Crop Solutions that Work

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Your May 2016 issue

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Spring burndown considerations

Spring is among us, and every spring results in the hustle and bustle of field operations occurring in a compressed amount of time. While the spreading of dry fertilizer is important, let's not forget the importance of timely herbicide burndowns. The warm winter with a cool spring has definitely caused some concerns when we think about this area of weed management.

The warm winter has allowed our winter annual weeds to germinate and flourish. Winter survival of these weeds was very good, and in many cases, continued growth occurred through the entire winter season. This mild winter has allowed our winter annuals, including marestail, to be at a later growth stage than normal. Due to this accelerated growth, marestail may begin bolting soon. Therefore, herbicide burndowns may need to occur very soon.

While the winter has been mild, the same is not true of this spring. It has been unseasonably cool for the first few weeks of April. We have experienced multiple morning frosts which can have a negative effect on herbicide uptake. Additionally, the cool temperatures can halt metabolism of the weeds. Weeds have to be actively growing for a systemic herbicide to be taken up by plants.

Marestail growth central IL 4-2-16

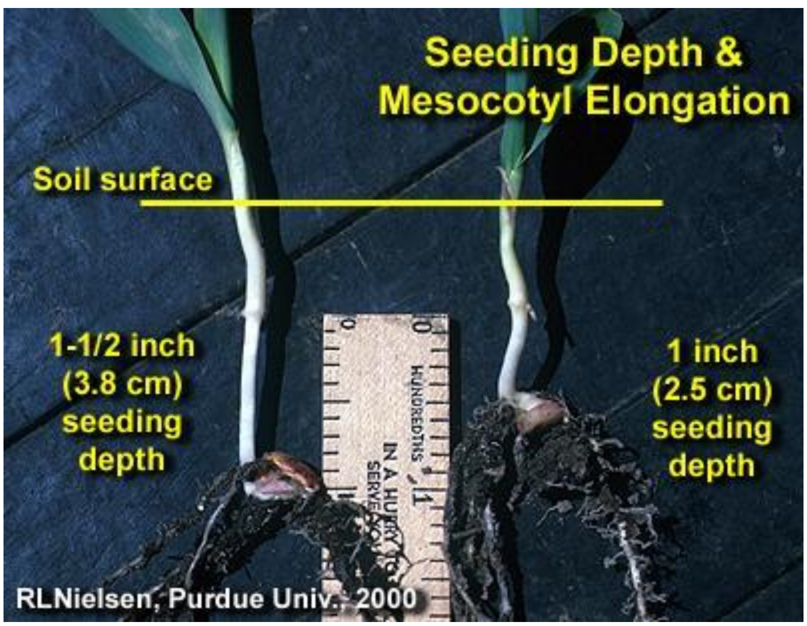
So, how do we manage these challenges? First, we have to wait for the weeds in our fields to outgrow the frost damage. This is especially important for summer annual weeds, such as giant ragweed, which don't tolerate frost well. This should only take a few days for tissue recovery. Next, we need to take a look at the forecast. Burndown herbicides are much more consistent if the nighttime temperatures stay above 5°C. Lastly, we need to make sure we are spraying small weeds and using multiple effective sites of action. If we follow these principles, we will be successful with our remaining burndown applications.

Corn Mesocotyl and Coleoptile

The corn plant mesocotyl; the structure between the corn seed and the crown, is responsible for pushing the coleoptile to the soil surface. The mesocotyl also serves as a temporary pipeline between the seed and the crown, until nodal roots begin development. Experiments have demonstrated that the mesocotyl may successfully push the coleoptile to the soil surface from a depth of six inches or more, although three inches is the maximum practical emergence depth for most soils.

Normal mesocotyl elongation can be affected by weather conditions, herbicides, fertilizers, diseases and insects. Growth regulator herbicides are known to cause "corkscrew" growth of the mesocotyl or may cause the mesocotyl to "hyper-elongate," causing the corn plant's crown to be positioned too shallow in the soil, or even above the soil surface. Other herbicides may burn the mesocotyl. Wide fluctuations in day-night temperatures can cause distorted mesocotyl and/or shoot growth. Diseases, like Pythium, often target the mesocotyl, as do insects, such as white grubs. Free ammonia or excessive salt concentration in the soil may burn the mesocotyl, causing it to develop a brown, dry appearance. If the mesocotyl is damaged or severed before nodal roots begin to function, the seedling usually dies.

The corn plant coleoptile contains the embryonic structures that will develop into the nodal root system and all above-ground plant parts. While the mesocotyl is rapidly elongating to lift the coleoptile to the soil surface, the coleoptile is also elongating at a much slower rate. When the tip of the coleoptile breaks the soil surface and is exposed to light in red wavelengths, mesocotyl elongation stops. This causes the crown (at the base of the coleoptile) to be positioned consistently at ½ to ¾ of an inch in depth. So, no matter how deep the corn was originally planted, the rooting node should always be within ½ to ¾ of an inch of the soil surface. At the same time, expanding leaf tissue splits the coleoptile sheath and leaf emergence takes place.



Crusted, compacted, or cloddy soils may have different effects on corn emergence, mostly affecting the coleoptile. If the developing coleoptile hits an obstruction, the mesocotyl continues to push and the coleoptile may split, causing the corn plant to leaf-out underground. Under these conditions, the mesocotyl may also swell as it continues to push. In cloddy soils, the coleoptile may sense light between the soil clods, causing the coleoptile sheath to split and leaves (plumule) emerge, only to have these newly emerged leaves run into more soil clods.

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One of the strangest growth effects occurs when corn is emerging in loose, fluffy soil, or where there is a deep, loose layer of crop residue. The mesocotyl continues to push the coleoptile until the coleoptile senses light. This positions the crown within ¾ of an inch of the surface. However, if the loose soil or residue later settles around the plants, this may leave the rooting node too shallow and rootless corn symptoms may develop. The same is true where erosion moves soil away from the rooting node. Use of 2,4-D as part of a burndown or pre-plant herbicide application can sometimes cause hyper-elongation of the mesocotyl or can cause distorted growth. Planting the corn too shallow may also cause the crown to be too close to the soil surface.

Useful Tip: When corn is seeded very shallow (less than about 1/2 inch), the crown of the coleoptile will naturally be closer to the soil surface, if not right at the surface. Subsequent development of the nodal root system can be restricted by exposure to high temperatures and dry surface soils.

Watch for Alfalfa Weevil early feeding

Rarely do we have to deal with alfalfa weevil damage to first cutting alfalfa because most of the weevil eggs are laid in the spring. Feeding by weevil larvae normally doesn't start in our area until about 300 heat units (base 9°C) is accumulated. First crop harvest in northern areas often takes place in time to reduce or eliminate the weevil threat. In southern areas, eggs may be laid in both fall and spring, and weevil activity starts early enough to seriously damage the first cutting.

As a general threshold, insecticide treatment may be advised when between 30 and 40 per cent of the stems show obvious feeding and there is an average of three or more larvae per stem, if at least seven to ten days remain before the crop can be harvested. This is a "static threshold" that does not account for varying value of the hay crop or differences in treatment costs.

Or, here is a different approach to the alfalfa weevil threshold, provided by Dr. John Tooker, assistant professor, Pennsylvania State University Department of Entomology. This table uses alfalfa height, value of the alfalfa hay, and cost of treatment to arrive at the number of weevil larvae, in a 30 stem sample, that will justify insecticide application (dynamic threshold).

Economic Threshold for Alfalfa Weevil

Number of Larve/30 stems

Plant Height (inches)

Value of Hay ($/ton)	12 to 18				18 to 24				24 to 30			
	$12	$14	$16	$20	$12	$14	$16	$20	$12	$14	$16	$20
120	68	79	91	114	75	87	100	124	78	91	105	130
140	59	68	77	99	64	75	86	107	67	78	90	112
160	51	60	68	86	56	65	75	93	58	68	79	98
180	45	53	60	77	50	58	67	84	52	61	70	87
200	41	48	54	69	45	52	60	76	47	55	63	79
220	37	43	49	63	41	47	55	69	42	50	57	72
240	34	40	45	58	37	43	50	63	39	46	53	66
260	31	37	42	54	35	40	46	59	36	43	49	61
280	29	34	39	50	32	37	43	55	33	40	45	56
300	27	32	36	47	30	35	40	51	31	37	42	53
320	26	30	34	44	28	33	38	48	29	35	40	49
340	24	28	32	41	26	31	36	45	27	33	37	46
360	23	26	30	39	25	29	34	43	26	31	35	44
380	22	25	28	37	24	27	32	41	24	29	33	42
400	20	24	27	35	22	26	30	39	23	28	32	39

Cost of Insecticide & Application Per Acre

Early alfalfa tip feeding and 1st instar weevil larvae

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Corn survival risks with early planting

Our number one concern with planting date usually is whether soils are warm enough to allow emergence of the crop. As this year again demonstrates, the calendar is an unreliable indicator for the best planting date.

For corn, we typically target minimum soil temperatures (four inch soil depth) between 10 and 12°C. Some agronomists prefer to see the soil temperature above 15°C. The soil temperature should be stable or rising. Remember that, early in the season, one cold rain shower can cause soil temperatures to plunge. Fortunately, improvements in early crop vigor, and use of certain seed treatments, have frequently allowed us to get by with early planting, or even profit by it.

Seed that is placed in a cool, moist environment will soak up (imbibe) moisture, even though it may not be warm enough to trigger germination. Some damage to cell membranes inevitably occurs during this process. Research has also shown that cell mitochondria may also be affected under these conditions. Rapid water uptake under cool conditions can reduce the protective nature of the seed coat, damage some embryonic cells and allow entry of seed-rotting pathogens. Usually, if warm soils allow the seed to germinate rapidly and the seedling continues rapid growth, the developing corn seedling can often repair the early damage and escape problems from these pathogens.

A similar situation exists for crops that successfully emerge and begin growth, only to be slowed by a later period of cool and/or cloudy weather. Root and stem pathogens find this to be ideal conditions for infection. Actually, any type of stress that slows growth or diverts resources away from growth can cause increased disease infection.

Another common effect associated with chilling injury of corn seed and seedlings is distorted growth. Corn seed that imbibes cold water will often exhibit varieties of distorted growth. The most dramatic effect is to have the coleoptile shoot curl back on itself or just grow the wrong direction. We often see the radicle or coleoptile fail to emerge, or emerge and then stop growing. In some cases, the coleoptile sheath will rupture prematurely, as if it hit a compaction layer. Be aware that it is not only cold moist soils that can cause early corn growth problems. Research has also shown that wide swings of approximately 30°F in day-night temperatures can also cause distorted growth.

Corn growth distortion caused by cool soils

Herbicides can injure corn seed or seedlings that are in cool, moist soils. A seed that germinates and grows rapidly can avoid a selective herbicide's harmful effects by metabolizing and breaking down the product. But, if emergence and growth is slowed by cool soil or air temperatures, the seed or seedling may be unable to effectively metabolize the herbicide, and injury results. Following corn emergence, a period of rapid growth allows equally rapid uptake of the selective herbicide. Then if a period of slowed growth (from cool or cloudy weather) intervenes, this can result in increased crop injury.

Effects of frost and freeze conditions on young corn

Air temperatures at or below -2°C for just a few hours can kill corn outright, even when the growing point of the corn is below ground. Air temperatures above -2°C have a variable effect on young corn. Frost injury to corn can actually occur at temperatures well above freezing.

When we have light frost occurrence, it typically shows up in bottom ground and lower parts of fields where the cold air has a chance to collect. It may also show up in fields protected by trees, since a light breeze can otherwise stir the air and prevent the cold air from collecting in one spot. Occasionally, frost injury is worse on high ground because this ground has better drainage and will lose stored heat faster than the moist lower ground. During very still, clear nights, exposed crop plants can rapidly give up their heat to the upper atmosphere, resulting in freeze injury to the plant tissue, even when recorded air temperatures are several degrees above freezing.

We often see tillage or soil moisture effects with frost. Light tillage or cultivation tends to open the soil to rapid heat loss. Dry soils also tend to rapidly give up stored heat. A thick layer of crop residue on the soil surface will insulate the soil. This sometimes prevents radiant heat from protecting the young corn as air temperatures drop. It is important to note that the net effect of variable terrain and soil conditions on the young corn can be drastically different, depending on the time and duration of the cold temperatures. Injury patterns in fields sometimes leave us scratching our heads until detective work helps explain what happened.

Frost injury on young corn plants typically has very little effect on yield. The growing point remains protected underground through growth stage V4. At V5 the growing point is right at ground level and by V6 it is above ground. Even after the growing point lifts above ground, it remains somewhat protected in the center of the rolled leaves. The growing point can be inspected by splitting the corn plant with a razor blade. A healthy growing point will appear firm. Dark or water-soaked tissue is a sign that the growing point may have been damaged and the field should be monitored closely for a couple of days to assess the level of damage.

Frost injury is usually evident within two days or less following the frost event. Damaged leaf tissue will initially appear pale, or water soaked, and flaccid. The damaged tissue will subsequently turn brown, or straw-colored. Assuming that the frost was not of duration or intensity to kill the growing point, new leaves will emerge through the damage. Mowing damaged corn has not been shown to accelerate the recovery from frost injury and is not advised. In fact, mowing may introduce pathogens to freshly cut leaf tissue.

Frosted corn plant beginning to show signs of recovery

Postemergence applications of herbicides may need to be delayed following a frost. Injury to the crop may make it sensitive to the herbicide, while injury to weeds may make them tolerant to the herbicide. Affected fields should be evaluated carefully until the crop resumes normal growth and at least one new leaf collar (corn) is visible.

For more information or discussion on any of the topics in this newsletter, please contact your local FS crop specialist.

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