

Discussion of Why VRI May Not Being Used to Its Full Potential

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Abstract. *VRI, variable rate irrigation, sometimes call site specific irrigation was introduced to farmers in 2001 by the University of Georgia and early versions became available in 2004 commercially. The major OEM manufacturers of center pivots began to introduce center pivots equipped with VRI in 2010. Many different groups have touted the concept of water savings and improved water use efficiency when VRI is used. However after discussions with a number of farmers in 2016 and 2017 using center pivots equipped with VRI zone or individual sprinkler control it was found some had never used the VRI function or had tried to use and stopped for a variety of reasons. This paper will present the findings on why VRI is not being used to its full benefit exploring both hardware and software. In addition some suggested recommendations to improve the use of this technology will be presented.*

Keywords. VRI, variable rate irrigation, site specific irrigation, center pivot, linear, water use efficiency, water savings

Background

Since the introduction of the center pivot in the mid-1950s, the mechanical move industry has continued to improve and develop products to better meet the needs of production agriculture. The overall goal has been to provide cost-effective, uniform irrigation across the field with a specific application depth. With the introduction and acceptance of precision agriculture, more information has become available for a particular field and areas in the field, including yield, EC maps, soil and grid sampled fertility maps. Farmers now have data indicating the variability across the field, which was already suspected but not generally considered at a sub-field level. The challenge became how to use this data to change the depth of irrigation application for different areas of the field. The goal is to apply the 'right' amount of irrigation to each management zones within a field.

Early research with commercial fields by the University of Georgia indicated substantial water savings as many fields have areas that require less water or no water at all (Perry and Milton, 2007). However a number of researchers have identified significant barriers to adoption. The foremost need is for the development of guidelines and tools to assist consultants and grower in predefining standards for economically defining sizes and numbers of management areas and writing basic prescriptions, (Evans 2013). And more recently Dr. Troy Peters, Washington State University said "The data collection, analysis, and creation of optimal VRI prescriptions for a specific field's needs can be complex, time consuming and expensive, especially since many field situations require these prescriptions to vary both in time, and in space" (Peters 2017).

Growers continue be as efficient as possible and do not have time to spend on using highly detailed or difficult to use software.

Discussion

The following discussion focuses on VRI zone and individual sprinkler control. Speed control is not considered.

Beginning in 2010 with the introduction of VRI zone control Valmont's team worked closely with each grower adopting the product. Over time as the hardware matured less emphasis was placed on supporting the customer with creating prescriptions after the VRI hardware was installed and operational. A very simplified prescription software was provided with each VRI package. It was presumed the grower and/or their consultant would handle the prescriptions. Growers and/or consultants collected data from soil maps, yield maps and electro-conductivity maps generated from Veris or Dual EM scans of the field to generate prescriptions. Valmont early in the commercial roll-out of VRI provided consultants access to the format required for uploading a prescription via telemetry products

During this same time in general researchers utilized VRI to simplify their irrigation projects by providing easy control of water delivery by plot. Limited emphasis on field trials using the hardware to manage irrigation to the spatial variability of the field has been done.

An early observation was rarely were prescriptions changed during the growing season. Also few changed their overall irrigation scheduling program.

While the following does not specifically mention VRI, it seems to be a very apt description of the current situation with VRI - The overall driving force for adopting irrigation scheduling is economics – scheduling is used by the farmer because it makes or saves money. Nonetheless, even irrigators who find scheduling profitable will discontinue its use if it becomes too burdensome (Hennegler, 2013).

During 2016 to 2017 an unscientific survey was done where a number of owners of center pivots with VRI zone control or individual sprinkler control purchased between 2010 and 2014 were contacted either by phone or in a personal interview. The rough total ended up being about 41% of the fields where VRI was installed. This was to understand why and how they were using the VRI package and any challenges they were facing.

The focus of this work was on those already owning VRI. It is worth mentioning common reasons cited by growers why they are not interested in VRI are:

- Long perceived payback
- Limited perceived value

The planned use of VRI by growers can be broken broadly into two different categories

- To shutoff water delivery completely in different areas of the field for ponds, water ways and other non-cropped areas.
 - Definitely reduces water use
 - Stop application of crop production products in non-crop areas
 - Generally one prescription meets the needs and no adjustments are made unless the non-cropped area changes
 - See figure 1



Fig. 1

- To vary the water depth applied to different parts of the field
 - May reduce water use depending on goals
 - Based on specific characteristics of the field base
 - Soils
 - Topography
 - Yield
 - Other
 - Unlikely one prescription is suitable for the entire season
 - See figure 2

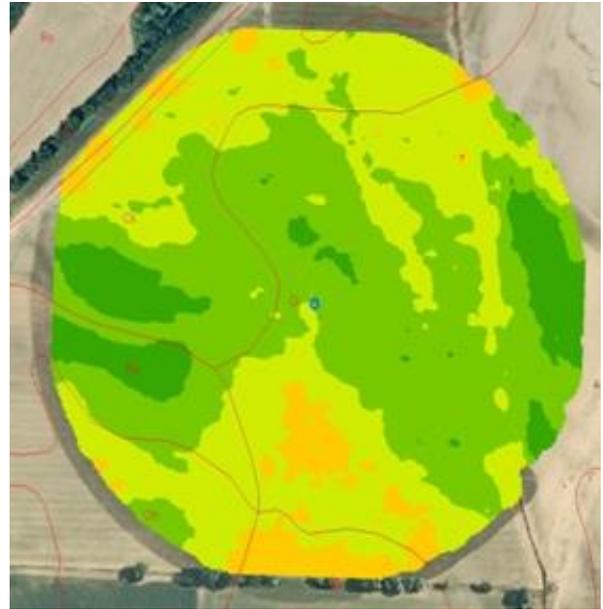


Fig. 2

From discussions with growers it was found their use of VRI can be broken into three broad categories

- Had never used for a full year – 3% of those contacted
- Had used for a few years and quit – 27% of those contacted
- Still using – 70%
 - Rarely if ever change the prescription – 47% of those contacted
 - Change three or more times during the growing season – 23% of those contacted

Reasons given for not using after installation or stopping use include

- Hardware challenges – 17%
 - Loading prescriptions
 - Valves
- Challenges with prescriptions – 72%
 - Knowing what to base the prescription on
 - Creating the initial prescription
 - When and what to base changing the prescriptions on
- Consultant quit offering or became too expensive – 11%
 - The change in commodity prices was cited as a reason

This was information that was very eye opening and may help explain why adoption of VRI has not been as rapid as expected.

Conclusions

The adoption and use of variable rate irrigation zone and/or individual sprinkler control has not grown at the rate the irrigation industry expected.

Information from an unscientific poll conducted in 2016 and 2017 indicated growers who had purchased VRI zone or individual sprinkler control current status of use to be:

- Did not use a full year – 3%
- Had used some and quit – 27%
- Still using - 70%

Of those who indicated they had not used a full year and/or had used some and quit they cited the reasons to be:

- Hardware issues 17%
- Challenges with prescriptions 72%
- Consultants quitting or cost 11%

Based on the information collected the following are suggested for future work by both for the public and private sectors:

Hardware

- Dependable and reliable sprinkler controls
- Easy to troubleshoot problems
- Provides as applied information

Creation of initial prescriptions

- Easy to prepare
- Automated based on a variety of inputs

Creation of future prescriptions

- Easy to use requiring minimal grower intervention
- Easy to incorporate data collected during the growing season
- Automated based on a choice of inputs

Information on the economics of using VRI

While the survey did not collect data on VRI speed control it should be mentioned most if not all of the center pivots computerized control panels being manufactured in the United States today come with the software for speed control.

Speed control has not received attention from the public sector but does offer easy access to a form of variable rate irrigation and has the potential to provide improved field irrigation for growers. The preparation of prescriptions and economics certainly deserve attention.

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References

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