Promoting innovation

Course for field agents on promoting innovation in rural producer groups

Contents

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Foreword

In 2007, the Kiumai Producer Marketing Group of Ipililo Village in Maswa District, Mwanza Region, Tanzania with 38 members, 28 men and 10 women, was facing obstacles. In 2005 and 2006 the group had successfully marketed 62t and 51t of pigeonpea collectively. But now the annual Ministry of Home Affairs Society registration fee had not been paid, there was not enough money to rent a warehouse to store their produce, and the monthly bank charges were eating into their capital. The group members were looking for ways of resolving these difficulties.

It was then that the members of Kiumai Producer Marketing Group learnt about savings and internal lending groups from their local development organization, the Diocese of Shinyanga. Interest in Ipililo Village was high and 7 savings and lending groups were formed. Quickly the confidence of Kiumai members was restored as they saw how by using their own resources they could support each other in meeting immediate household needs.

Then in December 2007, representatives of the seven savings groups in Ipililo Village visited farmers in neighboring Magu District where they learnt about the success that groups similar to theirs had achieved by forming an apex organization to support the marketing of their crops. On their return to their village, they decided to form their own apex association to bring together all the savings and lending groups, with a total of 175 members.

The larger group is clear about the advantages that they will get from forming the association: 'being together will make it easier to help each other, initiate joint businesses and market collectively, and it will give us access to funding and better training opportunities'. Their immediate plans were to expand individual members' production of chickpea and pigeonpea and build a warehouse for their produce. In the future they want to initiate a Farmer Field School to improve their crop yields.

The experience of the Kiumai Producer Marketing Group illustrates the interplay of five critical skills that smallholder farmers need to engage successfully with markets.

- The entry point for the Kiumai farmers was through building **organizational and business skills** to improve production and marketing of pigeonpeas. However, these skills alone were not sufficient to ensure success.
- Through savings and loans, farmers strengthened their **financial skills** and appreciated how they could further consolidated their gains through **disciplined and transparent group management.**
- In parallel, the group with their fellow farmers in Ipililo village saw the opportunities afforded by adopting **innovative** forms of organization that could resolve problems associated with economies of scale in marketing and access to important technical and financial services.
- And finally, the lasting success of Kiumai's business will depend on the ability to maintain their competitiveness. Through a Farmer Field School members will acquire new knowledge, test new technologies and adapt their crop management practices to increase **production** at lower costs and **conserve their natural resources**.

Over the years CRS has made a dedicated effort to review and realign its agricultural development strategy according to the needs and demands of our partners and those we serve in developing countries. Ten years ago we saw the need to shift from a production-oriented response to recovery from disaster, to one that incorporates market- and business-oriented approaches. We observed that increased household food production alone is no vehicle for moving poor rural people permanently out of poverty. Understanding markets and building the capacity of smallholder farmers to engage in profitable enterprises that earn them cash income have therefore become integral parts of our agricultural development strategy.

This shift has required a new mindset among managers and technical staff alike. Opportunities for market-led responses to crisis situations and the building of business capacity in partners and other local development agents are replacing indiscriminate transfer of assets and provision of services with little thought about the sustainability of these interventions.

This approach requires new skills. Managers have to engage new staff with appropriate education and experience. And existing staff are retrained to acquire new skills. Farmers' demands go beyond production practices and new technologies. They now want to master a wider set of skills that include how to look for new markets and negotiate sales, how to manage savings and loans, how to calculate costs profits, how to do bookkeeping, and even how to develop environmentally sound products or technologies.

The modules in this series on "Five skill sets for preparing smallholder farmers to successfully engage with markets" are part of CRS's response to these new needs. Their audience is the vast cadre of field agents, within CRS, our partners and other public and private extension and development agencies dedicated to supporting smallholder farmers finding a pathway out of poverty.

None of these skills by themselves are new or unique – farmers have always needed them to successfully engage with markets. But development agencies have seldom if ever provided integrated facilitation of these skills; they have been content to support farmers only in those areas of their particular expertise. Through strong and integrated capacity-building processes based on skills, we are reshaping the way we support vulnerable communities. As in the case of La Esperanza, communities progressively become agents of their own change. They identify and grasp opportunities that turn previous desperation into a brighter hope for the future.

Carolyn Woo
President and CEO, CRS

Preface

This set of manuals on "Five skill sets for preparing smallholder farmers to successfully engage with markets" presents an integrated and sequential approach to building vulnerable farmers' capacity for linking with markets. The manuals have been prepared for use by development facilitators, field extension agents and community leaders working with poor rural communities. The aim is to improve the livelihoods of these communities through better production and marketing of their crops and livestock products.

Where the five skills sets came from

The identification of these skills has its origin in the establishment of the Agroenterprise Learning Alliance between the Catholic Relief Services and the International Center for Tropical Agriculture (CIAT) in 2002. The purpose of a Learning Alliance on agroenterprise is to strengthen the participating organizations' capacity to advance and refine approaches to agroenterprise development. CRS has used this modality across Africa, Latin America and Asia, with up to 35 countries participating in one or more learning cycles. In Central America and Southern Africa, the learning alliances are multi-institutional with the participation of several national, regional and international research and development organizations. In 2005, the Learning Alliance identified the need for a new approach to improve the capacity of the poorest farmers to link effectively to markets, and to sustain and manage these links in the long term.

To address this need, the Learning Alliance organized a study tour that visited five different farmers' groups in Uganda, Bolivia and India to improve its understanding of the formation and development of groups of farmers whose aim is to link with markets. A team of eight scientists and technical advisors drown from both institutions reviewed the literature on five different approaches to farmers' group formation, and visited examples of each. Their aim was to look for common elements in farmers' groups that are successful in achieving their goals. The approaches to forming farmers' groups that were visited included:

- Farmer field schools
- Producer or agribusiness groups
- Self-help groups for internal savings and lending
- Watershed management groups
- Farmer research committees.

From their visits to these groups, the team observed that independently of the country, the cultural setting or the original purpose for forming the group, poor farmers who wanted to increase their income were proactively trying to acquire one or more of five sets of skills. These skill sets are:

- Group management skills
- Internal savings and lending skills
- Basic market skills
- Innovation and experimentation skills
- Sustainable production and natural resource management skills.

Even though all groups were receiving external assistance in developing or strengthening at least one skill set in a formal way, no one group was receiving facilitation in all five skill sets. Although there is nothing new about any one of the skill sets on its own, the team discovered that the farmers' groups demanded all five skills in combination. In many cases, farmers commented on the difficulty in making progress from their original purpose of savings or experimenting with technology into market engagement, unless they had acquired other types of skills.

The team therefore concluded that the five essential skill sets combined will effectively contribute to successful and sustainable market engagement by the poor.

At CRS, we are excited about the way in which our early experiences in applying the five skills in an integrated way are having important results for both the communities we work with and our development partners. The application of the approach makes high demands on field agents. The intention of these modules is to facilitate the learning process for both field agents and the farmers they serve. As the process is rolled out and experimented with in different situations, we look forward to receiving feedback on modifications and improvements so that these learning products can be continually improved.

What is in the manuals

Each manual contains the following parts:

- **The subject matter**: the knowledge and skills you need to master in order to teach the skills.
- **Quizzes** to test your own knowledge.
- **Exercises** for you and other field agents to practice your skills.
- **Field lesson plans** for you to use in helping farmers master the knowledge and skills they need. These lesson plans are printed in shaded pages. They typically include a set of instructions, along with a big picture for you to use as a discussion starter. The lesson plans are also available as a PDF document on the CRS website www.crsprogramquality.org/agriculture/. You can print out this document and have the pages laminated so it lasts longer.

How to use this manual

As a learner. Read through this manual lesson by lesson, section by section, trying to absorb the information presented. At the same time, imagine the situations that you encounter in your work, and picture how you would use the information and techniques described to help you work with farmers on developing their agroenterprises. Imagine how you would use the exercises and field lesson plans. At the end of each lesson, answer the short quizzes. If you get all the answers right, congratulations! Go on to the next lesson. If you did not get all the answers right, go back to review that section again before moving on to the next lesson.

As a trainer working with field agents. You can use this manual to teach other field agents about marketing. You can present the information in the text, then work through the exercises and field lesson plans with the participants. The exercises are designed especially for field

agents, while the field lesson plans are intended for use with farmers and other rural people. If you use the lesson plans with field agents, ask them to pretend that they are farmers.

As a field agent working with farmers and other rural people. Once you have taken this course and passed the quizzes, you will have gained useful marketing knowledge that you can share with farmer groups.

You can use the information and exercises in this manual to plan how to work with farmers to develop their agroenterprises. Every farmer group and every situation is different, so this manual does not try to tell you exactly what to. Instead, choose those items that you think the farmers need and can benefit from, and use this manual as a basis for building your own series of learning events so you can pass this information on to farmers. Feel free to **adapt** the exercises, field lessons and quizzes to suit your own situation, and to **develop new materials** as needed.

Wherever possible, you should work in a **participatory manner** with the farmers. This means you should make sure that it is not you but the farmers who are gathering and analyzing information and making decisions that will affect them. Your role is to facilitate their learning, not to do the job for them.

As a reference source. You can also use this manual as a reference. If you need to check on a technique or concept, look it up in the table of contents.

Learning online

If you are a CRS staff member or partner, you can also study the ideas in this manual online, through an e-course. Contact your CRS supervisor for a **username and password**, then visit https://crs.brainhoney.com to register and start an online course. In some cases these courses may be available on a thumb drive, or smart stick.

The e-courses courses use the same text, quizzes and exercises as in this manual. Many of the tables are presented as **forms** that you can fill in online to help you record and analyze the date you have collected.

Farmbook software

CRS and partners have developed a software application called **Farmbook**, which you can download from the CRS website. You can use Farmbook to register a farmer group and collect information about their production and business performance. Planned features for Farmbook will allow you to do the following:

1. Register a farmer group
2. Do a profitability analysis for a single product for your farmer group
3. Write a business plan
4. Produce a production plan for the season
5. Keep a record of training events and asset transfers to a group
6. Undertake a baseline survey and follow up annual audits.

To learn more about Farmbook, visit www.crsprogramquality.org/agriculture/Farmbook.php.

Introduction

Many small-scale farmers in the developing world learn how to grow crops and raise livestock in a very practical way: by working in the fields and by tending animals. They grow food for their families, and sell any extra to visiting traders or at the local market. But they have never studied farming in school. They have not learned how to earn more money by producing and marketing their produce in a better way.

This manual aims to help you, **the field agent**, help groups of farmers maintain the gains they make in improving their production and marketing by building their capacity to look for, experiment with and apply new ideas or technologies that resolve constraints or problems that they are facing. The module will help you facilitate locally-relevant learning sessions with farmers and other rural inhabitants that wish to form an **innovation group**.

Farmers are constantly making observations, developing ideas and taking risks to put these ideas into practice in order to increase their livelihood, food security and income generating options. They have effectively been innovators for a long time – knowing through observation, learning through informal experimentation, performing studies to solve problems. And often the result is an innovation – an improvement or changes in knowledge or technologies that result in an increase of productivity or competitiveness of the crops and livestock that farmers produce and market.

This manual illustrates the basic principles of innovation and experimentation which can be used in a variety of settings and situations with farmers and other rural actors.

As a field agent working with farmers to increase production and improve marketing, you will need a range of skills. These include:

- Group organization and management
- Financial management
- Marketing and agroenterprise
- Natural resources management for sustainable production
- Innovation (this manual)

These five sets of skills are covered in separate modules in this series. The farmers you work with will also need these skills. One of your tasks is to help the farmers learn and practise these skills so they can improve their incomes from agriculture. The manual "Introduction to the five skills sets" guides you on how to plan and implement a training curriculum to give them these skills.

Purposes of this manual

This manual has two main purposes:

- To help you **learn about why innovation is important, how it occurs and how it can be fostered** in farmers, farmer groups and other rural people.
- Once you have mastered the knowledge and skills yourself, to help you **teach innovation skills** to farmers and other rural people.

Activities covered

You can apply the principles of innovation explained in this manual to:

- **Agricultural technology and practices:** increasing productivity or introducing a new crop or livestock product.
- **Management of the ecosystem** and of the natural resources that are used in the production process.
- **Post-harvest technology and practices**, related to conservation and storage, processing, product quality, packaging and transport.
- **Marketing** and the presentation of the product in the market.

What type of farmer are we targeting?

This module is about how to help small-scale farmers in developing countries organize themselves into a research or innovation group and what they need to do to ensure that the group is able to carry out the steps of an innovation process.

We will assume that the farmers cultivate 1–2 ha (roughly 2–5 acres). They do not own mechanized tools, use little fertilizer and other inputs, and are not well organized. We also assume they have few links to formal financial institutions such as banks or microcredit institutions, and that they sell their produce mostly to informal traders or in the local market.

Of course you can also use the ideas in this manual with people in other situations: farmers with less land and whose principal sources of income come from selling their labor rather than from agricultural or livestock activities, or from taking part in non-farm income generating activities such as petty trading of agricultural products, food preparation and sale, activities that process farm products, etc. They can also be used with farmers who cultivate a larger area or who are slightly better off, or people who depend mainly on livestock for a living.

After learning about innovation

After setting up an innovation group and taking them through the innovation process, farmers will be able to:

- Analyze their situation and problems and find solutions
- Implement, monitor and evaluate their experiments and trials of production, postharvest and marketing technologies and practices
- Establish links with other groups and institutions that may be able to support them with information, technology and other types of advice

What is in this module

This manual takes you through the steps that a group of farmers undertake during a process of innovation. It includes the skills and knowledge you will need to lead a farmer research or

innovation group through that process. Each of the steps involved is accompanied by one or more exercises.

The manual is made up of seven lessons:

1. **Introduction to innovations.** Explains what innovation is and why it is important for smallholder farmers and other rural people.
2. **Identifying and understanding problems.** Deals with how farmers can identify topics to research that can help them solve their most important problems
3. **Exploring possible solutions.** How to look for different solutions and decide which are the best to experiment with.
4. **Designing experiments.** Explains how to set up an experiment with treatments and controls.
5. **Collecting and recording observations.** Deciding on what information to record, how to collect it and how to record it.
6. **Analyzing and evaluating the results.** Methods and tools for making the analysis evaluation of results easy.
7. **Applying findings and sharing knowledge.** Ways for making use of the results of the experiments and sharing with others in the community what you have found.

The seven lessons in this manual can be organized to be done with farmers as they go through the innovation process. Each lesson will take between 1 and 3 hours. See the exercises and farmer lesson plans for ideas on how to present the materials. Feel free to adapt the ideas and exercises where appropriate.

Lesson 1. Introduction to innovations

An innovative village

Welcome to the village of Desa Baru! Let us introduce you to some of the villagers, and how they are trying to improve their lives.

	This is **Albert.** He notices that if he plants maize in a field where he has sown beans the year before, the maize seems to grow better. He decides to alternate maize and beans in his fields from now on.
	**Beatrice** gets some seeds of a new tomato variety from her aunt in another village. She sows them in her garden and is pleased when they produce a bumper crop.
	**Charity** wants to grow the new tomatoes too, but she is not sure if they are any better than the variety she already grows. So she asks for a handful of seeds to sow them in a corner of her garden so she can compare the two varieties.
	**Dana** wants to know if she can sell tomatoes. She goes to the market to find out about prices and potential buyers.

	**Everett** is tired of having to shell maize by hand. He also repairs bicycles, so he has a workshop and some tools. He designs and makes a maize-shelling machine from wood and bits of an old bike.

The importance of innovations

For rural communities to improve their livelihoods, they have to change the way they do things. They have to grow more and better-quality produce, reduce their costs, and improve how they process and market their output. All these changes are **innovations**. They all help to improve people's lives and incomes in some way.

Innovations are also vital for another reason: the **world is changing**. More and more people mean that it is necessary to grow more on the same amount of land. But the soil is degrading and water is becoming scarce. A changing climate means farmers have to plant new types of crops and change the way they produce food. New marketing opportunities are arising, but markets are becoming more competitive and demand better quality.

Figure 1. An innovation is an improvement or change in knowledge or technology that results in an increase of productivity or competitiveness of a given product.

How might innovations occur?

Innovations may come about in various ways.

- They may be the result of a **chance observation** – like Albert who saw that his maize grow better after beans.

- They may be **introduced from elsewhere** – like Beatrice and the vegetable seeds from her aunt.
- They may be the result of a **deliberate experiment** – like Charity, who compared the two varieties of tomato.
- They may result from a **survey** – like the one that Dana made of the market for tomatoes.
- They may be the result of an **invention** – like Everett's maize sheller.

Types of innovations

Innovations may come into all stages in the production and marketing of farm products:

- **Agricultural technology:** increasing productivity or introducing a new product.
- **Management of the ecosystem** and of the natural resources that are used in the production process.
- **Post-harvest technology**, related to conservation and storage, packaging and transport.
- **Marketing** and the presentation of the product in the market.

Role of research, extension and farmers

Developing new technologies is one of the main roles of research institutions. Scientists at these institutions study problems, come up with ideas for solving them, conduct experiments to test their ideas, and evaluate their results.

The researchers pass on their findings to extension workers and field agents, who in turn introduce them to farmers.

Does that mean that farmers and other rural people should leave research to researchers?

No – for several reasons:

- **There are only a few researchers**, and they cannot possibly solve all the problems that farmers face.
- **Solutions already exist** for many problems, but rural people often do not know about them. They need to go out and find those solutions.
- **Farmers and other rural people constantly make observations**, develop ideas and take risks to put these ideas into practice. They can make a huge contribution to their own development.
- **Conditions vary** from place to face and from farm to farm. Rural people need to adapt solutions to suit their own soils, climate, abilities and pockets. They can take into account factors that outsiders do not know about or understand.
- **People are much more likely to adopt** ideas that they themselves have identified and tested.

Figure 2. Farmers play a vital role in generating and spreading innovations.

Sugar for shoes

Here is an example of local people taking into account factors that were important to them.

In Honduras, a well-meaning NGO tried to persuade farmers to plant vetiver grass along the contours on slopes to control erosion. But the farmers' fields were so small that they could not afford to grow anything that did not produce food, fuel or fodder. Instead, some of the farmers planted sugarcane instead of vetiver along the contours.

When the NGO project ended, farmers who had grown vetiver switched to sugarcane. They harvested and sold the cane in time to pay for their children's school fees, shoes and supplies.

Figure 3. The farmers decided that sugarcane was more useful than vetiver.

Needed: A systematic approach

What the farmers in Honduras lacked was a systematic way to compare different practices and choose the best option for them.

This module shows you how to help farmers identify problems and analyze their causes and effects, find and test solutions, and put these into effect.

It is possible for individual farmers to develop, test and implement innovations on their own. But innovations are more effective and spread faster if rural people are organized to solve problems they face.

Figure 4. A systematic approach can make innovation efforts much more effective.

Role of field agents

You can support rural people to innovate by helping them:

- Analyze their problems and seek solutions.
- Get organized to obtain information, conduct research, and evaluate and spread the results.
- Monitor and evaluate their activities.
- Develop links with other groups and organizations (such as research institutions) that may be able to support them.

Figure 5. The field agent's role is to facilitate, organize and train people.

Organizing innovation groups

Not everyone in a farmers' group is likely to be able or interested in doing research. And experiments and surveys are best done by a small number of people. Here are two ways to organize this:

- **Innovation groups.** Help interested members of the community organize as separate innovation group. This group can then conduct experiments and spread them to other people in the community.
- **Innovation subcommittees.** Help each farmers' group form subcommittees that focus on innovation. These subcommittees report their findings to their parent group.

Some things to consider when helping such groups or subcommittees get organized:

- **Ensure representation.** Make sure that women and poorer people in the community are adequately represented.
- **Start small.** Encourage the groups to focus on a small number of manageable subjects. It is tempting to try to solve a lot of problems at the same time – or to start with the big problems. But this is not usually realistic.
- **Aim for success.** At first, choose problems that can be solved easily. That builds interest and research skills.
- **Ensure that ideas spread.** Encourage regular, open discussion, and find ways that the innovation groups or subcommittees can share their findings with the wider community.

Figure 6. Organize groups to develop and test innovations.

Who should be in an innovation group?

Figure 7. The innovation group

The size of an innovation group depends on the topic or area it covers. For crops, groups should have at least 10 members, with 15–20 being optimum. Smaller groups of 6–10 are sometimes sufficient for market or post-harvest topics.

Sometimes the members will come from an existing farmers' group such as a farmer field school or marketing group. The innovation group is then a sub-group of the larger group.

Some things to look for in members:

- **Time and resources (land, materials, etc.) to participate.** Testing innovations takes time and perseverance. Members must be enthusiastic and have a vision of the advantages of learning to benefit others in the community.
- **Representativeness.** Aim for a balance in terms of age, gender, wealth and, if relevant, ethnicity. Different people have different ways of looking at a problem and have different ideas of they want in a solution. If the group consists only of men, women may feel that its findings are not relevant to them.
- **Experience and expertise.** At least some members should be known locally for their experience and expertise, for instance in growing a particular crop, or making deals with buyers.

- **Experimentation.** In many communities certain people are interested in trying out new ideas. They are always the first to test a new type of seed or try out something they have seen elsewhere. Try to get such people into the group.
- **Communication.** Innovation is not just about experimenting or learning. It is also about sharing findings and encouraging others to adopt them. Members should be good at communicating with their friends and neighbors.

Not everyone in the group will have all of these characteristics. But the group as a whole should have a mix of people with these attributes.

Basic principles of a participatory process

- Play a neutral role. Do not dominate (or allow others to dominate) meetings. Encourage all to express their opinions freely.
- Ensure that the least articulate people (often women) and marginalized members of the community are able to contribute and to benefit.
- Cross-check information by asking different people and using different participatory tools to cover the same issue ("triangulation").
- Learn from different stakeholders and involve them in all stages of the process. Value their knowledge and skills.
- Link with research institutions and other possible sources of information about innovations.
- Ensure that local communities make as many as possible of the decisions. But participatory tools are not an end in themselves: they are a way of finding solutions and should always lead to concrete activities implemented in the communities.
- Make sure that activities are sustainable and continue after outside support has ceased.

Figure 8. Use your participation skills to organize innovation efforts.

Lessons in this manual

This remaining lessons in this manual guide you through the following steps:

- **Lesson 2. Identifying and understanding problems.** How to help local people analyze the problems they face.
- **Lesson 3. Finding more information.** Ideas on where to find ways to solve the problems.
- **Lesson 4. Exploring possible solutions.** Thinking through the implications of various potential solutions.
- **Lesson 5. Designing research.** Planning experiments to test ideas.
- **Lesson 6. Collecting and recording observations.** How to manage the experiment and collect the right types of data.
- **Lesson 7. Analyzing and evaluating the results.** Working out what the findings mean.
- **Lesson 8. Applying findings and sharing knowledge.** Planning what to do with the results.

Summary

- Innovations are vital for rural people to improve their income and livelihoods, and to deal with changes in the world around them.
- There are many types of innovation, and good ideas can come from many different sources.
- Farmers and other rural people can play a key role in identifying, developing, testing and implementing innovations.
- Farmers and other rural people have always innovated. You can help rural people innovate by helping them make the process more systematic.
- You can organize innovation groups, either as part of existing community groups, or as stand-alone groups. You can also train them on how to develop and test new ideas.

Quiz for Lesson 1

1. **Farmers who are well known for trying out new things and observing how some plants grow better than others are good candidates for innovation groups.**
   A. True
   B. False

Correct answer: A. Innovation needs people who want to try out new things and who observe carefully.

2. The role of the field agent in the innovation process is to:

Select all that apply.

A. Make contact with the nearest agricultural research station and obtain the best seeds for farmers to produce.

B. Make sure that the most advanced farmers, especially those with access to extension and credit services, are part of the innovation group.

C. Guide the community in selecting innovation group members that have the appropriate experience and expertise, experiment on their own and have the ability to communicate to others what they see and what they learn.

D. Lead the innovation group through steps that make up the innovation process with the goal of building their capacity to continue the process on their own.

Correct answer: C and D. It is not the field agent's job to do things for the innovation group, like finding out knowledge or accessing technology. Rather it is to help the group contact others who can provide information or technology. Farmers who have close contacts with extension and credit may not be best member of the innovation group as they may prefer technologies that most farmers cannot afford.

3. Why is innovation important for rural people?

Select all that apply.

A. It makes an enterprise more competitive.

B. It helps pay school fees.

C. It stops floods from occurring.

D. It builds the capacity to solve problems without depending on others for solutions.

Correct answer: A and D. Innovation is a process that improves how people do things.

4. You need a genius in your group to be innovative.

A. True.

B. False.

Correct answer: B. A group does not need a genius to innovate, although a highly innovative person can speed up the innovation process. What a group needs is the ability and enthusiasm to search for solutions to their problems, and to test and adapt these solutions to their needs.

5. The field agent's role in supporting farmer group innovation and experimentation is to:

A. Assist local communities in analyzing their situation and problems and in finding solutions.

B. Assist communities to implement, monitor and evaluate their activities.

C. Help local communities and groups to establish links to other groups and institutions that may be able to support them.

D. Play a neutral role, not dominating or allowing others to dominate meetings, rather encouraging all to express their opinions freely.

E. All of the above.

Correct answer: E. All of these are important roles.

Lesson 2. Identifying and understanding problems

Introducing Achieng

Achieng grows maize and vegetables, she raises chickens, and she keeps a couple of goats for their milk.

Like most farmers in her village, she faces many problems. Her maize does not yield well, pests attack her vegetables, she has too few chickens, and her goats yield only a little milk.

Figure 9. Achieng faces many problems in her farm.

Prioritizing problems

Achieng and her friends know they cannot tackle all their problems at the same time. Instead, they want to solve one at a time. They decide to focus first on chickens.

The friends list their problems, then vote on the highest priority. Chickens got nine votes, compared to five votes for maize (Table 1). So Achieng and her friends decide to look for ways to increase the number of chickens.

Figure 10. The friends prioritize their problems.

Table 1. Prioritizing problems

	Votes	**Priority**
Poor maize yields	|||||	2
Cabbage pests	||||	3
Too few chickens	||||| ||||	1
Low milk yield from goats	|||	4

See Exercise 1 for how to prioritize problems.

Understanding problems

Chickens are important to Achieng. She and her family eat the eggs, and occasionally kill a chicken to eat. She also sells chickens or eggs in the market, or gives them to friends or visitors.

But only a few chicks ever grow to maturity. Her best hens hatch as many as 15 eggs. But they roam free and search for their own food. The mother hens cannot protect them all, and hawks and other birds of prey steal many chicks.

Plus, many of the villagers' chickens die from Newcastle disease. The women have to build up their flocks again from scratch.

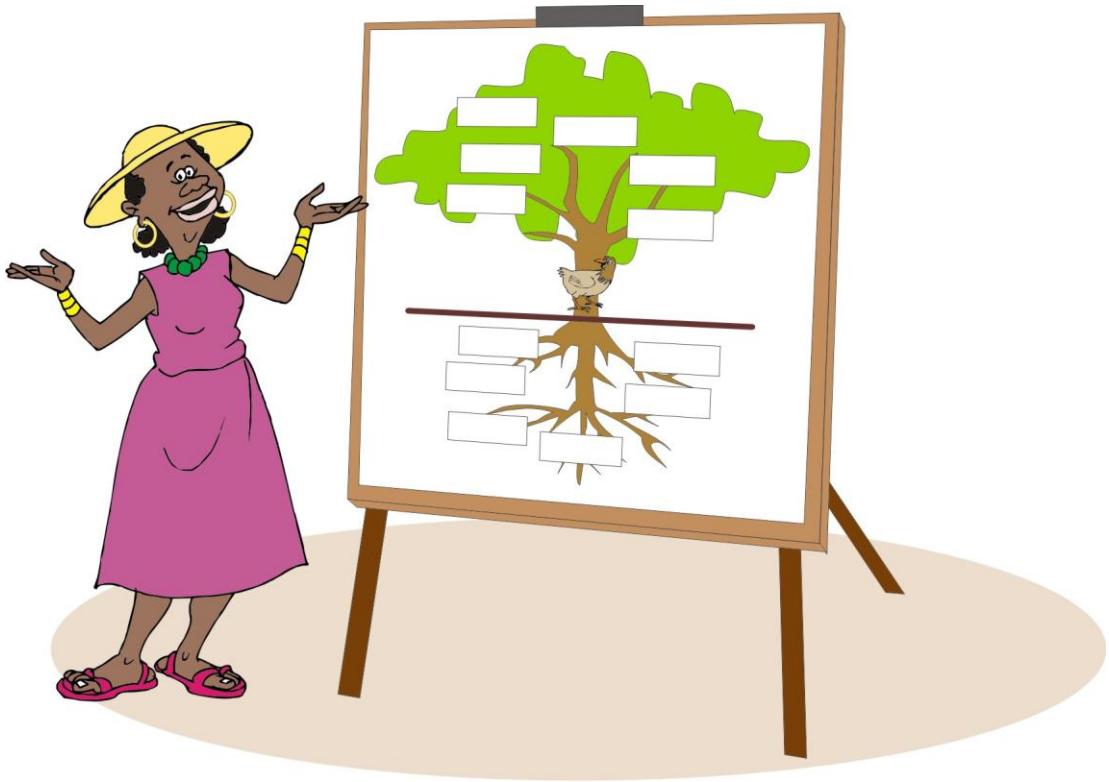


Figure 11. Drawing a problem tree.

Problem trees

Understanding the root causes of a problem is important to find the most effective solution. One way to do this is build a **problem tree** showing the causes and effects of the problem.

Figure 12 shows the problem tree Achieng draws up for her chickens. It shows that if she can get more chicks to reach maturity, she can improve her income, have more food for her family, and give presents to her visitors.

Achieng and her friends realize there are two root causes of why so many chicks die: Newcastle disease, and birds of prey.

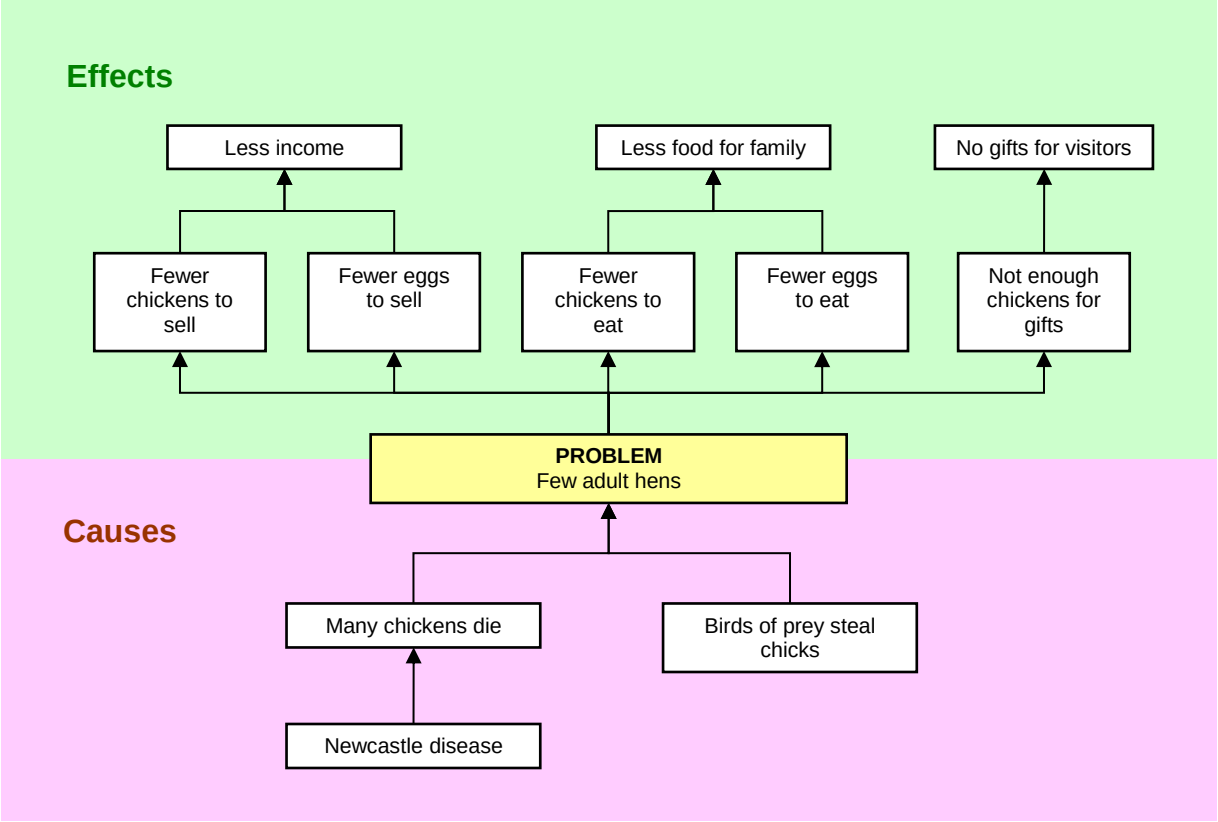


Figure 12. Achieng's problem tree

See Exercise 2 on how to construct a problem tree.

Choosing potential solutions

How can Achieng and her friends increase the number of chickens in their flocks? They first list the **root causes**: Newcastle disease and birds of prey (Table 2).

They then note their **current practices**: they do not vaccinate their chickens, and they let the hens and chicks roam around to search for food.

What **potential solutions** did Achieng's group see? In a third column they write "vaccinate" and "protect chicks."

For each potential solution, they then list the **constraints**: the difficulties they see in putting the solution into practice. For vaccine, for example, it is difficult to find someone to supply the vaccine, and it is expensive to vaccinate just a few chickens.

Finally, they suggest some ways of **overcoming these constraints**. They agree to look for a vaccine supplier, and if they find one, to pool their money so they can vaccinate all their chickens at once.

Table 2 summarizes their discussions. They have identified some concrete ways to overcome their problem of too few adult chickens. They do not know yet whether these approaches will work. That is the subject of the next Lesson.

See Exercise 3 for how to help farmers choose among topics.

Table 2. Achieng's topic selection matrix

Root causes of problem	Current practice	Potential for improvement	Constraints	Suggested topics
Newcastle disease	None	Vaccinate	Finding vaccine Cost of vaccine	Find source of vaccine Pool money to buy vaccine
Birds of prey	Free range	Protect chicks	Lack of time	Keep young chicks under basket Provide feed

Summary

- It is important to identify and understand problems and their causes. One way to do this is by drawing a **problem tree**.
- After identifying and prioritizing problems, the participants should identify possible solutions.

Exercise 1. Choosing which problem to address

Source: FAO. Piloting farmer field schools

This exercise enables the group to determine the most important problem to address. It gives each person the same voice as everyone else. This is important to ensure that the richer or more powerful farmers do not dominate the decision making.

Objective

- To prioritize problems and choose which one to address.

Equipment needed

- Large sheet of paper, marker pens (or blackboard and chalk).

Expected outputs

- A prioritized list of problems, and agreement on which the farmers wish to address.

Time required

1 hour

Preparation

None

Suggested procedure

1. Divide the participants into small groups of 3–4 people.
2. Ask each group to identify two or three major problems they face in crop or livestock production, processing or marketing.
3. In plenary, ask the groups to report the problems they have identified. Write all the problems on the large sheet of paper, one above the other. Draw horizontal lines between the problems to separate them.
4. Explain to the participants that they each have three votes. They should vote for the three problems that they think are the most important. They vote by drawing a vertical stroke (|) next to each of these three problems.
5. Each of the participants goes individually to the chart to put three strokes next to their priority problems.
6. When everyone has finished, add up all the strokes next to each problem. The problem with the highest score is the one the participants as a whole think is the most important.
7. Review the results to ensure that there is a consensus. Then discuss whether the problems represent the topics they would like to study further and learn about during the farmer field school.

Notes

Men and women often have very different ideas on what the most important problems are. Consider dividing the group into men and women to do this exercise.

Similarly, cattle owners and crop growers are also likely to think that different problems are important. They may decide to form separate groups to find solutions to their own problems.

You can also do this exercise with illiterate farmers using symbols or drawings to represent the problems. Give each person 3 (or 10) stones or dried beans. Each person votes by putting a certain number of stones or beans against each problem: more for serious problems, less (or none) against less important problems. When everyone has voted, count up the number of stones or beans against each problem to find out which people think is the most important.

Exercise 2. Problem tree

This exercise enables farmers to analyze the causes and effects of their problems.

Objective

- To analyze the causes and effects of problems, and identify possible solutions.

Equipment needed

- Large sheets of paper, marker pens (or blackboard and chalk).

Expected outputs

- Diagram showing the causes and results of a problem.

Time required

1 hour

Preparation

None

Suggested procedure

1. Divide the farmers into small groups. Give each group a large piece of paper and some marker pens.
2. Ask each group to select one **crop or livestock** type that they grow or a **product** they produce (such as maize, milk or coffee). Then ask them to think of the biggest problem they face with this product (e.g., a pest or disease, low yields, or problem with processing). Ask them to write this problem (or draw a picture showing it) in the middle of the large sheet of paper.
3. Ask each group to think of the **results** of the problem. Write each result on the paper and connect them with arrows to show how they relate to each other.
4. Ask each group to think of what **causes** the problem. Write this cause underneath the problem on the sheet. If the group identifies several causes, they should write each one on the paper, and connect them with arrows to show how they relate to each other.
5. Ask each group to present their problem tree to the plenary. Invite the members of the other groups to comment on and ask questions about the trees.
6. Ask the groups to save their diagrams so that they can be used in a later session.

Questions to stimulate discussion

- What is your biggest problem with a particular crop or livestock type?
- What are the consequences of this problem? What other problems does it cause? Does one consequence in turn create other problems?
- Why does this problem occur? When does it happen? What causes it? Does something else cause that?

Notes

Instead of writing on a piece of large sheet of paper, you can use several smaller pieces of paper or cards. Write each problem, cause or effect on one card, then put them on the table or on the ground and move them around so they are in the right order. Show the links between them with sticks or pieces of bamboo or string. This makes it easy to adjust the diagram as you go on. Copy the final diagram onto paper to make a permanent record.

To make the diagram easier to understand, first draw a big tree on the paper. Write the problem on the trunk, the causes on the roots, and the results on the branches and twigs.

Exercise 3. Selecting topics to study

This exercise enables farmers to select possible solutions to problems that they wish to test.

Objective

- To identify various possible solutions to a problem.

Equipment needed

Large sheet of paper, marker pens

Expected outputs

- Table showing potential solutions to the problem.

Time required

1 hour

Preparation

Choosing which problem to address (Exercise 1), Problem tree (Exercise 2)

Suggested procedure

1. Invite members of the group to review the results of the problem tree
2. On a large sheet of paper, draw five columns (Table 3). In the leftmost column, ask the farmers to list the main problems they have identified in the previous exercises.
3. For each problem, ask the farmers what they currently do to deal with it. Write these in the second column.
4. Ask the farmers for ideas on how to solve the problem. Write these ideas in the third column.
5. Ask them to think of constraints that make it difficult to put these solutions into effect. List these ideas in column 4.
6. Ask the farmers to suggest ways of overcoming these constraints. Write these in the column 5.
7. Ask the farmers to vote on which solutions they would like to explore further. Note these in the last column.

Notes

- Encourage the farmers to offer their own ideas on how to solve the problems. Prompt them with questions or suggestions if necessary. Feel free to suggest additional potential solutions if they fail to do so.

Table 3. Table to analyze and select topics for study

Problems	Current practice	Potential for improvement	Constraints	Suggested topics	Priority

Quiz for Lesson 2

1. **In the innovation process, identifying the cause of a problem should be done after the experiment is designed.**
   A. True.
   B. False.

Correct answer: B. Identifying the cause of the problem will help you design an innovation that solves it.

2. **Your group has identified soil erosion as a major problem. Which of these are causes of soil erosion, and which are results?**
   A. Poor soil fertility
   B. Cutting trees.
   C. Silting up of irrigation canals.
   D. Landslides
   E. Plowing on steep slopes.
   F. Allowing animals to graze freely.

Correct answer: Causes: B, E, F; Results: A, C, D.

3. **Which are potential solutions to the soil erosion problem?**

Select all that apply.

   A. Fencing off areas to prevent animals from grazing there.
   B. Planting trees and grass along the contours.
   C. Growing potatoes instead of fodder crops.
   D. Building checkdams on gullies.

Correct answer: A, B, D. Growing potatoes (C) is unlikely to control erosion. You can probably think of several additional ways to prevent erosion.

Lesson 3. Finding more information

Exploring sources of information

Achieng's group know that chicken farmers in a nearby village faced similar problems and had found solutions. They decide to visit them to find out.

The visit teaches them a lot about raising chickens. Their hosts tell them about a dealer who sells vaccine, and shows them how to vaccinate their poultry using eye drops.

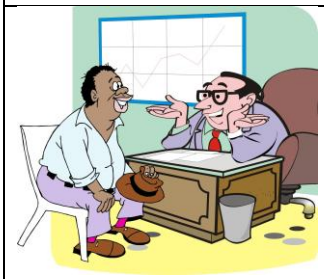
Figure 13. Achieng's group on a cross-visit.

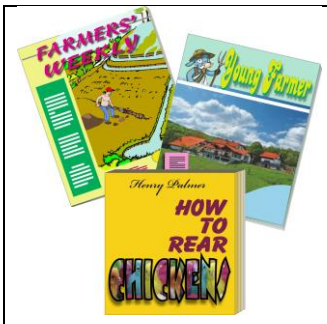
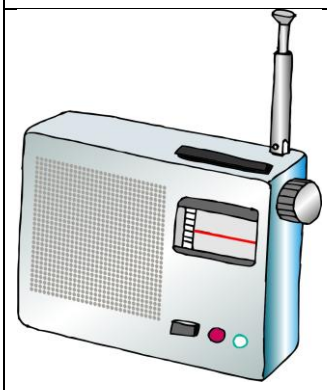
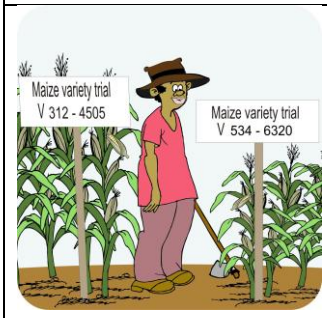
They go to visit the dealer. She tells them that for the vaccine to be effective, all the chickens have to be vaccinated at the same time. One bottle of vaccine is expensive, but contains many doses – enough for all the chickens in the village.

Where to find solutions to problems

You should encourage farmers and other rural people to look for information from as many sources as possible. You can also help them search for information. Here are some possible sources:

	**Other farmers.** Get them to talk to their neighbors, and arrange field visits to other villages and projects.
	**Innovators**. Some farmers are known as innovators: they try out lots of new ideas.
	**Researchers.** Get in touch with a nearby research institute. Even if the scientists cannot answer your specific question, they may know where to go for the information.
	**Extension workers.** Government and NGO extension agents often have training and expertise in specific areas.

	**Input dealers.** They supply seeds and agrochemicals, and may have details on how to use them.
	**Traders.** They may know a lot about markets, prices and commodities.
	**Business service providers.** Organizations such as banks, microfinance institutions and business services can often provide advice on technical, financial and organizational issues.
	**The internet.** Search for the information you need, but make sure it is relevant to your area before passing it on.

	**Books, farming magazines and training materials.** Check your project or organization library for useful materials.
	**Radio and television.** Programs about farming and rural development can introduce people to new ideas.
	**Experiments.** You can help the farmers test promising ideas on a small scale to see if they work. We will discuss this further in the following Lessons.

See Figure 20 for how to help participants identify promising sources of technical information.

Quiz for Lesson 3

1. **What is innovation?**
   A. Innovation is invention.
   B. Innovation is a process that takes an invention, adapts it to local conditions and makes it available for use by many people.

Correct answer: B. Innovation often means taking an existing practice from somewhere else and adapting it to your needs.

2. **Which of these is likely to be the best source of information on solutions for problems faced by smallholders in your area?**
    A. A research institution focusing on high-tech agriculture.
    B. A project with smallholders in a neighboring, but much drier, province.
    C. A successful group of farmers in the next village.
    D. An input supplier who sells expensive chemicals.

Correct answer: C. The farmers in the next village probably face the same type of problems as people in your area. They are likely to be the best source. Also explore other potential sources of information before settling on an option to test.

3. **Books and the internet are always good sources of information.**
    A. True: They have been checked carefully and are always reliable.
    B. False: They often have useful information, but you should always test it to see if it works in your area.

Correct answer: B. While you can get many good ideas from books and the internet, do not rely on them exclusively. Always check that the information is valid in your area!

Lesson 4. Exploring possible solutions

Putting ideas into practice

Achieng's group discuss the idea of vaccinating against Newcastle disease.

Figure 14. Evaluating an idea before putting it into practice.

If the farmers are confident that the solution will work, they may decide to put it into practice straight away.

You may need to help them get organized to pay for inputs (like vaccine), coordinate activities, contribute labor, or pool their produce for marketing.

All-or-nothing technologies

It is not realistic for Achieng's group to try out the vaccination on a small scale. To be effective, all the chickens have to be vaccinated. It is a question of all, or nothing.

Some technologies are naturally large-scale. Farmers have to adopt these technologies in full: it is not possible to try them out on a small scale.

Examples are new irrigation schemes, erosion-control measures, and expensive equipment.

To help the farmers decide whether they want to adopt these technologies:

- Organize visits to other villages which already use them.
- Arrange for specialists (such as researchers, extension agents or input suppliers) to talk to the farmers.
- Make sure that the farmers understand how to use the technology and what they have to do to make it a success. Arrange training for them if necessary.
- Discuss with the farmers the implications of the technology: the costs and benefits, the pros and cons.

Figure 15. Some technologies, like this irrigation canal, are all-or-nothing.

Trying things out on a small scale

But many technologies are not all-or-nothing. It is possible to try them out on a small scale first, and it is a good idea to do so. That helps people decide whether to adopt them. It also

helps people learn about the technique and builds their confidence in it. It lets people adapt the technique to suit their needs, and keeps the cost low if it does not work.

These technologies include new crop varieties, practices such as plant spacing and timing of planting, ways to control pests, treatment of diseases, feeding of animals, and so on. You can help the farmers organize experiments so they test these ideas.

Figure 16. Try things out on a small scale first.

Ideas to test

During her visit to the neighboring village, Achieng notices some baskets made of bamboo. How about if she kept the young chicks under such a basket to protect them from birds of prey? She discusses this with Dorcas and Josephine, two other members of the group.

Figure 17. Spotting an idea.

This is a technology that the farmers can test on a small scale. They could put a few hens and their chicks under baskets to see if it helps the chicks survive. If it works, they can then gradually use baskets to protect more and more chicks.

Thinking of implications

But keeping the chickens confined under baskets might result in two new problems: feeding them, and avoiding pests and diseases.

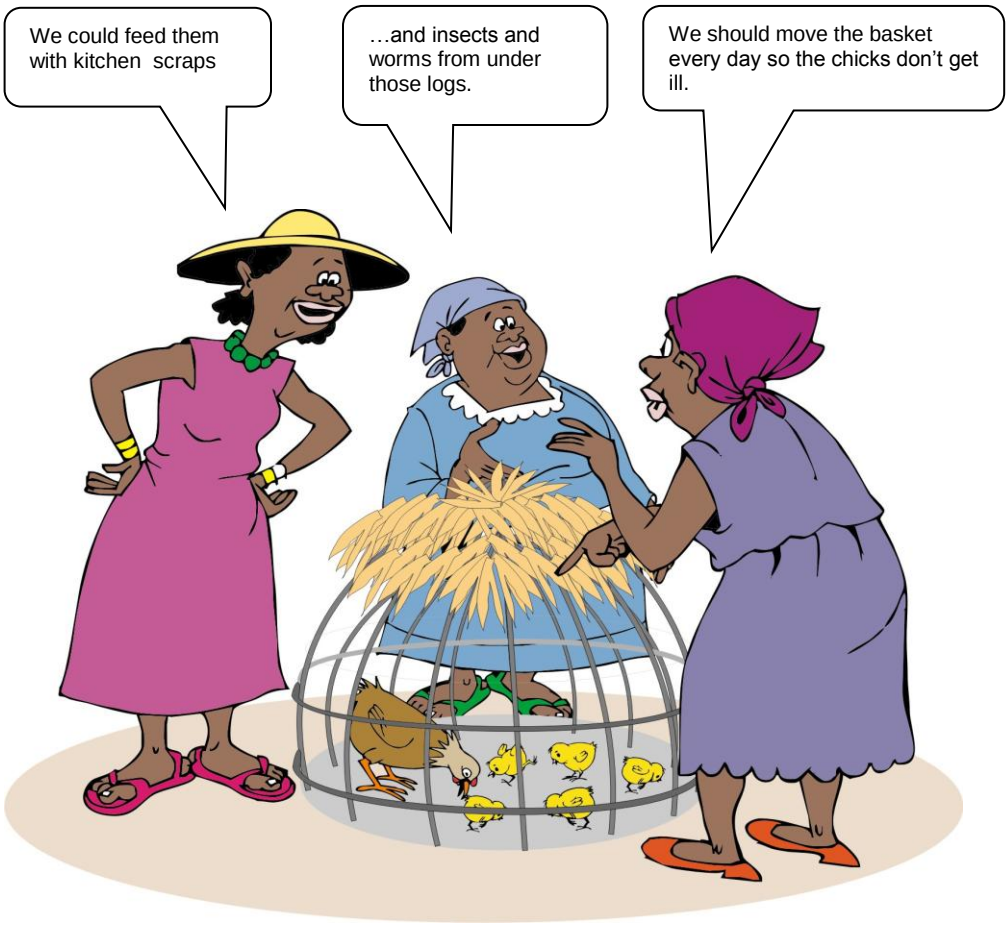


Figure 18. Thinking through an idea.

How can you help Achieng and her friends decide whether to use the baskets? Help the farmers think carefully about the implications.

- What are the advantages and disadvantages?
- Does this solution fix the problem they are concerned about?
- Does it require something they do not have?
- Has anyone in this neighborhood tried it?
- Why did it work for that farmer?
- How much time and money will this solution save (or cost)?
- Can they change it to suit their own needs?
- Are they willing to experiment with it?

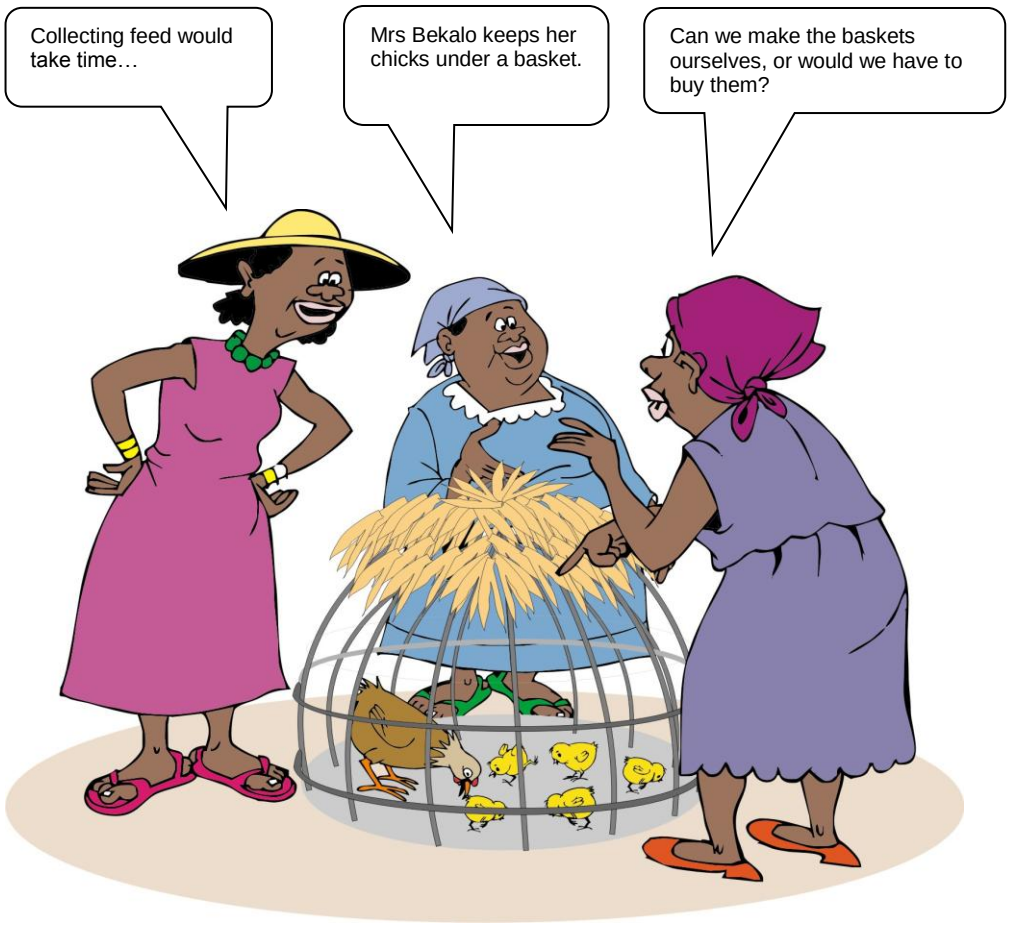


Figure 19. Evaluating an idea before putting it into practice.

Achieng lists these considerations in a table (Table 4).

See Exercise 5 for one way of guiding participants how to do this.

Table 4. Considerations and likely results of confining chicks under baskets

Problem: Chicks eaten by birds of prey	
Solution: Keep chicks under a basket	
Considerations	**Likely results, comments**
Cost	Moderate cost: use local materials to weave baskets
Labor	High cost: finding food is labor-intensive
New knowledge/skills?	Low
Effectiveness	High: effective against birds of prey
Simplicity	Simple
Possible benefits	High:

	• More mature chickens = more to sell = more income • More mature chickens = more eggs and meat = more food for family • Collect droppings to add to compost
Possible negative impacts	High: • Lack of feed • Risk of pests and diseases

Positive and negative consequences

Help the farmers think of all the possible positive and negative consequences.

- **How will it affect the farm?** Growing more of one crop may mean producing less of another.
- **How will it affect the ecosystem?** Clearing land to plant a crop may result in erosion or destroy trees that serve as a windbreak.
- **How will it affect the household's finances?** Can they afford the investment? Can they take the risk?
- **How will it affect men, women and children?** Will it mean more work for someone?

[GRAPHIC innov034: Dorcas, Josephine and Achieng with list on flipchart:

- More chickens
- More feed
- Low investment
- More work for women]

Figure 20. Pros and cons of an innovation

Summary

- Rural people can find information on innovations from many different sources: other farmers (especially those known as innovators), researchers, extension workers, input dealers and traders, as well as the internet, printed material and the mass media.
- Some innovations are **all-or-nothing**: it is not possible to try them out on a small scale. Help local people become familiar with them by organizing visits and training, and getting them to discuss the pros and cons, and thinking through the implications.
- Other technologies can be tried out on a **small scale**. Help the local people to decide which of these they want to test, and how to organize the trials.

Exercise 4. Seeking technical information or advice

This Exercise helps participants think of where they can find information about different technologies.

Objectives

- To list promising sources of information on various technologies.
- To encourage participants to think of seeking information from outside sources.

Equipment needed

Large sheets of paper, marker pens

Expected outputs

- Lists of promising sources of information on various technologies

Time required

1 hour

Preparation

None

Suggested procedure

1. Divide the participants into groups, and ask each group to choose an enterprise (such as maize growing or raising chickens).
2. Ask the groups to write all the sources of technical information for their enterprise on a large sheet of paper. Go around the groups and prompt them if necessary.
3. Ask them to rank the sources according to how useful they are.
4. Invite each group to present their lists and rankings.
5. Invite the other participants to suggest additional sources of information.
6. Facilitate a discussion about the merits of different information sources.
7. Ask the participants what they think is the best way to approach each of the most promising sources.

Questions to stimulate discussion

- Where do you normally go if you need to solve a particular problem?
- Are there any people in the village who are experts? How about individuals or groups in nearby villages? Perhaps someone has a relative who has studied agriculture?
- Can you get information from the radio, newspapers, magazines, the internet?
- Does the local extension office offer training? Is there a research institution nearby?
- Can seed dealers or traders offer any information?

Exercise 5. Exploring possible solutions

This Exercise helps participants explore possible solutions to their problems by identifying positive and negative characteristics. You can use this Exercise for both all-or-nothing technologies and ones that participants can try out on a small scale.

Objective

- To enable participants to think through possible solutions to their chosen problem.

Equipment needed

Large sheets of paper, marker pens

Expected outputs

- A list of criteria to decide whether it is worth pursuing a potential solution to a problem.

Time required

1 hour

Preparation

- Exercise 3 **(**Selecting topics to study**)**

Suggested procedure

1. Remind participants of the problem they had chosen and the solutions they had identified (in Exercise 3). Explain that they will now explore these solutions in more detail. Discuss why it is important to think of positive and negative consequences of an innovation before implementing it.
2. Ask the participants to think of the criteria they would use to judge an innovation: things like the cost, feasibility, effectiveness, amount of work needed, ease of use, benefits, problems it might cause, and so on. List these criteria on a large sheet of paper.
3. Divide the participants into groups, and ask each group to select a problem they want to solve.
4. Ask them to think of between one and three possible solutions to the problem. Get them to draw a table like Table 5 on a large sheet of paper, with one column for each potential solution.
5. Ask them to list the criteria from Step 2 (above) in the first column of their table.
6. Invite them to fill in the remaining columns in the table with the likely results and any comments (see Table 4 for an example). If the group is evaluating more than one potential solution, ask them to compare among them.
7. Invite the groups to report on their discussions to the plenary.

8. Highlight those considerations that the groups thought were most important. Which potential solutions appear to be the most promising, and why? Which ones would they reject, and why?
9. If the group evaluated more than one solution, ask them to select the one that they would like to pursue further.

Table 5. Form for exploring possible solutions to a problem

Problem:		
Considerations	**Solution 1:**	**Solution 2:** .....
Cost Labor New knowledge/skills needed Effectiveness Simplicity Possible benefits Possible negative impacts …		

Quiz for Lesson 4

1. Which of these technologies is it easy for a group of smallholders to try out on a small scale?

A. Diverting a river to irrigate crops.

B. Testing new varieties of crops.

C. Removing vegetation that harbors biting flies.

D. Building a road to improve access to market.

Correct answer: B. All the others are large-scale interventions.

2. Achieng's group has listed some possible constraints to keeping chicks under baskets. Which is not likely to be a problem?

A. It will be necessary to feed the chicks.

B. The group will have to make baskets.

C. The chicks may fall ill if the basket stays in the same place.

D. The neighbors may complain about the noise.

Correct answer: D. Noise is not likely to be a problem.

3. Here are some positive and negative consequences of starting to keep dairy cattle. Put each one into the correct category.

A. We will need a loan to buy equipment.	1. Farm
B. We can use the dung to fertilize the fields.	2. Ecosystem
C. It will be more work for the women who feed the animals and do the milking.	3. Finance
D. We will have to grow fodder to feed the cows.	4. People

Correct answer: A3, B2, C4, D1.

Lesson 5. Designing research

What is research?

"Research" sounds as if it is complicated, expensive and demands lots of skill and specialist equipment. Some research is indeed like this – it is best done by scientists in research institutions.

But some types of research are simpler and easy to do. In fact, **many farmers do research every season**: they try out new crops, they look for ways to increase their yields, and they seek out information on the best prices. **All these things are research!**

[GRAPHIC innov035: Scientist in lab with flasks and test tubes; farmer in field looking at crop]

Figure 21. Anyone can do research.

Types of research

Here are some types of research that farmers and other rural people can do easily.

[GRAPHIC innov036: experimental plot in farmer's field with two varieties of maize: one tall, one short]	**Crop experiments:** testing crop varieties, planting and harvesting dates, plant spacing, fertilizer applications, pest and disease management…
[GRAPHIC innov037: Achieng, Dorcas and Josephine with notebook looking at chickens under basket.]	**Livestock trials:** testing new breeds or species of animals, different types of feed and housing, ways to control pests and diseases…
[GRAPHIC innov038: Everett with his maize-shelling machine]	**Post-harvest processing trials:** testing ways to harvest, dry and store crops, methods to process the output…
[GRAPHIC innov039: Dana with notebook in market asking about tomato prices]	**Market research:** gathering information about potential markets, prices, standards and value chains.

We will look first at crop experiments before returning to Achieng's group to look at livestock trials. At the end of this Lesson we look at post-harvest processing and market research.

Choose an appropriate comparison

Suppose you want to test a new maize variety. You buy some seed and sow your field. You wait for it to grow, then you harvest it and count how many bags your store. You find you have 20 bags. But last year you harvested 25 bags of the old variety. You conclude that the new variety is no good.

But wait a moment! Maybe the weather last year was better. Maybe the old variety would have produced only 15 bags this year. And come to think of it, you applied more fertilizer last

year. And some cattle broke into your field just before harvest this year and trampled some of the crop.

Comparing one year with another is not a good idea: there are too many other factors that may affect the yield. You need a **better way** to compare the two varieties.

[GRAPHIC innov040: Farmer with stack of 15 bags of grain, looking puzzled.]

Figure 22. An experiment should compare one thing with something else.

Treatments and control

You decide to split the field in two: you plant one half with the new variety, and the other half with your old one. You plant both halves the same day, and you apply the same amounts of fertilizer to each half. You can now compare the yield from the two halves of the field, and be confident that the difference is because of the variety, not the weather.

In research jargon, the new variety is called the "treatment," while the old variety is the "control."

[GRAPHIC innov041: farmer with bag of seed labeled "New variety" (with caption underneath saying "Treatment"); same farmer with bag labeled "Old variety" (caption underneath saying "Control")]

Figure 23. New technique to test = treatment. What farmers already do = control.

More than one treatment

Supposing you want to test two new varieties at the same time. You would then have **two treatments** (the new varieties) and **one control** (the old variety). You split the field into **thirds**, and plant one-third with each type of seed.

Of maybe you want to test different amounts of fertilizer: you normally apply 30 kg of urea per hectare, but want to see if more or less fertilizer would give you a bigger yield or earn more money.

[GRAPHIC innov042: test plot with maize of 3 different heights. Signs: next to smallest plant "0 kg urea"; middle-sized plant "20 kg urea"; tallest plant "30 kg urea"]

Figure 24. Testing three maize varieties.

Keep it simple

Imagine you want to test a new variety, different fertilization rates and a new pest-control technique on your maize. Should you test them in the same field at the same time?

No. That would cause confusion. How would you tell what caused a good yield: was it the variety, the fertilizer, or the pest-control method? Or some combination of all three?

It is better to keep it simple and **test one thing at a time**. Choose which you want to test first (say, the varieties), then wait till next season to test the fertilizer rates or the pest-control

methods. If you cannot wait that long, test the varieties in one field, the fertilizer rates in another field, and the pest-control in a third field.

[GRAPHIC innov043: Farmer in field with maize crop, scratching head and looking confused. On sign next to maize plant: "New variety + 40 kg urea + pest control"]

Figure 25. Test one thing at a time: either varieties, or fertilizer rates, or pest control methods, but not all together.

Start small

It can be risky doing an experiment on a whole field. What if the new variety fails completely? The whole family may go hungry.

Instead of using a whole field for your experiment, you can save money and reduce the risk of failure by setting aside just a small part of the field.

Measure out several plots carefully – say, 10 m by 10 m, and mark them with sticks. Sow one variety in each plot. Put a sign next to each plot so you know what variety you have sown there.

[GRAPHIC innov044: 2 farmers: Farmer A looking sadly at huge field with bad crop; Farmer B looking at 2 small plots, one with bad crop and another with good crop.]

Figure 26. Starting small reduces your risks if something goes wrong.

Repeat experiments

You plant two plots: variety A in plot A, and variety B in plot B. At harvest time, you find that variety A yields more. You conclude that it is better than variety B.

But wait: maybe something else caused the higher yield in plot A. Maybe the soil there is more fertile. Maybe it is further down the slope, so gets more water. Perhaps the soil is deeper and less stony. Maybe plot A gets more sun, or is more sheltered from the wind. Or perhaps your neighbor's cattle broke through the fence again and trampled the plants in plot B.

How to avoid such chance factors ruining your experiment? The answer is to repeat the experiment in several different places. In research jargon this is called **replication**.

If possible, repeat the experiment in three different places. Here are two ways to do this:

- Get three farmers to plant the test plots on their land. Try to make the plots as similar as possible: on similar soils, slopes and cropping history.
- If you want to test three varieties, plant nine plots in a field: three for each variety.

[GRAPHIC innov045: three farmers, each with 3 test plots of maize (same as next graphic, without the signs)]

Figure 27. Replicating experiments gives you confidence in the data.

Make the pattern random

If you repeat (**replicate**) the experiment, make sure the treatments are in a different order in each of the plots. You should assign the plots at random – by chance.

For example, three farmers plant test plots with three different varieties, A, B and C. Their farms are all on a slope. They lay out their plots like in Figure 28.

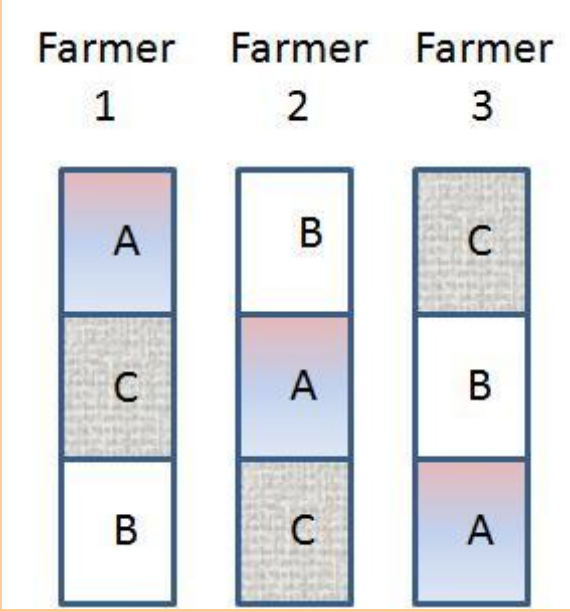
[GRAPHIC innov046: Three neighboring farmers, each with 3 plots of maize on a slope. Plots with signs A, B and C. Plots of farmer 1 in order A (at top of slope), C, B; farmer 2: B, A, C; farmer 3: C, B, A.]

Figure 28. Decide which variety goes in which plot at random. That avoids factors like slope or soil fertility from affecting the results of the experiment.

Keeping records

Keep careful records of what you have sown, the dates of sowing, weeding and harvesting, etc. Make a sketch of the plots so you know what treatment is in what plot – in case the signs get lost or mixed up.

[GRAPHIC innov047: Page of notebook showing layout of plots



]

Figure 29. Keep a careful record of what treatment is where.

Livestock trials

Let us now look at how Achieng's group applies these principles to test using baskets to protect chicks from birds of prey.

1. **Choose an appropriate comparison.** The women need to compare the confined chicks (the treatment) with those that are free to roam as usual (the control).

2. **Start small to reduce the risk of failure.** They start with just two clutches of chicks per person. They each take two hens that hatch about the same number of chicks – about 10 chicks so there are plenty of chicks at the start of the experiment. They put the hens and chicks under baskets.
3. **Keep it simple.** They test just a single innovation: the baskets. As far as possible, they keep everything else the same as for the free-roaming chickens: the same feed, the same amount of water, and so on.
4. **Repeat the experiment.** Achieng, Dorcas and Josephine all do the experiment in their own backyards with two hens and their chicks. That gives them six replicates – enough to get a good idea of whether the baskets are effective at protecting the chicks.
5. **Make the pattern random.** The women agree to move the baskets each day so the chicks can scratch in a new place and so they do not have to walk on their own droppings. That will keep them clean and healthy. It will also avoid problems like having the baskets in the sun all the time – which might affect the chicks' survival.
6. **Keep records.** The women keep a careful record of the number of chicks under the baskets, the number that run around free, and how many of each are lost. They also note how much time they spend collecting feed for the chicks, and the chicks' general health and vigor.

[GRAPHIC innov048: Achieng, Dorcas and Josephine with notebook looking at chickens under basket.]

Figure 30. Livestock trials follow the same rules as crop experiments.

Experiments with larger animals

Doing experiments with chickens is relatively easy. But experiments with cattle and other animals are difficult because farmers only have a few and each animal is valuable. The farmers cannot risk even a small drop in productivity.

Some ways around this:

- **Test fodder and feeding.** Fodder production is important, and farmers may be interested in doing tests on improved fodder, pasture production and livestock feeding.
- **Compare existing practices.** Instead of doing an experiment, the farmers could visit different farms to observe traditional and new livestock management practices.
- **Compensate for losses.** A group of farmers could agree to compensate members who suffer lost production if an experimental treatment fails.

[GRAPHIC innov049: Three farmers, each with a cow. Each cow is eating a different type of fodder: hay, green fodder, concentrate.]

Figure 31. Be careful with trials with big animals: they are valuable!

Post-harvest processing

You can also design experiments to test different types of handling after harvest. Some examples:

- **Drying and preservation:** What is the best way to dry grain or preserve a crop? How long should you dry grain for?
- **Storage:** What is the best way to store a crop? How can you protect it from pests or mold?
- **Processing methods:** How best to process the crop? How to increase its value so it fetches a higher price?
- **Quality tests:** Which variety produces the best-quality output? Which has the best taste or fetches the highest price?

[GRAPHIC innov050: Farmers looking at 3 sacks of grain: sack A labeled "Dried 5 days", sack B labeled "Dried 3 days", sack C labeled "Dried 1 day" (sack discolored and with flies buzzing around it, shoots growing out of it)]

Figure 32. An experiment on grain storage.

Market research

It is important that farmers study the market for the products they are thinking of producing.

Sources of information include:

- Buyers, traders, wholesalers, processors, retailers, consumers.
- Research and extension organizations.
- Banks and microfinance institutions.
- Input suppliers, business service providers.
- Mobile phones, market information services, radio, internet.

Things to study:

- **Different products:** prices, quality requirements and standards, amounts needed, packaging requirements, terms of delivery and payment.
- **The value chain:** the chain of people and organizations who buy, process and sell the product, from the farmer to the consumer.
- **Service providers:** people and organizations who provide services to the value chain, such as finance, transport, processing, information and inputs.

[GRAPHIC innov051: Farmers in marketplace with a notebook, interviewing a trader about a crop]

Figure 33. Research is a vital part of marketing.

Ideas for market research

- **Conduct a simple survey** of sample of people who might purchase the product. That can reveal consumer preferences, needs and constraints, what they are willing to pay, and how many might buy the product.
- **Use mobile phones** to get information on prices from urban markets to inform negotiation of farm-gate prices.
- **Learn from others** who specialize in the product or have started a similar enterprise.
- **Talk to extension and local NGO staff** who have experience in marketing.
- **Form a marketing research team** to gather information to share with the wider community.

For more information on market research, see the training module on Marketing.

Selling pigs or making bread?

Here is an example of the difference market research can make.

A group of Nicaraguan women have formed a community savings and lending group. Over the last 6 months they have collected some savings. They decide to try a small business together.

Their first choice is to raise pigs, which fetch a high price. But the group's field agent recommends they first do a simple market survey. She explains how to identify market opportunities and evaluate costs, benefits and feasibility.

The group discovers that pigs need a lot of water – which is scarce in their village. But the small shops in three nearby villages never have enough bread. So the group develops a business plan and use their savings to build clay ovens and a small shed. They now bake bread and sell it twice a week.

[GRAPHIC innov052: Nicaraguan women turning their backs to pigs, and baking bread instead]

Figure 34. Baking bread was more profitable than raising pigs.

Summary

- Farmers and other rural people are already experienced researchers: they try out new things every season.
- Type of research include crop experiments, livestock trials, post-harvest processing, and market research.
- When planning an experiment, choose one or more "treatments" (new techniques) to and compare them with what the farmers already do (the "control").

- Keep experiments simple: test only one thing (such as type of crop variety or amount of fertilizer) at a time. Start small, and repeat ("replicate") experiments to make sure the findings can be relied on.

Exercise 6. Designing an experiment

This Exercise leads the participants through designing an experiment. It is best if the participants can plan an experiment that they will then put into practice. But you can also use the Exercise to plan hypothetical experiments. In this case, try to make them as realistic as possible.

Objective

- To plan an experiment involving a crop or type of livestock

Equipment needed

Large sheets of paper, marker pens

Expected outputs

- A design for an experiment

Time required

1 hour

Preparation

Exercise 5 (Exploring possible solutions)

Suggested procedure

1. Ask the participants to recall the problem and solutions they discussed in Exercise 5, and the priority solution they wished to pursue further. Tell them that they will now design an experiment to test whether the solution is indeed better than the current practice.
2. Invite the participants to get back into the groups they were in for Exercise 5.
3. Ask the groups to design an experiment to test their priority solution.
    - The experiment should contain: one or more "treatments" (new technologies they wish to test), and a "control" (the current practice).
    - It should be simple and small.
    - It should have at least three replications.
4. Ask the groups to present their plans to the plenary. Facilitate a discussion of their plans.

Questions to stimulate discussion

- Why is it important to start small?
- What can happen if the comparison you make is not appropriate or fair?
- Is the experiment simple enough? Or does it try to test too many types of innovations at the same time?
- What types of information should be observed and recorded?
- Why is it important to conduct an experiment more than once?

Quiz for Lesson 5

1. Who can design and do a successful experiment?

A. Extension agents.

B. University scientists.

C. Farmers.

D. All of the above.

Correct answer: D. You do not have to have a degree to do research!

2. When designing an experiment, one should…

Select all that apply.

A. Replicate treatments on different plots or farmers' fields.

B. Randomize the pattern of replicated treatments to reduce bias.

C. Study many factors at one time to gain more results per experiment.

Correct answer: A and B. If you include too many factors, it will be impossible to see which one is important.

3. The field agent has to have experience in setting up agricultural experiments to be able to facilitate the innovation process effectively.

A. True

B. False

Correct answer: B. You do not need prior experience in agricultural experiments. But you should read and understand this manual. Seek advice from the local research institution if you need more information.

4. In an experiment, you should do everything you can to make sure the treatment produces a higher yield than the control.

A. True.

B. False.

Correct answer: B. An experiment aims to find out which option is better. It does not try to prove that one option is better than another.

Lesson 6. Collecting and recording observations

Deciding what information to collect

Achieng's group is deciding what information to collect on their experiment.

[GRAPHIC innov053: Achieng, Dorcas and Josephine discussing their chickens.

Achieng: "We should count the number of chicks each week."

Dorcas: "And make a note of their health and condition."

Josephine: "And how much work it takes to collect feed for them."]

Figure 35. Deciding what information to collect.

It is important to keep good records of an experiment. Things to decide:

- What do you want to count or measure?
- How will you measure it?
- When (and how often) should you measure it?
- How to keep records?

What do you want to count or measure?

Achieng's group decide that they need to record three types of information:

- The number of confined and free-roaming chicks that survive over an 8-week period
- The general health and vigor of the confined and free-roaming chicks
- The labor required to feed the chicks.

They will need to record the first two types of information for both the confined and the free-roaming chicks. They will have to record labor only for the confined chicks, since the free-roaming birds look for their own food.

[GRAPHIC innov054: Notebook with text and table:

Observe each Saturday

	Under baskets	Free
Number of chicks	✓	✓
Health of chicks	✓	✓
Labor for feeding	✓	✗

]

Figure 36. Deciding what data to collect.

Observations for crop experiments

The observations will depend on the type of experiment. If you are comparing a local maize variety to two new varieties, the observations might include:

- Dates of planting, weeding and harvest.
- Amount, type and dates of fertilizer application
- Number of plants that show pest or disease symptoms, type and severity of infection (each week)
- Plant height (each week)
- Number of plants harvested (at harvest)
- **Weight of cobs harvested** (at harvest).

Note that you are only really interested in the weight of the cobs harvested. But things like pest and disease attacks are important too: they will help you interpret the results of the experiment and decide whether to adopt the new variety.

Recording this other information also shows whether all the plots are treated the same.

It is tempting to collect lots of information from an experiment. But that takes time and effort, and makes it harder to analyze the results. It is better to measure just the most vital things, and make a note of other things as you notice them.

[GRAPHIC innov055: Several farmers crowding around a maize plant: one counting cobs, one measuring height, one inspecting leaves, one holding notebook and pencil.]

Figure 37. Don't try to collect too much information.

How will you measure it?

You need to decide exactly how and when to measure or count each observation.

For example, how do you measure plant height? From the ground up to the growing tip? Or up to the top of the highest leaf (which may be higher). Do you use a tape measure?

How do you measure maize yield? Do you count the number of cobs? Do you weigh the grain? Before husking or after husking or shelling? Before or after drying? Are your scales accurate? If you count bags, how many kilograms does each bag contain? Are the bags a standard size?

[GRAPHIC innov056: 3 farmers: one counting cobs, one counting bags, one weighing bags with scale]

Figure 38. Decide what to measure and how to measure it.

When and how often to make observations?

It is a good idea to visit experiment plots regularly – perhaps each week. That lets the group observe what is happening to the crop (or the animals, if it is a livestock trial) and maintains their interest in the experiment. Observing the crop carefully also increases their awareness of certain aspects, such as how a pest may damage a crop over time.

Some types of information need to be collected regularly: plant height, pests and diseases, weed problems, and health of animals.

Other types of data need to be noted only once: planting and harvesting dates, amount of fertilizer used, and yield.

[GRAPHIC innov057: Page on calendar marked "11 July: harvest maize and weigh yield"]

Figure 39. Plan when and how often to collect data.

Tips for data collection and observation

- Take all measurements under the same conditions, using the same methods.
- Be as uniform as possible when applying treatments and collecting data.
- Collect data from each plot separately: do not add together the plots with the same treatment. (You may do this at the end of the experiment if it is clear that there have been no problems in running the experiment.)
- Note additional useful observations: the weather, types and amount of weeds, pest damage, soil conditions, dates of weeding and fertilizer applications, things that went wrong, diseases, chemicals applied, and who worked on which plots.

[GRAPHIC innov058: Farmer writing in notebook: "11 July: weather hot and dry"]

Figure 40. Keep notes on things like pests and the weather.

How to record information

[GRAPHIC innov059: Achieng, Dorcas and Josephine discussing their chickens.

Achieng: "We should keep careful records, otherwise we will forget."

Dorcas: "We should have a standard form that we all use."

Josephine: "Let's use school exercise books."]

Figure 41. Use an exercise book to keep records.

Some tips:

- Individual sheets of paper can easily get lost. Instead, use a sturdy exercise book that is big enough to record all the observations you make for your experiment.
- Use separate pages for different record sheets.
- Always include the date that observations are made.

- If more than one person is recording the information, have a space on the sheet for that person's name.
- Record observations immediately when they are made. Write them directly in the book, not on a scrap of paper to be transferred later.
- Write the observations neatly and clearly.
- Do not change or erase an observation that you made earlier. Instead, write a note or clarification with the correction.

Designing forms for records

You need to design forms so you can record your observations. Here is the form Achieng's group design to record the number of chicks (Table 6).

The women decide to count the chicks every Saturday evening when they get back from the market.

The form has two columns: one for the treatment (chicks confined under baskets), and one for the control (free-roaming).

There is one row for each week, up to 8 weeks (when the chicks will be big enough to fend for themselves).

There is an extra row at the bottom so they can calculate percentages.

Each of the three women copies the blank table into their own exercise book.

Table 6. Form for recording chick survival

Start date: End date:

Week		**Under baskets**	**Free-roaming**
Number hatched			
Number of chicks alive at end of week	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
Percent of chicks surviving (number of chicks alive at 8 weeks, divided by number of chicks hatched x 100)			

Recording health of chicks

The women also want to compare the general health and vigor of the confined chicks with those that are free. They record things like the condition of the chicks' feathers, their relative size, and whether or not one group looks healthier than the other (for example, one clutch might be sluggish and the other active).

They will collect this information once a week, at the same time as they count the chicks.

They decide they can record their observations about the comparison on a single line (Table 7).

Table 7. Record sheet for observations on the chicks' health and vigor

Week	Comments
1	
2	
3	
4	
5	
6	
7	
8	

Recording labor

Recording labor can be tricky: for work that is done throughout the day, it is difficult to remember accurately how many minutes someone spends. It is even more difficult to remember how much time one spent yesterday or the day before.

Some guidelines:

- Record each task and the amount of time it takes to do it.
- Update the records every day.
- If several people do the work, keep a note of how long each one takes.

Table 8 shows a form to use or adapt.

Table 8. Record sheet for daily labor

Week	Minutes taken							
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	**Total**
1								
2								
3								
4								
5								

6								
7								
8								

Simple ways to record data

Many farmers and other rural people are not used to writing things down. Some are illiterate. Such participants can still do research! But you may need to find simpler ways of letting them record observations.

Consider using simple line drawings instead of words, and strokes instead of numbers (| | | = 3).

You can also use sticks, stones or large seeds as counters. For example, to keep track of labor, a farmer could put a counter in a pot every time she goes to fetch feed.

[GRAPHIC: Table with graphics instead of words:

Achieng's chicks	**[GRAPHIC innov060: Chicks under basket]** **Under baskets**		**[GRAPHIC innov061: Chicks outside]** **Free-roaming**	
[GRAPHIC innov062: Several eggs and newly hatched chicks] Hatched	||||| ||||| ||	12	||||| ||||| |||	13
Week 1	||||| |||||		||||| |||	
2																				
3																		
4																
5																
6																
7																
8											9					3

]

Figure 42. It is possible for illiterate people to keep records.

Keep it simple

When doing an experiment or conducting a survey, it is tempting to collect lots of data because it is interesting or might come in useful.

But collecting mountains of data can take a lot of time, and the information can be hard to analyze. So it is better to decide on just a few things to observe, and to make sure you keep careful records of these. Choose these carefully, involving several people in the discussion so you get different points of view.

You can have a "Notes" column in your form to write observations on other aspects you do not measure regularly.

[GRAPHIC innov063: Farmer looking confused with lots of notebooks full of numbers and forms]

Figure 43. Don't try to collect too much information.

Summary

- It is vital to keep good records of an experiment. First, you must decide what you want to count or measure. Make sure you keep track of the most important things, and do not try to collect too much information.
- Decide exactly how to make each observation, and how often to collect the information. As far as possible, make sure that all measurements are made in the same way, in the same conditions.
- Design forms to help you record the information. Use an exercise book to record the data, not loose sheets of paper that can get lost.

Exercise 7. Planning data collection

This Exercise guides participants through the steps needed to collect and record observations from an experiment. After this Exercise, the participants can begin to conduct their own experiments.

Objective

To determine what to measure in an experiment.

To design a method of keeping records.

Equipment needed

Large sheets of paper, marker pens

Expected outputs

- Forms for recording observations from an experiment

Time required

1 hour

Preparation

Exercise 6: Designing an experiment

Suggested procedure

1. Remind the participants of the results of Exercise 6 when they designed an experiment.

2. Divide the participants into the same groups as in Exercise 6. Ask them to list the types of observations they will need to make: yield, plant height, number of chicks, etc.
3. Ask the groups to discuss how they will measure each item, and how often. For example: "Plant height: Every Saturday, measure the height of five plants in each plot with a tape measure. Measure from the ground to the tallest point on the plant."
4. Ask the groups to design a form for each item, using the large sheets of paper. Make sure they think through the requirements for each type of observation.
5. Invite each group to present its forms and the reasoning behind them to the plenary. Invite comments on each form and suggestions for improvement.
6. Explain why the participants should use exercise books, not loose sheets of paper, to keep their records. Invite them to copy the forms into their exercise books (if they have them).
7. Tell the participants that they are now ready to start their own experiments. Guide them if necessary as they do so.

Quiz for Lesson 6

1. When collecting data, it is not necessary to take all measurements under the same conditions using the same methods.

A. True

B. False

Correct answer: B. You want to be able to compare one measurement with another. That means taking them under the same conditions.

2. In an experiment, it's a good idea to measure everything that might come in useful. That way you can be sure of not missing something important.

A. True

B. False

Correct answer: B. If you measure too many things, you may end up with confusion. It's better just to measure a few things, but keep notes on other factors that might be of interest.

3. Match the correct equipment with the thing you want to measure.

A. Maize yield	1. Tape measure
B. Number of days between planting and harvest	2. Magnifying glass
C. Plant height	3. Scales
D. Identity of insect pests on crop	4. Calendar

Correct answer: A3, B4, C1, D2.

Lesson 7. Analyzing and evaluating the results

Analyzing data

Eight weeks have passed, and it is time for Achieng and her friends to analyze the data from their experiment.

Everyone brings their exercise books, and they meet in Achieng's house to compare their records.

When they look at Achieng's records (Table 9), they notice two things:

- Many more chicks survived under the baskets than if they were roaming free: Nine of the 12 confined chicks (75%) survived, while only 3 of 13 free chicks (23%) survived.
- After Week 4, no more chicks died, either under the baskets or outside. If free-roaming chicks were OK once they were 4 weeks old, then there would be no need to keep them under baskets for longer than that. That would halve the work needed to collect feed, and would free up baskets: by the 4th week, the chicks were too big to be kept under a single basket.

When Dorcas and Josephine look at their data, they see similar patterns.

Table 9. Achieng's chicks

	Under baskets	Free-roaming
Hatched	12	13
Week 1	11	8
2	11	6
3	9	4
4	9	3
5	9	3
6	9	3
7	9	3
8	9	3
Percent surviving	9 × 100 / 12 = 75%	3 × 100 / 13 = 23%

Reaching conclusions

The friends come to two conclusions:

- Keeping chicks under baskets was a good idea: it enabled more to survive.
- They will keep the chicks under baskets for 4 weeks only.

[GRAPHIC innov064: Achieng, Dorcas and Josephine looking at notebook with data.

Achieng: “Looks pretty convincing…”

Dorcas: “The baskets help the chicks survive…”

Josephine: “…But only up to 4 weeks. Then they can go out on their own.”]

Figure 44. Spend time to draw conclusions.

Tools for analyzing results

Here are some tools that participants can use to analyze the results of their experiments:

- Numerical evaluation
- Focus groups
- Descriptive evaluation
- Subjective scoring
- Cost-benefit analysis.

Tool 1: Numerical evaluation

This table compares the results of the current practice (the “control”) with the alternatives (the “treatments”). It lets you draw conclusions for each idea.

Table 10. Numerical evaluation of Achieng's experiment with chicks

Ideas to be tested	**Results**						**Conclusion**
	Control (Chicks roaming free)			Treatment A (Chicks under basket)			
	Achieng	Dorcas	Josephine	Achieng	Dorcas	Josephine	
Survival of chicks after 8 weeks	23%	40%	30%	75%	80%	85%	Chicks under baskets survive better!

Tool 2: Focus groups

What did the participants think of the experiment? Facilitate one or more focus groups to openly discuss the ideas, issues, experiences, results and problems.

Focus groups are a good way to discuss the results of the experiments, decide whether to implement the conclusions, and to plan future research.

Keep in mind that the participants should consider not only their records, but also social aspects (e.g. labor availability), environmental pollution and human health.

[GRAPHIC innov065: Group of women sitting and discussing, with flip chart]

Figure 45. Focus group to discuss findings.

Tool 3: Descriptive evaluation

The group can use Table 11 to list their perceptions of each of the treatments they test. This can be a good way to get a focus group discussion started about the experiment.

Table 11. Table to compare opinions about different treatments

	Things you did not like	Things you liked
Control (current practice)		
Treatment A		
Treatment B		
Treatment C		
…		

Tool 4: Subjective scoring

This is another way to collect people's opinions about the results of an experiment.

Ask people to give a score to each of the treatments for the characteristics they are interested in. Table 12 gives an example.

You can sum the scores in the bottom row to give you a general idea of what people think overall. But of course some characteristics may be more important than others – so make sure that the participants discuss each in detail.

Table 12. Table for subjective scoring of an experiment with five crop varieties

1 = bad, 2 = fair, 3 = good

Characteristic	Treatment (crop variety)					Comments
	Control	A	B	C	D	
Resistance to pests	3	1	2	3	2	
Resistance to diseases	2	1	2	3	2	
Earliness in maturity	1	1	3	3	1	
General crop vigor	2	1	2	3	2	
Overall (total)	**8**	**4**	**9**	**12**	**7**	

Tool 5: Cost-benefit analysis

The new treatment may produce better yields, but how much does it cost? Does it give more profit? You can do a cost-benefit analysis to compare it with the control. You need good records to analyze the costs of inputs, labor, selling price and yield.

Table 13 shows an example for an experiment to compare two crops: maize and beans. The two plots are the same size, allowing us to compare them directly. Let us look first at the benefits.

- The plot of maize produced 8 bags, worth 10 shillings each, resulting in a total benefit of 80 shillings.
- The beans plot produced 4 bags, which were sold for 25 shillings each, or 100 shillings in all.

How about the costs?

- The maize cost a total of 50 shillings to produce, while the beans cost 60 shillings.
- Even though the beans cost more to produce, they gave a higher profit: 40 shillings compared to only 30 shillings for maize.

Table 13. Costs and benefits per plot

		Control (maize)	**Treatment A (beans)**
Benefits	Bags of grain	8 bags × 10 shillings	4 bags × 25 shillings
Total benefits		**80**	**100**
Costs (shillings)	Seed	0 (own seed)	10
	Fertilizer	20	10
	Labor	30	40
Total cost		**50**	**60**
Total benefits – total costs		80 – 50 = **30**	100 – 60 = **40**

Summary

Here are five tools for analyzing the results of an experiment:

- **Numerical evaluation:** compares the results of the current practice (the "control" with the new technologies (the "treatments").
- **Focus groups:** focused discussions to get participants' opinions of the experiment and its results.
- **Descriptive evaluation:** a way of finding out what participants liked and did not like about each of the technologies they tested.
- **Subjective scoring:** a way to evaluate opinions about each of the technologies tested.
- **Cost-benefit analysis:** compares the costs and benefits of the different technologies and tells you which one gives the biggest profit.

You can use these tools to help the participants work out what the experiment findings mean, and how to use them on their own farms and in their enterprises.

Exercise 8. Evaluating an experiment

The Exercise enables participants to evaluate the results of their experiment. Do it after they have completed the experiment in the field.

Alternatively, you can manage this Exercise before the participants have run their own experiments to give them an idea on how to do the analysis. You can use the examples in Table 9 to Table 13 for the participants to analyze, or use data from experiments conducted by groups elsewhere.

Objective

- To evaluate the results of an experiment and decide on further steps.

Equipment needed

Large sheets of paper, marker pens

Records from the participants' experiments (or example data from elsewhere)

Expected outputs

- Analysis of the results of the experiment
- Decision on what actions to take in the future.

Time required

3 hours

Preparation

Help the participants conduct the experiments and record their observations.

Suggested procedure

1. Ask the participants to briefly describe their experiments and the results.
2. Introduce the **numerical evaluation** tool (Table 10). Help the participants to analyze their data using this tool.
3. Introduce the **descriptive evaluation** (Table 11) and **subjective scoring** (Table 12) tools and help the participants to use it to summarize their opinions about the treatments.
4. Introduce the **cost-benefit analysis** tool (Table 13), and help the participants summarize their costs, income and profits.
5. Facilitate a **focus group** discussion about the findings. Help the participants decide how they will use the results of the experiment on a larger scale next season.

Questions to stimulate discussion

- What differences did you see between the treatment with the highest yield and lowest yield?

- Did costs vary between treatments?
- What are the differences in costs compared to outputs (seeds, fertilizer, pesticides, labor…)?
- Did anything unexpected happen? Did this complicate the results?
- Which aspects remain unknown?
- Which new questions are raised, and how could they be addressed?
- What can we conclude from this experiment? Which of the treatments do you want to use on a larger scale next season?

Quiz for Lesson 7

1. **Rupert, Shaun and Geoff conducted an experiment to test fertilizer. Here are their yields. What do you conclude?**

	Without fertilizer (control)	With fertilizer (treatment)
Rupert's plot	3 bags	6 bags
Shaun's plot	2 bags	5 bags
Geoff's plot	3 bags	1 bag

   A. Applying fertilizer gives higher yields.
   B. Applying fertilizer gives lower yields.
   C. There is no difference in yields.
   D. It is not possible to draw a conclusion as the yields vary.

Correct answer: A. In Rupert's and Shaun's plots, the fertilizer more than doubled yields. Why the low yields in Geoff's plot? Something happened: he says that elephants broke in one night and trampled the crop.

2. **Rupert, Shaun and Geoff find that applying a bag of fertilizer increases their maize yield by 2 bags an acre. A bag of maize fetches 30 shillings in the market. A bag of fertilizer costs 15 shillings. What is the net benefit?**

   A. 15 shillings.
   B. 45 shillings.
   C. 60 shillings.
   D. 75 shillings.

Correct answer: B. Two bags of maize are worth 60 shillings, minus 15 shillings for the fertilizer, leaves 45 shillings.

Lesson 8. Applying findings and sharing knowledge

Sharing results

Achieng, Dorcas and Josephine share the results of the experiment with the other members of their farmers' group. They plan how to present the information and what to say.

They describe why they did the experiment – many chicks were being eaten by birds of prey. They described how they came up with a solution – keeping the chicks and mother hen under baskets – and how they tested it.

They present their data, and their conclusion that the baskets effectively protected chicks up to 4 weeks of age.

[GRAPHIC innov066: Achieng, Dorcas and Josephine presenting information on chicks to group of women farmers]

Figure 46. Achieng and her friends share their findings.

Deciding on follow-up

The group is enthusiastic, and they agree on three things:

- All the members who keep chickens will start using baskets to protect their chicks. They will start making baskets straight away! They will ask Achieng and her friends for advice on how to feed the chicks.
- Achieng, Dorcas and Josephine, along with several other group members, will form an innovation committee to try to solve other problems with chicken-raising.
- The group members realize that if they can produce more chickens, there is a promising market in the nearby town. They start working on a plan to produce more chickens and find suitable buyers.

[GRAPHIC innov067: Women farmers making baskets and looking after chickens]

Figure 47. Decide how to implement the findings.

How to share information about innovations

Here are some ways that participants can share information about their innovations.

- Hold meetings to discuss the results of experiments.
- Invite people to visit the experiment site while it is running.
- Run a demonstration of the innovation – for example to show people how to do a particular task.

In addition, you can help them by:

- Arranging cross-visits, field days or training for people from other villages.
- Produce posters, brochures or information sheets about the innovation.
- Organize groups in other villages to test and adopt the innovation.
- Invite the local community radio station to cover the innovation.
- Invite extension workers, government officials and researchers to see the innovation.
- Arrange training for extension workers and villagers.

[GRAPHIC innov068: Field agent with group of farmers getting out of minibus, being welcomed by people in another village. Experimental plot visible in the background]

Figure 48. Work out how to share the information within the community and outside it.

Summary

There is no point in going to the trouble of doing experiments if you do not use the results. You need to:

- Help the participants decide **what action to take** in light of the experiment. Do they want to adopt the innovation. If so, how?
- Help them **share the results** within the community by holding meetings, running demonstrations, arranging training, and helping others adopt the innovation.

Exercise 9. Planning for sharing and scaling up

After doing an experiment or conducting research, it is important to plan how to use the results. This Exercise helps participants to do this.

Objective

- To enable participants to plan how to share and scale up the findings.

Equipment needed

Large sheets of paper, marker pens

Expected outputs

- Plan on how to share the results of an experiment within the farmers' group and with others.
- Plan on how to put the findings from the experiment into effect.

Time required

1 hour

Preparation

Exercise 8 (Evaluating an experiment)

Suggested procedure

1. Remind the group of the results of the experiment(s) discussed in Exercise 8.
2. Explain to the group that they will create two types of action plan based on the results of their experiment.
3. Split the participants into two groups for each experiment, Group A and Group B.
4. Ask Group A to prepare an action plan on how to share the results of the experiment with other farmers' in the group and with people from other villages.
5. Ask Group B to prepare an action plan on how to put what they have learned from the experiment into effect.
6. Explain that the action plans should show what activities to perform, who will do these activities, and when they will start and be completed. The groups should also estimate how much each activity will cost and how they will cover these costs.
7. After the groups have discussed and drawn up their plans, invite them to share them with the plenary. Facilitate a discussion and invite comments on each plan.

Quiz for Lesson 8

1. Once you have finished an experiment, you should keep the results secret so no one else can find out.

A. True.

B. False.

Correct answer: B. It takes a lot of effort to do experiments, so be sure to share the results widely. If you share your findings, you can be confident that others will share their results with you.

2. You should not share the results until the experiment is over.

A. True.

B. False.

Correct answer: B. You can invite people to see an experiment while it is running – for example, to check on plant growth or pest numbers. That will increase interest and the likely impact of the experiment. But make sure that this does not interfere with the experiment itself – for example, do not allow people to damage the plants.

3. Innovation is for big companies, not for groups of smallholder farmers.

A. True.

B. False.

Correct answer: B. Everyone can innovate – households and smallholder farm enterprises, groups of farmers, and up to the largest multinational companies.

4. Match each of innovation steps mentioned below with what the farmer members of the innovation group should do in that step.

A. Collecting and recording observations.	1. Farmers set the objective of a trial and the materials and methods they will use. They agree on what data to collect and who is responsible for each task.
B. Sourcing information and ideas.	2. Once a problem has been clearly defined, farmers identify its causes and effects so they can look for ways to solve it.
C. Designing an experiment to test an innovation.	3. Farmers collect and record the data from the experiment to compare among different solutions.
D. Identifying a problem's causes and effects.	4. Farmers seek information and advice about their chosen topic from other farmers, knowledgeable people, extension agents and researchers.

Correct answer: A3, B4, C1, D2.

Resource materials

Reference material

Ashby, J. A., Braun, A., Gracia, T., Guerrero, M de P., Hernández L. A., Quirós, C. A. and Roa, J. I. 2000. Investing in Farmers as Researchers. Experience with Local Agricultural Research Committees in Latin America. Centro Internacional de Agricultura Tropical. Cali, Colombia.

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Proyecto IPRA (Investigación Participativa en Agricultura). 1993. Comités de Investigación Agricola Local (Local Agricultural Research Committees). Cartillas 1 a 9. Centro Internacional de Agricultura Tropical, Cali, Colombia.

Wettasinha, C. and Waters-Bayer, A. (eds). 2010. Farmer-led joint research: experiences of PROLINNOVA partners. A booklet in the series on Promoting Local Innovation PROLINNOVA). Silang, Cavite, Philippines: IIRR / Leusden: PROLINNOVA International Secretariat, ETC EcoCulture. October.

Useful webpages

Prolinnova. Prolinnova is an NGO-initiated multistakeholder programme to promote local innovation in ecologically oriented agriculture and natural resource management (NRM). http://www.prolinnova.net/

Global Farmer Field School Network and Resource Centre is a decentralised network and resource centre to cater for strategies and mechanisms for institutionalisation and scaling-up, quality control mechanisms, low cost implementation strategies and mechanisms. It also provides a discussion forum, exchange of experiences, and quick access to resource and training materials, trainers, experts and documentation. http://www.farmerfieldschool.info/