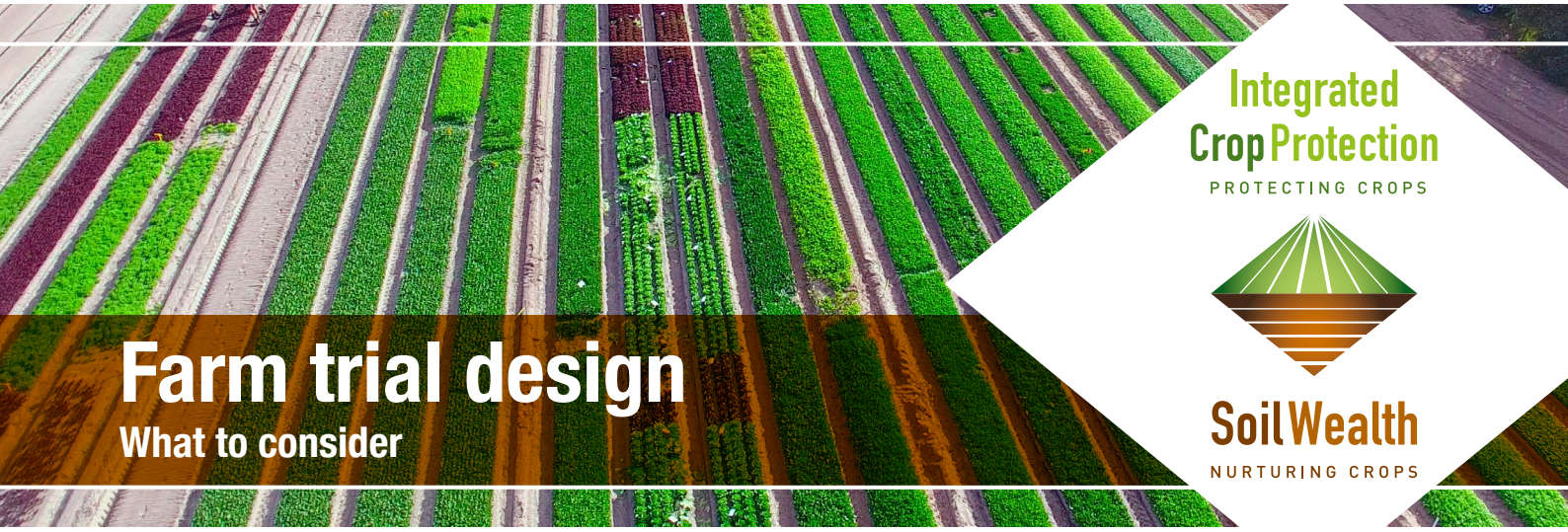

Farm trial design

What to consider

Integrated Crop Protection
PROTECTING CROPS

SoilWealth
NURTURING CROPS

What is the question? What is your goal?

Be clear about what actually is your question. Ask how it fits into your long-term goals and plans and what the gains or learnings could mean in that context.

Research your question, ask others you trust for input. Then narrow down your question to just one or two variables, or treatments. For example, does this cover crop provide improved saleable yield gains, is this variety better than the one I have been using, does the new equipment save time and fuel costs? You may want to find out about multiple benefits but have a clear, priority research question that you write down.

Planning

It is worth spending extra time planning to ensure a better final outcome. Badly planned trials usually fail and are a waste of time and money. Put somebody in charge of the trial and allow for sufficient time to run it well.

Start planning preferably half a year before you need to start the trial. Things to be considered include – extra time needed to set up and look after the trial, which blocks/strips or bays are suitable, what data you will collect and who will do it, what inputs or equipment you need to have on site in time.

Strive to only have one or two variables that you are testing. This is especially important if you plan to only have one or 2 replicates for each treatment. Results from split paddock trials can be misleading, if conditions are not the same.

You will need extra time for data collection. You will need to check the trial throughout the growing season and record your observations and measurements. You will also need to record weather events such as hail, frost, excessive heat and humidity. Time will be particularly important at harvest as you should harvest and asses all the trial plots on the same day. Data collection could require harvesting, sorting (by size and quality) and weighing the product from smaller sub-plots for each individual treatment area at the trial sites or harvest large plots or entire treatments and running the product from each over the grading line separately to get yield and quality data. Load cells on harvesters can be used to obtain total yield data but it will be important to still determine saleable yield for each quality grade.

Example plot design

	BLOCK 1		BLOCK 2			BLOCK 3		Dimensions	
	Bed 1	Bed 2	Bed 3		Bed 4	Bed 5	Bed 6		
	Buffer		Buffer			Buffer		7.5 m	
	Treatment 1		Control			Treatment 3		20 m	
	Buffer		Buffer			Buffer		5 m	
	Treatment 2		Treatment 3			Control		20 m	
Buffer	Buffer	Buffer	Buffer	Sprinkler row	Buffer	Buffer	Buffer	5 m	110 m
	Treatment 3		Treatment 1			Treatment 2		20 m	
	Buffer		Buffer			Buffer		5 m	
	Control		Treatment 2			Treatment 1		20 m	
	Buffer					Buffer		7.5 m	

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Hort Innovation

ahr applied horticultural research

RMCG

Knowing market prices and production cost will then allow you to estimate profitability of a new technique or product you trialled.

It may be worth considering:

- conducting a trial in collaboration with others in your area
- involving research or extension specialists or advisers during planning and data analysis
- discussing the trial with your peers, they may want to run the same trial for comparison
- asking company reps about possible trial inputs, markers, sample packs or contributions such as soil or plant analyses.

Factor in the difference in cost estimates between the control and the treatment.

If you want to be able to confirm differences between treatments mathematically, you need to involve somebody who understands statistical analyses in trial planning.

Choosing sites

Rules for designing a good field trial are:

- include an untreated control plot, which is managed 'as usual'
- use accurate measurements or visual/photographic assessment that are repeatable, document them
- use several trial plots with the same treatment, especially if soil conditions are not identical across the trial
- do not include paddock edges, headlands or any obviously different areas
- allow for buffers between plots to ensure treatments do not overlap e.g. when using sprays or fertilisers.

The untreated control site gives you a baseline to compare your treatment to. It allows you to determine if the treatment has had a measurable effect. As far as possible, the only difference between the control sites and the treated site should be the trial treatment you are testing. Timing and application of any other treatments, including irrigation, should be the same as practicable. Variety, soil, cropping history, topology, etc., should also be as uniform as possible. By minimising the differences, you are ensuring that any difference in result is solely due to the treatment.

Create a diagram of the trial - show trial plot layouts, including allowing for edge effects.

Data / what should you measure?

Measurements should relate to marketable yield and quality i.e. number of heads, bunches, cartons or tonnes per hectare sored by quality (grade 1, 2, processing, waste). Record/photgraph what defects were found that downgraded the product. If your treatment is directed towards pest and disease incidence, it may be worth monitoring for differences in target pests or diseases. Use visual asssments of incidence and severity in each treatment. Take samples and send to a dignostic lab (patholgy or entomolgy) if you need to confirm the type of disease or pest present. If the trial is aimed at crop nutrition, consider taking soil and plant samples for analysis to confirm differences.

Visual assessment may not be particularly reliable unless they are well described and repeatable e.g. incidence = number or % of plants per small plot or transect affected and severity = % leaf area diseases or damed on affected plants.

Each treatment needs to be assesesd at the same time using the same method. Photos taken of permanent observation plots may be useful.

While there may appear to be a difference between the results from your control and your treated plots, it may not actually be due to anything other than trial set up; i.e. the differences are due to differences in soil, nutrients or irrigation, not treatment. You will only see yield differences if they are above 20%. If you want to be sure about differences, you need to repeat each treatment and control at least four times using a randomised design. Then, given data is collected for each treated area (plot) seperately, you could do, or ask somebody for, a statistical analysis. If that is what you are aiming at, involve the specialist in the trial planning phase.

Sharing your results

Consider sharing your results with other growers.

Resources

Search for 'on farm trial design' for further information.

Example Farm Trial Protocol / Checklist

1 Version number and date

Keep the protocol up to date, both while it is being revised during planning and when details change during implementation.

2 Author(s)

3 Crop(s)

4 Farm Location

5 Trial Reference or Number

Introduce a unique reference or number for each trial. Needed to keep track of each one and not confuse it with others with similar names.

6 Trial Name/Title

Choose a short, memorable title that people quickly learn relates to your trial.

7 Investigators

7.1 Responsible Investigator

Remember the PI is the person responsible for the design and implementation, recording and analysis of the work.

7.2 Team members

As applicable

8 Background and Justification

In each of the following sections you must make it clear:

8.1 The problem to be addressed

8.2 How your trial will help solve the problem

8.3 What is the next step (when this trial is concluded) expected to be

8.4 Cost estimate

Actual $ needed for consumables or capital items plus time (hours) you think you will spend. Attach details if required

8.5 Summary of what is already known

What is known about the problem and possible solutions e.g. from literature? Past trials by you and others in this area.

8.6 Links to other trials

Describe how this trial links to other activities, such as other trials or training activities.

8.7 Trial hypotheses

Trial Hypotheses: statements which you believe to be true and when this is to be confirmed by the trial allow the work to progress.

8.8 Potential Impact

If the work goes as planned and hypotheses are confirmed (or not), what will the effect be? Who will benefit? How will they benefit and by how much? How sustainable will the impact be?

9 Trial Objectives

The trial design and the protocol depends on the objectives. List them clearly, completely to leave no doubts about any aspect of the trial later. You may want to include a description of who the resulting information is aimed at.

The objectives must be consistent with each other and capable of being met with a single trial.

Your team or others may need to get involved in deciding the objectives, If that has not yet been done it is probably too early to write a detailed protocol.

10 Methods

Give enough detail here for the protocol to be useful for:

- Anyone to see what you plan to do, so that suggestions for improvement can be made.
- As the permanent record of what should be done, to be referred to during implementation, recording and analysis. It should be good enough for this even if the Responsible Investigator leaves.

10.1 Trial type

E.g. pruning nutrition, irrigation etc.

10.2 Duration

Be realistic! The start date must be far enough in advance to make proper preparations. The trial must be long enough to get results) but short enough to keep everyone interested. The appropriate length will depend on the objectives.

10.3 Trial location on farm

Block

10.4 Treatments

Describe both the treatments to be compared and the method of arriving at these. If "current practice" is included as a control treatment make it clear exactly how this is defined.

10.5 Layout, Trial plan

Describe where the treatments will be applied and how these are chosen. Describe trial area location and how it is marked within a farm. Include block/plot layout and sizes, as well as method of allocating treatments to plots.

10.6 Inputs

Describe what inputs (e.g. seeds, chemical, fertiliser) are needed and how, by whom these will be supplied

10.7 Trial Management

Who is responsible for deciding on management activities (e.g. planting, weeding, spraying, harvesting)? Who is responsible for carrying them out? List each management decision and who is making it. Distinguish decisions about the management (e.g. how many times to weed) from carrying out the work (e.g. doing the weeding)

10.8 Non-experimental Variables / Risks

Describe key variables or risks that could have an influence but are out of your hands

10.9 Data collection

Describe sampling schemes, sample sizes and measurement unist (plants, kg, plot.) and times e.g. by growth stage

Data may be collected on 'response variables' such as

- agronomic performance parameters
- economic performance parameters
- Visual assessments
- Off-site impact
- Observations (recorded)…

Describe the monitoring process (eg how will you collect data planned data collection)

10.10 Data Management

Describe who will be collecting and managing the data. Explain how this will be organised and if any training is necessary. Describe how and where data will be looked after / recorded electronically. Who will have access to it? How and where will it be archived?

10.11 Communication

Who is looking after team communication and communication of results? In which format will they be communicated?

10.12 Data analysis, reporting and feedback

Describe methods to be used for analysing, interpreting and reporting the data. Who will do it and when.

11 Outputs

List tangible outputs e.g. a report, a presentation

12 References

As required