Indian Journal of Agriculture and Allied Sciences
A Refereed Research Journal

ISSN 2395-1109
e-ISSN 2455-9709
Volume: 2, No.: 4, Year: 2016

www.mrfsw.org

Received: 08.07.2016, Accepted: 09.09.2016

PRODUCTIVITY ENHANCEMENT OF MOONG BEAN (*Vigna radiata* L.) BY APPLICATION OF THIOUREA UNDER SUMMER CONDITION

I.M.Khan[1], S.M. Kurumvanshi[2] and O.P.Dhurve[1]

[1]Department of Plant Physiology and [2]Agronomy, JNKVV, College of Agriculture, Rewa (M.P.), E-mail: imkagc@gmail.com, Corresponding Author: I.M. Khan

Abstract: *A field study was conducted at JNKVV, Kuthulia farm College of Agriculture, Rewa (M.P.), India during summer season, 2015 to assess the productivity of moong bean as influenced by the foliar application of thiourea. The moong variety TJM-3 was sown in randomized complete block design with three replications. Foliar spray of three levels of thiourea (0.25, 0.50 and 1.0 g^{-1} litre) were applied on crop foliage in two combination ie; at 15 and 30 days after sowing (DAS) and at 15, 30 and 45DAS comprising seven treatments including one control The results revealed that there was significant increase in all phenological parameters, growth and yield attributing charactersunder different concentration of thiourea treatments and foliar spray combination. Treatment T4 (0.50 g/litre foliar spray at 15, 30 and 45 DAS) exhibited superiority in all phenological parameters. Chlorophyll content and pod length, number of pods/plants, number of seeds /pod, 100 seed weight and seed yield increased significantly in comparison to control. Seed yield was increased from 8.17 to 38.71% over control in different treatments of thiourea. Maximum increase of 38.17% was associated with the treatment T4. Foliar application of 0.50 g/ litre at 15, 30 and 45 DAS treatment was found the best concentration and foliar spray schedule combination for summer moong.*

Keywords: *Moong bean, Thiourea, chlorophyll content, foliar spray, growth, Seed yield.*

Introduction: Moong bean (*Vigna radiata* L.) is one of the popular and ancient crop is specially recognized as an excellent source of protein. The calorific value of green gram is 334 calories per 100g and its chemical composition is as follows: crude protein 24.0 %, Fat 1.3%, Carbohydrate 56.6%, Minerals 3.5%, Lysine 0.43%, Methionine 0.10%, Calcium 124 mg, phosphorous 3.26 mg and iron 7.3 mg [14]. 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. Nodules on the root of green gram having Rhizobium bacteria, fix about 35 kg ha-1 atmospheric nitrogen. In dry and semi-arid regions plants suffer from nitrogen deficiency due to lack of organic matter. In these soils though atmospheric nitrogen (N) is about 79 % but plants are unable to utilize N as it is. Organic matter contains more than 95 % (immobilized) of the total soil nitrogen that gets converted into ammonium ($NH4^+$) by soil microorganisms. NH_4^-N is then converted into nitrate ($NO3^-$) by the process of nitrification. But being negatively charged, nitrate ($NO3^-$) leaches down easily. Urea is used as a source of nitrogen which readily loss nitrogen through its hydrolysis into CO_2 and NH_3 gases by the action of urease enzyme in the soil besides of percolation/leaching, volatilization of ammonia, and nitrification. Furthermore in soil, the concentration of urea depends upon soil pH, moisture content, temperature, organic matter, and season of the year [1]. According to an estimate, an average cultivated land loss about 22 kg nitrogen per hectare annually [2]. Therefore, there is need to minimize the nitrogen losses from the soil by the use some slow release fertilizers. Coated urea has been reported to be more effective in reducing environmental pollution and increasing crop yield [3]. Sulfur-containing compounds/ metabolites can be used as fertilizers to reverse the effects of abiotic stresses in agricultural crops [4]. Foliar application is an alternative approach to reduce the risk of nitrogen loss by urease activity in soil

medium. Thiourea (TU) plays a bio-regulatory role in improving growth and yield under abiotic stresses, such as salinity, heat, drought, and H_2O_2-induced oxidative stress [5-8]. TU is water-soluble and can be readily absorbed in living tissues and regulate diverse biological activities [9-10]. It increases fresh and dry biomass, leaf area and yield, total chlorophyll contents, starch, reducing sugars, soluble proteins, and nutrients uptake in many crops [11, 12, 7]. Summer moong bean (*Vigna radiata* L.) is an important short-duration legume crop but high temperature stress adversely affects growth and physio-chemical characters that lead to considerable (50 %) yield loss [13-15]. As a leguminous crop it requires less amount of nitrogen fertilizer and very well used in crop rotation and in cropping system because it maintains the soil fertility [16].

Therefore, in view of nutritional and economic importance of summer moong bean and regulatory role of thiourea, this study was conducted with the main objectives to find out the productivity enhancement through foliar application of thiourea on moong bean plants.

Methods and Materials

A field experiment was conducted during summer season of 2015 at JNKVV, Kuthulia farm College of Agriculture, Rewa (M.P.) to evaluate the effect of foliar application of thiourea on moong bean. Seeds of moong variety TJM-3 was sown in randomized block design with three replications. Plot size of each treatments was 5.0x4.0 m sq with spacing of 30x10 cm. Soil of experiment was silty clay loam with neutral in reaction (pH 7.1), low in available nitrogen (235 kg/ha) and phosphorus (9.6 kg/ha) and high in available potash (461 kg/ha) (Anon2012). Nitrogen and phosphorus Potash fertilizers were applied as basal at the rate of 20:40:20 Kg/ha. Foliar treatment of three levels of thiourea (TU) (0.25, 0.50 and 1.0 g^{-1} litre) was applied on crop foliage. Each dose of treatment was foliar sprayed in two combination ie; at 15 and 30 days after sowing and at 15, 30 and 45 days after sowing (DAS) comprising seven treatments including one control. Data for different phonological and yield attributes were collected during flowering and maturity stages and Chlorophyll content was measured by opti-science chlorophyll meter, USA, which is a portable diagnostic tool that measured greenness or relative chlorophyll content of leaves of summer moong bean crop. The collected data were statistically analyzed using Fishers' analysis of variance (ANOVA) technique and the treatments were compared at 5% level of significance.

Weather condition of crop growing period during Summer 2015.

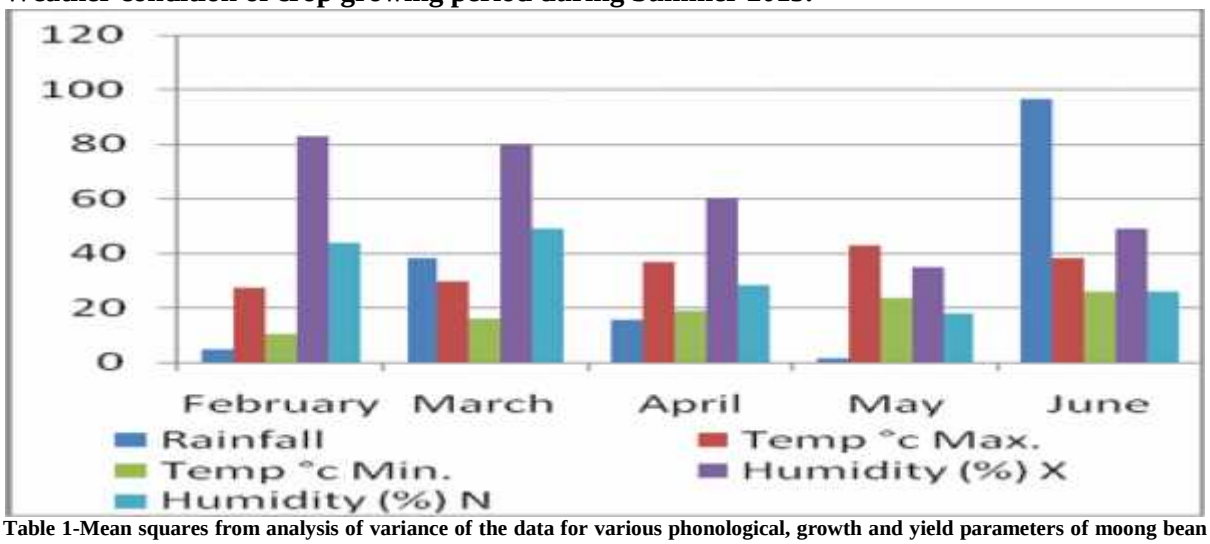

Table 1-Mean squares from analysis of variance of the data for various phonological, growth and yield parameters of moong bean plants foliarly sprayed with thiourea under summer conditions.

S.N.	Source of variation	DF (T)	MSS	DF (Error)	Error-MSS	Coefficient of Variation
1	Days to bud initiation	6	10.129***	12	2.034	3.563
2	Days to flowering	6	5.268***	12	0.860	2.097
3	Days to pod initiation	6	7.203**	12	0.842	1.957
4	Chlorophyll content index	6	6.826***	12	0.702	9.533
5	Number of pods/plant	6	12.981**	12	4.296	10.984
6	Number of seeds/pod	6	3.970**	12	1.284	12.790
7	Length of pods	6	0.473**	12	0.146	6.076
8	100 Seed weight	6	0.661**	12	0.164	7.133
9	Seed yield (kg/ha)	6	145248.41**	12	3191.86	13.439

Results and Discussion

Phenology of Control and TU Treated Plants: Days to floral bud imitation, days to 50% flowering and days to pod imitation was recorded treatments of thiourea foliar spray. However, treatment T3 (0.5 g/litre at 15 and 30 DAS) and T5 (1.0 g/litre at 15 and 30 DAS) were at par. Similarly treatment T2, T1 and T6 were also found at par with each other but superior to control.

Chlorophyll Content Index (CCI) of TU Treated Plants: The chlorophyll content index was measured during flowering stage of crop growth indicated that foliar TU regulated the leaves CCI in summer moong bean. Significantly superior CCI was noted in treatment T6 (fig. 1B) while, T5, T4 and T3 were at par may be due to increase dose of TU from 0.50 to 1.0 g/litre improving the photosynthetic pigmentation. TU is an effective growth regulator that maintains membrane integrity and functioning of cellular organelles [9].

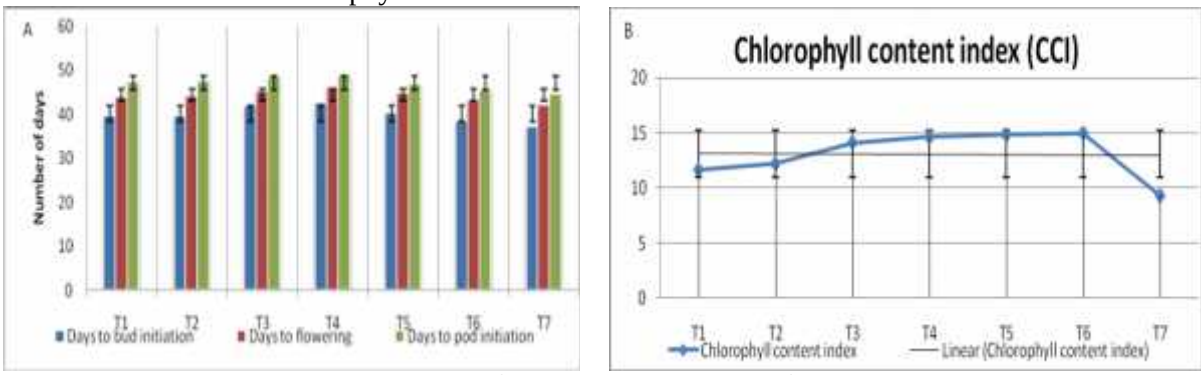

Figure 1. Phenology (A) and chlorophyll content (B) of Moong bean cv TJM-3 plants foliarly sprayed with thiourea during summer condition.

Yield and its Attributing Characters in Control and Treated Plants: Number of pods / plant varied significantly among the different TU treatments. Foliar spray of 0.5 g/litre at 15, 30 and 45 DAS (T4) exhibited superiority over all other treatments (fig. 2A) while, treatment T5, T3 and T6 were found at par indicating that number of pods are genetically controlled character but TU has a potential for improving growth [6]. Similarly the length of pods and number of grains / pod was also differed significantly among the treatments and highly significant superior values was associated with treatment T4 (0.5 g/litre TU foliar spray at 15, 30 and 45 DAS) while, treatments T3 followed by T5 was at par. Similar positive response of foliar application of Thiourea was observed on Faba bean [17]. Effect of different concentration treatments of thiourea was found significant on 100 seed weight of summer moong bean cv TJM-3. Foliar application of 0.5 g/litre at 15, 30 and 45 DAS exhibited superiority over all other treatments followed by T3 and T5 treatments.

In this study, foliar spray of different thiourea concentrations at different DAS significantly increased all yield attributing parameters indicating positive response may be due to increased level of chlorophyll contents results an increased photosynthetic efficiency and assimilate partitioning. Seed yield was varied significantly among different levels of thiourea treatments (fig. 2B). Application of TU @ 0.50 g/litre at 15, 30 and 45 DAS exhibited superiority over all other treatments (1610 kg/ha). Higher seed yield was associated with T4 may be due to higher length of pods / plant, number of pods / plant, number of seeds / pod and 100 seed weight. Enhance level of chlorophyll content maintain integrity of membranes, stabilizes enzymes/ proteins complexes and prevents protein loss at higher temperature. TU induced to increase in growth and yield of moong bean plants during summer could also be attributed to its stimulation of enzymatic, osmoregulation protection of photosynthetic pigments during summer season [18]. Seed yield was increased from 8.17 to 38.71% in different treatments of thiourea over control. Maximum increase of 38.17% was associated with the treatment T4 followed by T3 (32.95%) and T5 (26.0%). Treatment T1 and T6 was also exhibited 16.26 and 8.17 % increase over control.

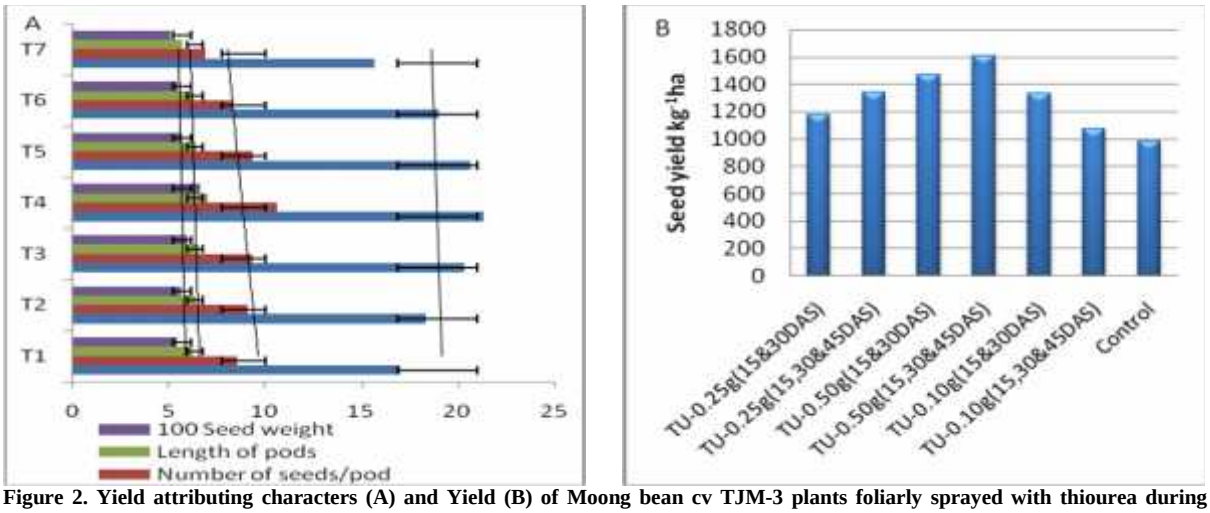

Figure 2. Yield attributing characters (A) and Yield (B) of Moong bean cv TJM-3 plants foliarly sprayed with thiourea during summer condition.

Conclusion: The foliar application of thiourea at 0.50 g/litre foliar spray at 15, 30 and 45 DAS increased chlorophyll content, number of pods / plants, length of pods, number of seeds / pod, 100 seed weight and seed yield Therefore this application was found appropriate to enhance productivity of moong bean.

References

1. Divya, J., Belagali, S.L. (2015). A study on seasonal variations of physico-chemical characteristics of soil samples with chemical fertilizer residues under different cropping patterns. *Int J Appl Pure Sci Agric*, 01: e-ISSN: 2394-5532, p-ISSN: 2394-823X
2. IFDC (International Fertilizer Development Corporation). (2003). Input subsidies and agricultural development: Issues and options for developing and transitional economies. IFDC Paper Series No. 29. Muscles Shoals, Alabama.
3. Ning, T.Y., Shao, G.Q., Li, Z.J., Han, H.F., Hu, H.G., Wang, Y., Tian, S.Z., Chi, S.Y. (2012). Effects of urea types and irrigation on crop uptake, soil residual, and loss of nitrogen in maize field on the North China Plain. *Plant Soil Environ*, 58:1–8.
4. Khan, M.I., Asgher, M., Khan, N.A. (2014b). Alleviation of salt-induced photosynthesis and growth inhibition by salicylic acid involves glycinebetaine and ethylene in mungbean (Vigna radiata L.). *Plant Physiol Biochem*, 80:67–74
5. Garg, B.K., Burman, U., Kathju, S. (2006). Influence of thiourea on photosynthesis, nitrogen metabolism and yield of cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) under rain fed conditions of Indian arid zone. *Plant Growth Regul*, 48:237–245.
6. Asthir, B., Thapar, R., Farooq, M., Bains, N.S. (2013). Exogenous application of thiourea improves the performance of late sown wheat by inducing terminal heat resistance. *Int J Agric Biol.*, 15:1337–1342.
7. Kaya, C., Sonmez, O., Aydemir, S., Ashraf, M., Dikilitas, M. (2013). Exogenous application of mannitol and thiourea regulates plant growth and oxidative stress responses in salt-stressed maize (*Zea mays* L.). *J Plant Interact*, 8:234–241.
8. Shanu, I.S., Naruka, P.P., Singh, R.P.S., Shaktawat Verma, K.S. (2013). Effect of seed treatment and foliar spray of thiourea on growth, yield and quality of coriander (*Coriandrum sativum* L.) under different irrigation levels. *Int J Seed Spices*, 3:20–25
9. Shivastava, A.K., Ramaswamy, N.K., Mukopadhyaya, R., Chiramal Jincy, M.G., D'Souza, S.F. (2009). Thiourea modulates the expression and activity profile of mt ATPase under salinity stress in seeds of *Brassica juncea. Ann Bot* 103:403–410.
10. Sahu, S., Sahoo, P.R., Patel, S., Mishra, B.K. (2011). Oxidation of thiourea and substituted thioureas: a review. *J Sulfur Chem*, 32:171–197.
11. Mathur, N., Sachendra, J.S., Bohar, B.A., Vyas, A. (2006). Improved productivity of mung bean by application of thiourea under arid condition. *World J Agric Sci*, 2:185–187.
12. Jagetiya, B.L., Kaur, M.J. (2006). Role of thiourea in improving productivity of soybean. *Int J Plant Sci*, 1:308–310.
13. Singh, H., Malik, B.P., Sharma, H.C. (1989). Relative performance of mungbean (*Vigna radiata* L.Wilczek) cultivars under varying levels of soil salinity. *Haryana J Agron*, 5:171–173.
14. Kumar, S.B., Prakash, M., Gokulakrishnan, J. (2011). Genetic role of biochemical, biophysical and morpho-physiological characters in enhancing the seed yield in mungbean (*Vigna radiat*a (L.) Wilczek). *Global J Plant Ecophysiol*, 1:14–25.
15. Ashraf, M.A., Rasool, M., Ali, Q., Haider, M.Z., Noman, A., Azeem, M. (2013). Salt-induced perturbation in growth, physiological attributes, activities of antioxidant enzymes and organic solutes in mungbean (*Vigna radiata* L.) cultivars

differing in salinity tolerance. *Arch Agron Soil Sci*, 59:1695–1712.
16. Roychoudhury, A., Ghosh, S. (2013). Physiological and biochemical responses of mungbean (Vignaradiate L. Wilczek) to varying concentrations of cadmium chloride or sodium chloride. *Unique J Pharm Biol Sci*, 01:11–21.
17. Amin, A.A., Abouziena, H.F., Abdelhamid, M.T., El-ShM Rashad, Fatma Gharib, A.E. (2014). Improving growth and productivity of fababean plants by foliar application of thiourea and aspartic acid. *Int J Plant Soil Sci* 3:724–736.
18. Kanwal, S., Ashraf, M., Shahbaz, M., Iqbal, M.Y. (2013). Influence of saline stress on growth, gas exchange, mineral nutrients and nonenzymatic antioxidants in mungbean [(Vigna radiata (L.) Wilczek]. *Pak J Bot*, 45:763–771.