SUSCEPTIBILITY OF THE REPRODUCTIVE PROCESS IN CORN TO ACID RAIN

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Although corn, Zea mays L., is a major economic crop of the United States, only a limited number of studies have investigated the sensitivity of this crop to acid precipitation. Yet, corn is affected by acid precipitation as changes in yield have been measured on plants treated with a simulated acid rain. The reason(s) for reduced yields when the plant is exposed to acid rain is (are), unknown, but could be due to the reproductive processes being a relatively more sensitive life stage than other growth periods of the plant.

This study proposes to determine the relative sensitivity of corn to acid precipitation by investigating the effect of ambient and simulated acid rains on the germination and growth of pollen of plants growing in the field. Evaluation of pollen vigor is appropriate as this may well be one of the most sensitive and potential yield reducing developmental stages in the corn life cycle. Being a monoecious plant with separate pistillate and staminate flowers, pollen from the corn tassel must move in the ambient atmosphere to the silk located in the leaf axil. As such, both the male and female reproductive organs are open to contact with acid precipitation. Formation of kernels on the ear requires germination and growth of a pollen tube down the silk to the egg nucleus.

Acid rain is composed primarily of sulfuric and nitric acids, plus a number of other inorganic and organic acids and a range of cations and anions, depending upon the season, geographical area, and source of chemical compounds. Numerous studies have demonstrated that the vitality of pollen is very susceptible to environmental stresses and it appears that either the acidity or other components of acid rain could pose a serious threat to the ability of corn pollen to germinate and grow on the silk. Potential injury to the system could be of many physical or physiological forms, including morphological and/or anatomical changes in the reproductive organs due to necrotic lesions, membrane disruption or other alterations in surface structures of silk and/or pollen, and chemical changes in hormones, ion balances and metabolism. Reductions in the density or potency of pollen on the female reproductive organ have already been associated with decreased corn yields.

Of special importance following acid rain episodes are any effect the acid has on alterations in inorganic ions and ion ratios in pollen and silk. Testing corn in the field under ambient conditions, coupled with laboratory experiments to elucidate the acidity and other acid rain component roles, should indicate if the corn reproductive process is susceptible to acid precipitation and the nature of any susceptibility in the reproductive cycle. Three hybrids differing in maturity are being tested.