# Principles of experimentation that farmers need to understand

Ric Coe, 11 September 2015

If farmers take more roles in experimentation then they need to understand the basic principles of how an experiment works. Here is an attempt at listing the minimum set of principles that it would be useful for farmers to understand, along with a simple explanation of each. The aim is to express these in a way that an interested farmer could understand, and that could be translated into local languages.

There are additional principles and practices that researchers and facilitators need to understand. This list only concerns what farmers need to know.

This document has no suggestions of how farmers can be helped to understand these principles. Those need developing, testing and describing by people with relevant experience. An experiment done with farmers should be part of a larger process of dialogue and learning done with farmers, researchers and others. This document describes principles for only a small part of that process.

| **Principle** | **Explanation and examples** |
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| The aim of an experiment or trial is to compare alternatives. | Experiments in agriculture are the main tools available when we have alternatives or options and need to understand their relative performance.<br>Examples of options that can be compared in an experiment include:<br>- Crop varieties<br>- Agronomic practices<br>- Pest control methods<br>Comparisons need to be made:<br>- in farmers' fields, as the performance will probably depend on where the comparison is made<br>- by farmers, as only they can assess performance in terms that matter to them. |
| Experiments and demonstrations have different aims so have different requirements | The aim of a demonstration is show how something is done so others can learn. The aim of an experiment is to find out the effects of doing things differently. Experiments are needed when something is not known- such the effect of changing practice or variety – and this can be found out by direct comparison of the alternatives. A demonstration requires someone (the person demonstrating) to know what they are doing and be able to show others. |
| The minimum number of options to compare in one experiment is 2. There is no maximum. | Since experiments are based on comparison between alternatives, the minimum number of things to compare must be two. There is no maximum number, but the more options compared the more complex the experiment will be. A successful experiment with very many options compared will be hard to design, management and learn from.<br><br>It is common for each farmer taking part in an experiment to compare all the |

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| | options being consider, but it is not a requirement that every farmer has the same set. |
| Include a 'baseline' option to compare new ones with. | New options need to be compared with something that acts as a baseline. The 'something' will usually be the current practice or variety. It should be something farmers are familiar with. It would only be a 'zero input' option if that is current practice. There may be more than one baseline option in a trial. The term 'control' is sometimes used for the baseline option, but can be confusing and is best avoided. |
| Compare like with like. | Options are usually compared on small plots. These should be as similar as possible in all ways except the option that is being compared.<br><br>For example, if comparing two methods of soil fertility management then the two plots should be of similar fertility before starting. |
| Allocate options to plots randomly | Decide which option should be planted on each plot at random – for example by pulling numbers from a hat – so as to avoid any possible bias due to putting a favoured treatment on the best plot, or always making the first plot the baseline. |
| Repeat comparisons to be sure differences between options are consistent. | Performance of small plots can be influenced by many different things, some of them unknown and invisible. Confidence in the results of an experiment is increased by making sure that each comparison between options is repeated, and then checking for the consistency across repeats of differences between options. For example, if a local and new variety are compared, we need several repeats of the pair of plots. Repeats can be on the same farm, on different farms, in different locations and in different seasons. Each type of repeat gives a different sort of information |
| Manage the alternatives in the same way in all respects except those you want to compare. | The management of plots in the trial should be the same for all options being compared and be as similar as possible to normal practice. Each plot should be fertilized the same way, planted on the same day and weeded on the same day (unless these are the options being compared). |
| Keep good records of what you do and what you see. | Keep a careful record of which plot is which. Either label them with something that will not get lost, or make a plan of the plots and label each option on the plan.<br>Keep notes of dates when plots are planted and managed. Keep notes of any observations of things happening to the plots. |
| Take unbiased observations of each alternative and record them carefully. | If you take any measurements of the plots then carefully follow the instructions, assess each plot fairly and honestly, and keep careful records of the results. Remember this is not a competition between the options or between farmers taking part. You need to know exactly how each performs, and if some don't perform well everyone need to know that. |
| Learn by comparing experiences from several farmers doing the same trial. | Everyone learns most from experiments if the results from many farmers are put together.<br>[This is the simple version of the point on 'repeats'. Which is better?] |