Integrated Pest & Crop Management

Early Corn Seedling Growth is Dependent on a Strong Root System

By Bill Wiebold

Although the majority of Missouri's corn crop has been planted, recent weather conditions have had, and may continue to have, negative effects on the health of the resulting plants. Some of these effects are visible enough to result in replanting. Unfortunately, some effects are hidden below ground and may not become apparent until later in the growing season.

One possible effect from this weather is a weakened or slowly developing root system. Corn plants, like most annual grass plants, produce two root systems. The first root system (primary) is composed of seven roots that all arise from within the seed. These roots anchor the seeding and sustain the seedling for the first couple of weeks after emergence. The main root system (secondary) of the corn plant is composed of numerous roots that originate from stem tissue. These adventitious roots are located at nodes along the stem, both below and above ground.

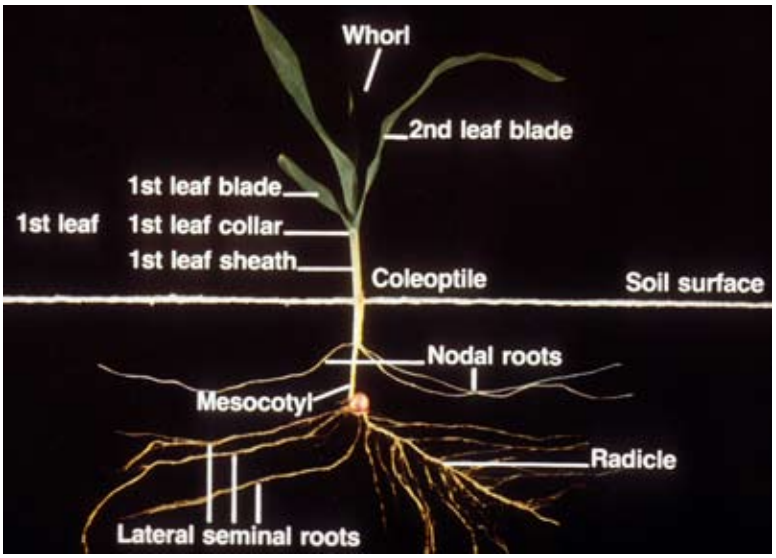

Figure 1. Corn seedling at late V1 stage of development. Nodal roots are the same as adventitious roots. Image from Iowa State University.

Adventitious roots begin their development shortly after the seedling has emerged, but it takes several weeks before the roots are capable of sustaining the plant. Until at least several adventitious roots are functioning, corn plants are dependent on the primary root system for water, mineral nutrients, and anchorage in the soil. The only link between these roots and the rest of the plant is a thin piece of stem called the mesocotyl. The mesocotyl is the first stem internode and stretches from the scutellar node (junction between the stem and root tissues) inside the seed to the first stem node. The mesocotyl elongates and pushes the growing point toward the soil surface. Detection of light by the coleoptile usually stops mesocotyl elongation when the first node and the growing point is about three fourths of an inch below the soil surface.

The mesocotyl can be damaged by disease organisms or insects. Damage to the mesocotyl slows or completely stops translocation of water and mineral nutrients to the developing seedling. The mesocotyl also is the connection between the young seedling and the stored reserves of

Continued on page 74

Table of Contents

Early Corn Seedling Growth is Dependent on a Strong Root System *continued from page 73*

the seed. Timing of damage is critical to understanding the magnitude of its effects. If the mesocotyl is damaged early, then the life of the seedling is at risk. If the mesocotyl is damaged after the adventitious roots have developed the effect is minimal.

The transition between the plant's reliance on the primary root system to a fully functioning secondary root system is usually smooth with few problems. This year a sequence of weather conditions may happen that may cause some concern. In some fields, cool and wet soils have limited adventitious root growth. If the cool, wet weather is rapidly replaced with hot weather, small root systems may not be able to supply enough water to the leaves to prevent wilting. Some wilting is survivable, but if the stress is severe in intensity or in length of time, plants could be killed.

This first stem node is the site where the first set of adventitious roots arises. As stated earlier, the first node will be about three fourths of an inch below the soil surface. Since the next four or five internodes of the stem undergo little if any elongation, five nodes, all capable of producing adventitious roots, are located just under the soil surface. This is why soil conditions near the soil surface can have a large effect on corn root development. Root development requires pore spaces large enough for root tips to enter, but not too large so that air touches the root tips rather soil particles. Moisture must be present, but if the soil is waterlogged, then critical oxygen is excluded. And, although cool temperature slow root growth, hot temperatures can inhibit growth and even kill the emerging root tips.

Soil conditions that limit adventitious root growth can lead to what is often called rootless corn syndrome. With this syndrome, corn plants may appear normal through V4 or V5. But soon, plants begin to lodge because adventitious roots had not formed properly. Cloddy soils that were tilled too wet, compacted soils, especially within the top inch, and hot dry soils can all lead to rootless corn. Unfortunately, little can be done to counteract the syndrome. Although it may seem an odd wish this year, a timely rain is about the only thing that can stimulate adventitious root growth and anchor the plants.

Figure 2. Poor adventitious root development on corn plants at V5 stage of development. Stem "goose-necking" occurred because plants were not

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Anthracnose of Corn

By Laura Sweets

Anthracnose leaf blight, caused by the fungus *Colletotrichum graminicola*, usually occurs early in the season on the lower leaves of young corn plants. Anthracnose lesions tend to be brown, oval to spindle-shaped lesions with yellow to pinkish to reddish-brown borders. Lesions may be 0.2 to 0.6 inch in length. Lesions may merge or coalesce to kill larger areas of leaf tissue. Concentric rings or zones are sometimes apparent within the diseased areas of leaf tissue. Lesions may be concentrated towards the leaf tip (or portion of the leaf that was emerged when rain occurred) giving the leaves a fired appearance that might be mistaken for nutrient deficiency or herbicide injury.

Anthracnose tends to be most common early in the season on the lower leaves of young corn plants. These leaves may be severely affected, yellow and die prematurely. Generally the disease stops at this point because of drier, warmer weather conditions and is not considered a significant problem. Under favorable weather conditions, the fungus may move up the plant causing foliage symptoms on higher leaves. If favorable weather conditions occur mid-season (especially wet), anthracnose may actually move up to the ear leaf. The anthracnose fungus can also cause top dieback and stalk rot later in the season. High temperatures and extended periods of wet weather favor anthracnose. Anthracnose leaf blight is more likely to occur if corn is planted following corn.

There have been several reports of anthracnose leaf blight on young corn plants. In a normal year anthracnose leaf blight in Missouri is not serious and would not warrant a fungicide application. The switch in weather patterns to drier and hotter weather could also restrict continued spread and development of the disease. If the forecast was for frequent rains over the next 7-10 days, the disease could continue to spread in the infected plants resulting in symptoms on leaves higher up in the canopy. The decision to apply a foliar fungicide this early in the season should take into consideration the yield potential of the field, the extended weather forecast, the cost of application, whether weather will permit application now and the possibility that a second application might be necessary later in the season for diseases such as gray leaf spot and southern rust

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Seed Decay, Seedling Blight and Crown Rot of Corn

By Laura Sweets

The May 5 issue of the *Integrated Pest & Crop Management Newsletter* contained an article entitled *"Seed Decay and Seedling Blights of Corn".* This article focused more on seed decay and early seedling blight. Recent questions concern larger seedlings and plants which are growing slowly because of cool, wet conditions. This article describes in more detail seedling blight and crown rot symptoms.

The long spell of unusually wet and cool weather has resulted in poor stands, uneven stands and yellow, stunted plants or dead plants in fields in some areas of the state. There are numerous factors that that have contributed to these poor stands and poor plant vigor. The cool, wet weather has been a major factor, but other contributing factors may include herbicide injury, insect damage, nutrient deficiencies and seed decay or seedling bights. It is difficult to impossible to determine which problem occurred first, what percent of damage is due to each problem and which problem finally killed the corn.

While symptoms of many of these problems may be evident on the above ground portions of the plants, to diagnosis seed decay, seedling blights and crown rot, it is important to dig up plants and examine the seed, root systems and mesocotyl. Symptoms that may be evident include the following:

Seed Decay: seed rotted prior to germination or just as germinating. Affected seeds are discolored, soft and may be overgrown with fungi or putrid from bacterial decay. Rotted seed may be difficult to find because they decompose very rapidly and because soil adheres fairly tightly to the decomposing seed.

Decay of Initial Root System and Mesocotyl: initial root system may be poorly developed and roots discolored and deteriorated. Mesocotyl also may show brown to blackish-brown discoloration and be soft and water soaked. In some cases, the mesocotyl is more extensively rotted perhaps to the point of rotting completely through.

If the initial or primary root system and mesocotyl are severely affected before the nodal or permanent root system has developed, the plant has little chance of surviving.

Decay of Permanent Root System and Lower Crown of Plant: some plants show little decay of the initial root system or mesocotyl, but the permanent or nodal root system and base of the crown of the plant show discoloration and deterioration.

Tips of the permanent root system are water soaked and discolored with the outer layers sloughing off. The base of the crown on the young plant is discolored and soft. This discoloration may be evident on the outside of the plant and may also show up in internal tissues if the crown is split open. Severely affected plants are not likely to survive. Less severely affected plants may survive but may remain stunted and low in vigor throughout the rest of the season.

Outlook: unfortunately, there are no controls for seed decay, seedling blights and crown decay in corn at this point. Warm, drier conditions that would favor corn growth would be the best thing right now. With good growing conditions, marginally affected plants might recover and take off. If stressful conditions continue, marginally affected plants may continue to decline and more plants may show symptoms. Also, although warm, drier conditions would be helpful; hot, dry conditions, especially with drying winds would not be helpful. Warm temperatures with drying winds could stress plants with poor root systems causing them to wilt, turn gray-green to brown in color and even die.

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Field Crop Disease Update - May 24, 2010

By Laura Sweets

Wheat: Leaf rust and stripe rust are showing up in some wheat fields especially in southwest Missouri. Conditions have also been somewhat favorable for Septoria leaf blotch. The wide range in wheat growth stages across the state makes it difficult to generalize on fungicide application. However, if fungicides are still being considered for the control of foliage diseases on wheat be sure to check the fungicide label for the preharvest interval or any growth stage restrictions on timing of application.

Symptoms of Fusarium head blight or scab tend to be most obvious up after flowering and before heads begin to turn or mature. Since the wheat crop is further along in southeast and southwest Missouri, symptoms of scab might be beginning to develop in fields in those areas of the state.

Corn: Seed decay, seedling blights and crown rot continue to be of concern in areas of the state which have been unusually cool and wet. See article in this issue of the newsletter.

Anthracnose leaf blight is also beginning to show up on young plants particularly in fields with corn on corn. See article in this issue of the newsletter.

Environmental conditions have been favorable for the development of crazy top but symptoms may not be evident until later in the season.

Soybean: Soybean planting is still somewhat behind normal because of wet conditions. In fields which have been planted Pythium damping-off and Phytophthora seedling blight could be problems.

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Weather Data for the Week Ending May 24, 2010

By Pat Guinan

Station	County	Weekly Temperature (°F)						Monthly Precipitation (in.)		Growing Degree Days‡	
		Avg. Max.	Avg. Min.	Extreme High	Extreme Low	Mean	Departure from long term avg.	May 1-May 24	Departure from long term avg.	Accumulated Since Apr. 1	Departure from long term avg.
Corning	Atchison	78	60	91	48	69	+4	3.45	0.00	544	+157
St. Joseph	Buchanan	75	58	87	47	66	+1	6.50	+2.65	514	+106
Brunswick	Carroll	76	59	91	49	68	+3	5.91	+1.92	560	+135
Albany	Gentry	76	57	89	46	67	+3	5.96	+2.40	492	+115
Auxvasse	Audrain	76	57	89	48	67	+2	4.52	+0.50	585	+154
Vandalia	Audrain	76	57	90	47	67	+2	4.80	+0.97	568	+168
Columbia-Bradford Research and Extension Center	Boone	77	56	90	45	67	+2	4.24	+0.18	557	+96
Columbia-Sanborn Field	Boone	77	58	90	46	68	+2	5.41	+1.36	654	+168
Williamsburg	Callaway	76	57	90	47	67	+2	3.82	+0.07	611	+195
Novelty	Knox	75	56	88	46	66	+2	5.01	+1.13	493	+95
Linneus	Linn	76	57	90	46	67	+3	6.08	+2.10	496	+111
Monroe City	Monroe	76	56	89	46	67	+2	4.36	+0.71	536	+112
Versailles	Morgan	79	57	91	46	68	+2	5.31	+1.10	644	+133
Green Ridge	Pettis	78	58	90	46	67	+1	5.08	+1.42	589	+149
Lamar	Barton	76	60	87	49	68	+1	6.36	+1.72	660	+137
Cook Station	Crawford	79	53	91	42	66	0	3.90	+0.06	612	+88
Round Spring	Shannon	80	54	91	45	66	+1	4.24	+0.04	623	+140
Mountain Grove	Wright	78	54	88	46	66	+1	6.02	+2.17	610	+162
Delta	Cape Girardeau	80	60	91	51	70	+1	4.06	-0.03	765	+142
Cardwell	Dunklin	84	62	93	54	72	+1	3.12	-0.60	919	+188
Clarkton	Dunklin	83	61	92	52	71	+1	3.32	+0.26	856	+152
Glennonville	Dunklin	82	61	92	53	71	+1	4.55	+1.47	875	+168
Charleston	Mississippi	80	61	90	53	71	+2	4.80	+1.23	851	+234
Portageville-Delta Center	Pemiscot	83	63	93	56	72	+1	6.47	+3.05	934	+218
Portageville-Lee Farm	Pemiscot	82	63	92	56	72	+2	7.24	+3.81	943	+238
Steele	Pemiscot	84	64	95	57	73	+2	7.14	+3.20	969	+247

* Complete data not available for report

‡Growing degree days are calculated by subtracting a 50 degree (Fahrenheit) base temperature from the average daily temperature. Thus, if the average temperature for the day is 75 degrees, then 25 growing degree days will have been accumulated.

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