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# Effect of seed priming by potassium nitrate on nodulation of common bean (*Phaseolus vulgaris* L)

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**ABSTRACT:** Legumes are an important food source brimful of protein in human and animal nutrition. Common bean (*Phaseolus vulgaris* L.) is one of the most important legume plant families includes important effect in human nutrition. This research was conducted for study of effects of seed priming by potassium nitrate on nodulation ability of common bean plants in the green house of agricultural research at Islamic Azad University Saveh branch in 2013. This experiment was done in a factorial complete randomize blocked design, with one treatment and four replications the prepared seeds of common bean were treated with different levels of potassium nitrate include zero as control, 0.25 and 0.35 moles per liter. Common bean seeds were primed for 10 hours in specified density and then were transferred to pots for planting. Base on the results of this experiment we found that use of potassium nitrate at rate of 0.35 moles per liter causes increasing the fixed number of root nodules nitrogen in bean plant seeds. According to the position of legumes in human diet and importance of nitrogen fixing the use of potassium nitrate as seed priming implies the seed yield improvement and yield parts in bean plant.

***Keywords*:** seed priming, nodulation, common bean, potassium nitrate

## INTRODUCTION

Legumes are an important food source of protein for human and domestic nutrition. Human nutrition is about 22% vegetable protein, 32% fat and 7% carbohydrates that provides from legumes. On the other hand, in animals feed there are 38% vegetables protein 16% fat and 5% carbohydrates which come from this source. Legume seeds have 18-32% protein with respect to animal proteins but it is a quiet important nutrition source for human specially for the low incoming people is called (poor people meat) legumes have another characteristics effects the world agricultural ecosystems in alternating with other plants and stabilizes the atmosphere nitrogen in living with bacteria that provides the main nitrogen necessity of the agricultural plant which are the main part of plants nitrogen prepared for themselves. Every year after the harvest with decay of the roots a lot of nitrogen is added to soil and causes fertilization of soil especially in the regions with low agricultural efficiency. Long roots legumes are able to reach the main source of soil wetness with respect to the other plants. This is done with biological plowing and has ability to reach valuable soil wetness with respect to other agricultural plants. One of positive and effective reason for chemical stimuli such as potassium nitrate on the germination of seeds probably due to hormonal balance and reduce the proportion of growth inhibiting substances such abscisic acid (ABA) the research (Demir and Van de venter - 1999) reported that possibility the potassium nitrate avoids the stimulus accumulation of toxic ions in fetus.

Some researchers reported that potassium nitrate acts as a stimulus to absorb oxygen (Hilton and Thomas, 1986) and also acts as a phytochrome co-factor (Hilhorst, 1990). Mohammadi, (2009) also in their research expressed that potassium nitrate have a positive effect on increasing the germination rate. Moreover, treated plants were stronger than the other plants which the seed strength indicator and also the plants weight were higher than

the other plants. Shoot and root length were effected meaningfully under main effect of priming reciprocal and drought tension. A research (Eddalatpishe,2009) has done on grain plant shows the positive effect of potassium nitrate on characteristics percentage of germination rate, reduction of the abnormal herb and roots length and effected on weight of drought and wet herbs were positive. In some levels of the potassium nitrate is recommended by (ISTA) for germination stimulation and in most of researches have been used (between 1 to 2 percent) and using from higher density has caused the germination reduction (Mahmud zadeh and Bagheri, 2005).

## MATERIALS AND METHODS

The purpose of this study includes considering the effect of seed preparation by potassium nitrate on nodulation ability of common bean plant that was done in greenhouse of agricultural research at Islamic Azad University of Saveh in 2013. This experiment was done in a factorial complete randomize blocked design, with one treatment and four replications the prepared seeds of common bean were treated with different levels of potassium nitrate include zero as control, 0.25 and 0.35 moles per liter. To prepare the seeds were built solution according to the treatments and density. Then, numbers of required seeds were put in the priming solutions within 10 hours then they were removed and transferred to pots. Distilled water was used as a control treatment. During the three sampling specified periods (30, 50 and 70 days). Number of nodes on the root was measured.

## RESULTS AND DISCUSSION

Based on the results of this research, the use of potassium nitrate in preparation of bean seeds has caused the increasing the yield and yield component of the product. In study (2002) Kaur et al expressed that the primed chickpea is a factor that increases the number of branches and leaves. In their research mentioned that enzyme activity of in verities acid at the end of the branch is the reason of increasing the number of branches and the main stems. Also many studies about the effect of physiological and biochemical primes on different kinds of legumes including alfalfa seeds black eye beans peas and lentil has been done and shows that priming treatment can improve the germination process resistance under the tension condition. (Hu, 2006 - Posmyk and Janas 2007 – Ghasemigolzani, 2008).

In addition, a research was done (Kaur, 2006) for priming effects on the growth improvement and plant germination which increases their resistance to environmental tension. The positive effect of this treatment on nodes and nitrogen fixing rate of pea root nodes have been proved. Increase of biomass and number of nodes in the pea seeds hydro and osmoic-priming was reported. Based on this experiment results(khodabakhsh,2010) pea priming by mannitol in rate of 4% causes increase of germination wet and dry weight, production of more branches and increasing number of root nodes of the plant. Based on another study (Pakmehr, 2010) it was found that priming seeds of black eye bean plants with salicylic acid causes the increase of pod length , pod numbers , and number of seeds, the weight of 100 seeds in pods of main and sub branches, biomass, seed yield and harvest specification. Based on (Maingopa, 2007) number of pods, number of sub branches and seed numbers under pea priming treatment increased from 6 to 12%. One reason for the positive effect of chemical stimulate such as potassium nitrate on seed germination is possibly due to hormone balance in seeds and reduction of inhibiting growth of substances like absicic acid (ABA) ( Ghasemipirbaluti, 2007). In a research (Demir and Van de venter, 1999) reported that probably potassium nitrate inhibits the toxic ions accumulation in the fetus. Some researchers reported that potassium nitrate is a stimulus for oxygen uptake (Hilton and Thomas, 1986) and also in their research declared that possibility there is a change of seed plant stimulus on the pea plant and stated that potassium nitrate has a positive effect on increasing the speed of germination. Moreover, the treated seedlings were stronger than the other seedlings so that the indicator rate ability of seeds and also the seedling weight was higher than the other seeds. The seedling and root lengths were under effectiveness of the effects and reciprocal priming and drought (Tensionharris, 2007) and Almudaris and Jutzi (1999). Use of potassium nitrate and zinc sulphate as two priming materials in soil causes the increase of zinc element nutrition and nitrogen in soil. According to our research, applying potassium nitrate in density 0.25 and 0.35 moles per liter causes growth number of nudes.

### *Number of nodes 30 days after planting*

The table analysis variance of nodes 30 day after planting shows the effect of potassium nitrate in significant at 1% level. The average comparison shows the number of nodes 30 days after planting (the effect of potassium

nitrate) that the number of nodes increases as we increase the potassium nitrate at a rate of 15.2 to 0.35 moles per liter of potassium nitrate and the minimum number of nodes was controlled at a rate of 8.67.

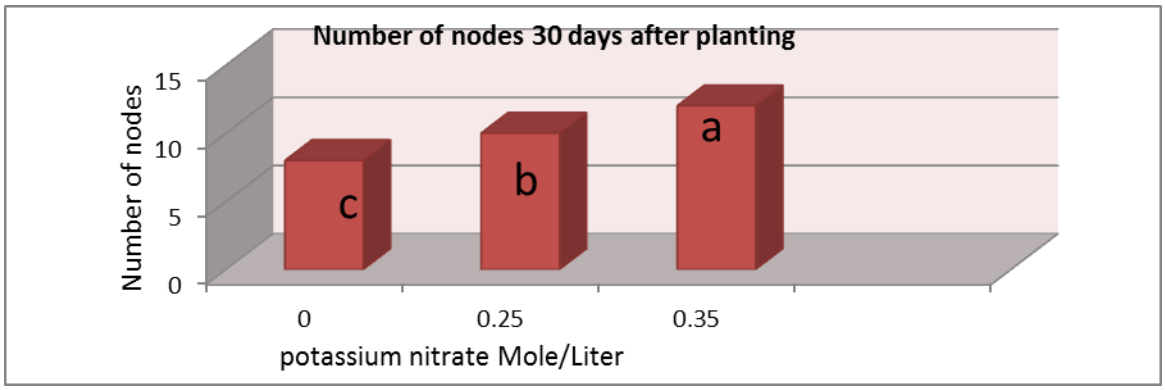


Figure1 shows effect of potassium nitrate on bean nodes 30 days after planting.

***Number of nodes 50 day after planting***

Table 1 shows the effect of potassium nitrate is significant at 1% level. The average comparison shows the number of nodes 50 days after planting (effect of potassium nitrate) that the number of nodes increases as we increase the potassium nitrate at rate of 15.53 to 0.35 moles per liter potassium nitrate and the lowest number of nodes was 14.17.

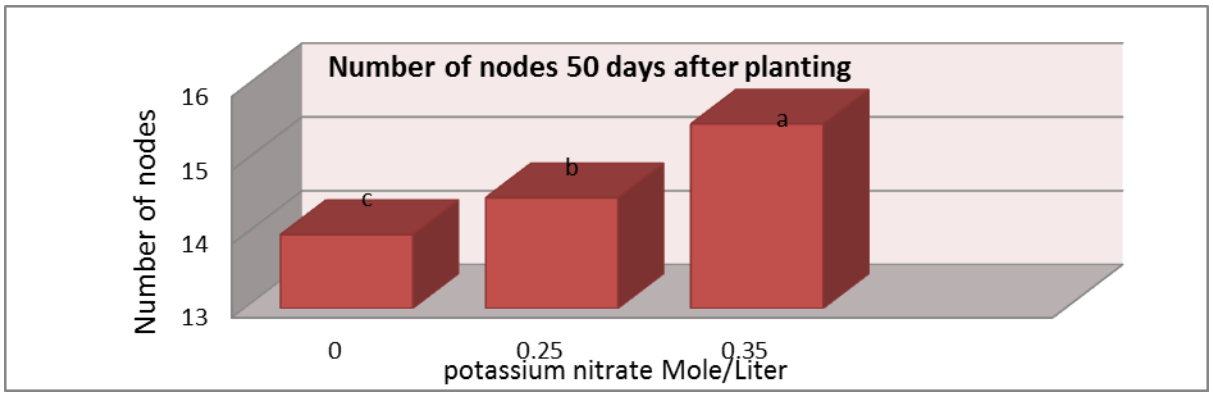


Figure 2 shows effect of potassium nitrate so days after planting

***Number of nodes 70 day after planting***

Table analysis variance of the nodes 70 days after planting shows the effect of potassium nitrate is significant at 1% level. The average comparison (graph 3) shows the number of nodes 70 days after planting (effect of potassium nitrate) that the number of nodes increases as we increase the potassium nitrate the number of nodes increases as we increase the potassium nitrate at rate of 0.35 to 13.67 mole per liter potassium nitrate and minimum nodes was at rate of 10.42.

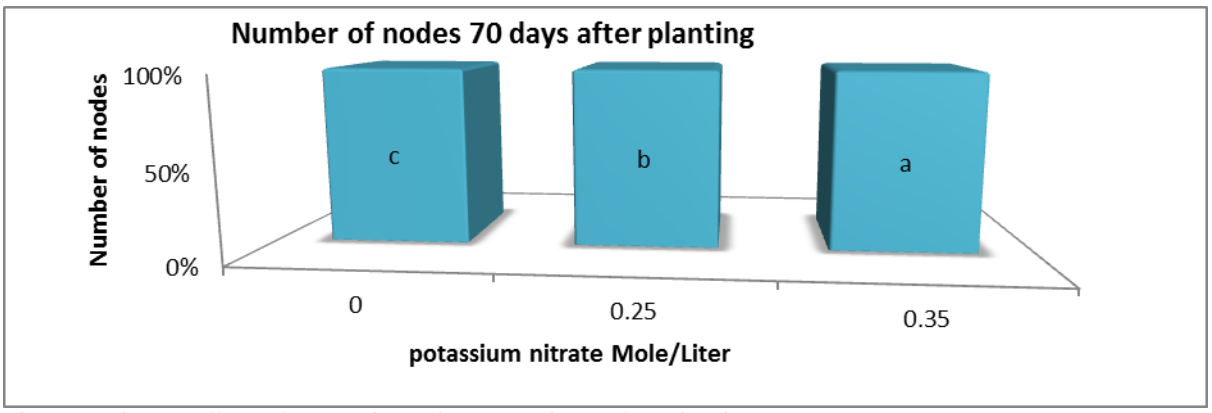


Figure 3 shows effect of potassium nitrate 70 days after planting

***Number of nodes 90 days after planting***

The table of analysis variance of node numbers 90 days after planting table 2 shows the effect of potassium nitrate in significant at 1% level. The average comparison shows the number of nods 90 days after planting (the effect of potassium nitrate) Figure 4 shows that the number of nods increases as we increase the potassium nitrate at rate of 0.35 to 9.58 moles per liter minimum number of nods at a rate of 6.58.

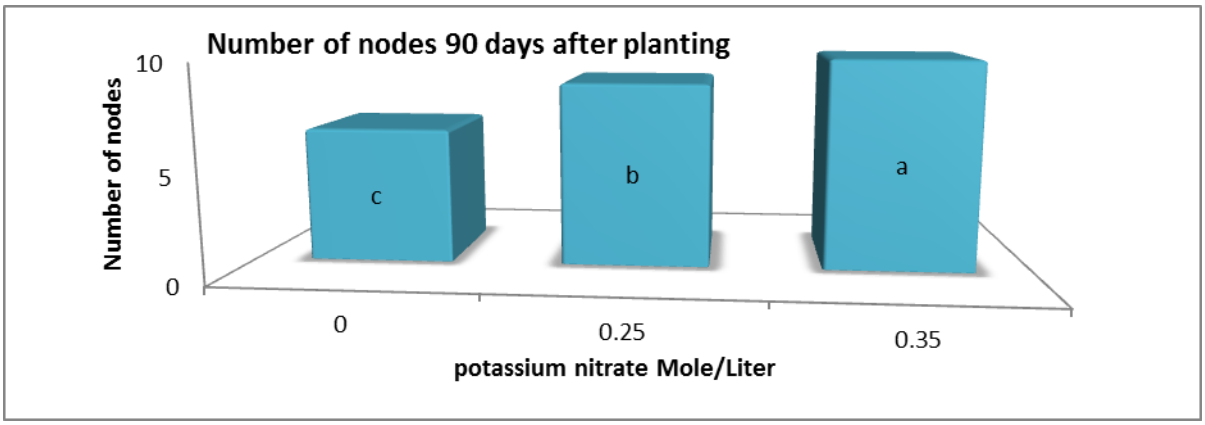


Figure 4 shows effect of potassium nitrate on been nodes 90 days after planting

Table 1. Indicates analysis variance of effect of potassium nitrate on number of nodes

| Number of nodes | | | | f | Variance source |
|---|---|---|---|---|---|
| 90 days | 70 days | 50 days | 30 days | | |
| 3.3 | 21.8 | 51.8 | 1.7 | 3 | Block |
| 27.25 | 23.2 | 8.5 | 24.33 | 3 | Potassium nitrate |
| 0.26 | 0.8 | 0.41 | 0.17 | 24 | Error |
| 6 | 4.8 | 4.27 | 4 | | CV % |

Table 2. The effect of different levels of potassium nitrate on number of nodes

| Number of nodes | | | | Potassium nitrate mole per liter |
|---|---|---|---|---|
| 90 days | 70 days | 50 days | 30 days | |
| 6.58 | 10.42 | 14.17 | 8.67 | 0 |
| 8.33 | 12.42 | 14.75 | 10.33 | 0.25 |
| 9.58 | 13.67 | 15.5 | 11.5 | 0.35 |

Similar letters in each column are not statistically significant

## REFERENCES

Al-Mudaris MA and Jutzi SC. 1999. The influence of fertilizer-based seed priming treatments on emergence and seedling growth of Sorghum bicolor and Pennisetum glaucum in pot trials under greenhouse conditions. Journal of Agronomy and Crop Science. 182:135-141.

Ansari SA, Samiullah N and Afridi MMRK. 1990. Enhancement of leaf nitrogen phosphorus and potassium and seed protein in Vigna radiata by pyridoxine. Plant and Soil (The Netherlands) 125: 296- 298.
Arrigoni O, Calabrese G, De Gara L, Bitonti MB and Liso R. 1997.Correlation between changes in cell ascorbate and growth of Lupinus albus seedlings. Journal of Plant Physiology, 150: 302-308.
Asghari M, Eradtmand Asli D, Yosefi Rad M and Ghandian Zanjan M. 2013. The effect of pyridoxine and its duration application on bioactive compounds and biochemical activities of germinated wheat. Annals of Biological Research, 4 (3): 31-36.
Ayub MA, Tanveer K, Mahhmud A, Liand M and Azam M. 1999. Effects of nitrojen and phosphorus on fodder yield and quality of two sorghum cultivars. Pak. J. Biol. Sci. 2:247-252.
Badanova KA and Tomakin NA. 1976. The possibility of mechanizing for process of resowing drought hardening in cereals. Sel,skokhozyaistvennaya Biologiya. 11:31-33.
Berland BR, Bonin DJ and Maestrini SY. 1978. Facteurs limitant la production primaire d'une aire côtière méditerranéenne (calanque d'En-Vau, Marseille). Int. Revues. Ges. Hydrobiol., 63 (4): 501-531.
Bewley JD. 1997. Seed Germination and Dormancy. Plant Cell, 9, 1055-1066.
Black M and Bewley DJ. 2000. Seed Technoloy and Its Biological Basis. CRC Press LLC. Bressani, R. and Elfas, L. G. 1979. Improvement of the nutritional quality of food legumes. Food Nutrition Bull. UNU 1(4):23-34.
Farrokhi GhR and Paykarestan B . 2010 . The effect of Pyridoxine and different levels of Nitrogen on physiological indices of Corn (Zea mays L . var . sc 704 ). World Academy of Science , Engineering and Technology 66 , 511 – 513.
Gallardo K, Job C, Groot SP, Puype M, Demol H, Vandekerckhove J and Job D. 2001. Proteomic analysis of Aarabidopsis seed germination and priming. Plant Physiology, 126, 835-848.
Ghassemi-Golezani K, Aliloo AA, Valizadeh M and Moghaddam M. 2008. Effects of hydro and osmo-priming on seed germination and field mergence of Lentil (Lens culinaris Medik.). Journal of Agronomy and Plant Breeding 36: 29-33.
Guillard RRL and Ryther JH. 1962. Studies of marine planktonic diatoms. I. Cyclotella nana Hustedt and Detonula confervacea Cleve. Can. J. Microbiol.8: 229-239.
Hamada AM and Khulaef EM. 2000. Stimulative Effects of Ascorbic Acid, Thiamin or Pyridoxine on Vicia faba Growth and Some Related Metabolic Activities . Pakistan Journal of Biological Sciences, 3: 1330-1332.
Harris D, Joshi A, Khan PA, Gothkar P and Sodhi PS. 1999. On-farm seed priming in semi-arid agriculture: development and evaluation in Maize, Rice and Chickpea in Indian using participatory methods. Exp. Agric. 35: 15-29.
Harris D, Rashid A, Miraj G, Arif M and Shah H. 2007. Priming seeds with zinc sulfate solution increases yields of maize (Zea mais L.) on zinc deficient soils. Field Crops Research. 102:119-127.
Hasegawa PM, Versan RA, Zhu JK and Bonhert HJ. 2000. Plant cellular and molecular responses to high salinity. Ann. Rev. Plant Physiol. and Plant Mol. Biol., 51: 463-499.
Hashimoto T. 1958. Increase in percentage of gibberellin-induced dark germination of tobacco seeds by N-eompounds. Botanical Magazine (Tokyo) 71: 430-431.
Hickey M and King C. 1997. Common families of flowering plants. Cambridge: Cambridge University Press.
Hilhorst HWM. 1990. Dose-reponse analysis of factors involed in germination and secondary dormancy of seeds of sisymbrium officinale.11.Nitrate. Plant physiology 94: 1096-1102.
Hilton JR and Thomas JA. 1986. Regulation of pregerminative rates of repiration in seeds of various seed species by potassium nitrate. Jornal of experimental botany 37: 1516-1524.
Hilton JR. 1984. The influence of light and potassium nitrate on the dormancy and germination of Avena fatua L. seed and its ecological significance. New Phytology 96: 31-34.