BETWEEN THE ROWS

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HYBRID OBSERVATIONS AND YIELD ESTIMATES
KERNELS — IT'S MORE THAN NUMBERS

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CURRENT CROP SITUATION

Field reports and observations of hybrids indicate some growers are reporting shallow appearing kernels and tip die back (kernel abortion on ear tips) in some areas. Other reports are of outstanding yield potential and excellent ear appearance. These reports indicate the varied condition of the maturing crop. Significant weather events have impacted the growing crop both positively and negatively. Several factors can negatively impact the ear appearance during grain fill. Factors that limit photosynthesis can reduce yield and cause less than desirable ear appearance. This is not a new observation as this occurs in most years. This year in addition to continued leaf disease development, two of the most likely factors limiting photosynthesis are N supply and warm night temperatures which increase plant respiration.

FACTORS IMPACTING PHOTOSYNTHESIS

Photosynthesis produces sugars that are translocated to the developing kernels. When there are limiting factors to photosynthesis, the sugar produced will not adequately supply the needs of all the kernels. Photosynthesis requires light, water and nutrients, and carbon dioxide. Carbon dioxide is not limiting, but other factors can be. High plant population is designed to intercept the maximum amount of sunlight per acre. This usually means that each individual plant receives less light due to shading caused by the adjacent plants. A slight reduction in light per plant could impact the fill of each ear. However, the high population could result in the maximum yield per acre as research data suggests. An extended period of cloudy days reduces the light intensity received by each plant. Reduced light intensity limits the amount of photosynthesis and less sugar is produced.

Water and nutrient uptake can be limiting. We are well aware of the impact drought can have on corn performance. Serious drought conditions at pollination will have a large impact on yield. Late season dry weather has less impact but can still reduce yields. Reduced nutrient uptake during grain fill can be a limiting factor as well. Because of the heavy rains and saturated soils, increased N loss can cause low soil N levels. Low N uptake can impact the number of kernels set and amount of sugars available to fill each kernel. Leaf N deficiency symptoms that occurred at or prior to pollination is the best clue that soil N may be limiting. When stress conditions occur during the first two to three weeks after pollination, the result is the tip kernels being aborted. The tip kernels are last on the priority list during grain fill. When stress occurs later, yields are reduced through smaller or reduced weight kernels instead of aborting tip kernels.

THE IMPACT OF TEMPERATURE

Grain fill is influenced by temperature. Warm daytime temperatures (86 degrees F.) are very beneficial to photosynthesis. However, warm night time temperatures are usually detrimental to corn performance. Respiration is a metabolic process that occurs in plants all day and all night, and consumes some of the sugars produced during photosynthesis. Night time respiration under warm conditions utilizes larger quantities of sugars and robs them from being used to fill the developing kernel.

YIELD OBSERVATIONS

Yield observations or yield estimates need 3 components measured in order to determine a performance estimate: number of harvestable ears per acre, number of kernels per ear, and kernel weight. The first two components can be obtained through field counts to determine an average ear population and kernels per ear. The kernel weight is difficult to estimate and an average number of kernels per bushel is used in many calculations. The final kernel weight is not determined until black layer is formed. Many calculations use 90,000 kernels per bushel.

Observations at the dent stage of growth that only report a shallow appearing kernel leaves out the other two important components in yield estimation. If you compare the appearance of ears during grain fill, do not leave out observations on population or kernels per ear as all impact the yield performance. Hybrids with more ear length and slimmer cob will look quite different when compared to hybrids with more girth (more kernel rows) and a larger cob. More beneficial observations during grain fill are plant populations, plant health and disease tolerance, insect presence, stalk integrity, and the presence of ear or kernel molds.

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USING YIELD ESTIMATES ON A WHOLE FIELD BASIS

Some growers routinely make whole field yield estimates for grain marketing purposes or to determine estimated storage needs. A common method used is the Yield Component Method. This method is popular because it can be used well ahead of harvest (R3 milk stage or beyond) and the components measured are from actual field samples. The calculation for estimating yields is as follows: number of kernels/ear (i.e. 16 rows around X 34 kernels long = 544 kernels) X number of harvestable ears/ac divided by kernels/bu = estimated bu/acre. This calculation is best used for whole field estimates. It is not useful for hybrid comparisons because the k/bu factors for each hybrid is different and is unknown at the time the estimate is made.

The first two components (number of kernels/ear and number of harvestable ears/ac) are easily measured in the field. However, crop uniformity greatly influences the accuracy of this estimate. A less uniform field would need more samples counted to ensure a fair representation is obtained. The third component of kernels/bu (actually kernel weight) cannot realistically be measured until maturity (black layer). Consequently, an average value of 90,000 kernel/bu is used in the yield estimation equation.

Example: 16 rows X 34 k long =544 k/ear X 34 harvestable ears per 1/1000th ac divided by 90 (represents 90,000 k/ 56 lb bushel) = 205.5 bu/ac estimated yield.

The 90,000 k/bu represents the average number of kernels in a 56 lb bushel of corn. Unfortunately, this number can vary significantly due to hybrid differences in kernel size and shape and environmental differences impacting grain fill. Because of this variation, the yield estimate may only be accurate within plus or minus 25-30 bu/ac.

To improve accuracy, the 90,000 k/bu factor needs fine tuning. Since individual hybrids have various kernel sizes and shapes, an individual factor for each hybrid may be useful and could improve the accuracy of some estimates.

Wyffels research has developed a factor for k/bu for each hybrid on the chart below. It is based on replicated yield trials in 2006-2009 that also had grain samples obtained for each hybrid and kernel weights determined. These kernel weights were compared to actual yields. This factor can be substituted for the 90 (90,000 k/bu) for each individual hybrid. Not all hybrids have a factor calculated. A few are estimated based on expected kernel size. Remember that environmental conditions can also impact kernel weight, so this estimate is only as good as the representative ears counted and the k weight assumed. The yield factors in the chart are based on replicated trials typically yielding 200 bu/ac plus. So are best used for that yield level. Estimating fields with lower yields may require a higher factor (more k/bu). Other factors of whole field yield can also be subtracted if field conditions indicate losses at the combine or in handling.

Example calculation:

These steps are to be repeated in several representative areas of a field.

1. In one row measure off 1/1000th of an acre. For 30" rows this is 17' 5".
2. Count and record the number of harvestable ears in this area. Do not count small ears that the header may miss or ears not harvestable due to lodging.
3. Sample every 5th ear and count the number of rows around and number of kernels long to determine the number of kernels per ear. Sample up to 5 ears at each area sampled. Do not count extremely large butt kernels or small tip kernels. Record the average number of kernels per ear.
4. Calculate kernels per acre by multiplying ear population per 1/1000th of an acre X average kernels per ear.
5. Divide the kernels per 1/1000th acre by 90 (represents 90,000 k/bu)
6. For individual hybrids, substitute the new factor from the chart below. If the hybrid sampled was W6261, use 86.2 instead of 90.

Calculations:

2. number of ears in 1/1000th acre = 34
3. 16 X 34 = 544
   16 X 36 = 576
   18 X 34 = 612
   18 X 36 = 648
   16 X32 = 512

   2,892 divided by 5 = 578 k/ear
4. 34 ears per 1/1000th of an acre X 578 k/ear = 19,652 kernels per 1/1000th acre.
5. 19,652 k per 1/1000th ac divided by 90 = 218.4 bu/ac estimate
6. If the hybrid = W6261, use 86.2
   19,652 k per 1/1000th ac divided by 86.2 = 228.0 bu/ac estimate

YIELD FACTOR

W1721	88.5*	W5641	87.8
W1831	88.0*	W6261	86.2
W1941	86.0	W6440	84.0*
W1953	86.0	W6454	95.3
W2329	87.8	W6526	87.8
W2681	89.6	W6927	90.0*
W2751	82.0*	W6871	74.1
W2849	84.5*	W7071	73.4*
W3629	79.3	W7251	72.1
W3730	84.5	W7381	82.0
W3944	78.6	W7644	81.5
W4179	85.0*	W8253	76.6
W5051	86.7*	W8361	87.0
W5159	88.7	W8437	85.0*
W5281	92.4	W8681	82.2
W5568	90.1*	W9121	77.9

* = limited data; this number is estimated and is subject to change