

REPORT

Expert group workshop on preparation of technical guidelines on organic cultivation of tropical and sub-tropical fruits

**Kuala Lumpur, Malaysia
22-26 July 2002**

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I. Organisation and Objectives

The Workshop on preparation of technical guidelines on organic cultivation of tropical and sub-tropical fruits was organized at the conference facility of INTAN, Kuala Lumpur, with financial and technical support from FAO. The International Tropical Fruits Network (TFNet), based in Malaysia, was the coordinating organisation and provided additional in-kind support. The workshop was convened by the TFNET Chief Executive Officer, Mr. Khairuddin Md. Tahir. who was supported by Ms. Khoo Gaik Hong, Technical Officer, TFNET. The overall objective of the workshop was to develop a framework for systematic, science-based collaboration to generate comprehensive information for profitable cultivation of tropical fruit crops under certifiable organic management. In line with this objective, the workshop set out to achieve the following outcomes:

- Technical review of key problems and priority issues in organic tropical fruit cultivation characterized;
- Plan, structure, method, division of responsibilities, timetable for producing technical adaptation guidelines on selected organic tropical fruit production;
- Inter-regional programme proposal to support continuing collaboration on technology generation.

II. Participants

The workshop was attended by participants from Cuba, Sri Lanka, Malaysia, Bangladesh and participants representing the International Organisations IFOAM, AGRECOL and TFNet. A complete list of participants is given in Annex 1.

III. Workshop Strategy

After an introductory session to clarify the workshop objectives, a series of presentations were made in order to obtain an overview of the problems and priorities in research and development in organic horticulture in the different countries represented in the meeting. At the same time, the topics of pest management and knowledge management were further analysed by AGRECOL/Dr. Gabrielle Stoll. A detailed presentation of organic farming was given as an example of an organic farm in Malaysia that is creatively catering for the niche organic produce market in Kuala Lumpur and its surroundings.

A discussion followed on contents of crop-specific information needed to assist farmers in informed decision-making regarding conversion to organic as well as assisting them in efficiency of improvement of organic cultivation of tropical and subtropical fruits. A preliminary list of priority tropical and sub-tropical fruit crops for further work was also established.

The background to this discussion was provided by:

- The presentations mentioned above;
- A presentation of the outline of a manual on organic fruit cultivation, currently being developed to reflect the experience of Cuba;

- Outlines of crop-specific guidelines (organic production of oranges and mangos) developed in other parts of the world

By dividing into two informal discussion groups, annotated outlines for adaptation guidelines on pineapple (semi-perennial) and mango (perennial) were constructed and the approach and format of each case was subsequently refined through re-analysis in a plenary session.

Working groups and work plans were formed for the preparation of material in pineapple, mango and citrus.

In the final working session, the group identified priority technical problems as a shared focus for inter-country collaboration on research and technology development in organic production of tropical and subtropical fruits.

IV. Workshop presentations and discussion: Summary of the main issues.

The presentations helped the group to look at issues concerned with the practice of organic management in a wide variety of fruit-growing situations, ranging from large-scale conversion of intensively managed citrus plantations in Cuba to the low-input cultivation of tropical fruit in the traditional home gardens of Sri Lanka.

Fertilisation and soil management

Inevitable comparisons were made between use and effects (particularly on yield) of organic fertilisers and composts, on the one hand, and NPK use from conventional agriculture, on the other.

Results reported were variable depending on the type of organic fertilizers used. In several cases, high yields were associated with the use of organic fertilizers in both annuals and perennials.

With organic fertilisers/manures/composts, C/N ratio management is much harder to achieve at critical phenological points such as flowering, and the effect of different types of residues on C/N ratio can in turn impact upon soil microbial activity.

The issue of using chicken manure was raised and discussed intensively:

Chicken dung is difficult to use for crop manure, even though it is a potential source of nutrients, necessitating careful composting, drying and dilution practices to avoid damage to soil and plants.

In organic cultivation there are further issues related to the use of poultry dung:- ethical considerations associated with battery raising of poultry and its incompatibility with organic principles, and risk of residues from pharmaceuticals used in intensive poultry farming. As these are not always the norms of poultry farming in developing countries, doubts as to the adequacy of international organic standards in this regard were flagged, together with the need for these kinds of issues to be considered in the process of review/revision of standards. Further investigation is needed into other possible negative effects of using chicken dung and particularly verification of farmers' observations about increased crop pest and disease incidence.

The often specialised nature of fruit farming has significant implications for being able to strictly apply the “closed farm” concept of organic farming where farm-based recycling of organic matter provides inputs for crop cultivation. Other sources of organic matter are thus critical, in terms of the quantities required, the costs and logistics of its use and the composition characteristics.

Crop and agri-processing residues are a potential source of organic matter and some nutrients but their characteristics need to be known, and in many cases pre- treatment is required (e.g. half-charring of rice husks) so that they can be used with crops.

Empirical experience also alerted to the risk of contamination in some organic waste materials sourced off-farm that might otherwise be used for compost, e.g. heavy metals in sawdust from treated timber, coir dust with tanning residues, oily substances in oil extraction residues, pointing to the need for methods of testing, and for inexpensive decontamination methods based, for example, on holding and rain leaching where practicable.

Green manuring, live mulching and cover-cropping with leguminous plants are useful for both fixing nitrogen, increasing soil organic matter and weed management but needs a total management approach that takes into account selection of species for local adaptability and seed availability.

The use of bio fertilisers (such as *Rhizobium*, *Azotobacter*, phosphorine, mycorrhizal fungi etc.) and liquid fertilizers (animal manure- and plant-based) can play an important role in making essential nutrients available to crop plants and methods have been developed for mass-production.

The development of IPNS – Integrated Plant Nutrition Systems – has recently been providing useful approaches to improving soil structure and fertility without emphasis on chemical fertilisers and the experience gained in its implementation in different areas can usefully be brought into the development of organic crop management.

In particular, tools for measuring nutrient cycling that can be applied by farmers will be critical to the development of reliable soil fertility management practices.

There is a strong need for sharing empirical experience and scientific results in organic methods of fertilisation, in order to put together a more complete picture of what happens in the soil and the system with different treatment after some years of organic management.

Water management

Management techniques for mulching materials like coir dust for effective soil water management in pineapples needs careful attention

Irrigation water and run-off can be a vehicle for the introduction of pests and also non-permitted substances and these factors need to be carefully controlled in organic cultivation systems. Source and composition of irrigation water need special attention in organic management.

Pest control

- Weed control is a critical issue;
- Plant health and proper pest management is easier to achieve in sites which are ecologically appropriate for given crop plants, suggesting that fruit species for organic cultivation should be matched as well as possible with the right ecological niches
- The interface between crop management and pest management is an issue to be highlighted: proper crop management with due attention to cultural practices is a basic tool for effective pest management, with a tendency towards precision management of the habitat and the canopy in order to impact upon breeding of pests and pathogens and thus reduce pest pressure.
- The work in IPM on fruit crops has yielded a wealth of information that could be useful for pest control in organic fruit cultivation; however, the importance of local development of ecologically-based pest control strategies is underlined in organic agriculture, just as it is in IPM;
- Management of natural enemies is an important issue. Two strategies were outlined: maintenance and promotion of the local population, and introduction of natural enemies. Introduction and population with natural enemies is the basis of biological control strategies and the technology behind this is considerable; nonetheless, adaptation of the scale of production plants for bio control agents to meet small farmers' needs can be feasible.
- Botanical pesticides can be used with some effect and more work needs to be done to understand the activity and specificity of different substances, the way in which they interact with pest reproductive cycles and to ascertain their compatibility with accepted organic standards. Practical experience suggests that control of the pest sources is, in any case, fundamental, with botanical pesticides providing a useful auxiliary method of intervention.
- Hygiene and sanitation are very important in all stages of crop management, starting from attention to the health status of planting stock, and carrying through to the control of any pest-promoting effects of crop residues in the field.
- Detailed knowledge of insect life cycles (both pests and beneficial insects) is very important; making use of monitoring tools such as traps for harmful insects needs to be better understood by practitioners and farmers.

Crop Management Issues

- Treatments for flowering induction and fruit development in some crops such as pineapple and mango are an important issue in organic management.

Issues for conversion and setting up organic fruit systems

- Detailed knowledge of the history of the land use, soil properties and their characterization is important;
- Ready access to organic matter sources or provision for on-farm generation of biomass will be required to be able to build up and maintain soil fertility;
- For new plantations, the question was raised whether it was better to establish as a conventional orchard and convert, or to set up an organic orchard. If the conversion period overlaps with the gestation period for tree crops it may not seem to be worthwhile (to some farmers) to follow organic methods from the start. Establishment of perennial orchards is faster and easier in conventional agriculture.
- Some different sets of concepts apply to organic tree fruit management when it is conducted on small and a large scale. Conversion of large scale operations presents specific problems, for example, the generation of large quantities of biomass.
- Weed management can be a problem in the conversion phase. Cuba has gained experience in this field.
- Farmers need to be able to have a clear understanding of all aspects involved in organic production and marketing before conversion. In order to be able to plan the various phases properly, they need support for informed decision making.

Post harvest

A general lack of effective post harvest practices that comply with both organic and phytosanitary norms while helping to extend shelf life tends to limit current possibilities for trade in fresh organic tropical fruits.

The shortage of information available on organic post harvest methods highlights an area for further work in adaptive technology generation.

Certification system

Where there is no regulatory and national certification system for organic agriculture, producers remain dependant on international certifiers, which is considered to be pushing up costs.

Further, certification systems and particularly the standards, are based on a holistic philosophy, but usually do not directly address specific technical problems. It is a problem for producers to develop solutions for production problems within the context of the different certification systems they have to comply with, particularly when their agro-ecological/social/ economic situation may not have been considered specifically by the standard-setters.

Organic standards are not meant to be immovable: review processes are in place for EU, CODEX, IFOAM etc. standards (although revision can be difficult) and the organised

representation of growers' concerns about workability could be one key element inputting into the review process.

Knowledge management

The presentation on knowledge management stressed that it is important to focus not only on content but also on the way of disseminating the information. In the case of the work of this group, considering the fact that the objective is to quickly generate documentation that is easily accessible and available to the user- public, the work could, in first instance, be published electronically. Other forms of publishing will also be used to be able to reach other segments of the target population with less access to internet resources (e.g. hardcopy).

Appropriate methodologies of including indigenous knowledge in research and extension to farmers are of vital importance for the development and adoption of organic farming practices.

Appropriate methodologies including indigenous knowledge and approaches to improving the linkage between research–extension and farmers are of vital importance for the development and adoption of some organic practices.

V. Outcomes: Working groups and workplans for developing crop specific manuals for pineapple, mango, papaya, citrus (orange, pomelo and lime):

Fruit crops were selected to be addressed in successive stages of the project to develop adaptation guidelines. The fruit crops selected to start with were those for which world markets are biggest and which are universally important in all tropical regions: pineapple, mango, papaya and citrus. Banana could also be considered for inclusion after reviewing the outcome of other ongoing initiatives to develop organic banana production guidelines. As the group completes the pilot stage of the project and takes in more collaborators, other fruit crops of more regional importance could be addressed, i.e. rambutan, jackfruit, mangosteen, lychee, guava, passion fruit, durian, sapodilla, carambola, annona, etc.

An analysis of critical points in the production chain proved to give a useful framework for developing organic cultivation methods through an integrated approach.

The group was able to develop outlines for information in specific areas that needs to be collected and compiled in the field of mango and pineapple cultivation. The outlines can be found in Annex 4. It was agreed that guidelines for all crops should have a fairly similar general introductory section on certification, standards, regulation; production; definition of terms; market trends and markets; knowledge management; organic principles and concepts as they relate to perennial and semi-perennial fruit cultivation.

Roles within the editorial group for each crop were identified, with technical lead writer/s, contributing writers and other possible contributors. The leader will be expected to take a

fair share of the responsibility in terms of collecting and harmonizing the contributions and setting and keeping the time schedule. Contacts and interactivity within the groups will be facilitated by electronic means of communication, and when necessary and useful, electronic forums for simultaneous exchanges of ideas and brainstorming at critical stages of development could also be employed.

A leader for the editorial group on pineapple was identified (Subha Heenkenda – Sri Lanka) as well as contributing writers and other potential collaborators; hence it was possible to complete the work plan for this crop. For the other crops, the writers and other potential contributors have been identified, with leaders still to be identified through further contacts and correspondence. It was considered that the groups and work plans for the other crops would be easy to develop subsequently, following a similar method and structure. In this regard, Arnaldo Correa and the Cuban collaborators will take the lead in assembling an editorial group and developing the outline and work plan for the guidelines on organic citrus.

A tentative timeframe was developed for producing the first set of guidelines, as follows:

Aug 2002	Sept. 2002	Oct. 2002	Nov. 2002	Dec. 2002	Jan. 2003	Feb. 2003	Mar. 2003	April 2003	May 2003	June 2003	July 2003	Aug 2003
First draft						Review (crop group members)		Review by review group		Editing		Publ ishin g

The detailed work plans can be found in annex 3.

VI. Priorities for Collaborative Research and Development

The group discussed major technical issues and constraints in organic tropical and subtropical fruit cultivation that could be addressed by a coordinated, collaborative research and technology development initiative. The main issues identified were:

1. Flowering induction in pineapple. Specific points for attention were:
 - Finding organic materials – to be spearheaded by Mr. Heenkenda
 - Exploring possibilities for inclusion of ethylene/carbide in standards
 - Discussion of the issue with the organic materials research institute (OMRI) in the USA. (This institute is specialized in the evaluation of inputs in organic agriculture)

2. Post harvest management of fruits. Little is known on the subject. Areas of interest are:
 - water quality in post-harvest treatment
 - treatments for extended shelf life (natural waxes, natural fungicides, organic sprays, fruit harvesting timing, ...)
 - Natural ripening agents and,

- Methods for extension or delaying of ripening period.
- Wageningen Agricultural University might have activities in this field. .Further, ICIPE has done activities in mango in relation to African fruit fly. They have developed practices and post harvest standards for quarantine compliance with importing countries. They might be interested in working on production and post harvest aspects in relation to organic standards as well.
3. Treatments for Micro nutrient deficiencies in peat soils and in soils in general in case of perennial/semi-perennial fruit crops
 4. Flower induction in Mango: currently chemicals are used. Evaluate alternative methods available to organic farmers.
 5. Pest control issues:
 - Inventory and evaluation of organic methods to control pineapple mealy bug.
 - Survey/research on local knowledge to get information on local pest control methods. Ongoing process. (Can be linked to the work Gabriele Stoll and Pesticide Action Network (PAN) are doing, and efforts in this field in India.)
 6. Soil management, plant nutrition, organic nutrient sources, bio fertilizers, cover crops and weed control
 7. Soil moisture management: fertirrigation using permitted inputs
 - Better knowledge of neem properties and effects
 - Effects of organic soil and pest management practices on soil microbial activity and nutrient availability.

VII General Conclusions

It was recognized that farmers have difficulty finding practical information about the organic cultivation of specific fruit crops in the tropics and subtropics and that there is scope for collaboration among fruit crop specialists and the organic agriculture community in order to generate and disseminate production guidelines that will help farmers meet certification requirements and get returns.

It is important to recognize that the principles of organic agriculture imply a completely different approach to developing crop management systems; nonetheless, crop science in all its derivations offers much knowledge that can be adapted and used in this pursuit.

The mechanism of informal, flexible work groups, based on voluntary collaboration and sharing of information, was found to be appropriate for activating both editorial initiatives and research/technology generation to meet the specific needs of organic tropical fruit growers. It will be important to find ways of integrating the experience of pioneering organic farmers in the method of work adopted.

The joint sponsorship by FAO, IFOAM, and TFNET, of these initiatives should be a significant message to potential collaborators, as well as sponsors and donors, and will help to impress upon the scientific, organic and trade communities the importance of collaboration for mainstreaming organic agriculture.

A dedicated website needs to be developed for the organic tropical fruit guidelines and research collaboration projects. This could be set up within the FAO website with links to sites of all sponsors and contributors: IFOAM, TFNET, AGRECOL, Pesticide Action Network's on-line data-base on natural crop protection and all the other contributing institutions, as well as links to useful resources.

Linked to the website, future support activities will include setting up an electronic forum mechanism for generating and facilitating subsequent action.

Efforts should be made to have the information material translated into French and Spanish so that it is accessible to practitioners in most tropical countries. Cuba-IITF offered to take care of translating all material into Spanish, and FAO will look for possible collaborators to translate material generated into French.

Annex 1

**FAO Expert Group Workshop on Preparation of Technical Guidelines on Organic
Cultivation of Tropical and Subtropical Fruits 22-26 July 2002**

List of Participants

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WORK PLANS

A. EDITORIAL GROUP COMPOSITION

A.1 WRITERS

Pineapple

Writers for the pineapple document:

- Sri Lanka Subha Heenkenda (Leader)
- Cuba, IITF
- Malaysia/MARDI - IPRS, Dr. Mohamad Selamat
- Malaysia/DOA - Dr. Lim Jit Sai <limjs@doa.moa.my >
- Malaysia/UPM – Dr. Siti Hajar hajar@agri.upm.edu.my & Dr. Rosenani rosenani@agri.upm.edu.my

Other potential writers/contributors to be contacted by FAO and the Lead writer to seek their collaboration:

- Prof Bt Bartholomew: University of Agronomy, Hawaii
- Prof Nestor Bondad Department of Horticulture. University of the Philippines Los Banos
- Cameroon organic pineapple group

PROPOSED EDITORIAL GROUP COMPOSITION FOR MANGO, PAPAYA AND CITRUS

Mango

A. Contributing writers:

- Mohd. Rakibul Bari Khan (BRAC), Bangladesh
- IITF, Cuba,
- Sandini (Italy)
- Tengku Malek Tengku Mahmood, MARDI, Malaysia. tamtm@mardi.my

B. Other people/organizations to be contacted:

- Bangalore India: Mr. Madukar Reddy. (contact details)
- Prof. Khoo Khay Chong (entomologist, wrote book about Mango UPM)
- University of Western Australia (Parlevliet and McCoy);
- Philippines/UPLB
- Pakistan

Papaya

A. Writers:

MARDI, Malaysia. Zabedah <zabedah@mardi.my>
IITF, Cuba (starting project on organic papaya)

B. Other people/organizations to be contacted:

Australia: Queensland DPI

USA: University of Hawaii
Thailand: Kasetsart University
Cuba, Caribbean and Latin America: Correa can provide a list of experts in Latin America
Philippines: UPLB same people as working on pineapple and mango.

Citrus

A. Writers:

Cuba, IITF (leader)
MARDI Shamsuddin Osman <shamos@mardi.my>
Malaysia, DoA: Mr. Tan Hoe Hing <tanhoehing@yahoo.com>

B. Other organizations to be contacted:

University of Florida: Dr. Ferguson
Spain: IVIA
Costa Rica: Correa will find the contact
Brazil:
Bolivia: contact via Gabriele Stoll
Argentina: via Correa
Agriculture Western Australia
South Africa: Ministry of Agriculture/ARC/Outspan
University of California DAVIS
University of Western Sydney Centre for Horticulture & Plant Sciences
ICIPE – on African fruit fly and other relevant initiatives
For tropical citrus species such as pomelo and lime, other writers organizations/countries should be contacted:
Thai scientists
Vietnamese scientists: to be contacted via the University of Western Sydney Citrus IPM group

Writers for the general part:

Certification: IFOAM
Knowledge management: Gabriele Stoll
Note: Composition of the introductory chapter will be most intensive for the first exercise, whilst it will only need to be adapted for successive crop guidelines.

IFOAM will also promote contributions by:

- communicating the objectives of the project to IFOAM members and seeking their collaboration
- looking into the possibility of getting its collaborators to contribute case study material

A.2 REVIEW GROUP

The review group for this document will include:
TFNet

IFOAM

DOA - Horticulture, Malaysia

2 FAO colleagues in the regional office in Bangkok (Papademetriou, Chapman)

B. Timeframe 12-13 months for the first publication

Aug 2002	Sept. 2002	Oct. 2002	Nov. 2002	Dec. 2002	Jan. 2003	Feb. 2003	Mar. 2003	April 2003	May 2003	June 2003	July 2003	Aug 2003
First draft						Review (crop group members)	Review by review group	Editing	Publ ishing			

Steps to take to come to the final product:

1. To develop a first draft (six months):
 - 1.1. Contacting/briefing of other members (2 months) - Lead writer; with FAO/TFNet to support by confirming sponsorship to potential collaborators.
 - 1.2. The lead writer obtains the inputs of all the members (2 months)
 - 1.3. The lead writer harmonizes the inputs and finalizes the first draft (2 months)
2. Review (four months):
 - 2.1. Review and revision of the first draft by the crop group members the document (2 months)
 - 2.2. Review by the review panel and finalizing the document accordingly (2 months)
3. Editing: FAO, TF Net, IFOAM (plus adding forewords, final text approval for sponsorship) (2 months)
4. Publishing (FAO), 1 month
Publishing/dissemination will be as rapid as possible, electronically to start with and then in hard copy

C. Other supports to be ensured:

Development of a dedicated website for the organic tropical fruit guidelines and research collaboration projects. To be set up within the FAO website with links to sites of all sponsors and contributors: IFOAM, TFNET, AGRECOL, Pesticide Action Network on-line data-base on natural crop protection and all the other contributing institutions, as well as links to useful resources.

Setup of an electronic forum for generating and facilitating subsequent action (task of FAO and TFNet).

Translation: efforts should be made to translate the material in French and Spanish so that it is accessible to practitioners in most tropical countries. Cuba-IITF offered to take

care of translating all material into Spanish, and FAO will look for possibilities to translate material generated into French

D. Formatting style

The guidelines will be produced with photograph illustrations as a downloadable PDF or Hyperlinked document for the website and on CD Rom;

The printed material is to be based on text and graphs only, printing options will favor low cost.

The target document length should consist of 40 to 50 pages for each crop.

E. Other considerations:

As much actual experience documented as possible in text boxes and as annexes.

A separate chapter with links to other resources is recommended.

F. Means/supports required:

For information of other possible contributors and collaborators the workshop report will be useful. FAO, TFNET and IFOAM to confirm their sponsorship to contributors;

ANNEX 3: CROP SPECIFIC OUTLINES

OUTLINE FOR ORGANIC MANGO CULTIVATION

General Introductory Section – (for a large part shared for all tropical & subtropical semi-perennial and perennial fruits).

1. Certification, Standards, Regulation,

Box: marketing from where you are

- Specific limitations
- Specific allowances
- Private seals & implications, concerns about harmonization

2. Knowledge Management

- Need for database – structure for its development
- References to sources of information
- Description of Methodological tools for monitoring and decision making at farmers, extension workers level

3. Organic principles and concepts in perennial fruit production

- Flag GMO issue to clarify
- Planting material from OA to current practice re. Conventional
- workers welfare - requirements of current standards and special seals, ongoing discussion
- ethical considerations
- Specific considerations for perennials

4. Definition of terms

5. Market trends & markets

- very small market for organic tropical fruits, describing how environmental agenda is coming into the markets,
- Market trends in year of publication
- Concept of value-addition implicit in pricing

Crop-specific - mango

Introduction

- a. general crop description, botany, distribution
- b. economic importance in general + nutritional value
- c. Ecological and climatic requirements
- d. Organic “specific fruit” experiences on cultivation, production, processing, fresh and processed. Where are the fruits grown organically?

Production systems

- a. Characteristics of organic mango production systems: plantation style, homestead style, bond style (in rice fields), multi-cropping and intercropping etc.

Mono-cropping

Multi-cropping

Farm level - poly-cropping
Integration with animal husbandry, fisheries
Field level - intercropping with other crops

- b. Major varieties (for different markets and regions)
- c. Major concepts and principles of the production system with an overview of the major challenges and problems to be expected
- d. Specific problems e.g. flowering and fruit development

Conversion in perennial crops (new area, requirements conversion of an existing farm)

- a. Site analysis (history, soil, state of trees, pests, diseases, neighboring farms)
- b. Development of a conversion plan
- c. Documentation, key concerns, no standard approach to certification requirements

Nursery management

- a. Main practices and difficulties

Organic care – critical points based framework

- a. Build up of soil fertility (types of fertilizers, rates, frequency, methods for quantifying nutrient cycling, typical problems e.g. micronutrient deficiency (Bo))
- b. Crop protection
 - Major pests and related beneficial insects (and the place they occur); monitoring techniques;
 - Cultural management practices
 - Pruning, field hygiene
 - Functional linkages between crop, crop practices and pest management
 - Bio regulators and bio pesticides
- c. Tree management (spacing, pruning/cleaning/thinning, bark ringing)
- d. Indigenous knowledge and solutions
- e. Irrigation – water management and water quality

Post harvest: critical points based analysis

- a. Post harvest treatment (Anthracnose)
(Practices: Selection of good fruits; hot water treatment, (chlorine containing))
- b. Ripening (irregular due to lack of stimulants for ripening. Regular checking and selection of good fruits)
- c. Latex: burns on fruit
- d. Specific issues for Packaging, storage, transportation

Re-cycling of production and processing wastes

Economic aspects - criteria for comparison to conventional agriculture, cost and output-based, critical points determining cost differences, selling price influence and evaluation (boxes with case examples)

OUTLINE FOR ORGANIC PINEAPPLE CULTIVATION

General Introductory Section – (shared for all tropical & subtropical semi-perennial and perennial fruits).

1. Certification, Standards, Regulation,

Box: marketing from where you are

- Specific limitations
- Specific allowances
- Private seals & implications, concerns about harmonization

2. Knowledge Management

- Need for database – structure for its development
- References to sources of information
- Description of Methodological tools for monitoring and decision making at farmers, extension workers level

3. Organic principles and concepts in semi-perennial fruit production

- Flag GMO issue to clarify
- Planting material from OA to current practice re. Conventional
- workers welfare - requirements of current standards and special seals, ongoing discussion
- ethical considerations
- Specific considerations for semi-perennials, especially concerning the issue of rotation

4. Definition of terms

5. Market trends & markets

- very small market for organic tropical fruits, describing how environmental agenda is coming into the markets,
- Market trends in year of publication
- Concept of value-addition implicit in pricing

Crop-specific - pineapple

1. Introduction

- a. general crop description, botany, distribution
- b. economic importance in general + nutritional value
- c. Ecological and climatic requirements
- d. Organic “fruit specific” experiences on cultivation, production, processing, fresh and processed. Where are the fruits grown organically?

2. Production system

Characteristics of pineapple production systems.

Mono-cropping

Multi-cropping

Farm level - poly-cropping

Integration with animal husbandry, fisheries

- Field level
- intercropping with other crops
 - intercropping with green mulch/legumes
 - Rotations with other crops
- a. tendency for mono-cropping and need for external sources of crop residues for compost carrying risk of pest introduction
 - b. Traditions of intercropping (biodiversity); incidence of allelopathy
 - c. Processing as affected by permitted inputs
 - d. Impact of phytosanitary restrictions on post-harvest treatments for fresh export
 - e. Recycling crop residues – caution about phytosanitary dangers of recycling crop residues
 - f. Crop combinations in cropping system
 - g. Economics of production

3. Conversion in semi-perennial crops (new area, requirements conversion of an existing farm)

- a. Site analysis (history, soil, pests, diseases, neighboring farms)
- b. Development of a conversion plan
- c. Documentation, key concerns, no standard approach to certification requirements

4. Target market and implications for variety choice, fruit quality standards

- Export
- processed
- local fresh

5. Main problems of cultivation

- a. Soil fertility build up (types of fertilizers, rates, frequency, methods for quantifying nutrient cycling

Soils –need to know composition, peat can be suitable, certain preferences for acidic soil

Considerations for plant health

Peat soils make microelements unavailable → need for application of Cu, Bo - can't use chemicals except Cu

Seaweed extracts → mixture of micronutrients

Correction of pH in peat soils

- Importance of conservation methods in sloping land
Poorly drained soil, tendency for water logging a limiting factor (promotes fungal disease incidence

1. Agronomy - land preparation

- shallow rooting → erosion risk in hilly areas
 - Flower induction techniques- smoke, carbide, etherel (not approved in EU, but unclear procedure about evaluation)
 - mulching essential, grass from weeding, coconut coir dust, coir + sawdust, risk of contaminants
 - shading fruits
 - Crop rotation with maximum care to avoid pest build up

- Fruit size regulation for fresh market and canneries
 - Variety
 - Irrigation frequency
 - No need for plant growth regulators
- Lower temperatures naturally induce flowering
 - Synergy with bee keeping
 - (smoke)

Water-related issues with intercropping (Water quality)

- b. Planting material - clonal
 - health – virus and disease-free
 - size of propagules affects time to flowering
 - sizing –uniformity importance
 - disinfection of suckers/slips
 - pineapple nursery using gouging to promote suckering – can be organic

- c. Pests and diseases/crop protection
 - Pineapple wilt - introduced by mealy bugs
 - Prevention of mealy bug infestation
 - Disease- free planting material
 - Avoid rotation and use of crop's own residues
 - Infected material can be hot water treated
 - Selection of healthy mother plants for suckers
 - Ants are vehicle for mealy bugs
 - More information needed on existing resources on pest biology, predators, beneficial organisms – Hawaii good source
 - Fungal collar rot / heart rot
 - Prevention by good drainage, blocking runoff between plantations on slopes to prevent spread
 - Intercropping can increase risk in some cases

Intercropping with Banana → provides material for mulching and shade to maintain moisture and lower risk of common pests

Other fungal diseases → need for information about bio control

6. Harvesting/post harvest (critical points based analysis)

- Depends on market - mature for processing
Fully mature for fresh organic
Ripening during post-harvest
- Disease
Anthracnose
Rots
Phomopsis
Internal tissue breakdown physiological depends on Ca soil enrichment possibilities
Harvest with part of stalk, crown intact
Decrowning for local consumption promotes sweetness
Post harvest treatments in pineapple
Specific issues for Packaging, storage, transportation

7. re-cycling of production and processing wastes

8. Economic aspects - criteria for comparison to conventional agriculture, cost and output-based, critical points determining cost differences, selling price influence and evaluation (boxes with case examples)

9. Communication

10. Water quality