Soil Management for Baby Corn in Organic Farm

Introduction

Organic agriculture is a holistic production management system that promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system.

Methods of organic farming vary. Some farms follow the strict production guidelines of a particular regulatory code, others develop their own independent systems. However, all organic systems share common goals and practices:

- No use of synthtic fertilizers or pesticides, and No GMOs;
- Protection of soils (from erosion, nutrient depletion, structural break down);
- Promotion of biodiversity (e.g. growing a varieties of crops than a single crop);
- No drug (e.g. antibiotics, hormones) and access to outdoor grazing, for livestock and poultry.

Within this framework, farmers develop their own organic production system, determined by factors like climate, crop selection, local regulations, and the preferences of the individual farmer.

In many parts of the world, organic certification is available to farms for a fee. Depending on the country, certification is either overseen by the government, or handled entirely by private certification bodies. Where laws exist, it is usually illegal for a non-certified farm to call itself or its products *organic*.

It is important to make the distinction between organic farming and organic food. Farming is concerned with producing fresh products - vegetables, fruits, meat, dairy, eggs - for immediate consumption, or for use as ingredients in processed food. The manufacture of most commercially processed food is well beyond the scope of farming.

It is also important to note that organic farming is not "new". In fact, it is a reaction against the large-scale, chemical-based farming practices that have become the norm in food production over the last 80 years. The differences between organic farming and modern conventional farming account for most of the controversy and claims surrounding organic agriculture and organic food. Until recently, the comparison looked something like this:

	Organic	**Conventional**
Size	relatively small-scale, independent operations (e.g. the family farm)	large-scale, often owned by or economically tied to major food corporations
Methods	low use of purchased fertilizers and other inputs; low mechanization of the growing and harvesting process	intensive chemical programs and reliance on mechanized production, using specialized equipment and facilities
Markets	often local, direct to consumer, through on-farm stands and farmers' markets (see also local food), and	wholesale, with products distributed across large areas (average supermarket produce travels

through specialty wholesalers and retailers (eg: health food stores)	hundreds to thousands of miles) and sold through high-volume outlets

The contrast is as much economic as it is between methods of production. To date, organic farming has been typically small business, often based in local economies, and conventional farming is big business (often called agribusiness or, negatively, corporate farming) that is closely integrated with all aspects of the global food production chain. However, the situation is changing rapidly as consumer demand encourages large-scale organic production.

Development of modern organic farming techniques is also a function of economics. Most of the agricultural research over the last several decades has concentrated on chemical-based methods - little funding and effort have been put into using current scientific tools to understand and advance organic agricultural approaches.

Principles of plant cultivation, in many situations identical to those of organic farming, are applied - often, though not necessarily, at a smaller scale - in the plough-less practice of organic horticulture.

Organic farming incorporates scientific knowledge and comprehensive traceability with traditional farming practices, based on knowledge and techniques gathered over thousands of years of agriculture to improve the social, economic and ecological sustainability of agricultural systems. It is easiest to describe by contrasting it with modern commercial techniques.

In general terms, organic farming involves natural processes, often taking place over extended periods of time, and a holistic approach, while chemical-based farming focusses on immediate, isolated effects and reductionist strategies (some

would argue that this reductionism is greedy reductionism). In large commercial operations, technology is used to regulate local conditions—hybrid seed, synthetic chemicals, high-volume irrigation—while sophisticated machinery does most of the work, and operators' feet may seldom touch the ground. Beyond the strictly technical aspects, the philosophy, day-to-day activities and required skill sets are quite different

In Thailand, baby corn variety development began in 1976 with the open-pollinated variety (OPV), and resulted in subsequent years in hybrids enhanced both by the private and government sectors.It is a good source of folate and vitamin B. There is also rich in several other nutrients too such as potassium, vitamin B6, riboflavin, vitamin C and fiber. Finally, researchers were able to develop Rangsit 1, a composite variety that met objectives then in 1981. The objectives focused on creating a composite variety with high yield, nice yellow color, neat kernel arrangement, resistance to downy mildew and good adaptation. Nowadays, researchers try to do research and development of hybrid baby corn. They suggested that hybrid baby corn should be more suitable for baby corn production in the future because it can produce ears, which have better quality and more regular sizes.

Organic baby corn is one of the pilot organic agricultural export production of Thailand between 1999-2003 to Singapore and European Union. Thailand’s growing areas in 2001-2002 is 231,865 rai in Cental plain, Western and Northern parts of Thailand. It can be grown in every period of the year where soil and water are managed. If water is sufficient, it could be 4 times a year,

Thai Government under the leadership of Police Lieutenant Colonel Thaksin Shinawatra had announced to the cabinet in February 26, 2001 about the

agricultural policy refer to rehabilitate and strengthened of mixed and organic farming in order to promote Thailand to be the center of organic product.

Land Development Department (LDD) who responsible for land use policy and give advise in soil and plant relationship therefore produces a manual of organic baby corn to be used as the guideline and transferring to other sectors.

Land Use in Thailand for Growing Baby Corn

Baby corn grows well in a wide range of soil types but it thrives best in loose soil, which drains well. A suitable soil for baby corn has a wide pH range, from 5.5 to 7.0. It can also grow in quite very acid soil, but cannot grow in wetland with low drainage. As for temperature, the plant prefers full sunlight necessary to its growth. Consequently, successful growth requires a minimum average temperature of 72 or 75 °F. Nevertheless, when daytime temperature exceeds 85°F, baby corn may be injured, and have to suffer slow growth**.** It can be grown before and after rice in paddy field or in irrigated rolling upland most probably in central plain of Thailand.

The lands that is not suitable for baby corn are:

1. Water logging.
2. Low fertility soils.
3. Lacking of water.

Land Use in Thailand for Growing Baby Corn

1. Levee greyey loamy soils (Soil series group 21)

This group includes somewhat poorly drained, medium-textured soils that are commonly stratified with sand and silt layer that occur mostly on flood plain or alluvial plain. They are moderately low fertility. Soil reaction is strong to medium acid. Soils in this group are Petchaburi (Pb) and Saphaya (Sa) series.

Most areas are covered with paddy rice in rainy season and cash crops in dry season if water supply is available.

Problems: Sandy and silty layer soils induce lack of water, but overland flow or water logging in rainy season in some places.

2. Upland fine silty soils on both banks of the rivers: (Soil series group 33)

This group of soils is well drained or moderately well drained, deep, medium textured (silt loam to silty clay loam). They always occur mainly on flood plain or alluvial fan in low rainfall areas. Soil fertility is moderate. Soil reaction is medium acid to neutral. Hard pan could be found in cultivated land. Soils in this group are Don Yang En (Don), Kamphaeng Phet (Kp), Kamphaeng San (Ks), Lam Sonthi (Ls), Nam Duk (Nd), Tat Panom (Tp) and Taphan Hin (Tph) series.

Various upland crops and fruit trees are commonly found in the areas. Crop production is relatively high.

Problems: Lack of water in dry season, hard pan from management practices may be found.

3. Upland sandy soils (Soil series group 43)

This group of soils includes deep sandy, somewhat excessively drained that occurs on beach ridge along the coastal line. The fertility is very low. Soil reaction is medium acid to neutral. Soils in this group are Bacho (Bc), Hua Hin (Hh), Lan Suan (Lan), Mai Khao (Mik), Pattaya (Py), Rayong (Ry) and Sattahip (Sh) series.

Majority of the land uses near the shoreline are coconut, while cassava, watermelon and pineapple are inland.

Problems: Low fertility, thick sandy soils.

Soil Management system for organic baby corn

1. How to Select Soils & Soil Preparation: Baby corn can grow in almost every soil type but the most suitable soils should allow well circulation of water. Then, it will grow well in friable soil or sandy-friable soil. Unfavorable to it is wet soil, where circulation of water is difficult. A pH level should range between 5.5 and 7.0. Baby corn grows well in quite very acid soil. In case of soil with a pH level less than 5, 1 month before planting baby corn, cultivators should sow lime on the soil in a quantity of 500-700 kilogram per rai. Then, they should plow soil so as to properly mix soil and lime together. Next, the mixed soil should be watered. In this way, acidity in soil will be reduced.

The preparation of baby corn planting beds is done by digging 25-centimeter-deep holes and accumulating soil in the height of about 25 centimeters around the holes. The holes should be 50 centimeter distant from each other. Space between rows is 50 centimeters as well. Furrows should ease circulation of water. In the rainy season, cultivators should sow manure or fermented fertilizers over planting areas so that soil will become friable. The areas should be watered 3 days before planting, and a humidity level would be properly sufficient to the growth of breeding seeds.

2. Planting: Before planting, put a handful of manure or compost at the bottom of a hole. Mix all the components properly and slightly layer soil on the top. Then, drop

3-4 breeding seeds in each hole in the form of a triangle. They should keep a proper distance from each other. Afterwards, put soil on them, about 2-3 centimeters high. (Breeding seeds should be tested to see their viability and saturated in an anti-fungus solution before being planted.)

After planting, water growing areas immediately. When breeding seeds have grown for 2 weeks, or they reach the height of 15-20 centimeters, weak stems should be pulled out until 3 viable ones are left. As for the dropping of seeds, a seed dropping machine called Jack or Jab can be used. It gives considerable convenience, saves time and can control an amount of seeds used more consistently than manual seed dropping. A trick is proper adjustment of the seed releasing blade in the machine. In the way, the machine can drop 2-3 seeds each time as cultivators want.

3. Cultivation Density: In general, each hole contains 3 trees or there are approximately 19,000 trees per rai. Although productivity depends on a number of trees per a growing area, too many trees in a growing area can result in defects of produce. For example, there is a decrease in weight and size of ears. An amount of ears per tree drops. Trees not bearing ears increase. Growth is unusually slow.

In Thailand, 50*50 cm. or 75*25 cm. (row*plant) and 3.5-5 cm. depth.

4. Soil improvement by organic matter:

4.1 Green manure crops: That are utilized to upland dry areas namely: ***Sesbania rostrata***, ***Vigna spp*** and ***Crotalaria juncea*** **L**.)

4.1.1 Mix residue with soils and spray 5 litres/rai (diluted 1: 500-1000) liquid LDD fertilizer:

4.1.2 Plant the green manure i.e.:

- ***Crotalaria juncea* L.** : Broadcast 5 kg/rai ***Crotalaria juncea* L.** (90 % viability) then cut and ploughdown after 50 days or at flowering stage.
- ***Canavalia ensiformis* L.**: Rowing of 10 kg/rai ***Canavalia ensiformis* L.** (95 % viability) then cut and ploughdown after 50 days or at flowering stage.
- ***Vigna spp.*** : Rowing of 8 kg/rai ***Vigna spp.*** (95 % viability) then cut and ploughdown after 35 days or at flowering stage.

4.1.3 Green manure should be planted 2 months before baby corn. To produce more fresh weight green manure, 5 litres/rai of LDD liquid fertilizer (1: 500-1,000 water dilution) should be applied every 10 days.

4.1.4 Green manure should be ploughdowned at flowering stage and left in the field for15 day before planting baby corn.

4.1.5 Green manure are recommended once after 2-3 baby corn crops.

4.2 Inter cropping: is the cultivation of another crop in the spaces available between the main crop. Legumes are always recccommended to be inter cropping of baby corn. They should have short, bush-like stem and broad leaves to get light that pass through corn stems.

4.2.1 Legumes as inter cropping:

- ***Canavalia ensiformis* L.** : 10 kg/rai, rowing and ploughdown at 50 days.
- ***Vigna spp.*** : Rowing of 8 kg/rai and ploughdown at 35 days.

- **Soya bean:** Rowing of 8 kg/rai and ploughdown at 40 days.
- **Mung bean:** Rowing of 6 kg/rai and ploughdown at 40 days.

4.2.2 Time of inter cropping:

Considering the proper time to ploughdown i.e.: ***Canavalia ensiformis*** **L**. at 10 days, ***Canavalia ensiformis*** **L**. at 25 days and Mung bean at 20 day after planting baby corn.

4.2.3 Spray 5 litres/rai (diluted 1: 500-1000) liquid LDD fertilizer to inter cropping at the same time as baby corn.

4.3 Compost fertilizer or animal manure:

4.3.1 At the soil preparation:

- After soil preparation and raisebeding for baby corn, compost fertilizer or animal manure will be applied in plant rows and mix with soils.
- Compost fertilizer = 4.5 ton/rai or animal manure = 2 ton /rai
- 1 after another times of baby corn.

4.3.2 During vegetative growth to increase activity of green manuring and plant nutrients. Apllication of 2.5 ton/rai compost fertilizer or 1 ton/rai animal manure along the baby corn's row.

4.4 Liquid LDD. Fertilizer: To add the value of liquid fertilizer, 5 litres/rai (diluted 1: 500-1000) should be applied with organic soil improvement by:

4.4.1 Spraying to the soils at soil preparation.

4.4.2 Apply to the soils every 15 days during baby corns' growing period.

4.4.3 Spraying to baby corns' leaves every 7 days after emergence of baby corn.

4.4.4 Application of LDD. liquid fertilizer both in the soils and to the leaves until 40 days after planting will support growth and second pods of the baby corn.

5. Crop management:

5.1 Detasseling: Detasseling is achieved by removing all the tassels of corn plants. This is done as soon as the tassels emerge (40-45 days). This will increase quality, numbers of pods and weight of baby corn and will be earlier harvested. Normally, tassels will be seen 5-10 days before pods.

5.2 Watering: Baby corn trees grow well and yield good quality produce, when planted in soil having humidity during all the cultivation period. If too much water is given to them, or a lack of water occurs for a time, the trees will suffer interruption in growth and consequently yield low quality produce. Defective ears result from a lack of water during corn ear producing time. In general, baby corn trees should be consistently watered from the beginning of cultivation to the end of harvest. When they are small, they should be watered every 2-3 days. As they reach the height of 50-60 centimeters, water should be given every 5-7 days. After that, every time soil gets dry, farmers have to water the trees.

6. **Crop Protection:** Baby corn requires practically no application of pesticides because the crop has short growth duration thereby eliminating the residue factor and minimizing in production cost.

6.1 Deseases that always harmful to baby corns is Downy mewdew in humid condition. The others are leaf bright, Rust, and Leaf spot. To control are:

- **Seed control** by soaking the seeds by 50-55^{o}C water, 10-30 minutes long. Or mix with *Tricoderma sp*., *Bacillus subtilis* bacteria. Or apply tolerated seeds i.e. Suwan 1, Suwan 2, Nakhonsawan1 and Nakhonsawan 72.
- *Tricoderma sp*. Can be applied when the soils is preparing.
- During vegetative growth, often observation of insects and diseases in the field are recommended. If they are found, the detected plants will be destroyed by burning or application of organic liquid pesticide i.e. from *Andrographis paniculata* (Burm.F.), *Tinospora crispa* (Linn.) Miers ex Hook. f. et Thom., *Azadirachta indica* A. Juss., *Phyllanthus urinarria* Linn., skin of mangosteen fruit , skin of pomegranate fruit , skin of malberry's root, skin of rambutan fruit, banana fruit and skin, garlic, skin of bitter lemon fruit, skin of cashew nut fruit, leaves of *Moringa oleifera* Lamk.,

Sercocalyx schomburgkii 's leaves, Eucalyptus' leaves, castor beans' leaves, *Piper sarmentosum's* leaves, lemon grass (*Cymbopogon citratus* L.), *Cymbopogon nardus*, *Octimum sanctum* Linn., *Ocimum basilicum* Linn., *syzygium aromaticum* (Linn.) Merr. et Perry, *Zingiber cassumunar* Roxb., *Durant repens.*, L., celery and *Acorus calamus* L.

6.2 Insects: Insects found in baby corn's fields are Groun Weevil, Onion cutworm, Corn stemborer, Rice thrips and Aphid.

Insect control:

6.2.1 Extraction of herbs:

a) Bitter herbs: *Andrographis paniculata* (Burm.F.), *Tinospora crispa* (Linn.) Miers ex Hook. f. et Thom., *Azadirachta indica* A. Juss. *Phyllanthus urinarria* Linn., *Physalis angulata* Linn.,

b) Toxic herbs: *Derris elliptica* (Roxb.) Benth., Tobacco, *Euphorbia origona* Haw., *Stemona tuberosa* Lour. Anona's leaves, Milk bush, *Pedilantus tithymaloides* (L.), *Adenanthera pavonina* Lam.'s seeds,

c) Sour herbs ; Skin of Citrus' fruit i.e. orange, lemon, bitter lemon, vinegar, tamarind juice, chili, pepper.

d) Aroma herbs : Lemon grass (*Cymbopogon*

citratus L.), *Cymbopogon nardus*, *Octimum sanctum* Linn., *Ocimum basilicum* Linn., Corriander, *Eupatorium odoratum*, *Ageratum conyzoides* L., *Passiflora foetida* Linn., Ginger, Calanga.

6.2.2 Micro organism that is not harmful to human being:

a) Virus: Nuclear polyhedrosis virus (NPV) i.e. NPV for Onion cutworm,

b) Bacteria: *Bacillus thuringiensis* (BT)

c) Nematode: *Steinernema carpocapsae* that can kill insect within 24-48 hours.

6.2.3 Biological control or Biopesticides are pest management tools that are based on beneficial microorganisms (bacteria, virus, fungi and protozoa), beneficial nematodes or other safe, biologically based active ingredients. They can be effective control of insects, plant disease and weeds. They also play an important role in providing pest management programs.

a) The insects that can control Onion cutworm in baby corn are **Earwigs** and **Lacewings**.

b) The ones to control stemborer are *Trichogramma* spp. who will kill stemborer by laying its eggs inside butterflies eggs.

c) *Rodolia* sp.(both worms and adults) is one of the most important natural enemies of Aphids and

mealy bugs.

d) *Eocanthocona furcellata* who has a long mouth to suck the liquid from cutworms.

6.2.4 Glue and light traps:

a)Yellow glue can trap adult insects in the daytime like rice thrips by put the glue trap 1 foot over corn's tips.

b) Purple or marine blue light (or fluorescence) can trap onion cutworms' mods at night . The light must be placed 150 cm. over the land and the vessels of water will be put 30 cm. below the light.

7. Post harvest:

Timeliness is the most important consideration in harvesting baby corn. Ideally, young corn is harvested 2 to 3 days after silking or 50 to 55 days after emergence. Harvesting duration may last for 15 to 18 days which is carried on by hand picking.

Cobs for market must have a good quality. Young cob corn of excellent quality is straight, has uniform ovary alignment, is 4 to 11 cm. Long, 0.8 to 1.8 cm. In diameter, slightly yellow to yellow color, sweet and not fibrous (Yodpetch and Bautista). Cobs must be free from bites of corn borer, must be clean and not broken.

The top cob will be picked first, follow by second cob after 1-2 days. The harvesting duration will not be more than 7-10 days due to over size.

In the case of large field, the time of planting should be 7-10 days overlapping in order to save laboring.

8. Soil management after harvesting

1. The tassels that were cut could be used to cover the soils. The decomposed tassels can add 2.94, 0.45 and 3.30 % of nitrogen, phosphorous and potassium respectively.

2. It was learned that 7 days after mixing the whole plant of maize with soils can add 1.27, 0.20 and 3.21 % of nitrogen, phosphorous and potassium respectively.

9. Field records:

Field records i.e. environment, varieties, watering, organic fertilizer, pesticides, problems during management for organic farming is necessary to be used to ask for organic product certification. The record can be used as prototypes to another organic farmers.

10. References:

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Appendix

Varieties of baby corn

In Thailand, baby corn variety development began in 1976 with the open-pollinated variety (OPV), and resulted in subsequent years in hybrids enhanced both by the private and government sectors. Finally, researchers were able to develop **Rangsit 1**, a composite variety that met objectives then in 1981. The objectives focused on creating a composite variety with high yield, nice yellow color, neat kernel arrangement, resistance to downy mildew and good adaptation. Nowadays, researchers try to do research and development of hybrid baby corn. They suggested that hybrid baby corn should be more suitable for baby corn production in the future because it can produce ears, which have better quality and more regular sizes.

At present, Thai farmers mostly use 5 varieties in their cultivation and all belong to hybrid baby corn. These are **Suwan1, Suwan 2, Suwan 3, Rang sit 1** and **Chiangmai 90**,which have been developed to resist downy mildew, grow rapidly. Then, they will have reasonable prices. But, farmers have to be concerned with harvesting methods. These hybrids grow very fast. When their baby ears are mature, farmers must reap them immediately otherwise they will be too big to meet factories' standards. Early-maturity varieties of baby corn are preferred because they reach full flowering more quickly than full-season varieties.

The close pollination varieties will give more production than the open ones but can not be propagated by seeds. They are uniformity in colour, size and good in quality and quantity but the seeds are more expensive. These are **G 5414, SG. 18, Pacific 116, Pacific 283, Uniseed B-65 and Kasetsart 2.**