

***A TRAINING ON ORGANIC VEGETABLE  
CULTIVATION PRACTICES THAT PROMOTE SOIL  
PRODUCTIVITY AND CONSERVATION***

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*This training is more practical with trainees learning-by-doing. This guide is prepared to give additional knowledge to trained persons on organic vegetable cultivation practices for the sustainable management of their farms.*

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## **ABOUT CAMGEW**

CAMGEW is a not-for-profit organization created in October 2007 with authorization number N° 000998/RDA/JO6/BAPP to look for a solution to environmental and women's issues in Cameroon. CAMGEW works locally and thinks globally, integrating gender in solving environmental problems in Cameroon. CAMGEW from 2012 to 2017 planted 64000 bee loving trees in the Kilum-Ijim forest and trained 818 bee farmers in honey production and bees wax extraction. She has also distributed more than 695 beehives to trained bee farmers. She has organized more than 1000 bee farmers into 5 Oku White Honey cooperatives located around Kilum-Ijim forest. 572 farmers have been trained on agroforestry techniques. As of December 2017 about 987 women have been trained on business skills and 907 women received financial assistance in form of loans. 24 teenage boys and girls have been trained on dress making, shoe making and hair dressing. CAMGEW has also developed 3 tree nurseries with more than 150.000 trees. CAMGEW believes that the future of our mother planet-earth is in the hands of men and women, young and old and also that this planet can be sustained by putting social and environmental justice at the centre of development

## **WHY VEGETABLE GARDENING FOR MBORORO WOMEN**

CAMGEW sees the need for Mbororo women to join in the fight against poverty and unemployment. Mbororo women are a treasure to our nation and need to contribute in nation building. CAMGEW has identified their potentials as follows

- Their husbands have animals and so they have access to animal dung that they can use as manure in their farms or sale to other farmers to make money
- They have enough land and animal dung to produce enough food to feed their families and remain healthy
- The vegetable market or value chain is still unexploited and this is an opportunity for them to create jobs and fight poverty
- The women form part of the family and so need to support their husbands to develop this family and their community through their contribution to health, education of children, clothing, feeding of the family
- Many women now have strong economic power and so mbororo women have this potential

## INTRODUCTION

Organic vegetable gardening means the use of natural manure on the soil. A balance of nutrients in adequate supply is maintained by applying nutrient-rich natural materials like animal dung, compost manure or humus to supplement nutrients supplied by soil minerals and organic matter. Some organic fertilizer materials are purchased as processed inputs.

In many poor communities with animals they use animal dung to add soil fertility. Compost manure is also good for improving soil fertility. A combination of some plants in farms that are rich in nutrients can increase soil fertility. This include nitrogen fixing plants like beans, tephrosia, sesbania, leuceana, calliandra, etc

Naturally grown food either in natural soil or soil that are fertilized with natural manure is healthier and helps farmers reduce cost as chemical fertilizer is more expensive.

Food is considered organic if chemical fertilizer and pesticide is not used on the soil or on the plant to fight pest. We need to take care of our health through what we eat and conserve the soil as a gift to mankind that needs to be transferred to future generations. It is for this reason that CAMGEW is promoting organic vegetable gardening. This will permit the use of animal dung like sheep, goat and cow dung which is available in the community to produce vegetable for consumption and marketing. There are many people in towns and even around your community who want to eat organic vegetable and they cannot get it. Cultivating vegetable will satisfy other people's needs, raise money and become employed. The animal dung will not more be useless. Our husbands and family need our support to support the development of our families and community.

We should know that compost manure and other agroforestry systems can help us improve soil fertility without using chemicals.

Organic food is produce without the use of chemicals like chemical fertilizers and pesticides (herbicides, rodenticides, insecticides, etc). We use biological pest control like scare crews, organic pesticides, traps, etc). We are going to discuss ways we can produce organic vegetable.

Vegetables are delicate food because it has a short period to get to maturity and when chemicals are poorly used to add soil fertility or tackle pests they became a danger to mankind. Health problems resulting from vegetables come immediately.

We discourage the use of chemicals in farms because they are expensive, they make the soil sick, they kill useful insects and organisms to farmers, they bring some diseases to man like cancers, growths, etc in a long term when they are poorly used. When poorly used they are harmful to man, the biodiversity, soil, and the environment in general. They can increase food production but the quality of food produced needs to be verified whether they are good for human consumption. If you have a means to avoid using chemicals in farms especially with the availability of organic manure then do it.

# I. TYPES OF WAYS TO DO ORGANIC AGRICULTURE

## A) USE OF ANIMAL DUNG IN VEGETABLE FARMS

There are many ways we can use animal dung in farms for vegetable gardening. We are going to look at the various ways:

- a) Free movement of animals in area to be cultivated with vegetable: We could allow animals to move freely in areas to be cultivated with vegetable so that they eat the vegetation there, defecate and urinate in this area. Animal urine is rich in urea and animal dung is rich in organic manure. The animals will fertilize the area. This area could then be fenced and cultivated with vegetables like huckleberry, cabbages, pumpkin, garden eggs, etc.
- b) Collecting of animal dung to apply in farms: We can collect animal dung like cow dung, sheep dung, goat dung, fowl droppings to apply in vegetable farms. Cow dung could be collected from the field where cows feed and move daily. They defecate as they move or feed. The dung need to be dry before applying on farms if the farm is cultivated and vegetable planted. They could be applied during cultivation and allowed to rotten. If it is dry it should be turned to powder and then mixed with soil in the ridges in the farm. The dung could be collected where the animals stay and dried for use. We should know that not every person who want to cultivate organic vegetable have organic manure. This is an opportunity for us to collect the animal dung use some and sell some to other people ready to practice organic farming. This will give us extra money to buy other family needs that we cannot get from the farm or help us support our husbands in paying children school fees, paying hospital builds, building our houses, etc. It will help other people cultivate healthy food for consumption.

The animal dung could be applied in farms either by mixing the dry one in powder form with soil in ridges before planting or spotting it in prepared holes where the crop will be planted. The best where to apply dung in farm is to mix dry animal dung on the soil in the ridges before planting. This will permit the plant fibrous roots to make use of the manure found all over the bed.

## B) ALLEY CROPPING

Alley cropping is the planting of strips of 'green manure' trees among crops. These green manure trees serve the vital role of producing nitrogen-rich organic matter (mainly in the small, easily degradable leaves) which drops naturally or is harvested and mixed into the soil like animal dung, ultimately increasing soil fertility. Despite the fact that the rows of trees reduce space for planting, experience shows that because of the increased soil fertility and crop production has increased. For example, a field with leucaena, Acacia and Calliandra trees will produce massive quantities of vegetables, fuel wood, organic fertilizer and high-protein animal forage, all at different times of the year. CAMGEW trainers will demonstrate this during training

in the training hall and in the demonstration farm. Trees used in alley cropping also helps in reducing soil and water erosion in farms.

**Design:** Spacing among the rows of trees and among the trees themselves is highly variable. One of the major considerations is that the rows should run east to west - following the path of the sun to ensure that there is not too much shading among rows. Spacing between rows ranges from 4 to 20 meters, depending on the farmer's preferences.

**Harvesting:** The rows of trees are often harvested at 50 cm to 1 meter height. Branches are used for construction and fuel wood, and leaves are mixed into the soil as an organic fertilizer, though leaves of some species like leucaena are also collected and used as a high-protein animal forage (after which the manure can be added back to the soil). These trees must be ready to grow fast and even after cut many times. CAMGEW team will work with you to identify other locally available trees in your locality that can increase soil fertility and see how an agroforestry system could be developed using these trees to increase soil fertility in your farms.

### **C) COMPOSTING FOR VEGETABLE CULTIVATION**

Compost is a cheap and effective organic method that can be used instead of commercial fertilizers to improve the soil. Composting is a process that transforms organic materials into humus. This in simple terms is the bringing together of organic matter that is moist and allowing it for some time to rotten or biodegrade to ready-made-manure or humus for use in farms. Soil is composed of both organic and inorganic material. Humus is the organic matter component of soil. Many types of organic waste can be decomposed to create a valuable natural fertilizer that enhances the quality of your soil. Proper use of compost improves soil structure, texture and aeration, and increases the soil's water-holding capacity. It loosens clay soils and helps sandy soils retain water.

**Home practice:** We use to dig a hole where all waste from the house was dumped excluding plastics, metallic materials and other non biodegradable materials. The dumped waste get rotten and forms manure. We could remove this manure and use in farms or plant crops like yams, plantains, banana, etc and they will do well. In this compost hole we poured dirty water, the sun shined on it and compost manure was formed fast.

Adding compost improves soil fertility and stimulates healthy root development. The organic matter provided in compost is further broken down by macro-organisms like earthworms, millipede, centipede, etc and microorganisms like bacteria and fungi in the soil, keeping the soil in a healthy, balanced condition. It is for this reason that it is not a healthy practice to burn farms or use pesticides in farms because they kill even untargeted useful organisms in farms. Adding compost to gardens, nurseries, and crop fields adds natural strength to soil in the form of nutrient-rich organic matter along with plenty of beneficial microorganisms. When organic matter biodegrades, nutrients (Nitrogen, Phosphorous, Potassium, Aluminum, Magnesium, etc) are release to the soil. Adding chemical fertilizers is a short-term fix that actually causes long term problems, while adding compost to soil is a long term solution that causes no problems.

You will know the compost is ready when it no longer heats up after being aerated. Finished compost is dark brown and earthy smelling.

When you gather organic waste in one place and allow it to rot, it gives you organic manure.

### **What Goes into Compost?**

Proper composting relies on aerobic decomposition, which consists of: 1) carbon and nitrogen rich organic materials, 2) air, and 3) water. Carbon-rich materials are old brown or yellow fibrous vegetation like stalks and dry leaves. Nitrogen-rich material includes green vegetation and fresh manure. You can put nearly any organic waste into compost; just be sure it does not have any pesticides or other chemicals on it. Anything green or brown can be added. Crop residues, weeds, peanut shells, grass clippings, weeds (the high temperatures and decomposition will kill the weed seeds so they are not distributed when you use your compost), tree leaves, animal manure, fruit peels, egg shells, coffee grounds, etc. You should also mix in soil and a little wood ash.

### **Putting Compost Together**

The compost will begin decomposing more quickly if the materials you add are chopped into small pieces. Mix the compost pile regularly to maintain adequate aeration; the decomposition process will need plenty of oxygen or it will begin to smell badly. During rainy seasons, the compost can be arranged in a pile. During dry seasons, it is best to put it in a hole or pit to keep the moisture from evaporating.

## **D) IMPROVING SOIL FERTILITY IN FARMS THROUGH NITROGEN FIXING TREES**

Some trees help in fixing nitrogen in the soil. Nitrogen is one of the 3 essential elements that increase soil fertility. Some plants absorb nitrogen through their roots into root nodules and fix it to useful nitrogen for plants. Some organisms help these plants in fixing nitrogen like nitrogen fixing bacteria. These plants are leguminous plants. When you uproot these plants from the soil you will find nodules on the roots of the plants. Examples of these plants are beans, Luecaena, Tephrosia, Calliandra, etc. The leaves of these plants are very rich in nitrogen and it is for this reason that these leaves are harvested to feed animals because of their nutritive value. When the leaves are cut and littered on vegetable garden they enrich the soil heavily with nutrients. Most of these trees are used in Alley Cropping. Beans also enrich the soil as they fix nitrogen to the soil.

## **E) WASTE SORTING**

Farmers need to work hard to improve on soil fertility. Sometimes a lot of waste is produced at homes. This waste is mixed with non-degradable materials like plastics, metallic, biodegradable materials like pilings of plantains, potatoes, leftovers of food, stalks of corn, beans, etc. The waste that can rot should be separated from waste that cannot rot. The waste that can rot should be applied in farms. They could be placed on furrows ready for use as manure during cultivation. We can all testify that food crops cultivated around home do better than those cultivated further away and the simple

reason is that much waste is deposited close to the surroundings where we live and this later serve as manure that makes crops grow better. CAMGEW encourage waste sorting to get better organic manure and also to better manage waste to protect the environment.

## II. SEEDS AND TRANSPLANTS

The selection of vegetable seeds for transplant should be careful. We must make sure we get good seeds because if you nurse bad seeds you will get poor yields or the seeds will not germinate and this is time wastage. If there are places to buy seeds make sure you check that they are not expired and that the variety of vegetable is one that is grown locally. We have some people who have experience in vegetable gardening and they have been doing it for long. They have gathered much experience and can be useful. We should make use of the government agricultural technicians posted in your areas or persons with skills.

## III. DISEASE MANAGEMENT

Diseases can be very difficult to control in organic systems. Once a disease is present and the environmental conditions favor disease, there is little an organic grower can do. Therefore it is best to be proactive. The following items are important to understand plant disease management.

- ***Crop Rotation*** - Many disease-causing microorganisms (**pathogens**) can survive in plant debris. When one plants a specific crop year after year in the same soil, the pathogens can build up to high levels. Crop rotation allows the plant debris to decay and the associated pathogens to die out. If pathogens survive in the soil itself, crop rotations will have to be longer. Growers should rotate from the crop in question to a crop in another family. For example, after growing tomatoes, one should avoid tomatoes, potatoes, peppers, and eggplants for the length of the rotation. Whether crop rotation is effective or not and the length of crop rotation required under each crop/disease combination. If the table lists two years, plant a different crop for two years before planting the original crop again.
- ***Tillage*** - Decay of plant debris can be hastened by tilling the debris into the soil. The sooner the plant debris is buried, the sooner decay starts and the pathogens die out. Therefore, it is often wise to till a field. The deeper the debris is buried, the better.
- ***Resistant Varieties*** are an organic grower's best friend. Plant resistant varieties to avoid disease problems in the first place. Some varieties are listed as partially resistant or tolerant. Whereas resistant varieties show very few symptoms of the disease.
- ***Saving Seed*** - It may be tempting to save seed from your favorite varieties for use in future years. All vegetable growers should realize, however, that there are certain dangers to saving seed. Many diseases can be seed borne. This means that a disease that was present in the plant can be carried in the seed and thus may cause disease problems when planted. In addition to plant disease problems, saved seed may not have the characteristics of the original variety. Saving vegetable seeds requires special skills and equipment.

## IV. WEED MANAGEMENT

Organic growers manage weeds using a combination of methods. The mix of weed species in a field changes in response to the cropping practices used over a period of years; the weed species and types most adapted to the practices in use will increase in number, and those poorly adapted will decrease. The more diverse the weed management program, the better chance that no weed will be well-adapted to it.

- **Prevention** - Minimize weed seed additions to the soil. Weed seeds can live for many years in the soil, but some buried seeds die or are eaten every year. If the addition of weed seeds can be avoided, the number of viable weed seeds decreases and it will be easier to control the remaining weeds. Do not allow weed to flower before weeding and should this happen make sure seeds are not formed. Weeds can also be brought into a field in manure, compost, hay, animals, animal feed, and other material. Whenever you apply something to a field, make an effort to learn whether there are weed seeds present, and evaluate benefits of the material versus potential for causing a weed problem.
- **Cultivation** - Cultivate using mechanical and hand tools designed for the particular crop and weed stage.
- **Crop Rotation** - Rotate crops and planting dates to disrupt weed life cycles. Organic growers can plan rotations so that a weed species favored in one year will not be favored in another year.
- **Mulching** - Mulch is a material covering the soil surface. To control weeds, the mulch must block nearly all the light that reaches the soil, so that weeds which emerge underneath the mulch do not have enough light to survive. Mulches provide additional benefits, including keeping the crop clean, reducing loss of soil moisture to evaporation, and (if organic) adding organic matter to the soil.
- **Biological Diversity** - Encourage biological activity to reduce weed seed survival. Weed seeds are eaten by a variety of soil organisms, attacked by microbes, and eaten by insects, rodents and birds. The more biological activity in the soil and environment, the fewer weed seeds will be left to germinate. Practices such as adding organic matter to the soil, using mulching, rotating crops, planting a variety of crops, and cultivating diversity along field edges all promote biological activity.



## CASE STUDY

### *SOLANUM SCABRUM- Njama-Njama or Huckleberry*

#### **Seed processing and germination problems with *Solanum scabrum***

*Solanum scabrum* berries are easy to collect since they always remain on the plant. A popular way to extract seeds in Cameroon is for farmers to put the berries in a bag with small holes on the bottom and hang the bag in a ventilated environment. The fruits rot and juice leak out and the seeds dry out. The seeds are collected dry in berries and this reduces chances of damage by mice and other rodents. Fruits could also be squashed in a container with or without water and seeds collected and dried. From 1 Kg of *Solanum scabrum* berries, farmers obtain about 40 g of seed. The number of seeds/berry varies from about 20-60 depending on variety and conditions. Many farmers experience problems with the germination of seeds. This may be due to: low vigour caused by inadequate removal of sugar and removal of germination inhibitors present in the fruit. These inhibitors include Abscic acid and ethylene, which normally prevent seeds from germinating within the fruit. The second reason is that seeds may not be dried well enough or that seeds are kept under ambient conditions in an environment with varying humidity.

Seeds need to be very dry and kept in airtight container. Seeds can remain viable for several years when kept dry. Seeds usually take 5-7 days to germinate but could take longer when the soil moisture content is inadequate.

#### **Pests and diseases**

Huckleberries and black nightshades are frequently eaten by insects but apparently people do not mind buying leaves with holes in them (it is a sign that chemicals have not been used). In

Cameroon, ants are said to be responsible for holes. Black aphids may cause leaves to curl and affect further growth of the plant. In some areas aphids appear to have taken over altogether and even when they are controlled by chemicals, the characteristic curly leaves remain. Caterpillars and occasionally grasshoppers can also be most problematic.

Small black beetles found at the underside of huckleberry leaves cause those leaves to twist and fold, making them unattractive for sale. Black aphids, millipedes and snails have been reported in Kenya. A traditional cure for pests is wood ash, spread onto the leaves. Chemicals are not always effective against insects that are hiding underneath the leaves. Many farmers believe that the effects of chemicals last only 24 hours and will thus harvest one day after spraying, thus causing problems to consumers. A major disease in huckleberry was found to be *Phytophthora infestans*, the late blight which is also common in tomatoes and Irish potatoes. This causes a grayish rot of leaves and stems and drop of leaves. It is said to be particularly problematic during the rainy season when temperatures are low. A second important disease is *Cladosporium oxysporum* which can be recognized by a greyish green mould on the lower side of the leaves and the light green-yellow colour above. Other diseases recorded include a species of downy mildew, the eye spot, *Cercospora nigrescens* and the powdery mildew, *Leveillula taurica* with yellow spot and the upper surface and a white mould below (Schippers, 1998).

The selected seedlings should be planted 20 cm apart to permit it to give branches and develop many leaves. The heights of *solanum scabrum* are usually about 60 cm but could grow to 1.20 m or more and that there are both small and large leaf cultivars with different leaf shapes and leaf colour which can be either green or dark purple. As the crop develop much leaves and branches it should be harvested.

## Cultivation of Cabbage (*Brassica oleracea*)

**Botanical Name:** *Brassica oleracea* Var. *Capitata* f. *alba*. **Family:** Cruciferae.

**Botany:** The word cabbage is derived from the French word 'coboche', meaning head. A cabbage head is made up of numerous thick, overlapping smooth leaves which cover smooth terminal bud. Sometimes small heads of 5 or 7.5 cm. In diameter are formed, which are known as 'cabbage sprouts' having no commercial importance. Normally it is biennial but it is grown in India as annual crop.

**Season and Climate:** It grows best in cool moist climate and is very hardy to frost. In areas with comparatively dry atmospheres, its leaves tend to be more distinctly petiole than in the more humid areas. In hot dry atmosphere, its quality becomes poor and much of its delicate flavor is lost. Its germination is best at a soil temperature of about 55 °F to 60 °F. Temperatures below this and above this are not suited for it. Well hardened seedlings can tolerate temperature of 20 °F to 25 °F. It is grown mainly as rabi crop during winter. But in and around Nasik (Maharashtra), Ootacamond (Madras), and in semi parts of Kerala, it is grown as kharif crop also.

**Soil and its Preparation:** It can be grown almost in all types of soil ranging from sand to heavy soils. But small quick growing cabbage varieties do well in sandy soils, while large and late maturing varieties in heavy soils. Soils intended for cabbage growing, should have good drainage. Acid soils are not good for cabbage. The best PH range for cabbage is between pH 5.5 to 6.5. Lime may be added in acid soil to make it neutral or alkaline for growing good crop of cabbage. Land is prepared by ploughing it 3 to 4 times. The first ploughing should be done by soil turning plough, and the bulky organic manures should be spread in the field. Then the land should be ploughing and leveling the land, beds of suitable size and irrigation channels are made.

**Layout & Spacing:** Ridges & furrow type of layout is used for crop. Before that seedlings are prepared in nursery bed (Raised bed) & transplanted in main field after 3-4 weeks. Spacing for early crop is 45x45 cm and late crop it is 60x60 cm.

**Manures & Fertilizers:** Many farmers apply organic manure like animal dung directly on holes where cabbage seedlings will be planted.

**Irrigation:** Irrigation at the time of transplanting is essential. Steady supply of moisture is necessary for good growth and development. Interval between two irrigations depends upon climate, soil and plant growth. In the dry season cabbage need much watering.

**Harvesting and Yield:** Cabbage harvesting is done depending on the maturity of the head and demand in market. Normally harvesting is done when heads are firm. If prices are high in the market harvesting is done earlier. Proper grading is followed before heads are sent to market the yield of cabbage variety from 15 to 25 tons per hectare. The yield of cabbage depends upon the variety, growing season and management practices, Hybrid cabbage yields upto 50 tonner per hectare The yield of early varieties ranges between 12to 15 tones/ha. The yield of late season varieties is about 20 to 25 tones /ha.