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Corn & Soybean Science Group Newsletter

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Cooperating Departments: Agricultural Economics, Biosystems and Agricultural Engineering, Entomology, Plant and Soil Sciences, Plant Pathology
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In this Issue:

1. Timing of Postemergence Herbicides and Corn Growth Stage

J. D. Green and James R. Martin, Plant and Soil Sciences

The size of corn is often a critical factor in determining when it is safe to apply postemergence herbicides. Labels of postemergence herbicides often use plant height or growth stage (or both) when discussing timing of applications relative to corn growth. While this may sound simple, there is come confusion on how to determine height or growth stage of corn with respect to herbicide applications.

A common method for determining corn height is done by using free-standing plants. When checking individual plants, measure from the soil surface to the arch of the uppermost leaf that is more than 50% emerged. Because of the variability among corn plants in the same field, it is better to get an average from several plants than relying on just one plant. A temptation for some folks is to measure from the soil surface to the tip of outstretched leaves. The measurements by stretching leaves upward and measuring to the uppermost leaf tip often leads to a greater height than intended by the herbicide label.

The collar stage is another method used to determine the proper timing and method of application of many postemergence herbicides. Staging corn plants in their vegetative growth stage is usually done by counting the number of leaves that have visible collars. The collar is the part of the leaf that joins the leaf blade and leaf sheath and occurs as a discolored line. Collars are not evident until the leaves are well developed and emerged from the whorl; consequently, as you progress up the plant, count only leaves with visible collars and not the uppermost ones that are still in the whorl. For example, a plant may appear to have 5 leaves, but after close examination, it may have only three leaves with visible collars and would be considered in the V3 growth stage.

The first true leaf that emerges during seedling development is characteristically oval-shaped and is the reference point for counting leaves. Once plants reach stage V5 (5 leaves with visible collars), the leaf and ear shoot initiation will usually be complete and a small tassel is initiated in the stem apex tip (i.e. growing point). During tassel initiation, corn will be approximately 8 inches tall and the growing point will be just at or beneath the soil surface. Once plants reach V6, the growing point and tassel will be above the soil surface and the stalk elongation will be rapid. The growth of the stalk and nodal roots will eventually result in the tearing and deterioration of the lowest leaves, thus making it difficult to accurately determine the growth stage.

Staging corn plants that are beyond V6 is possible but may require some practice to become efficient. Dig a plant and cut the stalk lengthwise through the root area. Check for the first elongated internode, which is usually about one centimeter (0.4 inch) in length. The first node above this internode is generally connected to the 5^{th} leaf. Once the 5^{th} leaf has been determined, then use it as the reference point for counting to the uppermost visible leaf collar.

The use of drop nozzles can limit the risk of injury from certain herbicides, especially as the corn canopy develops. Directed applications help in some instances by keeping the herbicide from being intercepted in the top of the canopy where it can be funneled into the whorl and increase exposure to the growing point. This is particularly a problem with certain ALS-type herbicides such as Accent, Spirit, or Lightning. In cases involving contact herbicides such as Gramoxone MAX, the directed sprays must be fairly precise to limit the amount of contact with the corn plants.

The recommended timings for several postemergence herbicides used in field corn can be found in University of Kentucky Extension Bulletin “Weed Control Recommendations for Kentucky Farm Crops-2005” (AGR-6). Always check the product label for specific directions.

Table 1. Timing of Postemergence Herbicides Relative to Corn Growth Stage.

Herbicide	Recommended Ranges or Maximum Corn Heights / Growth Stages
Accent	Broadcast up to 20" tall or 6 collars (V6). Apply with drop nozzles when corn is between 20" to 36" tall. Do not apply when corn exceeds 30" tall or has 10 or more collars.
Accent Gold	Up to12" tall or 6 collars (V6), whichever is more restrictive.
Aim	Up to 8 leaf collar (V8).
Atrazine	Up to 12" tall.
Basis Gold	Up to12" tall.
Beacon	Broadcast between 4" to 20" tall. After corn is 20" tall or exhibits more than 6 collars (whichever occurs first) use directed applications. Apply before tassel emergence.
Callisto	Broadcast on corn up to 30" tall or up to the 8-leaf stage stage of corn growth, whichever occurs first.
Celebrity Plus	Broadcast 4" to 24" tall.
2,4-D	Broadcast before corn exceeds 8" tall. Use directed applications when corn is >8" tall and before tassel emergence.
Dicamba [Clarity, Banvel, etc.]	8 to 16 oz/A rate: Apply from emergence through 5^{th} leaf stage or 8" tall, whichever is more restrictive. 8 oz/A rate: Apply when corn is 8” to 36" tall, if 6^{th} true leaf is emerging, or 15 days before tassel emergence. Use directed applications: 1) corn leaves limit spray coverage of weeds, 2) sensitive plants are nearby, or 3) tank mixing with 2,4-D.
Distinct	6 oz/A rate: Corn 4" to 10" tall. 4 oz/A rate: Corn 10" to 24" tall.
Equip	Broadcast on corn when in the V1 through V4 growth stage, whichever is more restrictive. Use drop nozzles for applications when corn is greater than V4 and less than V8 growth stage.
Exceed	Broadcast between 4"and 30" tall. To limit injury apply with drop nozzles when field corn is >20" up to 30" tall or exhibits more than 6 collars V6, whichever occurs first.

Table 1. Timing of Postemergence Herbicides Relative to Corn Growth Stage (continued).

Herbicide	Recommended Ranges or Maximum Corn Heights / Growth Stages
Expert (RR-corn ONLY)	Up to 12" tall corn
Gramoxone Max	Apply only as a **DIRECTED** treatment after smallest corn is 10" tall. **Do not** apply broadcast over-the-top of corn.
Hornet WDG	Broadcast from corn emergence (spike stage) up to 20" tall or V6 stage, whichever occurs first. Use drop nozzles for corn 20" up to 36" tall.
Liberty (LL-corn ONLY)	Broadcast on corn up to 24" tall or 7 collars (V7), whichever comes first. Apply with drop nozzles for corn 24 to 36" tall.
Liberty ATZ (LL-corn ONLY)	Up to 12" tall.
Lightning (Clearfield-corn ONLY)	Broadcast on corn up to 20" tall; Use drop nozzles if corn is >20" tall or has 6 or more collars (V6), whichever is more restrictive. Do not apply within 45 days of harvest.
Marksman, etc	Through 5th true leaf stage or 8" tall, whichever occurs first.
Option	Broadcast on corn when in the V1 through V6 growth stage. Use drop nozzles when corn is >16" and less than V8 growth stage.
Permit	Spike through layby stage of corn.
ReadyMaster ATZ (RR-corn ONLY)	Up to 12" tall corn
Roundup WeatherMAX or Glyphosate 4S (RR-corn ONLY)	Through V8 stage or 30" tall whichever occurs first. For “Roundup Ready 2 Corn” hybrids drop nozzles can be used to direct applications on corn 30” to 48” tall.
Spirit	Broadcast on corn between 4" to 24" tall. Use drop nozzles when field corn is 20" to 24" tall or exhibits more than 6 collars (V6), whichever is more restrictive.
Steadfast	Apply to corn up to 20" tall or exhibiting 7 collars (V7), which is more restrictive.
Steadfast ATZ	Apply to corn up to 12" tall or exhibiting 7 collars (V7), which is more restrictive.

2. Higher Yields – A Fixture in Kentucky?

Dennis B. Egli, Plant and Soil Sciences

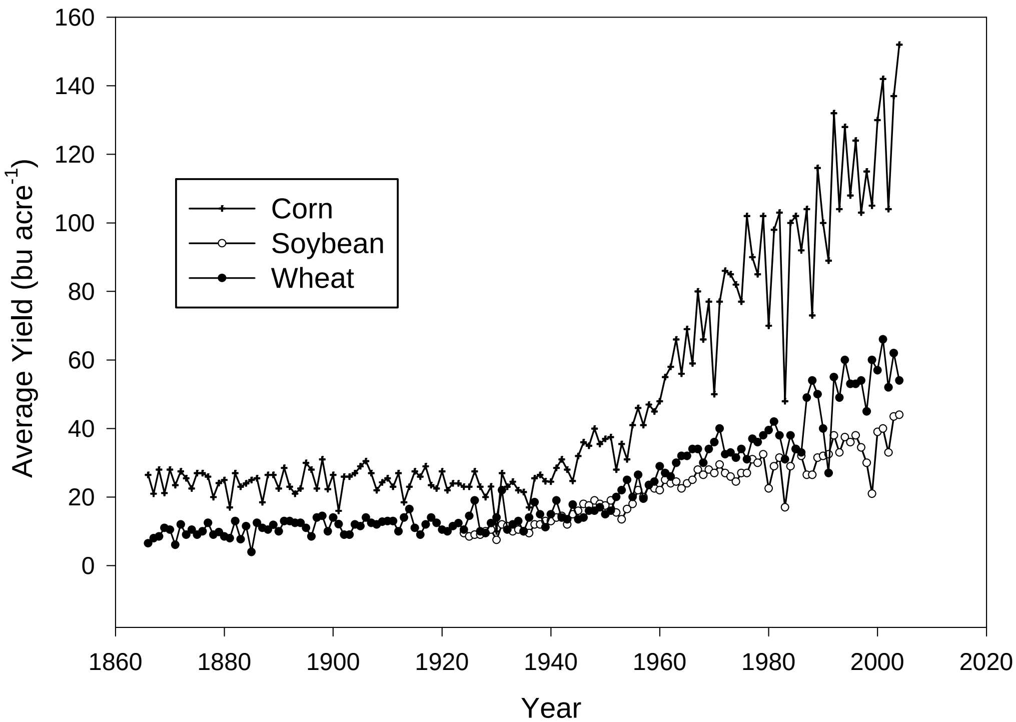
Most Kentucky farmers expect crop yields every year to be higher than the year before. Such expectations may seem unreasonable to some, but they do have a solid basis in fact - average state corn, soybean and wheat yields have been increasing steadily, when the weather cooperates, for the last 50 years or so (Figure 1). Bad weather or disease may interrupt this trend (Southern Corn Leaf blight epidemic in corn in 1970, for example, or drought in 1983), but assuming that next year’s yields will be records has been a pretty good bet for at least the last half century - but not always.

Betting on higher yields from 1886 (the first year data were reported by the National Crop Reporting Service) through about 1940 – roughly 75 years – would have been a terrible idea. Yields were the same in 1940 as they were in 1866 (Figure 1) - talk about a major yield plateau! Today’s farmers would not be happy if their yields were the same as their grandfathers.

Agriculture before the middle of the last century was a fairly low-input system – similar to what many would refer to today as sustainable or agro-ecologically based agriculture – rotations involving forage legumes were probably common, few farmers used inorganic fertilizers or pesticides and genetically improved plant varieties were generally not available. Productivity was maintained for 75 years with this system, but it did not increase.

Something drastic happened in the middle of the twentieth century and the yield of corn, wheat and soybean started up. New technologies from the Land Grant Universities and industry were applied to agriculture - plant breeders were busy producing new, higher-yielding varieties, hybrid corn was finding its way to the farmer’s fields and the use of N fertilizer and pesticides was more common. This massive application of technology ended yield stagnation and started productivity on an upward trend that continued through the beginning of the 21st century. The contrast between the two systems could not be more dramatic – in 2000 twice as much grain was produced in Kentucky on half as many acres as in 1900. Modern technology makes it possible to produce the large quantities of food and fiber needed by a growing population and to also protect the environment by using only the soils best suited for crop production.

Figure 1. **Average state corn, soybean and wheat yields in Kentucky reported by the National Agriculture Statistics Service *(www.usda.gov/nass/) from 1866 to 2003.**



3. Sidedressing Nitrogen in Corn

Lloyd Murdock, Plant and Soil Sciences

Sidedressing is the best way to assure the most efficient use of nitrogen (N) fertilizers and to also assure an adequate supply of N is available when the plant needs it. Sidedressing works because young corn (6 to 7 weeks after planting) needs only about 5 pounds of N per acre. In fact, the N requirement of corn doesn't begin to increase rapidly until the corn is between knee high to waist high. A small amount of N applied early is sufficient until this stage of growth.

The effectiveness of and the amount needed for sidedressed N is dependent on soil type. Soils that are not well drained will lose about 35 lbs/ac of N if the N fertilizer is applied before planting. On extra wet years, it will be more. In 2004 it was about 50 lbs/ac. These soils are the most responsive to sidedressing and N rates can be substantially reduced by sidedressing. If two-thirds or more of the N is applied 4 to 6 weeks after planting, the total N can be reduced by 25 to 50 lbs. of N/acre. On well-drained soils, there is little or no advantage to sidedressing. N applied at planting is just about as efficient as sidedressed N since these soils loss were little N. Although sidedressing is still a good practice on these soils, the nitrogen rates can not be reduced since little or no N is lost. In 2005, heavy rains early in the season resulted in 50 lbs/ac of N lost for N applied at planting on a somewhat poorly drained soil and no nitrogen was lost on a well-drained soil about 2 miles away with the same rains.

Although sidedressing N is usually applied to the corn crop when it is small, due to equipment restrictions on taller corn. It can be effectively applied to much taller corn. Even if no N is applied at planting, yield losses are little or none if the corn is properly sidedressed when the corn is knee high, or a little above. The yields will still be 70-80% of its potential if the N is not applied until tasseling. So timing of application is mostly determined by equipment restrictions rather than plant timing needs.

The method of sidedressed applications is influenced by the tillage used, type of N fertilizer and distribution of N. The distribution of N is almost always better with the use of a row applicator such as that used with anhydrous ammonia or UAN. A pneumatic applicator is also more accurate than a spinner spreader. Distribution becomes more important as the nitrogen rate is lowered to the optimum rate without higher "insurance levels". Therefore the method of distribution becomes more important.

Sidedressing with a row applicator that injects the nitrogen is the most efficient and results in better crop performance than the other methods, if the crop is no-tilled or has a lot of residue on the surface. Injecting the N reduces the N lost due to nitrogen being immobilized (tied-up) by the bacteria that is decomposing the residue. Injecting N below the soil surface increases the N efficiency by 10 to 15%. It also prevents volatilization losses from fertilizers containing urea (UAN). If urea is broadcast on the surface at sidedress without a rain within 5 to 7 days, then 10 to 15% of the N may be lost in no-till situations. The losses can be higher or lower. A rain or tillage within 2 days after application prevents a loss. The addition of Agrotain to urea or UAN for surface application greatly reduces the changes of N loss by volatilization.

If the soil surface has very little residue on the surface, the chances and amount of N loss from fertilizers containing urea are greatly reduced and precautions to reduce this loss are not necessary.

This has been a dry spring so the amount of N loss that we usually expect from soils that get saturated with water after the preplant N was applied has not occurred. Therefore, higher preplant N rates will probably result in over application of N to this year's corn crop due to the unexpected drier weather. This is money that would have been gained by sidedressing.

Sidedressing is the most efficient method of N application on soils that are not well-drained.

4. Soybean Stands for Maximum Yield

Chad Lee and James Herbek, Plant and Soil Sciences

Determining the stand of soybeans soon after emergence will help a producer know if enough plants are present to produce maximum yields. Table 1 helps producers make accurate stand counts. Producers should make five or more counts across a field to determine an average plant population. If the stands are not uniform then you will need to estimate the stand in the areas of the field where populations are low. In addition, you must determine how much of the field has the low population.

Soybeans are able to compensate for wide ranges in plant population. For example, our recommendations for soybean populations range from 104,000 to 179,000 plants/acre depending on row width. However, numerous studies indicate that uniform, final stands near 100,000 plants/acre will produce maximum yields in most row widths.

Yield losses for uniform stands of 75,000 plants/acre were often as little 5% in Missouri[1] and between 5 and 15% for Kentucky. Yields do not drop drastically until soybean populations are below 50,000 plants/acre. Yield losses in Missouri were projected to be little as 13% for soybeans in 7-inch rows at a uniform stand of only 40,000 plants/acre[1]. In Kentucky, yield losses were 25% for full season soybeans in 15-inch rows at a uniform stand of 34,000 plants/acre. Yield losses increased to 40% for short-season or doublecrop soybeans. Populations below 20,000 plants/acre caused yield losses around 40% for full season soybeans and near 60% for double crop soybeans in Kentucky.

After estimating the yield of the existing stand, you will need to consider when you can replant. There is usually a 1.5% per day yield loss when planting is delayed past June 10 in Kentucky. For example, if replanting could not occur until June 30, then there would be an expected 30% yield loss for the replanting delay[2]. If the existing stand were about 40,000 plants/acre, then the expected yield loss would only be about 25%. In this case, yield losses from the poor stand and from replanting would be similar. Once the cost of replanting was considered, replanting probably would not pay.

Replanting Roundup Ready soybeans will cost about $24.00 per 50-lb bag of seed. This seed price does not include the technology fee, which is waved by some seed companies for replanting. Depending on the targeted seeding rate, the cost per acre is likely around $24.00/acre to replant. Once fuel, equipment and labor costs for replanting are included, the cost for replanting may approach $30.00/acre. Any yield losses from a surviving stand of soybeans would need to cost more than $30.00/acre before replanting should be considered. Additionally, replanting would need to produce a high enough yield to at least break even for replanting. At $6.50 per bushel in this example, a replanting would need to gain at least 4.6 bushels/acre to break even.

For more information about replanting soybeans or to have someone help evaluate your situation, contact your county extension office.

Table 1. **Estimated soybeans per acre for various row widths.**

	Row Width (Inches)					**Row Width (inches)**		
Soybeans Per Foot of Row[1]	**36**	**30**	**20**	**15**	**Total Number of Soybeans in 40 Feet of a Row[2]**	**7.5**	**7**	**6**
	Estimated Plants/Acre					**Estimated Plants/Acre**		
0.5	7,260	8,712	13,068	17,424	5	8,712	9,340	10,890
1.0	14,520	17,424	26,136	34,848	10	17,424	18,679	21,780
1.5	21,780	26,136	39,204	52,272	15	26,136	28,019	32,670
2.0	29,040	34,848	52,272	69,696	20	34,848	37,358	43,560
2.5	36,300	43,560	65,340	87,120	25	43,560	46,698	54,450
3.0	43,560	52,272	78,408	104,544	30	52,272	56,037	65,340
3.5	50,820	60,984	91,476	121,968	35	60,984	65,377	76,230
4.0	58,080	69,696	104,544	139,392	40	69,696	74,716	87,120
4.5	65,340	78,408	117,612	156,816	45	78,408	84,056	98,010
5.0	72,600	87,120	130,680	174,240	50	87,120	93,395	108,900
5.5	79,860	95,832	143,748	191,664	55	95,832	102,735	119,790
6.0	87,120	104,544	156,816	209,088	60	104,544	112,074	130,680
6.5	94,380	113,256	169,884	226,512	65	113,256	121,414	141,570
7.0	101,640	121,968	182,952	243,936	70	121,968	130,753	152,460
7.5	108,900	130,680	196,020	261,360	75	130,680	140,093	163,350
8.0	116,160	139,392	209,088	278,784	80	139,392	149,432	174,240
8.5	123,420	148,104	222,156	296,208	85	148,104	158,772	185,130
9.0	130,680	156,816	235,224	313,632	90	156,816	168,111	196,020
9.5	137,940	165,528	248,292	331,056	95	165,528	177,451	206,910
10.0	145,200	174,240	261,360	348,480	100	174,240	186,790	217,800
10.5	152,460	182,952	274,428	365,904	105	182,952	196,130	228,690
11.0	159,720	191,664	287,496	383,328	110	191,664	205,469	239,580
11.5	166,980	200,376	300,564	400,752	115	200,376	214,809	250,470
12.0	174,240	209,088	313,632	418,176	120	209,088	224,148	261,360

[1] For soybeans in row widths of 36, 30, 20 and 15 inches, determine the number of soybeans per foot of row. To determine soybeans per foot of row, count the number of soybeans in 10 feet of a row and divide the number of soybeans by 10. Match the soybeans per foot of row to row width you are using to determine the estimated plants/acre.
[2] For soybeans in row widths of 7.5, 7, and 6 inches, determine the total number of soybeans in 40 feet of a row. Better estimates are made when 10 feet of four separate rows are counted. Match the total number of soybeans counted to the row width you are using to determine the estimated plants/acre.

References

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5. Crop and Pest Management Field School

J.D. Green, Plant and Soil Sciences

The Crop and Pest Management Field School for private consultants, agribusiness professionals, and producers is scheduled for June 30, 2005 from 8:30 am to 4:00 pm at the UK Agronomy Research Farm near Lexington, Kentucky. Topics to be covered include: Herbicide Symptomology on Grain & Horticultural Crops; Weed Identification; Insect Problems, Identification, & Management; Corn Growth and Development Stages; Soybean Production, Soybean Rust, & Other Foliar Diseases; and Phosphorus Losses in Agricultural Soils.

Preregistration of $10.00 is requested by June 17 to participate in this training program. This educational training session has been approved for Certified Crop Advisers credits (3 hrs Pest Management, 2 hrs Crop Management, and 1 hr Soil & Water) and Pesticide Applicator Training recertification (4 hours) in categories 1A, 10, and 14.

The UK Agronomy Research Farm (Spindletop) is located at 3250 Ironworks Pike (Hwy 1973) on the north side of Lexington between Newtown Pike (Hwy 922) and the Kentucky Horse Park. The preregistration form is linked at the Agronomy Extension website: http://www.uky.edu/Ag/Agronomy/Extension/.

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