

Crop Circles 2 – Teacher Notes

Intro

A major objective for this lesson is to have students determine a path of inquiry in central-pivot irrigation systems that can be examined mathematically. This may sound like a tall order, but I think the subject is sufficiently interesting and with the proper guidance on your part the results can be satisfying. The purpose of this approach is to remove the familiar, dictated format used in math textbooks. Like science, math should be used to understand the world around us. Most of the problems we face in life are rarely presented in neat packages.

To accomplish the above feat, I would start with the Google Earth file in class. View the crop circles from above and then zoom into the first two placemarks. The second placemark contains a SketchUp model of a central-pivot irrigation system. Point out the parts: wellhead, sprinkler sections, and wheel towers. They need to understand that this is a chain of sprinklers motorized around the center and that water is flowing through the entire line. The wheels divide the sprinkler system into segments and mark the ring appearance on the field. These systems vary depending on the crops they are used for. Some have sprinklers dangling below only a foot or two above the ground, while others have the sprinklers positioned above. Each section may have up to 20 sprinklers mounted. The wheel towers are all motorized but the outermost tower controls the pace while sensors keep the others in line. Water is pumped through the suspended pipe. The pressure declines the further out but the system keeps it within acceptable limits. The trusses are arched because of the weight of the water. Central-pivot irrigation systems are economical because of their low maintenance, and they can apply fertilizer and pesticide as well as water to the crops.

Again, you'd like to follow the students' questions, but lead them towards the different sizes of the rings and what obstacles that might produce. Each section covers a different sized area and so how is the water application kept uniform? If the water flowed at the same rate, the center of the field would flood. How much do the rings' areas differ? At this point you'll want the students to suggest the formula used to find a circle's area and how the area of a ring can be found by finding the difference between two circles' areas. Go to Field 1.

Field 1

Demonstrate how the ruler tool can measure the radius of the different circles. Discuss what unit would be best. I suggest miles because the results won't differ much and you can convert into acres easily. Have the students record the radii of Field 1 on a sheet of paper and find the area of each region with a pencil and calculator. At some point this should become sufficiently tedious, so ask them if they'd like to do these calculations in an easier way.

Using spreadsheet to perform functions is the next major objective of the lesson. If they start the exercise with pencil, they will be sure to realize the value of spreadsheets. Spreadsheets enable them to phrase their equations and perform their calculations easily. Data can be entered into the same table or replaced

with new numbers. Depending on their experience with spreadsheets, you'll want to help the students set up their charts and phrase their spreadsheet formulas. You'll find tips and samples in the *Crop Circles 2 – Teacher's Guide* download.

Be sure to take time to analyze the resulting numbers. Use them to reaffirm or deny previous ideas and to spark new questions. Make it purposeful and personalized.

At this point you should have an idea of how long these will take. You may have been able to accomplish the above in a class period or off and on during a week. You know your students best, so determine the best pacing. You may want to introduce a field in class and then assign the spreadsheet for homework.

Fields 2-5

You can find suggested investigations for the Fields 2-5 on the *Crop Circles 2 – Teacher's Guide*. Your tables may differ, depending on what your students are interested in. Just be sure to adapt their questions into spreadsheet exercises.

Suggested links:

[Wessels Living History Farm](#)

[Wikipedia](#)

[USDA](#)

The following companies manufacture or install central-pivot irrigation systems. Contact them through their websites if you have questions and I'm sure they'll help you as they helped me.

[T-L Irrigation Company](#)

[Reinke Manufacturing Company, Inc.](#)

[Roberts Irrigation](#)