Adaptive Research for Agricultural and Rural Development

Phase II Workshop Report

Organized by

Participatory Ecological Land Use Management (PELUM) Association

PELUM KENYA

Workshop Held at

Hill Spa & Resort, Nakuru

29th to 31st August 2012

Reported by Lilian Njogu

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Abbreviations

ARDP – Agriculture and Rural Development Programme

CRD – Completely Randomized Design

PELUM Kenya – Participatory Ecological Land Use Management

RCBD – Randomized Complete Block Design

SPD – Split Plot Design

1.0 Background and Introduction

Following an increased appreciation and increase in the role of research in agriculture and rural development, PELUM Kenya has been carrying out capacity building in the area of adaptive research. Adaptive research is also known as on farm research, and is conducted to validate, modify or calibrate a new technology on specific soil, climate, and social economic or environmental characteristics of a given area. In this type of research farmers play a key role in the research process.

In November 2011, PELUM Kenya, held the first introductory training that mainly focused on discussions around concepts and definitions. The participants were taken through basic aspects of adaptive research such as its importance, roles, levels, types, processes, research plan, development and dissemination. The participants visited community projects to identify research aspects that can be incorporated regular development work.

To build on this process, PELUM Kenya organized the second workshop to progress the adaptive research analysis and discussions. During this workshop, the participant shared the information they gathered on the results of the implementation of the plans laid down in the first workshop, which included achievements and challenges.

1.1 Opening Remarks and Introduction of Members

The participants were welcomed to the second phase of the workshop by Maryleen Micheni, the workshop coordinator and Programme Officer, Research and Information Management at PELUM Kenya. She welcomed the participants and asked those who were not in the first phase to read through the report for the first phase, so that they are not left behind.

Ms Maryleen Micheni welcoming participants

She gave the participants the opportunity to introduce themselves in pairs and each participant to introduce

his/her partner to the rest of the participants. This was followed by a selection of welfare officials and norms to guide all participants during the 3 days workshop were put in place.

1.2 Key Opening Speech

The workshop was officially graced with opening prayers by one of the participants. An official, Mr. Stanley Bii, the Acting Programme Coordinator, Agriculture and Rural Development Programme (ARDP) delivered an opening speech. In his speech, he said investigating more on research has helped to improve farm production. He said in ARDP they work through farmer groups and encourage farmers to transfer their indigenous knowledge to other generations. ARDP who were the host organization for the workshop had organized a group of farmers to come and meet with the participants to carry out some interviews to help in the research project. He ended by wishing the participants a good time and a warm welcome to Nakuru noting that the climate condition was expected to be rainy and cold.

1.3 Programme Overview and Objectives

Maryleen took the participants through the overall aim of the workshop as well as the main objectives. She also asked participants to state their expectations and fears of the workshop. The overall aim of the training was ***to increase the knowledge and skills of field agricultural facilitators in conducting on farm/ adaptive research while executing community development***.

1.4 Objectives

- To outline the research designs commonly used in social and in agricultural research
- To elaborate on key elements in adaptive research data collection and processing
- To highlight on preparation of research reports and their use in dissemination of findings
- To carry out some practices in the field on the set-up and consequent implementation of adaptive research/ on farm research projects.
- To share experience on successes and challenges from programmes and projects that are focusing on adaptive research metrics based on workshop plans from November 2011 training.

1.5 Expectations of the workshop

- Learn about field design for adaptive research
- Build on introductory workshop
- Share experience on adaptive research
- Learn more on Adaptive Research
- See how Kenyan workshops and organized
- Share experience from Spain
- Share experience on livestock
- Get to know more people
- Gain Knowledge and learn new ideas
- Socialize
- How to design Agricultural Research
- Simple ways to help farmers get through Adaptive Research
- How farmers can approach Adaptive Research
- How often research will be repeated
- Communication of result by farmers to the future generation
- Learn application of Adaptive Research

1.6 Fears expected during the workshop

- Knowledge trickling down to farmers
- Time challenge
- Field work, the weather might be wet
- Will farmers adapt the Adaptive Research?
- Kiswahili / Language Barrier
- How Adaptive Research is domesticated
- Catching up with the phase / training
- Terrorism and Ebola from Uganda
- If participants will be friendly
- Unsure of next destination (movement from one hotel to another)
- Time frame might be too short

1.7 About PELUM Kenya

Participants of the Adaptive Research phase II workshop

Maryleen introduced PELUM Kenya, stated the objectives of the association, values, aims and mission as well as the programmes at PELUM Kenya. She mentioned the core functions of PELUM Kenya and its role in advocating and supporting small scale farmers' initiatives all over East, Central and Southern Africa.

What is PELUM Association?
Participatory Ecological Land Use Management (PELUM) Association is a network of Civil Society Organizations / NGOs working with small-scale farmers in East, Central and Southern Africa. The membership has grown from 25 pioneer members (in 1995) to over 230 members in 2010.

PELUM Kenya's Vision
To see communities in Kenya become self organized to make choices towards an improved quality of life that is socially, economically and ecologically sustainable

PELUM Kenya's Mission
To build the capacity of the member organizations and partners in Kenya to empower their local communities through participatory methodologies in ecological land use management and sustainable development.

PELUM Kenya Programmes
Four activity based Programmes run at the secretariat:

i. Capacity Enhancement Programme (CEP) – Headed by a Programme officer
ii. Campaign Advocacy and Lobbying (CAL) Programme – Programme Officer
iii. Research and Information Management (RIM) Programme - headed by a Programme officer
iv. Results Based Management (RBM) – Programme officer,
v. Management, Coordination and Support - headed by the Country Coordinator, Programme Operations Manager (POM) & the Finance and Admin Manager (FAM). This programme offers support and facilitatory role to the 4 activity based programmes above.

2.0 Introduction to Adaptive Research for Agricultural and Rural Development Phase II

The session was facilitated by the main facilitator of the workshop, Johnstone Tungani, of Sacred Training Institute, Bungoma. Johnstone, who was the facilitator during first workshop in November 2011, asked the participants to state what they learnt during the first phase. The participants stated the following in brief:

Mr. Johnstone introducing Adaptive Research Phase II

- We defined research as a systematic process of data collection, analysis & interpretation to create problem solving knowledge
- Stated the emphasis we put in involving farmers in our on farm research
- We should take the process of dissemination more seriously by engaging farmers
- We defined different types of research and how to adapt each.
- Understanding the concepts used in research, uses and sources of research
- Collaboration between the farmers and the researcher
- Research facilitates good planning and decision making.

The facilitator then kicked off his presentation by reviewing in brief the main topics that were covered in the previous workshop.

2.1 Topics Covered in Phase I

- Definition of adaptive research
- Importance of research
- Types of research
- Identifying research topics/issues
- Ethical issues in research
- Overview of research proposals
- Overview of research reports

a) Definition

Research is the systematic process of data collection, analysis and interpretation aimed at generating useful knowledge / information

Adaptive research is similar except it is more about technology validation mostly with the communities / farmers.

b) Importance of Research

- Explore into new information
- Accurate description of issues
- Accurate explanation of scenarios
- Informed evaluation of systems/persons
- Reliable prediction of future

c) Types of Research

- Method Based
- Purpose based

d) Identifying Research Topics/ Issues

- Experience & consultation
- Literature & reports
- Beneficiary needs assessment
- Keen observation

e) Ethical issues in research

- Morals
- Non plagiarism
- Legal issues
- Mentoring
- Culture / Environment mindful

f) Research proposals

A document on the projected plan of action

- Introduction
- Literature review
- Methodology

g) Research reports

A document on findings and recommendations from research

- Introduction
- Literature review
- Methodology
- Results
- Discussion, Conclusions & Recommendations

It is the key tool for dissemination (outreach) of research findings.

3.0 Research Problem (Statement)

It is defined as a significant challenge facing community (One that lowers living standards) or an issue where society has inadequate knowledge / understanding causing curiosity/ real problem.

Factors to consider in stating a problem in adaptive research:

a) 'Felt' problem, b) Study literature to widen knowledge of the problem
c) Clarity of statement

3.1 Research Objectives

Research objective is a statement of the task(s) the researcher intends to undertake with the aim of 'solving' the problem.

Qualities that a research objective must have are:

- Directly related to the problem
- Have an action/verb word
- Specify the area/location where task will be done
- As specific as possible
- Have a measurable nature
- Be realistic
- Have an estimate time frame

Examples of Objectives

The facilitator stated some examples of research objectives.

- To establish the prevalence of striga weed on farms in Ugunja Division of Siaya District.
- To investigate the causes of declining yield of tea among small hold farmers in Teremi Division in Vihiga District
- To determine effect of decreasing land sizes on the dairy industry in Molo District of Nakuru County
- To suggest strategies for reducing the impact of drought on livestock in Makueni Division of Makueni District.

Mr. Johnstone Odera then asked the participants to give examples of research objectives. The examples given were:

- To determine the yields of four cassava varieties in Ugenya.
  On this example, the participant said she felt the need to research on it because cassava is a main food source in Ugenya. She therefore wants to advice the Ugenya farmers on the best type of cassava to plant among the four varieties available
- To identify the root cause of continuous poor yield of *Wairimu* bean in Mathira North Zone, Nyeri County.

3.2 Sample Selection

- Study area is the geographical boundaries within which a research will be done.
- Population is the total number of units/individuals from which the research can collect data.
- Sample is the fraction of the population from which the research is actually collected

Sampling in research is done to reduce the cost of study, reduce time of completion and to improve efficiency. The sample size on the other hand is determined by the funds available, time allocated, degree of variability in the population and the quality of sampling.

During sampling, weaknesses such as errors arise due to estimation. Another weakness is that sampling may give room for researcher bias.

3.3 Sampling Options/ Methods

Probability Sampling- Has high reliance of chance / nature/ luck

- Simple Random Sampling – Use the Ballot method

- Systematic Sampling – Select at regular in an organized list of population
- Cluster Sampling – Select from prepared geographical zones
- Stratified Sampling- Select based on quality criteria
- Multistage Sampling – Select sample in phases

Non- Probability Sampling – It does not rely purely on chance. It has some researcher's logic input.

- Purposive – In this kind of sampling, you go for people who have details of what you want. If you want very fine details.
- Convenience – You select farmers within the area of research for your own convenience
- Availability – Take only those available within the study area
- Voluntary – Go for those who are freely willing to give information
- Snow Ball – Being referred from one farmer to another. It is mostly used when the researcher does not know anyone within the study area. You rely on someone to direct you to another.
- Quota – Setting a certain percentage for example you decide to target 60% of female and 40% male.

Questions to the facilitator from the participants

1) Which among the probability and non probability method is recommended for a farmer researcher?
   - Both methods are applicable to the farmer, but the probability sampling is much better because non-probability is best for social research where you are dealing with people's perception.
2) How do you deal with unreliable farmers who can mess the research?
   - Use a reliable farmer whom you know cannot inconvenience. This can be established from previous working relationships
   - Work with different farmer groups to be able to identify the reliable group. Working with a group is more appropriate because one farmer cannot make a decision without consulting the other farmers.
   - The researcher sometimes contributes to messing of the research because they do not explain clearly and in details to the farmer what the research entails for him to understand the importance of it.

4.0 Research Designs

The arrangement / strategy /plan for data collection deemed ideal for the study in question

i) Survey Design

- Ideal for most social studies
- Non manipulative
- Emphasizes a good number of respondents
- Relies mostly on use of questionnaires
- Questionnaires can be administered through Self method, Telephone and face to face.

4.1 Factors to consider when developing questionnaires.

- Study purpose / objectives
- Language
- Clarity of meaning
- Sequence of questions

- Number of questions
- Format of questions (Closed or Open ended)
- Pre test

When drafting a questionnaire the researcher should have in mind that a very long questionnaire can give the wrong feedback. The number of questions should not be too many.

ii) Experimental Design

It is Ideal for most natural / agricultural studies:

- Manipulation / treatments
- Random allocation of treatments to units (Randomization)
- Several runs of the treatments on units (Replication)
- Data collection forms instead of questionnaires

It lays out options in experimental designs

- Completely Randomized Design (CRD)
- Randomized Complete Block Design (RCBD)
- Split Plot Design (SPD)

4.2 Sample of CRD Layout

Variety 1	**Variety 1**	**Variety 3**	**Variety 4**
Variety 2	Variety 1	Variety 2	Variety 4
Variety 2	Variety 3	Variety 4	Variety 3

4.3 Sample of RCBD Layout

Variety 1	**Variety 2**	**Variety 3**	**Variety 4**
Variety 2	**Variety 3**	**Variety 1**	**Variety 4**
Variety 4	**Variety 1**	**Variety 2**	**Variety 3**

4.4 Sample of SPD Layout

Compost	**Manure**	**Dap**	**Natural Fertilizer**
Variety 1	**Variety 1**	**Variety 1**	**Variety 1**

Variety 2	**Variety 2**	**Variety 2**	**Variety 2**
Variety 3	**Variety 3**	**Variety 3**	**Variety 3**

4.5 Management of Agricultural Experiments

All non treatment operations must be kept similar across all plots. These may include:

- Tillage
- Seed variety
- Fertilization
- Weeding
- Pest & disease control
- Tools for data collection
- Persons working in the plots

5.0 Preparation of a Sample Questionnaire for Field use

The facilitator divided the participants into two groups for each group to come up with a sample questionnaire to be used for field use.

The host organization ARDP had organized a group of farmers to assist the participants in filling up the questionnaire as part of the research. During the field visit, the participants were also involved in the farm to carrying out demonstrations on how to lay out the CRD, RCBD and SPD designs.

Participants in groups drafting a questionnaire

5.1 Adaptive Research Questionnaire

See annex 8.4

Participants Familiarizing with the farmers

Farmers / participants filling questionnaires

A group photo with the farmers and participants

5.2 Field Work: Laying Out Field Experiments

During the field work, the participants visited a farm where they were to carry out practical experiments on how to design the Completely Randomized Design (CRD), the Randomized Complete Block (RCBD) and the Split Plot Design (SPD).

The facilitator, carried out the first practical demonstration with the involvement of other participants assisting, and he later asked the participants to do it on their own without his input.

The photographs below show the process of designing the CRD by participants in a more practical way in the field.


Participants walking in a farm and on left Mr. Johnstone demonstrating how to measure a plot


Learning more practically by designing plots with the correct measurements in preparation for research work


A demonstration of the first measuring steps and on left participants view a designed plot

Participants re-designing their plots on their own

It starts with getting the correct measurements and fixing the pegs to mark the points!

A complete designed plot with the tags, ready for research

6.0 A Recap of Day 1 and 2

Johnstone took the participants through an unexpected way of recapping what he had trained throughout the sessions. He wrote 10 questions each on a different paper, and folded them one after the other to make a ball of papers. The participants were expected to "unfold the mask", read the question aloud and answer it before throwing the mask/ball to another participant. This kind of recap was unique and challenging because nobody knew the question he/she was to answer.

1) *What is adaptive research?* - It is an on farm research
2) *What is the meaning of research problem?* - Understanding your area of research more clearly
3) *What is sampling?* Coming up with what you will do in terms of method to use and where to carry out the research
4) *Why is sampling important?* – It helps to get quantified data. It can be biased or unbiased. Unbiased gives accurate results.
5) *State anything about probability sample?* – It is a sample that you predict. You cannot get actual results when looking at probability sample.
6) *Name one type of non-probability sampling* – Purposive sampling
7) *Tell us about Split Plot Design (SPD)* – It is where you can access other varieties in the same plot
8) *State any 3 things to consider in making questionnaires* – Clarity, simple language and objectives
9) *What on earth is Completely Randomized Design*? – It is a research design where you're looking at several treatments considering the differences in the area of research
10) *State a situation where a Randomized Complete Block design may be used* – It may be used on flat surfaces or continuous areas.

6.1 Data Processing

After collecting data from the field the researcher prepares the data for analysis that involves:

- ***Cleaning*** – If you have any forgotten information and do not have contacts of how to get it, delete it from your data.

- ***Coding*** – In questions where you got statements instead of numbers, provide numbers to represent. This will be easy for anyone analyzing your data.
- ***Data entry*** – Enter the data into soft copy
- ***Edit / Clean*** – Check any keyboard errors that may have occurred when typing

6.2 Data Analysis

Mathematical operations to which data gathered from the 'field' is subjected to reveal trends in the issues under investigation to enable interpretation and recommendation:

a) Median

The middle value when data collected is arranged in ascending or descending order:
9, 12, 15, 16, 17, 17, 18, 18 ((16+17)/2)

b) Mode

The value in the data that appears the most number of times:
9, 12, 15, 16, 17, 17, 18, 18 (17 & 18)

c) Mean

The average of the data values:
(9+12+15+16+17+17+18+18) / 8 = 15.25

d) Range

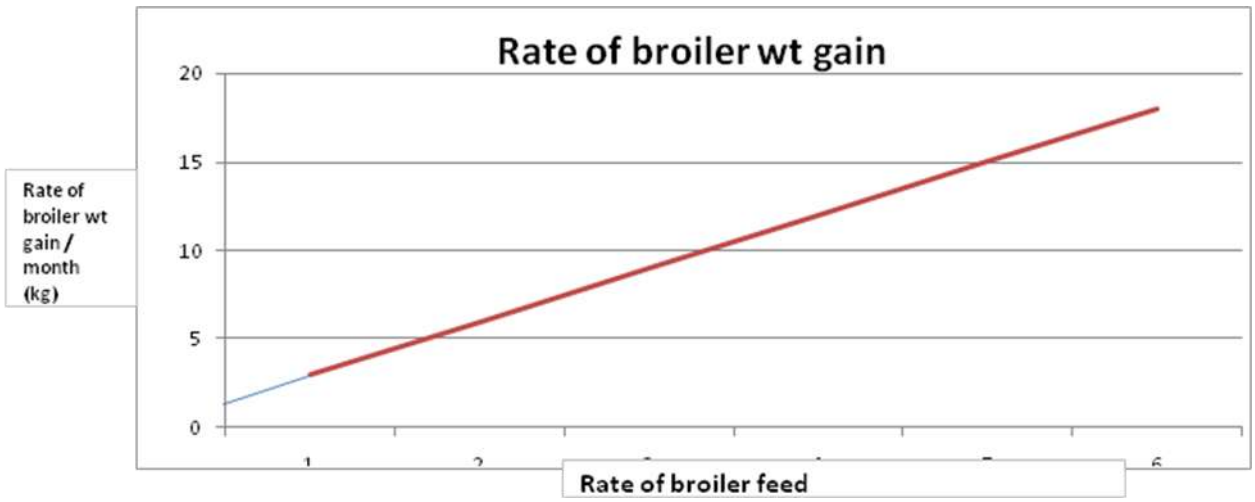
The difference between the highest and the lowest of the values in the data:
9, 12, 15, 16, 17, 17, 18, 18 = 18 – 9 = 9

e) Standard Deviation

The square root of sum of the squares of the difference between each value and the mean of the values:
$\sqrt{}$ $((9-15.25)^2+(12-15.25)^2+(15-15.25)^2+(16-15.25)^2+(17-15.25)^2+(17-15.25)^2+(18-15.25)^2+(18-15.25)^2) / 8$ $= \sqrt{}(1860/8) = \sqrt{}233 = 15.26$

Data from a Study Effect of Rate of Broiler Feed on Weight Gain

Rate of feed (Kg/week)	Weight Gain (Kg/month)
1	3
2	6
3	9
4	12
5	15
6	18



Association:
Model of relationship between two variables:
Y = K + bX: K is Y-intercept & b is the slope of the graph
Y intercept = 1.7
b = (Change in Y) / (Change in X) = (12 - 6)/ (4 - 2) = 3
Y = 1.7 + 3X

6.3 Data Presentation

Methods of making summarized / analyzed data available to those who would read our report. Proper titles and labels are the key thing in data presentation

- Narrative - Essay approach, rational flow of ideas
- Tables – Titles and column tables
- Pie Charts
- Bar Graphs – Histograms and Line graphs
- Photos

Results interpretation- it involves explaining the reasons for the trends reveals by the presentation based on:

- Rational knowledge – Rely on your knowledge
- Reference to literature – Rely on other researchers' literature
- Consulting authorities – Rely on an expert in that area of research

6.4 Research Report

The research report should consist of the following:

- Title – Derived from the problem to the objective
- Abstract – Gives an idea of what you're doing
- Problem Statement – Highlight what was missing / gap
- Statement of Objective(s) – Start by stating the broad objectives and narrowing down to specific objectives
- Methodology – Sampling, design, data collection, work plan / budget

- Results – Objective by objective or data by data
- Discussion - Interpretation of results preferable in the same order as in the results
- Recommendations – Statement(s) in the study based on the data and information from the research

7.0 Case Studies from Member Organizations based on Phase I Deliberations

NECOFA in Kibwezi - Case Study on Millet (By Priscilla Nzamalu)

NECOFA is based in Kibwezi within Makueni County. The area is semi arid and receives minimum rainfall.

The production of millet in Kibwezi has been very slow. The Market outlets are only within the households. There are a lot of imports from Tanzania yet the millet is the same type as what is grown in Kibwezi. The schools no longer prepare brown porridge from millet; they prefer to buy the white flour for porridge. Some farmers use the millet to make local brew. They want to research on why the production is slow and causes of the change in prices.

NIA in Kajiado - Case study on Local sheep v/s the Doba sheep from South Africa (By Joyce Saiko)

Kajiado County is home to the Maasai community in Kenya. The County is arid and most communities rely on keeping livestock

When the Doba sheep was brought the local sheep is no longer in existence. The Doba feeds more than the local sheep. Kajiado being a dry area, the Doba sheep is very expensive to maintain because it drinks lots of water and eats almost double the local sheep. Its production is very poor and expensive. They are researching on the viability of re-introducing the local sheep again.

INADES Formation in Machakos - Case study on Moisture Content and Seed storage (By Grace Mureithi)

INADES works within Machakos county, a semi arid zone where communities rely on keeping livestock and crop production.

The average moisture content is below 3 and they face a big challenge is retaining the moisture. The nature of the soil is seen to be one of the major problems. The instruments of measuring the soil contents are very expensive and unaffordable to farmers. They are doing a lot of management output as they research on how to maintain the moisture. They are also researching on how they can go back to using local seeds which are more adaptable to the prevailing ecological conditions. Most farmers do not have storage facilities and that is why they do not store the local seeds. They will research on affordable storage facilities and inform farmers on the usefulness of storing local seeds.

BIOGI in Vihiga - Case Study on Soil moisture testing By Ion Uranga)

In BIOGI, the case study was similar to that of Machakos. However, they had carried out some research and identified the problem and solutions. The presentation was done by Ion Uranga, a volunteer student from Spain who was on internship with BIOGI a Member Organization to PELUM Kenya.

Objective: To Collect data of soil conditions in the garden/s (physical and chemical) in order to see the improvement of the soil fertility.

Purpose:

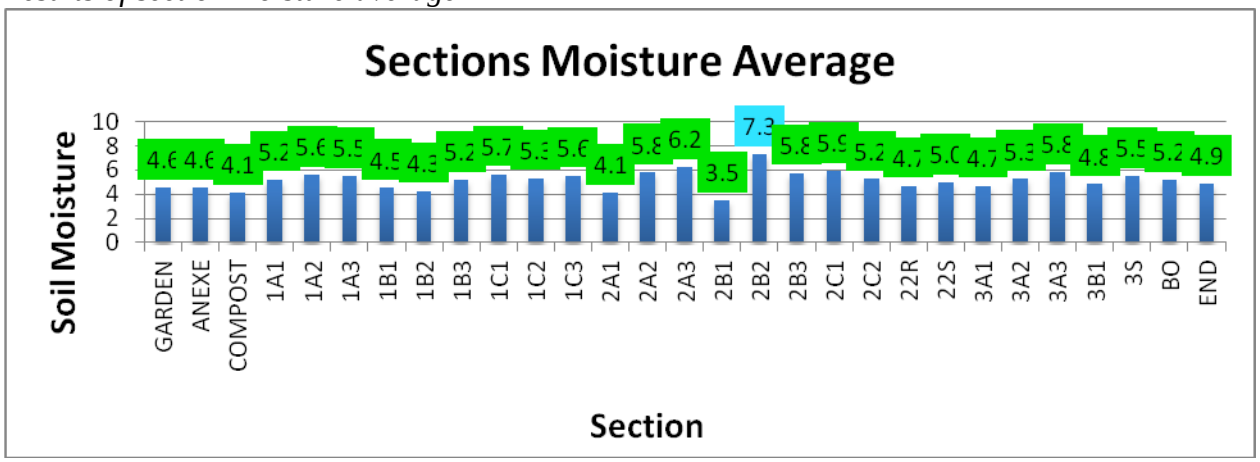
- Inform our extension work on fertility changes from inputs on yields, crop health
- Confirm whether changes in physical and chemical factors has maintained biodiversity and increased fertilization
- Have a better knowledge of our lands, in order to know which path to follow in the future.

Mr. Ion Uranga presenting the case study

Methods:

- pH measurement
- Soil moister measurement
- Soil texture
- Rain data collection
- Temperature data collection
- Physical observations

Results of section moisture average



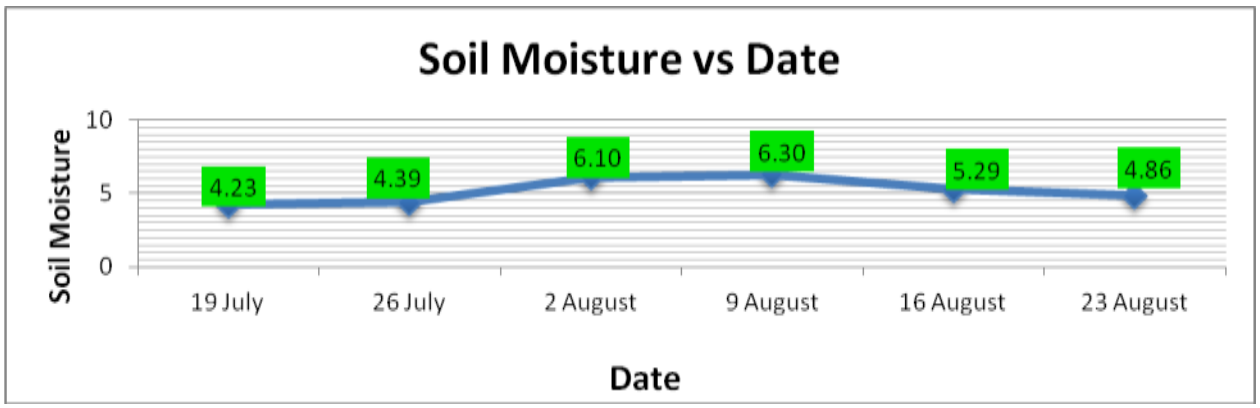
- All sections have been wet during the 5 weeks.
- The bed 2B2 with 7.3 points is the wettest.
- 2B1 bed is the driest with 3.5 points.

Possible Conclusions

- The fact that 2B2 bed has been with a lot of mulch and compost can be the cause of the high amount of moisture. Also the design for water catchment
- Crops with low need of water should be plant at 2B1 bed

Results of soil moisture vs date

- All weeks are wet and first week of August 2012 has been the wettest with above 6.1 points

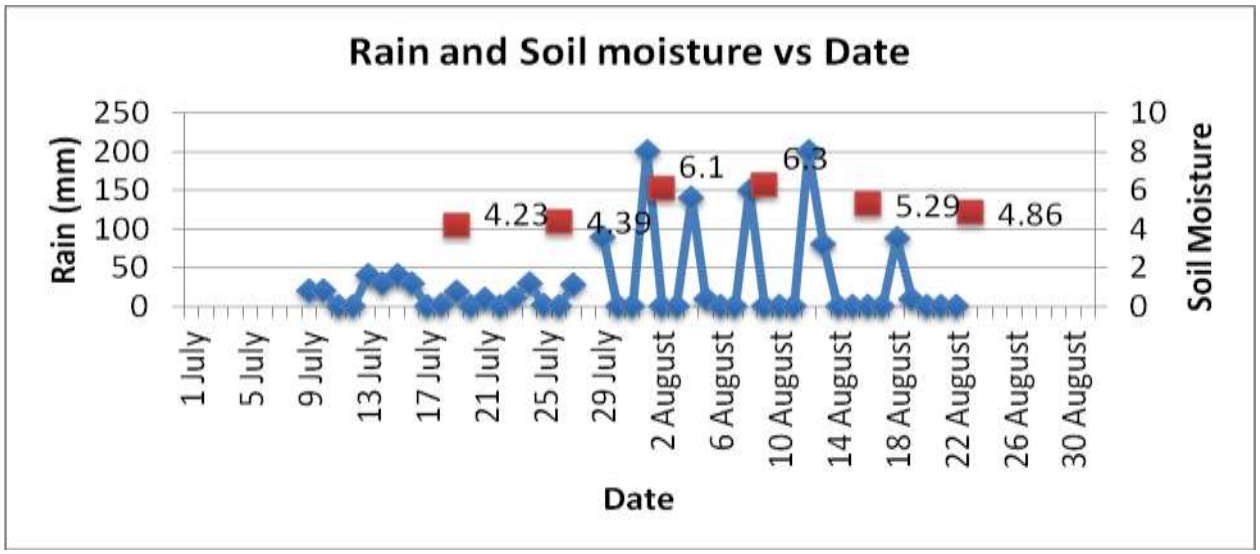


Possible Conclusions

- The water catchment strategies carried out in the garden such as terraces or trees plantation might be the cause of the high moisture of the soil.

Results of rain and soil moisture vs date

- August 2012 has been more rainy than July 2012.
- After heavy rains the soil gets wet.



Possible Conclusion

- The soil seems to retain water at least enough time until the next rain.

Results:

- pH measurements:
- pH (average) of the garden: 6.93
- Model farmers pH between: 6.5- 7.0

Final Observation; Slightly acid to neutral and good availability of Macro and Micro nutrients

MHAC in Kitale Case Study to verify published books from other countries, to determine what is suitable for Kenya e.g. a Case on pest Control methods (By John Okomba)

Kitale County is in a high potential zone within the rift valley. The county is among the highest producer of maize nationally.

MHAC gets published books from places like California in the USA and go through the information published, and it is from there that they pick on what is important and suitable for Kenyan cases/adaptation. They have taken like e.g. the case of pest control. Much information has been published but not all is suitable in Kenyan conditions. They have embarked on researching and publishing what is suitable and take to the farmers what they call "concluded research" They use the researchers and extensions officers to determine what is finally suitable for the local farmer. Once the farmers have enough information, they carry out the practical in their farms. The researchers visit the farms to see the progress to check if the results are positive.

SMART Initiatives in Kitale - Pokot Case Study to know the scientific name of a tress that preserves milk and how it works. (By Peter Namianya)

SMART Initiative do lots of research, they are currently researching on a certain tree which works well in milk preservation. The Pokot being nomads have lots of milk and they face a lot of competition from established market leaders in the milk industry in Kenya such as KCC and Brookside. Smart Initiative promotes the Pokot pastoralist in different ways so that the milk can be used by other communities. In their research, the milk from Pokot is more healthy, medicinal and nutritious because the animals feed on natural feeds in the fields.

The community has traditional knowledge on how to preserve milk without the use of chemicals. The researcher will now determine how the tree works in preservation and the scientific name of the tree.

RODI Kenya in Ruiru - Case Study of how the prisoners use their skills when out of prison (By Samuel Mwangi)

RODI Kenya is based at Ruiru town within Kiambu County. Most farmers in the County have small land units that they maximize in food production.

RODI Kenya focuses mostly on training prisoners and giving them knowledge on sustainable agriculture. Those in prisons learn and train a lot on agriculture but a big percentage do not practice it when they are released from prison. They lack the confidence to practice what they learn because most of them are not accepted back to the community. RODI Kenya therefore integrates them with the community during the trainings so that they are accepted back. The participants gave an example of a research case study for RODI to find out how the prisoners are using the skills given to better their lives once they are out of Prison.

7.1 Findings from the Survey carried out with Dondori Farmers

From the filled in questionnaires during the field visit, the participants analyzed the information and simplified the findings.

- 8 women 3 men
- 5 married, 1 single, 5 widow
- Average HH size; 6
- Farmers in 5 villages
- Average land size; 1.34 acres
- 90% quoted maize as key
- 45% quoted dairy goat, 35% dairy cow & 20% poultry

- Furthest & nearest water source 2.5 km & 0.02 km respectively
- 55% of them do not do any irrigation
- 45% rely on both family & hired labor, 27% on hired alone and 27 % on family labor alone
- Furthest distance to input source, 20km and shortest, 0.3km
- 81% quoted input cost as high
- 80% of the farmers have more than 50% of their income from farm activities.
- 54% sell produce at farm gate, 36% via brokers & 10% did not indicate any selling.
- Only 36% access credit facilities

Reasons for Joining Groups

- Knowledge empowerment
- Dairy goat project
- Easy selling of produce
- Widow affairs

Issues they needed addressed

- Finance support
- Peace in the community
- Access to good seed
- Skills for research
- Access to irrigation water
- Skills & means for pest control
- More training

7.2 Processed and Analyzed Questionnaire Carried out During the Field Work Trip

Responses to questionnaire administered to Dondori farmers in Nakuru

See annex 8.3

7.3 Adaptive Research Workshop Evaluation

Each participant was given an evaluation form to answer questions about the workshop. The information is to help PELUM Kenya improve on their work in future.

1) **List 1-2 things:**

a) ***Learnt from the workshop***

- The simple way to draft a questionnaire and what to put into consideration
- The approach to take in asking questions for my questionnaire.
- The basics of adaptive research
- Data analysis and Report writing
- Adaptive research really works
- How to design Split Plot
- How to formulate a questionnaire
- The importance of adaptive research
- Importance of farmers as researchers
- The process of conducting and analyzing research
- How to come up with good experiment (agricultural) designs
- The design layouts and report system
- Data preparation and presentation
- Methods of sampling and research designs

- How to demarcate plots for research and the process of doing it
- About the CRD and RCBD way of collecting data
- How to carry out adaptive research
- Activities in different organizations
- Community members have knowledge and can participate well in adaptive research
- Preparation of a questionnaire and the practical bit of it with the farmers.
- The work done in various organizations
- How to conduct social research
- How to carry out on farm research

b) Liked about the workshop

- The facilitator
- The workshop content was good
- Active participants
- Well organized field work
- Adequate time
- The way it was well facilitated
- The different experiences shared
- The good atmosphere
- Time management
- It was an eye opener for the researcher
- Sharing of research work by the participants
- Competence from the facilitator Mr. Johnstone
- Interactive from participants and the technical subject matter
- It was very comprehensive
- Excellent facilitation
- Training coming at a good time for implementation in the new season
- The filed experience – it did not take a lot of time which was convenient
- A friendly learning environment
- Value addition (acquired knowledge)
- Interactive lecture
- The ease in training – Facilitator was very down to earth

c) Did not like about the workshop

- The hotel note books – very few paged and the poor quality with papers plucking off
- Hotel management and organization
- Team building activities missing
- Being shifted from one hotel to another
- Getting good vehicles from the hotel to town is a big challenge
- The low rate of asking questions when the participant has not got the concept
- The hotel accommodation with incomplete facilities

- Lack of hard copies during presentation
- Location of the hotel was very inconveniencing
- Temperatures too low
- First day was mixed up
- Upper Chester management of customers was not good.

d) For c above what would you suggest for improvement

- Buy tangible good quality note books with firm pages or PELUM Kenya to provide instead of the hotel
- All participants should be put in the same hotel.
- More activities for group work to promote team building
- Workshops should end on Thursday or Friday morning to avoid burn-outs
- Better and improved hotel management
- Frequent follow-ups and meetings (not 2011-2012 gap)
- Active participants and more less continuity of the participants who were on the start of the subject matter
- Book the participants in a hotel with complete facilities
- Planning the hotel logistics early
- Issue power-point slides in hard copies so that we can follow up during the presentation.
- Book a venue with enough accommodation for all the participants

2) On a scale of 1 to 5 rate the following **(1=Poor, 2=Fair, 3=Good, 4=Very good, 5=Excellent)**

	Poor	Fair	Good	Very Good	Excellent
Extent of meeting your objectives		xx	xxxx	xxxxxxxxxx	xxxxx
Workshop relevance in your work			xxxxx	xxxxxxxxxx	xxxxxx
Facilitation Process			xxxxx	xxxxxxxxxx	xxxxxxx
Advance Information provided		xxx	xxxxxx	xxxxxxxx	xxxxx

3) For the Workshop Conference facility rate the following:
1=Poor, 2=Fair, 3=Good, 4=Very good, 5=Excellent)

	Poor	Fair	Good	Very Good	Excellent
Location of the hotel	xx	xxxxx	xxxxxxxxxx	xxxxxx	
Meals	x	xx	xxxxxxxxxx	xxxxxxxxx	x
Accommodation		xxxx	xxxxxxxx	xxxxxxxxx	xx
Hospitality		x	xxxxxxxxx	xxxxxxxxxx	xxx

4) For (3) above what would be your suggestion for improvement?

- To avoid movements, please maintain participants in one place.
- Carry a printer to avoid unnecessary movements

- We should all be in one place so that we can socialize and share work experience after the end of day workshop
- Improve on the booking system of the participants. The process was too slow
- We should go to a hotel not far from town
- Plan ahead of the workshop
- Conference rooms needs noise protection. The trucks turning and movement of people is very distrusting.
- The workshop halls should be more spacious for free movement
- PELUM needs to look at good places where things can be accessible with accommodation and hospitality up to date.
- Improve on facilitation. Rates to be improved
- Efficiency at the reception desk
- Good communication prior incase of change of venue
- The hotel should keep working hard to improve their services
- More space, we were too squeezed
- Good care of guests and being considerate on their welfare before money
- They need to improve their way of cooking and having a variety especially for vegetarians. A good example of the Chester in town.

5) Any other additional comments?
   - Very greatful to PELUM Kenya for organizing such an important training
   - Keep up PELUM, the workshop was very educative and the first phase report was informative especially for those who missed out.
   - We need more time for social networking
   - Keep up the good work as it is working for most of member organizations
   - Provide certificate for easy identification about trainings
   - Reporting date should be put into consideration
   - The organizers should ensure that there are enough rooms in their target venue before reporting date of the participants
   - There was great facilitation. The facilitator opened up our minds to be able to do much of our organizations and upcoming questions
   - The training is very productive
   - Though the hotel is still under construction, the parking area should be given first priority
   - Due to too much noise from the road, the second phase of the workshop should be situated elsewhere

- Next time we need more time with the farmers
- Improve on field visits and practical work which was well understood
- The workshop should be allocated more time
- Thank you for the workshop facilitation
- Greatful for the knowledge acquired. My God bless you

8.0 ANNEXES

8.1 List of workshop Participants

Name	Organization and Position	Contacts		
		Postal Address	Telephone	Email
1. Gathuru Mburu	ABN	6271-01000, Thika	0722643029	gathurum@yahoo.com
2. Gerald Yongo	ALIN East Africa	17-40302, Ndhiwa	0716760726	ndhiwamaarifa@alin.net
3. Stanley Bii	ARDP	1488, Nakuru	0722914862	agricrural@gmail.com
4. James Maina	ARDP	1488, Nakuru	0733966545	agricrural@gmail.com
5. Julius Karuga	Baraka Agricultural College	52, Molo	0722402544	jkaruga68@gmail.com
6. Ion Uranga Gonzalez	BIOGI		0708842840	uranga.ion@gmail.com
7. John Adeya	BERMA	42, Butula	0733893154	ngo.berma@yahoo.com
8. Johnson Nyaga	COSDEP	646, Nairobi	0725805899	postkenya2030@gmail.com
9. Millicent Akoko	CREPP	86-40122, Awasi	0725877195	millyakoko20@gmail.com
10. Peter Njeru	FH Kenya	125, Marsabit	0721947474	pnjeru@fh.org
11. Mary Wangui	GBIACK	4171, Thika	0724265889	mwangui36@yahoo.com
12. Anne Mbole	ICE Kenya	6072, Thika	0722663384	annmbole@yahoo.co.uk
13. Grace Mureithi	INADES Formation	1905-90100, Machakos	0722535263	aciemureithi@yahoo.com
14. Simon Buyobe	KICIP	384, Luanda	0728090428	simonbuyobe@gmail.com
15. John Okomba	M-HAC	MHAC Private Bag, Kitale	0715203463	johnokomba@yahoo.com
16. David Obiero	NASARDEP	62, Rodikopany	0725665781	obierotunya@yahoo.com
17. Joyce Saiko	NIA	366, Kajiado	0721324194	info@niakajiado.org j.saiko@yahoo.com
18. Priscilla Nzamalu	NECOFA	295, Kibwezi	0721404058	nzamalupn@yahoo.com
19. Samson Mwangi	RODI- Kenya	746, Ruiru	0726995483	samsonmwangi1@gmail.com
20. Robert Kihoro	RINCOD	9642-00300, Nairobi	0721395770	info@rincod-africa.com
21. Miriam Mutenyo	Self Help Africa	2248, Nakuru	0728830027	miriam.mutenyo@selfhelpafrica.net
22. Peter Namianya	SMART Initiatives	3761, Kitale	0731359246	penami78@yahoo.com
23. Moses Njenga	YARD	4781-01000, Thika	0728009782	yardcommunitydev@yahoo.com
24. Johnstone Odera	Facilitator	2248, Bungoma	0718473114	jotungani@yahoo.com
25. Lilian Njogu	Rappoteur	47985-00100, Nairobi	0722556263	lilynjogu@yahoo.com
26. Roland Mwalugha	PELUM Kenya	6123-01000, Thika	020 26 22 674	pelumkenya@pelum.net
27. Janet Lang'o	PELUM Kenya	6123-01000, Thika	0729223762	janet@pelum.net pelumkenya@pelum.net
28. Maryleen Micheni	PELUM Kenya	6123-01000, Thika	020 26 22 674 0723540417	maryleen@pelum.net pelumkenya@pelum.net

8.2 Work plans by Member organizations

Organization	Title of the study	Statement of the research problem	Statement of objective (s)	Description of the design including timeline and data collected	Highlight of key findings from the study	Statement of key lessons/ Recommendations for the community
ICE Kenya	The impact of embracing indigenous knowledge on seed saving sovereignty intervention	The problem of food insecurity in the country is alarming in most parts of the country and a big problem is people of Kenya cannot control what they feed on, simply because we have no control over what farmers plant, rather the likes of Monsanto control most of the seeds planted by our farmers and so we can't control what goes to our stomachs but the market dictates what is available. -During the times of our fore fathers, they could plan what to eat and feed their families and there was no hunger and people didn't suffer from starvation. Industrial farming has changed most of the indigenous farmer practices thus changing our seeds	-To outline the existing indigenous knowledge on seed saving -To investigate the reasons for or against the adoption of indigenous knowledge in seed work -To determine whether there is any significant impact on food security if indigenous knowledge in seed work is embraced by farmers at all levels of food production -To document the existing indigenous seed knowledge within Yatta community	A sample of 40 farmers active in the Kithio Kya mawithyululuko women group constituted the research population and a sample of 12 farmers' key with indigenous knowledge on seed work formed the basis of the study. 4 farmers practicing industrial farming formed the sample for comparative research. Data on the kind of seeds they plant, the kind of crop management they carry out, why they pant the kind of seeds they plant, Starvation data per household over the last one year-formed the date recorded.	Farmers have a lot of indigenous knowledge in seed saving and seed management -They do seed selection right from the farm for the crops that are vigorous in growth, and then the seeds are sun dried and well preserved using herbs such that seeds can be stored for at least 3 yrs without losing viability and without destruction by storage pests. -The 4 farmers practicing industrial farming didn't harvest anything	- There exists much indigenous knowledge in seed saving among farmer in Yatta –Kithio kya mawithyululuko women group. - Farmers are willing to go back to their indigenous seeds which are more adaptive to their weather conditions because those who plant hybrid seeds don't harvest anything but for them that plant indigenous seeds they harvest despite the changing climate. - Farmers that use indigenous seeds and indigenous knowledge in seed saving never lack food throughout the

		which is the countries heritage to hybrids and GMOs-and causing nutrition related ailments and food insecurity. With the embracing of indigenous seeds and indigenous knowledge in seed saving the nation will be food secure and have control over what one puts in the stomach.			over the last one year and dependent on shops for their food. These four farmers had no good reason why they plant hybrid seeds they had been mislead to think their harvest would be enormous after using the seeds which was wrong. Out of the 12 farmer sample there was no starvation recorded over the last 1yr because they plant indigenous seeds that adapt well to the prevailing weather conditions. Indigenous knowledge in seed work was embraced in the 12 households of study.	year and they can control what to put on their stomachs thus food sovereignty. - To document the indigenous seed work around Yatta it requires funding.
Baraka Agricultural	The effects of climate change on	Climate change has now become a global issue. The increase in emission of green	-To find out how climate change is affecting the small-scale maize	The design of the study was survey design. Questionnaire meant to elicit the desired	From the study it was clear that the small-scale maize	-The small-scale farmers should be diversifying the crops they grow on

College	maize production among small scale producers in Kamara division, Kuresoi district.	house gases such as carbon dioxide, methane, nitrous oxide and chloro-floro carbons has led to global warming over years. The greenhouse gases form a film over the atmosphere trapping heat and subsequently leading to increased temperatures hence heating the earth surface. Although global warming can be attributed by natural causes, human activities are considered to be the main cause of it. Climate change has affected many sectors in the country including the agricultural sector. Global warming has led to less productivity in agriculture since this sector highly depends on climate. Weather patterns have been disrupted and therefore people cannot predict seasons like they used to years ago hence cannot tell when certain crops can do well. - Maize is the staple food for the cosmopolitan Kamara	producers in Kamara Division ,Kuresoi District - To examine the challenges posed by climate change to the small-scale maize producers in Kamara Division, Kuresoi District. -To identify ways in which the effects of climate change on small-scale maize producers in Kamara Division can be reduced.	response from the study was administered and collected after two weeks. Data collected was analyzed and interpretations done .Conclusions and subsequent recommendation were made.	producers in Kamara Division have been adversely affected by the climate change. Maize production in the division has declined from the usual 15 bags to 8 bags per acre. The temperatures experienced in this area have continued to increase from the ordinary experienced temperatures. Food security situation in this area has worsened over time. School truancy due to lack of school fees has increased due to increased poverty. Farmers have generally moved to small livestock	the farms and include drought resistant ones. -The farmers need to implement the requirement by the government that 10 percent of the farm should be under forest cover. - Households in the area need to be educated not to over rely on maize as the staple food, and should include other tradition food crops on their diet. -Farmers should be encouraged to adopt coping strategies such as keeping of small livestock as income generating activities to boost their income level to reduce school going children truancy.

		Division; however its production has been affected by climate change. The low yield caused by the climate change has adversely affected community development in this area. This study will investigate the effects of climate change on maize production among small scale producers in Kamara Division in Kuresoi district. The expected outcomes include better coping strategies for small-scale maize producers in Kamara Division, improved food security situation the division and increased knowledge on ways to reduce the negative effects of climate change among small-scale farmers in Kamara Division, Kuresoi District.			keeping to reduce the effects of climate change	

NECOFA	To investigate the possible causes of rapid increase in figure millet prices in Kibwezi Township in the year 2012.	Since the start of 2012, figure millet consumers in Kibwezi Township have noted an unusual increase in the commodity price. At the first month of 2012, figure millet had a retail price of fifty Kenya shillings per kilogram. This price rose to sixty Kenya shillings by the end of the first quarter of the year. In the second and third quarter of the year, the price has risen to eighty Kenya shillings. This price is expected to increase more considering that the present retail price of the commodity in Nzaui district which is a large producer and consumer of figure millet has reached one hundred Kenya shillings per kilogram. Figure millet is an important nutritious food commodity known for her good taste, roughage rich whole meal, and many uses like animal feed, decoration, food, beverage, local brew and birds feed.	-To find review the fluctuation of figure millet prices over the year 2012 -To find out from producer, co-producers, traders and farmers their price experiences -To identify the possible causes of figure millet price changes in 2012	I programmed my research in the following order: Identified respondents(3 figure millet producers, 5 figure millet stockiest/traders; 5 consumers), formulated research questions, pretested questionnaire, administered questionnaire using individual and focused group discussions, processed data, analyzed findings, prepared this report.	There is reduced production of figure millet by peasants as most of them have sent their children to schools leaving few persons to chase birds from the crop which is a delicacy for many bird species. As a result most traders have had to import figure millet from Taveta. This costs the traders much more than purchasing the crop from within the local area. Kibwezi population has had a rise in nutritional diseases. Many people with diabetes, high blood pressure are now advised by doctors to take whole grain meals that have lots of roughage. Figure millet is preferred compared to sorghum. Hence	The demand for figure millet in Kibwezi Township is unquenched. Figure millet is good food for birds, animals and human. It is actually a preferred whole grain cereal for the Kibwezi community. Figure millet has multipurpose advantage over other grains. There is need to increase the production of figure millet around Kibwezi township. Farmers/peasants should be sensitized about the importance of figure millet and to take up its farming as a business, considering the ready market and nutritional value of figure millet. There is need for further on-farm research and training on figure millet.

					there is increased demand for figure millet. There has been an increase over time of day baby care centres, training institutions like private schools and the early childhood development teachers' (ECD) centres, where parents and learners prefer to take figure millet porridge compared to other staff. These have increased the demand for figure millet.	

8.3 Dondori analyzed research findings

Name	Sex	Mobile	Family	Household	Village	Land size	Best Crop	Best Live stock	Water Source (km)	Irrigation	Labour	Input Km	Input cost	Extension	Farm income %	Selling	Credit	Group	Need
Bilha N	2	0720668158	1	6	2	1.5	1	3	0.02	1	1	0.5	2	2	0.7	3	1	2	7
Agnes G	2	0725789474	3	4	1	2	1	1	2	1	1	10	1	4	0.75	1	1	1	1
Mary W	2	0720101142	3	7	4	0.4	1	3	0.02	1	1	20	2	3	1	1	2	3	5
Martha K	2	0710661385	3	7	2	0.45	1	2	0.02	1	1	0.5	2	1	0.8	3	1	4	6
Florence W	2	07164930	3	5	2	1.8	1	3	0.02	1	1	0.3	2	2	0.25	3	1	2	1
Mark K	1	0725818918	1	14	2	0.9	1	1	2.5	2	2	10	1	3	1	2	1	2	1
Dallis W	1	0722902257	1		3	2.5	1	1	0.02	2	2	16	2	4	0.66	1	2	2	4

Eunice M	2	0729606145	3	4	2	1.25	2	2	0.02	2	2		2	2	0.5	3	2	3	2
Danson K	1	0725536820	1	4	2	1.8	1	1	0.05	1	3	1	2	1	1	1	2	2	3
Ruth M	2	0725884542	1		5	0.5	1	2	0.4	2	3	15	2	2	0.4	3	1	2	1
Alice W	2	0733663460	2	4	5	1.5	1	3	0.02	2	3	20	2	2	1	3	1	1	7

Key

Villages	**Crops**	**Livestock**	**Labour**	**In-put cost**	**Selling**	**Group Reason**	**Need**	**Credit access**
Ndege	1. Maize	1.Dairy	1.Family +hired	1. Moderate	1. Brokers	1. Empowerment	1. Finance	1. None
Wanyoro	2. Kales	2. Poultry	2. Hired	2. High	2. None	2. Dairy Goat	2. Peace	2. Yes
Menengai		3. Dairy Goat	3. Family		3. Gate	3. Market access	3. Seed	
Tambuja						4. Widow affairs	4. Research	
Karusha							5. Water access	
							6. Pest control	
							7. Training	

8.4 Adaptive Research Questionnaire

Introduction

The participants of the Adaptive Research workshop wish to conduct a survey aimed at gaining some insights into the social and farming characteristics of the select farmers working with ARDP in Dondori Division of Nakuru North. The information obtained from this survey may be used by the participants to suggest to ARDP can do to improve the respondents farm productivity and income. The following set of questions are designed to enable achieve this purpose. We request you to set apart time to respond to the following questions as accurately as you can:

1. What is your name? _____
2. Sex: Male ( ) Female ( )
3. What is your mobile contact (If you have)? _____
4. Are you Married ( ) Single ( ) or Widowed ( )
5. What is the size of your house hold _____
6. What is the name of your village? _____
7. What is the total size in acres of your Owned land ( ) Leased land ( )
8. How much of your land (Owned + Leased) do you put to farming _____
9. Please provide the following information about the crops you grow on your farm in order of their importance to you:

Crop	Area grown	Purpose	Average yield (kg)	Average amount sold per season

10 Please provide the following information about the livestock you keep in order of their importance to you:

Livestock	Current number	Purpose	Average produce per month	Average income from the type per month

11 Highlight the sources of water for your home / farm in order of importance:

Source	Distance (KM)	Cost (High or Low)	Uses

12. Do you practice any irrigation on your farm? _____
13. Who provides labor for your farm operations? _____
14 How far do you source your farm inputs (KM) _____
15. How would you describe the cost of acquiring your farm inputs _____
16. Do you access to any agriculture advisory / extension services Yes ( ) No ( )

17. Please name the providers in 16 above and the extra information about them:

Provider	Services offered	Satisfied or Not Satisfied with services	Reason (s)

18. What fraction of your annual income is from your farming activities? _____

19. How do you sell your produce in order from the most to the least important option:

Means of selling	Distance to sell point (KM)

20. Please outline any credit facilities you access for your farm operations

_____

21. How accessible and affordable are basic social amenities in your area?

- Schools_____
- Medical facilities_____
- Transport facilities_____

22. Do you belong to any farmer group? Yes ( ) No ( )

23. What is the name of the group? _____

24. Why did you join the group?

_____

25. How do you resolve conflicts when they arise in your group?

_____

_____

26. What issues do think if addressed will greatly improve your performance as a farmer?

_____

27. Any other information you wish to communicate?

_____

Thank you for your time and responses.

8.5 Adaptive Research Work Plan

The participants were given a workshop plan to do based on what they had learnt during phase 1 and 11 Adaptive Research Workshops. The work plans will be used in the last phase of the workshop.

Each workshop participant will:

1. Identify an issue worth investigation in their areas of work using any of the research topic identification approaches outlined.

2. The participant will design and conduct a study to address the issue identified in (1). At the end s/he will prepare a report with the following components and email to PELUM by 31st October 2012:

a. Title of the study

b. Statement of the research problem

c. Statement of objective (s)

d. Description of the design including time lines and the data that was collected

f. Highlight of key findings from the study

g. Statement of key lessons / recommendations for the community based on the study findings

8.6 Adaptive work plan on indigenous sheep breeds

Title of the study: ***Indigenous breed resiliency to drought***

Statement of the research problem: The Maasai livelihoods depend almost entirely on livestock- cattle and shoats. Frequent and severe drought in the past few years has compromised these livelihoods. Livestock deaths of up to< 40% in the district have severely weakened the livelihood systems of the pastoralists. Consecutive rainfall underperformance in some years has further exacerbated the situation.

As subsistence shoats are a low-cost and inflation-proof alternative of saving, their value provides asset (financing) and security (insurance) benefits at times of difficulty. They help to adjust the consumption and savings of the household's income over time, by balancing the current cash needs against anticipated or unexpected cash needs of the future. These socio-economic benefits effectively increase a household's stock productivity.

But the fact that animals gradually lose part of the weight gained during the lush season to survive the long dry season is actually a biologically useful attribute that helps the smallholders to cope up with times of scarcity. The consequences of feed inadequacy for the indigenous red Masaai sheep may not go beyond some live-weight loss, but introduced crossbreds suffers substantial loss of fertility, and hence the decline in the longer-term overall production. Such adaptive features of indigenous sheep continue to be relevant even when additional labour and land resources are allocated to increase their contribution to household welfare.

Research objectives;

1. To reintroduce an indigenous breed that is resilient to local diseases, tolerant to handy climate conditions and uphold superior genetic strengthens in the ASAL.
2. To bring a cross- breed to market that carries the genetic vigor of both the doper and red Maasai sheep with a better market weight for better marbling fat distribution and tastier products to final consumers.

Description of the design: The project was carried out in Iloodo-ariak and Enkaroni neighborhoods. These neighborhoods have a human population of 13,906 based on emergency Operation (EMOP) figures of 2011 and approximately 2,301 house holes. Beneficiaries' selection was done by the Neighbourhood committee (N.C) in the selected areas. Beneficiaries selected are able farmers who are already practicing proper livestock keeping techniques and are willing to engage in the red Masaai initiative project.

Key findings of the study

DESCRIPTIVE ITEM	ILOODO ARIAK	ENKARONI
No of Sheep Farmers in Cluster	424 farmers	554 farmers.
Number of Sheep in Cluster	3,400	3,200
Willingness of the farmers to be involved in the project	Most of the farmers in the identified clusters are already involve in most of NIA's projects therefore will cooperate during the project	Most of the farmers in the identified clusters are already involve in most of NIA's projects therefore will cooperate during the project
Number of villages in the cluster	6 villages	6 villages.
Grazing patterns of the Sheep	The animals are kept under free range/herding in defined household grazing areas. However, sometimes in the dry season sheep are temporarily moved into areas with lush pasture resources.	The animals are kept under free range/herding in defined household grazing areas. However, sometimes in the dry season sheep are temporarily moved into areas with lush pasture resources.
Watering patterns of the Sheep	Local water pans are used for livestock watering during the wet season, while in dry season the sheep utilizes the local springs as watering points.	Seasonal earth dams are used as watering points during wet season while boreholes are used in the dry period.
Contact between each of the flocks	Contacts between flocks occur especially at watering points and in pasture resource concentrated areas during migration as well as grazing fields in the dry season.	Contacts between flocks occur especially at watering points and in pasture resource concentrated areas during migration as well as grazing fields in the dry season.
Migratory patterns: when is it likely to happen and overall effect on sheep health and body condition	Migration usually occurs from July to early November for all livestock farmers in this county. During these period many animals both cattle and shoats lose their body conditions and livestock diseases increase.	Migration usually occurs from July to early November for all livestock farmers in this county. During this period many animals both cattle and shoats lose their body conditions and livestock diseases increase.
Proportion of Red Maasai Sheep (RMS) and Doper or other local breeds in the flock within the cluster	There are mainly red Maasai sheep and the black head Persia (locally called Isuk). There are many red Maasai sheep (60%) than the black head persia	There are red Maasai sheep, Black head Persia and doper in this cluster The doper and red Maasai sheep are many compared to black head Persia (40% red Maasai sheep, 38% doper, and 22% black head Persia)
Proximity to markets: Which markets are farmers close to?	Iloodo-ariak farmers are able to access Kiserian and Mile 46 weekly markets.	Farmers from this cluster can access ilbisel, piliwa, sajiloni, Mile 46 and Kajiado markets respectively.
Management practices taking place –grazing control, de-worming, treatment/vaccinations	Currently the animals are kept under free range/herding in defined household grazing areas. Individual farmers are de-worming and vaccinating their animals on individual convenience basis and also using their traditional knowledge in general animal husbandry.	Currently the animals are kept under free range/herding in defined household grazing areas. Individual farmers are de-worming and vaccinating their animals on individual convenience basis.
Area occupied by cluster in Km. Sq.	142.8 km.sq	157.8 km.sq
Presence or absence of network signals in cluster-indication of use of mobile phones	There is good network signal(More than 40% farmers have mobile phones and almost 40% herders have mobile phones)	There is good network signal(More than 60% farmers have mobile phones and almost 50% herders have access to mobile phones)

Household characteristics: average number of HH members, proportion of men to women and children	There is an average of 6 members in each house hold(4 children, husband and wife,) In each house hold there are more women than men (52% women)	There is an average of 6 members in each house hold(4 children, husband and wife,) In each house hold there are more women than men (52% women)
Level of education: Literacy levels within the HHs	Most of the parents in each house hold are illiterate but majority of children have at least basic education.	General illiteracy level for Kajiado central district stands at 52%. Most of the parents in each household are illiterate but majority of children have at least basic education.
Road network condition: accessibility of the cluster	There are two roads leading to the cluster; an all seasonal murram road leading to Mile 46 and connects to the cluster and the Kiserian-Magadi tarmac road. To the cluster you turn left from cross junction which is an all season murram road.	The main road from Kajiado is tarmac ked up to Nkoile town. To the cluster you turn right on the road to which is an all season murram road.

Highlight key lessons/ recommendations for the community base on the study findings

1. The red Maasai Sheep is handy, resilient to diseases and uphold superior genetic strengthens than the doper
2. Kajiado livestock farmers are emphasizing red Maasai sheep keeping after counting great loses when keeping the high breed doper.
3. Due to diminishing land resource through land selling and population growth the pastoralists have no choice but to embrace sustainable sources of livelihoods.
4. Lambing period is short for red Maasai sheep
5. Flock productivity and efficiency of red Maasai is high in the ASAL
6. Fertility rate of red Maasai ewes is higher compared to other breeds
7. Growth rate for red Maasai sheep' lambs are superior in ASAL areas.

8.7 Guidelines for On-farm Research

By Alan Sundermeier

Research conducted to validate, modify, or calibrate a new technology to specific soil, climate, socioeconomic, or environmental characteristics of a given area.

On-farm research is nothing new to farmers. However, many times much effort and expense is put forth to conduct comparisons that are not valid. On-farm research must be practical for the farmer by using plots that are field-scale with standard farm machinery. So that the results of the comparison are not misleading, statistically valid designs should be used. In this way, field variation and other factors will not discredit the reliability of the results. Successful on-farm research begins with thorough planning before going to the field. By using the following guidelines, it is hoped that farmers can conduct research on their farm to answer their production and management questions.

1. Define the Question

Simplify your research objective into a single researchable question that makes a comparison. Many test plots are too complicated because they are looking at too many treatments. The problem enters when field conditions or other variables cannot be separated from true differences in treatments. On-farm research is most successful when comparing just two practices. For example:

"Is the profit from corn fertilized with 200 lbs nitrogen per acre different from that of corn with 150 lbs nitrogen?" Now the farmer can identify the type of treatment to set up and the data to be collected to answer the question.

2. Plot Layout

Randomizing and replicating is the key to laying out a scientifically valid plot. This procedure is what separates a purely demonstration plot from one which can be used to make valid conclusions. When comparing two treatments, they must be repeated in side-by-side strips across the field. To adequately overcome field variations, each pair of treatments should be repeated four times, although six is better. To further overcome field variations, the treatments should be randomly located within the pair. Always having treatment A on the left and B on the right may favor one treatment. The following example shows one method of proper plot layout.

```
Pair        1     2     3     4     5     6
          ^     ^     ^     ^     ^     ^
          A B,   B A,   B A,   A B,   B A,   A B
```

Treatment A = 200 lb N, Treatment B = 150 lb Often a planter is used to layout a plot. One treatment or hybrid will be applied on one side of the planter and the other on the other side. To achieve randomization, a few more strips should be planted and then skipped during data collection and harvesting.

Strip Treatment Pair

```
 1     2   3      4      5      6
 ^     ^   ^      ^      ^      ^
A B, A B A, B A, B  A B, A  B A , B A B
   |         |     |      |
   S         S     S      S
   K         K     K      K
   I         I     I      I
   P         P     P      P
```

The above are examples of Randomized Complete Block Design experiments.

3. Field Site

Choose a site that is as uniform as possible. Whenever possible, avoid fields that have variable soil types, slopes, irregular boundaries, and tile lines running parallel with the rows. Longer, field-length strips are preferred to reduce variability in the test.

Plots should be as narrow as possible but still be convenient to plant and harvest. Border rows are needed on each side of the plot to avoid edge effects. Be sure to flag the plot and record treatment locations on a plot map.

4. Data Collection

Plots should be monitored frequently during the growing season. Record and date your observations in a notebook for safe keeping. Much useful information can be gathered including-emergence, stand, weed and insect damage, soil conditions, and weather conditions. All crop inputs also need to be recorded. Additional data to collect may include spring soil nitrate, tissue tests, fall corn stalk nitrate tests, and yield. Farmers need to be aware of problems that arise which may make the plot unusable or eliminate some strips, such as weed patches or misapplied crop inputs. The best designed field research is of little value if data is not collected accurately.

5. Analyzing the Data

Statistics are used to determine if the data collected from each treatment is due to treatment differences or due to chance. Calculation of the L.S.D. (Least Significant Difference) will show the minimum difference needed between treatment average results to be considered a real difference and not due to chance. The probability that the difference between treatments could occur by chance is called the p-level. A p-value of 95% means that the probability is only 5% that the difference between the treatments could occur by chance. Using the above example of a randomized complete block design, farmers can use a computer statistical program to calculate the L.S.D. A simple, user-friendly program called AGSTATS is available by sending a disk and postage return mailer to Russ Karow, Crop Science Building 131, Oregon State University, Corvallis, Oregon 97331-3002.

6. Economic Evaluation

If the average difference of the treatments is greater than the calculated L.S.D. then we have some confidence that the difference is real. But is it the best choice economically? Is the advantage given to one treatment worth the cost difference between the treatments? A farmer should analyze his records to determine where cost differences occurred such as seed, fertilizer, pesticides, tillage, and management time between the treatments. The additional income benefit can then be weighed against the possible increased costs for that treatment. Non-tangible benefits such as improved soil quality and environmental improvement also are to be considered. General conclusions are more safely drawn from trials repeated in more than one location and year.

ON FARM RESEARCH

On-Farm Trials - Some Biometric Guidelines

Release date: March 1998

This is one of a series of guides for research and support staff involved in natural resources projects. The subject-matter here is **on-farm trials**. Other guides give information on allied topics. Your comments on any aspect of the guides would be welcomed.

1. Introduction

Farmer-participatory research trials have rapidly gained popularity in the past few years with due consideration being given to the knowledge, problems and priorities of farming families. The move towards participatory on-farm research means that many researchers, such as breeders and agronomists, who have been trained in techniques of on-station research, are now under pressure to move on-farm. It is therefore perhaps not surprising that the design of such trials has, too often, resulted in miniaturized research institute experiments. Conditions for on-farm trials are typically less controlled than those for research institute fields, and this means that more thoughtful designs are needed.

This booklet concentrates primarily on providing guidelines on aspects of the design and analysis of on-farm trials that are different from on-station research. It is concerned primarily with experiments where the farmer has considerable involvement - and not situations where the farmer's only participation is by providing land. Equally, it does not include experiments that are really just demonstrations. You should therefore ask yourself whether your experiment (a) involves the farmer in design, management or assessment, (b) seeks to address unanswered questions and (c) is an experiment, i.e. it involves planned changes.

2. Types of on-farm experiment

The common distinction is whether an experiment is both designed and managed by the research team, or researcher-designed and farmer-managed or, to some extent, farmer-designed as well as farmer-managed. Let us consider first the trials that are researcher designed and managed. These are trials where the farmers' fields are effectively borrowed by the research team. They become temporarily a part of the research institute. This type of trial is important in the same way as there remains an important place for on-station trials. Furthermore, bringing the research

institute, to some extent, onto farms can broaden the range of soils, pests and diseases that are encountered as well as encourage interaction with farmers. The design of such trials is broadly the same as on-station trials, so the information to be given in the booklet of guidelines on Design of Experiments can be used. For researcher-managed, on-farm trials, the present booklet is relevant on problems of site selection and on collaboration with farmers concerning site characterization and blocking etc. However, the main emphasis of this booklet is on guidelines for trials that are, at least to some extent, managed or designed by the farmers.

From a biometric perspective, a key point in participatory on-farm trials is that their design needs some ideas that are normally associated with the design of a survey, together with concepts from the design of an experiment. Thus we collect some data at the plot level (as in an experiment) and other data at the farmer level (as in a survey). This latter component is new to some scientists, who are used to on-station trials. It implies that concepts of survey design need to be considered, in particular that of stratification. We give guidelines for these two components in sections 4 and 5.

3. Specifying objectives

The initial stimulus for organizing experiments on farmers' land was to broaden the range of validity of conclusions beyond the narrow confines of a research institute setting. This is still a valid reason for conducting on-farm trials, but it is now recognized that farmer participation is important and that successful programmes must incorporate farmers' abilities to experiment and innovate.

As with any scientific investigation, it is crucial to specify the objectives of the study clearly. Time must be allowed for this phase and the objectives need to be re-assessed during the planning of the trial, to see whether they need to be revised. This is particularly challenging in on-farm trials, where researcher and farmer are now working together, often with extension staff and NGOs. It is important that the objectives are clearly identified from all perspectives.

Trials should be designed to resolve specific research questions, and researchers need to be impartial to the perception that donors expect to see the words "on-farm" and "participatory" before they will consider supplying funds. Usually a careful assessment of the gaps in the current knowledge will show that a series of initiatives is needed. These may include a small survey, plus a number of trials, some on-station and others that are on-farm, possibly some researcher- and some farmer-managed.

In defining the objectives it is important to check that there remains some genuine research, i.e. some hypotheses to be tested. If the major objective is to encourage adoption of a new technology by farmers, then this may be important extension work, but it is not research. Check also that there are not too many objectives for a single study. For example, objectives relating to adoptability and profitability of different technologies often imply different levels of farmer participation and hence may be better considered in separate studies.

4. Choice of farms and villages

The selection of farms must be closely related to the objectives of the research, and in turn to the recommendation domain for which results are intended. The large variation that generally exists between farms means they must be selected with care to ensure that conclusions will apply to the appropriate group of farmers. An initial survey is valuable in identifying how farms may be grouped, for example according to their socio-economic characteristics and environmental conditions. Decisions have then to be made whether research results will be relevant to all groupings or only to a subset of such farming groups. A representative (usually a random) sample of farms is then selected from the relevant group(s) of farms. Enough farms have to be used to have a reasonable estimate of between-farm variability. Stratified sampling may be recommended, to ensure that a wide range of farms is included in the sample.

A multistage sampling scheme is often used, with village as the primary unit and farming household as secondary units. The Guidelines for Planning Effective Surveys booklet gives more guidance on this part of the design. The sample of farmers must be large enough for a valid analysis when split into different groups, for example by soil type, tenants and owners, access to credit or not. Where resources seriously limit the number of farms in the study, the objectives of the study may have to be re-examined. For example, for a new topic, the first year may become a pilot study, from which ideas and objectives are refined for the following year's research.

When selecting villages, consideration must be given to how long a village remains associated with a research institute. Repeated use of the same villages, or use by different organisations is simple, but such villages may become less representative of the region. When selecting farms any restriction of the sampling scheme so that only "good" farmers are included will restrict the recommendation domain in the same way. One justification for using "good" farmers is that they set an example for their neighbours. Here this argument is at best weakly relevant because we are concerned with research not demonstration.

5. Choice of treatments and units

5.1 Choice of treatments

As noted in Section 4, the decision on the treatments and their layout within the farms depends on the objectives of the study.
The same concepts of treatment structure are needed in participatory on-farm as in on-station trials:
* Treatments may be unstructured, e.g. genotypes;
* There may be a need for one, or more, control (or baseline) treatments;
* Factorial treatment structure remains important;

* The number and levels of quantitative factors have to be determined.

Below we concentrate on two points, where guidelines may be different for on-farm studies. In participatory experiments the farmers may choose some of the treatments themselves. For example, varieties may be chosen from a village-level nursery, or from open days at a research institute for an experiment in the following season. This is sometimes done on a group basis, to arrive at a consensus for the trial. Alternatively it may be done on an individual basis, with a design that then has some treatments that differ from farm to farm. It may also result in some farms having more treatments than others. We would encourage this flexibility: the extent to which it is permitted will depend on the objectives of the trial. If the main objectives relate to yield differences, then some recommended varieties may be included in all fields, to which the individual farmers add further plots as they wish. Other objectives might imply greater, or less, freedom for individual farmers.

The second topic is that of the control treatments. These must be justified, as treatments in their own right. In on-farm trials the control is often the farmer's normal practice. Since this is likely to be different for each farmer, it cannot be regarded in the usual sense of "control", i.e. as a baseline treatment for the experiment as a whole, against which other treatment are compared. The farmer's normal practice will be useful as a baseline for each farmer, but the researcher may also wish to have a common baseline in addition.

In participatory trials, farmers may wish to use the concept of "controls" for their evaluation in a way that is broader than researchers are familiar with. For example, in a soil fertility experiment, they may request fertilizer on the control, on the grounds that the new technology should be as good as fertilizer. Or the enhanced treatment may be planted on a poor part of the field, because it should bring the yield to the level of the rest of the field. The extent to which such suggestions are accepted depends on the agreed objectives of the research.

5.2 How many treatments?

We would not wish to see any rules prescribed here. The minimum may be one, when a single new variety is distributed in an adoption study. However, normally there are at least two treatments being compared.

We do not agree with the frequently-made statement that four treatments is in any sense a maximum number. The statement may be related to the general view that many on-station trials have only about eight to ten treatments, and that participatory on-farm experiments should be simpler than on-station trials. This logic is flawed for a number of reasons. The first is that often on-station trials could usefully have more treatments. The second is that experiments are time-consuming and costly, and it would often be wasteful to go to the effort of an on-farm trial with just three or four treatments. We suspect that, as real participation develops, the researcher/farmer group will often suggest more than four treatments for experimentation.

Set against the inclination to have a large number of treatments is the recognition that many treatments per farm usually imply complexity of the design, which may lead to partial failure of the trial. Where there is no simple solution, the design team should reassess the objectives.

They could also consider splitting a complex study into simpler related experiments that may differ in their level of farmer participation.

5.3 How many treatments per farm?

In animal experiments, where there is only one animal per farm, or in fish farming, where farmers have only a single pond, it is only possible to study one treatment per farm. For further discussion of this problem see section 5.7. Otherwise there are usually at least two treatments per farm.

Questions which experimenters often ask include, "What do I do when there are more treatments to be investigated than there are plots in each farm?" "What if some farms have more plots available than others?" These are practical realities in on-farm experimentation, and the answer need not be to cut down the number of treatments, or restrict the experiment only to farmers who have a certain amount of land available to them. Care in the allocation of treatments within farms, at the design stage, can ensure a successful experiment is carried out in such circumstances.

5.4 Replication and resources

In designing an on-farm trial the researchers need to consider their resources carefully. For precise treatment comparisons there needs to be sufficient replication - but at what level? It is usually preferable to have more farms and fewer repeats of the same treatment per farm, rather than fewer farms and more replication within a farm. Consequently, in on-farm experiments, it is frequently the case that there are many farmers but each farmer has only one replicate of each treatment.

The problem with having no within-farm replication is that the farmer-treatment interaction is then normally used as the random (or residual) variation. However, the treatment effects may really be different for the different farmers and understanding this interaction, e.g. which treatments are most effective for which types of farmers, may be an objective of the research. In such cases one would like to distinguish between the interaction and the residual, and having some within-farm replication is the obvious way to do this. This does not necessarily mean that there should be complete replication of all treatments within each farm, which would be wasteful of resources. We suggest instead that consideration be given to a design where each farmer repeats a single treatment. If there are a reasonable number of farms in the experiment then this should allow a valid subsequent analysis of the data. The replication should also be sufficient if the data are to be split into two or three subsets for analysis. The choice of which treatment is to be repeated is not critical. It could always be the same, most important, treatment, which is then estimated with greater precision. Alternatively, several (ten or more) farmers could each repeat one treatment, not necessarily the same one throughout.

If within-farm replication proves impossible, then it is still possible to carry out some investigation of the farmer-treatment interaction, provided there is information on the characteristics of the farms (see section 7).

5.5 Crop Experiments: Plot size

It is often assumed that the plot size should be larger for on-farm than for on-station trials. This is the result of past on-farm trials usually having been at the validation stage of the research. There is no general justification, on statistical grounds, for preferring large plots in on-farm trials. The most efficient use of a given area, or of a given number of trees, is normally achieved with more small plots rather than fewer larger plots, unless there is considerable lateral interference, as is the case e.g. with some agro forestry systems, or areas with nutrient or water movement. Normally, there is a balance between the preference of farmer and researcher for larger plots on the basis of realism, or ease of treatment application, and the statistical benefit of improved precision from more, smaller plots.

The cases for realism when seeking farmer opinion regarding treatments, or when comparing treatments with regard to labour requirements are examples of compelling reasons for using large plots. However, the case for large plots should be made in relation to the objectives of the experiment; merely stating that on-farm experiments require large plots is not enough.

5.6 Crop Experiments: Plot layout

Layout of plots within each farm will primarily be guided by perceived or known variation within the farming area. The farmers' knowledge about the variation in their fields should be used to determine the location of the plots and any blocking scheme, and to avoid using particular patches of the field where necessary.

It is important to ensure that farmers and researchers are using the same criteria to define suitable locations. Researchers normally strive for homogeneity, while farmers may have particular parts of their field where they would like to try some treatments. For example, they may feel that addition of crop residues is most appropriate on degraded patches. Where large sections of the field are degraded, this can be accommodated within the design by putting all treatments on this type of land. Otherwise the liberty given to farmers will depend on the objectives of the trial. If farmers' opinions are of paramount importance, then the loss of randomness in the allocation of treatments to plots is of minor concern. The important sampling is at a higher level, namely in the choice of farmers. On the other hand, if a comparison of yields is an important part of the trial, then it is important to allocate treatments "fairly" (i.e. with some element of randomness) to the plots. In such a case, use of the degraded patches could be in addition to a replicate of the treatment on ordinary parts of the field.

Many practical considerations need to be taken into account when considering block and plot layout. In an on-station trial, for instance, a split-plot experiment may be carried out because it is convenient to plant one large area at one time, whilst the application of different levels of fertilizer can be on smaller areas. In on-farm trials these considerations may still apply. Another important practical aspect is the interview process. For instance if a farmer is to give an assessment of different varieties, where fertility is a secondary factor, then it may be convenient if the varieties are grouped together.

5.7 Livestock Studies: Units and replication

Most of the principles discussed earlier with respect to crop experiments also apply to on-farm livestock experiments. However there are particularities of livestock studies that require further consideration.

First is the definition of the experimental unit. In livestock experiments the experimental unit is most likely to be an individual animal, although there will be some instances where it is a group of animals. When designing an experiment, it is important to be clear on what constitutes the experimental unit, to ensure sufficient replication of the units. For instance in a vaccine trial where each animal is injected with a dose of vaccine, the experimental unit is the animal. In a poultry feeding trial where a brood of chicks eats from the same handful of feed, the experimental unit is the brood. The fact that measurements might then be made on each chick does not increase the amount of replication.

The second issue is that of blocking. In crop trials the natural blocking unit is the farmer. With livestock trials, breed, parity and age of the animals are also well defined blocking units. Some of these blocking units often need to be incorporated in the design, to construct a satisfactory experiment.

Linked to the issue of blocking is that of resources. Farmers will have different numbers of animals and hence, if an individual animal is the unit, this can involve a different number of treatments per farm. In addition, many farms may have only a single animal. The value of these farms, in an experiment, depends largely on the use of the other blocking factors, such as age and breed of the animal.

Finally, it is sometimes possible to investigate more than one treatment on an animal. Because of the variation that exists between animals, an appropriate design might be a cross-over design where each animal receives successive treatments over a period of time, and so acts as its own "control". In such designs, the order of the different treatments is varied for different groups of animals so the conclusions are unrelated to the sequence of treatments. Here the experimental unit is an animal for the period of time in which a single treatment is applied.

With livestock experiments there can therefore be several different levels of variation. There is variation between farms, between animals within a farm, and between periods within animals. Depending on the particular situation, treatments can be allocated at one or more of these different levels. Researchers who wish to do such studies, and who are in doubt on how best to design their experiment, should consult a statistician for advice.

6. Measurements

In participatory trials, we can distinguish between three types of measurement.

(i) Measurement of the type that are taken in on-station trials. These are usually yield components, time to flowering, milk yields, disease scores, etc.

(ii) Measurements of concomitant variables. These can be at a plot level, for example problems of waterlogging, or at a farm level, for example rainfall or soil type. Some variables, such as dates of sowing and weeding, and other management practices may be at either level.

(iii) Measurements of the farmers' opinions. These are from informal discussions or from questionnaires.

In on-farm trials, there is often still too great an emphasis on the first type of measurement, because the implicit assumption is that the methods of analysis will be the same as on-station. Whilst these data may still be of interest, we suggest that more attention be given to the collection of measurement types (ii) and (iii). The main reason for devoting time to the concomitant information is that we still need to try to understand the causes of as much of the variability as possible. In on-station trials the plots may be smaller and are likely to be more homogeneous. In on-farm trials there may be more variation within a farm than on-station and in addition there is variation between farms. In on-station trials there is a consistent management structure, whereas here there can be large differences in management practice between the farms. As a general guide, what is not controlled should be measured, both at the plot level and at the farm level, if it is of direct interest or if it might explain some of the variation in the data.

In general, the objectives of the trial determine what is to be measured. Thus the direct and concomitant measurements to be taken are normally decided at the planning stage. Often too much data is collected that is never analyzed. Our encouragement to measure potential concomitant variables is not intended as support for the measurement of all possible data, just in case they may be useful.

In some trials, where farmers have chosen where they will apply particular treatments, there may be little reason for measuring yields. What is needed, instead, are the farmers' reasons for choosing a particular plot and their reactions at the end of the season. In less extreme situations there may still be little reason to devote much time to the detailed measurements of yield components. A quick assessment of yields using "number of bundles", plus some idea of harvest index, will often be sufficient.

A participatory trial is not really participatory, unless a record is kept of the important contributions made by the farmers. These may be the actual farmers who use the land, or others who view the fields. There are many ways of recording this type of data: please see the booklet Guidelines for Planning Effective Surveys.

7. Analysis

As with the design, the analysis of the data will use a mixture of methods that are appropriate for the analysis of experimental and survey data. The analysis can be viewed in three stages:
(i) Analysis of questionnaire-type data, resulting from interviews and other observations. This information is normally at the farmer level, though some questions can relate to particular plots.
(ii) Analysis of yield type data. This information is mainly at the plot level, though with some observations at the farm level.

(iii) Combination of (i) and (ii) above, using the results from interviews to understand the variation in yield type data

The type of trial will dictate the proportion of time spent at each stage. One extreme might be a farmer designed and managed trial, within which, the main objectives relate to their choices and opinions. Most of the analysis effort would therefore be on (i) above. In some researcher-designed and managed trials the yield data is of particular importance, in which case most of the time is spent on (ii).

Experiments with sufficient within-site replication and detailed measurements of yield response can have separate within-site analyses initially, then a combined analysis. This is usually only the case for researcher-designed and managed trials. Others will use the data within a single analysis. However there are two main differences between on-station and on-farm trials that have a bearing on the analysis. One is that with on-farm trials we expect a farm by treatment interaction, and one of the objectives of the trial is often to explore this interaction. The other difference is that there is now variation at different levels - there is variation between farms because of characteristics such as different agro climatic conditions, management practices, as well as variation between plots within farms. As always, any analysis should try to explain as much of the variation as possible.

Approaches used can range from some simple analyses on different subgroups of the data to more sophisticated modeling of the whole data set. The analysis is often to evaluate relationships between biophysical responses and environmental, management and social variables. The data are also used to understand reasons for farmer assessments. These may be turned into decision trees for farmers or maps of recommendation domains. In analyzing on-farm trials data we should be ready to:

(i) Split the data up into subsets, e.g. groups of similar farms;
(ii) Omit particular plots, e.g. the farmer's own treatment; or particular farms;
(iii) Pay close attention to comments made about individual plots, e.g. "crop eaten by animals" may mean that a recorded yield of zero should be treated as a missing value;
(iv) use additional information, both at the farmer level and at the plot level, e.g. farmers may be classified as wealthy or poor, or plots may have information about pest damage;
(v) In the absence of within-farm replication, use treatment contrasts at the farm level to investigate the farm by treatment interaction, or investigate the interaction using the additional farmer information (as in (iv) above);
(vi) Report on, and possibly follow up on, particular farmers who show interesting results.

Data recorded on questionnaires, such as preference for varieties, can be summarized in two-way (or n-way) tables of response by farm type. Percentages can be presented if the total number of farmers is large enough. Provided there are sufficient data, models can also be fitted to these tabulated data to explore how the responses vary across different farm types.