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SHORT COMMUNICATION

EFFECT OF CALCIUM ON ACID PHOSPHATASE ACTIVITY IN GROUNDNUT (*ARACHIS HYPOGAEA* L.) SEEDLINGS DURING WATER STRESS

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The effect of calcium on acid phosphatase activity (ACPH) during water stress was estimated in the seedlings of two groundnut cultivars. Lower levels of ACPH activity was observed in the seedlings subjected to water stress. On the contrary higher levels of acid phosphatase activity was associated with $CaCl_2$ treated seedlings. Further, external application of Ca^{2+} maintained higher levels of ACPH activity in the seedlings of cv. TPT-4 than that of cv. TPT-1. Thus it appeared that Ca^{2+} modulates the levels of enzyme activity under water stress.

***Key words*: Acid phosphatase, calcium, groundnut, water stress.**

Phosphatases are a group of phosphohydrolase enzymes of wide specificity (Ikawa *et al.* 1964) and its action is mainly on the orthophosphate ester bonds. Phosphatase is indispensable enzyme produced by the higher plants as well as micro organisms. The acid phosphatase (ACPH) is believed to play an important role in P metabolism during early phases of seed germination, catalyses a variety of biochemical reactions and plays a vital role in the regulation of plant cell metabolism by modulating inorganic phosphorous level (Tamura *et al.* 1982). The changes in the levels of the acid phosphatase activities in relation to water and salinity stress have been reported in seedlings of rice (Dubey and Sharma 1989), sesame (Muthusamy *et al.* 2001) and leaves of coconut (Shivashankar *et al.* 1991). In the present study an attempt has been made to study the effect of calcium on acid phosphatase activity in early growth of groundnut cultivars under water stressed conditions.

Groundnut (*Arachis hypogaea L.)* cvs. TPT-1 and TPT-4 recently released by N.G. Ranga Agricultural University, are drought tolerant and suitable for the cultivation of surrounding villages of Tirupati. The seeds of uniform size were surface sterilized with 0.1% (w/v) mercuric chloride solution for 2 min, washed thoroughly with distilled water and germinated in bread boxes containing 20ml of distilled water for one week. The seeds were treated with PEG (6000) of -1 MPa $CaCl_2$ (20 mM) and combination of -1 MPa PEG + 20 mM $CaCl_2$ for seven days with continuous illumination (9.6×10^3 sec^{-1}) at 25° ± 2°C. Seeds treated with distilled H_2O served as control. At 2 days interval, the seedlings were removed from the bread boxes and blotted dry. The calcium contents and the levels of acid phosphatase activity were measured separately both in the cotyledons and embryonic axis on 1st, 3rd, 5th and 7th day after giving the treatment. Acid phosphatase activity was measured by the method of Sadasivam and Manickam (1996). Total Ca^{2+} content of seedlings was determined as per the method of Piper (1957). The concentration of Ca^{2+} was measured at 422.7 nm using Atomic Absorption Spectrophotometer (Smith Hiefize 12).

In the present study acid phosphatase activity decreased from 1st to 5th day followed by an increase from 5th to 7th day in cotyledons and embryonic axis of both the cultivars under water stress. The PEG treated seedlings of cv. TPT-1 showed lower levels of acid phosphatase activity than cv. TPT-4 (Fig. 1). Soybean

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seeds treated with PEG caused decrease in percentage germination index (GI), acid phosphatase activity, ATP levels and the electrical conductivity (EC) of the imbibing solution (Wang and Zhao 1990). The PEG treatment in *Capsicum annum fruits* reduced activity of acid phosphatase (Wang *et al.* 1995). $CaCl_2$ treated seedlings maintained higher levels of acid phosphatase activity among the treatments including control seedlings in cv. TPT-4 than of cv. TPT-1. On the contrary, the acid phosphatase activity was markedly increased in young leaves of red gram under Ca^{2+} stress (Sinha *et al.* 1998). The role of Ca^{2+} in activating the synthesis and translocation of the enzymes in plants is well known (Bush *et al.* 1986, Marschener 1986). The ability to modulate intracellular Ca^{2+} pools provide a means for plants to gain resistance to various external stresses (Person *et al.* 2001).

The results obtained in the present study showed that the calcium content decreased in cotyledons and increased in embryonic axis during seedling growth from 1st to 7th day in all the treatments in both the cultivars. The water stressed seedlings showed lower levels of calcium content than the other two treatments including control seedlings in cv.TPT-1 than that of cv.TPT-4. (Fig. 2). $CaCl_2$ treated seedlings maintained higher levels of calcium content than the other two treatments including control seedlings in cv.TPT-4 than that of cv.TPT-1. Decreased levels of calcium content were observed in PEG treated seedlings of maize (Shi *et al.* 1994) seeds of soybean (Keiser *et al.* 1995) and sunflower (Ravi Shankar *et al.* 2000). But the calcium content in the seeds of sorghum (Ahmed *et al.* 1991) and maize (Gong *et al.* 1997) were found to increase with calcium chloride treatment. Some of the deleterious effects of water stress could be attributed to nutritional imbalances (Zekri 1995). Higher levels of calcium and acid phosphatase activity were found in the $CaCl_2$ treated seedlings which may be due to the involvement of Ca^{2+} in the modulation of acid phosphatase activity under water stress during early growth of groundnut seedlings.

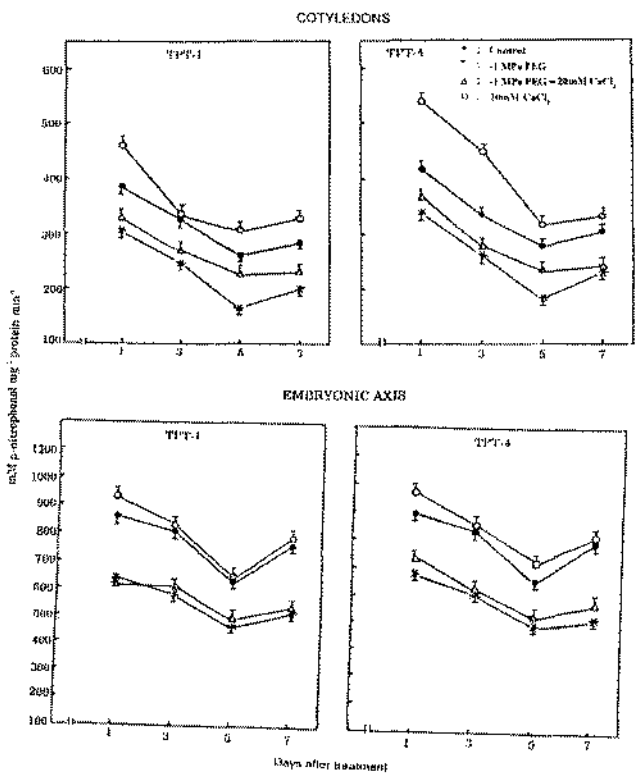

Fig. 1. Effect of PEG (-1MPa), $CaCl_2$ (20mM) and their combination on the changes in the acid phosphatase activity of cotyledons and embryonic axis of two groundnut cultivars (TPT-1) and (TPT-4) during seedling growth

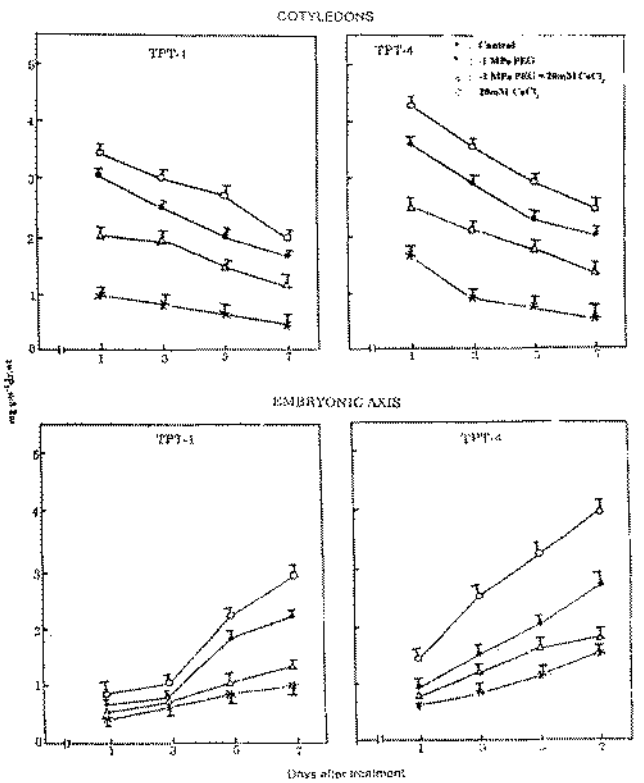

Fig. 2. Effect of PEG (-1MPa), $CaCl_2$ (20mM) and their combination on the changes in the calcium content of cotyledons and embryonic axis of two groundnut cultivars (TPT-1) and (TPT-4) during seedling growth

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