EFFECTS OF WEED SEED OF SWEET CLOVER (*MELILOTUS INDICA L.*) AND NACL ON GERMINATION AND SEEDLING GROWTH OF RICE (*ORYZA SATIVA* L.)

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Abstract

Weed seeds of sweet clover (*Melilotus indica L.*) were evaluated alone or in combination with sodium chloride (NaCl) for their effects on germination and seedling growth of rice. The seed germination of rice was affected significantly when weed seeds were incorporated with 0.4% NaCl solution. It was observed that weed seeds alone and with 0.2% NaCl had significant effect on shoot length. Similarly, a 0.4% NaCl alone or in combination with weed seeds reduced the shoot length. The root length was also reduced by application of weed seeds alone and in combination with NaCl. It was also observed that root length was affected more than the shoot.

Introduction

Weeds are of the major constraints to crop production worldwide. A variety of organic compounds has been implicated as the possible agent responsible for growth reduction and it has been assumed that in most cases it was the collective action of several compounds, which caused the growth depression. Literatures have revealed that allelopathic interference by weed seed or weed extract has been established as one of the several factors that regulate the growth of plants (Alam, 1993; Evenari, 1949; Putnam and Weston, 1986; Rice, 1984).

The seeds of many plant species including wheat and rice often failed to germinate promptly after being exposed to stress conditions. Phytotocix substances have been found in weed and crop seeds (Evenari, 1949). Seed germination and seedling growth may be partially inhibited or delayed often resulting in poor stands.

In the process of competition weed seeds frequently absorbed nutrients much more than the crop plants. Evenari (1949) reviewed the various studies conducted and concluded that most weed seeds contain essential oils, alkaloids, or glycosides which inhibited germination and seedling growth of other crops present in their immediate vicinity. The findings of McCalla and Dulley (1948) have revealed that soaking corn seeds in aqueous extract of sweet clover for 24 hours reduced germination and growth of tops and roots in petri dishes.

Saraswat (1987) reported that sweet clover exhibited allelopathic effects on the growth of rice seedling. Anaya *et al* (1987) reported that leachate from fresh material of sweet clover produced light inhibition of radical growth of bean, corn and squash and a reduction of 68 per cent in the growth of corn has been reported.
They further reported that reduction was due to the allelopathic potential of this weed. Germination of lettuce seeds as well as their root and hypocotyls elongation were inhibited when the seeds were sown in Petri-dishes together with a few seeds of *Heracleum maximum* (*Heracleum laciniatum* Horn.) (Junttila, 1975).

Sweet clover (*Melilotus indica* L.) is a common weed of several crops. It is grown in summer season and caused heavy losses to the crops. The presence of weed and salinity together may be more hazardous to the growth of crop than weed and salinity alone. Most of the studies were reported earlier for the effects o weed on agricultural crops under normal growth conditions. There seems to be no report on the effect of sweet clover on plants growing under saline conditions. This information is of special significance to countries like Pakistan, where salinity is an important constrains for crop production. It was therefore, considered worthwhile to ascertain the effect of seeds of sweet clover in interaction with NaCl or without NaCl on germination and seedling growth of rice.

Materials and Methods

Weed seeds of sweet clover were collected from matured weed plant growing in agricultural field. The seeds were cleaned and then sun dried. The laboratory experiment was carried out in glass bowls of 250 ml capacity.

A sterilized agar-gel (0.8%) was prepared and this agar-media was incorporated with sodium chloride solution to get control (0.0), 0.2 and 0.4 per cent NaCl salinity levels. Fifty ml of each salinized agar-media was poured into sterilized glass bowls of 250 ml capacity for seed planting. Both seeds of rice (cv. R-8-5) and weed seeds of sweet cover were surface sterilized by 1 percent sodium hypochlorite (NaOCI) solution for three

minutes and then rinsed with several lots of distilled water. Ten healthy rice seeds were placed in a circle on the surface of each bowl containing agar-media salinized solution and 0.5g weed seeds. A set containing no any weed seed and no solution of sodium chloride (NaCl) was also kept and treated as control. All the bowls were then covered with sterilized Petri-dishes and incubated at 28^{o}C. The experiment was terminated after 5 days. The germinated seeds noted and their shoot and lengths were measured. The data were analyzed and presented in Table 1.

Results and Discussion

The maximum reduction (24.7%) in seed germination occurred when weed seeds of sweet clovers were placed in the medium containing weed seed + 0.4% NaCl (Table 1). But it did not differ significantly from 0.4% NaCl and 0.2% NaCl + weed seed. This showed that for germination phenomenon, there was a negative effect of the two stresses on rice seed germination.

Seed germination was considered to be the most critical stage especially under stress conditions. It is also know that during germination, biochemical changes took place, which provided the basic frame work for subsequent growth and development. The initial metabolic changes that occurred immediately after the imbibitions of water were the increase in the hydrolic enzymes such as alpha-amylase and protease (Viera de Silva, 1976). The synthesis of this enzyme during germination is regulated by gibberellic acid (Chrispeels and Varner, 1976) and hence starch hydrolysis. Inhibition of seed germination of crop plant was also due to disturbance in the activities of peroxides, alpha-amylase and phosphates. Many investigators have suggested phenolics as the main cause of inhibition of metabolic process during germination (Kuiters, 1989; Williams and Hoagland, 1982). The weed seed alone, 0.2% NaCl + weed seed, 0.4% NaCl and 0.4% NaCl + weed seed had similar effects and reductions in shoot length were 39.4, 45.3, 38.0 and 57.4%, respectively. The differences between weed seed alone, 0.2% NaCl, 0.2% NaCl + weed seed and 0.4% NaCl were non-significant.

Table 1. Effect of weed seeds of sweet clover (*Melilotus indica* L.) and NaCl on germination and seedling growth of rice.

Treatments	Germination (%)	Shoot length (cm)	Root length (cm)
Control (No wed seed, No NaCl)	97 ± 5.77 (-)	3.71 ± 0.45 (-)	9.17 ± 0.54 (-)
Weed seed alone	98 ± 5.77 (-4.1)**	2.25 ± 0.26 (-39.4)	0.40 ± 0.18 (-95.6)
0.2% NaCl alone	100 ± 0.0 (+3.1)	2.97 ± 0.40 (-20.0)	9.63 ± 0.26 (+5.0)
0.2% NaCl + Weed	83 ± 5.77 (-14.4)	2.03 ± 0.09 (-45.3)	0.56 v 0.05 (-93.9)
0.4% NaCl alone	80 ± 10.00 (-17.5)	2.30 ± 1.00 (-38.0)	5.61 v 1.30 (-38.8)
0.4% NaCl + Weed seed	73 ± 20.82 (-24.7)	1.58 ± 0.70 (-57.4)	0.44 ± 0.12 (-95.1)

- 0.5g Weed seed / bowl.
- ** Figures in the parentheses have indicated percent increase (+) or decrease over control.

The effects of weed seed alone and in combination with 0.2 and 0.4% NaCl significantly reduced the root lengths by 95.6, 93.9 and 95.2%, respectively compared to control. The 0.2% NaCl had no effect on root growth. At 0.4% NaCl the root length was reduced by 38.8% compared to control. In the present study, the root length of rice was affected more than the shoot. Although, we did not determine the biochemical parameters, but it was obvious that the seed of sweet clover contains leachable allelochemicas, which have more profound effects on roots than shoot. Literatures have suggested that different parts of sweet clover contain large amount of courmarin, O-courmarin and metabolic acid as major active compounds (Langer and Hill, 1982.; Nicollier *et al,* 1985; Einhelling and Suoza, 1992; Winter, 1961) and was considered to be highly effective in reducing plant growth. The findings of McCalla and Duley (1948) have revealed that sweet clover extract has been shown to reduces germination, shoot and root length of corn. It had exhibited the high inhibition of radical growth in bean, corn and squash (Anaya *et al,* 1987). Saraswat (1987) found adverse effects on the rice growth.

It was obvious from the findings that the seeds of sweet clover has contain leachable allelochemicals which have more profound effect on the inhibition of seed germination, overall stunted growth, injury to root systems and killing of the plants.

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