Soil Management for Kao Dok Mali 105 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 through specialty wholesalers and retailers (eg: health food stores)	wholesale, with products distributed across large areas (average supermarket produce travels 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.

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.

Thai Hom Mali Rice (Kao Dok Mali 105)

Thai Hom Mali Rice has enjoyed an international reputation for its aroma and the texture which is tender and versatile to blend effectively with a wide variety of dishes. Grown only in Thailand, Thai Hom Mali Rice is the world's only indigenous rice with a natural fragrance.

Hom Mali, generally known as "Fragrant Rice" or "Jasmine-scented rice", grown in Thailand has quality that its variety grown in other parts of the world does not have.

With high nutrients, rice is a good source of insoluble fiber, which is also found in whole wheat, brand and nuts. Insoluble fiber reduces the risk of bowel disorders and fights constipation. Among other nutrients, rice is rich in carbohydrates, the main sources of energy, low in fat, contains some protein and plenty of B vitamins. Husked rice or brown rice gives higher nutrition than white rice. It was confirmed by Mahihol University (Table 1)

Table 1. Nutrition facts of rice

Nutrition Facts Serving: 100 g	White Rice	Dok Mali 105	Brown	Glutinous
Calories, kcal	361	355	362	355
Moisture (water), g	10.2	11.9	11.2	11.7
Total Fat, g	0.8	0.7	2.4	0.6
Dietary Fibre, g	0.6	0.8	2.8	0
Calcium, mg	8	5	12	7
Phosphorus, mg	87	65	255	63
Potassium, mg	111	113	326	0
Sodium, mg	31	34	12	0
Vitamin B1, mg	0.07	0.12	0.26	0.08
Vitamin B2, mg	0.02	0.02	0.04	0.03
Niacin, g	1.8	1.5	5.5	1.8
Protein, g	6	6.1	7.4	6.3
Carbohydrates, g	82.0	81.1	77.7	81

Source: Thai Food Composition Table (1999), Institute of Nutrition, Mahidol Univesity

Kao Dok Mali Rice, is grown in north-eastern part of Thailand i.e Surin, Yasothorn, Burirum, Nakhorn Ratch Sima, Srisaket, Ubol Ratch Thani Roi et and

Mahasarakham and the place that can give good quality is in Kula Rong Hai plain which cover the area of 2.1 million rai.

Land Development Department (LDD) who responsible for land use policy and give advise in soil and plant relationship therefore produces a manual of organic Kao Dok Mali 105 to be used as the guideline and transferring to other sectors.

Land use in Thailand for growing Kao Dok Mali 105

The land in Tung Kula Rong Hai is degraded because of salinization, water shortage and flooded sometimes. LDD had introduced reforestation, compose fertilizer, green manure etc. since 1971.

Topographically, Tung Kula Rong Hai is a big basin, <2% slope and surrounded by upland. It covers 5 provinces, 10 districts, 79 sub-districts and 1048 villages with the areas of 2,100,000 rai. Land use is normally paddy field and sometimes the upland areas were bunded for rice fields for own consumption.

Land use classification

1. Lowland had been use for paddy field covers 1,748,722 rai and classified into 882,188 rai clay soils, 421,834 rai loamy soils, 71,608 rai sandy soils, 365,073 saline soils and 8,069 rai shallow soils.
2. Upland covers 293,467 rai.
3. Urban areas covers 45,076 rai.
4. Water body covers 20,382 rai.

Dis- advantage of the land in Tung Kula Rong Hai

1. Low water holding capacity and low nutrient absorption sandy soils that leads to water shortage in growing season.
2. Salinity limits growth.
3. Shallow soils with gravels and laterite within 50 cm. limits root penetration and soil preparation.

4. Low fertility soils due to continuation of growing rice without conservation.
5. Water shortage for rain-fed agriculture.
6. Flooding in rainy season if rainfall is continuously.

Classify paddy land

1. **Grey clayey lowland soils** (Soil group 2, 3, 4, 5, 6 and 7)

Deep grey clayey soils from old alluvium, flat, < 2% slope (Slope A), grayish brown clay loam with mottling top soils, grayish brown clay or silty clay and yellow or red mottling of laterite, slow permeability, porly drained, moderate to high fertility, moderate P and K availability, neutral to low acid, water logging in rainy season.

Problems: Heavy clay, crack when dry, difficult soil preparation, deep soil water, lack of water in dry season.

2. **Grey loamy lowland soils.** (Soil group 16, 17, 18, 21, 22 and 59)

Very deep grey loamy soils from alluvial deposit, poorly drained to somewhat poorly drained, medium textured (silt loam grading to silty clay loam) soils that developed mostly in the areas of alluvial plain or flood plain.

Problems: Massive structure, low fertility, strong acid in some places, lack of water in dry season in deep ground soil water, and water logging in rainy season.

3. Grey sandy lowland soils (Soil group 24)

This group of soils is moderately well drained and coarse-textured that occupy on slightly undulating terrained coastal plain, alluvial terrace and wash surface. They are very low fertility. Land uses commonly vary as location and farmers' need.

Problems: Thick sandy and silty layer soils induce lack of water, waterlogging in rainy season in some places. To grow rice is very risky because
yield will be very low.

4. Shallow grey lowland soils (Soil group 25)

This group of soils are of poorly drained and shallow that always occur mainly on low-lying of alluvial terraces and erosional surface. Coarse fractions compose mainly of iron stones or laterlitic gravels. The underlying material beneath gravelly layer is mottled of plinthic clay. They are low fertility.

Problems: Very shallow soils with stones or laterite which is not suitable for agriculture should be left to be forest or fast growing trees.

5. Lowland grey saline soils (Soil group 20)

This group of soils consists of somewhat poorly drained, coarse-textured soils that are salt affected and occupy on low-lying terrain of the north-east plateau and coastal plain. Most of the areas are paddy rice but yield is relatively variable due to degree of salinity.

Problems: Saline soils with hard pan in saline accumulated layer, low fertility, lack of fresh water in strong saline areas, especially in dry season, water logging in rainy season.

Soil Management system for organic Kao Dok Mali 105 rice

Kao Dok Mali 105 is rainfed photo- sensitivity variety of rice, flowering around 20-25 October. Its production in north-eastern part of Thailand is relatively low due to low soil fertility and uncertainty of rain. For more production, application of organic fertilizer is recommended. It was founded that Kao Dok Mali 105 ‘s aroma correlates to soil qualities espectially Roi Et (Re), Kula Ronghai (Kr), Ta Tum (Tt)

and Nakhon Panom (Nn) soil series will give good aroma. Rainfall distribution affects its production depend upon low grain filling.

Production organic rice farming will always be less than the one with application of chemical fertilizers and pesticides. In general, rice planting dates, seeding rates, preferred varieties, and harvesting methods vary among regions, but they are largely the same for conventional and organic systems. Organic systems avoid the use of synthetic fertilizers, pesticides, and growth regulators. Instead they rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm wastes, mechanical cultivation, mineral-bearing rocks, and biological pest control to maintain soil health, supply plant nutrients, and minimize insects, weeds, and other pests. Weed control and soil fertility are the principal challenges associated with organic rice production. Primary weed-control practices include crop rotations, land leveling, seedbed preparation, water management, and rotary hoeing. The following is organic rice production in Thailand.

1. **Soil preparation**

   1.1 Site selection

   Land should have not been under chemical production system before or production of the first year of organic farming could not be accepted. Examination of residual effects of chemical substances after the first year is recommended. The land would be isolated from chemical production i.e. with guard rows by fast growing trees.

   1.2 Land levelling

   Keep and improve land level.

   1.3 Soil preparation

   Primary tillage is the first operation to prepare the soil for planting. Mouldboard ploughs fully invert the soil and disk ploughs partially invert the soil Tillage can reduce weed burdens e.g., till on moist soil and re-till after two weeks just prior to planting to kill germinating weeds. Soil does not have to be saturated for residue to break down.

2. Soil improvement by organic fertilizer

2.1 Residue decomposition is best at soil moisture levels of a moist but well drained field (i.e., less than field capacity) and at soil 'Temperatures of 25° and greater. Spraying 1: 500 -1: 1,000 dilution of 5 litres liquid organic fertilizer after raining and leave for 2 weeks.

2.2 Broadcast 6kg/rai Sesbinia rostrata (soaked with organic fertilizer) and spraying 5 litres/rai organic fertilizer every 10 days.

2.3 Mix 60 days Sesbinia rostrata with soils and leave for 2 weeks.

2.4 Mix broadcasting 500-1000 kg/rai animal manure and spraying 1: 500 – 1: 1,000 dilution of 5 litres liquid organic fertilizer with the soils before transplanting.

3. Rice Establishment

3.1 Pre-germinate seed Organic rice seeds should be from organic production system :

- 48 hours before planting soak seed - change water (with copper sulfate: water = 1:1) every four hours if possible.
- After 24 hours, incubate seed in the shade - rinse if possible to avoid seed becoming too hot.

3.2 Seedling : 100 gm. seeds/m^2 is recommended. (7 kg seeds per rai)

3.3 Transplanting: Plant in rows - generally with a spacing of the order of 20 cm x 20 cm. and 5 seedlings/hole can be also applied. If soils and water are well managed broadcasting of will give more yield.

3.4 Cropping system: Cropping system could be rice – fish raising or Rice- duck raising sytems to control weeds and insects.

4. Crop management

4.1 Weed control : Weed would be controlled by cutting or crop rotation.

4.2 Rice pest: The most important pest of rice is rodents which can be control by biological control i.e. cat, dog, snake, owe etc. or mechanical control i.e. trap. The field should be always cleaned to prevent from rodent. Golden apple snail can cause missing of seedlings, floating cut leaves, cut stems, decreased plant stand sparse or uneven stand. Duck could be raised in rice field to destroy golden apple snail. Its eggs would be destroyed immediately. Birds should be get rid of by reflection or noise producing or scarecrow. To prevent from nematodes, field should be flooded for sometimes. Ricefield crab could be controlled by using strong seedlings, water drainage right after transplanting and flooding again at the beginning of vegetative growth.

4.3 Rice Deseases:

4.3.1 Ragged Stunt Disease of Rice: The causal agent of rice ragged stunt disease is {{Rice ragged stunt virus}e} (RRSV). The infected plants are stunted but remain dark green. Leaves are ragged and twisted. Vein swelling on leaf collar, leaf blades, and leaf sheaths occur. Modern approaches to crop protection emphasize on management rather than control or eradication of the pests. They are:

- Destroy the infected residue and hosts of virus.
- Destroy infected rice.
- Crop rotation with legume to cut virus cycle.

4.3.2 Bacterial leaf blight: is caused by bacteria Xanthomonas campestris pv oryza. The incidence of the disease is

characterized by the appearance of lesions, which start near the leaf tips of leaf margins or both, and extend down the outer edges. Young lesions are pale green and subsequently turn grey. In very susceptible varieties lesions may extend to the entire leaf including the leaf sheath. Kresekor seedling blight causes wilting and death of the plant. The preventive control are:

- Crop rotation with crops that are no susceptible to the bacteria
- Use of disease free seeds, disease-free planting materials and cuttings, and use of resistant cultivars.
- Hot water seed treatment
- Deep plowing to bury plant debris and followed by fallowing the area
- Destroy its host i.e.beans, cassava, cotton, cucurbits etc.
- Spray lemongrass or mint extract

4.4 Insects

4.4.1 Brown plant hopper: The plant hoppers attack all plant growth stages but the most susceptible stages are from early tillering to flowering or during the first 30 days after seeding until the reproductive stage.Its symptoms are:

- Hopperburn or yellowing, browning and drying of plant
- Ovipositional marks exposing the plant to fungal and bacterial infections

- Presence of honeydew and sooty molds in the bases of areas infected
- Ragged stunt or grassy stunt virus disease plant may be observed

To control brown plant hopper is to drain the rice field for 3-4 days during the early stage of infestation, synchronous planting within 3 weeks of staggering and maintaining a free-rice period, let Nymphs and adults be eaten by general predators, particularly spiders and coccinellid beetles, fungal pathogens also infect brown planthoppers.

4.4.2 Stem borers: The characteristic damages of stem borers are dead hearts and white ears. Infestation at the early vegetative stage results in dead hearts, where the tillers wilt and ultimately perish. Infestation at the reproductive stage result in the formation of white ears where the entire panicle is chaffy and devoid of filled grains.

To control stem borers of rice is to burn its worms in rice residue after harvesting and destroy by collecting insects with fluorescent.

4.4.3 Leaf roller: The larvae of leaf rollers feed on the leaf tissue except the epidermis and cause typical white streaks. They create a leaf tube during later stages of feeding. Critical periods are Seedling to stem elongation.

To control is to clean the field and destroy affected Leaves and collecting insects with fluorescent to be destroyed.

4.4.4 Rice bug: Rice bugs ({{Oebalus poecilus}e}, {{Oebalus ypsilonoides}e}, Oebalus insularis, and Leptocorisa oratorius) feed on the developing grains. Feeding during milk stage results in empty grains and feeding during soft dough stage results in lower grain quality and broken grains.

To control is to clean the fields.

5. Post harvest:

Water from the field should be dried 10-15 days before maturity in order to control uniformity of rice. After harvesting, rice will be left not more than 3 sunny days in the field for the quality of husk with 14% humidity.

Burning of crop residue in the field is not recommended. Application of legumes i.e. 10 kg/rai of broad bean or 8 kg/rai cow pea are very good soil improvement. They can be well grown after harvesting Kao Dok Mali 105.

6. Field records:

Field records during management for organic farming is necessary to be used to ask for organic product certification. The record can be prototypes to another organic farmers.

7. References:

7.1 Department of Agriculture., 2000. Standard for organic crop production in Thailand. Ministry of Agriculture and Cooperatives, Bangkok. 17 p.

7.2 Roi Et Land Development Station., 2002. Application of LDD liquid fertilizer to Kao Dok Mali 105 rice. Report. Land Development Department, Ministry of Agriculture and Cooperatives, Bangkok.

7.3 Organic farming: (http://en.wikipedia.org/wiki/Organic_farming#Overview)

7.4 Rice knowledge: (http://www.knowledgebank.irri.org/troprice/default.htm)

7.5 Rice Research Institute, 1996. Development of Organic Rice (In Thai). Department of Agriculture. Ministry of Agriculture and Cooperatives, Bangkok. 15 p.

7.6 Somrit, B., 1995. Organic Rice Production Technology (In Thai). Department of Agriculture. Ministry of Agriculture and Cooperatives, Bangkok. 11 p.

7.7 Thai rice Foundation Under Royal Patronage: (http://www.thairice.org/eng/aboutRice/rice_production.htm)

Appendix

Kao Dok Mali 105 Rice:

Kao Dok Mali 105 (or jasmine white) rice is a Thai indigenous variety best known worldwide. It is the high quality rice and preferred by consumers. Kao Dok Mali 105 was originated from Bang Kla District of Chachengsao Province, eastern of Bangkok. Kao Dok Mali 105 grain is very white (this is where it got the name "jasmine white") and has fragrance of "pandan" leaf. Many people misunderstand that the jasmine was the fragrance of the rice. Kao Dok Mali 105 is officially known as "Kao Dok Mali 105". The name came from the code numbering assigned to this particular variety during selection programme where hundreds of Kao Dok Mali varieties were collected from all part of the country. The full code number is 4-2-105 where number 4 indicates the collection location, 2 is variety types, and 105 is the selected grain panicle. Kao Dok Mali 105 was declaired to the public on May 1959. It can grow well in north, north-eastern and some places in central part of Thailand.

Khao Dowk Mali 105 is

- Photosensitivity, 140-145 cm. high.
- Flowering around October 20 and harvesting around November 20.
- 56 days or 8 weeks seed dormancy .
- Size of brown rice = 7.5 * 2.1*1.8 mm.

Dominant characters:

- Soft and aroma.
- Tolerate to drought, acid sulfate and saline soils.
- Good grain qualities
- Good market and good price.

Constaints:

- Sensitive to bacterial leaf blight, yellow orange leaf virus, brown spot and blast diseases.
- Sensitive to rice gall midge and brown planthopper insects.
- Young plants will be lodged in high fertility soils.