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THE EFFECT OF SODIUM CHLORIDE AND POLYETHYLENE GLYCOL ON GERMINATION AND WATER CONTENTS OF TWO MUNGBEAN (*PHASEOLUS AURA* L.) VARIETIES

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Abstract

Effect of NaCl and PEG, at iso-osmotic concentrations, on germination and water contents of two mungbean varieties was studied. Responses to salinity indicates that EgMg 6-D is a tolerant and CES-55 a sensitive variety. The mode of action of PEG was different than NaCl in that the effect of latter seems to have been predominantly induced by specific ion(s) whereas the former produce osmotic effect only.

Introduction

The salinity effect of salts on plants growth can be divided into two categories, i.e. effects caused by specific ion(s) and effects caused by water deficit due to higher osmotic pressure of the external salt solution. According to Strogonov and others (Babaeva *et al.*, 1968; Collek, 1973), the effects of specific ions accounts for most of the salt damage, while Bernstein (1961, a, b) attributed most of these effects of salt to water deficit due to osmotic stress. These diverse opinions had been results of the fact that it is often difficult to differentiate between the effects of the above two categories.

Since polyethyleneglycol of low molecular weight (PEG-1000) has been found to be most satisfactory in creating water deficit (Janes, 1974) it was considered worthwhile to reinvestigate the problem and provide evidence to differentiate between the ionic or osmotic effects in mungbean at the germination stage.

Materials and Methods

Twenty seeds of mungbean Cv. EgMg-6D (tolerant) and CES-55 (sensitive), after weighing, were placed on Whatman No. 10 filter paper in 11 cm Petri dishes. After cover-

ing the seeds with another filter paper, 13 ml of the test solutions were added to moisten the two filter papers. Each treatment were assigned random places on a bench in a dark room and were replicated three times. After 0, 4, 8, 12, 16, 24, 32 and 40 hr seeds were weighed and their dry weight subtracted to determine their water content. Seed were considered germinated when radicle or coleorhiza were visible. Water content of the seeds were determined only upto 24 hr. The seeds were dried in an oven (70°C) for 48 hr after which their dry weight was determined. For recovery/test the seeds which did not germinate in the above treatments were washed with distilled water for 15 minutes and transfered onto filter papers in Petri dishes as described earlier and allowed to germinate for 48 hours.

Results

Visible sign of germination in both the varieties were observed after 8 hours and were complete within 16-24 h (Table 1). There was a marked decrease in germination under NaCl and variety CES-55 was most affected whereas EgMg-6D remained unaffected during the course of experiment. On the other hand at 10 atm. PEG was effective in inhibiting germination in both varieties till the end of the experiment. There appears to be a delay in the initiation of germination in presence of NaCl as compared with control and no germination commenced upto 16 hours (Table 1).

Seeds soaked in PEG for 48 hr showed high recovery rate in both the varieties when compared with control (Table 2). However, the recovery of NaCl treated seeds

Table 1. Germination (percent of control) of two Mungbean varieties with time in NaCl and PEG at 10 atm with a control (distilled water)

Time in hours	Variety EgMg-6D			CES – 55		
	Control Treat.	NaCl Treat.	PEG Treat.	Control Treat.	NaCl Treat.	PEG Treat.
4	–	–	–	–	–	–
8	8	–	–	75	–	–
12	35	–	–	92	–	–
16	68	–	–	100	–	–
24	100	17	–	100	10	–
32	100	23	–	100	11	–
40	100	37	–	100	11	–

Table 2. Recovery test of Seed placed in distilled water after soaking 48 hours in different osmotica.

Treatment	% of Control	
	EgMg-6D	CES-55
NaCl	66.0%	0
PEG	80	82

varied and EgMg-6D variety registered 60% germination while CES-55 seeds did not germinate.

The seed water contents of EgMg-6D variety was higher than CES-55 in all the treatments. Seed hydration occurred rapidly in both varieties during the first 4 hr of imbibition (Fig. 1) after which it was much slower. Though the total water content of the seeds in NaCl and PEG varied at each time period, the pattern of uptake during the time course registered similar trends.

Discussion

The result of seed germination test (Table 1) further confirm our earlier findings (unpublished) that EgMg-6D is comparatively tolerant and CES-55 is a salt sensitive variety. Report of varietal differences in crops exists in the literature (Mass & Hoffman, 1977) but very few studies have used sensitive and tolerant varieties within the species to study physiological processes. The initiation of germination was delayed over a period of hours and final germination percentage was reduced in both varieties under NaCl and PEG treatments. According to Wiggns & Gardner (1959), and Evans & Stickler (1961), water stress can affect germination by delaying initiation, slowing down the rate or decreasing the final percentage. Cianiporova & Luxova (1976) noted cessation of root growth in maize plant when exposed for 24-48 hr to PEG solution as a result of the inhibition of cell elongation and division. The changes induced by 24 hr exposure were reversible but it was not so for 48 hr, indicating a irreversible damage. But this was not the situation in our studies where inhibition of germination due to exposure of seeds to PEG for 48 hr were reversible. The water uptake data (Fig. 1) shows high rate in EgMg-

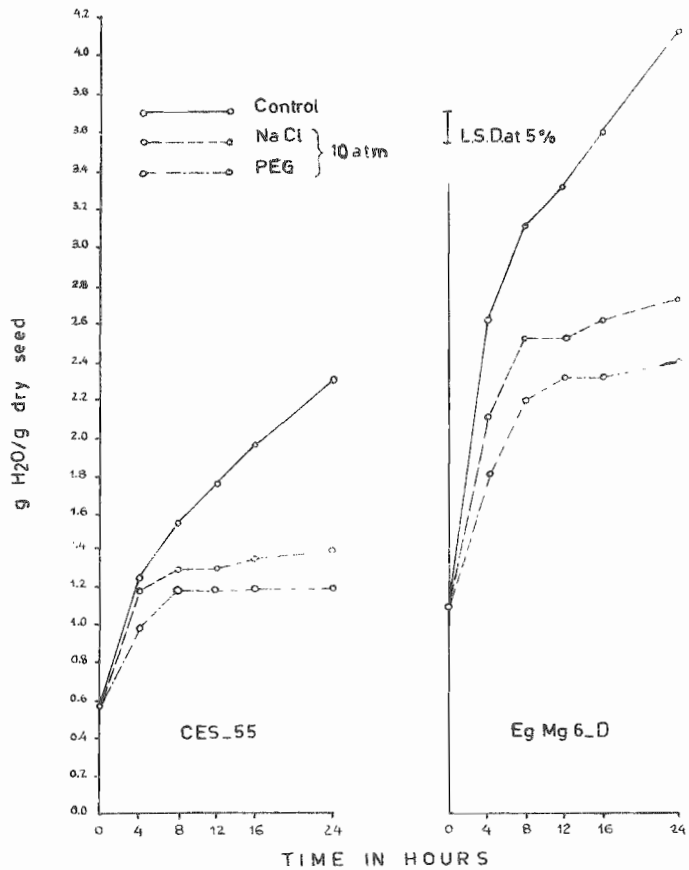

Fig. 1. Effect of NaCl and PEG at 10 atm on the uptake of water by the germinating seed of two Mungbean varieties with time (g H_2O/g dry seed).

6-D variety as compared with CES-55 which may be a reason in their response to salt. It can be further noted that PEG acts only as an osmoticum its effect was countered by washing only and the seeds germinated normally. Hegatory (1980) has described germination inhibition due to osmotic stress as a form of dormancy which when relieved germination is restored. On the other hand, as mentioned earlier, Na and Cl enters into the seeds and may increase their internal osmotic pressure. This will result in higher water uptake but still the ionic toxicity predominates and the sensitive variety CES-55 completely failed while the tolerant EgMg-6D registered 66% germination on being transfered to distilled water, similar results have also been reported for wheat (Younis, *et al.*, 1971). It is therefore concluded that EgMg-6D is a salt tolerant variety and the effect on germination was produced by specific ion(s) and not by the osmotic condition in the range tested.

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