

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

**GUIDELINES FOR INTEGRATED PRODUCTION  
OF POME FRUITS**

IOBC TECHNICAL GUIDELINE III

2002. 3rd 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 2002 as agreed by the Integrated Fruit Production Guidelines Sub-group of the IOBC/WPRS Orchards Working Group at its meeting in Lleida, Spain in October 2000. It is intended as a framework for formulation of regional or national guidelines and standards according to IOBC standards and to facilitate their harmonisation. The IOBC principles of Integrated Production and Technical Guidelines I and II (2<sup>nd</sup> edition), published in IOBC/WPRS Bulletin Vol. 22(4) 1999, are an integral part of these crop specific Technical Guidelines III.

**I. Definition of Integrated Production of Pome Fruits**

In the frame of the IOBC definition for Integrated Production, 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
- To preserve and promote long-term soil fertility
- To minimise pollution of water, soil and air

## **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.

Farm managers must be professionally trained in all aspects of Integrated Fruit Production by attending locally organised training courses. They should have a thorough knowledge of the aims and principles of Integrated Fruit Production and of regional guidelines and standards. They should have a positive and sympathetic attitude to environmental conservation and human health and safety. A requirement for attendance at an introductory training course as well as at regular updating and review meetings is mandatory.

Pome fruit growers must be members of an officially recognised IP association. A contract has to be signed between each member and its IP-association that lists the obligations of the member as defined by Technical Guideline I

## **3. Conserving the Orchard Environment**

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, nor 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 compensation areas with no input of pesticides or fertilisers in order to enhance botanical and faunistic biodiversity.

In areas with predominantly perennial crops and small farms, where a surface area of 5% or more of a common and homogeneous agro-climatic 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. 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.

#### **4. Site, Rootstocks, Cultivar and Planting System 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. Frost pockets, poor drainage and shallow non-moisture retentive soils for instance, must be avoided. 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 russetting, 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.

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. Soil Management and 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 determine 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.

## **6. 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 Section 10) and to avoid soil erosion and compaction in the alleyways, without detriment to yield with minimum inputs of fertilisers and irrigation water.

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.

## **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. 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.

## **9. 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.

The use of the plant growth regulator prohexadione-Ca to control the secondary spread of fireblight is permitted.

## **10. Integrated Plant Protection**

The modern approach to Integrated Plant Protection in sustainable production systems is described in Technical Guideline II. All available prophylactic (indirect) plant protection measures must be applied before direct control measures are used. The decision for the application of direct control measures must be based on economic thresholds, risk assessments and forecasts including those provided by official forecasting services. A restrictive list of key pests and diseases that require regular attention must be established.

Priority must be given to natural, cultural, biological, genetic and biotechnical methods of pest, disease and weed control, and the use of agrochemicals must be minimised. Plant protection products may only be used when justified and the most selective, least toxic, least persistent product, which is as safe as possible to humans and the environment, selected. Products meeting these criteria must be identified in regional guidelines and standards (see below).

Populations of key natural enemies (e.g. phytoseiid mites on apple or anthocorid predators on pear) must be preserved. At least two key natural enemies in each crop must be identified in national/regional guidelines. This means plant protection products toxic to them may not be used. Where phytoseiid predators are absent from apple orchards, they must be introduced where control measures are required for phytophagous mite pests.

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. Provision of nesting boxes for insectivorous birds and avoidance of vigorous shoot growth susceptible to pests and diseases is recommended.

Populations of pests, diseases and weeds 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 and a decision as to whether or not treatment is required, based on scientifically

established threshold levels wherever possible, taken and recorded. Predominant weed species present, their growth stage, distribution and extent should also be recorded.

Wherever an additional control measure is deemed necessary, a biological, genetic or biotechnical control method (e.g. granulovirus for codling moth, *Bacillus thuringiensis* for noctuid caterpillars in summer, or pheromone mating disruption for codling moth and/or tortricids) must be used if available and effective.

Where the use of plant protection products is necessary, the product selected must be the least hazardous to human beings, livestock and the environment whilst providing effective control of the pest, disease or weed problem.

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 man

Toxicity to key natural enemies

Toxicity to other natural organisms

Pollution of ground and surface water

Ability to stimulate pests

Selectivity

Persistence

Incomplete information

Necessity of use

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†

Non-naturally occurring plant growth regulators

Organochlorine insecticides and acaricides

Toxic, water polluting or very persistent herbicides

† Footnote: 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

#### 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 13).

## **11. Efficient and Safe Spray Application Methods**

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.

## **12. Harvesting, Storage and Fruit Quality**

Fruit must be harvested at the correct time according to the cultivar and for the purpose intended. 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.

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.

### **13. Post-harvest treatments for the control of storage rots and disorders**

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:

- 1) Post-harvest fungicide treatments may only be used where suitable non-chemical methods are not available.
- 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.
- 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.
- 4) Fruit treated with fungicides for storage rot control pre-harvest may not be treated post-harvest.
- 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.
- 6) A safe and legally acceptable method for disposal of excess fungicide solution must be used.

### **14. Inspection Procedures and Guideline Structure**

National/regional IP-organisations applying for endorsement by the IOBC commission 'IP-

Guidelines and Endorsement' have to organise and operate their inspection and certification systems according to the standards defined by Appendix 2 of the Technical IOBC Guideline 1 (2<sup>nd</sup> edition 1999). With respect to the establishment of flexible national and regional guidelines, we refer to the recommendation in Appendix 1 of IOBC Technical Guideline 1 (2<sup>nd</sup> edition 1999).

### **Selected literature**

Anonymous. 1998. Integrated Production in Europe: 20 years after the declaration of Ovrannaz. IOBC/WPRS Bulletin 21(1), 1998.

Anonymous. 1999. Integrated Production: Principles and technical Guidelines. 2<sup>nd</sup> edition. IOBC/WPRS Bulletin 22(4), 1999.