UNIVERSITY OF DELAWARE
COOPERATIVE EXTENSION

Estimating Yield Goal for Crops

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Introduction

Many crop management decisions require farmers or their agronomist, crop consultant, or nutrient consultant to make an estimation of the expected yield from a given field. Farmers recognize that yields for the same crop are variable from field to field and that a given crop cannot be expected to produce a consistent yield across the entire state.

Climate, crop genetics, crop management (intensity as well as management skill level), and the physical and chemical properties of soils have significant effects on crop yield. Soil conditions vary considerably from farm to farm and field to field; conditions can actually vary even within an individual field. In addition, advances in crop genetics (e.g., increased drought and pest/disease resistance) can increase yield potential for field crops from 0.5–2 bu/A annually, depending on the crop. For these reasons, it is important for the grower to establish a realistic yield goal for each field each year to project production costs, promote farm profitability, and protect environmental health. The purpose of this publication is to outline the proper methods for estimating yield goals.

Why Use a Realistic Yield Goal

The primary reason for using realistic yield goals is **economics**. Yield goals are necessary if growers are to control their unit cost of production to improve farm profitability. Several production decisions, including crop species selection, seeding rate, and fertilizer recommendations, are directly impacted by the yield goal. For example, crop species selection is strongly influenced by yield goals. On fields that cannot be irrigated, the choice between growing dryland corn and grain sorghum frequently rests with the expected yield from the field. If the farmer has determined that a given field has a realistic yield goal of 100–120 bu/A for dryland corn, corn should be the crop selected. However, the crop of choice should be grain sorghum in rotation with soybeans if the realistic yield goal for corn is <100 bu/A. For fields with realistic soybean yield goals of less than 15 to 20 bu/A (perhaps due to soybean cyst nematode infestation or frequent drought conditions), farmers should again consider a crop rotation with a non-host, drought-tolerant crop, such as grain sorghum.

Another production decision affected by the yield goal is plant population. On droughty soils, reduced seeding rates are used to improve crop drought tolerance when irrigation is not available. For example, reasonable planting populations for irrigated corn would be 30,000–34,000 seeds per acre. Populations could be reduced to 24,000–28,000 for dryland corn. Elements like weather, environment, and soil factors should be considered when determining planting populations. Planting population directly affects production costs both through seed costs and through final yield levels attained.

Yield goals also directly influence the amount of nitrogen (N), phosphorus (P), and potassium (K) applied to the crop. With the exception of N, nutrient recommendations for macro- and micronutrients are based on the results of a soil sample analysis and expected yield goals (P and K). If yield goals are too high, the grower may spend money on fertilizer that is not needed. Fertilizer use can be a large part of the projected cost of production. If yield goals are set too low for the crop, the recommended nutrient rates will not be sufficient to produce the maximum economic yield, and again farm profitability will be reduced.

A second important reason for using yield goals is the **environment**. If yield goals are too high, growers could mistakenly apply too much N or P as commercial fertilizer or manure. The use of N and P in excess of crop needs not only wastes money but also increases the potential for N or P to move off-site during erosion, runoff, or leaching events. Nutrients that move from the root zone of the plant can pollute local water bodies and groundwater.

A third reason for using realistic yield goals is **successful marketing**. Since yield goals strongly influence production practices, they have a direct impact on a grower's projected cost of production. Decisions that involve forward contracting, futures options, and other marketing tools depend on accurate anticipated costs of production. Farm profitability is directly influenced by marketing decisions.

Available Methods for Estimating Yield Goal

While there are a number of methods available for setting realistic yield goals, Delaware growers are required by state law for any operation under a nutrient management plan (i.e., where nutrients are applied to 10 or more acres) to use the *optimal rolling average method* for determining yield goal, unless data is not available.

With the optimal rolling average method, the farmer uses the field yield averages for the past seven years and then drops the lowest three yields. The remaining four highest yields are averaged to provide the estimated yield goal (Table 1). It is important to note that due to crop rotations, the last seven years of data for a specific crop may not be from consecutive years.

Table 1. Estimated yield goal for corn and soybean using the optimal rolling average method where the top four of the last seven years of yield data were averaged for each crop.

Year	Corn Yield	Soybean Yield
1	142	~~36~~
2	~~98~~	42
3	~~127~~	44
4	~~138~~	~~38~~
5	~~76~~	~~29~~
6	149	48
7	139	~~32~~
Yield Goal	**142**	**43**

The optimal rolling average approach usually results in a moderately optimistic yield goal because the low yields from bad years are dropped from the yield goal calculation. This method is ideally suited for progressive growers who use a high-yield-in-place management system. With this system, growers use every available management technique to ensure maximum yields if weather conditions permit.

In the absence of seven years of data for a crop, a Delaware certified nutrient consultant can use best professional judgement to assign a realistic yield goal. Under this circumstance, we recommend applying one of the following methods to estimate the realistic yield goal until such time that seven years of yield data are available.

1) Use an adjusted average of any existing yield data for the field. If there is any yield data available for the selected crop grown in the field, these yield values can be averaged and increased by 1-2 percent. This adjusted average yield goal generally accounts for a realistic annual rate of increase in productivity of agricultural crops.

2) Use yield data from a neighboring field with similar soil types. This is a relatively easy method to use if accurate farm records have been kept in the past. Select a field with similar soil types (e.g., texture, drainage, etc.) to the field with no yield data and apply the optimal rolling average yield goal from the similar field.

3) Use yields from local variety trials. Another useful method is based on university variety performance trial results. A range can be calculated for most major agronomic and vegetable crops for several locations based on the average of the five highest yielding varieties and the five lowest yielding varieties over a number of growing seasons. As a medium value, the trial yield averages are used.

4) Use state or county yield averages from USDA National Agricultural Statistics Service (USDA-NASS). Each year the Delaware field office of USDA-NASS publishes a statistical summary of state and county crop production averages in conjunction with the Delaware Department of Agriculture. State or county yield averages incorporate both high and low yields, providing a good starting point for fields with no yield history. However, progressive growers may want to choose another method rather than shooting for the status quo.

5) Use soil productivity charts. Soil (or vegetative) productivity charts are based on soil capability class and subclass and are available in the county soil survey. Soil survey data is available from a variety of sources; the Web Soil Survey and SoilWeb are two free web-based services for obtaining soil data.

Capability classes range from 1 through 8, with an increasing number indicating more limitations for the particular soil series. Capability subclasses group soils within the class based on their most limiting condition. Estimates of expected yield were developed for grain corn and soybean for all Delaware soil series based on these capability classes and subclasses under irrigated and non-irrigated conditions (Table 2). Yield estimates for small grains and select vegetable crops are also available for some soil series.

In many cases, expected yields based on soil productivity charts will be lower than what growers can achieve, especially for irrigated crops. The yield values in these productivity charts are likely based on older (and possibly outdated) information. As such, they do not account for improvements in crop genetics, grower ability, and other local environmental conditions. Therefore, growers will find the optimal rolling average and the best choice for applying fertilizers to achieve maximum economic yield whenever historical yield data are available.

Table 2. Expected yield for grain corn and soybean yields for selected Delaware soil series under irrigated and non-irrigated conditions as indicated in the soil survey.

Soil Series	Land Capability	Corn		Soybeans	
		Irrigated	Non-irrigated	Irrigated	Non-irrigated
		bu/A			
Fallsington drained	3w	160	130	50	40
Hurlock drained	3w	150	120	50	40
Barryland drained	2w	185	150	50	40
Mulica drained	2w	185	150	50	40
Pepperbox	2s	140	115	45	35
Rosedale	2s	140	115	45	35

Summary

Estimating yield goals is important for many crop management decisions, including crop species selection, seeding rates, and fertilization. Delaware growers who are required to maintain a nutrient management plan (10 or more acres of fertilized land per operation) have only two options for estimating yield goals. The most desired method is to take an optimal rolling average by averaging the best four yields for a particular crop over a seven-crop year period. In the absence of seven crop years of data, yield should be estimated based on soil productivity charts, which are likely to underestimate actual yields.

Peer Reviews

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