



**GENERAL GUIDELINES FOR THE ESTABLISHMENT OF  
PERMANENT ORGANIC RESEARCH PLOTS AND ORGANIC  
DEMONSTRATION FARM**

**Tirtha Bdr. Katwal and Dawa Dem**

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## Acronym

ARDC	Agriculture Research and Development Centre
BAFRA	Bhutan Agriculture Food Regulatory Authority
BOS	Bhutan Organic Standard
BOGS	Bhutan Organic Guarantee System
GMO	Genetically Modified Organisms
FYP	Five Year Plan
FYM	Farm Yard Manure
ILM	Integrated Landscape Management
IFOAM	International Federation for Organic Agriculture Movement
SRF	State Reserve Forests
NOFP	National Organic Flagship Program
NOP	National Organic Program
NWFP	Non Wood Forest Products
OA	Organic Agriculture
PAMS	Prevention, Avoidance, Monitoring and Suppression
ROP-Organic	Research Outreach Program- Organic

## Contents

Section A-General Introduction .....	4
1.0 Introduction .....	4
2.0 Principles of Organic Agriculture .....	4
3.0 Bhutan Organic Guarantee Systems (BOGS).....	5
3.1 Bhutan Organic Mark .....	5
3.2 Bhutan Organic Standards (BOS) .....	6
Section B- Establishing Permanent Organic Research Plot.....	8
4.0 Permanent Plots for Organic Research.....	8
4.1 Rationale for Establishment of Permanent Organic Research Plots.....	8
4.2 Objectives of Permanent Organic Research Plot .....	9
4.3 Approaches for Site Selection of Permanent Organic Research Plot.....	9
Section C- Establishing Organic Demonstration Farms .....	13
5.0 Organic Demonstration Farm .....	13
5.1 Objectives of Organic Farm.....	13
5.2 Approaches for Site Selection of Organic Farm .....	14
5.3 Key consideration to be made.....	14
5.4 Organic Practices and technologies.....	14
6.0 Suggested structures in Organic Farm.....	19
7.0 Materials Required for Permanent Plots.....	19
8.0 Registration and Certification.....	19
5.0 Conclusion.....	20
Reference .....	20

## **Section A-General Introduction**

### **1.0 Introduction**

Organic Agriculture (OA) is a globally accepted sustainable approach to food production. OA entails several positive ecological impacts and promotes socially, economically sustainable food production systems. Organic movement in Bhutan therefore befits well with the national development philosophy of Gross National Happiness. The country has a long term vision to make Bhutanese agriculture fully organic and has accorded a high priority towards the development and rapid scaling up of OA. There is a strong advocacy and enabling policy support for organic sector development. The government has also approved the National Organic Flagship Program (NOFP) to propel, upscale and strengthen the organic sector. In the current 12 Five Year Plan, development and promotion of organic technologies has received the highest priority. National Centre for Organic Agriculture (NCOA)-Yusipang is mandated to coordinate and nationalize research and development in OA. NCOA- Yusipang and its stakeholders are therefore engaged in strengthening the research and development of OA by developing research and development strategies, mechanisms, guidelines and packaging of OA technologies. This guideline for establishing Permanent Plot for OA Research and Organic Demonstration Farm is one of the initiatives of NCOA Yusipang to further strengthen the organic research and development. Furthermore, to rapidly promote and upscale proven OA technologies on-farm a separate guideline for Research Outreach program (ROP) - Organic has also been developed.

This guideline is prepared and expected to support the implementation of NOFP and achieve its outputs. The NOFP will support and promote the organic permanent research plots and organic farms as the key strategies to propel, promote and popularize OA technologies across the country. The permanent plots for OA research and demonstration farms are expected to be the platform to initiate organic research and demonstrate OA technologies including organic inputs.

### **2.0 Principles of Organic Agriculture**

According to International Federation for Organic Agriculture Movement (IFOAM), “Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved”. OA develops and grows around four main principles that define the way people manage soil, water, plants and animals to produce and distribute food and other resources. The principles of OA guides the development of OA policies and standards required. The four underlying principles of OA are:

- i. **Principle of Health** - Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible. The health of individual and community cannot be separated from health of soil ecosystem- healthy soils contribute to healthy crops that stimulate the health of the animals and people.
- ii. **Principle of Ecology**- Organic Agriculture should be based on living systems and cycles, work with them, emulate them and help sustain them.
- iii. **Principle of Fairness** -Organic Agriculture should build on the relationships that ensure fairness with regard to the common environment and life opportunities.
- iv. **Principle of Care**- Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well being of current and future generations and the environment.

### **3.0 Bhutan Organic Guarantee Systems (BOGS)**

The global standard operating procedure for OA demands for structured Registration, Certification and Regulation. It is the most critical components of the organic value chain. Registration and Regulation of the organic guarantee systems have to be mandated with one apex agency in the country while Certification has to be executed by another independent Certifying Body. In Bhutan, the Bhutan Organic Guarantee System (BOGS) is the existing system in place for organic certification. BOGS refers to the whole set of options, both on the standard side and on conformity assessment side, that enables a producer/product to access the Bhutan Organic Mark. The first edition of the document is published by National Organic Program, and NCOA- Yusipang. It also defines the rules for which conformity assessment systems are acceptable for verification of compliance to the Bhutan Organic Standard. The third-party certification by Bhutan Agriculture and Food Regulatory Authority (BAFRA) is one of conformity assessment systems endorsed through Bhutan Organic Guarantee System.

#### **3.1 Bhutan Organic Mark**

The Bhutan Organic Mark is the logo used to designate Bhutan certified organic products. It is a certification mark which is the property of the Ministry of Agriculture and Forests, Bhutan .The Bhutan Organic Mark is useable for promotion and education activities related to organic agriculture in Bhutan, as well as for the marketing of organic products verified in accordance to the BOGS.

## **3.2 Bhutan Organic Standards (BOS)**

The Bhutan Organic Standard is a system which assures the production and supply of food and food materials are free from unnatural treatments, additives and any synthetic agro-chemicals which are hazardous to human health and ecosystem. It is the minimum requirement for any organic operators to be certified “Organic”. Any designated research and demonstration permanent plots should abide to the basic standards prescribed in the Bhutan Organic Standards. Organic standards and conformity assessment systems help to promote organic products in the market through product differentiation and help to fetch premium price besides ensuring quality and safety of the product. The important standards to be met under the different sectors are summarized below:

### **3.2.1 Agriculture**

In agriculture the permanent research and demonstration plots for certification and obtaining Bhutan Organic Mark should fulfill the following criteria.

- i. Simultaneous production of conventional, in conversion or organic crops which cannot be clearly distinguished from each other is not allowed
- ii. As far as possible organic seeds and planting materials should be used.
- iii. When certified organic planting materials are not available, chemically untreated conventional materials shall be used.
- iv. Any Genetically Modified Organisms (GMOs) are not allowed in OA.
- v. Use of mineral fertilizers: rock phosphate, gypsum, lime, mica and others is permitted in their natural composition.
- vi. Use of Chilean nitrate and all synthetic nitrogenous fertilizers including urea is prohibited
- vii. Use of synthetic herbicides, fungicides, insecticides and other pesticides is prohibited
- viii. Clearing of land by burning of residues should be restricted to the minimum. Clearing of primary forest for farming is prohibited
- ix. During processing, handling and storage of products, care should be taken to not mix any inorganic products.

### **3.2.2 Wild collection**

For certification and obtaining of Bhutan Organic Mark for wild collections it should fulfill the following criteria.

- i. The collection area shall be at an appropriate distance from conventional farming, pollution and other potential contamination sources.
- ii. Any wild collections should be derived from a clearly defined collecting area, which is not exposed to prohibited substances.

### **3.2.3 Animal Husbandry**

In animal husbandry, the permanent research and demonstration plots for certification should fulfill the following criteria.

- i. Ensure sufficient free movement of animals
- ii. Breeding systems should be based on breeds that can both copulate and give birth naturally
- iii. Embryo transfer techniques are not allowed
- iv. Hormonal heat treatment and induced birth are not allowed unless applied to individual animals for medical reasons and under the advice of a veterinarian.
- v. All feed and fodder used should be organic
- vi. Natural systems of medicine and Ethno Veterinary practices are permitted

### **3.2.4 Apiculture**

Apiculture or Bee keeping is an important component of OA. All types of bees support crop production through pollination. Bee keeping in the permanent research and demonstration plots for certification should fulfill the following criteria.

- i. Bee hives should be kept in organic fields and wild/ natural areas. The area within 3km radius of the hives shall consist of organically managed field, uncultivated areas and wild natural areas. Bee hives shall be at least 5km away from conventional field with intensive use of chemicals or from other source of chemical contamination.
- ii. Bee hives should consist of natural materials with no risk of contamination to the environment or the bee products

## **Section B- Establishing Permanent Organic Research Plot**

### **4.0 Permanent Plots for Organic Research**

Establishing long term “**Permanent Organic Research Plots**” where organic technologies are can be evaluated following acceptable organic standards is one of the proven methods of OA research. Permanent organic research plots are long term initiatives and have to be planned carefully. These plots are designed and established to assess OA technologies and generate empirical data for long term trend analysis of OA. Permanent research plots can adopt any suitable statistical designs. Such permanent research plots also serve as the avenue to asses and evaluate integrated technologies from different disciplines such as soil fertility, plant protection, crop management, weed management, water management, crop combinations, rotations and input use. Apart from research, the permanent plots should serve as the demonstration for any organic interventions. Therefore, NCOA, Yusipang has attempted to come up with the broad architecture for the establishment of “**Permanent Organic Research Plots**” for initiating organic research in Bhutan by considering all the principles and requirements of OA. This is very critical because the design of the long term trials in the permanent plots should be conceptually and scientifically acceptable across the OA scientific community. The ultimate output from the permanent research plot is the OA technologies and information that have to be based on OA principles and qualify the OA standards. To ensure that research outputs from such permanent organic research plots are within the OA norms and acceptable, permanent plots should be organically certified by an authorized Certifying Body. To be organically certified, permanent organic research plots have to follow Bhutan Organic Standards (BOS) under Bhutan Organic Guarantee System (BOGS).

#### **4.1 Rationale for Establishment of Permanent Organic Research Plots**

The agriculture research strategy of the Department of Agriculture, 2018 has identified research in OA as one of the research programs to be initiated under the national agriculture research system. NCOA-Yusipang which has the national mandate to coordinate the Organic research and development is assigned to lead the organic research. The agriculture research strategy emphasizes the need to initiate organic research with the focus on organic technology development. The design and establishment of long-term permanent organic research plots integrating different research disciplines both on-station and on-farm to obtain time series data for evaluating OA technologies is outlined as the key approach.



At present there are no designated OA research sites where researchers can initiate the evaluation and adaptation of organic technologies. There is an urgent need to lay the foundation for the organic research and focus on organic technology development, packaging and promotion through the establishment of permanent plots. OA research has to be conducted in a specific permanent site that qualifies as organic based on OA standards and norms. Further the OA process and dynamics are fairly slow and long term compared to the conventional farming system where the outcome of treatments can be established and documented much faster. The establishment of permanent organic research plots to assess and evaluate OA technologies in all the ARDCs is seen as the most pragmatic mechanism for promotion and up scaling of organic technologies. As OA research is fairly new to Bhutanese research system designing research methodologies, protocols and evaluation procedures for organic agriculture research is also very fundamental. The permanent plots while serving as the platform to generate empirical data on OA technologies will also serve as demonstrations of OA technologies and approaches to the farmers and any stakeholders engaged in the organic value chain.

#### **4.2 Objectives of Permanent Organic Research Plot**

- i. Evaluate and adapt OA technologies following acceptable OA principles, valid research methodologies and OA standards.
- ii. Serve as the avenue for researchers engaged in OA to generate information and knowledge on organic technologies, observe and analyze results and package the technologies.
- iii. Generate data on OA technologies for long term trend analysis to establish the benefits of OA.
- iv. Serve as the avenue and platform for awareness, advocacy and promotion of OA for all stakeholders engaged in OA value chain.

#### **4.3 Approaches for Site Selection of Permanent Organic Research Plot**

Apart from NCOA-Yusipang, all other three ARDC farms are conventionally managed. Therefore the selection of site with the ARDCs research farm is very critical for the establishment of permanent organic research plots. As OA research and demonstration farm is a long term process, utmost attention has to be given in identifying the sites for the permanent plots. As the final research output from permanent plots has to be acceptable within OA norms and standards, permanent plots have to be organically certified based on Bhutan Organic Standards. The basic idea behind the proposed approaches is to target a contiguous or a well defined land with an established boundary which can be certified as organic.

### **4.3.1 Integrated Landscape Management Approach**

Bhutanese farmers largely continue to practice integrated farming. In the integrated mountain farming systems, no component of the farming system can be singled out and managed organically or otherwise. The Integrated Landscape Management (ILM) approach appropriately provides holistic scope to appreciate large-scale processes in an integrated and multi-disciplinary manner, combining natural resource management with environmental and livelihood considerations. This approach protects vital ecosystem services and sustains livelihoods, tackling food security challenges while adapting to the likely future impacts of climate change. The landscape approach recognizes that the root causes of problems may not be site-specific and that a development agenda requires multi-stakeholder interventions to negotiate and implement actions). With Organic Farming as the entry point, the ILM will consider the following:

- Without considering the landscape and its entities holistically, organic production of a single commodity in isolation will not be possible
- The entire production landscape, farming systems, other livelihood and enterprises and stakeholders will be targeted for organic farming
- A landscape managed organically will facilitate organic certification of land which is fundamental for certification of products produced thereof.
- Consider conservation of traditional crops and livestock species through commercialization to promote economic value to the products.

### **4.3.2 Watershed Based Approach**

Watersheds are contiguous landscape and in Bhutan we have well defined watersheds in abundance. Watershed based planning and development has been consistently adopted for the integration of the agriculture, livestock and forestry sector activities. Watersheds have well-defined natural boundaries that make them ideal for initiating organic farming. The water source needs to be free from any potential sources of contamination. Establishing permanent organic research and demonstration plots in a well defined watershed will facilitate the certification of the entire area and produces produced in that location.

### **4.3.3 Soil Nutrient Management and Plant Protection in Permanent Plots**

Improving and maintaining soil health and fertility through adoption of locally available organic resources is fundamental for promoting organic farming in the permanent plots. There is wide range of technology options available for soil nutrient management and plant protection in OA. However, the present methods of composting are primitive and crude. There is need to improve the composting

processes to enhance the quality and efficiency. Some of the practical intervention includes: promotion of cover crops, green manures, animal manures and crop rotations; soil and water conservation techniques, enhance microbial activity in soil (soil health), create awareness on nutrient re-cycling through proper management of crop residues. To this effect, a comprehensive soil fertility strategy should be developed and implemented.

Prevention, Avoidance, Monitoring and Suppression (PAMS) is the best strategy to reduce pest and diseases in the organic sector. Prevention and avoidance are the first line of defense against pests, weeds, and diseases. If pest or weed suppression becomes necessary, producers should be encouraged to use mechanical and physical practices, such as mulch, intercultural tools and cultural operations in both crops and livestock. Suitable and affordable bio-pesticides/ ethno veterinary should be promoted while the use of pesticides and drugs for animals should be done in consultation with organic certifier as the ultimate resort.

#### **4.3.4 Focus on Indigenous Crops and Livestock Conservation in Permanent Plots**

Currently, there is a drive on commercialization of agriculture and livestock production in the country with the emphasis on the promotion of hybrid seeds, inorganic inputs and commercial breeds of livestock. The immediate outputs from these conventional systems of commercial farming are high but have been proven to be unsustainable overtime. Most of the exotic species are nutrient exhaustive and demand the use of high levels of external input and all external inputs used in the conventional farming have to be imported, are often adulterated and expensive. Further, several imported vegetables and livestock products are observed to have high levels of residual pesticide and antibiotics that poses risks to human health and environment.

Our traditional crops, land races and varieties; and livestock can equally ensure household food security. There is high potential to promote the indigenous crops and species. In spite of very good demand in the market for traditional crops and local livestock products, there is a declining trend on the area cultivated, production and productivity of native crops and livestock species. The locally produced commodities have high demand in the market but they are not readily available. Moreover, there are chances of the indigenous crops and livestock diminishing if not conserved. Under the organic production regime with no external inputs the use of traditional crops and livestock species will be more sustainable. Besides making safe food available and ensuring bio diversity conservation, the commercialization and conservation of traditional livestock and crop commodities fits very well with the organic principles. There should be enough focus on producing adequate quantities of

organic seeds of traditional crops and promotion of local breeds of livestock inputs by instituting input multiplication programmes in the permanent organic sites.

#### **4.3.5 Integration of Forest Component**

Traditional farming in Bhutan is strongly associated and supported by the forest system. The State Reserve Forest (SRF) which covers over 71% and the Protected Area Network which constitutes 51% of land area provide food, fodder, grazing area, NWFPs, fuel wood, leaf litter, top soil, including other resources and ecosystem services to sustain farming. *Sokshing* (area designated for collection of leaf litter) has traditionally been the primary source of biomass for FYM and composting. Community and private forestry further compliment the role of SRF and *Sokshing*. Forests serve as the habitat for different flora and fauna and contribute to biodiversity conservation. In view of the significant role of forests in organic farming, some of the specific intervention that could be promoted in the permanent plots are agro-forestry which is commonly practiced by integrating fodder trees in agriculture lands, intercropping of fruit trees with annual crops, promotion of *Sokshing*, integration of organic farming in all watershed management plans, introduction of organic management in protected areas, promotion of plant species with pest repellent properties, and multipurpose species.

#### **4.3.6 Integration of Livestock Component**

Rearing livestock as source of food, draught and manure is an integral part of Bhutanese farming systems. Livestock sector plays a critical role in nutrient flow and recycling at landscape level. Livestock is the primary source of nutrient in the form of manures and an important source of income for small holder farmers. In addition to cattle dung; chicken manure, pig and goat manure are increasingly used. In many areas draught power continues to be important for land preparation in agriculture where mechanization is difficult. Traditional livestock breeds will play a very important role to sustain organic farming. There is an increasing consumer preference for local livestock products due to pesticide contamination in imported products. In the organic permanent research and demonstration plots all animal husbandry practices, feed and feeding practices should be practiced based on the Bhutan Organic Standards.

#### **4.3.7 Other Important Considerations**

- Permanent plots previously managed conventionally should have a conversion period of minimum two years.
- Permanent plots should have minimum contamination risks.

- Permanent research plots can adopt any suitable statistical designs based on the objectives of the trials.
- All other statistical principles used in conventional research can be applied in organic research.
- The research outputs generated from permanent plots should be within the acceptable OA norms.
- It is important to ensure that water used for irrigation in permanent plot is free from contamination.

## **Section C- Establishing Organic Demonstration Farms**

### **5.0 Organic Demonstration Farm**

Although Bhutanese agriculture is largely traditional with very minimum use of external inputs, it lacks the systemic OA approaches and principles. The principles and scientific approaches of OA are relatively new to Bhutan and understanding of certified OA in general is limited. Less awareness and lack of guidelines on the principles and practices of organic farming coupled with a lack of technical capacity have impeded the promotion and adoption of organic technologies. At present there are fewer numbers of certified organic farms that can be used for demonstration of successful organic farming practices to the farmers and organic operators.

There is a need to initiate and develop organic farms at different locations for demonstrations of OA technologies and processes. Developing certified Organic farms in the Dzongkhags is seen as a pragmatic method for promotion and upscaling of OA in Bhutan. Organic farms can be used to show various available technologies in organic farming while serving as the platform to generate knowledge and information on the benefits of OA.

An organic farm should be self-sustaining, conform to the principles of OA, registered with the National Organic body and certified based on BOGS. It should comprehensively demonstrate organic technologies which will help promote OA in that location.

#### **5.1 Objectives of Organic Farm**

- i. Serve as the avenue and platform for education, awareness and advocacy on OA.
- ii. Serve as the avenue for interested organic operators to access information and knowledge on organic technologies, view results of proven organic farming practices and get hands on training through field days and on the job trainings.

- iii. Showcase dynamic and integrated organic farming practices adopting the principle of ecology, care, fairness and health of all living beings.
- iv. Demonstrate best OA practices for crop production by taking into consideration soil fertility management, weed management, plant protection, water management, crop diversity and water conservation technologies.
- v. Serve as the demonstration site for training, teaching and advocacy of OA to farmers, students, youths, and any interested organic operators focusing on organic technologies, farm-inputs such as organic seeds, organic fertilizers, bio fertilizers and bio-pesticides.

## **5.2 Approaches for Site Selection of Organic Farm**

Farms across the country are mostly conventional with use of various agro-chemicals in the name of increasing productivity. There is need to switch to Organic farming which is more sustainable and beneficial to our farmers. The approaches and principles which are mentioned for the Permanent Research plots should also be duly followed for the development of Organic Farms.

## **5.3 Key consideration to be made**

- i. The farm should meet the standards required for establishing the organic farm. If it's conventional field, conversion period considering the soil quality and crops to be grown must be followed.
- ii. The farm should be situated away from conventional farms or sources where there is possibility of any form of contamination.
- iii. The farm should be maintained in a self sustaining manner using locally adaptable farming practices.
- iv. The farm should be managed using materials which are low cost or obtained from the farm as much as possible.
- v. The Organic integrity should be maintained throughout the value chain of crop production.

## **5.4 Organic Practices and Technologies**

Organic Farms avoid use of synthetic inputs for crop production and crop protection which necessitates the alternative options which could enhance the productivity while keeping the use of agro-chemicals away. The various technologies related to crop production, plant protection, soil fertility management, water conservation which could be used for various crop production measures in Organic Farming are given below:

### 5.3. 1 Soil and Nutrient Management

Soil is the most the vital component of crop production in both OA and conventional system. In OA, soil health and nutrient management is more critical as supplementation of nutrients through inorganic fertilizer is not allowed. A healthy soil produces healthy crops which in turn produces healthy food. For production of healthy crops and to sustain health of soils and their fertility, it is important to follow soil management practices and sustainable soil fertility management practices. The soil should be kept dynamic by enriching with living micro-organism.

Some of the suggested organic practices and technologies which can be incorporated are:

- i. **Crop rotation-** Crop rotation is growing of series of dissimilar/different crops in the same land to prevent the weeds, pests, diseases and nutrient exhaustion of soil. Growing crops in this method prevents soil erosion and increases soil fertility. In crop rotation, heavy feeder crop should be grown with light feeder and no two crops of same family should be grown together. For instance, rotating leguminous crop with non leguminous crop,
- ii. **Cover cropping-** Entails growing a specific crop for the benefit of the soil rather than the crop yield. Cover crops prevent soil erosion, soil degradation and creates micro climate. Cover crops are typically legumes but may be also comprised of other non leguminous crops like wheat and buck wheat.
- iii. **Green manuring-** Crops which are incorporated in the fields after they have produced a significant amount of bio-mass or fixed a significant amount of nitrogen in the case of legumes. Green manures increase organic matter and provide the maximum amount of nitrogen to the following crop. Green manuring crops like Dhaincha (*Sesbania aculeata*) and leguminous crops like peas, beans, lupines and many others.
- iv. **Animal manure-** Tethering of the live stock where the cultivation is to done is a good means for enrichment of soil with manures. Manures from poultry and cattle are very helpful for nutrient enrichment of soil.
- v. **Farm Yard Manure (FYM) -** Manure produced by decomposition of cow dung, cow urine when mixed with the litter and roughages given to animals.
- vi. **Composting-** The decomposition of materials from plant and animal origin into humus rich stable product which nourishes the soil. The micro-organism disintegrates the plants and animals materials into available forms which are suitable for application to the soil.

Manures from the animals needs to be composted before applying in the field so that they don't burn the plants when applied to the plants.

- vii. **Vermi-composting-** Is a process in which the bio degradable waste are converted into compost by selected species of earthworms. Some of the species of earthworms that can be used are *Eisenia foetida*, *Eudrillus eugeniae*, *Perionyx excavatus*, *Perionyx sansibaricus*, *Lampito mauritii*, *Lumbricus rubellus*.
- viii. **Bio-char-**Bio char is produced after controlled burning of organic material from agricultural waste. Bio- char application in the field increase soil fertility of acidic soils (low pH soils), increase agricultural productivity and provide protection against some foliar and soil borne diseases.
- ix. **Bokashi-** It is fermented organic fertilizer. Bokashi can be applied for disease and pests control as well as a composting agent.
- x. **Bio-digester-** It is a simple concrete tank constructed in the field where organic materials are collected and allowed to digest biologically.
- xi. **Bunding:** This reduces the slope length and run off losses of organic matter during heavy rain fall.

### 5.3.2 Plant Protection

The use of synthetic pesticides is not allowed in OA and hence the management of pests, diseases and weeds is most challenging. The spray of agro-chemicals has several harmful effects on soil, human and ecosystem. These harmful chemicals cause imbalance of ecosystem and destroys several beneficial micro-organisms. The use of several beneficial microbes along with plants of potent bio-pesticidal property coupled with cultural and mechanical methods can effectively manage the pests and disease incidence.

Some of the suggested organic practices and technologies that can be demonstrated are:

- i. **Crop rotation-** Crop rotation is effective for pests which are less mobile and whose feeding is confined to a specific crop. For instance the Solanaceous crops like tomato and potato when planted in rotation with other crops that are not in same family minimizes the risk of late blight disease and Colorado beetles.
- ii. **Intercropping** – Two or more crops grown in close proximity is known as inter cropping. This approach increases bio diversity and decreases pest outbreak. Natural enemies are abundant in the inter crops than the mono crops. Intercropping also obstruct the egg laying of the pests. For example, cabbage along with carrot or tomato is an important intercrop combination to effectively manage diamond back moth.



- iii. **Trap cropping-** Trap crops when sown in the main field or along the borders, the pests gather on them and can be used to trap the pests. For instance, a row of marigold planted in close proximity of tomato field for attracting fruit borer, Mustard along with cabbage is a trap crop for the control of the diamond back moth, aphids and the leaf Webber.
- iv. **Mixed Cropping** - It is a method where mixture of seeds of different crops is sown together. Mixed cropping systems facilitate the natural enemies of the pests.
- v. **Soil Solarization-** Soil solarization is done by covering the soil with plastic during summer. This allows the soil to be hot enough to kill many pathogens, yet it allows microbial spores to survive. Survivors can re-establish the microbial population needed for healthy soil. For controlling soil dwelling pests and diseases.
- vi. **Companion planting-** Planting of different crops in proximity for any of a number of different reasons, including pests control, pollination, providing habitat for beneficial insects, maximizing use of space and to otherwise increase crop productivity. Example; Maize + beans+ Pumpkins (three sister companion planting)
- vii. **Sticky traps** – Sticky traps are glue based traps which attract insects and other pests. Yellow sticky traps are very effective in capturing Aphids, Thrips and White Flies. The traps to a large extent are useful for monitoring of pest infestation which helps to take appropriate remedial action
- viii. **Pheromone traps-** Pheromone is chemical produced by animal which changes the behavior of another animal of the same species. These traps use lure impregnated with pheromones to attract insects. For instance for fruit fly, the pheromone attract the male fruitfly into trap and kills them. With the male population killed, this makes it more difficult for females to find males to mate and produce more maggots.
- ix. **Predators-** Providing habitat for the natural predators like lady bird beetles, green lace wing bug will keep the pests like aphids and mites under control. The multiplication of these predators can also be done and released in the field.
- x. **Light trap** – Use of light traps in the field helps to control the nocturnal flying insects like moth, midges. Cutworm can be controlled if the adult moths are controlled effectively.
- xi. **Net covering-** Net covering prevents the insects from attacking the crops and also damage from the birds.
- xii. **Organic mulches-** Organic mulches cover the crop and suppresses weed. In the long run as they decompose, it also supplies nutrients to the soil. Mulching with locally available materials like paddy straw, wood chips and plant biomass.
- xiii. **Botanical (bio-pesticides)** – These are the preparations made from specific plants for managing pests and diseases. Different parts of the plants can be used for preparation of the botanicals. A

few to list are *Allium sativum*, *Azadirachta indica*, *Ocimum sanctum*, *Sesamum indicum*, *Annona squamosa*, *Melia azadiracta*, *Artemesia* and many others. Extracts like ginger-garlic-chilli, Jholmol, chilli extract, etc

### 5.3.3 Water Management

Water is the basic necessity for the health of human and ecological system. It sustains the production and socio-economic resilience. Water is one of the most essential elements of organic farming; therefore it is important to ensure that it is free from contamination from any source. The care must be taken that the irrigation water is not loaded with agro-chemicals or any hazardous chemicals.

Some of the suggested technologies that can be used:

- i. **Contour farming-** It is the sustainable farming where farmer plant crops across the contours of a slope. Slope plays a role in soil conservation, in that flat ground erodes less than sloping ground with equal amounts of ground cover. Contour farming slow water runoff during rain storms to prevent soil erosion.
- ii. **Drip irrigation-** This kind of irrigation provides water directly to the roots of the plant and minimize irrigation. Irrigation with such technology saves water and ensures the sustainability in future.
- iii. **Pond-** Pond acts as water reservoir and also warms up water before entering to the main field. Many of the predators like dragon flies hovers around the pond which is very helpful for the crop and it is also home to several aquatic insects enhancing the bio-diversity.

### 5.3.4 Integrated Farming Technologies

i. **Livestock-** Integration of Livestock with crop is helpful in nutrient recycling as well as for maintaining the economic stability of the farmers. Livestock provides manures to the crops while crop residues can be fed to animals.

#### ii. Agro forestry

Growing of trees or shrubs hedge rows between the crop spaces will provide bio mass for manure production, if trees with insecticidal properties are grown, they can be also used for botanical preparations. If leguminous trees are grown, their foliage can be also used for green manuring purpose.

#### iii. Apiculture

Maintaining the bee hives in the organic farms will have synergistic benefits. The bees will be benefitted with the chemical free environment, at the same time they will reward the farm with

enhanced pollination and organic honey. It will give a diversified look to the farm. Moreover, the productivity of the cross pollinated crop will be greatly enhanced.

## **6.0 Suggested structures in Organic Farm**

- i. Nursery
- ii. Herbal garden
- iii. Composting sheds
- iv. Indigenous fruits and vegetable blocks
- v. Mushroom production shed
- vi. Low cost storage chamber
- vii. Solar dryer

## **7.0 Materials Required for Permanent Plots**

- i. Map of the area
- ii. Map of demonstration and research area
- iii. Efficient irrigation system (taking into consideration both soil and water conservation)/no contamination/buffer zone)
- iv. Seeds/seedlings of domestic varieties for production/conservation.
- v. Cropping system (crop rotation) and cropping calendar
- vi. Signboard
- vii. Trellis
- viii. Utility Shed to demonstrate different botanical extracts.
- ix. Tools and equipments exclusively for the organic plot
- x. Raw materials for Bio-inputs
- xi. Materials for landscapes
- xii. Water harvesting and irrigation materials
- xiii. Footpath/trails/bridge

## **8.0 Registration and Certification**

All the organic producers and operators are required to fulfill and follow the Bhutan Organic Standards (BOS 01:2019) in order to be certified as Organic which will enable them to obtain the Bhutan Organic Mark. The Bhutan Organic Standard is the currently established norm for organic production, processing, labeling and marketing of agriculture, livestock and NWFP in Bhutan. It will be the basis for authorized use of Bhutan Organic Mark. For the certification, the farmers, institutes and any organic operators should first apply for registration to the National Center for Organic

Agriculture (NCOA), Yusipang. This will be followed by the certification process. Depending on the objectives of the organic certification either Local Organic Assurance System (LOAS) or Third Party Certification by BAFRA will be done.

## 9.0 Conclusion

In order to rapidly propel and upscale OA initiatives in Bhutan, there is an urgency to develop and promote organic technologies. The permanent plot for organic research and organic demonstration farm is seen as one of the most pragmatic platform to horizontally expand the organic initiatives in the country. It is also expected that through the establishment of organic permanent plots at ARDCs, Research Sub-centers, Geogs and Dzongkhags, we will be able to clear and dispel many myths of OA. This is expected to pave the way for the rapid adoption and upscaling of OA. This document is a general and very broad guideline which will remain a dynamic document for further improvement as we gain more local experiences in OA.

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