Estimating Corn Yield Based on Yield Components

Corn is one of the most important crops grown in the US. American farmers grow almost a billion acres of this crop each year with most of the production occurring in Midwestern states, but at least some corn is grown in all 50 states. The average corn field will produce 180 bushels per acre with each bushel weighing 56 pounds. About 99% of corn grown in the US is from hybrid seed. Hybrid seed is created by mating two unrelated parents. This provides the offspring with hybrid vigor with the potential of producing higher yields than inbred varieties.

Grain yield is usually the most important and complex improvement goal in most corn breeding programs. There are several pathways by which yield is achieved. Plant breeders often use these pathways called **yield components** to indirectly select for plants with high yield potential. The most useful yield components are highly heritable and easily measured. Yield components are unique to each crop species. For example, pod size and seed size in soybean, number of kernels per head in wheat, number of seeds per boll in cotton all contribute to yield. For corn, one of the most useful yield components is kernels per ear, also known as a cob.

In this exercise, we will demonstrate how corn yield can be estimated by counting the number of kernels on an ear of corn. This skill is useful for not only plant breeders, but also those needing an estimate of what the yield potential of the corn crop might be such as commodity traders, crop insurance adjusters, and grain elevators to plan for how much corn will need to be stored and shipped. The method most commonly used involves yield components such as number of ears per acre, number of kernel rows per ear, number of kernels per row, and weight per kernel. The first three yield components (ear number, kernel rows, kernels/row) are easily measured in the field. Because we can't take you to a corn field today, we will have to make some assumptions.

Assumptions:

1. **Weight per kernel** - kernel weight is affected by moisture content of the grain, growing conditions and hybrid genetics. Kernel weight can vary from as much as 65,000 kernels to as little as 100,000 kernels per 56-pound bushel. We will assume the kernel weight is 90,000 per 56-pound bushel.
2. **Ears per acre** - most commercial hybrid corn in the US grows one and sometimes two ears per plant depending upon the plant population density. We will assume each plant only has one ear. The usual distance between rows upon which corn is planted can vary from 12 to 38 inches, but a common row width is 30 inches. So if we assume seeds are planted at such a rate that we have one plant every 7 inches along the row, this should give us a final plant population of 29,870 per acre which equates to 29,870 ears per acre.

Measure:

1. **Kernels per ear (cob)** – count the number of rows of kernels on the cob (FYI: corn always has an even number of kernel rows and usually it is 16 rows). Then count the

number of kernels per row. Do not count the kernels that are small or misshapen. Do not count the extreme end of the corn. Stop counting a kernels within a row once it appears that there is no longer a ring.

Calculate:

1. Multiply the number of rows by the kernels within a row. The product will be the number of kernels per ear.
2. Multiply the number of ears per acre by the number of kernels per ear. The product will be the number of kernels per acre.
3. Divide the number of kernels per acre by the number of kernels per 56-pound bushel. The quotient will be the bushels of corn grain per acre.

Example using our assumptions:

1. Measured kernels per ear: 16 rows x 28 kernels per row = 448 kernels per ear (Figure 1)
2. 29,870 ears per acre x 448 kernels per ear = 13,381,760 kernels per acre
3. 13,381,760 kernels per acre / 90,000 kernels per bushel = 148.7 bushels per acre

Figure 1. This ear has 16 rows of kernels and 28 full kernels per row.

Discussion Questions:

1. Why are yield components important to plant breeders?
2. Besides the number of kernels per ear of corn, what other factors can affect corn yield per acre?
3. If a corn breeder created a new corn hybrid with the same number of kernels per ear in a plant density of 40,000 plants per acre as an older hybrid at 30,000 plants per acre, how much yield have they improved yield potential with the new hybrid?