sinha ,(1961); Kabir et al., (2004); Musolf et al., (2004) etc. have reported that positive effect of potassium in vegetative and reproductive growth of several crops.

The comparison of the mean value of several vegetative and yield characteristics of Mungbean (*Vigna radiata* (L.) Wilczek var. K-851) between control population and the population treated with different concentration of potassium as foliar spray at the time of flowering was made and the data are presented in table 1 & 2 at half and full basal fertilizer dose. The Mungbean at half basal fertilizer dose revealed an increase in all the vegetative and yield characters with the increasing concentration of foliar application of potassium at the time of flowering (Table-1). The characters like height of the plant, length of petiole, length and breadth of lamina, number of stomata per unit area, length and breadth of guard cell, length and breadth of stomatal aperture and length of pod showed maximum enhancement at T_5 treatment where plant received 1.0 kg K/ha as foiliar spray at the time of flowering in addition to half basal fertilizer dose. The characters like number of pods per plant, number of seeds per pod and 1000 grain weight showed maximum increase at T_4 treatment i.e. 0.8 kg K/ha applied as foliar spray at the time of flowering with half basal fertilizer dose (Table - 1).

The comparison of the mean value of a number of vegetative and yield characters between the control population and the population sprayed with different concentration of potassium at the time of flowering at full basal fertilizer dose was made and the data are tabulated in table 2. The pooled data revealed that the foliar application of potassium at the time of flowering enhance all the characters studied. The increase in characters was directly proportional to the increase in potassium concentration at full basal fertilizer dose. The maximum increase in almost all the vegetative and yield characters except breadth of guard cell, breadth of stomatal aperture and 1000 grain weight was recorded at T_5 treatment where plant was supplied with aqueous solution of potassium at the rate of 1.0 kg K/ha. The characters such as breadth of guard cell breadth of stomatal aperture and 1000 grain weight showed maximum increase at T_4 treatment where the plant was supplied with 0.8 kg K/ha as foliar spray at the time of flowering (Table-2).

The data pooled in table 1 & 2 indicated that the foliar spray of potassium at the time of flowering enhance all the vegetative and yield characteristics taken into consideration at half and full basal fertilizer dose. The treatment T_5 was proved to be the best treatment for almost all the parameters studied at both the basal fertilizer doses.

REFERENCES

Beg M. Jaish, 1998. Effect of Vitamins on Yield and Grain Quality of *Triticum aestivum* and *Hordium vulgare* L. Ph.D. thesis submitted to V.B.S. Purvancahl University, Jaunpur,India.

Kabir M.E., Karim, M.A. and Azad M.A.K., 2004. Effect of potassium on salinity tolerance of mungbean (*Vigna radita* (L.) Wilczek). Journal of Biological Sciences, **4**(2) : 103-110.

Mengel K. and Kirby E.A., 1982. Principles of plant nutrition. 3rd Edn. Switzerland International Potash Institute, Bern, Switzerland.

Musolf R., Grizebirz W. and Szczepaniak W., 2004. Effect of potassium fertilization under diversified water condition on yield and quality of sugar beet (*Beta vulgaris* L.) Part II Quality of taproots and Yield of Sugar. Soil and Fertilizers, Poland : 23-25.

Qaseem S.M., 1975. Effect of Nitrogenous and Phosphatic Spray on the Yield and Grain Quality of Barley and wheat. Ph. D. Thesis, A.M.U., Aligarh.

Qaseem S.M., Beg M.Z., Ahmad A. and Beg M. Jaish, 1996. A study of pre-sowing seed treatment of vitamin B1 (Thiamin) on the seedling growth, yield and characteristics of *Zea mays* Linn. Var. MEH-115. Indian J. Applied and Pure Biol., **11** : 63-66.

Salisbury F.B. and Ross C., 1986. Plant Physiology 2nd Edn.. Pretice Hall of India Pvt. Ltd., New Delhi.

Sinha H., 1961. Effect of potassium-born interaction upon growth and composition of soybean and vegetable crops. Diss. Abstr., **22** : 1343-1344.