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Commission "IP-Guidelines and Endorsement"

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GUIDELINES FOR INTEGRATED PRODUCTION OF POME FRUITS

IOBC Technical Guideline III

4th Edition, 2008

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The content of the contributions is in the responsibility of the authors

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Preface of 4th edition

The necessity of a revision of the pome fruits guidelines (3rd edition 2002) is mainly due to the necessity to incorporate some components of Good Agricultural Practice contained in important international food safety standards (such as EUREP-GAP). Although we refer often to the full details published in the IOBC basic document of 2004 we repeat many aspects in the pome fruits guideline in order to make our IOBC guidelines and IOBC inspection systems compatible with major international food standards.

The first draft of this revised edition was prepared by Ernst Boller in early 2008, circulated between expert of the IOBC/WPRS Orchards Working Group and discussed in a specific expert panel during the Avignone Meeting held on 30th October 2008.

We would like to extend our thanks to all persons that assisted in the preparation of this document by their direct input and advice.

The final text of the 4th edition was read and approved by the Commission on November 2008.

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International Organisation for Biological and Integrated Control of Noxious Animals and Plants

GUIDELINES FOR INTEGRATED PRODUCTION OF POME FRUITS

IOBC TECHNICAL GUIDELINE III

2008. 4th EDITION
(Original text in English)

This document sets out revised general principles, minimum standards and guidelines for Integrated Production of Pome Fruits in the geographic areas covered by the IOBC/WPRS starting from 2009 as agreed by the Integrated Fruit Production Guidelines Sub-group of the IOBC/WPRS Orchards Working Group at its meeting in Avignon in October 2008. It is intended as a framework for formulation of specific regional or national guidelines and standards according to IOBC standards and to facilitate their harmonisation. The requirements for Integrated Production of pome fruits as defined in this document are based on the IOBC Principles of Integrated Production and Technical Guidelines I and II (3rd edition) published in the IOBC/WPRS Bulletin Vol. 27 (2), 2004 and available in full text on internet www.iobc.ch. These documents or up-dated versions thereof, are integral parts of these crop specific Technical Guidelines III.

I. DEFINTION AND OBJECTIVES

In the framework of the IOBC definition for Integrated Production (IP), Integrated Fruit Production (IFP) is defined as the economical production of high quality fruit, giving priority to ecologically safer methods, minimising the undesirable side effects and use of agrochemicals, to enhance the safeguards to the environment and human health.

Based on this short definition, Integrated Production of pome fruits emphasises the following objectives:

- To promote pome fruit production that respects the environment, which is economically viable and sustains the multiple functions of agriculture, namely its social, cultural and recreational aspects.
- To secure a sustainable production of healthy pome fruits of high quality with a minimal occurrence of pesticide residues.
- To protect the farmer's health while handling agrochemicals
- To promote and maintain a high biological diversity in the ecosystem of the orchard and in surrounding areas.
- To give priority to the use of natural regulating mechanisms for pests and diseases.
- To preserve and promote long-term soil fertility
- To minimise pollution of water, soil and air

II. REQUIREMENTS

1. Formal Requirements for IP Organisations and Their Members

1.1. Organisations: Basic requirements, inspection procedures and guideline structure

National or regional IP-organisations applying for endorsement by the IOBC Commission on 'IP-Guidelines and Endorsement' have to fulfil the basic requirement defined by the "Admission Criteria for Organisations seeking IOBC Endorsement" (see www.iobc.ch). They have to organise and operate their inspection and certification systems according to the standards defined in the Technical IOBC Guideline I and its Appendices 2 and 3 (3rd edition 2004 or more recent version). With respect to the establishment of flexible national and regional guidelines, we refer to the recommendations given in Appendix 1 of the Technical Guideline I and in the "IOBC Tool Box" published by the IOBC Commission on internet www.iobc.ch.

1.2. Professionally trained, environmentally and safety conscious growers

Successful Integrated Fruit Production requires professional, up-to-date training and a positive and sympathetic attitude to its aims. The requirements for the farmer (member of the regional IP-organisation) are defined by the IOBC Technical Guideline I and are summarised as follows:

The farmer or responsible farm manager must:

- Be professionally qualified to manage the farm according to IP principles;
- Be a member of an officially recognised IP association and has to sign a contract defining clearly the duties as member;
- Have a thorough knowledge of the aims and principles of Integrated Production and of regional IP-guidelines and standards and should have a positive and sympathetic attitude to environmental conservation and human health and safety.
- Undertake basic training and education in IP, and participate actively in the regular updating courses offered by his/her IP organisation;
- Keep complete farm records demonstrating essential farm operations such as fertilisation, pesticide applications, soil management, irrigation, according to the rules of the IP association.
- Carry out each year (preferably before harvest) a self-evaluation by completing the check-list (= inspection protocol) of the organisation (Technical Guideline II, point 1.4).

2. Conserving the Orchard Environment: Biodiversity and Ecological Infrastructures

An important aim and requirement of Integrated Fruit Production is conservation of the orchard environment, its habitats and wildlife. They must not be detrimentally altered, grubbed, drained, nor polluted.

As far as possible, a balanced and natural orchard environment with a diverse ecosystem of plants and animals must be created and conserved. According to IOBC standards, at least

5% of the entire farm surface (excluding forests) must be identified and managed as ecological infrastructures (= ecological compensation areas) with no input of pesticides or fertilisers, in order to enhance botanical and faunistic biodiversity. The surface of ecological infrastructures should eventually increase to 10%.

In areas with predominantly perennial crops and small farms, where a surface area of 5% or more of a common and homogeneous agroclimatic unit (e.g. municipal district) has been set aside as an ecological conservation area by official and well documented programmes, the 5% rule has not necessarily to be applied to the individual farm.

Existing ecological infrastructures on the farms must be preserved. Headland attractants (flowering field margins) should be established as reservoirs of pest antagonists. Regional organisations must establish lists of plants to be avoided (e.g. sources of infestations of major diseases, viruses etc). Areas of linear elements (e.g. flowering border strips, hedges, ditches, stone walls) and non-linear elements (e.g. groups of trees, ponds, etc) being present on the farm or planned should be combined in a manner to obtain spatial and temporal continuity as a prerequisite for the enhancement of faunistic diversity and for the maintenance of a diverse landscape. Practical examples on the evaluation of the ecological quality of the infrastructures, their functions, establishment and maintenance are given in the IOBC Toolbox on internet www.iobc.ch.

Particular attention must be devoted to headlands and windbreaks. Diversity of composition and structure should be the aim, using or encouraging native species where possible. IP guidelines must require implementation of at least two ecological options for active enhancement of biological diversity by each member farmer. A list of options for enhancing biological diversity must be provided. Examples are as follows: (i) Nesting boxes and/or perches for birds. (ii) Refuges for predators. (iii) Host plants for beneficials. (iv) Resistant cultivars as pollinators. (v) New wildlife habitats. Hedgerows should provide adequate screening to prevent pollution and contamination of fruit by exhaust fumes from busy roads.

Development of a professionally formulated conservation assessment and plan for the farm and its implementation are recommended.

3. Site Selection and Preparation for New Orchards

For new orchards, site, rootstocks, cultivar and planting system must be selected and harmonised so that regular yields of quality fruit, and hence economic success, can be expected with the minimum use of agrochemicals and environmentally hazardous practices. Chemical soil sterilisation is not permitted. Sites with a favourable aspect and good soils must be selected.

Analysis and preparation of the soil prior to planting

The measures must consist of:

- soil analysis: texture, organic matter, macro nutrients (at least P, K, Mg);
- basic fertilisation with organic and/or mineral components if necessary;
- land improvement if necessary (e.g. drainage, increasing content of organic matter where below 1%);
- thorough elimination of sources of disease inoculum (i.e. roots of old vines);
- elimination of perennial problem weeds.

Large scale melioration (e.g. excavations and land-fillings) should be examined critically with respect to their environmental impact and destruction of a diversified topography and existing ecological compensation areas. Frost pockets, poor drainage and shallow non-moisture retentive soils for instance, must be avoided.

4. Site Management: Alleyways and Weed-free Strip

The aims are to maintain plant species diversity in the orchard so fostering ecological stability, to minimise the use of herbicides (avoiding residual chemicals completely, see chapter 8) and to avoid soil erosion and compaction in the alleyways, without detriment to yield with minimum inputs of fertilisers and irrigation water.

Maintaining overall bare soil management of orchards is not permitted. Alleyways must be of grass and/or herbs and of adequate width to easily accommodate tractor wheelings. Non-competitive grass/herb mixtures are recommended. Regional or national guidelines must specify a maximum width for the weed free strip and/or percentage of the soil surface which may be weed-free. Where possible, in established cropping orchards with excessively vigorous growth the use of herbicides must not be permitted. To avoid undue competition for moisture and nutrients, a weed free strip should be maintained by mulching or covering the soil surface or by mechanical cultivation. Where soil moisture is adequate, ground cover must be allowed to develop in the weed free strip in the winter and, where possible, at other times of year. Herbicides permitted in Integrated Fruit Production (see Section 10) may only be used to supplement such cultural weed control methods. They must not be used to achieve overall bare soil. It is recommended that use of selective broad-leaf weed herbicides in the alleyways is avoided.

5. Rootstocks, Cultivars, Planting and Training Systems

5.1 Cultivars

The cultivar chosen must offer good prospects for economic success with minimal use of agrochemicals. For example Golden Delicious must not be planted on sites prone to russeting, nor Jonagold on sites unfavourable for fruit colouring and firmness. Cultivars resistant or tolerant to diseases and/or pests are preferred. Planting material should be sound and certified virus-free. Where this is not available then planting material of the highest health status available must be used.

5.2 Planting

Planting systems may be single or multi-rows, but single rows are preferred. Small trees of uniform size are the aim for the future so that safer, more efficient spraying practices can be adopted.

Planting distances should allow enough space for the tree throughout its expected life span without the use of synthetic plant growth regulators or severe pruning.

5.3 Tree Training and Management

Trees must be trained and pruned to achieve a manageable uniform size, a balance between growth and regular yields, and to allow good penetration of light and spray to the tree centre.

The use of non-naturally occurring, synthetic plant growth regulators is not permitted except for those instances set out in section 9. Excessive growth should be controlled by cultural measures, including reducing fertiliser and irrigation supply, summer pruning and encouraging greater set of blossom.

5.4 Fruit Management

Regular yields of quality fruit with minimal use of chemicals are a central aim of Integrated Fruit Production. Where excessive numbers of flowers have pollinated and set during blossom and an excessive crop is likely to result, the young fruitlets must be thinned shortly after blossom to the optimum number to ensure adequate fruit size and quality. Hand thinning is preferred and is often most reliable. However, chemical thinning agents are permitted on varieties where their use is required for economic production.

Conversely, where weather during blossom is unfavourable for pollination and set, sprays of naturally occurring (but chemically synthesised) crop setting agents (e.g. gibberellins, NAA) are permitted. The use of non-naturally occurring, synthetic plant growth regulators as fruit finishing, colouring or ripening agents is not permitted.

6. Tree Nutrition

The structure, depth, fertility, fauna and micro-flora of the soil must be conserved and nutrients and organic matter recycled where possible. The minimum quantities of fertilisers consistent with high yields of quality fruit may only be used when chemical analysis of soil or plant material shows they are justified. Risks and levels of pollution of ground water with fertilisers, especially nitrates, must be minimised.

Soil must be sampled and chemically analysed prior to planting. For new orchards, the pH should be corrected before planting. After planting, plant and/or soil analysis must be done on a regular basis to define nutrient and fertiliser requirements. Regional or national guidelines must set out a clear method by which requirements are determined, including sampling and analytical procedures and rules for decision making. It is recommended that N-min tests are used. The total maximum nitrogen input (expressed in kg N/ha/year) and period and methods of application must be set to minimise leaching. The total amount of available nitrogen in organic fertilisers should be accounted for a period of 3 years. The same rules apply for other major nutrients. The amounts of P and/or K applied, indicated by soil or plant analyses, must not exceed the indicated amount by more than 10%, except for organic fertilisers applied every second or third year. Records of soil and/or plant analyses and of all nutrient applications must be kept and made available for inspection by the controlling officer. Fertilisers or manures contaminated with toxic or environmentally hazardous substances such as heavy metals or pathogenic micro- organisms are not permitted.

7. Irrigation

Trees must be supplied with adequate soil moisture to ensure balanced growth and high internal and external fruit quality. Excessive soil moisture may result in poor fruit quality, leaching of nutrients and increased risk of root rot. Excessive use of irrigation water is wasteful. Irrigation must be applied according to need.

In orchards where irrigation is required, daily rainfall must be measured and the soil moisture deficit estimated. Irrigation water of adequate quality (conductivity, CI-content) must be supplied according to the soil moisture deficit and the water storing capacity of the soil. National/regional guidelines must define the maximum water volume that may be supplied.

8. Integrated Plant Protection

8.1 Principles of Integrated Plant Protection

The modern approach to Integrated Plant Protection in the context of sustainable production systems has been described in Technical Guideline II (2004) and can be summarised as follows:

Preventive (indirect) measures and observations in the field on the pest, disease and weed status must have been considered before intervention with direct plant protection measures takes place.

For further details on plant protection strategies we refer to the IOBC Technical Guideline II (2004) and its Appendices 4 and 5, respectively.

8.1.1 Prevention (= indirect plant protection)

The prevention and/or suppression of key pests and diseases should be supported among other options especially by the

- choice of appropriate resistant/tolerant cultivars;
- use of adequate cultivation techniques. The cultural practice of removal of overwintering sources of infestation or infection (e.g. wood scab, canker, brown rot) as far as practically possible is required.
- use of optimum fertilization (especially low nitrogen input) and irrigation practices;
- protection and enhancement of beneficial organisms (e.g. predatory mites, aphid predators, parasitoids);
- utilisation of ecological infrastructures inside and outside production sites, to enhance a supportive conservation biological control of key pests by antagonists (see chapter 2).

8.1.2 Risk assessment and monitoring

Basically, all available prophylactic measures (= indirect plant protection) must be applied before direct control measures are used. The decision for the application of direct control methods is based on economic thresholds (tolerance levels), risk assessment and the services provided by the official forecasting services (prognoses).

Populations of pests and diseases must be regularly monitored and recorded. Scientifically established assessment methods appropriate to the region or locality must be used. For each pest or disease the approximate level of infestation or the risk of damage must be estimated. The decision, if a treatment is necessary, must be based on scientifically established threshold levels and the official forecasts of pest and/or disease occurrence and

risks. Existing and validated forecasting models for diseases should be used and the use of adequate monitoring devices by groups of growers recommended.

8.1.3 Direct plant protection measures (= control)

Where indirect plant protection measures are not sufficient to solve the problem and the forecasting operations and threshold values indicate a necessity of intervention with direct plant protection measures, priority must be given to measures with minimum impact on human health, non-target organisms and the environment. Biological, biotechnical* and physical methods must be preferred to chemical methods if they provide satisfactory control (e.g. granulovirus for codling moth, *Bacillus thuringiensis* for noctuid caterpillars in summer, or pheromone mating disruption for codling moth and/or tortricids).

(*Biotechnical control methods are defined in applied entomology as highly specific procedures that influence the behaviour or development of pests without direct biocidal activity, such as mating disruption, selective attractants and traps, deterrents, sterile insect technique. IOBC approved biotechnology methods do not include genetically modified organisms/ GMOs).

8.2 The choice of direct plant protection methods (= control)

All agrochemicals used must fulfil the basic requirements of GAP as detailed in the IOBC Technical Guideline II. All crop protection products applied must be officially registered or permitted by the appropriate governmental organisation in the country of application and final destination of produce. Where no official registration scheme exists reference is made to the FAO Code of Conduct on the Distribution and Use of Pesticides.

The crop protection product applied must be appropriate for the target pest or disease as recommended on the product label or for officially approved off-label uses.

IP-Organisation guidelines must set out a strategy of mandatory measures for minimising the risk of the development of resistance of pests and diseases to pesticides. The strategy must require the alternation of the use of pesticides with different modes of action (where available). The maximum number of applications of any one fungicide group with a risk of resistance development must be set to three per crop per annum and the maximum number of applications of any acaricide group for control of spider mites must be set to one per crop per annum.

Pesticides available locally or nationally identified as meeting these criteria, as well as being as safe as possible to key natural enemies, must be identified in a list of permitted products (green list) in regional guidelines and standards with restrictions where appropriate (yellow list). All other pesticides must not be permitted and examples may be given (red list).

The following criteria should be taken into account in the classification of pesticides into 'permitted', 'permitted with restrictions' and 'not permitted' categories:

- Toxicity to humans
- Toxicity to key natural enemies
- Toxicity to other natural organisms
- Pollution potential for the environment (soil, water, air)
- Ability to stimulate pests
- Selectivity
- Persistence
- Incomplete or missing information
- Necessity of use.

Regularly updated data on the side-effects of pesticides are compiled and published by IOBC (see IOBC Toolbox on internet www.iobc.ch) and must be taken into account.

Based on these criteria, the IOBC sub-group for Integrated Fruit Production Guidelines and Standards has identified and agreed the following categorisation of certain pesticides and pesticide groups.

Not Permitted

- Pyrethroid insecticides and acaricides [1]
- Non-naturally occurring plant growth regulators
- Organochlorine insecticides and acaricides
- All acaricides toxic to Phytoseiid mites
- Toxic, water polluting or very persistent herbicides (e.g. Paraquat, Diquat)

Permitted with Restrictions

- Benzimidazole fungicides (storage rots and blossom wilt and, as a paint for canker control, only).
- Dithiocarbamate fungicides (normally a maximum of 3 applications per season and not in succession so that predatory phytoseiid mites are not affected. On pear crops in regions where *Stemphylium versicarium* is a severe problem, the maximum number of applications is 4 per season).
- Sulphur (use must be limited so that predatory phytoseiid mites are not affected).
- Residual herbicides, except toxic, water polluting or very persistent products (in the first three years after planting, maximum of one dose-equivalent per annum).

Statutory maximum residue levels must be observed. The occurrence of pesticide residues on fruits at harvest must be further minimised by maximising safe-to-harvest intervals and by minimising post-harvest chemical treatments.

Where available, officially-recognised dose adjustment protocols must be used to adjust dose rates to suit the size and density of the target trees being sprayed. No pesticide should normally be applied within 21 days of harvest. However, in seasons where there is significant rainfall and/or a high risk of pest or disease during late summer, insecticide or fungicide sprays may exceptionally be applied nearer to harvest if required, but not if post-harvest fungicide treatment is to be applied (see section 10.3).

8.3 Lists to be compiled by IOBC endorsed regional IP organisations

Each IOBC endorsed regional IP-organisation must establish for each geographically defined production zone:

- a ***list of key pests, key diseases and key weeds*** that require regular protection measures in the region concerned and
- a ***list of the most important known antagonist(s) of the key pests*** (“Passport”). At least *two key natural enemies* must be identified and their protection and augmentation be declared important (e.g. in apple usually a Phytoseiid mite, important aphid predators; in

[1] The use of a single spray application of a non-acaricidal synthetic pyrethroid per season for control of Mediterranean fruit fly shortly before harvest is permitted, as a temporary exception where no alternative control method is available. Where such use is permitted by national/regional guidelines, a research programme to find effective non-pesticidal alternative treatments must be rigorously pursued

pears anthocorid predators). Where phytoseiid predators are absent from orchards, they must be introduced where the pest situation (e.g. spider mites) requires regular control measures;

- a ***list of*** field-evaluated, available and recommended ***indirect plant protection measures*** (= prevention) as important part of the "Green list of plant protection measures" (see IOBC Toolbox www.iobc.ch) .
- a ***selective list of officially registered pest control measures*** divided clearly into those that can be used without restrictions in the IP program ("green list") and into those products that can only be used with clearly defined restrictions ("yellow list"). The IP-organisation applying for IOBC endorsement must prove that either no ecologically safer alternatives are available or that the active ingredient is necessary for a planned resistance management. Guidelines must define clearly the restrictions and permitted indications.

8.4 Application of pesticides and recording of pesticide treatments

For full details see Technical Guidelines II, chapter 8.4

There must be documented evidence on the application according to label instructions and that the application has been accurately calculated and prepared. Label doses are, however, maximum doses approved by the registration authorities. Reduced dosages are possible (especially in herbicides) if applied on the user's own risk (declined liability of companies) and if resistance management criteria (especially fungicides) do not require the full dosage.

The official pre-harvest intervals must be followed and should, if possible, be extended to minimise pesticide residues. They must be recorded for all crop protection product applications made and evidence provided that they have been observed. In situations with multiple harvest periods, systems must be in place in the field to ensure fail-safe compliance (e.g. warning signs).

8.5. Efficient and safe storage and handling of pesticides

The basic requirements of Good Agricultural Practice (GAP) with respect to storage, safe handling and disposal of pesticides and to the operation and maintenance of spray equipments must be fulfilled. They are listed in IOBC Technical Guideline II (8.5) and must be outlined in detail in IOBC endorsed regional IP guidelines.

The following selected list of mandatory requests include some of the general aspects and address the specific situation in pome fruit production as follows:

8.5.1 Safety and Handling: There must be adequate facilities for measuring, mixing and filling the products. Adequate emergency facilities must be provided to deal with potential operator contamination, such as running water, eyewash facilities, first aid box and emergency procedures. The emergency plan must include a list of emergency telephone numbers and the location of the nearest telephone. Operators must have appropriate protective clothing and equipment for all operations involving chemicals.

8.5.2 Application and Training: The use of best application techniques available to minimize drift and loss is highly recommended. All sprayer operators must have appropriate training and hold, where relevant, the appropriate certificate of competence. Operators on training for the certificate of competence must be supervised during pesticide application by a certificate holder and must be within sight and sound of the supervisor.

8.5.3 Storage: The regulations on storage of pesticides are numerous and contain in certain GAP standards close to 20 “must” items. Pesticides must be stored in accordance to local regulations, in a locked room and separated from other materials. Keys and access to the pesticide store must be limited to workers with formal training in the handling of pesticides. Pesticides must only be stored in their original package. Only pesticides that are approved for use on the crops must be stored in the same room; crop protection products used for purposes other than application on crops according to IOBC endorsed IP programs must be clearly identified and stored separated from “green” and “yellow list “products.

8.6 Spray equipment

Radial flow air assisted sprayers, traditionally used for top fruit spraying, are inefficient and generate high levels of spray drift. An important requirement of Integrated Fruit Production is that these sprayers are used as safely and efficiently as possible and that new designs of sprayer which are safer and more efficient are gradually adopted.

Sprayers must be regularly serviced and calibrated by the grower and must comply with officially-recognised sprayer testing requirements. They must be serviced by a recognised agent at least every four years. The size and shape of the spray plume generated by the sprayer should be set to match the tree target. Spraying in windy conditions is not permitted. Statutory buffer zones must be observed to protect watercourses from pollution by spray drift. When new sprayers are purchased, transverse flow designs or tunnel sprayers (where spray not deposited on the tree is collected and recycled) must be selected where possible (i.e. in modern intensive orchards). When planting systems for new orchards are chosen their compatibility with these safer spraying methods must be taken into account. Wherever possible, tractors must be fitted with a cab.

8.7 Disposal of surplus mix, obsolete pesticides and empty containers:

Under normal circumstances surplus spray mix should not occur. However, if surplus should occur, disposal must comply with local regulations. Surplus application mix or tank washings must be either disposed of by a registered waste contractor or sprayed onto a designated untreated part of the crop. When surplus mix or tank washings are applied onto designated fallow land, it must be demonstrated that this is legal practice and there is no risk of surface water contamination.

The safe disposal of redundant pesticides must be planned and recorded, and obsolete pesticides must only be disposed of through an approved chemical waste contractor. Empty pesticide containers must be rinsed with water three times and the rinsate returned to the spray tank. Empty containers must not be re-used and are crushed or perforated to prevent re-use.

8.8 Pesticide residues

Statutory maximum residue levels must be observed. The occurrence of pesticide residues on fresh fruits at harvest must be further minimised by maximising safe-to-harvest intervals.

9. Harvest

Harvest and post-harvest handling practices have to fulfil the general requirements for product quality, food safety and traceability established by national or international food safety standards and are outlined in the IOBC Technical Guideline II (chapters 9 and 10). Some selected “must” items are listed below.

9.1 Produce quality

Fruit must be harvested at the correct time according to the cultivar and for the purpose intended. Only fruit of sound internal quality may be certified and labelled as meeting Integrated Fruit Production standards. Standards for internal quality based on sound scientific evidence must be defined in regional or national guidelines wherever possible. Where such quality standards are established regional guidelines and standards must set out measures for checking the quality of fruit (including taste, firmness and internal conditions if possible). A representative sample of fruit of each major variety, from each orchard and from each store must be assessed for fruit quality before marketing.

9.2 Hygiene

All staff must be aware of the need to harvest, transport and handle the fruits with care having received basic training in personal hygiene requirements for handling of fresh produce.

A documented and up-dated risk assessment covering hygiene aspects of the harvest process and of produce handling operations must be made and hygiene procedures be implemented.

Workers must be provided with clean fixed or mobile toilet facilities at all permanent sites and in vicinity of fieldwork.

Staff must have access to clean hand washing facilities in the vicinity of their work.

10. Post harvest Management and Storage

10.1 Hygiene

See chapter 9.2.

10.2 Post-harvest washing

When necessary, post-harvest washing could be performed to reduce hygiene risks.

10.3 Post-harvest treatments

Where effective non-chemical post-harvest treatments (e.g. physical treatments or approved biological control agents) are available, they must be used for the control of storage rots and/or disorders. Post-harvest treatment with synthetic, non-naturally occurring anti-oxidants for control of superficial scald and other disorders is not permitted.

In order to minimise the use of fungicide sprays shortly before harvest for control of storage diseases, post-harvest fungicide treatment of fruit is permitted where the following conditions have been fulfilled:

10.3.1 Post-harvest fungicide treatments may only be used where suitable non-chemical methods are not available.

10.3.2 Post-harvest fungicide treatment is only permitted on cultivars with a moderate to high susceptibility to storage rots. Such cultivars should be avoided where possible. Cultural methods to minimise the risk of rotting, including where appropriate mulching of the soil surface to minimise soil splash, removal of sources of *inoculum* from orchards, measures to ensure correct fruit mineral composition and high quality storage conditions, must be specified.

10.3.3 The risk of storage rots, based on store rot history, fruit mineral analysis, orchard factors and weather, must be determined and recorded for each orchard before harvest using scientifically sound and published methods. Only fruit with a significant risk of storage rots but which is otherwise suitable and intended for long-term storage (beyond 31 December) may be treated with fungicide post-harvest.

10.3.4 Fruit treated with fungicides for storage rot control pre-harvest may not be treated *post- harvest.*

10.3.5 The dose (or concentration) of fungicide must be adjusted so that adequate control is achieved with minimum fungicide residues on fruits. Residues (and MRLs) must not *be greater than for pre-harvest treatment.*

10.3.6 A safe and legally acceptable method for disposal of excess fungicide solution must be used.

10.4 Storage and/or further processing

Storage methods must be such as to maintain high internal and external fruit quality. Stores and refrigeration equipment must be maintained to ensure maximum efficiency and must be regularly monitored to ensure correct operating conditions. Accurate records must be required. Fruit in store should be regularly monitored for external and internal condition and firmness: Records must be kept and made available for inspection.

11. Animal production on mixed farms

See Technical Guidelines II (chapter 11)

12. Workers' health, safety and welfare

The aspects of the workers' health, safety and welfare are detailed in IOBC Technical Guideline I (2004) and in the "Admission Criteria for Organisations seeking IOBC Endorsement", respectively. The criteria are those outlined in the Declaration of the International Labour Organisation (www.ilo.org), an organisation of the United Nations.

III. SELECTED LITERATURE (*available in full text on internet www.iobc.ch)

*Boller, E.F; Avilla, J.; Gendrier, J.P.; Jörg, E.; Malavolta, C. 1998. Integrated Production in Europe: 20 years after the declaration of Ovrannaz. – IOBC/WPRS Bulletin 21(1), 41 pp.

*Boller, E.F.; Avilla, J.; Jörg E.; Malavolta C.; Wijnands, F.; Esbjerg, P. 2004. Integrated Production: Principles and technical Guidelines. 3rd edition. – IOBC/WPRS Bulletin 27(2), 49 pp.

*IOBC Toolbox: www.iobc.ch