2013 Purdue Soybean On-Farm Trial – SEEDING RATES

Shaun Casteel, Extension Soybean Specialist, Purdue Agronomy
scasteel@purdue.edu, 765.494.0895
WWW.SOYBEANSTATION.ORG

OVERVIEW

This protocol describes the design and conduct of on-farm, field-scale research trials. The protocol is fairly simple, but a discussion of the logistics is needed to ensure a successful evaluation. Please do not hesitate to contact me with questions.

Objective: To identify agronomically optimum and economically optimum seeding rates for soybean production in Indiana.

Seed Rates: We are interested in range of seeding rates from low to high in 5 or 6 increments, such as ~60, 100, 140, 180, and 220 OR 60, 95, 130, 165, 200, and 235 thousand seeds per acre. These rates are guidelines and do not have to hit the exact rate. The low rates will probably yield less than the mid and high rates.

Replication: Minimum of 3 replicates. Seeding rates will be randomized within each replicate.

Variety: More than one is acceptable, but land area and complexity of trial increases.

Row Width: It is based on cooperator's equipment. Ideally, narrow row widths (~7.5 to 20 in) and wide rows (~30 in) will be evaluated across Indiana within these seed rates.

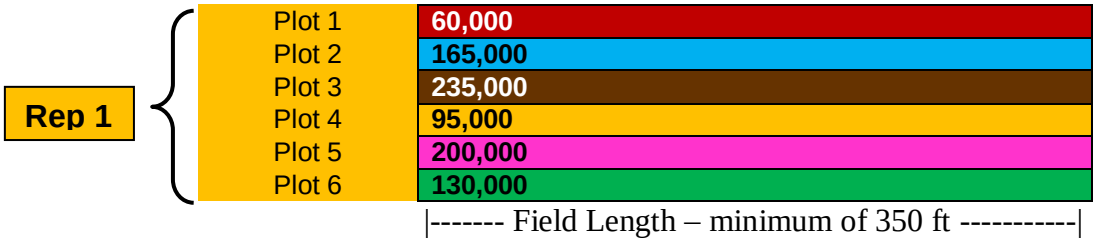
Plot Size: Length is typically the field length, which should be a minimum of 350 ft.

Plot width depends on drill/planter and combine platform widths. The basic setup would be to plant 1.5 to 2 times as wide as the combine header, so that the center of the plots can be harvested without effects from border plots of different rates.

Planting: Randomization of the seeding rate strips within each replicate favors those cooperators with either in-cab variable seeding rate controls and/or auto-steer capability. The logistics will be negotiated with cooperators who do not have these technologies. Calibration of planting equipment is highly desirable.

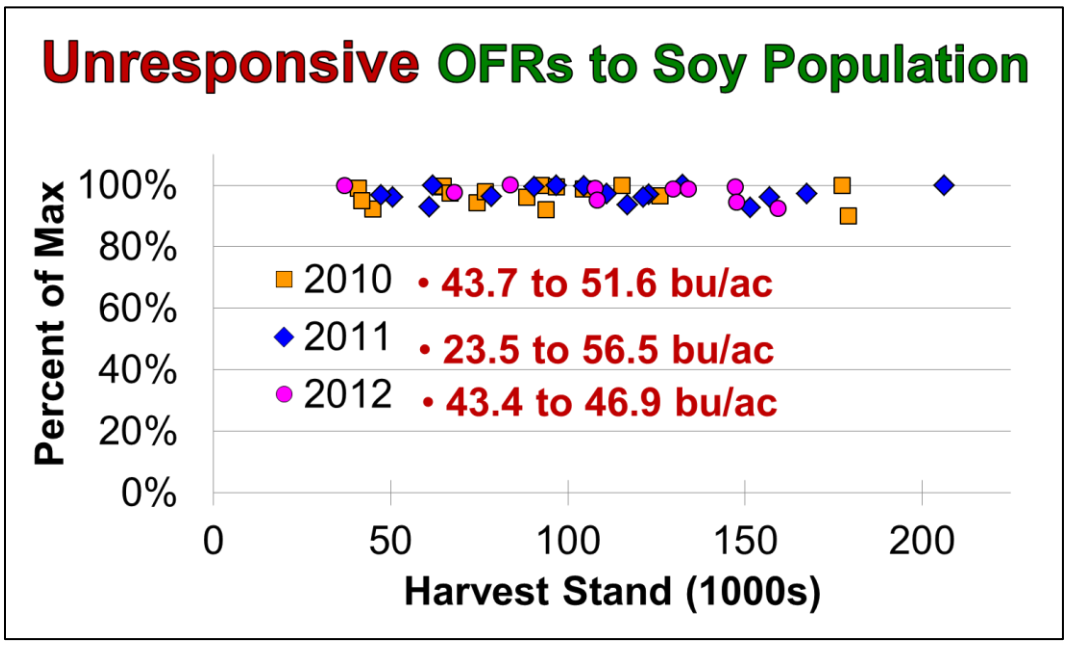
Harvest: Yield monitors equipped with GPS certainly minimize the harvest logistics of this trial. Cooperators with yield monitors need to be willing to calibrate the units to the conditions of this trial. Calibration will require access to a grain cart with load cell, weigh wagon, or other weigh scales. A weigh wagon will be needed for those without yield monitors.

Example of Six Seeding Rates Within One Replication:

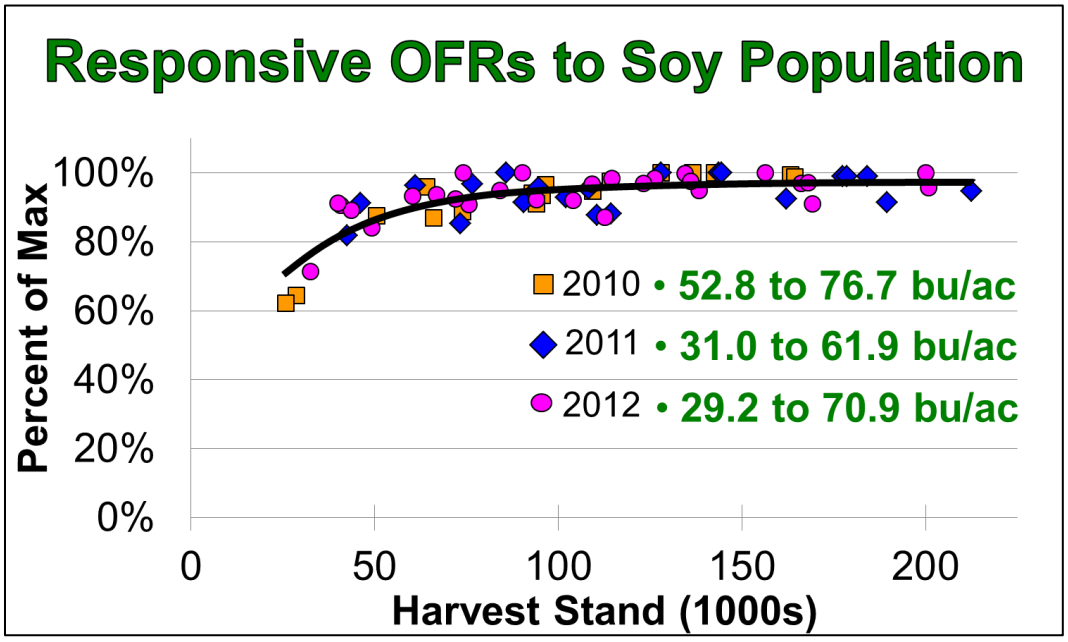


2013 Purdue Soybean On-Farm Trial – SEEDING RATES

Shaun Casteel, Extension Soybean Specialist, Purdue Agronomy
scasteel@purdue.edu, 765.494.0895
WWW.SOYBEANSTATION.ORG



9 out of 21 OFR trials are not responsive to soybean seeding rates.



12 out of 21 OFR trials are responsive to soybean seeding rates.

PROTOCOL DETAILS

Objective: This protocol describes the design and conduct of on-farm, field-scale research trials with the objective of identifying agronomically optimum and economically optimum seeding rates for soybean production in Indiana. The protocol is fairly simple, but a discussion of the logistics is needed to ensure a successful evaluation. Please do not hesitate to contact me with questions.

Seed Rates: Seeding rate trials for soybean should include five to six seeding rates. I would suggest seeding rates of ~60, 100, 140, 180, and 220 thousand seeds per acre. If field space allows for six seeding rate "treatments", then I would suggest rates of 60, 95, 130, 165, 200, and 235 thousand seeds per acre Seed rates do not need to be exactly the same as suggested, but a seed rate that is near the target is the goal.

Prior to planting the plots, determine the closest actual seeding rate settings for your drill/planter based on the operator's manual tables. I strongly encourage cooperators to calibrate their seed meters prior to the season to ensure that the targeted seeding rates will be actually be the seeding rates that are dropped by the drill/planter.

It is important to recognize that the low and high seeding rate "treatments" are important for accurately defining the yield response curve that then enables us to more accurately calculate both the agronomically optimum and economically optimum seeding rates. Simply comparing your standard seeding rate with, say, a single rate that is 40,000 plants per acre higher does not answer that question. NOTE: Potential farmer cooperators should recognize and accept the fact that they may incur some yield loss at the low seeding rate, higher seed cost without yield gains at the higher seeding rates, and possible lodging or disease pressures at the higher seeding rates.

Plot Size: Each treatment plot (strip) should be at least 350 feet long. Most of the time, the plot length in an on-farm trial is simply the length of the field. The seeding rate treatments must be replicated at least three times, but preferably four times in the field (Fig. 1). Replication is necessary to enable the mathematical statistical analyses of the plot data.

The width of each plot (strip) should be nearly equal to 1.5 to 2 times the width of the combine header to enable harvesting a full header width down the center of each plot yet avoid having to glean partial header widths between plots. Harvesting the center of each treatment plot instead of the entire plot avoids possible border effects caused by adjacent seeding rates. Table 1 shows examples of compatible plot sizes for different planting swaths and combine header widths.

Variety: You may want to include more than variety in an on-farm seeding rate trial. A second variety can easily be evaluated if your planter setup allows for splitting the units. For example, variety #1 can be placed in the first half and variety #2 in the second half of the planter. Then including two varieties in a seeding rate is easy to do but does increase the complexity of the plot layout. Basically, three planter passes per seeding rate treatment results in two harvested treatment plots provided that two planting passes would be double the width of the combine header (Fig. 2). The difficulty of planting two varieties across seeding rates with a drill or other central hub planters increases, but could be discussed.

Planting Through Harvest: If your tractor/planter is equipped with auto-steer navigation and variable rate seeding control, we can design a planting layout based on the GPS field boundary that will simplify your planting of the plots. If your VR system allows for the use of a prescription seeding rate map, that would further simplify your logistics.

Additionally, the travel direction of a sprayer applying herbicides, insecticides, fungicides, etc. should be the opposite direction of the seeding rate plots. This spray pattern will ensure that all seeding rate plots will have equal effects from the tire tracks.

Availability of a combine with GPS-equipped yield monitor greatly simplifies your harvest logistics. To ensure accurate yield estimates, yield monitors should be calibrated to the conditions of the test field (Questions on calibration? Talk to me before harvest). If a yield monitor is not available, a weigh wagon can be used to measure the grain weight harvested from each plot, but the length of each plot must also be known and recorded. Harvest and record data from each treatment plot separately.

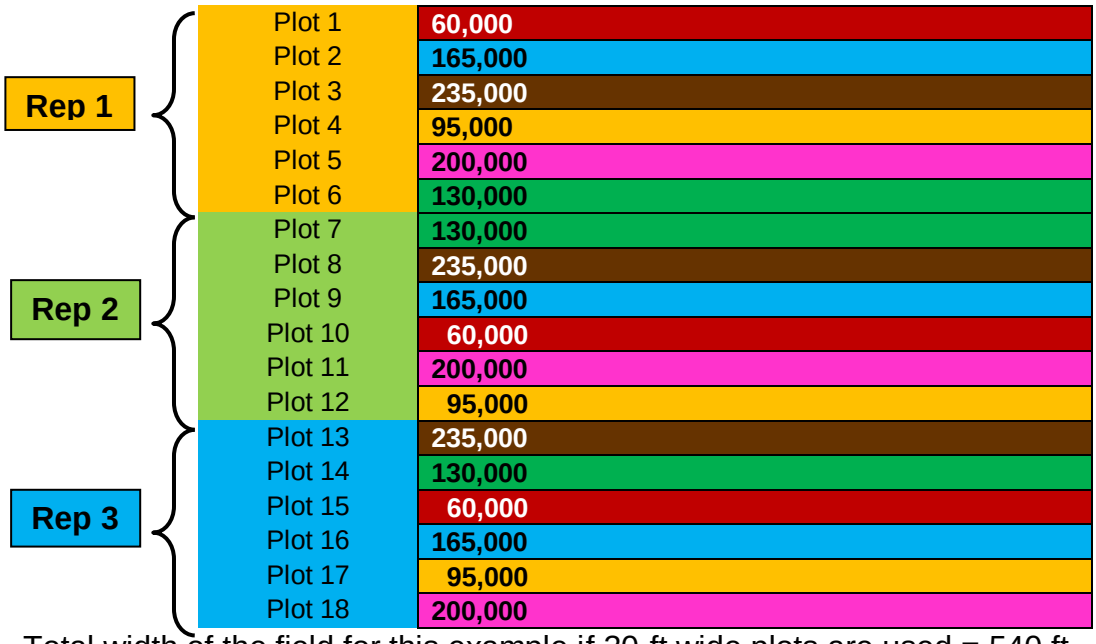
Interests: *Regardless of the details of the on-farm trial, contact me if you have any interest in participating in this research. We can discuss the specific details for your field and equipment to help you decide whether you will be comfortable in becoming an on-farm research collaborator.*

Table 1. Plot width options for different combinations of planting equipment and combine header widths. Numerous plot orientations are possible, but the basic layout is to plant seeding rate treatment plots twice as wide as the combine header. Some examples are listed below.

Planting Swath	Combine header width	Plot width	Harvest
30-in rows with 12 units (30 ft)	30 ft	60 ft (24 rows)	Center 30 ft
30-in rows with 6 units (15 ft)	15 ft	30 ft (12 rows)	Center 15 ft
20-in rows with 36 units (60 ft)	30 ft	60 ft (36 rows)	Center 30 ft
15-in rows with 23 units (28.75 ft)	18 ft	57.5 ft (46 rows)	Center 18 ft
7.5-in drilled rows (20 ft)	24 ft	60 ft	Center 24 ft

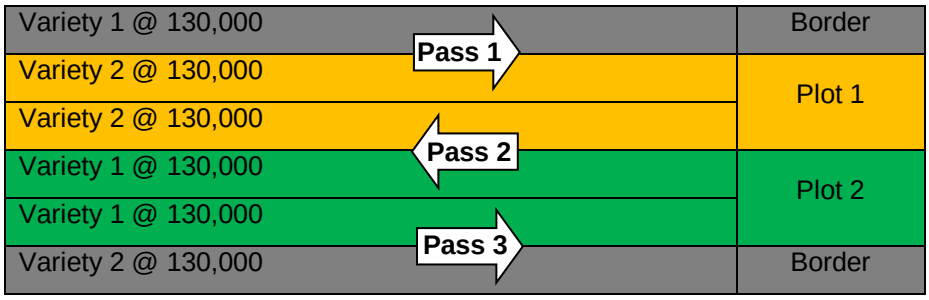
Figure 1. Example of randomized plot layout for 6 seeding rates, each replicated 3 times for a total of 18 treatment "plots". Each rectangle is equal to a treatment "plot" and would equal a compatible plot size listed in Table 1. The sequence of the treatment plots within each replicate can be changed, but each replicate should contain one and only one plot of each seeding rate treatment. As one might imagine, such a randomized treatment layout is most easily accomplished with the availability of in-cab variable seeding rate controls and GPS-enabled lightbar navigation or true RTK-enabled auto-navigation capability. Questions? Talk to me.

Example of Plot Layout Using One Variety



Total width of the field for this example if 30-ft wide plots are used = 540 ft.

Figure. 2. Illustration of split-planter seeding rate study where three planter passes result in two plots of a single seeding rate; one for each of two varieties.



Use this form to record the requested information about the on-farm trial and return to:
Shaun Casteel, Purdue Univ., Agronomy Dept, 915 W State St, West Lafayette, IN 47907-2054.

Purdue On-Farm Research Trials – Plot Information

Name:							
County:			**Soil series:**				
Tillage [1]:			**Drainage [2]:**				
Most recent soil sample results [3]:	**OM**	**pH**	**P**	**K**	**Ca**	**Mg**	**CEC**
			Lbs per acre or ppm?				
Soil sample date:			**Previous crop:**				
Variety:			**Seed Treatment[4]:**				
Plant date:							
Harvest date:							
Broadcast fertilizer [5]:							
Starter fertilizer [6]:							
Manure application [7]:							
Weed management [8]:							

Rainfall amount: (Inches per month)	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct.**

[1] Tillage method preceding this crop, such as no-till, strip-till, disc, moldboard plow, etc.
[2] Whether tiled or not plus assessment of overall drainage (e.g., poor, good, excellent).
[3] A copy of a recent soil sample for the field if it is available or record on sheet. Soil O.M. is a strong interest.
[4] Seed treatment: date applied, rate, type (fungicide, insecticide, inoculants, and/or plant growth promoter)
[5] Rate, analysis and date of broadcast fertilizer application if any (e.g., DAP).
[7] Rate (tons or gallons), date of application(s), application method, and manure analysis (if available).
[8] Product and rate. Rate overall weed pressure and control.

Other comments: