

MEMO**To: County ANR Agents****From: Chad Lee****Date: May 10, 2006****RE: Field Plots**

The following is a rough draft of some guidelines for conducting on-farm field plots.

Conducting County Trials for Hybrid or Variety Comparison or for Seeding Rates

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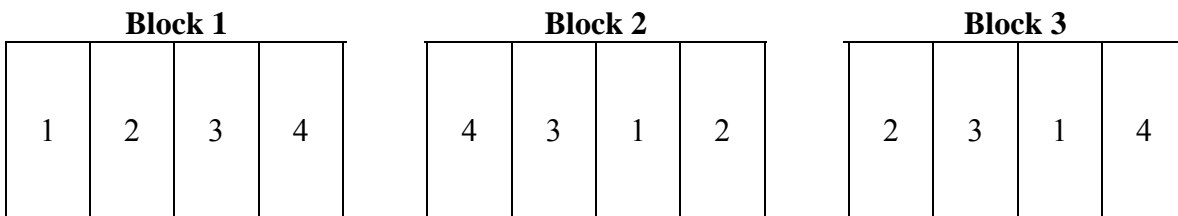
There are several options for designing field plots in variety trials and seeding rates trials. The option you choose will be a balance between providing the best information possible with the time commitment that you and the cooperating farmer are willing to invest. The following examples will use hybrids as the example. The same principles apply for seeding rates.

Randomized Complete Block Design

The first design that is commonly used in field research is the randomized complete block design (RCBD). The RCBD is a rigorous design that allows the investigator to account for field variability. The analysis for the RCBD requires a statistical program, but the analysis provided allows the results to be reported in the order of treatment performance.

The University of Kentucky Corn Hybrid Performance Tests uses an RCBD, with three blocks at each location. The testing program uses a modified corn planter that can plant multiple hybrids and different seed types uniformly into an RCBD.

Example of a field layout of an RCBD, where 1, 2, 3, and 4 = different hybrids.



Advantages: Allows the investigator to measure the variability (or error) in the study. Differences between treatments can be determined by the Least Significant Difference (LSD). This helps the investigator know what differences are due to the treatments and what differences are likely due to the variability (error). Allows for more confidence in the final results than do other tests.

Disadvantages: Complicated to set-up. Typically need to lay out markers or flags first. A larger number of treatments may make this comparison difficult with large-scale farm equipment. Need a computer program to calculate error and LSD.

Report: The final report should include:

1. Hybrid yields averaged over all blocks, reported in order of highest yield to lowest yield.
2. Average yield of all hybrids.
3. Least significant difference (LSD).
4. Notes on any strange observations from the study.

Check-Strip Trial

The check strip trial evaluates each treatment once across a field. These treatments are compared to a check-strip that is repeated across the field. The check-strip must include a check at each end of the study for the proper comparisons to be made.

Example of a check-strip:

Ch	1	2	3	Ch	4	5	6	Ch	6	7	8	Ch
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Advantages: Relatively easy to set-up. Each treatment is built upon the one next to it. Can easily incorporate more treatments.

Disadvantages: While the check-strips help to determine the variability across the field, this method is not as rigorous as the randomized complete block design. More difficult to identify an unusual event within a treatment in the field. Treatment performance should be listed in order of field placement. This order will allow the audience to see if yield trends occur across the field. Adjusting yields according to the check-strips can be complicated at first. An example of the calculation is below.

Report: The final report should include:

1. Data should be reported in order it was planted.
2. Average yield of entire study.
3. Average yield of all check-strips.
4. Notes about whether yields tended to be higher at one of the field than another.

Calculation for adjusting yields to check-strips.

$$\text{Adjusted Yield} = \frac{(\text{mean of all checks})n}{(\text{Ch}_1)n_1 + (\text{Ch}_2)n_2} \times \text{yield of variety}$$

Where Ch_1 and Ch_2 refer to the check strips on either side of the variety and n_1 and n_2 refer to the numbers of strips the variety is away from the Ch_1 and Ch_2 , respectively. In addition, n refers to the total number of strips between Ch_1 and Ch_2 . The sum of n_1 and n_2 must equal n .

Calculations for adjusting yield in strip plots with multiple check strips.

Example of adjusting yields for check-strips.

Ch	1	2	3	Ch
100 bu	150 bu	130 bu	110 bu	125 bu

Example 1

If we were to adjust the yield for variety 1 (var_1), then the equation would be:

$$\text{Adjusted Yield} = \frac{(112.5) \times 4}{(100) \times 1 + (125) \times 3} \times 150 = 158.8 \approx 159 \text{ bu/a}$$

So, Hybrid 1 recorded a yield of 150 bu/acre. When that yield was adjusted to the check-strips on either side, the adjusted yield equaled 159 bu/acre. This calculation should be repeated for each hybrid in the trial.

Strip Plots

The strip plot examines each hybrid once in the field. There is no check-strip, no replication in this type of design. Because strip plots are relatively easy to establish, seed companies often use these strip plots for farmer demonstration plots. However, most seed companies will have the same comparisons on many farms across the region. They will average all of the data together across the region to make conclusions. Data from a single location is not examined by itself, unless a something unusual occurred, such as foliar disease or a hail storm hit one location.

1	2	3	4	5	6	7	8	9	10	11	12
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Advantages: Strip plots are the easiest plots to establish at one location. Multiple hybrids can be added to the end of a trial. Many hybrids can be evaluated.

Disadvantages: Strip plots should never be used for conclusions by themselves. The same comparisons should be made at several locations across the region before any conclusions are made. If a single location is used by itself, then the yields of hybrid could be due to random placement of the hybrids as much or more so than the actual performance of the hybrids.

County Trials

Conducting trials does take time, regardless of the plot design used. Below is a general guideline of time requirements for conducting trials.

Gathering hybrid seed: one-half day to one day
 Work through details with farmer: one-half day to one day
 Planting: one whole day
 Harvest: one whole day
 Summarizing data: one-half day
 Scouting for stand, pests, lodging, etc.: three one-half days

When making comparisons, be sure that everything else is as similar as possible to avoid confounding the results.

Parameter (factor)	Hybrid Performance	Type of Comparison	
		Seed Rate	Row width and seed rate
Tillage	same	same	same
soil type	same	same	same
soil fertility	same	same	same
seed treatment	same	same	same
seed rate	same	different	different
hybrid/variety	different	same	same
herbicide	same	same	same
fungicide	same	same	same
insecticide	same	same	same
N rate (corn)	same	same	same
Harvest date	same	same	same
Row width	same	same	different
Plot dimensions	same	same	same

Know your limitations:

Rainfall, soil type, pests, etc. can all be limitations on the outcome of the comparison. Were there any other differences between treatments (i.e. different seed treatments between hybrids)? Document any of these limitations in the comparisons.

Checklist: Before the Day of Planting

- _____ Visit with farmer about objectives of the trial. Identify soil type, crop history, weed history, etc. of proposed field. Determine planting and harvesting capabilities. Determine cooperators' interest in the project.
- _____ Develop a plot plan (possibly in a notebook), plus a copy for the cooperator (be ready to make changes to the plot plan on the day of planting)
- _____ alert the producer that laying out the plots will require 30 minutes to one hour BEFORE planting
- _____ arrange for additional help (if needed)
- _____ know combine width in advance to know planter box layout
- _____ know the total number of passes in the plot and know the width of the entire study – be sure the plot will not encounter a ditch, fencerow, etc.
- _____ MOST IMPORTANT – invite cooperator to provide input/suggestions for what they would like on their farm. They are donating land, equipment and time; the project should be of interest to them.

Checklist: The Day of Planting the Trial

- _____ Plot plan (possibly in a notebook), plus a copy for the cooperator
- _____ Seed
- _____ flags (or similar markers or GPS)
- _____ two-way radios (walkie-talkies, cell phones)
- _____ 100-foot to 300-foot tape to measure plots
- _____ alert the producer that laying out the plots will require ½ to one hour BEFORE planting
- _____ additional help (if needed)
- _____ latex or nitrile gloves (safety for handling treated seed)
- _____ soil thermometer
- _____ planter, in good operating conditions
- _____ proper seeding depth
- _____ proper seeding rate
- _____ proper closing of seed furrow
- _____ empty hoppers before adding test seed
- _____ know combine width in advance to know planter box layout
- _____ 3 to 4 5-gallon buckets for dumping seed into (very important if using a check), easier to dump into than sacks
- _____ Shop Vac and generator if using an air planter or drill
- _____ duct tape (bags do rip)
- _____ know the total number of passes in the plot and know the width of the entire study – be sure the plot will not encounter a ditch, fencerow, etc.
- _____ BE ON TIME or call in advance. The farmer needs to be planting, not waiting
- _____ If a single pass is to be made with each hybrid, then borrow a Gator or Mule to carry seed and buckets to other end of field.
- _____ MOST IMPORTANT – invite cooperator to provide input/suggestions for what they would like on their farm. They are donating land, equipment and time; the project should be of interest to them.