Purdue Corn Seeding Rate Trial Protocol

RL (Bob) Nielsen, Purdue Agronomy
rnielsen@purdue.edu, 765.494.4802

This protocol describes the design and conduct of on-farm, field-scale research trials with the objective of identifying seeding rates that optimize corn grain yield. While the protocol is fairly simple, the actual logistics of conducting the trial often require further discussion, so please do not hesitate to contact me with questions.

It is important to recognize that the number of seeding rates suggested for this trial, as well as the unusually low and high seeding rate “treatments”, is important for accurately defining the yield response curve that then enables us to more accurately calculate optimum seeding rates for a given trial. Simply comparing your standard seeding rate with, say, a single rate that is 5,000 plants per acre higher does not answer that question. Such a paired comparison is good for demonstration purposes or to convince a grower of the benefit, but does not help define the actual optimum seeding rate range.

Seeding rate trials for corn should include no less than five different seeding rates with no less than 4,000 seeds/ac increments. I would suggest seeding rates of 23, 28, 33, 38, and 43 thousand seeds per acre. If field space allows for six seeding rate “treatments”, then I would suggest rates of 23, 27, 31, 35, 39, and 43 thousand seeds per acre.

Prior to planting the plots, growers need to determine the closest actual seeding rate settings for their planter based on the transmission setting table in the operator’s manual. I strongly encourage cooperators to calibrate their planter’s seed meters prior to the season to ensure that the targeted seeding rates will be actually be the seeding rates that are delivered by the planter.

Typically, plot length in an on-farm trial is the length of the field (minus the end rows), but preferably no shorter than 500 feet long. The seeding rate treatments should be replicated no less than twice, but preferably three or four times in the field (see example in Fig. 1). Replicating the treatments helps us determine whether the effects of the seeding rates are consistent and allows us to conduct the mathematics of the statistical summary of the trial. Using a GPS field boundary of your field, I can easily design the layout of the trial for you prior to planting. Talk to me.

The width of each planted plot (strip) should be equal to two or more combine header widths to enable harvesting a full header width down the center of each plot to avoid possible border effects caused by adjacent seeding rates, while at the same time not leaving partial header widths between plots. The width of each plot must also be compatible with the widths of all the equipment that will be used in the field (fertilizer applicators, combines, etc). Sometimes it takes a little imagination to identify the one plot width that best accommodates all the field machinery widths. Table 1 shows examples of compatible plot sizes for different planter and combine header widths. If the width of other field equipment, like sidedress applicators, will be an issue, they must also be taken into consideration. Talk to me.

If your tractor/planter is equipped with auto-steer navigation but not prescription-based variable rate seeding control, I can work with you prior to planting to design a planting navigation scheme that will simplify your planting of the plots. Talk to me.

If your tractor/planter is equipped with prescription-based variable rate seeding control, I can work with you prior to planting to create a planting prescription file to download to your rate controller that will essentially eliminate any logistics of planting the field trial. Talk to me.

Table 1. Plot width options for different combinations of planter width and combine header width. Examples are for 30-inch row spacing equipment.

Planter width	**Combine header width**	**Compatible plot width**
12-row	12-row	24-row, harvest center 12
6-row	6-row	12-row, harvest center 6
12-row	8-row	24-row, harvest center 16
12-row	6-row	12-row, harvest center 6
24-row	12-row	24-row, harvest center 12

You may want to include more than one hybrid in an on-farm seeding rate trial. If your planter setup allows for planting one hybrid in half of the planter and a different one in the other half, then including two hybrids in a split-planter seeding rate is easy to do. However a split-planter option increases the land area required for the trial, because three split-planter passes per seeding rate treatment are required to obtain two harvested treatment plots (see example in Fig. 2).

One can also evaluate yield response to seeding rates for two different fertilizer N rates; e.g., your usual N rate versus one that is 50 lbs higher. See Fig. 3 for an example of such a plot layout.

Prior to grain harvest, cooperators and/or their consultants should measure and document the harvest plant population **for each plot in the trial**. If your trial has 24 plots, then you ought to record 24 estimates of harvest populations. My suggestion would be to select areas of the field that you believe to be fairly representative and record the number of plants in 30 linear feet of two adjacent rows.

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.

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 and interested in becoming one of our on-farm research collaborators.

Bob

Rep	Plot	Bulk (border) plot
Rep 1	Plot 1	23,000
	Plot 2	43,000
	Plot 3	31,000
	Plot 4	35,000
	Plot 5	39,000
	Plot 6	27,000
Rep 2	Plot 7	23,000
	Plot 8	43,000
	Plot 9	39,000
	Plot 10	31,000
	Plot 11	35,000
	Plot 12	27,000
Rep 3	Plot 13	35,000
	Plot 14	31,000
	Plot 15	39,000
	Plot 16	43,000
	Plot 17	27,000
	Plot 18	23,000
		Bulk (border) plot

Total width of field required for this example if 12-row plots are used = 600 ft

Fig. 1. Example of randomized plot layout for a seeding rate trial with 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 are randomized within each replicate.

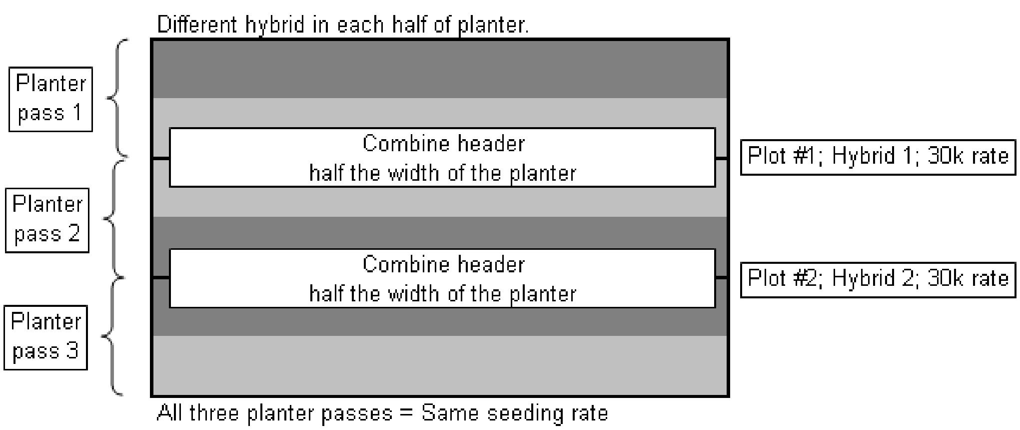

Fig. 2. Illustration of split-planter seeding rate combination where three planter passes result in two plots of a single seeding rate; one for each of two hybrids. The figure only illustrates 2 of the possible 36 plots if six seeding rates were replicated 3 times in a split-planter trial.

Example Seeding Plot Layout Combined w/ Two Nitrogen Rates

		Bulk (border) plot	
Plot 1	Rep 1	Standard N rate	31,000
Plot 2	Rep 1	Standard N rate	39,000
Plot 3	Rep 1	Standard N rate	23,000
Plot 4	Rep 1	Standard N rate	27,000
Plot 5	Rep 1	Standard N rate	35,000
Plot 6	Rep 1	Standard N rate	43,000
Plot 7	Rep 1	Std. N rate + 50 lbs N	39,000
Plot 8	Rep 1	Std. N rate + 50 lbs N	23,000
Plot 9	Rep 1	Std. N rate + 50 lbs N	27,000
Plot 10	Rep 1	Std. N rate + 50 lbs N	43,000
Plot 11	Rep 1	Std. N rate + 50 lbs N	35,000
Plot 12	Rep 1	Std. N rate + 50 lbs N	31,000
Plot 13	Rep 2	Std. N rate + 50 lbs N	23,000
Plot 14	Rep 2	Std. N rate + 50 lbs N	31,000
Plot 15	Rep 2	Std. N rate + 50 lbs N	39,000
Plot 16	Rep 2	Std. N rate + 50 lbs N	43,000
Plot 17	Rep 2	Std. N rate + 50 lbs N	35,000
Plot 18	Rep 2	Std. N rate + 50 lbs N	27,000
Plot 19	Rep 2	Standard N rate	39,000
Plot 20	Rep 2	Standard N rate	35,000
Plot 21	Rep 2	Standard N rate	43,000
Plot 22	Rep 2	Standard N rate	23,000
Plot 23	Rep 2	Standard N rate	27,000
Plot 24	Rep 2	Standard N rate	31,000
Plot 25	Rep 3	Standard N rate	35,000
Plot 26	Rep 3	Standard N rate	23,000
Plot 27	Rep 3	Standard N rate	27,000
Plot 28	Rep 3	Standard N rate	31,000
Plot 29	Rep 3	Standard N rate	43,000
Plot 30	Rep 3	Standard N rate	39,000
Plot 31	Rep 3	Std. N rate + 50 lbs N	31,000
Plot 32	Rep 3	Std. N rate + 50 lbs N	43,000
Plot 33	Rep 3	Std. N rate + 50 lbs N	39,000
Plot 34	Rep 3	Std. N rate + 50 lbs N	35,000
Plot 35	Rep 3	Std. N rate + 50 lbs N	27,000
Plot 36	Rep 3	Std. N rate + 50 lbs N	23,000
		Bulk (border) plot	

Total width of each "block" of N rate if 12-row plots = 180 ft
Total width of field required for this example if 12-row plots are used = 1140 ft

Fig. 3. Illustration of a plot layout if you wanted to evaluate yield response to seeding rates within two different fertilizer N rates. Each seeding rate rectangle is equal to a treatment “plot” and would equal a compatible plot size listed in Table 1.

Use this form to record the pertinent information about the trial and return to the appropriate Purdue campus specialist.

The online PDF version[1] allows you to input the information directly.

Purdue On-Farm Research Trials – Corn Plot Information

Name:							
County:							
Soil series:				**Drainage [1]:**			
Most recent soil sample results [2]:	**OM**	**pH**	**P**	**K**	**Ca**	**Mg**	**CEC**
Soil sample date?:			☐ **Lbs per acre or** ☐ **ppm?**				
Previous crop:				**Tillage [3]**			
Individual plot length (ft):				**Individual plot width (ft):**			
Hybrid (Company and brand):							
Planting date:				**Seeding rate:**			
Foliar fungicide?	☐ **Yes**	☐ **No**	**If yes, product and appl'n timing:**				
Harvest date:				**Header width (ft):**			
Yield monitor?	☐ **Yes**	☐ **No**	**If yes, equipped w/ GPS?**	☐ **Yes**	☐ **No**		
Broadcast fertilizer [4]:							
Starter fertilizer [5]:							
Pre-plant nitrogen [6]:							
Sidedress nitrogen [6]:							

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

[1] Whether tiled or not plus assessment of overall drainage (e.g., poor, good, excellent).
[2] 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.
[3] Tillage method preceding this crop, such as no-till, strip-till, disc, moldboard plow, etc.
[4] Rate, analysis and date of broadcast fertilizer application if any (e.g., DAP).
[5] Rate/gallons, starter fertilizer and placement (2x2, surface band, etc.) if any.
[6] Type (UAN, urea, AA, etc.) and date of application.

Other comments:

[1] Online at http://www.agry.purdue.edu/ext/ofr/protocols.html .