SEEDING AND PLANTING PLOTS FOR CROP PERFORMANCE EVALUATION USING GPS-RTK AUTO STEERING

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ABSTRACT

Crop performance evaluation plots are seeded both on and off the University of Nebraska West Central Research and Extension Center. Plots off the Center must match the producer's rows for pesticide application, cultivation, ditching, irrigation, fertilization and any other operations performed in the fields. With row crops the producer blank-plants the plot area before we can follow up with planting the plots. This means that we have to wait for the producer to plant in the field. Blank-planting dries out the soil and can plant weed seeds, especially if a physical marker is used. If precipitation occurs, it becomes difficult to determine where the blank planted rows are. With small grains in narrow row spacing the objective is usually to seed the plots before the producer seeds the rest of the field. This requires a lot of flagging, and the plot still may lack the precision desired for research. With GPS-RTK auto steering, row crops can be planted with near perfect guess rows, which increases accuracy in the plot. It also greatly reduces the possibility of cultivation blight. With no till cropping practices such as skip row, the crop residues are not destroyed in the unplanted rows. With small grain plots, a great amount of time is saved in laying out and flagging the plots. A narrow guess row in small grain plots is very difficult to harvest. Auto steer greatly increases the accuracy of guess row width, making harvesting much easier and more accurate. This paper will discuss the equipment needs and how to set up plots using GPS-RTK auto steer.

Keywords: GPS, RTK, Auto Steering, Crop Performance Evaluation

INTRODUCTION

The goal of the Crop Variety Evaluation Program is to provide unbiased information to producers. At the University of Nebraska West Central Research and Extension Center in North Platte, Nebraska, trials are performed each year on several different crops. These include corn, winter wheat, soybeans, sunflowers,

grain sorghum and dry edible beans. These trials are located both at the center and in producer's fields throughout southwest and central Nebraska. Care is taken when selecting field locations for plots, with the goal being as uniform a site as possible. Soil types, residue levels, slope and drainage are a few of the factors that need to be considered when selecting an area for a plot. Although a completely uniform site is not possible, minimizing the effects of these factors makes for more accurate data.

Another factor that comes into play is proper seeding of the plots. Plot equipment is usually much smaller than commercial equipment, for example a two row plot planter being used for row crops. A guess row exists every other row. For seeding small grain plots, a five foot drill is used. Wide or narrow guess rows can greatly affect the results of the plot, especially under rainfed conditions. A wide guess row will have more soil water and sunlight available to the rows on either side of it. Weeds may also grow in a wide guess row. Narrow guess rows make harvesting plots more difficult, especially in small grains when the row spacing is narrow to begin with.

POSSIBLE SOLUTIONS

When working in a producer's field, plot rows must match with the rest of the field to allow for cultivation, irrigation, fertilization, pesticide applications and any other field operations. One solution in row crop plots is to have the producer blank plant the plot area. The plot planter can then follow the rows without seed. One drawback to this method is waiting for the producer to plant in the field. Blank-planting also dries out the soil and can plant weed seeds, especially if a physical marker is used. If precipitation occurs after the field is blank-planted and before the plot is planted, finding the exact location of the blank-planted rows can be difficult if not impossible.

Another option is to flag each pass the plot planter or drill must make. This is done quite often in small grains research, as the plot is usually planted before the rest of the field. It is also done in rainfed row crop plots as well. A skilled operator is needed to center the tractor over the flags. This can be difficult when the wind is blowing, as is often the case, making it hard to see where the flag is rooted. Flags can also be hidden behind residue in no till situations. Conditions in no till can also make it difficult to place flags accurately, as corn and wheat residue that is present causes difficulty in stringing a tape measure precisely. All these factors can affect planting accuracy. Flagging does work well in tilled ground with a relatively calm wind.

A third option is to employ auto steer technology. At the one inch RTK level of accuracy, near perfect guess rows can be achieved.

SETTING UP AUTO STEER FOR PLOTS

A single auto steer system is used at the West Central Research and Extension Center on two tractors. One tractor is utilized with the row crop planter and another with a no-till wheat drill. Each tractor has its own hydraulic valve which controls the oil flow to the power steering rams. A dual receiver system is

mounted overhead and a touchscreen computer contains the software to operate the system. These components are moved from one tractor to the other as necessary, and are removed during equipment transport. A mobile base station is setup on site to provide corrected GPS signals. A mobile system is used as many trials are conducted at sites hundreds of miles from each other, making a subscription service unfeasible. The base station is necessary to achieve one inch accuracy. With the mapping capabilities of the software, it is possible to return to a site and have the tractor run down the same rows, within one inch. This is only if the base station is located in the exact same location as when the map was made.

Setting up the system for a plot is relatively simple. For winter wheat plots, the dual receiver is placed in a bracket mounted above the tractor, and a cable is connected. The touchscreen computer is placed in a bracket near the driver's seat, and a cable connected. The base station is set up on a tripod and receives 12 volt dc electrical power from the pickup. The station is usually ready within a minute of being powered on. After getting a rough area to place the plot in the field, three flags are all that is needed to start. A right angle is made with the three flags in the lower left corner of the plot. With the tractor, two AB lines are made perpendicular to each other along either side of the right angle in the software. One line is for following when planting alleys between reps, the other for seeding the plots. Plots are 30 feet long, making the alleys 30 feet apart as well. In the software, the implement being pulled can be set to that width to first seed the alleys between replications. When finished, the AB line perpendicular to the alley line is followed to seed the individual plots. The implement width is set to 5.5 feet for these passes.

For row crop plots, the process is similar. First, select the area needed for the plot and the direction the rows are to go. Place a flag on one corner and another on the opposite corner. Set the AB line by driving the tractor directly over the two flags. When planting in a skip row pattern, the implement width must be set to account for the open space desired between the rows. If border rows are to be planted in several different passes, these can be done at the same time if the pass number is known. The planter can be set for these just once, saving time. It can also be done for different seeding populations.

CONCLUSIONS

Using RTK accuracy auto steer has made planting crop variety evaluations more efficient. Time is not spent setting out flags for each pass and windy conditions are not such a hindrance. Guess rows are near perfect, eliminating the problems associated with narrow or wide guess rows. Time needed to setup the system when arriving at a site is ten minutes or less. One drawback to GPS auto steer is when the vehicle is near trees, buildings or other tall structures the GPS signal is lost. Care must be taken to not place plots too close to these potential obstructions.