TRAINING MODULE

DIVERSIFIED AND INTEGRATED FARMING SYSTEM

2012
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The **Training Module on DIFS** is one of the seven training modules produced by SIBAT on Sustainable Agriculture or SA.

SA is a farming system that is based on ecological approaches and on the conservation of agricultural resources, aiming to develop these resources (especially land and seeds) for the economic and social well-being of farmers and their communities. SA promotes the rights of farmers to manage and control their resources, towards self-reliance, food sufficiency and food safety. SA links to small rural enterprise and industry, in an interactive process that continues to promote benefits to producers and consumers.

SA concept and practices are opposed to those of modern farming system that is based on monocropping with the use of external chemical inputs (fertilizers and pesticides). Brought to our rice farms through the Green Revolution (and through hybrids and genetically modified seeds today), this had resulted in the loss of indigenous knowledge systems or IKS in agriculture; traditional seeds and agricultural biodiversity; self-reliance, traditional cooperation and cultural wisdom and diversity.

The inroad of modern agriculture has resulted in periodic indebtedness and income deficit for farmers. Rural conditions today see rural communities striving to cope with the problem of a declining rural resource base, often driven by rapid commercialization of agriculture that forcibly divest farmers of their land, erode subsistence production and increase wage labour dependence. Problems resulting from these are mirrored in deteriorating conditions in many rural communities, such as heightened poverty, environmental crisis, and the out-migration of men and women. In these circumstances, women suffer the brunt, as they play a crucial role in maintaining livelihoods, securing food for the households, and cultural and community cohesion.

SA is being promoted to recover the IKS and resources being lost to modern chemical farming, recover agricultural biodiversity, and help pave the way for the recovery of all basis for sustainable development derived from agriculture.

This material promotes SA through **DIFS** or **Diversified and Integrated Farming Systems**, explains the concepts and instructs its process in detail, and thus is also a useful reference for students and learners of SA.
Gender Framework in the DIFS Training

This module is herewith developed and presented with a gender perspective, based on the recognition of the role and place of women in traditional agriculture and in DIFS in particular. Peasant men and women contribute to traditional agricultural food production with their shared and distinct responsibilities.

Women are farmers and are key food producers in traditional agriculture. Their roles, and associated with these, women’s knowledge and skills are vitally necessary for food production, and for ensuring food security for the household and community. Women’s work in traditional agriculture is both wide-ranging and multi-faceted throughout the year. Hence, women’s intimate knowledge of seed preparation and soil management, of plants, of pest control, post-harvest processing and storage, livestock keeping and animal husbandry, as well as food processing and meal preparation – have contributed immeasurably to the survival and sustainability of rural households and communities. ¹

But with the prevalence of modern agriculture that eroded genetic resources and removed the cropping diversity, women, traditionally regarded as primary stewards and managers of agrodiversity, were eventually displaced from their traditional roles. Women comprise the majority of world’s agricultural producers. They play crucial roles and the greater body of agricultural IKS is managed by women.

Students of Sustainable Agriculture (SA) should bear in mind that the problems of farmers, both men and women, stem from the loss of traditional agriculture in their hands, then as basis of sustainable development of agriculture. The outcomes of low productivity, loss of resources especially land and seeds, had limited the capacity of farmers to produce and innovate to meet the food needs of their families, of their communities and of society. Women farmers were doubly affected, by the culturally ingrained factors of double burden and patriarchy, and by the control by corporations of women’s lives through profit.

¹ Module on Documenting Women’s Knowledge in Agriculture, PANAP, 2010.
HOW TO USE THE TRAINING MODULE ON DIFS

This training module on Diversified Integrated Farming Systems (DIFS) contains two parts. First, is on the preparation, conduct and facilitation of the training module in the conduct of and facilitation of the training (methodologies and tools), and second, on DIFS principles and technologies.

The DIFS Module is developed using the concept of participatory learning. The module follows an integrated approach that not only enhances the capability of farmers to analyze farm production problems but also to understand its environment and determine risks and solutions. This will be done not just through application of techniques and knowledge learned, but through pursuing innovations particular to the individual farm and rural community.

The DIFS Module is comprised of six (6) sub-modules that are divided into three (3) learning levels, namely: 1) familiarization of concepts, 2) skills enhancement (learning by doing) and 3) innovation (applying the learning). The following are presented in every module:

- **Objectives**: These are statements which help guide the users/facilitators on the output to be achieved by the users/facilitators.

- **Methodology**: These are guides which can be followed by the users in achieving set of objectives of each module.

- **Materials**: These are list of basic requirements needed by facilitators for conducting the sessions.

- **Topics**: These are detailed topics included in each module.

- **Tools**: These are forms, games, tables that can be used to aid in the facilitation of each module.

- **References**: These refer to source materials for this Module that can be read for further information of the user.
MODULE I. DIVERSIFIED AND INTEGRATED FARMING SYSTEM AND ITS COMPONENTS

Objectives of the Module

At the end of the topic, the participants should be able to:

1. Understand DIFS and its components, and achieve a deeper understanding of their dynamic relationship;
2. Understand the advantages and challenges of a diversified and integrated farm; and
3. Understand the role and place of productive forces especially women farmers in agricultural production.

Methodology

Small workshop: The groups are divided into 6-8 members. They are asked to compare organic agriculture and conventional agriculture with respect to diversification, integration, chemical use, pesticide, seeds, cropping system etc. They will be given 15-20 minutes to finish the workshop after which, the leaders of the group are asked to present the group output.

Case presentation: Two cases of farmers who shifted from conventional agriculture to organic agriculture will be presented, describing the levels of diversity and integration attained. The differences between the two will be emphasized for the participants to distinguish.

Visual presentation and discussion: Discussion between the participants and resource person is interspersed in the lecture session. This is done either by encouraging the participants to ask questions or by tossing questions to them. Visual aids will be used.

Materials Needed

1. Pictures of different farm components
2. Visual aids
3. Masking tape
4. Scissors
5. Thread
6. Meta cards
**A. CONCEPTS**

A **Diversified Farming System** consists of components such as various crops, animals and production practices that co-exist independently of each other. Farms can have cattle, pigs, goat and different crops as separate units.

The purpose of diversification is to support the farming household with a variety of resources and income so that there is no dependency on just one crop.

An **Integrated Farming System** is composed of plants, animals and production practices which act together as a whole. Each component is interconnected or interrelated with one another. To better understand integration, the system should be viewed entirely and not as separate parts.

Integration occurs when outputs (usually by-products) of one production sub-system are used as inputs by another within the farm unit.

An integrated approach in a farming system is about learning to work with and taking advantage of beneficial connections and natural processes that support productivity. Higher yield is looked at from the productive combination of the whole system rather than from the high yield of just one component.

Essential to this approach is a long-term view of the direction of the farm development moving towards becoming an integrated system.

A **Diversified and Integrated Farm System (DIFS)** has diverse types of plants, animals and farm production activities all of which are integrated with one another. It is not just the number of diverse components that is taken into account, but how the components are related to another.

DIFS aims to restore farm biodiversity to the fullest, and to achieve maximum and multiple benefits from the farm.

**B. ADVANTAGES OF DIVERSIFIED AND INTEGRATED FARMING SYSTEM**

1. Biophysically: DIFS improves soil fertility, increases the bulk and types of organic materials in the farm, and improves the natural or environmental control mechanism for pest management.

2. Economically: DIFS increases income from farm production and reduces risk of fluctuating prices.

3. Nutrition and food safety: With safe and healthy food, DIFS protects the farming household from chemical poisoning and contamination, and improves the household’s general health and nutrition.
4. Climate change: DIFS improves farm resilience to crop failures, pest and disease infestation, and occurrences of natural climate phenomena such as prolonged drought and severe flooding.

5. Farmer innovation: DIFS enhances the capability and learning of a farmer as agrobiodiversity is enhanced. The nurturing ability of a woman farmer works best in a DIFS setting.

Women promote crop diversity in traditional farming because of their reliance upon the diverse agro-environment. Women are managers of the environment and play a central role in sustaining the use of biological resources and enhancement of genetic resources. The stability and sustainability of the intrinsically woven ecosystem of forests, crops, and livestock depended on the practices and knowledge systems of the local women. Their collection of fodder, fuel, and other forest material was vital to the continued flow of resources that maintained the local economy in a sustainable way. (Module on Documenting Women’s Knowledge in Agriculture, PAN AP, page 8, 2010.)

C. LIMITATIONS OF DIVERSIFIED AND INTEGRATED FARMING SYSTEM

1. DIFS requires a wide or broad knowledge about management system of different animals, plants, and trees. The farmer should be aware of things that can be combined together and which are not. Here, local or indigenous knowledge of agrobiodiversity, knowledge that is held in reserve mostly by women, will greatly contribute.

2. DIFS is labor and capital intensive during the first cycle of farm activities.
D. FARMERS AS PRIMARY PRODUCTIVE MOVERS OF A FARMING SYSTEM

Farmers consist the primary productive movers of a farming system.

As primary productive movers, farmers should decide on matters related to farm production.

In the Philippine rural setting, decisions by farmers are based on a number of issues or factors that include: capital availability or non-availability, status of ownership over land resources which allow any possible leeway to decision-making, work or labor force available, traditional plantation crops (e.g. sugarcane) that compete with food crops, incentives offered by corporate or commercial farm businesses, and changing weather patterns. Hence, the decisions by farmers lie mainly on the extent of their control over and access to their farm resources.

The woman farmer plays critical roles in production. She is central to the tasks of promoting agro-biodiversity, conservation of genetic resources, and sustainability of food crops for the household -- among the many roles she plays.

In Philippine traditional agricultural system, women are primary food producers, being crucial to genetic selection and good harvest of the rice and corn staple crops, and in-charge of vegetable and rootcrop production in the home gardens and swidden farms. Household food security is thus a function of women.

Despite the many roles played by the woman farmer in many Asian countries, she is not regarded as co-equal with men in decision-making in household matters and in production. In most Asian agricultural setting, patriarchal relations continue to limit or curtail the voice and initiative of the woman farmer.

Women’s knowledge and perspective of knowledge creation (such as decision-making on farm production) are generally different from those of men’s, and take birth from their roles as farmers, livestock keepers, farm managers, pro-creators, healers and caregivers. What is important is to understand the purpose and logic behind the creation of knowledge by rural women, and to understand the construction, history and politics of gender relationships so that the factors behind the knowledge by women could be well understood. (Module on Documenting Women’s Knowledge in Agriculture, PAN AP, page 9, 2010.)
E. COMPONENTS OF A DIVERSIFIED AND INTEGRATED FARMING SYSTEM

DIFS in vegetables is a primary area for the woman farmer. Choice of what to plant in the vegetable farm or backyard is influenced by the woman’s nurturing role as a mother. Seed selection is a traditional concern and assignment for women farmer.

1. Biophysical component: The Farm Environment

The biophysical component of DIFS refers to the living and non-living resources of the farm environment. There are two biophysical components in the farm environment:

a. Biotic components: these are the living components in the farm like animals, plants, micro-organisms and even the farmers.

b. Abiotic components: are non-living conditions such as climate, habitat (soil) that influence or affect a farm ecosystem and the organisms in it. Abiotic factors can determine which organisms will survive in a given environment conditions. Shown below are abiotic factors:

- **Sunlight.** This may be abundant or limited in places. Amount of sunlight available for photosynthesis is an important abiotic component for making of foods in the plants life cycle. Sunlight availability can be affected by weather, topographic location and natural phenomena.

- **Soil and Nutrients.** Soil composition and soil pH are essential to plant growth, soil pH and soil composition dictate the types of plants, animals and micro-organisms thriving on it. Available soil nutrients play a key role in the life cycles of plant and micro-organisms.

- **Water.** In farming environment, water is very vital for the biotic components to thrive. Water may also constitute a risk or harm to the thriving biotic forms in the farm environment, when it is scarce or in excess to what is required. The amount of available water, water quality, location of water source, and precipitation are major abiotic components of an ecosystem.

- **Terrain.** The geography and geology of an area greatly influence the communities that exist within an ecosystem. Terrain or topography dictates the types of plants and animals that can survive adapt to or live in a specific time (cropping patterns, weather and climatic conditions) and niche (soil).

- **Temperature.** Although life as a whole can survive a wide range of temperatures, individual species tend to have relatively narrow temperature requirements. Few species can tolerate a great fluctuation of temperature, and organisms adapted to extremes of temperature have difficulty surviving and competing outside their optimal temperature range.
In a farm environment, biotic and abiotic factors interrelate with each other. If one factor is altered, imbalance may result which may negatively impact on the system. *(Example: Slash-and-burn agriculture, also known as kaingin system, brings about soil erosion, landslide, crop damage and low crop yield resulting in hunger.)*

Mountainous areas are prone to soil erosion thus optimum plant yield is less than in the plain areas. Mountainous areas, however, can produce vegetables with vigor compared to those in the plains, considering the climatic conditions of the topography.

2. **Plant as a component in DIFS**

Plants are an important component in farm diversification. Mastery of plant life cycle classification and adaptation to the farm environment are essential in the promotion of DIFS. Plant life cycle can be classified into:

a. **Annuals** – plants whose lifespan extends to a maximum of one year. Annuals can be: (i) Consumed earlier, thus crop rotation can be made in the field; (ii) intercropped with the perennials while the latter son its vegetative growth.

   i. **Legumes** – sometimes have trifoliate or pinnate leaves. The fruits are in pods or capsules. The roots possess nodules where rhizobium is housed.

   *Examples:* Snake bean (*Pole sitao*), mungbean, cowpea, white beans, black beans

   *Rhizobium* is one type of bacteria that is present at the roots of legumes which aid in trapping nitrogen in the air and converting it to available nitrate for the use and benefit of the plants.

   ii. **Fruit crops** – plants that bear fleshy fruits  
   *Examples:* Bitter gourd (*ampalaya*), okra, eggplant, cucumber

   iii. **Root crops** – plants that are grown for their modified, thickened root or stem which generally develop underground.  
   *Examples:* Yam, sweet potato, cassava, raddish

   iv. **Leafy crops** – plants that are utilized more for their leaves  
   *Examples:* Pechay, cabbage, mustard, lettuce
b. Perennials – crops whose lifespan extend for more than two years.

Perennials could serve as fences or windbreaks. Fruits could be consumed or sold. The branches could be used as firewood. The dried leaves and decayed parts help improve the soil fertility.

Examples: Fruit trees like mango, papaya, jackbean multi-purpose tree species (MPTS) like madre cacao (*kakawate*) and lead tree (*ipil-ipil*).

Reasons why plants are an important component of DIFS:
- Nutrients coming from the soil are maximized and developed due to the availability of plants that decrease erosion and return organic materials to the soil.
- The combination of annuals and perennials promotes synergy in the farm. Soil fertility is maintained, reduces erosion and could be a source of food and livelihood.
- One should avoid the combination of the following: (1) Plants from one family because the same pests attack them; and (2) plants that have the same root length because nutrients from one level are depleted immediately.

c. Families of Vegetable Crops

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>Common &amp; Scientific Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaryllidaceae</td>
<td>Chives (<em>Allium schoenoprasum</em>), Garlic (<em>Allium sativum</em>), Leek (<em>Allium ampeloprasum</em>), Onion (<em>Allium cepa</em>)</td>
</tr>
<tr>
<td>Solanaceae</td>
<td>Bell pepper or chili (<em>Capsicum annuum</em>), Eggplant (<em>Solanum melongena</em>), White potato (<em>Solanum tuberosum</em>), Tomato (<em>Lycopersicon esculentum</em>)</td>
</tr>
<tr>
<td>Chenopodiaceae</td>
<td>Beet (<em>Beta vulgaris</em>), Chard (<em>Beta vulgaris var. cicla</em>), Spinach (<em>Spinacia oleracea</em>)</td>
</tr>
<tr>
<td>Compositae</td>
<td>Endive (<em>Cichorium endiva</em>), Globe artichoke (<em>Cynara scolymus</em>), Lettuce (<em>Lactuca sativa</em>)</td>
</tr>
<tr>
<td>Gramineae (Poaceae)</td>
<td>Corn (<em>Zea mays</em>)</td>
</tr>
<tr>
<td>Liliaceae</td>
<td>Asparagus (<em>Asparagus officinalis</em>)</td>
</tr>
<tr>
<td>Leguminosae (Fabaceae)</td>
<td>Dry bean (<em>Phaseolus vulgaris</em>), Fava bean (<em>Vicia faba</em>), Lima bean (<em>Phaseolus limensis</em>), Snap bean (<em>Phaseolus vulgaris</em>), Pea (<em>Pisum sativum</em>)</td>
</tr>
<tr>
<td>Cucurbitaceae</td>
<td>Chayote (<em>Sechium edule</em>), Cucumber (<em>Cucumis sativus</em>), Muskemelon/ cantaloupe/ honeydew (<em>Cucumis melo</em>), Pumpkin/squash (<em>Cucurbita pepo</em>), Watermelon (<em>Citrullus lanatus</em>)</td>
</tr>
<tr>
<td>Umbellifera</td>
<td>Carrot (<em>Daucus carota</em>), Celery (<em>Apium graviolens</em>), Parsley (<em>Petroselinum crispum</em>), Parsnip (<em>Pastinaca sativa</em>)</td>
</tr>
</tbody>
</table>
d. Examples of plants that cannot be integrated:

I. Guava, jackfruit and cottonfruit/santol should not be planted near vegetables because they are prone to be attacked by fruit flies and mites which in turn could be transferred to vegetables. If there is a jackfruit or guava tree, do not let the fruit fall and rot on the ground because the smell of the ripe fruit invites pests.

II. Trees of Gmelina and Eucalyptus grow fast but absorb high amount of nutrients and water and thus compete with other trees nearby.

III. It is not good to plant sweet potatoes/kamote in shaded areas because it will only produce more leaves instead of tuber.

6. Animals as component in DIFS

Farm animals are vital in integrated farming system, a source of food and additional income and ‘draft power’ for the farm. Their by-products or waste are also used as organic fertilizers.

a. Farm animal categories:

1) Ruminants are animals that feed on grasses. The types of ruminants are:
   
i. Small ruminants: usually found in rain-fed lowlands and uplands [Examples: goat, sheep]
   
ii. Large ruminants: usually found in irrigated and rain-fed lowland [Examples: cow, carabao, horses]

2) Non-ruminants are animals that do not feed on grasses [Example: swine]

3) Poultry are animals with feathers [Examples: chicken, goose, other birds]

b. Tips in selecting animals for integration:

1) Availability of food sources for the animals within the community or vicinity;
2) Availability and cost of food for animals; To decrease potential costs, choose animals that do not require food that will compete with food needs of the household;
3) Choose animals that are resistant to diseases, and can be easily raised by the farmer;
4) Effect of climate on animals;
5) Tradition and culture in the community in raising animals;
6) Choose animals that are appropriate to the conditions in the farm.
c. Things to consider in selecting animals to be raised in a DIFS farm:
   i. Availability of sources of food for the animals
   ii. Number of animals to be raised
   iii. Effect of climate on the animals

a. Benefits of integrating animals in the farm:
   i. Useful to the farm like carabao as “draft power”
   ii. Source of food like milk, meat and eggs
   iii. Source of additional income and capital reserve (i.e., can be sold later for emergency purposes)
   iv. Source of income in case of low produce due to bad weather
   v. Animal manure is a good source of organic fertilizer

7. Aquaculture

a. Things to consider in integrating aquaculture:
   i. Location of the aquaculture pond
   ii. Ability of the soil to hold water
   iii. Ability of the soil to hold nutrients that will help the organisms (like algae) to remain healthy as source of food for the fish

b. Characteristics of fishes to be cultured:
   i. Found locally
   ii. Could easily reproduce
   iii. Could survive under fishpond condition
   iv. Grow easily and could survive with the available food
   v. Without known serious pests and diseases
   vi. Preferred food by the community

c. Advantages of putting up aquaculture:
   i. Provides a source of protein for the household
   ii. Provides additional source of income
   iii. Pond water could be used to water the crops

d. Problems in putting up aquaculture:
   i. Reduces the area to be used for crop production
   ii. Not favorable for areas with no stable supply/source of water
   iii. Pesticides used against predators is toxic to fishes like derris
MODULE II. PROCESSES IN DIVERSIFIED AND INTEGRATED FARMING SYSTEM

Objectives

At the end of the topic, the participants should:

1. Have a better understanding of the processes of synergy and complementation; and
2. Be able to enumerate ways to develop synergy and complementation within the farm.

Suggested Methodologies

Small workshop: The groups are divided into 6-8 members. They are asked to compare organic agriculture and conventional agriculture with respect to farming processes.

Case presentation: Two cases of farmers who practice complementation and synergy and monocrop farming will be presented. The differences between the two will be emphasized for the participants to distinguish the differences.

Visual presentation and discussion: Discussion between the participants and resource person is interspersed in the lecture session. This is done either by encouraging the participants to ask questions or by tossing questions to them. Visual aids will be used.

Materials Needed

1. Masking tape
2. Pictures of different farm components which shows cooperation and synergy.
3. Scissors
A. **COMPLEMENTATION AND SYNERGY**

**Complementation** and **synergy** are processes that take place in one system. A successful diversified and integrated farm gives importance to these two processes and uses both.

**Complementation** is putting together two components of a system to create harmony. Such harmony brings about positive effects to each component.

**Examples:**

I. Planting different plants with different root length to use the nutrients at different levels of the soil;
II. Planting different plants with different diseases or pests to avoid the increase or spread of pest and diseases;
III. Intercropping of crops with different fertility requirements to avoid competition;
IV. Intercropping of crops with different water and sunlight requirements to avoid competition, but rather enhance each other’s performance;
V. Raising livestock and growing crops at the same time because the crops or some plant parts serve as food for the animals, while animal manure is composted or turned into fertilizer.

**Synergy** is the combination of two or more components that leads to a much improved and enhanced condition. The total effect is greater than the sum of the individual component’s effects. Synergy promotes team work and results to a more productive and successful system.

1. Harvest from one crop is increased when it is planted together with crops whose distinct smell drive away pest.  [*Example: tomato and cabbage; onion, celery and cabbage]*

2. One crop can supply additional nutrients to another crop due to its ability to use the nitrogen from the air and convert it to a form that can be utilized by the other plants.  [*Example: Corn and mungbean or stringbean]*

B. **HOW TO ENHANCE COMPLEMENTATION AND SYNERGY IN THE FARM**

1. **Biodiversity**

   Increases the number and variety of different species that live within a particular ecosystem/habitat and the way these organisms function and interact with one another.

   Trees serve as windbreaks or shelterbelts to crops like coffee, pepper, lanzones and rambutan.

   Weeds serve as food for some animals.
2. **Develop different micro-climates in the farm**

   It is best to plant trees on the sides of a fishpond to avoid direct sunlight thus to lessen the evaporation of water. Planting of kangkong (*Ipomea aquatica*) lowers the pond water temperature creating a better environment for the fishes' growth and development.

3. **Use of plants or animals with multi-purposes**

   *Kakawate* (*Gliricidia sepium*) can be planted as hedges and serve as a source of timber and fuel. Its leaves can also be made into organic fertilizers.

4. **Soil management**

   High organic material in the soil should be maintained. Incorporation of leaves and animal manure improves the fertility and quality of the soil. Legumes that help increase the nitrogen content of the soil are highly recommended among which peanuts, mungbeans and stringbeans are.
MODULE III. PRINCIPLES AND PRACTICES OF DIVERSIFIED INTEGRATED FARMING SYSTEM

Objectives

At the end of the topic, the participants should:

1. Be able to understand the principles of DIFS; and
2. Be familiarized with different practices of DIFS.

Suggested Methodologies

Small workshop: The groups are divided into 6-8 members. They are asked to compare organic agriculture and conventional agriculture with respect to practices, chemical use, pesticide, seeds, cropping system etc. They will be given 15-20 minutes to finish the workshop after which, the leaders of the group are asked to present the group output.

Case presentation: Four cases of farmers who practice diversification (ecosystem, functional, etc) will be presented. The differences between the two will be emphasized for the participants to distinguish the differences.

Visual presentation and discussion: Discussion between the participants and resource person is interspersed in the lecture session. This is done either by encouraging the participants to ask questions or by tossing questions to them. Visual aids will be used.

Materials needed

1. Visual aids
2. Pictures
3. Masking tape
4. Scissors
5. Meta cards
A. DIVERSITY

Increased field biodiversity is integral in the enhancement of soil and soil nutrients, and aids in the farm’s water management. It facilitates elimination of pests and weeds, thus improving the chances for plant survival. Farmer survival is anchored on biodiversity as it offers a wide array of resources – food, medicine, fuel, fibers, and cash – to sustain the farmer’s basic needs.

B. DIFFERENT LEVELS OF BIODIVERSITY

1. **Genetic diversity** – is the diversity of genes within a species. It describes the genetic variability among the populations and individuals of the same species.

   *Example: rice has different varieties – early maturing or late maturing, resistance to pest and diseases, tall or short, etc.*

2. **Species diversity** – variety of species of animals, plants or micro-organisms. Keeping more than one species of livestock is a risk-minimizing strategy.

   *Examples of animal species are carabao, horse, chicken; examples of plant species are pechay, pumpkins, eggplant*

   I. Crop diversification and livestock integration help farmers resist devastations due to climate change. Even when rice fields are destroyed by drought or floods, farmers still survive through their livestock, root crops, corn, vegetables and other farm produce.
   
   II. An outbreak of disease may affect only one species, e.g. cow, and some species or breeds are better able to survive droughts and thus help carry the family over difficult periods.
   
   III. There are different reproductive rates of different species to rebuild livestock holdings after drought. For example, the greater fecundity of sheep and goats permits their numbers to multiply quicker than the camel or cattle. The small ruminants can then be exchanged or sold to obtain large ruminants.

3. **Ecosystem diversity** – ecosystem is the combination of all living and non-living (sand, water, stones) things in a defined area, interacting and functioning as a loose unit. It is dynamic and complex. Ecosystem diversity is the difference in types and condition of a place due to its existing vegetation, climate, topography, etc.

   *Example: coastal ecosystem; terrestrial ecosystem*
4. **Functional diversity** – different tasks performed by an organism in certain area or field.

   a. *Trap crop* – crop is intended to attract pests so they can be destroyed by treating a small area or by destroying the trap crop and the pests together. It can be cultivated either in between the crop or surrounding the crop.

   b. *Symbiotic nitrogen fixation* - legumes have the ability to fix atmospheric nitrogen for their own use and for the benefit of neighboring plants via symbiotic relationship with rhizobium bacteria.

   c. *Biochemical pest suppression* – there are plants that release chemicals from the roots or aerial parts that suppress or repel pests and protect neighboring plants. Marigold, for example, releases thiopene, a nematode repellent, that makes it a good companion for a number of crops infested with this pest.

   d. *Beneficial habitats* – the benefit is derived when companion plants provide a desirable environment for beneficial insects and other arthropods, especially those predatory and parasitic species that help in keeping pest populations in check.

   e. *Cultural diversity* – differences in knowledge and values shared by a society.

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**C. NUTRIENT RECYCLING**

Nutrient cycling is the repeated pathway of particular nutrients or elements from the environment through one or more organisms back to the environment or processes by which nutrients are transferred from one organism to another. Nutrient cycles include the carbon cycle, the nitrogen cycle, the phosphorus cycle, and so on.

In nutrient cycling, the nutrients coming from the soil is returned back to the soil.

**D. APPROPRIATE PEST MANAGEMENT**

1. **How to control the increase of pest and diseases**

   a. *Cultural control* – any farm operation that will make the environment least favorable for the development and multiplication of insect pests but favors crop production. Cultural control includes crop rotation, synchronized planting, good land preparation, use of locally adapted and resistant varieties, farm diversification, intercropping, trap cropping and animal integration.
1) **Crop rotation** – growing of two or more crops after each other in the same field in a given year. The succeeding crop is planted after the preceding crop has been harvested.

The basic principle of crop rotation is to separate a particular pest in space and time from its host plant. The interruption of the life cycle by introducing a non-host reduces the spread of pests in subsequent crops. Therefore, it is best to choose crops for successional plantings which have few common pests. The best effects result from the successional planting of crops which belong to different families.

*Rotation with non-rice crops (e.g. legumes and crucifers) helps to break the life cycle of insect pests such as the whorl maggots, green leafhopper (GLH), brown plant hopper and stem borers.*

2) **Synchronized planting** – this could significantly contribute in lowering the pest population. There is one month fallow period between cropping seasons and when the field is prepared simultaneously, this will destroy most of the pests. In synchronous planting, there is no overlapping generations of insect hence, pest population build-up is prevented.

3) **Good land preparation** – this is important step in crop production which aims to provide good soil conditions for growth and must be done well to give a good start over the weeds.

This practice reduces the population of highly destructive insect/pests. In corn and sugarcane, plowing could expose the white grubs (*Leucopholis irrorata*) to predators and extreme environmental conditions and when coupled with handpicking will significantly reduce grub population.

4) **Use of locally adapted and resistant varieties** – plants under natural environments depends entirely on their own defenses against insects and other herbivores – an indication of how effective the natural defenses can be. Farmers in traditional cultivation systems have been familiar with wide choice of local plants, which were appropriate to their needs and locally adapted which is more likely resistant to pest population in the area.
5) **Farm diversification** – planting different crops simultaneously with different varieties/cultivars offers a considerable degree of preventive protection. Diverse agro-ecosystems offer beneficial organisms more spaces for reproduction and general means of sustenance. Diverse habitats create variable micro-climatic conditions that result to greater availability of food sources (e.g. nectar and pollen) on which natural enemies can feed. Thus, a higher permanent population of predators and parasitoids is maintained. Pests can become confused or disoriented and are unable to spot their food plants. Flowers of Umbelliferae (sunflower family), Lamiacea and *Allium* spp. are known to attract large numbers of beneficial insects.

6) **Intercropping** - is the growing of two or more crops in the same piece of land at the same time.

*Examples:* The worm that attacks the cabbage is reduced when tomato is planted with it since the insect is repelled by the odor of “tomatine”; the diverse and rough canopy resulting when corn is planted with squash is believed to disorient the adult squash vine borer, sparing squash from damage; planting species like Amarillo (marigolds or *Tagetes patula*) and oregano in close association with crops repel pests.

7) **Trap crops** – a crop or portion of a crop intended to attract pests so they can be destroyed by treating a small area or by destroying the trap crop and the pests together. It can be cultivated either in between or surrounding the crop.

*Examples:*

i. Beans and legumes are row intercropped with corn to control leaf hopper and stalk borer.

ii. Cotton bollworm (*Heliothis zea*) prefers corn and lays eggs on cotton when it is grown as a sole crop. When a few rows of corn are grown alongside cotton, the eggs that are preferentially laid on corn are collected and destroyed.

iii. Tomatoes are planted in pineapple plantation to serve as host for nematode. Tomatoes are harvested and destroyed before nematodes have multiplied.
8) Animal Integration – integrating plants and animals in the farm ecosystem.

Example: Ducks feed on snails and weeds in the rice fields, and thus considered as the most effective way to control these.

b. Botanical Method – use of substances derived from plants or plant parts, mostly in the form of extract, to control crop pests and diseases.

Plants with pest-controlling properties include chili, garlic and ginger. The active ingredients are derived from plant leaves, bark, seeds, flowers or roots. These plants can be grown and can be increased in the farm.

Some botanical plants have negative effect to humans and beneficial insects, but are safer than chemical pesticides. Examples are tubli (poison vine) and derris that can poison and kill fishes.

c. Biological Method – the use of live organisms (parasitoids, predators or pathogens) to suppress the pest population.

Predators – animals that kill other animals (preys) and feed on them. Include insects and mites.

Earwigs feed on several host insects and were found promising not only in corn but also in vegetables like tomato, eggplant, string beans and others.

Praying mantis, dragonfly and damselfly feed on all types of insects; lacewings feed on aphids and soft-bodied insects; ground beetles, whirligig beetles feed on some insects; ladybird beetles feed on scales and aphids only; toads, snakes and spiders eat insects other than garden pests; and birds take in worms.

Parasitoids – a parasite that eventually kills its host. They are parasitic in their larval stages but are free-living adults.

In crucifers particularly cabbage, broccoli, pechay, cauliflower, radish, kale and mustard, the diamondback moth (Plutella xylostella) is the most destructive pest. Cotesia plutellae and Diadema semiclausum are its natural enemies and are capable of regulating its population.

In corn, a dominant natural enemy of Asian corn borer is Trichogramma spp. It attacks eggs of butterflies and moths.
E. **SOIL AND WATER MANAGEMENT**

1. **Cover crops** – any crop grown to provide soil cover, regardless of whether it is later incorporated. This can be also inter-planted with grain crops such as maize. Cover crops protect the soil surface from intense sunlight, wind erosion and rain. It also improves the soil through green manuring (the plowing-under of a green crop or other fresh organic materials) which are usually short-term crops (less than two years). Plants used as cover and green manure usually belong to legume family like: *Vigna radiata* (mungbean), *Sesbania rostrata*, *Cajanus cajan* (pigeon pea) and many more.

2. **Multiple cropping** – the planting of different crop species in a single patch of land.

3. **Strip cropping** – the practice of growing two or more crops in different strips across a field wide enough for independent cultivation (e.g., alternating six-row blocks of soybeans and corn). It is commonly practiced to help reduce soil erosion in sloping areas.

4. **Relay planting** – the growing of two or more crops simultaneously during a part of the life cycle of each crop. The second crop is planted after the first crop has reached its reproductive (flowering) stage but before it is ready for harvest. This ensures that the soil is not bare to minimize soil erosion.

5. **Mulching** – a soil and water conservation practice covering of the soil surface by various materials for protection such as green or dry organic matter. This prevents evaporation of water, regulate soil temperature and decrease soil erosion by intercepting the direct impact of raindrops on soil and increase soil organic matter.

6. **Incorporation of organic matters** – incorporating crop residues, animal manure and all organic materials in the farm helps improve the soil structure, fertility and moisture holding capacity of the soil. It is not good to burn the residues.

7. **Crop rotation** – this practice may result to better physical and nutrient composition of the soil. A variety of crop species are grown in sequence one after another in the same piece of a land. Each crop has a set of demands from the soil as well as some amount of beneficial residue or performs some action on physical structure of the soil. To be able to have a better crop rotation one must take a look into different characteristics of each crop, what it takes and gives back into the soil to be able to have a net effect which is an improved soil. This practice is very effective in improving the soil fertility as well as reduces the drain of the nutrients.
8. **Minimum or zero tillage** – simple farm implements such as hoes and digging sticks are used in this practice. It is very common and effective to apply the minimum tillage to control soil erosion in highly erosive, and in sandy and marginal soils that might not otherwise be feasible to cultivate. It minimizes soil degradation and slows down the rate of mineralization. This leads to more sustained use of nutrients in the organic matter.
MODULE IV. EXAMPLES OF DIVERSIFIED AND INTEGRATED FARMING SYSTEM

Objectives

At the end of the topic, the participants should:

1. Have a clearer picture of a diversified and integrated farming system; and
2. Be able to discuss the various features, advantages and disadvantages of the different examples of DIFS.

Suggested Methodologies

Small workshop: The groups are divided into 6-8 members. They are asked to compare organic agriculture and conventional agriculture with respect to chemical use, pesticide, seeds, cropping system etc. They will be given 15-20 minutes to finish the workshop after which, the leaders of the group are asked to present the group output.

Case presentation: Two cases of farmers who shifted from conventional agriculture to organic agriculture will be presented. The differences between the two will be emphasized for the participants to distinguish the differences.

Visual presentation and discussion: Discussion between the participants and resource person is interspersed in the lecture session. This is done either by encouraging the participants to ask questions or by tossing questions to them. Visual aids will be used.

Materials needed:

1. Visual aids
2. Pictures of different models
3. Masking tape
A. RICE-FISH SYSTEM

The rice-fish system is beneficial for the following reasons:

1. Fish grown with rice is effective against *stemborers* and *plant hoppers*, and decreases the numbers of *leafhoppers* and *leaf folders*. This is primarily due to direct predation by the fish on adults that fall into the water or on egg masses laid at the base of the plant.

2. Fish reduces the incidence of rice diseases and viruses, such as *sheath blight*, *bacterial leaf blight*, *rice stripe*, and prevents proliferation of *golden apple snail*.

3. Fish helps control the increase and growth of weeds through their movements that disturb the soil in the rice field.

4. Fish manure fertilizes the soil, while the carbon dioxide it exhales increases photosynthesis.

   *Reminder:* Do not put animal manure in the rice field 5-7 days before harvest to prevent fishes from tasting like mud or *burak*.

B. RICE-FISH-DUCK SYSTEM

The integration of ducks in the rice-fish system has added benefits which are:

1. Ducks help control the incidence of golden snails in the farm. They may be allowed to get into the rice field 25 days after transplanting.

2. Duck manure is an additional source of nutrients for the soil.

3. The paddling and feeding behavior of ducks can slow down the growth of the weeds.

4. The diverse diet of ducks helps regulate the population of insects, algae, worms and other pests.

5. Additional income from processing into duck eggs into salted eggs and *balut* (boiled fertilized egg).

Duck-raising is not easy, however, and skills development is necessary to make it commercially viable.
C. **RICE-PIG-FISH SYSTEM**

A small portion of large farms is usually allocated to this. In an intensive system, energy and nutrients are maximized. Harvest from this kind of system is 2.6 times higher compared to pure rice production.

The strengths of the rice-pig-fish system are:

1. **Manure from the pigpen directly placed above the fishpond, serves as fertilizer for the algae that is eaten by the fish.**

2. **Water in the fishpond can be used to clean the pig pen, irrigate the rice field and water the vegetables.**

3. **Pig manure can be collected and dried to be used as compost; dried manure can be directly applied to the rice field. Sanitation is a major issue that needs proper management in this system.**

D. **MULTI-STOREY CROPPING**

One of the most productive and profitable cropping system in the Philippines is the multi-storey system developed and practiced in Cavite and Batangas. Farmers from Silang, Cavite, who use coffee as the main intercrop, reported a net income of more than PhP 300,000 per hectare per year.

1. **Coconut-Based Multi-Storey Cropping**

   The system is coconut-based with a complex combination of annuals and perennial crops. Some of these combinations are:

   - Coconut + Papaya + Pineapple + Gabi
   - Coconut + Upland rice + Pineapple + Daisy + Banana + Sweet potato + Sayote + Ginger
   - Coconut + Coffee + Upland rice + Corn + Papaya + Pineapple
   - Coconut + Banana + Lanzones + Coffee + Gabi
   - Coconut + Papaya + Banana + Kakawati + Black pepper + Gabi + Pineapple
a. It should be noted, however, that these crop combinations may not work in some areas. There is a need for continuous selection for varieties adapted for localized farming conditions. Farmers need to do their own plant selection, and establish a nursery where selected planting materials are propagated, maintained and adapted to local conditions.

b. Among the reported crops that are adapted, and can be grown under 15-40 year old coconuts are: black pepper (Piper nigrum), cacao (Theobroma cacao), coffee (Coffeea spp.), ginger (Zingiber officinale), tomato (Lycopersicum esculentum) and vanilla (Vanilla planifolia).

c. Coconut leaf pruning (CLP) allows more crop species to be grown under coconuts. CLP is the pruning of leaves, retaining only 18 leaves of the upper region of the tree. This technique allows the palm to support normal development and maturity of palms, without significant yield reduction, and increases light transmission by at least 75%.

d. With CLP, the following crops will grow well and produce more under coconuts: abaca (Musa textelis), banana (Musa spp.), cashew (Anacardium occidentale), citrus (Citrus spp.), corn (Zea mays), squash (Cucurbita maxima), durian (Durio zibethinus), eggplant (Solanum melongena), lanzones (Lansium domesticum), mangosteen (Garcinia mangostana), mango (Mangifera indica), mungbean (Vigna radiata), papaya (Carica papayae), peanut (Arachis hypogaea), pineapple (Ananas comosus), rambutan (Nephelium lappaceum), rambutan (Nepheleium lappaceum), upland rice (Oryza sativa), sugar cane (Saccharum officinarum), sweet pepper (Capsicum anuum), sweet potato (Ipomea batatas), taro (Colocasia esculenta) and tobacco (Nicotiana tabacum).

- In multi-storey cropping, land is maximized by planting with different kinds of perennial and annual crops.
- To decrease competition of nutrients and water, different crops with different root depths should be planted.

2. **Sloping Agricultural Land Technology (SALT) Model**

   In 1978, Rev. Harold Watson and his associates verified and completed the scheme of Sloping Agricultural Land Technology. SALT is a way of farming that can turn a sloping parcel of land into a highly productive upland farm with agroforestry approach. It enables farmers to stabilize and enrich the soil and to grow food crops economically. It is a relatively simple, practical, low-cost, and appropriate method of diversified farming on sloping land that aims to sustain maximum benefit and minimize soil erosion at different altitudes. Hedgerows are used as effective barriers to soil erosion. These are pruned several times a year, and the pruned leaves are composted and used as green manure.
SALT consists of ten basic steps discussed below:

a. **Making the A-frame.** The A-frame is a simple device to determine contour lines across the slope. It is made of a spirit level and a three wooden or bamboo poles (two should be about two meters long each and one about one meter long) nailed or tied together in the shape of a capital letter A. The spirit level is mounted on the crossbar.

b. **Finding the contour lines.** One leg of the A-frame is planted on the ground, and then the other leg is swung until the spirit level shows that both legs are touching the ground on the same level. A helper drives a stake beside the frame’s rear (first) leg. The same level finding process is repeated with stakes every 5-meter distance along the way until one complete contour line is laid out, and until the whole slope is covered. Each contour line is spaced from 4 to 6 meters apart for a steep hill, and 7 to 10 meters apart for a more gradual one.

c. **Cultivating the contour lines.** One-meter strips along contour lines are ploughed and harrowed until ready for planting. The stakes serve as guide during ploughing.

d. **Plant nitrogen-fixing trees.** On each prepared contour line, make two furrows one-half meter apart. Plant the seeds of leguminous trees like *Leucaena leucocephala*, *Flemingia congesta*, *Leucaena diversifolia*, *Calliandra callothyrsus*, or *Sesbania grandiflora*. Branches of *Gliricidia sepium* can also be used. One furrow can be planted with *L. leucocephala*, and other furrow with *F. congesta*.

e. **Planting the permanent crops.** The space of the land between the thick double rows of nitrogen-fixing trees is called a strip, where the crops are planted. Permanent crops may be planted at the same time the seeds of leguminous trees are sown. Only the strips for planting are cleared and dug; and later, only ring weeding is employed until the nitrogen fixing trees are large enough to hold the soil for full cultivation to commence. Permanent crops are planted in one strip out of every four. This refers to strips 1, 4, 7, 10 and so on. Coffee, banana, citrus, cacao, and others of the same height are good examples of permanent crops. Tall crops are planted at the bottom of the hill and the shorter ones are planted at the top.

f. **Cultivating alternate strips.** The soil can be cultivated even before the nitrogen-fixing trees are fully grown. Cultivation is done on alternate strips, on strips 2, 5, 8 and so on. The uncultivated strips collect the soil that erodes from higher cultivated strips. When the nitrogen-fixing trees are fully grown, every strip can be cultivated.
g. **Planting the short-term crops.** Short- and medium-term income producing crops are planted between strips of permanent crops as source of food and regular income, while waiting for the permanent crops to bear fruit. Suggested crops are pineapple, ginger, sweet potato, peanuts, sorghum, corn, melons, squash, upland rice, etc.

h. **Trimming the nitrogen-fixing trees.** Once a month, the continuously growing nitrogen-fixing trees are cut down at a height of one meter from the ground. Cut nitrogen-fixing leaves and twigs are always piled at the base of the crops. They serve as an excellent organic fertilizer for the plants. In this way, only minimal amounts of commercial fertilizer, if any, are necessary.

i. **Management.** The non-permanent crops are always rotated to maintain productivity, fertility and good soil formation. A good way of doing this is to plant grains (sorghum, corn, upland rice, etc.), tubers (sweet potato, cassava, etc.) and other crops (pineapple, squash, melons, etc.) in strips where legumes (beans, peanuts, pulses, etc.) were planted previously and vice versa. Other crop management practices such as weeding, insect and weed control are also done regularly.

j. **Building green terraces.** To enrich the soil and effectively control erosion, straws, stalks, twigs, branches, leaves, rocks and stones are piled at the base of the thick rows of nitrogen-fixing trees. With time, strong, permanent and naturally green terraces will be formed which hold the soil in place.

The four models of SALT

a. **Forestry and staple crop combination (SALT model 1):** This model focuses mainly on food crop production. It is simple in application, low in cost, but is an effective agro-forestry technology with agricultural crops and forestry in a ratio of 3:1. Compared to traditional upland farming management practices, this technology substantially decreases erosion. This phase is staple food introduction and forestry rehabilitation.

b. **Agro-livestock Integration (SALT model 2):** This model focuses on agro-livestock technology. It is a simple modification of SALT 1 in the sense that it integrates livestock rearing with crop cultivation. The livestock species that can be raised under the system are cattle, sheep, and goats. The manure is a good source of fertilizer. Goats are potential source of milk, meat, hair and skin. In this phase, cut-and-carry system of livestock integration approach is recommended. Cut-and-Carry System in the SALT 2 phase utilizes small ruminants (usually goats, e.g. Anglo Nubian goat, for dairy production). The cut-and-carry system almost quadruples the land use potential. Through this system, a stocking rate of 10 to 12 head per one-half hectare of well-established forage could be achieved (MBRLC Editorial Staff 1992) as compared to average stocking rates of only 6 animals for free-ranging goats per hectare.
c. **Agro-forestry diversification (SALT model 3):** This model has three components – SALT 1, SALT 2, and a separate plot of land to produce valuable timber. Farmers owning landholdings of about two hectares can use this model. Apiculture also can be included in this phase when agro-forestry is very developed.

d. **Agro-forestry diversification and enterprise (SALT model 4):** This focuses on agro-forestry or crop-based system known as the agro-fruit livelihood technology. To improve hill agriculture and economics, commercialization of hill agriculture is required. The objectives of this model are to produce food, increase cash income, and conserve soil on farmlands.

**E. ADVANTAGES OF A DIVERSIFIED AND INTEGRATED FARMING SYSTEM**

1. DIFS results in higher food production to meet the food demand of increasing population in the country.

2. DIFS increases farm income through proper recycling of residues and other components.

3. DIFS ensures regular stable income through farm products such as eggs, milk, mushroom, vegetables, honey and silkworm cocoons from the linked activities in integrated farming.

4. DIFS promotes soil fertility and productivity through organic waste recycling.

5. DIFS produces nutritious food through the integration of allied activities that result in the availability of foods enriched with protein, carbohydrates, fat, minerals and vitamins.

6. Integrated farming will help in environmental protection through effective recycling of waste from animal activities like piggery, poultry and pigeon rearing.

7. DIFS reduces production cost of components through input recycling from the by-products of allied enterprises.

8. Inclusion of bio-gas and agro-forestry in the integrated farming system will help solve the energy crisis.

9. Cultivation of fodder crops as intercrop and border crop will result in the availability of adequate nutritious fodder for animal components like milk cow, goat, sheep, pig and rabbit.

10. Firewood and construction wood requirements could be met from the agroforestry system thus preserving the natural forest.
11. Agro-forestry and proper cultivation of each part of land by integrated farming, aid in preventing soil erosion.

12. DIFS helps in generating employment for small and marginal farmers.
Objectives

At the end of the topic, the participants should be able to:

1. Understand the different methods of conversion;
2. Identify the strengths and weaknesses of each method; and
3. Perform the conversion process in their own farm.

Suggested Methodologies

Small workshop: The groups are divided into 6-8 members. They are asked to compare organic agriculture and conventional agriculture with respect to chemical use, pesticide, seeds, cropping system etc. They will be given 15-20 minutes to finish the workshop after which, the leaders of the group are asked to present the group output.

Case presentation: Two cases of farmers who shifted from conventional agriculture to organic agriculture will be presented. The one adopted the horizontal approach while the other one, the vertical approach. The differences between the two will be emphasized for the participants to distinguish the differences.

Visual presentation and discussion: Discussion between the participants and resource person is interspersed in the lecture session. This is done either by encouraging the participants to ask questions or by tossing questions to them. Visual aids will be used.

Materials needed

1. Manila paper
2. Pentel pen
3. Masking tape
4. Visual aids
A. **VERTICAL CONVERSION**

*Vertical Conversion* is an approach to reduce the use of chemical fertilizers and/or pesticides throughout the farm. For example, from 10 bags of fertilizers applied, it could be reduced to eight in the first season of conversion, then to six the next season, and so on until it is totally eliminated. The reduction in the amount of fertilizer is augmented by the application of compost manure, green leaf manure, and other organic inputs. This approach is preferred in farms that made use of inorganics for a long time, to gradually prepare the land and allow farmers to adjust their practices and outlook on farming. This approach is considered simpler to implement than the horizontal conversion.

1. **Advantages of Vertical Conversion**
   a. The change in the farm is gradual and the sudden yield reduction, if it will occur, will not be felt as much by the farmer.
   b. Appropriate for farmers who have been practicing conventional modern agriculture for a long time and whose knowledge on sustainable agriculture may still be relatively limited.
   c. This is used if on-farm resources that could be used as substitutes to chemical inputs, e.g. manure or compost, are still very limited.

2. **Disadvantages of Vertical Conversion**
   a. Farmers may already be contented with the little changes implemented in the farm and may stop trying other options.
   b. It may take a longer time to achieve full conversion since agricultural chemicals are still being used on a reduced scale. Hence, it will take a longer time to obtain ecological balance in the farm.
   c. The farm products cannot be certified as ‘organically produced’ because the residues of the chemical pesticides will persist longer and are detectable in the process of certification.
B. **Horizontal Conversion**

1. **Horizontal Conversion** is the complete conversion of a portion of the farm to sustainable agriculture, while conventional farming is still being practiced in the remaining portion of the farm. For example, a farmer may convert only 10% of the whole farm to sustainable agriculture while the rest remain to be farmed conventionally. In the portion converted, the application of any chemical is discontinued altogether. Changes in the whole farm are therefore gradual. The size of the portion converted to sustainable agriculture is increased every cropping season until the whole farm gets converted to sustainable agriculture. This increase is usually determined by the experience gained by the farmer and the availability of materials that could be used as substitute for chemical inputs.

2. **Advantages of Horizontal Conversion**

   a. Any yield reduction in the initial stages of conversion will not affect the farmer very much since only a small portion of the farm is converted. If yield reduction is large in the portion converted, the farmer could opt to convert only a small portion in the next cropping season.

   b. The farmer gains valuable experience in the converted portion, and the learnings could be applied to a larger portion of the farm in the next cropping season. The experience builds farmer confidence in the use of technologies, methods and practices that are adapted to the conditions in his farm.

   c. This approach is useful if the farm lacks or has a limited supply of substitutes for chemical inputs. The rate of increase in the area fully converted to sustainable agriculture will depend on how fast the farmer could build up internal resources in the farm.

3. **Disadvantage of Horizontal Conversion**

   This approach is not recommended for large-scale planting because the effects of the conversion are not immediate. It may take a long time to change the ecological condition of the whole farm. Moreover, since only a small portion of the farm is converted, the effects of alternative strategies in the absence of conventional inputs and practices are not noticeable.
MODULE VI. IMPLEMENTING DIVERSIFIED INTEGRATED FARMING SYSTEM

Objectives

At the end of the topic, the participants should be able to:

1. Further enhance farmers’ capacity in managing their farms;
2. Understand basic principles and simple tools in the appraisal and analysis of their farm ecosystem’s situation;
3. Understand basic principles and simple tools in planning;
4. Promote documentation to aid in further honing of skills and as basis for further improvement and sharing of experiences;
5. Increase production capacity of the farm for additional income; and
6. Increase farm diversity and create a functional farm ecosystem for genetic conservation and soil quality improvement.

Methodology

Small workshop: The groups are divided into 6-8 members. They are asked to compare organic agriculture and conventional agriculture with respect to farm appraisal, planning and budgeting. They will be given 15-20 minutes to finish the workshop after which, the leaders of the group are asked to present the group output.

Case presentation: Farm situations of several farmers will be presented, according to peculiarities (biophysical conditions, typology, climate resilience, and others). The differences will be emphasized for the participants to distinguish.

Visual presentation and discussion: Discussion between the participants and resource person is interspersed in the lecture session. This is done either by encouraging the participants to ask questions or by tossing questions to them. Visual aids will be used.

Materials Needed:

1. Pictures of different farm components
2. Visual aids
3. Masking tape
4. Scissors
5. Thread
6. Meta cards
UNDERSTANDING THE FARM ECOSYSTEM

Firstly, we need to fully understand the concept of an ecosystem and its various interplaying factors, to enable the learner to critically examine or analyze the farm ecosystem.

1. **What is an Ecosystem?**

An ecosystem is a collection of interdependent components of both living/biotic (flora and fauna) and non-living/abiotic things in a given space, interacting with each other, and serving a specific purpose.

An ecosystem exhibits the following characteristics:

a. **Hierarchical**: Every planning area is contained in a larger ecosystem, and the planning area itself is consist of smaller ecosystems;

b. **Complex**: The living and non-living components of ecosystems are interconnected and interdependent;

c. **Dynamic**: Temporal changes occur in ecosystem structure and function;

d. **Sustainability**: Biodiversity, stability and resilience are supported or are made possible by many functions in the farm, including natural cycles (nutrient, energy, nitrogen and oxygen cycles);

e. **Humans are integral part of it**: Humans are the productive movers in the ecosystem;

Knowledge of ecosystems is incomplete. Only through continuing observation and appraisal do we get to fully understand the ecosystem.

2. **The Farm as an Ecosystem**

The farm as an ecosystem is a collection of humans, plants, animals, and microorganisms interacting with the physical environment – water, land, air, minerals, temperature, etc. that are interdependent of one another. The farm serves as the production site for food and income for the farmer and his family.

Interdependency can be illustrated in the marvelous harmony between plants and animals that accounts for the sustenance of living things. For instance, the soil which is formed though thousand years of elemental processes could conveniently stand alone by itself. But whenever a crop is grown, the soil comes into a dynamic relation with another living form in the environment. As the crop grows, other living forms also share the benefit from the relationship.
3. Process of Understanding the Farm Ecosystem

Understanding the farm ecosystem is one of the various phases of developing an efficient farming system. This is because such understanding should lead to the implementation of new "farm plans" or designs with clear objectives and targets. Performance monitoring and evaluation of the new implemented farming system may lead again to better plans and designs for the farm. There is thus, a continuous process of adjusting, re-planning, modifying, or eliminating practices that do not contribute to the achievement of the desired objectives and targets for the farm.

A. Identifying the Factors in a Rice Field Ecosystem

There are three primary categories that could serve as basic references in determining the various factors of a rice field ecosystem. These are the: (a) the field or farm; (b) the farming household; and (c) the community.

a. The Farm

Plant variety analysis is essential in determining which variety is most resistant to pests, adapts well with the soil, and has sufficient produce. Identification of the common/existing rice pests – their population and incidence of attack, life cycles and habits – leads to the design of an alternative pest control and management. Soil analysis enables the farmer to ascertain the nutrients that need to be put in. Water sources and utilization (especially for irrigated lowland) provide an estimate of the number of cropping a farmer could do.

The area surrounding the farm may have potential resources like plants that could serve as natural pesticides. Other factors to consider are the climatological pattern of the area, the cultivation system from generation to generation, and the yield output over the years. A list of the many factors that could be examined within the farm is shown in Table 1. The list could expand through the years with experience of the farmers.

b. The Farming Household

The farmer couple and their family are at the center of the whole farm ecosystem. It is for the simple reason that the farming household directly works on land - from land preparation, transplanting and ultimately, harvesting the produce. Family labor in production, especially the woman’s labor, is important in preserving and sustaining the indigenous knowledge gained from their forebears and years of farming experience.

The farming households' priority in production is a major factor as this provides an idea on how the production would look like. Knowing the landholding status will give us a hint on how much decisions could be made in the cultivation system. If the family is only a tenant, and the landlord alone decides on the
cropping pattern and number, then the farmer would be hindered to make cropping innovations. Awareness of such limitation could make the farmer identify possible solutions to this problem. The household’s income, expenditures and liabilities could determine their capacity to address production concerns of capital.

Philippine traditional agriculture or its elements thereof are yet sustained in many indigenous communities working their small farms as subsistence producers. Vestiges of traditional farming in these areas still see the varied roles of women in farm planning and management, planting, crop care and management, up to harvesting. Women perform these tasks alongside their roles in the care of home and family within usually patriarchal or male-dominated relations.

And in these areas, indigenous women farmers remain as the collectors, keepers and propagators of seeds, and thus have a central role to play in ensuring good harvest. They have a special knowledge of the properties, value and uses of diverse plants for nutrition, health and income. Women’s specialized knowledge of domesticated crop species and varieties extend to wild plants that are used as food in times of need or as medicines and sources of income. This indigenous knowledge is highly sophisticated and is traditionally shared and handed down to generations. Through experience, innovation and experimentation, sustainable practices are developed to protect soil, water natural vegetation, including biological diversity.

Women are thus, regarded by the community as experts, holders and preservers of indigenous knowledge on farming and plant genetic resources management, conservation and development.

The role of women in agriculture has been widely weakened by the incursion of modern agriculture in the Philippine rural areas, launched through the wide transformation of rice farms through the International Rice Research Institute and the profit motives of agro-chemical corporations. Women’s role in farm maintenance had been displaced by machines and chemical inputs. Their knowledge in diversity had been weakened with the replacement of domesticated crops by cash mono-crop as well as the destruction of the environment that support crops and wild plants. And with the loss of the traditional seed resources, women’s role in conservation, and many traditional practices of conservation and cooperation, are correspondingly lost.

Only in few indigenous communities that have kept elements of traditional farming intact and traditional seeds largely conserved, do we still find the role of women respected and nurtured.

Documenting women’s knowledge in crop production requires a good grasp of the above framework.

c. The Community

The immediate environment of the farm is the community. The type of socio-economic and political factors prevailing in the community would have an impact to the farm production system even if indirectly. Knowing what these factors are enables the farmer to have a realistic plan and design for the rice field.
### Table 1: Factors and Determinants of the Farm Ecosystem

<table>
<thead>
<tr>
<th>Factors/Determinants</th>
<th>Purpose</th>
<th>How to Get Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Plant</strong></td>
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<tr>
<td>Variety/seed types</td>
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<td>Maturity period</td>
<td></td>
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<td>Yield</td>
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<td>Growth stages</td>
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<tr>
<td>Leaf production</td>
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<td>Root development</td>
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<tr>
<td>Tillers</td>
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<tr>
<td>Panicle formation</td>
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<tr>
<td></td>
<td>Come up with appropriate cropping pattern, varietal improvement, and propagation methods.</td>
<td>Field monitoring and evaluation of the crop at its different growth stages</td>
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<td></td>
<td>Understand the causes of pest susceptibility, low yield and crop instability.</td>
<td>Interview with farmers</td>
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<td></td>
<td></td>
<td>Review of secondary information (from practitioners/farmers, NGOs and reading materials)</td>
</tr>
<tr>
<td><strong>Biophysical Traits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topography</td>
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<tr>
<td>Elevation altitude</td>
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<tr>
<td>Soil conditions (texture, structure, properties, depth, fertility, classes)</td>
<td>Understand the relationship between the various factors of plant growth, conditions of the soil, sunlight, field topography, yield performance, and resistance to pests and calamities (typhoon and drought).</td>
<td>Secondary barangay data Maps Time lines Analysis of soil samples Transect walk Interviews with farmers Seasonality graphs for climate and rainfall patterns Matrix ranking for seed/variety preferences both for livestock and animals Farm lay-out detailing crops and irrigation patterns</td>
</tr>
<tr>
<td>Sunlight availability and duration</td>
<td>Avoid the risk of crop loss or damage.</td>
<td></td>
</tr>
<tr>
<td>Water availability/irrigation patterns</td>
<td>Utilize whatever available resource to improve soil fertility and provide necessary plant nutrients.</td>
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<tr>
<td>Rainfall patterns and area temperature</td>
<td></td>
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<tr>
<td>Drought periods</td>
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<tr>
<td>Typhoon occurrence</td>
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<tr>
<td>Wind velocity and directions</td>
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<tr>
<td>Vegetation cover (trees, shrubs, bushes)</td>
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<tr>
<td>Erosion status</td>
<td></td>
<td></td>
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<tr>
<td>Availability of seeds/planting materials and animals</td>
<td></td>
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<tr>
<td><strong>Pest and Diseases</strong></td>
<td>Determine alternative/appropriate pest management strategies.</td>
<td>Field pest and weed count through sampling</td>
</tr>
<tr>
<td>Types of pests and population</td>
<td>Select pest resistant varieties and farming methods that lower the risk of crop damage.</td>
<td>Field monitoring of incidence of pest attack</td>
</tr>
<tr>
<td>Types of friendly insects and population</td>
<td></td>
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<tr>
<td>Incidence of pest attacks and occurrence</td>
<td></td>
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<tr>
<td>Weed types and density</td>
<td></td>
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<tr>
<td><strong>Farming System</strong></td>
<td>Enable farmers to decide/perform the following:</td>
<td>Farm plan lay-out for the different cropping season showing the different cropping patterns</td>
</tr>
<tr>
<td>Farm lay-out per cropping season</td>
<td>o changes in land preparations patterns</td>
<td>Historical profile of agricultural practices</td>
</tr>
<tr>
<td>Cropping calendar</td>
<td>o selection of adaptable seeds and varieties</td>
<td>Time line to determine significant events in the agricultural practice</td>
</tr>
<tr>
<td>o Crop rotation</td>
<td>o crop rotation modification and diversification techniques</td>
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<tr>
<td>o Relay cropping</td>
<td>o adjustments on land preparation and clearing periods based on climate patterns</td>
<td>Formal and informal interviews</td>
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<tr>
<td>o Sequential cropping</td>
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<tr>
<td>o Diversification</td>
<td></td>
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<tr>
<td>Cultural practices</td>
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<tr>
<td>o Land preparation (time of clearing, plowing)</td>
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<tr>
<td>o Seeds and seedling preparation</td>
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<td></td>
<td>(seed source, selection, storage and transplanting)</td>
<td>(seed source, selection, storage and transplanting)</td>
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<tr>
<td>- Planting system (time of planting, plant spacing and orientation)</td>
<td>- Planting system (time of planting, plant spacing and orientation)</td>
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</tr>
<tr>
<td>- Pest management (mechanical, biological, and chemical control of pests, weeds, and diseases)</td>
<td>Strengthen positive cultural traits in production and mend limiting practices.</td>
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<tr>
<td>- Soil fertility practices (time and methods of fertilizing)</td>
<td>Improve post-harvest seed preservation and storage.</td>
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<tr>
<td>- Irrigation practices (time and methods of irrigating)</td>
<td>Identify practices that do not improve soil fertility and adopt corrective measures to remedy the situation.</td>
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<tr>
<td>- Harvesting practices (time and methods of harvesting; equipment and implements)</td>
<td>Improve utilization of available appropriate irrigation facilities or to establish one if there is an available water source.</td>
<td></td>
</tr>
<tr>
<td>- Post-harvest practices and processing (processing, storage and marketing of the produce; post-harvest waste processing)</td>
<td>Adopt alternative pest management measures that do not make use of chemical pesticides.</td>
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</tr>
</tbody>
</table>

Livestock production
- Types of livestock raised
- Care and management practices
- Breeding system
- Feeds and formulation

Nutrient cycling methods
- Utilization of farm waste and animal manure as soil fertilizer

with farmers
- Insect count through sampling
- Bio-resource flow for nutrient recycling
### The Farming Household

<table>
<thead>
<tr>
<th>The Farming Household</th>
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<tbody>
<tr>
<td>Tenure status</td>
<td>Gauge labor capacity vis-à-vis the requirements of production.</td>
<td>Formal and informal interview</td>
</tr>
<tr>
<td>Number of household members</td>
<td>Assess capital capacity vis-à-vis production expenditure.</td>
<td>Pie diagram for income and expenditures</td>
</tr>
<tr>
<td>Labor arrangements</td>
<td>Design a production system that is responsive to the food needs of the household.</td>
<td>Bio-clock comparison of male and female daily work activities</td>
</tr>
<tr>
<td>Gender-fair</td>
<td>Identify knowledge and skills that are needed to improve production.</td>
<td>Seasonality graph to illustrate peak period of income and expenditures</td>
</tr>
<tr>
<td>Allocations for production</td>
<td>Identify the farm equipment and implements necessary for production.</td>
<td>Inventory of farm tools and implements</td>
</tr>
<tr>
<td>Decision-making processes</td>
<td>Identify labor arrangements to make the necessary adjustments of household labor allocation vis-à-vis production requirements</td>
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<tr>
<td>Capital for production expenses</td>
<td></td>
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<tr>
<td>Family food requirements</td>
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<tr>
<td>Net farm income</td>
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<tr>
<td>Farming skills and knowledge</td>
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<tr>
<td>Access to seeds and technical support</td>
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<tr>
<td>Expenditures and liabilities</td>
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<tr>
<td>Farm equipment and facilities</td>
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</table>

### The Community

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<thead>
<tr>
<th>The Community</th>
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<tbody>
<tr>
<td>Location and accessibility</td>
<td>Determine the distance between production site and the market.</td>
<td>Spot map</td>
</tr>
<tr>
<td>Population demography</td>
<td>Estimate the volume of demand.</td>
<td>Demography</td>
</tr>
<tr>
<td>Market and credit facilities</td>
<td>Determine the mode of transport or disposal of produce from field to market.</td>
<td>Product flow diagram</td>
</tr>
<tr>
<td>Post-harvest facilities</td>
<td>Identify existing post-harvest facilities and support agencies</td>
<td>Venn diagram</td>
</tr>
<tr>
<td>Transport facilities</td>
<td>Evaluate the attitudes and cultural patterns that could strengthen and improve rice farming practices.</td>
<td>Seasonality graph for cropping patterns</td>
</tr>
<tr>
<td>Road systems</td>
<td></td>
<td>Market survey and informal interview</td>
</tr>
<tr>
<td>Technical agricultural agencies</td>
<td></td>
<td>Ocular survey</td>
</tr>
<tr>
<td>Cooperatives and other existing organizations</td>
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<td>Focus group discussion</td>
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<tr>
<td>Social services</td>
<td></td>
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<tr>
<td>Community leadership patterns</td>
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<tr>
<td>Existing agricultural program and policies</td>
<td></td>
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<tr>
<td>Prevailing attitudes and beliefs</td>
<td></td>
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<tr>
<td>Peace and order situation</td>
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<tr>
<td>Agricultural product marketing and trading systems</td>
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<tr>
<td>Agricultural labor patterns</td>
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<td>Dominant agricultural product</td>
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</table>
B. DOCUMENTING THE ROLES OF A WOMAN FARMER IN DIFS

<table>
<thead>
<tr>
<th>PURPOSE</th>
<th>METHODOLOGY AND TOOLS</th>
</tr>
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<tbody>
<tr>
<td><strong>Focus Area 1: FARM PLANNING AND MANAGEMENT</strong></td>
<td></td>
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<tr>
<td><strong>PLANNING PROCESS</strong></td>
<td></td>
</tr>
<tr>
<td>To identify the ROLE of women in farm management. (E.g. assessment, planning, evaluation, selection of components, budgeting)</td>
<td>Field immersion during the cropping season (staying in the areas, observing and sharing). Tools: video camera, recorders, journals and field notes. Focus group discussions. Tools: questionnaires, matrices. Key informant interview (KII) with selected individuals. Tool: KII interview form. Gender role disaggregation. Tool: gender role disaggregation matrix.</td>
</tr>
<tr>
<td>To document the KNOWLEDGE of women in the farming system. (E.g. varieties in season, inputs needed, farming system or crop pattern, oral traditions)</td>
<td>Field immersion during the cropping season. Tools: cameras, video cameras, recorders; journals and field notes. Focus group discussions. Tools: questionnaires, matrices. Interview with the farmers. Tool: KII interview form. Seasonal graphs and calendars.</td>
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</tbody>
</table>

The woman farmer has a role to play at every stage of production: planning process, planting stage, seed conservation (collection, selection and maintenance, and storage), crop care and management, pest management, and harvesting. It is important to document their roles through appropriate methods, guided by the following framework.
| To document the SKILLS AND PRACTICES of women in farm management. (E.g. planting methods, rituals and ceremonies) | Field immersion during the cropping season. Tools: cameras, video cameras, recorders; journals and field notes
Focus group discussions. Tools: questionnaires, matrices
Interview with the farmers. Tool: KII interview form
Farm lay-out |
| To identify and document INNOVATIONS/ COPING MECHANISM of women in farm management |

Table 2. Documenting Women’s Roles in DIFS
### Focus Area 2: PLANTING

#### PLANTING PRACTICES

| To identify the ROLES of women in planting. (E.g. land preparation, seed preparation, sowing) | Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes
| Focus group discussions. Tools: questionnaires, matrices |
| Interview with the farmers. Tool: KII interview form |

| To document the KNOWLEDGE of women in planting. (E.g. seed preparation, sowing, oral tradition) | Focus group discussions. Tools: questionnaires, matrices |
| Interview with the farmers. Tool: KII interview form |

| To document the SKILLS AND PRACTICES of women in planting. (E.g. seed preparation, sowing, rituals and ceremonies) | |
| |

### Focus Area 3: SEED CONSERVATION

#### SEED UTILIZATION

| To identify and evaluate the ROLE of women in the utilization of seeds. (E.g. crop production and food consumption) | Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes |
| Focus group discussions. Tools: questionnaires, matrices |
| Interview with the farmers. Tool: KII interview form |

| To document the KNOWLEDGE and SKILLS and PRACTICES of women in seed utilization. (E.g. varieties and physiological characters, quality, uses, availability, oral traditions/rituals/ceremonies, and food preparations) | Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes |
| Focus group discussions. Tools: questionnaires, matrices |
| Interview with the farmers. Tool: KII interview form |

| To identify and document INNOVATIONS/ COPING MECHANISM of women in seed utilization | |
| |

#### SEED SELECTION, COLLECTION AND MAINTENANCE

| To identify the ROLE of women in seed collection, selection and maintenance. (E.g. collection, classification of seeds/varieties, use and importance) | Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes |
| Focus group discussions. Tools: questionnaires, matrices |
| Interview with the farmers. Tool: KII interview form |

| To document the KNOWLEDGE of women in seed collection, selection and maintenance. (E.g. collection and selection criteria, maintenance of seeds, and breeding) | Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes |
| Focus group discussions. Tools: questionnaires, matrices |
| Interview with the farmers. Tool: KII interview form |

| To document the SKILLS AND PRACTICES of women in seed collection, selection and maintenance. (E.g. sampling and seed technology) | |
| |

| To identify, document and evaluate INNOVATIONS / COPING MECHANISM done by women in the collection, selection and maintenance of seeds | Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes |
| Focus group discussions. Tools: questionnaires, matrices |
| Interview with the farmers. Tool: KII interview form |

#### SEED STORAGE

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<table>
<thead>
<tr>
<th>Focus Area 4: CROP CARE AND MANAGEMENT</th>
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<tbody>
<tr>
<td><strong>SOIL MANAGEMENT</strong></td>
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<tr>
<td>To identify and evaluate the ROLE of women in soil management (E.g. land preparation, tillage and fertilization)</td>
<td>Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes Focus group discussions. Tools: questionnaires, matrices Interview with the farmers. Tool: KII interview form</td>
</tr>
<tr>
<td>To identify and document the KNOWLEDGE of women in soil management (E.g. soil fertilization techniques like composting, bio fertilizers, soil conditioners)</td>
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<tr>
<td>To identify and document the SKILLS AND PRACTICES of women in soil management. (E.g. rituals and ceremonies)</td>
<td>Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes, checklists Focus group discussions. Tools: questionnaires, matrices Interview with the farmers. Tool: KII interview form</td>
</tr>
<tr>
<td><strong>PEST MANAGEMENT</strong></td>
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</tr>
<tr>
<td>To identify the ROLE of women in pest management</td>
<td>Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes, checklists Focus group discussions. Tools: questionnaires, matrices Interview with the farmers. Tool: KII interview form</td>
</tr>
<tr>
<td>To document the KNOWLEDGE, SKILLS AND PRACTICES of women in pest management. (E.g. identification of pests and damages, control measures, rituals and ceremonies)</td>
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<tr>
<td><strong>Focus Area 5: HARVESTING</strong></td>
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</tr>
<tr>
<td>To identify the ROLE of women in harvesting.</td>
<td>Field immersion during the planting phase season. Tools: cameras, video cameras, recorders; journals and field notes, checklists Focus group discussions. Tools: questionnaires, matrices</td>
</tr>
<tr>
<td>To document the KNOWLEDGE of women in harvesting. (E.g. maturity, drying and classification)</td>
<td></td>
</tr>
<tr>
<td>To document the SKILLS AND PRACTICES of women in harvesting (E.g. seed harvesting for seeds and for food, seed drying, rituals and ceremonies)</td>
<td>Interview with the farmers. Tool: KII interview form</td>
</tr>
<tr>
<td>To study how DECISION MAKING is done by women with regards to crop production in under the changing context</td>
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</table>
B. Farm Appraisal and Data-Gathering Methods and Tools

There are vital steps, tools, methodologies and processes that should be observed in the examination of the various components of the farming practice. The information and insights that could be derived from these will help farmers plan and decide the kind of cultivation, farm components and farm practices/technologies that they are going to adopt.

1. **The procedure for farm appraisal** is presented below.

2. Participatory Data Gathering Tools and Techniques

   a. **Household and farm profiling.** The first step is to gather data per household on: general information (number of household members, educational attainment, occupations, monthly income, etc.), tenurial status, livelihood or income sources, farming profile (land area, crops planted, cropping calendar, crop production system, pests and diseases in the farm, chemical inputs, organic inputs, labor inputs, seed inputs, production yield) and expenses (farm and household).²

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² Please refer to the instrument in Attachment 1. Household and Farm Profiling.
b. Food security appraisal. This gives a bigger view of production work in relation to the food security of the household. It helps one see the need to adopt and properly plan for DIFS. The indicators for food security are:

1) Local concept or thinking about food security and hunger. This differs in varied localities depending on certain factors. The availability of rootcrops, even with scarce staple crops, may mean food security for some upland farmers.

2) Source/s of food. This measures the availability and accessibility of food for the households.

3) Consumption pattern. It establishes the varieties and amounts consumed per household during specific periods, and during occurrences of food shortages.

4) Food shortages. The reasons for food shortages and coping actions should be expounded. The roles played by household members, especially the woman and man head of the house, should be expounded.

5) Coping mechanisms during food shortages.

6) Quality and safety of foods being consumed by the household, and health effects, if any.

c. Farm appraisal tools and techniques. The following are some samples of the tools that could be used to gather the different factors and parameters that describe the rice farm ecosystem.

1) Time Line: It is a chronology or sequence of events that have taken place in a particular community or area. Events may pertain to the general history of the community, or to specific subjects or sectors such as health, education, agriculture, animal husbandry, etc.

Time line exercise can be applied to complete the background of a village or trace the evolution of specific activities or programs such as health, education, and other social amenities (such as transport, water supplies, etc.), animal husbandry and agricultural programs, or other economic activities.

Please refer to the instrument in Attachment 2. Food Security Appraisal.
Agriculture timeline for example, would indicate the occurrences of droughts, adoption of new crops and varieties, HYVs, fertilizer usage, years in which major crop failures took place and so on.

Similarly, a time line on animal husbandry would indicate the trends in animal husbandry practices, shifts in the populations of small and large animals, introduction of cross breeds, installation of veterinary infrastructure, major disease epidemics, etc.

2) **Venn Diagrams**: These show relationships of various institutions, organizations, programs or individuals with each other and with the community as perceived by the members. The exercise is carried out with the use of different sizes of circles or paper contents, indicative of the relative importance of a particular institution/individual to the community.

This method could be used to establish the total picture in terms of the community's relationship with different institutions (e.g., banks, cooperatives, market, etc.). The exercise may be done by asking the villagers to indicate, for example, their perceived ranking of various constituents of each institution or sector.

3) **Seasonality Diagram**: This is used to determine seasonal patterns in rural areas as related to rainfall, farming practices, employment and so on. It attempts to determine the seasonal calendar as understood and practiced by the community (e.g., festivals, agricultural events, community rituals). This is then adjusted to the English calendar.
The seasonality diagram exercise builds upon the use of different lengths of sticks or numbers of stones or seeds to quantify items such as rainfall, employment, etc. The diagram/exercise can be adopted for other purposes, including, determination of credit availability, grazing patterns, milk yields, breeding periods, animal and human health, disease patterns, etc.

4) **Matrix Ranking**: This is to compare and study the merits and demerits of a variety of items such as different types of crops, animal breeds, trees, etc. The exercise is done by means of a visual chart with the items on one side and the criteria for comparing these items on the other side. For example, in the case of crops, the criteria could be gram yield, straw yield, quality, drought resistance, etc. In the case of animals, the criteria could be milk yield, fat percentage, disease resistance, requirement of green fodder, etc.

Once the chart is established, scoring is done, i.e., points can be given for each item by placing seeds or stones. For example, if a crop variety is extremely pest resistant, the farmer may give it a score of 4-5. If the resistance is lower than this, 2-3 points. If the crop is disease susceptible, 1-0 point, and so on.

Matrix ranking can be used to study a range of subjects such as trees, fodder, types of cattle and breeds, crops and crop varieties, soil types, etc.

5) **Mapping**: Farmers only need to do a little drawing of lines to indicate roads, a few squares to indicate houses, small dotted lines to indicate rainfall etc. These are designed to suit the needs of the small farmers who are not accustomed to do paper work.

i. **Social mapping** – This is the construction of a community map using chalk on the ground or a cement floor. This exercise helps towards the understanding of the village layout, showing the main features such as housing, stores, church, and other infrastructure.

Once the base map is established, it is possible to build unto it different types of information (e.g., animal and human census, education and health status, land holding and economic status) for the purpose of planning. Different types of seeds can be used to indicate a specific category or item. For example, in an animal husbandry census, tamarind trees are used to indicate bullocks, castor seeds for cross bred cows, maize seeds for buffaloes, black peas for goats, etc. indicating various animal populations per household.
Similarly, markers of different columns of seeds can be used to indicate irrigated rice fields, rain-fed or non-irrigated, upland or lowland, etc.

Social maps can be used to identify different social groups or sectors, animal owners, etc. The exercise can also be done to find out the household wide status of animal or land holding. Animal and human census can also be accomplished using different types of seeds as described above.

Mapping can also be used to identify past and future community project beneficiaries, families which have undergone family planning, household educational status, or health patterns.

ii. Resource Mapping – This method is used to locate and establish the extent of the resources of an area such as forest, watershed, water bodies, etc. Items such as dry land, irrigated land, grazing land, and other important resources can be indicated in the resource map.

This exercise can be used to prepare treatment plans for soil and water conservation, forestry and others. It is done using colored chalk or pens, either on the floor, plain ground or on paper.

6) Transects – It consists of observatory walks through the community and the surrounding area such as fields, hills, forests, grazing lands, etc. with farmers as guides. It locates and pinpoints various physical aspects of the community or watershed, and helps to understand and examine with the people, the backgrounds of these resources. For example, the cause of deforestation, the use of common land, soil and water management and other indigenous practices.

Transects are pre-requisites for mapping and are used for zoning of different areas in ecological zones, land use mapping, productivity zoning, locating indigenous technologies, and locating areas in the community which need to be developed.

i. Historical Transects – Indicate the trends that have taken place over a period of time. These show the changes that have taken place in terms of resource use, cropping patterns, livestock, populations, etc. These entail internal discussions with concerned target groups, which could be a basis for evaluation.

Historical transects could be kept as records and are useful in understanding, among others, the changes that have taken place in livestock practices, nutrition, health care and education, customs and social practices, forests, land use and agricultural practices, productivity, populations and demography.
3. **Data Organization and Consolidation**

Too much data could be generated from the field, farm and community levels. To gather information that one needs, the following considerations should be taken into account.

a. **Clarity of objectives:** It is important for the farmer to be clear on why he needs the information. If one wants thorough information on the various factors and determinants that characterize a particular rice ecosystem, then one may do a comprehensive data gathering on all the factors, and in the process, establish baseline information. However, one may just want to resolve the issue of pests, and thus, may only focus on a few but outstanding trends on the rice ecosystem pest infestations and pest resistance of the rice varieties.

b. **Validation of Information:** Ideally, information is validated through triangulation, that is, the accuracy is assured through interview, use of secondary sources, and direct observation. Information that is corroborated by these three processes is considered valid. In cases when one process cannot be performed, two of the above should be done (e.g. secondary source data may be validated through field interviews or direct observation; direct observation is validated by field interviews and vice versa).

4. **The Process of Analysis**

The information gathered would be useful only when it is processed. Analysis of information helps farmers identify problems in the farm ecosystem and to prioritize solutions or strategies in addressing them. Rigorous examination of the different factors and determinants that characterize the farm ecosystem enables the farmer to design and plan the production system.

Below are some of the basic and simple methods that could help farmers analyze the information gathered.

a. **Strength, Weakness, Opportunities and Threats (SWOT) Analysis:** Knowing one’s strengths and opportunities helps the farmers:

   i. Identify the strategic potentials in the farm, household and community that could influence changes towards a better and desirable situation. In this case, achieving an ideal farm ecosystem;
   ii. Locate functional and ready-at-hand capabilities that are within reach and means, the key is only to strengthen and make use of these capabilities;
   iii. Start production initiatives without having to spend additional labor, capital and time; and
   iv. Understand better the scope and extent of possible development one can do to the production system.
Surfacing of weaknesses and threats helps farmers:

i. Assess the problem areas in his production system and find solutions to these;
ii. Recognize and later avoid or eliminate the undesirable factors and determinants as these could not help farmers achieve a desirable end;
iii. Identify the causes and reasons for the bad state of his production system; and
iv. Identify the priority concerns and issues that have to be addressed and attended to.

It is good to pinpoint as many SWOT factors to enhance the analysis process. Thus, it is helpful to list all the SWOT factors that are raised in the narratives or visual reports. The wider the range of issues raised, the more probable one could pin down the root causes of problems.

b. **Looking at significant trends:** When the significant positive and negative factors across the three levels of information sources (farm, household, community) have been identified, the farmers should now look into the significant trends as it:
   - Helps farmers focus only on significant information that are relevant and those that have an immediate impact on the production system and life in general;
   - Gives focus, concentration and attention on immediate problems and helps determine the priorities to be attended to in the short term and long term;
   - Eliminates the burden of attending to too many information and data that do not pose significant concerns in the immediate when taken as a whole; and
   - Provides greater clarity and picture of the status of the agro-ecosystem as it could pinpoint directly the causes and effects of situations and dynamics of the activities.

A closer scrutiny of the narrative report, baseline information and the SWOT analysis facilitate identification of the significant trends.

c. **Probing:** A process of digging deeper into reasons and causes of factors and determinants that surface in the trend as problems, limitations and constraints. This pertains to the “WHYs” of things.

Probing helps us ascertain the otherwise unseen elements that constitute the primary, immediate and the ultimate causes of the problems. Through this, causes can be shortlisted, and through a logical process of elimination, the root or primary cause can be identified. Identification of the root cause is vital to the eventual resolution of farm issues and problems.
The process usually leads to the identification of several primary or core problems.

d. *Prioritization*: Ideally, it would be good to address all the core problems to immediately achieve the desired situation in the agro-ecosystem. Yet in reality this could not be done due to limitations in resources, capacities, manpower and skills. Thus, there is a need to sort the core problems according to which need immediate attention, and which ones can wait. Which ones need immediate solutions, and which ones need medium or long term solutions? This is prioritization. This enables us to focus our energies, resources and capabilities in solving problems depending on urgency.

Prioritization should be combined with the identification of our strengths and opportunities so that we will be able to overcome, and not be overwhelmed by the enormity of the problems.

e. *Strategies, Options and Recommendations*: The core problems should be addressed. Brainstorming, where suggestions and possible actions to resolve each problem, is undertaken by the group. List all strategies, options and recommendations. Then, study these considering our capacities, skills and resources to arrive at a short list.

C. **FARM PLANNING AND BUDGETING**

Putting the options and recommendations into action requires concrete steps and activities that are organized to come up with a coherent form of action. This is the process of "planning". Just like an army general, one has to assess the strengths and weaknesses of the enemy before one could devise a plan that would ultimately earn a victory. It is the action plan that effects the change or solves the problems.

After assessing and analyzing the situations in the agro-ecosystem, there is a need to design an action plan that will help overcome the problems in the production system.

1. **Elements of Planning**

Planning is devising a set of interrelated actions and activities coupled with harnessing and systematizing resources, capabilities and skills to achieve a desired situation and vision which is better and improved than the previous one. There is a careful thought-work process involved to guide actions towards the desired end. We have known how numerous activities, if uncoordinated and directed for no clear purpose, have wasted capital and energies of people and institutions. Planning then provides the compass with which activities could bear fruit and effect meaningful change. For this reason, we must consider the basic components of planning.
a. **Setting-up the objective/goals:** The first consideration of a plan is to be clear of what one wants to achieve. What is the purpose, expected outcome being envisioned for, which skills and resources would be deployed over a shorter and longer period of time? This part of the plan is the heart for which all succeeding components of the plan depend. The goal or objective sets the tone of the change that one hopes and desires after examining and analyzing the present situation. It is the governing motivation that sets the direction of succeeding actions. The goal of what one would do and achieve should be SMART, i.e. specific, measurable, appropriate/realizable, and can be achieved within a specific timeframe.

b. **Critical activities:** The plan must outline the critical steps or activities, which when properly executed, would lead to the realization of the objectives. These steps and activities demonstrate how the goals would be achieved.

The steps and activities must be carefully selected. Activities must result or effect outcomes that lead to the attainment of the goals. Avoid activities that are not in line with the objectives.

The list of strategies, options and recommendations will give helpful insights as to the appropriate activities to undertake.

c. **Set indicators of achievement:** Indicators help farmers know when they have already achieved the goals. Outlining these provides the opportunity for farmers to determine and measure whether the steps and activities have led to the fulfillment of the objectives. The indicators will tell what activities and components should be strengthened and avoided so that the action plan would run smoothly in its intended course and direction.

d. **Schedule of implementation:** Having set the objectives/goals, critical steps/activities, and the indicators, a plan must have a timeframe that sets the various time elements and sequence in implementing the activities. It provides the demarcation when the activity ought to begin and stop. Arranging the regular periods of implementation provides the rhythm of activities and put all things in order.

e. **Persons-In-Charge:** Assign individuals who will take responsibility in the execution of the action plan. Identifying individuals who will be accountable for each task ensures the smooth implementation of the plan. The persons-in-charge must have a full understanding of the plan objectives and critical activities. They must be fully aware of the concept and framework that guides it. A full understanding of the context of the plan would conveniently situate them in a better position to monitor and evaluate its progress and impact over a period of time. A process of leveling off among persons-in-charge may be undertaken, so that they will act harmoniously.
f. **Budget**: Outlining the cost allocation of the planned activities provides the overall direction of the capital requirements needed. Costing provides ideas for decision-making, i.e. whether the activity is feasible and attainable. It helps define the activities that would be implemented.

g. **Application**: The farm plan is a guidepost that must be referred to, from time to time, in the course of implementation. Thus, it must be properly written. It is difficult to keep track of the different goals and activities unless there is a document to refer to. The document also serves as basis for future farm plans.

It is important to note that visualization is an effective tool in planning. Visualization helps farmers to transcend the present, and incorporate changes, innovations and patterns in the physical layout of their fields and community. The envisioned change is designated in specific form and structure.
TRAINING AND DISCUSSION TOOLS

The following are participative and group activities that may be used in the discussions and training proper.

1. Web of Life

Participants are given 5-10 minutes to observe the objects around them and think of the purpose or use of it. After the time given, each participant is asked to identify one thing and explain the role of this in the community and the one end of the thread is held by the first participant. Another participant is asked to give their answer and the thread is also passed to the participant. The procedure is repeated until all the participants have talked. A web-like formation of the thread is formed. Some of the participants will be asked to pull the thread they are holding and to observe what will happen. Other participants will be asked to release the thread that they hold until the web-like formation of the thread is no longer visible which signals the end of the game.

This game helps in explaining the importance of each component of to be able to have a stable ecosystem. The thread serves as symbol of the hidden interconnection or interrelatedness of each component.

2. Charade

Example: Name the Practice

The participants are grouped into 6-8 members. One group will be assigned to act out while the remaining groups will compete in guessing what they are acting-out. The category will be “practices in the community” where “bayanihan” is observed. The group that will guess should explain what is/are the benefits of this practice. The group that will guess the most will be the one who wins.

This game will be useful especially to farmers in order to appreciate the essence of jointly working together and realize its mutual/synergistic effect. This can help in explaining and relating these rules to the practices in the farm.

3. Jumble Word

The participants are grouped into 6-8 members. They are given different practices of DIFS in jumbled words and they should be able to rearrange to come up with the correct word. The groups are given equal number of words to fix and the first group who will finish rearranging all the words given to them will win.
Example of words that can be used:

<table>
<thead>
<tr>
<th>- Biodiversity</th>
<th>- Mulching</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Nutrient cycling</td>
<td>- Botanical method</td>
</tr>
<tr>
<td>- Crop rotation</td>
<td>- Mechanical method</td>
</tr>
<tr>
<td>- Multiple cropping</td>
<td>- Cultural method</td>
</tr>
<tr>
<td>- Intercropping</td>
<td>- Biological method</td>
</tr>
<tr>
<td>- Minimum tillage</td>
<td>- Cover crops</td>
</tr>
</tbody>
</table>

4. Jigsaw Puzzle

*Example: Farming systems identification*

The participants are grouped into four and each group is given a puzzle and they should rearrange/fix the puzzle and to be able to come up with one picture of the different farming systems. The groups should post the pictures to the board. The first group that will finish will win.
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