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Estimating Yield Goal for Crops

Introduction

Many crop management decisions require farmers or their 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, especially, vary considerably from farm to farm and field to field, and conditions can 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 to 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 cost, promote farm profitability, and protect environmental health. The purpose of this publication is to outline the proper methods for estimating yield goal.

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 goal. 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 70 to 90 bu/A for dryland corn, corn should be the crop selected. If, however, the farmer has determined that a given yield level is not realistic for that field, the crop of choice is grain sorghum in rotation with soybeans. 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 yield goal is plant population. On droughty soils, reduced *seeding rates* are used to improve crop drought tolerance. This 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, *fertilizer 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 and/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 and/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 waterbodies 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 law to choose one of two approved methods for determining yield goal. These approved methods are 1) taking an *optimal rolling average* or 2) using *soil productivity charts* (in the absence of actual yield data). These methods are used to guide nutrient management decisions in the nutrient management plan, which is required for an operation applying nutrients to 10 or more acres.

The preferred method for estimating yield goal is the *optimal rolling average:* With this method, the farmer uses the field yield averages for the past seven years and then drops the lowest three yields. The remaining highest four 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 contiguous years.

Table 1. Estimating yield goal for corn and soybean using the optimal rolling average method. The last seven years of average yield data were listed and the three lowest yields were removed. The top four of the last seven years of yield data were then averaged to determine the yield goal.

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 of very 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, growers are limited to the use of *soil productivity charts* to estimate yield goal. 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 online via the Web Soil Survey. 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.

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/ac			
Fallsington, drained	3w	160	130	50	40
Hurlock, drained	3w	150	120	50	40
Berryland, drained	2w	185	150	50	40
Mullica, drained	2w	185	150	50	40
Pepperbox	2w	140	115	45	35
Rosedale	2s	140	115	45	35

In many cases, expected yields based on soil productivity charts will be lower than what growers can actually achieve, especially for irrigated crops. The yield values in these productivity charts are likely to be based on 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 the best choice for applying fertilizers to achieve maximum economic yield whenever historic yield data are available.

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 goal. 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.

Publication Date: January 2015

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Reviewed by: Review pending