Annals of Plant and Soil Research 22(2): 216- 217 (2020)
Short Communication

Influence of herbal extracts and plant growth regulators on phosphorus metabolism of soybean (Glycine max L.) under waterlogged conditions

R.P. KHAMKAR AND D. K. GAIKWAD

Department of Botany, Shivaji University, Kolhapur (M.S.) India

Phosphorus is a component of biological energy currency ATP and basic essential constituent of phospholipid and ATP. Organic form of P is found more in meristematic tissue than in storage tissue (Marschner, 1986). Acid phosphatase plays an important role hydrolysis and occurred in lysosome which is ruptured when plants are exposed to stress conditions and induces level of the enzyme activity. The acid phosphatase plays an important role in hydrolysis of organic phosphates in acidic conditions. Acid phosphates activity is often associated with phosphorous deficiency symptoms in the plant leaves (McLachlan *et al.*, 1987). Soybean is an important oil yielding, protein rich crop. In the present investigation alterations in the phosphorus metabolism due to foliar application of herbal extracts and PGRs under water logging stress condition have been studied to evaluate waterlogging stress tolerance in soybean. The present study was conducted in the greenhouse at Shivaji University, Kolhapur. Seeds of soybean (Variety JS-335) were sown in the twelve pots with two replications (first 6 with normal irrigation and other 6 with waterlogging stress). The earthen pots were filled with farmyard manure in the proportion of 3:1. Pots were watered twice a week and every care was taken to raise healthy and vigorously growing seedlings in each pot. Twenty days old seedlings were sprayed with respective herbal extracts and plant growthregulators such as UltraSil (0.3%), UltraK (0.2%), GABA (10 ppm), Putrescine (10 ppm) and Biotonic (100ppm) formulation. [Biotonic formulation is a compound mixture of amino acids (cysteine, methionine, lysine, valine and GABA), vitamins (Riboflavin B2 and Nicotinic acid B3), Saccharides (Myo-inositol), cytokinin (6BA) and protein (albumin). The influence of foliar application of Ultrasil, UltraK, GABA, Putrescine and Biotonic on phosphorous metabolism of soybean were studied separately for unstress and stressed pots. The activity of acid phosphatase was assayed according to the method of McLachlan, (1987).

The phosphorus content was reduced in leaf tissue and increased in root tissue under waterlogging stress as compared to unstressed plants. On the other hand it was significantly increased in response to foliar applications of herbal extracts and PGRs under waterlogging conditions.(Fig.1). Hanafy *et al.* (2010) reported that exogenous Putrescine application induces P concentration in snap bean leaves.

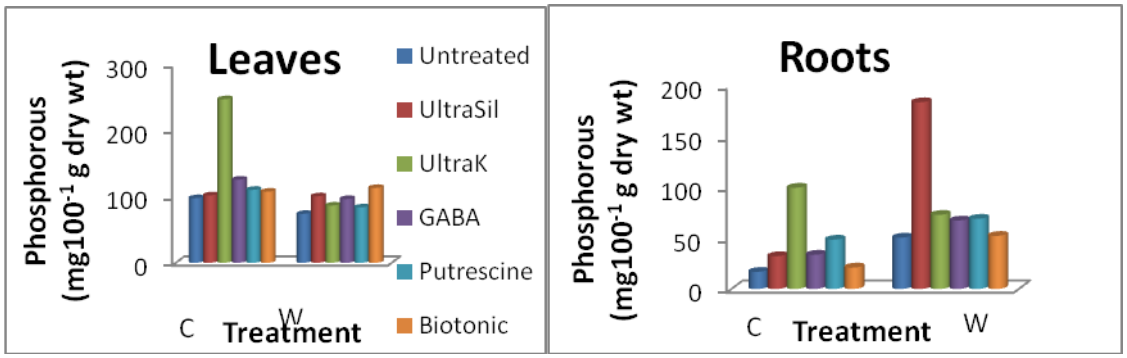

Figure: 1: Effect of foliar sprays of herbal extracts and growth regulators on P content in soybean

The activity of enzyme acid phosphatase was slightly decreased in leaf tissue and increased in root tissue under waterlogged conditions as compared to unstressed control plants. While in waterlogged plants sprayed with herbal extracts and PGRs, the activity of enzyme acid phosphatase was elevated as compare to control. (Fig.2) Zhen *et al.* (2010) noticed that

Corresponding author: Dr. Reshma Khamkar. ritu4pranav@gmail.com
Email: ritu4pranav@gmail.com; dkg_botany@unishivaji.ac.in

acid phosphatase activity gradually increased during waterlogging. Sharma *et al.* (2005) observed that under waterlogging stress acid phosphatase activity increased in *Sorghum* seedlings.

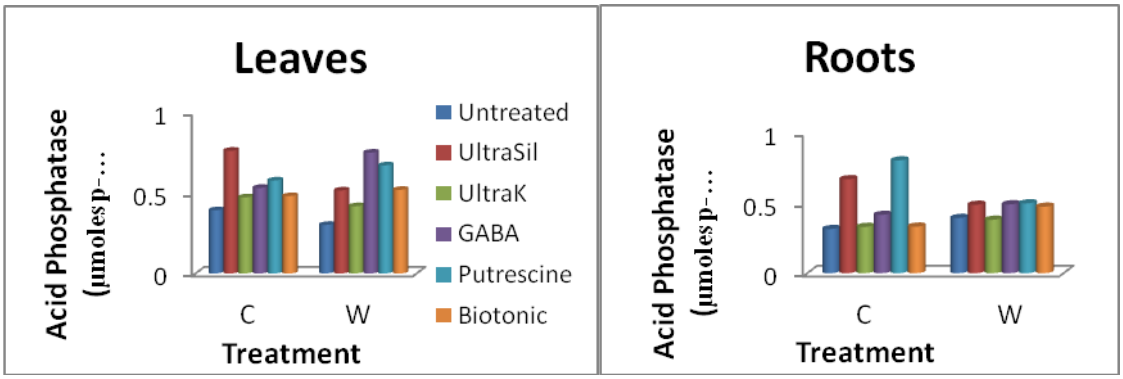

Fig.: 2: Effect of foliar sprays of herbal extracts and growth regulators on the activity of enzyme acid phosphatase in soybean

The P nutrition of leaf was significantly lowered under waterlogged conditions and maintained in root tissue. The elevation in P content of root tissue might be helpful for the development of energy balance in waterlogged root tissue and for the maintenance of plants under waterlogging stress. The activity of enzyme acid phosphatase was slightly altered in leaf tissue and significantly induced in root tissue. This might be helpful for the hydrolysis of cell components and maintenance of phosphorus metabolism under waterlogged conditions. The adaptation to all abiotic and biotic stresses involves metabolic adjustment that leads to the modulation of different enzymes. Increased levels of enzyme ACP due to foliar application of herbal extracts and PGRs might be helpful to cope with adverse effect of waterlogging stress of soybean. From the results, it may be concluded that phosphorus nutrition was significantly reduced in waterlogged leaf tissue and maintained in root tissue. Acid phosphate activity was elevated in unstressed and waterlogged root and leaf tissues.

REFERENCES

Hanafy Ahmed, A. H.; Nesiem, M. R.; Hewedy, A. M. and Sallam, H. E-S.(2010) Effect of some simulative compounds on growth, yield and chemical composition of snap bean plants grown under calcareous soil conditions .*Journal of American Science* **6**(10): 552-569.

Marschner, H. (1986). *Mineral Nutrition of Higher Plants*. Academic Press, New York.

Mc Lachlan, K. D. (1987) Acid phosphatase activity of intact roots and phosphorus nutrition in plants I assay condition and phosphatase activity. *Australian Journal of Agricultural Research.* **21:** 429-440.

McLachlan, K. D.; Elliott, D. E.; De Marco, D. G. and Garran, J. H. (1987) Leaf acid phosphatase isozymes in the diagnosis of phosphorus status in field-grown wheat. *Australian Journal of Agricultural Research,* **38**: 1-13.

Sharma, A. D.; Singh, M. and Kang, J. K. (2005) Short term waterlogging-induced changes in phosphatase activities in shoots and roots of *Sorghum* seedlings: roles of phosphatases during waterlogging in relation to phosphorus.*General and Applied Plant Physiolog,* **31**(1-2): 71-79.

Sharma, M., Kumar, B. and Pandey, D.M. (1997) Effect of pre – flowering foliar application of putrescine on ion composition of seeds of chick pea (*Cicer arietinum* L. cv. H – 82 – 2) raised under saline conditions. *Annals of Agri- bio Research* **2**(2): 111-113.

Zhen, J.; Xue-Fang, S.; Zhu-Qing, Z.; Li-Kai, W.; Ji-Wei, L.; Xiang- Yi, D. and Hai-Yan, F. (2010) Aerenchyma formation: programmed cell death in adventitious roots of winter wheat (*Triticum aestivum*) under waterlogging. *Functional Plant Biology* **37** (8): 748-755.