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How to get reliable yield estimates from terraces

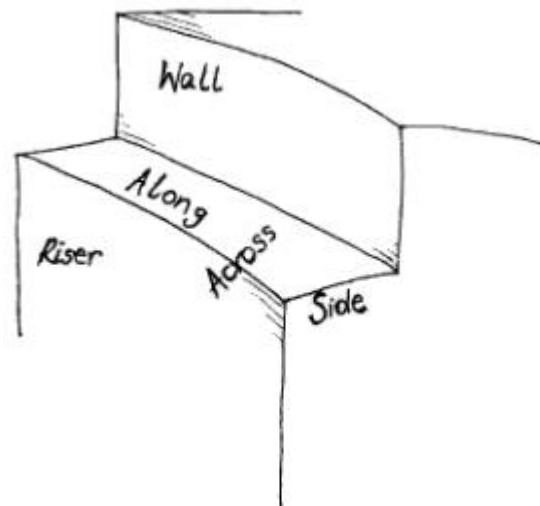
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On-farm trials are important tools used in Nepal to identify problems and test new technologies under farmers' conditions. The problems of participatory on-farm trials have often been raised in *PLA Notes*. From studies in Nepal it is clear that although many factors influence the adoption or rejection of a new variety (level of education, caste, level of food security) the single most important aspect that most farmers look for is high yield. Thus it is essential that reliable data on yields are obtained from terraces, the distinctive feature of the Himalayas.

Terraces pose problems for the researcher which are not necessarily encountered on farmers' fields. These include their small size, and the high level of variability of productivity both within and between terraces. Variability of production within a terrace is primarily due to the slope between the terrace riser and wall (see Figure 1 which shows the terminology associated with a terrace). This slope causes a difference in the moisture available within rainfed terraces and it alters the soil properties of the terraces for both rainfed and flooded terraces. Adjacent terraces can produce quite different yields.

It has been recommended in *PLA Notes* that on-farm trials should consist of at least duplicate plots and that the plot size should be large (see Fielding and Riley, *PLA Notes* 29). Farmers can often be reluctant to give up much land to a trial because the size desired by the researcher may be a large proportion of their holding and so represent an unacceptable risk. Further, the small size of many terraces means that large plot sizes may not be feasible on a single terrace, however, in some instances quite large terraces can be found.

Figure 1. Terminology associated with a terrace. The *riser* is the front of the terrace where one walks, and the *wall* is the back of the terrace (where there may be a drain). The terms *riser* and *wall* are interchangeable as the riser of one terrace is the wall of its neighbour. The terrace *side* is the edge which connects the riser to the wall. The direction from riser to wall is termed *across* the terrace and the direction from side to side *along* the terrace.

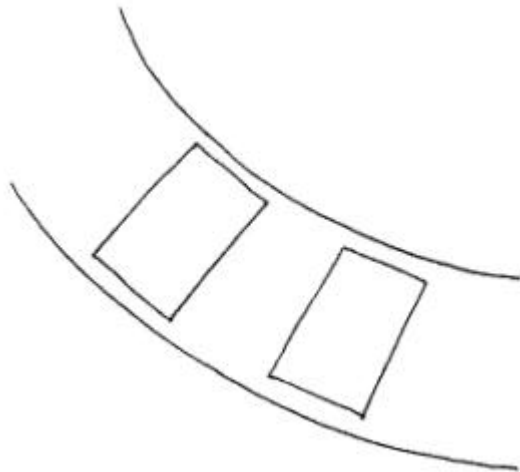


How should trials be arranged on terraces to get reliable yield measurements? Recent studies at Pakhribas Agricultural Centre suggest that the following guidelines should increase the reliability of yield data from terrace trials (see Figures 2 and 3):

1. One treatment **must not** be allocated to its own terrace; grow each treatment on every terrace in the trial. (If this is not possible seek the help of a biometrician).
2. Plots should be orientated so that they run from the riser to wall, not parallel to the riser.
3. Make plots as large as possible.

In order to get a large enough area from which to obtain reliable yield data, a "single" plot may need to be composed of smaller plots from several terraces in order to comply with Requirement 1 above.

Figure 2. A diagram of the recommended way of laying out plots on a terrace. The plots are orientated so that they run from terrace riser to wall or across the terrace.



Box 1 shows the effect of orientation of the reliability of yield data from a flooded terrace in Nepal. The effect of orientation is even more important on rainfed terraces so the example given here is a conservative one.

Terraces which do not differ in altitude by more than 25 m can be included in the same trial as

yields should not be effected by altitude over this range; changes in altitude of over 100 m should be avoided. Orientation effects temperatures on a terrace so could result in some plots being cooler than others if changes in aspect are severe. The importance of repeating treatments in a terrace trial is just as important as for field trials.

BOX 1

AN EXAMPLE SHOWING THAT YIELD ESTIMATES SHOULD BE MADE FROM PLOTS ORIENTATED ACROSS TERRACES

Yields of wheat were collected from 16 plots of 16 m², which were stretched out either to run parallel to the riser (2x8m) (along the terrace) or to run between the riser and wall (8x2m) (across the terrace). Using all the plots, the yield of the terrace was 4442 kg/ha.

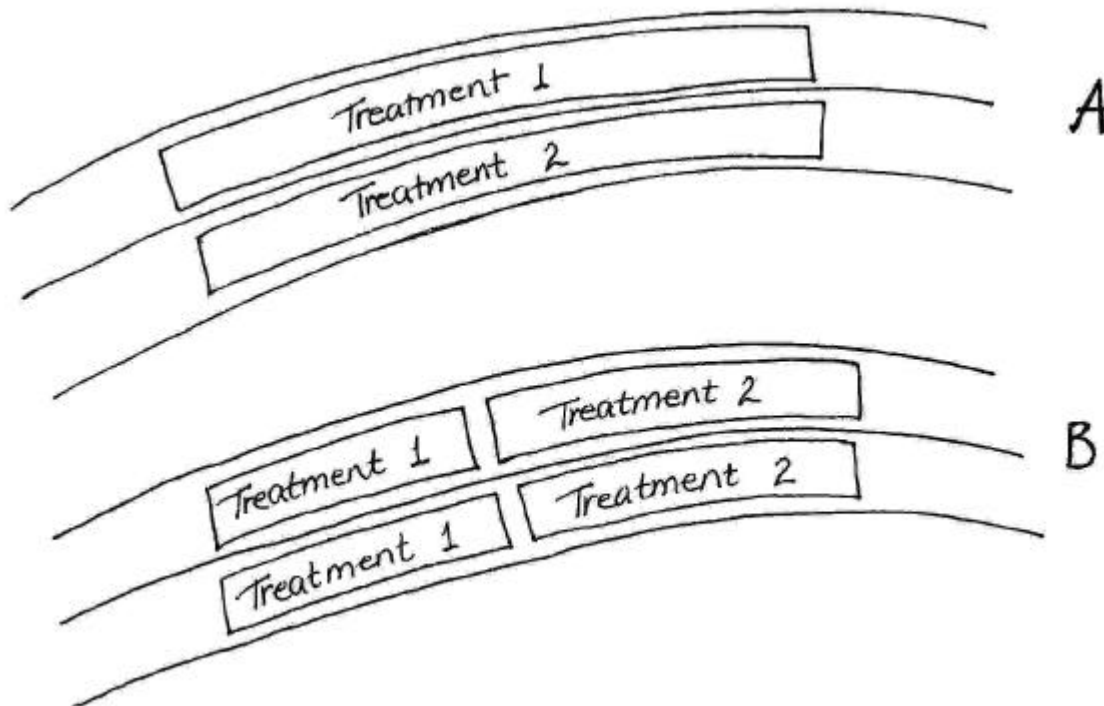
Plots orientated along the terrace gave yields which varied from 4837 to 3904, a range of 933 kg/ha.

Plots orientated across the terrace gave yields which varied from 4878 to 4095, a range of 783 kg/ha.

The range of the possible yield estimates which might have been obtained from a plot orientated along the terrace is about 20% greater than that from a plot orientated across the terrace.

In surveys or crop cutting for estimation of farmers' yields, the plot should also be orientated across the terrace to obtain accurate yields.

Figure 3. Treatments on terraces. Layout A is not a recommended way to test two treatments on two terraces. This layout assumes that the two terraces would be of equal productivity if the same treatment had been applied to each. Layout B is the recommended way to test the two treatments. If there are differences between the terraces, they will influence both treatments.



The recommendations above refer to terraces which have a single slope or are irrigated. Less is known about the variability of terraces with multiple slopes, but Recommendations 1 and 2 could be expected to hold for many types of terrace. The example in Box 1 shows that yields obtained when plots are orientated across the terrace can be expected to be closer to the 'true' terrace yield than plots orientated across the terrace. Because farmers attach great importance to yield, every effort must be made to correctly estimate this quantity so that farmers' reactions can be understood.

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RELATED READING

Fielding, W. J. and Riley, Janet (1997). How big should on-farm trials be and how many plots should be measured? *PLA Notes* 29: 19-22.

Fielding, W. J. (1998). Terrace experiments: A field guide. PAC Working Paper No. 222. Pakhribas Agricultural Centre, Dhankuta, Nepal, 20 pp.

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