Using Precision Agriculture to fine tune paddock management: A case study with the Yuna Farm Improvement Group in WA

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Abstract

On farm experimentation was used to help fine-tune the input rate for site-specific conditions. Simplicity of experimental design was a key to adoption of the result. These experiments can be overly complex. In one particular field, higher yielding areas responded well to fertilisers and gave a $67 per hectare increase in margin with an extra $21 of fertiliser. The lower yield potential areas responded less to fertiliser and suffered a loss (-$50/ha) with a rate of 60 kg/ha urea plus 75 kg/ha Agyield compared with the usual rate of 90 kg/ha Urea and 75 kg/ha Agyield. Our learning experience with the Yuna Farm Improvement Group is to keep the questions and solutions simple. Adding more complexity into the questions and solution at this time can often confound the results.

Key Words

Spatial management, production zones

Introduction

Considerable investment has been undertaken into precision farming by farmers. Although some outputs have been useful, such as the ability to visualise and quantify paddock variability with yield maps, the question still remains whether the use of precision farming will provide the farmer with a new tool to increase profits. The objective of this project is to provide the farmer with the empowerment to investigate the impact of management options by carrying out paddock scale on-farm experiments (OFE).

Methods

A group of farmers from the Yuna Farm Improvement Group with access to yield mapping technology was selected. The farmers had different levels of experience with yield mapping and some had access to variable rate technology. OFE was adapted to answer questions about their paddocks with a key component being the selection of the type of experimental design to put in place. This involved a number of generic decision tree steps.

1. Discussions with the farmers and agronomists about what issues were of greatest interest to the grower. From these discussions, potential alternatives and solutions can be developed.

2. Paddocks are then selected to test the alternatives and solutions by OFE.

3. Determine if the paddock has performed relatively uniformly in the past.

4. 4a. If uniform, apply either a strip or doughnut trial (Figure 1) of selected rates with at least 3 runs of the applicator bar. Results from this strategy can help optimise the uniform paddock.

5. 4b. If non-uniform, and without a variable rate technology applicator (or patience) apply a strip or doughnut trial replicated over the whole paddock. This method can be used to initially identify production zones. Once identified step 4a can help optimise the uniform sub paddock.

6. 4c. If the paddock is non-uniform and the production zones are known then use 4a. If a VRT applicator is available then the design of an OFE trial with zones can be implemented. Zones can either be flat rates or be validated with check squares (Figure 2). Fine-tuning of input rates is possible at this stage.

Results

Currently, 75 OFE have been attempted with growers from the Yuna Farm Improvement Group, all with varying degrees of success. A selection of results from these 75 OFE follows:

Paddock 6 on the Summerset farm in Yuna is relatively uniform. The value of spray topping was uncertain to the growers and a doughnut trial was undertaken to address this issue. The outside 100 metres were spray topped in 1999 and in 2000 the whole paddock was sprayed. In 2001, a yield difference of 0.2 t/ha was seen in the areas that had been spray topped in 1999. At last year's grain price, spray topping in 1999 provided an increase of around $30 per hectare in 2001.

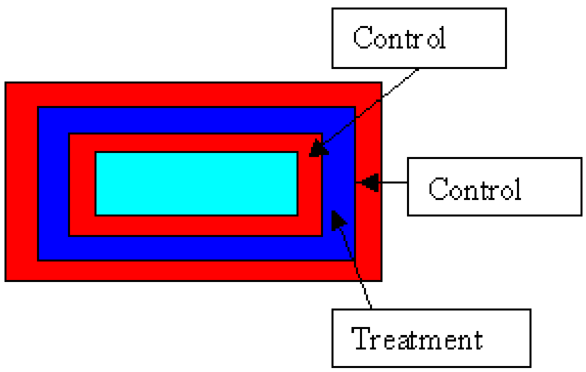

Figure 1. A doughnut trial design consisting of two controls and a treatment area.

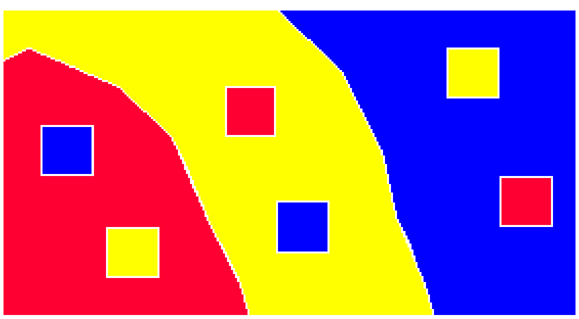

Figure 2. A zone based trial with high, medium and low zones with corresponding check squares.

Paddock 4E on the Nolba farm is a relatively variable paddock with yields ranging from nearly 0 t/ha to 4.5 t/ha. The farmer with the help of prior knowledge, yield maps and satellite imagery has identified productivity zones. The issue here was to determine the fertiliser requirement for the identified zones for an anticipated yield. In each zone, fertiliser rates were varied, higher yielding areas were given a higher rate of application and *visa versa* with a control rate of 90 kg/ha Urea plus 75 kg/ha Agyield (17.5% N and P, 4.5 % S). The higher yielding areas responded well to fertilisers and gave a $67 per hectare increase in margin with an extra $21 of fertiliser. The lower yield potential areas responded less to fertiliser and suffered a loss (-$50/ha) with a rate of 60 kg/ha urea plus 75 kg/ha Agyield compared with the usual rate of 90 kg/ha Urea and 75 kg/ha Agyield. The fine-tuning here related to applying more fertiliser to the higher yielding areas to take account of higher fertiliser demand.

Conclusions

Once more is understood about production zones in the paddock, OFE can be applied to neighbouring paddocks in order to identify common adjoining zones. Here, OFE can help reorganise land use and create a new farm geometry for more profitable land management. Full variable rate technology is not needed or wanted by growers at this stage. OFE can be done with a traditional constant rate input applicator, however, a yield monitor is needed in order to quantify and interpret the results

Acknowledgements

The authors wish to thank the Yuna Farm Improvement Group, FarmScan, Rinex, Primary Sales Australia, Morris, Wesfarmers Landmark and McIntosh and Son. This work is supported by a grant (CSO 213) from the Grains Research and Development Corporation.