SOIL HEALTH & LAND MANAGEMENT

NDSU EXTENSION SERVICE

EFFECT OF SOIL SALINITY ON DISEASE RESISTANCE OF SOYBEAN

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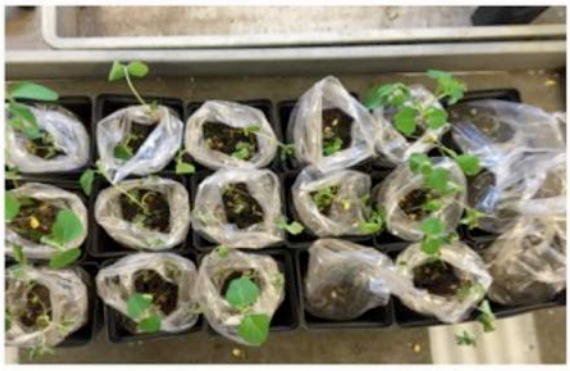
Two major diseases affecting soybean production in North Dakota are Phytophthora root rot and soybean cyst nematode (SCN). Both diseases are controlled primarily by using resistant cultivars. Many of the commercial cultivars grown in this area have resistance to one or both of these diseases. If salinity reduces the effectiveness of host resistance, then the primary method of disease management is useless in saline fields.

The objective of the project was to examine resistance to *Phytophthora sojae* race 4, the cause of Phytophthora root rot, under relatively low salinity where the soybean is still growing. Saline soil treatments established in the greenhouse and tested were 0, 0.5, 1.0, 1.5, 2.0, and 2.5 mmhos/cm (EC_e; saturated paste) using sodium sulfate and magnesium sulfate salts. Plants of the cultivars Barnes (with resistance gene Rps6) and LaMoure were grown in the various EC levels (see figure below). Barnes has resistance to race 4 while LaMoure is susceptible. LaMoure was included in the experiment as a positive check for disease development.

Barnes soybean: 6 days after inoculation with *Phytophthora sojae*



LaMoure soybean: 6 days after inoculation with *Phytophthora sojae*

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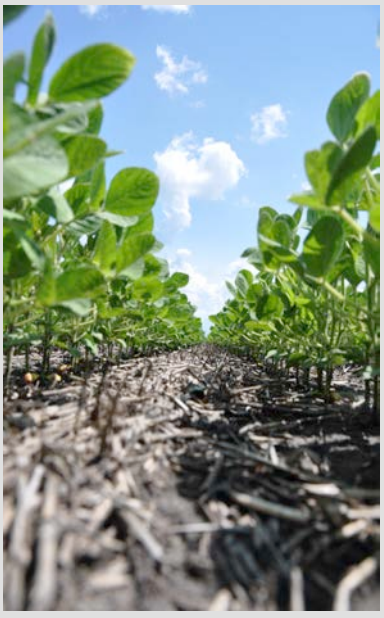
One Thought…

The effect of salinity levels above EC_e 2 mmhos/cm on plant growth was surprising.

The salinity levels used in these experiments are most likely of greater uniformity in salinity throughout the soil mix compared to what naturally occurs in a field soil, due to the method we use to create the salinity levels.

We believe the substantial damage to plant growth at the salinity level of EC_e 2.5 mmhos/cm in these experiments may be considerably greater than one might expect in a field soil registering EC 2.5.



The results over four experiments indicated that at the low salinity levels of EC_e 0.5 to 2, the resistant cultivar (Barnes) maintained resistance to P. sojae, while the susceptible cultivar (LaMoure) showed susceptibility throughout the salinity treatments. Barnes averaged over 98% survival from EC_e 0.5 to 2, while LaMoure plants averaged 15% or less survival (table below).

There was a dramatic reduction in emergence and growth of soybean seedlings such that there were few plants of either cultivar for inoculation at an EC_e 2.5 mmhos/cm. Additional experiments at EC_e 1.5 and 2 showed that three other resistant cultivars, two with the Rps 1k gene and one with the Rps 3a gene, also maintained their resistance to the pathogen when compared to the treatment with no salinity. Thus, three sources of genetic resistance to P. sojae were not adversely affected by salinity levels up to EC_e 2.

EC	% Surviving Plants	
mmhos/cm	Barnes	LaMoure
0	100	8
0.5	98	7
1	98	15
1.5	96	4
2	100	14
2.5	--*	--

*At EC 2.5 mmhos/cm, there were few plants for inoculation due to the effects of salinity on growth of plants

The research on effects of salinity on resistance to SCN is still in progress. We compared the SCN resistance of soybean plant introduction PI88788 to the susceptible cultivar Barnes at EC_e 0, 1.5 and 2. PI88788 has resistance to the common SCN race HG 0 that we have in this area. Resistance was measured by counting the number of female nematodes that were produced on the roots. PI88788 maintained resistance to SCN at all salinity levels whereas Barnes showed susceptibility.
At EC_e 2, there were 33 times more females on Barnes than on PI88788 after 5 weeks plant growth.

Thus far, this research indicates that under low levels of salinity of EC_e 2 or less, resistance to Phytophthora root rot and soybean cyst nematode is still effective.