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LIGHT AND SALINITY EFFECTS ON THE SEED GERMINATION OF *VIGNA RADIATA* L. AND *VIGNA ANGULARIS* WILLD.

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ABSTRACT:

The germination requirements of two pulses (*Vigna radiata* L. and *Vigna angularis* Willd.) were studied under control conditions in the laboratory. Treatments included two light levels (12 : 12 h light : dark period and 24-h dark environment), six salinity concentrations (0, 100, 200, 300, 400, and 500 mmol/L NaCl) using a completely randomized block design. Best seed germination of both pulses was obtained in a distilled water control. Increase in salinity progressively inhibited germination of both pulses. For example, 80% seeds of *Vigna radiata* L. germinated 0-100 mmol/L NaCl, while rate of seed germination progressively decreases in up to 500 mmol/L NaCl. Absence of light had little effect on the seed germination of *Vigna radiata* L.; however, germination was lower in all salinity treatments. In the case of *Vigna angularis* Willd. (Black gram) absence of light substantially inhibited the germination both in control and saline conditions

Key words: *Seed, Germination, Pulses, Black gram, Salinity.*

INTRODUCTION:

The standard germination test is conducted under optimum conditions for the seed germination. High salinity is a common abiotic stress factor that seriously affects crop production in some parts of the world, particularly in arid and semi-arid regions (Neumann, 1995). There are about of 8 million hectare agricultural land exposure to salt stress in the world (Munns, 2005). Irrigation with poor quality water is one of the main factors that lead to salt accumulation and the resulting decrease in agricultural productivity. The plant growth is ultimately reduced by salinity stress but plant species differ in their salinity tolerance (Munns and Termaat, 1986). Salinity is one of the major obstacles to increasing production in crop growing areas throughout the world. In spite of this extensive literature there is still a controversy with regard to the mechanisms of salt tolerance in plants (Neumann *et al*., 1995). Salinity in soil or water is one of the major stresses and especially in arid and semi arid regions, can severely limit crop production (Shannon, 1998).

Seedling establishment is a critical stage in crop production and considerably depends on biochemical and physiological structures of seed. In order to obtain fast and good establishment of seedling, high vigor seed is needed to provide essential nutrients for seedling until it becomes established and can photosynthesize independently (Derek Bewley and Black, 1994). Seed germination, seedling emergence, and early survival are particularly sensitive to substrate salinity (Baldwin *et al.*, 1996). Successful seedling establishment depends on the frequency and the amount of precipitation as well as on the ability of the seed species to germinate and grow while soil moisture and osmotic potentials decrease (Roundy, 1985).

Germination and seedling characteristics are the most viable criteria used for selecting salt tolerance and effect of light in plants. Germination percentage, germination speed and seedling growth are most criteria for cultivar selection. The present study was conducted to evaluate the light and salinity effects on the seed germination of *Vigna radiata* L. and *Vigna angularis* Willd.

MATERIAL AND METHOD:

Inflorescences of *Vigna radiata* L. and *Vigna angularis* Willd. were collected from their fields of Patan district. Seeds were separated from inflorescences, cleaned, and dry stored at room temperature after surface sterilization with 0.85% sodium hypochlorite for 1 min. Six salinity concentrations (0, 100, 200, 300, 400, and 500 mmol/L NaCl) were used based on a preliminary test for salt tolerance of the species.

Seeds were germinated in two folds of Whatman number 1 filter paper placed in 2.5 X 18 cm glass test tubes with 5 mL of test solution to prevent evaporation. The tubes were sealed using parafilm. Four replicates of 25 seeds each were used for each treatment. A seed was considered to have germinated at the emergence of the radicle (Bewley and Black, 1994). Seeds were incubated in photographic envelopes for the dark treatment. Germination was noted after five days.

RESULT AND DISCUSSION:

Seed germination of *Vigna radiata* L. was highest in distilled water while at 500 mmol/L NaCl twenty percent of the seeds germinated in light. In darkness, germination was significantly inhibited at all salinity, an increase in salinity progressively more inhibited germination in dark as compared to light. Few seeds germinated at concentrations higher than 300 mmol/L NaCl. This salinity-induced germination inhibition was greater with light effect. Absence of light had little effect in nonsaline controls, while under saline conditions it significantly inhibited seed germination as compare to control in *Vigna radiata* L. after five days (**Table. I, Figure I**).

Table I. Effect of light and salinity on the germination of *Vigna radiata* L. and *Vigna angularis* Willd. seedling

NaCl (mmol/L)	*Vigna radiata* L.		*Vigna angularis* Willd.	
	Light	**Dark**	**Light**	**Dark**
0	96	80	92	72
100	84	72	80	52
200	72	56	64	36
300	56	28	48	20
400	32	12	28	4
500	20	8	12	0

In *Vigna angularis* Willd. seed germination decreased with an increase of salinity. Germination was greatly reduced above 300 mmol/L NaCl treatment. Absence of light substantially inhibited germination under all concentration of salinity. However, at 500 mmol/L NaCl maximum inhibitory effect on seed germination in light while no seeds germinated in dark (**Table I, Figure II**). In both pulses it has been observed that increasing of salinity concentration gradually decrease the seed germination in dark and light period after five days.

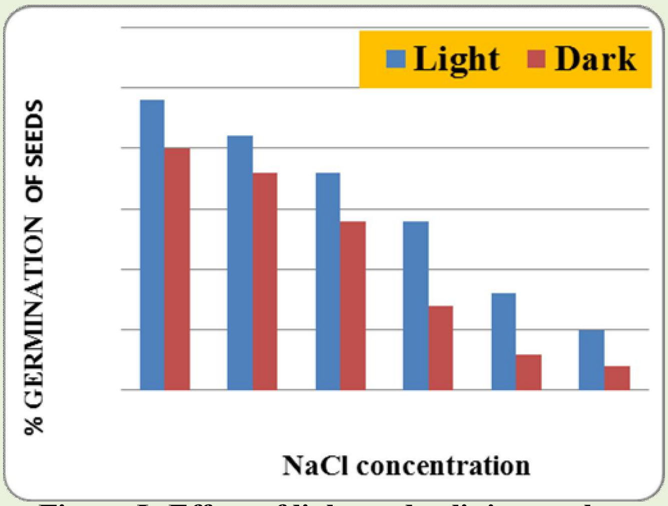

Figure I: Effect of light and salinity on the germination of *Vigna radiata* L.

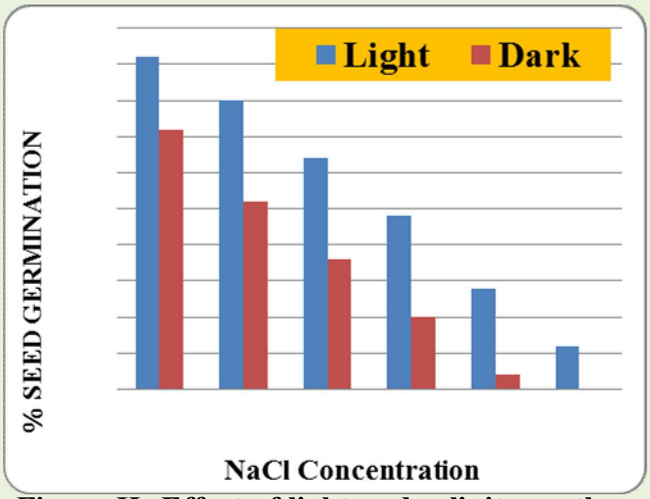

Figure II: Effect of light and salinity on the germination of *Vigna angularis* Wiild.

The test species differed greatly in their response to salinity, as quantified by the percentage germination. Best germination was obtained in distilled water controls in both *Vigna radiata* L. and *Vigna angularis* Willd. Increase in salinity progressively inhibited seed germination, and few seeds of *Vigna radiata* L. germinated above 300 mmol/L NaCl. The seeds of both *Vigna radiata* L. and *Vigna angularis* Willd. showed no germination at 500 mmol/L NaCl. This low salt tolerance may be related to their zone of occurrence along the coast where they are not inundated by exposed to underground brackish water or seawater the year round. The results showed that, different levels of salinity have significant effect on seed germination of *Vigna radiata* L. and *Vigna angularis* Willd. Many researches have been reported similar results (Ashraf and Mcneilly, 1990; Demir, and Aril, 2003; Jeannette *et al.*, 2002; Mauromicale and Licandro, 2002). It observed that, in all of cultivars there was a decrease in germination percentage due to salinity increment and maximum germination percentage was delayed. While in this experiment different cultivars had different response to the salinity (Fig. 1). Seeds of seven species required light for germination, five germinated to higher percentages in light than in darkness, two germinated equally well in light and darkness, eight germinated to higher percentages in darkness than in light, and one required darkness (Baskin and Baskin, 1998).

CONCLUSION:

It concluded that these pulses are well adapted to germinate under a seasonal temperature regime when availability of moisture and soil salinity levels are favorable for germination. Light and soil salinity play crucial roles during germination. It would be interesting to investigate the suitability of wave length and intensity of light during germination and whether they change with the change in light, and salinity or both. Present study points to some ecological strategies employed by seeds of pulses to deal with high salinity both under light and dark conditions.

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