DIY Research on-farm

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Doing your own on-farm trials is a low-risk way to evaluate how different practices, products and equipment perform in your growing system. Getting the trial design right before you start is crucial to getting valid, reliable results that are truly representative of what you can expect if you adopt the change on a large scale. In this article, we'll guide you through the steps you can take to create a successful trial on your farm. Doing this right will save you time, effort, and money in the long run.

Step 1: Determine the aim of your trial

What are you trying to find out? You may be interested in testing a new variety, plant density, growing medium, foliar spray, or root drench which may improve the marketable yield and/or help to prevent pests and diseases. Create a research question that is simple and easy to test and limit your investigation to just one factor. Do not be tempted to overlay another treatment or factor onto your planned trial. Otherwise, if you get an increase in yield, you will not know which treatment was the effective one.

In our hypothetical trial, our research question is: *Do strawberries grown in used media bags produce less marketable yield than strawberries grown in fresh bags?*

Step 2: Design your trial so that it's free from bias and the influence of outside factors

All plants in your trial must be treated the same with identical conditions except for the treatment being tested (e.g., age of the growing media). It's a good idea to conduct the trial in the most uniform part of the crop, avoiding edge rows, ends and other sources of influence like walkways.

Replicate your test treatment

Variability exists within all farming systems. Replication helps to account for this variability so that you can have greater confidence in your results. Start with a minimum of three test treatment replications to account for in-field variability, more if you can manage it.

Repeating the trial also provides replication; this also allows you to observe how the test treatment performs in different seasons.

In our hypothetical trial, we will include five (5) bags containing media which was used in a previous strawberry crop. *Each bag is a replicate, making a total of five test treatment replicates.*

Replicate your control

Control treatments must also be replicated. It's important to identify specific control treatments in the field to avoid bias. People tend to gravitate towards better looking plants or plants that suit their unconscious biases. If controls are selected 'randomly' during each sampling event this bias will alter the results of the trial.

In our hypothetical trial, there will be five (5) control replicates. *The five bags containing fresh media (the control treatment) will be used as a comparison to the five used grow bags (the test treatment).*

Randomise your test and control treatments

It can be tempting to stick all your test treatments together in the same area, separate to the control treatment. This is not a good idea however, as variability in the growing area will influence the results. Randomising the placement of test and control treatments allows in-field variability to be detected and accounted for when interpreting results.

Splitting a field in half, with controls on one side and treatments on the other, is not a sound way to conduct on-farm trials because there is no way to detect the influence of in-field variability.

Figure 1. Polytunnel with single table-tops showing the chosen experimental row and placement of control (Orange) and test (Blue) treatments. Photo credit: Helen Newman, APC

In our hypothetical trial, plants are grown in a north-south oriented polytunnel on single table-tops. *There are three rows of tabletops separated by a wider walkway. The central row on the eastern side of the polytunnel was chosen as the experimental row to keep away from the sides and the walkway (Figure 1).*

The coin toss method was used to randomly allocate test and control treatment bags in pairs down the experimental row. A roll of 'tails' meant a used media bag (test treatment) was placed first in line followed by a control treatment (fresh media bag). The first coin toss was 'heads' so a control treatment (fresh media bag) was placed first followed by a used media bag (test treatment). This process was repeated until all bags were allocated.

Determine what data to collect

What you measure depends on the aim of your trial. For example, if you want to see if the marketable yield has increased, you can count and weigh the fruit and record which fruit are marketable and which are not.

If you want to evaluate the incidence of disease following a preventative treatment you may count the number of affected plants, leaves or fruit with symptoms.

Whatever you are measuring, make sure you have clear and objective definitions (e.g. what does marketable fruit look like) and take photos of the parameters you are measuring.

In our hypothetical trial, we will count, weigh and class fruit according to marketability from each of the 10 trial bags for the entire season.

Supporting information is also good to collect such as growing conditions during the trial (temperature, humidity, feed and drain EC and pH), crop management activities and when they were conducted (e.g., removal of runners, release of bio-controls) and other important events (e.g., blackouts, storms, temperature extremes).

Pre-plan everything before you begin

Have recording sheets or a book dedicated to the experiment for collection of data and other information and ensure that the data you collect is traceable.

In our hypothetical trial, each media bag and picking bucket will be labelled with a unique number (from 1 to 10) to avoid any confusion in the crop or when weighing the fruit.

Our recording sheets have individual columns for media bag number, treatment/replicate number, marketable fruit count, marketable fruit weight, unmarketable fruit count, and unmarketable fruit weight (Figure 2).

Step 3: Collect, process and interpret your data

In our hypothetical experiment, using the marketable fruit weights as our example, all harvests over the season were added together to obtain a total weight for each bag. The total weights were then plotted in a graph giving a visual picture of how the test treatment yield compared to the control yield. You can create a graph (Box and Whisker chart) to see the data within a Microsoft® Excel spreadsheet. If you are unfamiliar with Excel, open the program and select a tutorial to get started.

Using Excel, enter the data as shown in Figure 3, with the total marketable yields from each replicate recorded in separate columns according to their treatment type ('Used media' or 'Fresh media'). Select rows 2 to 7 in column B and column C at the same time. Include the title of the columns, 'Used media' and 'Fresh media' in your selection. Select the 'Insert' tab, then from the drop-down menu tab as shown, select the 'Box and Whisker' option.

Interpreting the Box & Whisker chart

The blue box on the left summarises the used media data and the orange box on the right, the fresh media (Figure 4). Data is sorted from lowest to highest and separated into four quartiles. In each box, the cross represents the average (mean) total yield within each treatment. The box contains the middle two quartiles of the observations with the box ends representing the upper and lower quartile measurements for total yield. The ends of the 'whiskers' indicate the highest and lowest measurements, while the horizontal line in the box is the median (middle) measurement for total yield.

In general, the fresh media appears to have performed better than the used media treatment. The plants growing in the used media also have more variable yields, as the box and whiskers are longer compared with the fresh media, which in itself may be valuable information. This graph alone may be enough to help you make decisions about using a particular treatment that you have tested in your experiment. However, if desired, and since the experiment was designed with randomisation and replication, a formal statistical method could be used to help confirm if the treatment was more effective than the control.

Date: **Time:** **Staff Member:**

Bag No.	Treatment/ replicate number	Marketable Fruit count (number)	Marketable Fruit weight (grams)	Un-marketable Fruit count (number)	Un-marketable Fruit weight (grams)
1	Control Treatment (Fresh Media: Replicate 1)				
2	Test Treatment (Used Media: Replicate 1)				
3	Test Treatment (Used Media: Replicate 1)				

Figure 2. Example trial recording sheet. Make your recording sheet easy to use for the person taking and recording the measurements. Include a space for the date and the name of the person taking and recording the measurements.

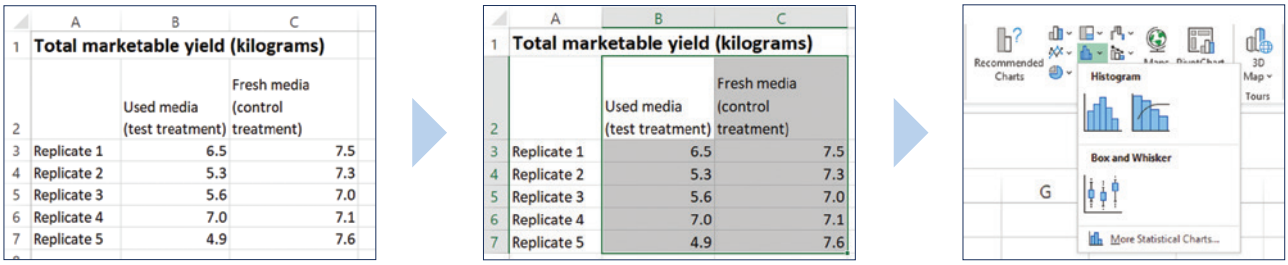

Figure 3. Visual display of how to enter data and create a 'Box and Whisker' chart in Excel.

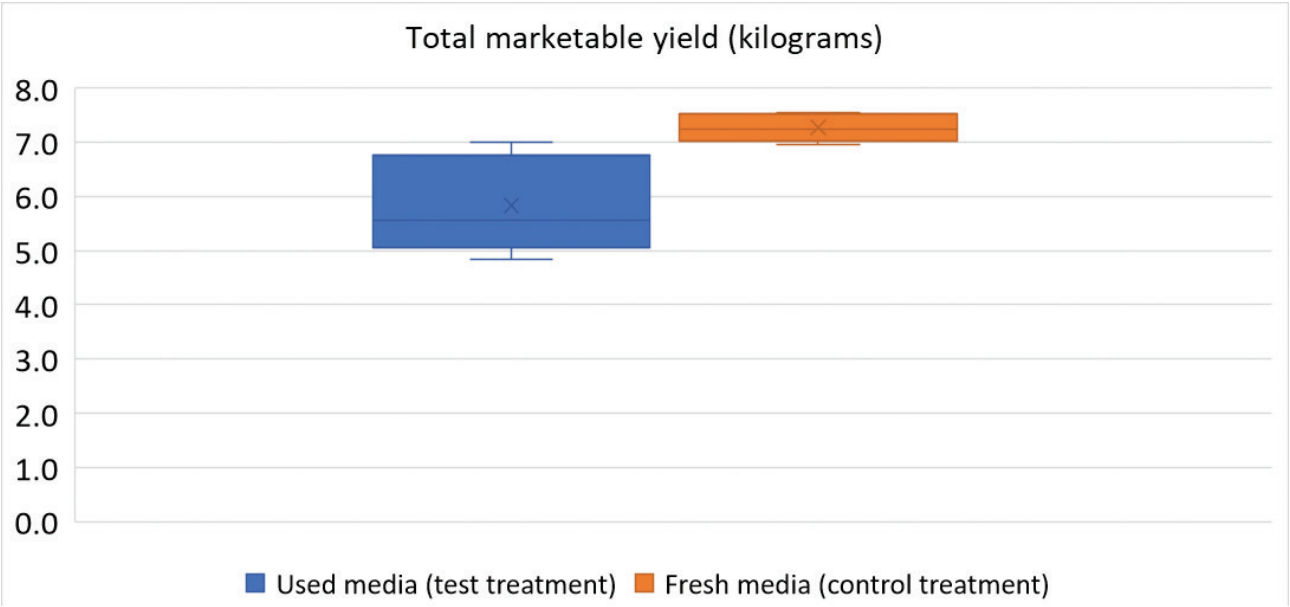

Figure 4. Completed Box and Whisker chart with a chart title and legend added.

Difficult to DIY treatments

Not all potential treatments are appropriate to test in your own research. Pesticides must only be used according to the label instructions and must be registered for the crop you are growing in a greenhouse setting. So, modifying the method of application of a pesticide or testing it on an unregistered crop, or testing in the greenhouse when it is registered only for field use is not possible.

Treatment evaluation can also be difficult in hydroponics if you want to test a solution additive or a new nutrient recipe, particularly if only one tank supplies the crop as replication is not possible. However, if the plants are in bags of media, some treatments could be applied to individual plants by manually applying the treatment solution (e.g. a microbial boosting solution) with a watering can and the control solution (i.e., water) supplied to other plants in the same manner.

Other treatments difficult to replicate include greenhouse coverings and climate control regimes.

More information

The Organic Farming Research Foundation has an excellent guide for on-farm research which you can download from bit.ly/ABJ-on-farm-DIY

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