TECHNOGUIDE

IN THE PRODUCTION AND MANAGEMENT OF

ORGANIC HIGHLAND

VEGETABLES

GO ORGANIC!

The production of agricultural crops particularly highland vegetables without the use of chemicals is becoming a common trend here in the Cordillera Administration Region. With its good climate, the region is very suitable for the production of highland vegetables such as cabbage, Chinese cabbage, broccoli and carrots making it among the communities' main sources of living.

Moreover, the vegetable-producing provinces such as Benguet and some parts of Mountain Province and Ifugao are seen to have a competitive advantage in promoting organic agriculture. To note, organic agriculture is becoming popular in many parts of the region as manifested by the growing numbers of organic agriculture practitioners and farm areas grown with organic products. In 2015, the Philippines ranked 4th with the largest organic area in Asia (NOAP FY2017-2023, 2018).

It is however, undeniable that conventional farming have and still dominates many farming areas that have brought many issues and concerns that need to be addressed. Various researches and testimony from farmers have noted that the continuous use of synthetic chemicals and fresh chicken dung, among others, for more than half a century created a problem in the soil, environment, human health and the profitability of vegetables.

Much has been said and done to counteract these issues, yet much still needs to be planned and done to prevent the total degradation of the soils. And one of these interventions by the government is the passing of the Organic Act of 2010 which served as the official start of race towards sustainable agriculture.

The Department of Agriculture through its Organic Agriculture Program, together with its partner implementing agencies, local government units and organic farming practitioners, continues to create awareness among the farmers on the negative impacts of relying solely on synthetic chemicals while promoting the advantages and benefits of going into organic farming.

Hence, this technoguide is crafted mainly to help create awareness and promote the production of organic highland vegetables that is seen to contribute towards healthy lifestyle, establishing and tending a garden of healing, environmental conservation and sustainable agriculture.

WHAT IS ORGANIC AGRICULTURE?

- It is the holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity;

- It emphasizes on the use of management practices over the use of off-farm inputs; and utilizes cultural, biological, and mechanical methods as opposed to synthetic materials, and

- It combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

The diversity of crops and cropping systems on organic farms should sustain and promote diversity that is suited to local agro-ecosystem. Crop diversification systems include crop rotation, intercropping, alley cropping, relay cropping and multi-story cropping may be used.

(Philippine National Standard for Organic Agriculture, 2016)

Principles of Organic Agriculture

Principle of Health.

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

Principle of Ecology.

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

Principle of Fairness.

Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.

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.

These Principles are the roots from which organic agriculture grows and develops. They express the contribution that organic agriculture can make to the world, and a vision to improve all agriculture in a global context. They also guide in the development of positions, programs and standards.

(International Federation of Organic Agriculture Movements – Organics International)

Organic farming is a holistic approach of farming that does not only consider one side of the coin, but turns both side of the coin as it tries to remind the people as stewards of these resources. Lessons learned from the increasing and alarming effects of chemical-based farming should now then be resolved. Farmers have two responsibilities in Genesis 2:15: And the Lord God took the man, and put him into the garden of Eden to dress it *(talonen na)* and to keep it *(aywanan na).*

FOUNDATION OF ORGANIC FARMING

Soil is one of the most important factors and considered as the foundation in organic farming. Good soil preparation defines good farm produce. Healthy soils are key to biodiversity, food security and it play fundamental roles against climate change. And one way of making the soil healthier is by applying composts.

Compost is naturally-occurring known as the most complete fertilizer. Compost is a nutrient humus-like material produced by the biological decomposition of organic materials such as vegetable debris with the help of microorganisms and other decomposing agents.

Properly composted materials are stored well. These are biologically stable, free from unpleasant odors and easier to handle than raw organic wastes.

HERE ARE SOME BENEFITS OF COMPOSTING:

- Enriches soil, helping retain moisture and suppress plant diseases and pests
- Reduces the need for chemical fertilizers
- Encourages the production of beneficial bacteria and fungi that break down organic matter to create humus, a rich nutrient-filled material
- Reduces methane emissions from landfills and lowers your carbon footprint
- Promotes cleanliness and help solve garbage problem
- Environmental-friendly
- There are also readily-available duly approved and recommended organic fertilizers in the market.

CULTURAL PRACTICES OF GROWING SEMI-TEMPERATE ORGANIC VEGETABLES

Seed Production/Selection

a. Seeds of temperate vegetables (e.g. cabbage, broccoli, cauliflower, Chinese cabbage, carrot) which require vernalization, are difficult to produce in the Philippines. Thus, farmers are entirely dependent on imported seeds.

b. Seeds of leguminous crops (e.g.snap beans, garden pea, lima beans) are easy to produce. Pods for seed extraction can be harvested from the base, middle or top portion of the vine (Kudan, 1995).

• To avoid weevil infestation, a major problem in bean seeds during storage, harvest the pods when they start to dry up. More weevils attack when bean pods are left or allowed to dry in the plant for 1-2 weeks (Tomas, 1999).

c. Organically-produced seeds may be obtained from accredited sources due to the difficulty in producing these seeds.

Pechay seeds attain physiological maturity 38 days after silique set with maximum seed dry weight. Siliques are yellowing and starting to shrivel with the seeds already black in color. At this period, germination is highest. The percentage of normal seedlings is also attained.

In CAR, planting crops for seed production must be done towards the end of October and early November not only to have higher yield, but also to provide enough sun drying period in March. Keep dry seeds (7% moisture content) in air-tight containers such as jars, plastic and tin cans then stored in dry and cool room.

Land Preparation

1. Clean the area intended for planting vegetable seeds.

2. Remove the weeds then prepare plots (1m wide and a length preferred by the grower).

3. Level the plots, then apply 2-4 kg per square meter of organic compost as fertilizer base-dress or basal fertilizer. Plots rich in organic matter do not require cultivation anymore which will have economic benefits and soil conservation advantage.

Seedling Production and Transplanting

a. Directly sowed vegetable seeds (e.g. carrot, radish, sugar beet, snap bean, garden pea, cucumber) in the garden need not to be established in nurseries.

b. Sow leafy vegetables seeds (e.g. Brassicas, lettuce, celery, pepper) in seedling trays. This practice is more convenient compared to growing the seedlings in seed boxes and seed beds.

• Sterilize the soil media to be used to ensure healthy and vigorous seedlings. Cool the media and place in the holes (cells) of seedling trays. Soil media is a mixture of one part compost, one part garden soil and one part sand or rice hulls. Make sure that the soil media is properly mixed.

• Transplant seedlings when they are 3-4 weeks old.

• Transplanting depends on the crops. Some crops such as celery and lettuce needs to be pricked before finally transplanting in the open field.

In transplanting the seedlings, the protruding bottom of each seedling cells are pushed for the seedlings to be released. The seedlings are set on the plot with the following spacing:

• **Cabbage:** 30 cm x 30 cm double rows per plot

• **Chinese cabbage:** 30 cm x 30 cm double rows per plot

• Broccoli: 35 cm x 35 cm double rows per plot

• Cauliflower: 30 cm x 30 cm double rows per plot

• Iceberg lettuce: 30 cm x 30 cm double rows per plot

• Romaine lettuce: 15 cm x 15 cm triple rows per plot

• Celery: 15 cm x 15 cm triple rows per plot

• Pepper: 40 cm x 40 cm double rows per plot

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Direct Planting of Vegetables

For vegetables like snap bean, peas, carrots, radish, cucumber, the seeds are directly transplanted in the plot with the following spacing:

- Snap beans and peas: 20 cm x 20 cm; two seeds are planted per hill at a depth of 2.5 cm, double rows per plot.
- Cucumber: 30 cm x 30 cm, two seeds per hill at a depth of 2.5 cm; double rows per plot.
- Sugar beet: 20 cm x 20 cm, one seed per hill at a depth of 2.5 cm, triple rows per plot.
- Radish: 25 cm x 25 cm, double tows; two seeds per hill at the depth of 1.5 cm.
- Carrot: 10 cm x 10 cm, 7 rows of plants; 2-3 seeds per hill at a depth of 1.5 cm.

Note: Snap bean is a short day plant so planting should be from September to March for better yield performance. Long day plants like spinach, carrot, radish and sugar beet which tend to elongate and flower when planted toward long days tare to be planted on the later part of April to May.

Thinning the Plants

Gently uproot or remove other plants and leave only one plant per hill in the production of carrot, radish, and sugar beet. This thinning is done 2-3 weeks after seedling emergence, when the weak and abnormal or unwanted seedlings can be distinguished.

In thinning, the soil is disturbed and so with the roots, thus make sure that the soil is moist and avoid thinning on a hot, sunny day.

Irrigation

Source of water for irrigation must be clean. Water the plants every three days or twice a week. Fruit vegetables such as pepper, cucumber, snap beans and garden pea require adequate water supply during flower initiation to fruit development. Use clean water in watering the plants.

Fertilizer Application

Compost is, by far, the most widely used fertilizer and soil amendment in organic farming. There are also certified farm input amendments available in the market. Always remember to only apply fully decomposed compost manure and use only as directed especially for those readily-available amendments. Manure of dogs, cats and humans are prohibited for compost.

ARE OF THE PLANTS

Hilling-up

It is an effective weed control and a way of fixing the plot to minimize water run-off during irrigation and to anchor the plants. This is the practice of bringing the soil from the canal in between plots with the use of grub hoe to the base of the plants. Hilling-up may not be done in plots of leafy vegetables such as spinach and lettuce, which can be harvested in a short time.

Hilling-up in carrot, radish, sugar beet and the rest of the vegetables, is necessary to cover the roots with soil to prevent discoloration due to sunlight exposure.

Trellising or Training

Immediately after hilling-up, provide trellis to the snap bean, garden pea, cucumber, and other twining or trailing crops. Put sticks interwoven diagonally (fence type) at the middle of each plot.

For garden pea, bind the vines with plastic twine when they are about 20 cm high to train them to follow the trellis. The vine may be tied four to six times along the trellis, depending on the crop's height.

Mulching

It is done when crop is already established. Cover the surface of the plot with dry grasses, at least 6-8 inches thick so that when it settles, the thickness will drop to two inches just enough to prevent the growth of weeds up to four months.

Mulching may be defined as the process of covering the soil surface around the plants in order to create congenial condition for the crop's growth. These conditions include moisture and soil conservation, temperature moderation, and weed control.

Pruning

Pruning is the removal of parts of a plant for various reasons like to control plant size, to help train plants that you want to climb a trellis, to improve light and air flow around the plant and thus, lessens the threat of pests and diseases. It also improves quality and size of harvest. This is usually done by removing all lateral branches maintaining 2-3 main branches to grow and pruning the damaged and other unnecessary branches.

Fruit thinning

This is usually done for fruit-bearing vegetables like tomato. Thin excess fruits when the fruits are already the size of the end of your little finger to enhance growth of remaining fruits. It also increases light exposure to fruit that decreases fruit pest or disease incident because of the increased space between fruits. Also, fruit thinning reduces total load on the branches, thus, preventing breakage.

METHODS IN PEST, DISEAS

A. Preventive Method

1. Crop rotation – practice of alternating the species or families of annual/or biennial crops grown on a specific field in a planned pattern or sequence so as to break pest and disease cycles and to maintain or improve soil fertility.

A good cycle for crop rotation starts with Heavy Feeder to Light Feeder to Heavy Giver.

Heavy feeder - heavy feeding on fertilizer like fruit-bearing (e.g. tomato), head forming (e.g. cabbage); flower heads (e.g. brocolli)

Light feeder - lightly feeding on fertilizer like the green plants (e.g. lettuce)

Heavy giver - gives fertilizers like the legumes (e.g. beans, peas)

companion planting marigold with vegetables

2. Companion planting - plant different plants that enhance each other's growth and protect each other from pest as it attracts beneficial insects, including pollinators. This method also help in keeping the weeds out and help in breaking/slowing down spread of disease.

Example: Trap plants like eggplant placed beside the pechay (main crop). Flee beetle will be attracted to the eggplant.

Aromatic plants (marigold, rosemary, oregano, and other herbs) placed beside the main crop has repelling action against insect attack.

3. Planting quality seeds which are more resistant to common diseases among crops.

4. Practice good sanitation/cleanliness - decomposing materials should be placed in one area. Infected crops should not be left in an area but collected and be buried deep so that it will not infect the other crops. Farm tools and equipment should be used exclusively in the organic farm. In case that these are used in non-organic farms, proper cleaning and sanitation to remove residues of synthetic pesticides must be done.

SE & WEED MANAGEMENT

B. Physical and Biological Methods

1. Physical barriers - barriers such as greenhouse, nets (nylon) is used to deter insects from infesting the main crop.

2. Biological control – this is done to control pests such as insects, mites, and plant diseases using other organisms known as biological control agents. Some of these biological control activities include placing of sticks in an open field for birds to rest wherein they can also eat larvae of pests.

- ***Predator insects:*** Adult lady beetles and their larvae are voracious aphid-eaters. Green lacewing larvae feed on all kinds of pests, including mealybugs, whiteflies, mites and thrips. These and other beneficial bugs are probably already in your garden.

- ***Parasitic insects:*** Parasitic wasps lay its eggs on and in its living targets. Eggs hatch, and then feed inside the pest. A mummified aphid with a round hole in its back is evidence that parasitic wasps have been at work.

- ***Biological pathogens:*** Bacillus thuringiensis, also known as Bt, is a soil-borne bacterium that fights mosquitoes and insects in the larval, caterpillar stage. This and other pathogens are effective biological insects for very specific pests.

The release of local and acclimatized predatory insects, such as earwig and Trichogramma, and the use of microbial pest control agents, such as bacteria, viruses, and fungi are allowed subject to appropriate existing phytosanitary regulations and measures. Releasing of such organisms must also be done in a manner that these do not damage the natural ecosystem. (PNS OA, 2016)

3. Hand-picking – this is the picking and removing of harmful pests, disease-affected crops and weeds in the area.

C. Concoction Production/Use of certified organic pesticides

This is done when the physical or biological methods are inadequate to control pests. There are certified organic pesticides that can be bought from the farm supply markets.

You can view full list of certified farm input ammendments from the official website of the Bureau of Agriculture and Fisheries Standards at www.bafps.da.gov.ph.

HARVESTING & POST-HARVEST MANAGEMENT

The farmer must ensure that the quality of harvested fresh crops be maintained before it reaches the intended market. Once the vegetable is harvested, its quality cannot be improved, but only maintained at best.

Guiding principles in harvesting vegetables

1 Harvest the farm produce before sunrise (general rule) - carbohydrates in crop turn into sugar during night time, causing the crop to taste sweeter. Mature crops should already be taken out from the field before photosynthesis takes place (or when the leaves are reached by the sun) to retain its sweetness. During photosynthesis, sugar are converted back to carbohydrates.

2 Harvest crops at its prime for optimum taste and quality or maturity index. Over-mature crops have reduced table quality and delay maturity of succeeding fruits.

3 Fruits ripened on the plant itself are healthier and tastes better compared to those picked before it reached its maturity.

4 Nice, clean cut adds quality to the vegetables. Cut vegetables using sharp knife or scissors to prevent damage to the plant. Use clean and sanitized harvesting tools to reduce post-harvest losses.

Note: There is no precise guideline to know if vegetables are to be harvested, but there are some rules of thumb to guide the vegetable grower.

5 Add a portion of the peduncle of some fruit vegetables which is a manifestation that the farm produce sold in the market is freshly harvested.

6 Severe or detach the vegetable or fruit at appropriate abscission zones or commercially accepted stem lengths. Avoid inflicting injuries during harvest.

7 Feel method is the easiest way of determining if a plant is ready for harvest. (e.g head is tough, when it softens, it is over-mature or past its prime). Feel method is the use of hand to feel the firmness of the vegetables to indicate whether the crop is already matured and ready for harvest.

8 Keep harvested crops in shady areas to keep it cool as possible. When directly hit by the sun, the water content in harvested crops will evaporate, causing reduced market quality.

Note: Harvesting time for vegetables is also affected by chosen market. If the produce is to be shipped , harvest in a less-ripe stage so that it will be firmer and be travelled better.

VEGETABLE HARVESTING CRITERIA

Here are your guide criteria for judging whether your vegetables are ready for picking (S. Kudan, 2013):

SNAP BEANS: Pick before the seeds are bulging. The pods should easily snap into two. It does not take long for beans to go tender to tough so checking everyday is a must. Under Benguet condition, harvesting is done every 2-3 days.

LIMA BEANS: harvest when the pods first start to bulge with the enlarged seeds. Pods must still be green, not yellowish.

There are 3 stages of maturity for peas and snap beans: green mature pod stage (for tender pods); tender seed stage (for tender seeds); and ripe seed stage (for ripened seeds which are mainly intended for planting).

BEETS: Ready any time after the beets' shoulders are protruding at the soil line. It is a matter of personal preference when it comes to the right size for harvesting.

BROCOLLI: harvest the dark green, compact cluster or head (curd) while the buds are tight before any yellow flowers appear. Smaller side shoots will develop later, providing a continuous harvest.

CABBAGE, CHINESE CABBAGE: harvest when heads feel hard and solid.

LETTUCE (HEAD): harvest once the head feels full and firm with a gentle squeeze. This is 55 to 60 days after planting. Hot weather will cause it to bolt or go to seed rather than filling out.

LETTUCE (LEAF): harvest the outer leaves once the plant has reached about 4-6 inches in height. Allow the younger, inner leaves to grow. Leaf lettuce can be harvested in this fashion for most of the summer.

CARROTS: this is difficult to judge. Harvest when the roots are 3/4 to 1 inch in diameter so it is needed to pull one to be certain. Carrots can be left in the ground once mature, if mulched. A light frost is said to improve and sweeten the carrot's flavor.

WATER CRESS: best grown in flowing waters. Can be harvested at 5-7 inches tall, after 25 days of transplanting.

CELERY: medium-sized celery is preferred by most farmers. Dark-green celery has high vitamin A.

PEPPERS: Harvest sweet peppers when the fruits are firm, crisp and full-sized. Green peppers will turn red if left on the plant. Allow hot peppers to attain their bright red color and full flavor while attached to the plant, cut and hang them dry.

VEGETABLE HARVESTING CRITERIA

POTATOES (IRISH): harvest tubers when plants begin to yellow and die down. Store the tubers in a cool, high humidity location with good ventilation such as basement or crawl space of the house. Exposing them to light causes greening which denotes the presence of dangerous alkaloids.

TOMATOES: harvest the fruits at the most appealing ripeness 3/4 up to fully red-ripe. Flavor is best at room temperature, but ripe fruit may be held in the refrigerator at 45-50 degree Fahrenheit for 7 up to 10 days. Depending on market, it can also be harvested while still green as it will ripen and soften later on.

PECHAY: For flowering, harvesting is best when three florets have opened which also provides best quality taste. Cut the vegetable 2 inches above the ground. For non-flowering, farmers may harvest it depending on their desired size. Usually, it can be harvested 35 days after planting.

CILANTRO (WANSOY): Can be harvested 35 days after planting the seeds or when the plants attain 18-25 cm high. This crop easily wilts so wrap the roots with wet tissue paper before packing in a plastic bag.

Quality of vegetables at harvest can only be maintained by proper postharvest handling.

Secondary handling practices should be avoided specifically repacking. It was noted that 20-30% of crop losses are due to repacking and rough handling of vegetables.

After removing crop from the mother plant, observe the following:

a. Keep it 90% clean then put it in harvesting trays.

b. Wait for the crop to cool down to eliminate the accumulated heat of the sun. It usually takes 2 hours during summer and around 30 minutes during the rainy season for the heat in the plant to subside.

c. Weigh the crop then pack it immediately.

Other post harvest activities:

A. WASHING - done in carrots, radish, green onion and sugar beets to remove the dirt and expose the attractive skin of the produce. These vegetables should be gently washed through the use of foam.

B. TRIMMING - usually done in leafy vegetables to remove the parts that are diseased, damaged and in carrots and radish to remove the leaves.

C. PACKAGING - cleaned vegetables are packed in plastic crates that can protect the produce from damage during its transport to the market. Proper packaging is also significant in maintaining the quality of the produce.

*Vegetables must not be packed in reused bags or containers that have been in direct contact with any harmful/contaminated substances.

D. LABELLING - Putting a label in your organic produce gives identity and integrity to your product. Always place the name of the producer in his/her product as a way of building the name of the producer and establishing his integrity as organic producer.

E. TRANSPORTING - always observe 'tender loving care" or TLC in handling the produce from the field to the market.

Here are some recommendations in transporting organic produce from farm to market:

1 Separate containers and even vehicles of organic produce with others.

2 Shipment at night is preferable because it is coolest time of the day. It reduces transpiration rate affecting leafy vegetables and other crops.

3 Add insulation between the produce and the outside. Containers with seal can be used to reduce the occurence of contamination from the outside.

Shelving: Depends on the maturity of the crops at the time it was harvested. Both immature and over-mature crops cannot stand long in the shelf.

Remember:
1. Do not mix organic farm produce from conventional products when they are displayed at the shelves in the market. Put demarkation or proper identification of organic and conventional produce.

2. Do not put root crops and fruits near leafy vegetables especially when there is less ventilation. Root crops and fruits emit ethylene gas that causes rapid maturity, wilting and yellowing of leafy vegetables.

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**Some of the photos used were lifted from the internet.*

**This technoguide has undergone technical review by Mr. Oliver S. Pe, Agriculturist II (Organic Agriculture Program) and Mr. Landes B. Teofilo, Senior Science Research Specialist (Research Division) of the Department of Agriculture-RFO-CAR.*

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