

CREATING A CROP MAZE WITH GPS

A crop maze is an attractive, unusual, and effective way to draw attention and visitors to a farm. It is also a good way to generate income if a farmer charges admission to the maze.

Creating a crop maze requires a design and careful planning. Designs for a maze can be fashioned from simple patterns or geometric shapes, or taken from photographs or other images. Mazes can be cut in almost any type of standing crop; however, corn is by far the most popular. Corn produces a thick wall of vegetation between the paths and is tall enough that people in the maze cannot see over it.

Mazes can be created from maps and drawings of fields using ordinary tools such as tape measures or measuring wheels, but while effective, these methods are time consuming. An alternative is to use a global positioning system (GPS) receiver and mapping software or geographic information system (GIS). GPS and GIS technology can greatly speed up and simplify the maze creation process.

Using GPS equipment and software to create a maze offers a farmer the ability to create elaborate designs that are well fitted to a field. Key factors to consider are:

- Size and shape of the field.
- Amount of detail in the maze design.
- Accuracy of GPS receivers used for maze layout.
- Availability of mapping software.

Field size and shape define the extent of the maze and the amount of detail it can contain. Large fields allow more features and details. Small fields are limited to fewer features or simpler designs.

The breadth of detail in the maze determines how accurate the layout must be. It also dictates the required accuracy of the GPS receiver used in the layout process. GPS equipment varies in accuracy, and the units that are available to a farmer or a designer may limit what can be accomplished.

Recreational GPS receivers are accurate to only about 10 meters. That means the position indicated by the receiver will be within a 10-meter radius of the true pinpoint position on a map. This limits their use to larger fields or to a design with minimal detail.

When equipped with WAAS (Wide Area Augmentation System) capability, some recreational GPS receivers are accurate to within 1 to 2 meters. WAAS is a free correction signal broadcast by the Federal Aviation Administration (FAA). Simple mazes in medium to large fields can be laid out effectively with WAAS-enabled GPS receivers. Agricultural receivers, or mapping grade receivers, can also be equipped with WAAS, which puts them in the same accuracy range as WAAS-equipped recreational receivers, and they often give more stable positions.

For much keener accuracy in agricultural receivers, many operators turn to differential correction, which will boost the accuracy to

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1 meter or less. Coast Guard beacons or private commercial satellites can provide differential GPS (DGPS). A DGPS receiver is often the most practical choice for creating mazes.

Survey grade receivers, which are single or dual frequency receivers, offer the highest accuracy and can determine a position to within a few centimeters. Some advanced agricultural receivers perform in this range as well. Survey grade receivers are ideal for laying out very fine details of mazes in small fields. But they are quite expensive and may not be cost effective for maze projects.

Mapping software or GIS software must be selected that will allow the user to download a map of the field and the maze design. The software should be able to run on a handheld PC or a laptop computer so it can be taken into the field. The software also should accept GPS data from a receiver connected to the computer. Real-time GPS data are needed to guide the designer to the critical points on the maze. “Real-time” means that the position determined by the receiver must be the actual position of the receiver at that moment. Long-term averaging of data to get an accurate position is not practical in creating a maze.

CREATING THE MAZE

MAKE A MAP OF THE FIELD’S BOUNDARIES

Once a target field is selected, a map of its boundaries must be obtained. Aerial images of the field can be used, or a map of the field boundaries can be recorded by using the GPS receiver and mapping software.

The preferred approach is to create a boundary map of the field with the GPS receiver and the mapping software. Turn on the GPS receiver, and set the software to record a boundary. Walk or drive around the perimeter of the field while logging boundary data from the GPS receiver. The mapping software can be configured to automatically log data or to log data on command from the operator. When you have traveled completely around the field, the software will have recorded the boundary and displayed it on the computer screen. Save the boundary data on the computer for later use.

If you are using an aerial image of the field, the image must be correctly geo-referenced in the mapping software. This means that precise latitude and longitude

coordinates must be assigned to several features on the map. This process is often called “registering the map.” Up to three points on the map must be identified and the coordinates of these points determined. Instructions for this procedure should be provided in the mapping software. Once a field image is acquired, you can use it to draw a boundary of the field with the drawing tools built into most mapping software.

Regardless of the approach taken, the objective is to create a boundary map of the field (Figure 1). Once established, the boundary map can be used as a frame for the maze design.

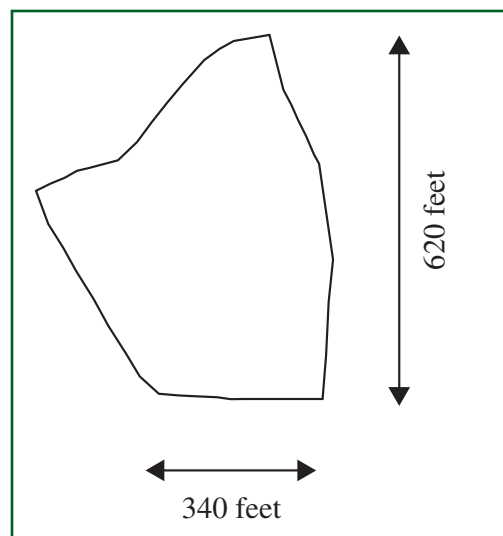


Figure 1. A field boundary map.

DESIGN THE MAZE

The maze design should be selected so that it fits easily within the borders of the field. This can be done in one of two ways. One approach is to draw the design directly in the digital map file using the drawing tools provided by the mapping software. Displaying the field boundary file in the background will ensure the design is properly geo-referenced, which is the advantage of using this approach. But, drawing a maze design on the screen may require a good bit of practice, particularly with more complex shapes. Use of a drawing tablet or a digitizing tablet may aid the process.

Another method is to print a copy of the boundary map. Make certain the boundaries of the field are clearly visible on the printout. If the map has not been geo-referenced, determine the coordinates of at least three easily located points on the field boundary. Record these coordinates on the map to use in geo-referencing later. These points should be spread out

and should not fall in a straight line. Next, draw the maze design on the printed map by hand, making sure to stay well within the field boundary. When complete, scan the finished design and save it in a file format that can be read by your mapping software. Finally, import the image file of the maze design and register it (assign geographic coordinates) in the GIS software so it can be used as a map (Figure 2). The software should have instructions for this process.



Figure 2. Image added within the field boundaries.

TRANSFER THE DESIGN TO THE FIELD

Use the portable computer and GPS receiver to transfer the maze design from the map to the field itself. Choose a GPS receiver with suitable accuracy and connect it to the portable computer. With the GPS engaged, the maze design can be viewed as a map and your location displayed. Select a part of the design as the starting point for the mapping, and guide yourself to that spot with the GPS receiver and computer. Carefully locate the position to ensure accuracy for the layout. You may wish to pause for a few seconds to be sure you are at the correct location. Mark the point in the field with a flag or stake from a supply of consecutively numbered markers. The numbers will be useful for later reference. (Also, if the maze is complicated, having different colored flags or different number sequences for different elements of the design will be helpful.) Once the first point is set, move to the next point and repeat the process. Continue until the entire maze design or part of the design has been transferred to the field. At this time you will have what looks like a “connect the dot” picture of your design. For

example, in Figure 2, an outline of the North Carolina State University “Strutting Wolf” design can be seen. Each star along the outline represents a point determined and marked with the GPS receiver and GIS software.

CUTTING THE MAZE

Once the design has been marked on the field, the crop can be cut with a mower or other implement. Choose a starting point. For example, you may wish to start cutting from the edge of the field to the first or closest marker to create an entrance to the maze. Then cut from marker to marker in the order they appear in the design. It is very helpful to have each marker numbered in sequence of cut. It is also helpful to have a spotter in the field to guide you to the next marker in sequence. As you cut from point to point, the maze design will take shape in the field, again, like “connecting the dots” on a large drawing. When cutting from marker to marker, the mower can pass to the side of the marker or the marker can be in the center of the swath. It is important to use the same approach consistently to ensure the design is cut correctly.

If the design requires cutting circles, an effective approach is to locate the center of the circle with the GPS receiver. Have the GPS operator stay at that point, and have someone measure the radius of the circle with a tape measure or marked cord. By holding the tape or cord taut, a circle can be drawn and marked around the GPS operator’s position.

In some cases, the pattern can be cut as the GPS operator lays out the design. For this procedure, the GPS operator locates his or her starting point, then finds a second key point on the design (an intersection, points in a curve, a change of direction) and marks it on the field. The mower operator immediately cuts a path from the start to that point. The GPS operator then locates the next point. Now the mower operator cuts from the previous point to the new point, and so on. The maze takes shape immediately without the need to mark dozens or hundreds of points to cut later. However, this process leaves very little room for error. Once an incorrect cut is made, it is part of the pattern, and you may not be able to undo the error or hide it in the design.

When ready to cut the maze, choose a mower that can handle the height of the crop easily. A maze can be created as soon as the crop is a few inches tall, and cuts can continue over the summer until it reaches its full height. The optimum time for the first cut is when the crop is just tall enough to show whether you have a good stand.

The width of cut for the pattern depends on the type of crop and the amount of detail in the maze. You should cut a path wide enough to allow visitors to walk along it, but narrow enough to keep a thick border of crop material around the pattern. Paths 4 to 6 feet wide are ideal, and you should try to keep 8 to 12 feet of standing crop between paths where possible. The thickness of crop between paths is important: if the crop stand is too thin, visitors will see other paths and may be tempted to create “shortcuts.” Also, if visibility from the air is desired, the swath should be wide enough to stand out boldly against the rest of the field (Figure 3).



Figure 3. Finished maze, the North Carolina State University “Strutting Wolf.”

SUMMARY

Creating a crop maze requires careful planning and design. A farmer wishing to make one should choose a pattern that fits the shape of the field and select a crop that lends itself well to a maze. DGPS receivers capable of accuracy to 1 meter or less are useful tools for laying out a maze in a field. Once the design is created in a GIS software package, the DGPS receiver can be used to guide a GPS operator along the pattern to be marked in the field. Markers can then be set along the perimeter

of each shape or pattern to provide a guide for cutting. Cutting the maze with a mower is the final step in creating the pattern.

When complete, a maze will provide a focal point for a farm. Visitors may be attracted, and another source of revenue may be created. The maze also will offer an eye-catching image from the air and may bring the farm fame outside the region.

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