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EFFECT OF FOLIAR APPLICATION OF POTASSIUM NITRATE AND SALICYLIC ACID ON PHYSIO-BIOCHEMICAL CHANGES ON MUNGBEAN (*VIGNA RADIATA* L.) UNDER SODIC SOIL

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ABSTRACT

The investigation conducted at the research site of Student Instruction Farm, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, India during *kharif* season of the year 2022-23. The experiment was laid in randomized block designed with three replication and variety Shikha with seven treatments viz., T_1-Control, T_2-Potassium nitrate (100ppm), T_3-Potassium nitrate (200ppm), T_4-Potassium nitrate (400ppm), T_5- Salicylic acid (50ppm), T_6- Salicylic acid (100ppm), T_7- Salicylic acid (150ppm), concentration and control set were also maintained. The potassium nitrate and salicylic acid were sprayed at 30 DAS of the crop.

The observation was recorded at 45, 60 DAS and maturity of the crop. Result of field study indicated that, the growth parameters, biochemical changes, yield attributing traits and quality of mungbean were significantly increase due to foliar sprayed of salicylic acid and potassium nitrate. The foliar sprayed of salicylic acid 150ppm was found most effective for increasing the number of branches Plant^{-1} (5.45), plant height (54.23cm), total dry biomass Plant^{-1} (53.51g) and biochemical changes viz: chlorophyll content SPAD value (12.87), protein content (24.50%), nitrate reductase activity (265.45microgram/fresh weight), RWC (92.84%), peroxidase content (72.82 g^{-1} fresh weight), proline (71.93 mg g^{-1} fresh weight), number of pods per cluster (9.97), number of pods per plant (39.77), number of seeds per pod (5.40), 100 seed weight (3.89g), seed yield per plant (6.70g), seed yield q/ha (21.30) and harvest index (56.90%) followed by foliar sprayed of potassium nitrate 400 ppm over rest of the treatments. However, growth parameters like plant height (54.23cm) was measured significantly increase due to foliar application of salicylic acid 150 ppm followed by foliar sprayed of potassium nitrate 400 ppm over other treatments including control.

Key words : Mungbean, Potassium nitrate, Salicylic acid, Physio-chemical changes, Sodic soil.

Introduction

Green gram (*Vigna radiata* L.) is one of the important pulse crop, rank third in area and production after pigeon pea and chickpea. It is grown in almost all parts of the country over a wide range of agro-climatic conditions. Mungbean (V*igna radiata* L. Wilczek) also known as green gram, is a fast-growing warm season legume and has a diploid chromosome number of 2n=22. Mungbean is native to India and Central Asia especially in tropical and sub-tropical Asia and belong to family Fabaceae and sub family Papilionaceae. Nutritive value of mungbean is high with easily digestible protein (25-28%), oil (1.0-1.5%), fiber (3.5-4.5%), ash (4.5-5.5%), carbohydrate (65-66%), water 9.1%, and vitamins on dry weight basis (Singh and Srivastava, 2014). In India mungbean crop is raised in three seasons viz. Kharif, Rabi and Zaid to about 4.5mha with production 2.5 million tones and productivity 548 kgha^{-1}. In Uttar Pradesh, the area under mungbean is 51000 ha with production 33000 tones and productivity 666 kgha^{-1} (Anonymous, 2021). Salinity is one of the most destructive factors among the abiotic stresses, which limit the crop production

worldwide. Mineral nutrients and plant growth regulators play significant role in mitigation of salinity stress. Salt stress has a triple effect on plant growth First, it decreases water absorption. Second, it leads to imbalance ion and third, it results in plant toxicity ionic effect. Ionic imbalance occurs in the cells due to excessive accumulation of Na^+ and Cl^- ions and reduce uptake of mineral nutrients such as K^+ and Ca^{+2} (Yusuf *et al*., 2012). Potassium (K) is the most abundant inorganic cation, and it is important for ensuring optimal plant growth. K is an activator of dozens of important enzymes, such as protein synthesis, sugar transport, N and C metabolism and photosynthesis (Rahman *et al*., 2017). It plays an important role in the formation of yield and quality improvement. K is also very important for cell growth, cell elongation, regulation of stomatal opening and closing, and other important physiological processes (Xu *et al.*, 2020). Salicylic acid participates in the regulation of various physiological processes in plants, such as stomatal closer, ion uptake, inhibition of ethylene biosynthesis, transpiration and stress tolerance. Foliar application of salicylic acid exerted a significant effect on plant growth metabolism when applied at physiological concentration and thus acted as one of the plant growth regulator substances (Navya *et al.*, 2021).

Materials and Methods

The experiment was conducted at Student Instructional Farm at Acharya Narendra Deva University of Agriculture and Technology's, Narendra Nagar, Kumarganj, Ayodhya (U.P.), India during *kharif* season of 2021-22. The following are the details of the materials utilized, the experimental procedure followed, the techniques used, and the climatic and edaphic conditions that prevailed during the experimentation are as fallows. The design is Randomised Block Design (R.B.D.) with seven treatments, three replications and variety Shikha. Concentrations of potassium nitrate (100, 200, 400 ppm) and Salicylic acid (50, 100, 150 ppm) foliar spray along with untreated control. Plant height at various intervals was measured from soil surface up to tip of the plant with the help of a meter scale and average height was calculated from the replicated data and represented in cm. Number of tillers per plant was recorded by counting total tillers while ear bearing tillers per plant was recorded by counting the number of ear bearing tillers. From the tagged, plants three panicles were randomly selected and the number of spikelet per panicle was counted for obtaining number of spikelet per panicle and also the length of panicle was measured from the neck nodes of panicle to the tip of the upper most spikelet and mean length was recorded as length of panicle in cm. Total number of grains were worked out by taking 3 panicles randomly selected from each tagged plants and number of grains were counted and expressed as average number of grains per panicle. All panicles of individually tagged plants were threshed manually and weighed to obtain grain yield per plant. Chlorophyll content of leaf was directly measured in intact leaves with the help of SPAD meter. Total protein content of the grains was estimated by the method given of Lowery *et al*. (1951). The significance of various treatments was judged by The Fisher method of analysis of variance was used to analyze data collected on various growth and yield parameters (Fisher and Yates, 1949).

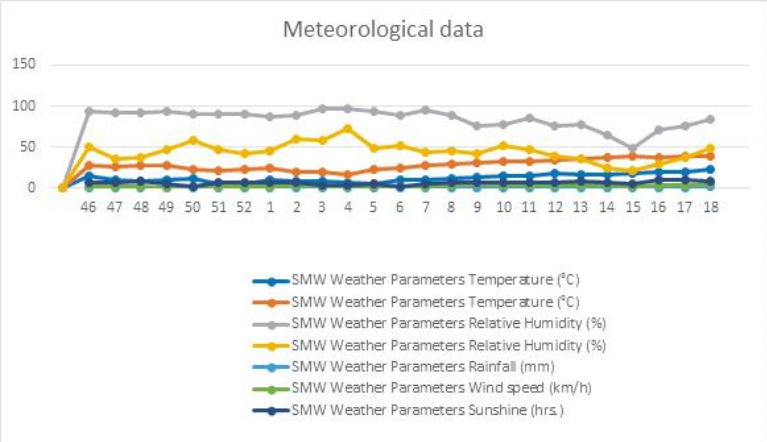

Fig. 1 : Meteorological chart during crop period 2022.

Results and Discussion

Growth parameters

Plant height (cm) : The data in Fig. 2 shows maximum plant height was obtained with T_4- potassium nitrate 400 ppm (25.14 and 66.01 cm) at 45 and maturity stages, T_7- salicylic acid 150ppm (47.79cm) 60 DAS, respectively, followed by foliar application of T_7-salicylic acid 150ppm over rest of treatments including control. The minimum plant height was found with foliar sprayed of T_5- salicylic acid 50ppm (22.71 and 53.36 cm) at 45 DAS and maturity, T_2- potassium nitrate 100ppm (40.86cm) at 60 DAS all stages of observation. Similarly finding were also recorded by Kumar *et al* (2017).

Number of branches plant^{-1} (mean value) : The data in Fig. 3 shows maximum number of branches has observed with foliar application of T_7- salicylic acid 150ppm (4.51, 5.45 branches plant^{-1}) at 45, 60 DAS, respectively, followed by foliar sprayed of T_6-salicylic acid 100ppm over control. Whereas, minimum number of branches was recorded with foliar sprayed of T_2- potassium nitrate 100ppm (3.27 branches plant^{-1}) over control. Similarly finding were also

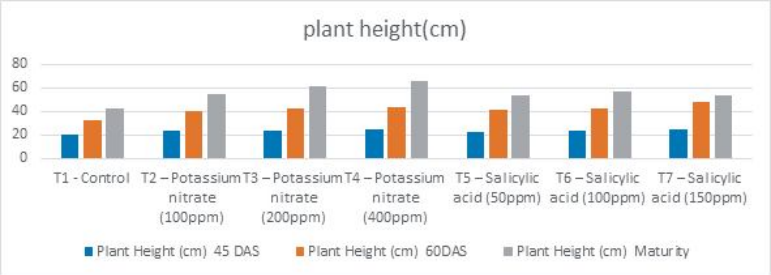

Fig. 2 : Effect of different treatments on plant height (cm).

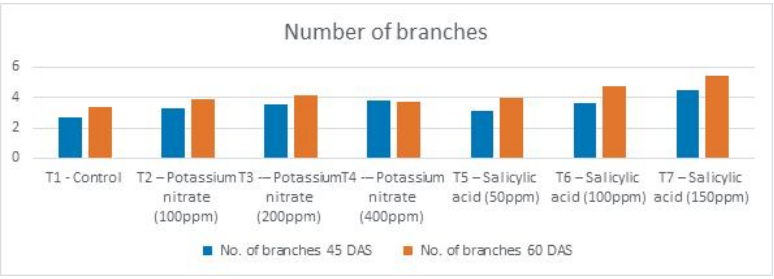

Fig. 3 : Effect of different treatments on number of branches.

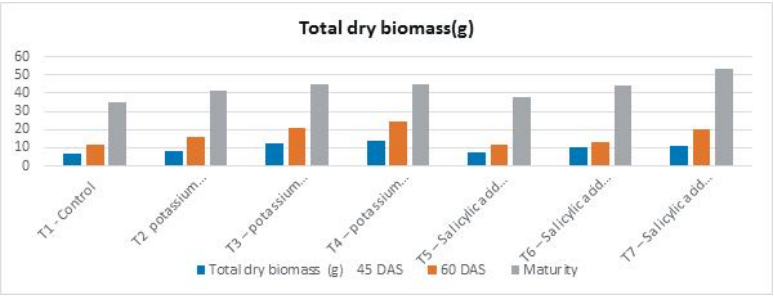

Fig. 4 : Effect of different treatments on total dry biomass.

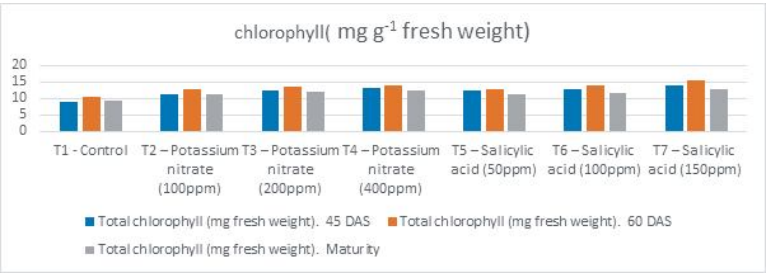

Fig. 5 : Effect of different treatments on chlorophyll.

recorded by EI-Yazeid (2011).

Total dry biomass (g) plant^{-1} : The data in Fig. 4 shows maximum dry biomass obtained foliar sprayed of T_4-potassium nitrate 400ppm (13.51 and 24.45 total dry biomass g plant^{-1}) at 45 and 60, maturity stage T_7-Salicylic acid 150ppm (53.51dry biomass g plant^{-1}) respectively, followed by foliar sprayed T_3- potassium nitrate 200ppm over control. Whereas, minimum total dry biomass was recorded with foliar sprayed of T_5- salicylic acid at 50ppm (7.34, 11.66 and 37.49 total dry biomass g plant^{-1}). Amount of total dry biomass produced as an indication of over efficiency of utilization of resources and better light interception. Similar finding has been reported by Patel and Hemantranjan (2012).

Bio-chemical parameters

Chlorophyll content in leaf (SPAD value) : The data in Fig. 5 shows maximum chlorophyll content (13.80, 15.51 and 12.87) at 45, 60 DAS and maturity were analyzed with foliar sprayed of T_7- salicylic acid 150ppm, followed by foliar sprayed of T_4-potassium nitrate 400ppm over other treatments including control. Whereas, minimum chlorophyll content was recorded with foliar sprayed of T_2- potassium nitrate 100ppm (11.43, 12.72 and 11.14) at 45, 60 DAS and maturity, respectively but maximum in control. Similarly finding was also recorded by Janmohammadi *et al*. (2017).

Protein content in seed (%) : The maximum increased in protein content (24.50%) was recorded with foliar application of T_7- salicylic acid 150 ppm, followed by foliar application of 400 ppm of T_4- potassium nitrate (24.15%), which found statistically significantly superior, over control. Whereas, the minimum protein content was recorded due to foliar sprayed of T_2- potassium nitrate 100 ppm (23.19%) as compared to control. The higher protein content in seed achieved with SA which may be increased structural component of RNA molecules of amino acids, increased DNA, RNA and protein synthesis in ribosome which is known as site of protein synthesis in plant. Similar result was reported by Senthil *et al*. (2003). (Fig. 6).

Seed yield quintal ha^{-1} : The maximum seed yield q ha^{-1} was recorded with foliar application of T_6-salicylic acid 100ppm (22.80 q/ha) followed by foliar sprayed T_4-potassium nitrate 400ppm (22.03 q/ha) was recorded over other treatments including control. Whereas, minimum seed yield q ha^{-1} was recorded with foliar sprayed of T_5- salicylic acid 50ppm (11.96q/ha) over control. This finding is close conformity with Navya *et al*. (2021) and Mandavia *et al*. (2006).

Seed yield (g) plant^{-1} : The data on seed yield (g) plant^{-1} was recorded highest (6.76 g) with foliar sprayed of T_4- potassium nitrate 400ppm followed by foliar sprayed T_7-salicylic acid 150ppm (6.70 g) whereas, minimum increased (3.98 g) was recorded of T_5-salicylic acid 50ppm as compared to control. This finding is close conformity with Navya *et al*. (2021).

100 seed weight (g) : Maximum increased in 100 seed weight was recorded with foliar application of T_7- salicylic acid 150ppm (3.89 g) followed by foliar

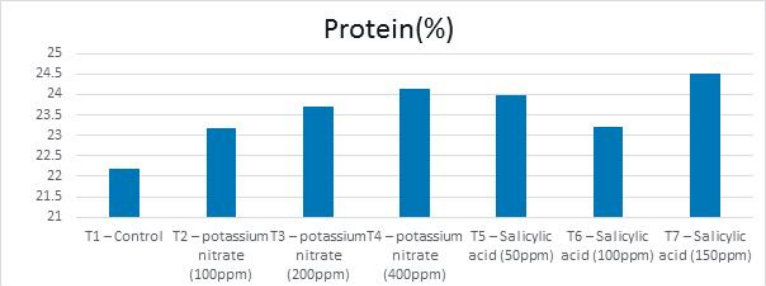

Fig. 6 : Effect of different treatments on protein (%).

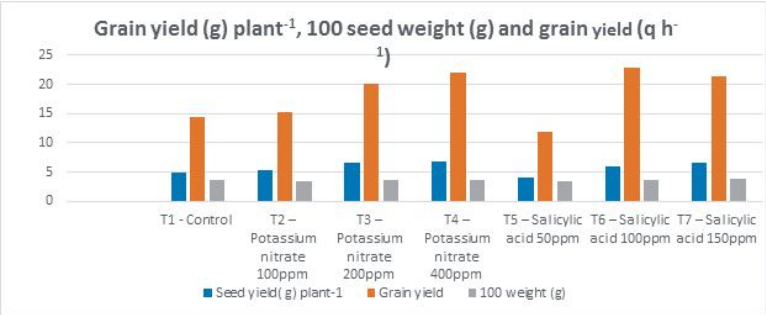

Fig. 7 : Effect of different treatments on grain yield (g) plant^{-1}, 100 weight (g) and grain yield (q h^{-1}).

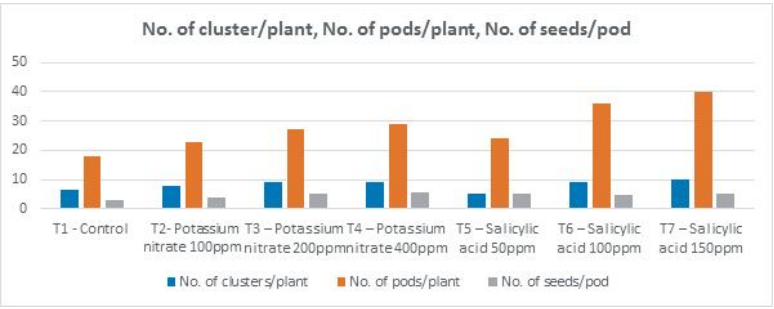

Fig. 8 : Effect of different treatments on no. of cluster/plant, no. of pods/plant, no. of seeds/pod.

application of T_4-potassium nitrate 400ppm (3.70 g) was recorded over others treatment. Where, minimum 100 seed weight (g) was recorded with foliar sprayed of T_5-salicylic acid 50 ppm (3.37g) as compared to control. Similar finding also reported by Kuttimani and Velayuthan (2011).

Number of pods plant^{-1} : The maximum number of pods plant^{-1} was recorded with foliar application of T_7-salicylic acid 150ppm (39.77) followed by foliar sprayed T_6-salicylic acid 100ppm (35.86) was recorded over other treatments including control. Whereas, minimum pods plant^{-1} was recorded with foliar sprayed of T_2-potassium nitrate 100ppm (22.83) over control. Similarly finding were also recorded by Ali and Mahmood (2013).

Number of seeds pod^{-1} : The maximum number of seeds pod^{-1} was recorded with foliar application of T_4-potassium nitrate 400ppm (5.68) followed by foliar sprayed T_7-salicylic acid 150ppm (5.40) was recorded over other treatments including control. Whereas, minimum seeds pod^{-1} was recorded with foliar sprayed of T_2- potassium nitrate 100ppm (3.78) over control. Similarly finding were also recorded by Ali and Mahmood (2013).

Number of clusters plant^{-1} : The maximum number of clusters per plant was recorded with foliar sprayed of T_7-salicylic acid 150 ppm (9.97) followed by foliar sprayed of T_4-potassium nitrate 400 ppm (9.32) was recorded over other treatments included control. Whereas, minimum clusters per plant was recorded with foliar sprayed of salicylic acid 50ppm (5.34) over control. This finding is close conformity with Hayat *et al.* (2010).

Conclusion

Present investigation clearly indicates that foliar application of salicylic acid and Potassium nitrate showed a beneficial effect on plant growth and development of mungbean crop. Significant increase in plant height, no. of branches, dry biomass, biochemical traits like chlorophyll content, protein content, yield characteristics like no. of cluster/plant, no. of pods/plant and number of seeds per plant, no. of clusters/plant, no. of pods/plant and number of seeds/pod. Present findings needs further validation at farmer fields. On the basis of above findings useful conclusions both having fundamental and applied values may be drawn. Foliar sprayed of SA @ 150 ppm can be used to improve the growth characteristics of mustard. Foliar sprayed of potassium nitrate @ 400 ppm can be used as a potential tool to enhance yield of mungbean. Present finding needs further validation.

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