

This is a reduced version of an IOBC document containing the full original English text

IOBC/WPRS Working Group  
Integrated Plant Protection in  
Orchards

and

ISHS Working Group  
Integrated Fruit Production

# **GUIDELINES FOR INTEGRATED PRODUCTION OF SOFT FRUITS**

**IOBC Technical Guideline III**

1<sup>st</sup> Edition, 1999

Edited by E. Jörg & J.V. Cross

**IOBC wprs Bulletin**  
**Bulletin OILB srop Vol. 23 (5) 2000**

---

The IOBC/WPRS Bulletin is published by the International Organization for Biological and integrated Control of Noxious Animals and Plants, West Palaearctic Regional Section (IOBC/WPRS)

Le Bulletin OILB/SROP est publié par l'Organisation Internationale de Lutte Biologique et intégrée contre les Animaux et les Plantes Nuisibles, section Régionale Ouest Paléarctique (OILB/SROP)

Copyright IOBC/WPRS 2000

Address General Secretariat IOBC/WPRS

INRA – Centre de Recherches de Dijon  
Laboratoire de Recherches sur la Flore Pathogene dans le Sol  
17, Rue Sully – BV 1540  
F-21034 Dijon Cedex, FRANCE

ISBN 92-9067-121-1

## Preface

The „Guidelines for Integrated Production of Soft Fruit“ are a further step to complete the IOBC - series of Technical Guidelines III defining Integrated Production at the crop level. Such guidelines have been published for pome fruits (1st edition 1991, 2nd ed. 1994), viticulture (1<sup>st</sup> edition 1996, 2<sup>nd</sup> ed. 1999), stone fruits (1997) and arable crops (1997). With the exception of citrus fruits (for which IP guidelines are in preparation), Integrated Production now is defined for all fruit crops.

Soft fruit crops are highly diverse. They comprise annual and perennial crops, row, bush and tree crops, they are grown in protected and non-protected environments and are cultivated in intensive or quite extensive growing systems. This diversity forces us to deal with manifold problems. For years the preparation of an IP soft fruit guideline was considered to be impossible. On the other hand the challenge was strong enough to start with the project.

The elaboration of this guideline for Integrated Production of Soft Fruit followed a procedure proposed by the IOBC Commission for „IP Guidelines and Endorsement“. In a first step, a panel of a few experts assembled at Vienna in October 1996. They fruitfully discussed which tools are available for an Integrated Production of the various soft fruit crops and defined a baseline for this way of production. The result was a rough but comprehensive draft covering almost all IP aspects. The colleagues of the panel meeting were Angela Berrie (UK), Dariusz Gajek (PL), Erich Jörg (D), Philip Lieten (B), Fritz Polesny (A) and Robert Steffek (A). In a second step, a detailed draft, structured in accordance with the Technical Guidelines III already published and keeping their standards, was produced by German colleagues (Rudolf Faby, Arno Fried, Peter Galli, Ulrike Gärtner, Erich Jörg and Norbert Laun). From the 7<sup>th</sup> to the 10<sup>th</sup> of October 1997 the „First Workshop on Problems in Integrated Production of Soft Fruits and on Guidelines for Integrated Production of Soft Fruits jointly organised by IOBC Working Group „Integrated Plant Protection in Orchards“ and ISHS Working Group „Integrated Fruit Production“ was held again at Vienna. Agronomists, plant pathologists and entomologists from all over Europe presented their experiences in soft fruit IP and intensively discussed the guideline draft. The foundation of a subgroup for Soft Fruit within the IOBC Orchard working group origins from this successful workshop.

The editors wish to express their gratitude to all the colleagues involved in the preparation of these guidelines. This also includes the members of the IOBC Commission for „IP Guidelines and Endorsement“ who strongly supported the work. Also many thanks to Jesus Avilla (E), Jerry Cross (UK), Dariusz Gajek (PL), Erich Jörg (D), Carlo Malavolta (I), Catherine Baroffio (CH), Jean-Paul Gendrier (F), Klára Balázs(HU) for the translations.

Erich Jörg, Jerry Cross  
Editors

# Table of Contents

Preface	i
GUIDELINES FOR INTEGRATED PRODUCTION OF SOFT FRUITS IOBC Technical Guideline III	1
DIRECTIVES POUR LA PRODUCTION INTEGREE DES PETITS FRUITS Directive technique III OILB	11
RICHTLINIEN FÜR DIE INTEGRIERTE BEERENOBSTPRODUKTION Technische OILB Richtlinie III	23
DIRECTRICES PARA LA PRODUCCIÓN INTEGRADA DE PEQUEÑOS FRUTOS Directriz Técnica III OILB	35
DIRETTIVE PER LA PRODUZIONE INTEGRATA DEI FRUTTI MINORI Direttiva Tecnica III OILB	47
WYTYCZNE DLA INTEGROWANEJ PRODUKCJI OWOCOW JAGODOWYCH IOBC Specjalistyczne Wytyczne III (Polish translation))	59
A BOGYOS GYÜMÖLCSÜEK INTEGRALT TERMESZTESENEK IRANYELVEI EUROPABAN IOBC Technikai Utmutato III (Hungarian translation)	69

INTERNATIONAL ORGANISATION FOR BIOLOGICAL AND INTEGRATED  
CONTROL OF NOXIOUS ANIMALS AND PLANTS  
&  
INTERNATIONAL SOCIETY FOR HORTICULTURAL SCIENCE  
JOINT GROUP FOR INTEGRATED FRUIT PRODUCTION GUIDELINES

# **GUIDELINES FOR INTEGRATED PRODUCTION OF SOFT FRUITS**

## **IOBC Technical Guideline III**

**(Strawberry, Raspberry, Blackberry, Currants, Gooseberry,  
Blueberry, Elder, etc.)\***

1999, 1st Edition

(Original text in English)

The following paper sets out principles, minimum standards and guidelines for in-soil Integrated Production of Soft Fruits in Europe starting from 1 January 1999 as agreed by the above joint-group of the IOBC/WPRS and ISHS in Vienna, Austria in October 1997. It is intended as a framework for formulation of regional guidelines and standards and to aid harmonisation of them throughout the geographic areas covered by IOBC/WPRS. The IOBC principles of Integrated Production (Guidelines I and II), which form the basis of this paper are published in IOBC/WPRS Bulletin Vol. 22, 1999.

\*Note: These guidelines are for soft fruit crops grown in the soil in the open or under non-heated protection only. Although only the major soft fruit crops are covered specifically, the same principles can be extended to other closely related minor soft fruit crops.

### **1. Definition of Integrated Production of Soft 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.

### **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.

### 3. Conserving the Fruit Crop Environment

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

As far as possible a balanced and natural cropping environment with a diverse ecosystem of plants and animals must be created and conserved. Particular attention must be devoted to headlands and windbreaks. Windbreaks are essential for the protection of raspberry, blackberry and blueberry plantations and must be planted on sites exposed to strong winds.

Diversity of composition and structure should be the aim, using or encouraging native species where possible. Species which are host plants of important soft fruit pathogens must be avoided. At least two ecological options for the active enhancement of biological diversity are required in national/regional guidelines. Examples are as follows: (i) Nesting boxes and/or perches for birds. (ii) Refugia for predators. (iii) Host plants for beneficials (iv) Provision of 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, Cultivar, Planting Material and Planting System for New Soft Fruit Plantations

For new soft fruit plantations, site, cultivars, rootstocks for currants and gooseberries 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 appropriate soils must be selected. Frost pockets or poor drainage must be avoided. For strawberry and especially for raspberry production, a preference for sites where these crops have not been grown previously must be stated. Sites with significant infestations of plant-parasitic or virus-transmitting nematodes should be excluded from production. It is recommended that a crop of *Tagetes* spp. is planted to reduce nematode infestation prior to planting sensitive crops. Sites infected with the soil-borne root rot fungus *Phytophthora fragariae* var. *rubi* must not be used for raspberry production. Ridge cultivation lowers the risk of infection with root rots and should be preferred in strawberries as well as in raspberries, especially on heavy soils. Neither strawberry nor cane fruit should be grown on sites infested with perennial weeds.

The cultivar chosen must offer good prospects for economic success with minimal use of agrochemicals. A preference for cultivars resistant or tolerant to fungal diseases, pests, viruses and/or phytoplasmas must be stated. National/regional guidelines must set out a list of the relative susceptibilities of the commonly grown cultivars of soft fruits to all important pests and diseases. Recommendations for i) strawberry cultivars resistant to Verticillium wilt and/or powdery mildew, ii) raspberry cultivars less susceptible to *Phytophthora fragariae* var. *rubi* and/or virus-transmitting aphids, iii) black currant cultivars resistant to black currant gall mite and/or reversion disease, iv) black currant and gooseberry cultivars resistant to powdery mildew, must be stated where available.

Planting material must be certified as being of high health status. The requirements of EU regulations must be fulfilled. It must be pointed out that problems with *Phytophthora* spp.,

*Verticillium*, *Xanthomonas*, *Colletotrichum*, virus diseases, tarsonemid mites or free living nematodes may often be avoided by the use of healthy planting material. Additional testing of the health status of planting material must be recommended. However, no recommendation for growers to propagate their own planting material may be given. The grower may only be permitted to use such material on his own farm with a recommendation for additional testing for the health status of the material. Care should be taken to avoid planting material contaminated with pesticide residues which may disrupt subsequent biological control programmes.

Planting systems must allow safer, more efficient spraying practices to be adopted. Planting distances should allow enough space for the plant throughout its expected life span without the use of growth regulators.

Cane fruit crops must not be grown on the same land twice. In order to avoid the spread of pests and diseases, the spatial and temporal separation between successive soft fruit crops should be maximised.

The maximum life span of strawberry crops must not exceed three years to avoid poor fruit quality and pest or disease problems. Strawberry crops must be integrated into diverse crop rotations, preferably including cereals or peas or beans. Break crops that are host plants for *Verticillium* wilt, e.g. potatoes, tomatoes or linseed, must be avoided. A break of at least three years is recommended. However for strawberry crops with a life span of only one year, continuous cropping is permitted as long as soil-borne diseases do not occur at significant levels.

## **5. Soil Management and Plant 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. 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 maximum nitrogen input (expressed in kg N/ha/year) and period and methods of application must be set to minimise leaching. The same rules apply for other major nutrients with high polluting potential. 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 cane and bush fruit plantations so fostering ecological stability, to minimise the use of herbicides (avoiding persistent, toxic or water polluting residual herbicides 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 fruit plantations throughout the year is not permitted. In arid areas, bare soil management by soil tillage is permitted in spring and

summer. Alleyways should be of grass and/or herbs and of adequate width to easily accommodate tractor wheelings. Non-competitive grass/herb mixtures are recommended.

To avoid undue competition for moisture and nutrients, a weed free strip should be maintained in the rows of cane and bush fruit crops by mulching or mulching the soil surface or by mechanical cultivation. For elderberry production, it is recommended that, where possible, ground cover is allowed to develop in the weed free strip at times of year (e.g. the winter) when soil moisture is adequate. 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. Regional/national guidelines must specify a maximum width for the weed free strip and a maximum percentage of bare soil surface. It is recommended that use of selective broad-leaf weed herbicides in the alleyways is avoided.

In strawberry crops, mulching the soil with straw and/or plastic reduces fruit pollution, weed competition and infection by fungal diseases. A preference for the use of such mulches must be stated.

## **7. Irrigation**

Plants must be supplied with adequate soil moisture to ensure balanced growth and ensure high internal and external fruit quality. Excessive soil moisture may result in poor fruit quality, leaching of nutrients and increased risk of root rots. Excessive use of irrigation water is wasteful. Irrigation must be applied according to species need. Wherever possible drip irrigation or fertigation should be preferred.

In plantations where irrigation is required, daily rainfall must be measured and the soil moisture deficit estimated. Irrigation water must be supplied according to the requirements of the tree, the soil moisture balance and water storage capacity.

Particular attention must be focused on water quality with particular reference to salt and content of polluting agents.

## **8. Horticultural Management**

Plants must be managed to achieve a balance between growth and regular yields, and to allow an optimal distribution of solar radiation and spray in the canopy. The use of growth regulators is not permitted. Excessive growth should be controlled by cultural measures, including reducing fertiliser and irrigation supply, pruning and encouraging an optimal fruit set.

## **9. Fruit Management**

The use of chemical agents for fruit management is not permitted.

## **10. Integrated Plant Protection**

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 the main natural enemies of soft fruit pests must be preserved. At least two main natural enemies in each crop must be identified in national/regional guidelines. This means plant protection products toxic to them should not be used.

Phytoseiid predatory mites must be conserved and utilised as far as possible in integrated mite management.

Wherever an additional control measure is deemed necessary, a biological or biotechnical control method (e.g. *Bacillus thuringiensis* or pheromone mating disruption for tortricids, entomopathogenic nematodes for vine weevil) should be used if available and effective. The cultural practice of removal of sources of infestation or infection (see Chapters 10.1, 10.2 and 10.3) as far as practically possible is required.

Populations of pests, diseases and weeds must be regularly monitored and recorded. Scientifically established assessment methods appropriate to regional or local conditions 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.

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.

Regional/national guidelines must set out a strategy of mandatory measures for minimising the risk of development of resistance of pests and diseases to pesticides. The strategy must require the alternation of use of pesticides with different modes of action (where available). The maximum number of applications of any one fungicide group with a risk 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 the main 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, together with the requirements of the anti-resistance strategy, should be taken into account in the classification of pesticides into 'permitted', 'permitted with restrictions' and 'not permitted' categories:

Toxicity to man  
 Toxicity to main 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 joint-group for Integrated Fruit Guidelines and Standards have identified and agreed the following categorisation of certain pesticides and pesticide groups for soft fruit crops.

#### Not permitted

- Plant growth regulators
- Organochlorine pesticides, except endosulfan where permitted with restrictions
- Persistent (DT50 > 3 months), toxic or ground-water polluting residual herbicides including triazines.

- Diquat, Paraquat
- Persistent or phytoseiid mite toxic OP insecticides

#### Permitted with Restrictions

- Non-persistent (DT50 < 3 months), non-toxic, non-ground water polluting residual herbicides (maximum of 1 dose-equivalent/annum)
- Benzimidazole fungicides (maximum of 1 application/year, except on raspberry a maximum of 2 applications per annum as directed sprays to control cane blight only)
- Other fungicide groups with risk of resistance development (including EBIs, dicarboximides and dithiocarbamates) (maximum 3 applications per group/year)
- Acaricides for control of spider mite (maximum of 1 application per chemical group /year)
- Endosulfan (maximum of 1 application/year for control of *Acalitus essigi* on cane fruit or for control of tarsonemid mite on strawberry or 2 applications/year for control of black currant gall mite)
- Pyrethroid insecticides (maximum of 1 application/year for control of *Anthonomus rubi* or thrips on strawberry)
- OP insecticides of short persistence and low toxicity to phytoseiid predatory mites (maximum of 2 applications/year)

The use of synthetic pyrethroids should not be permitted.

However, as a short-term measure, so that more selective control methods can be identified, the use of synthetic pyrethroids may be permitted with the restrictions specified above.

Regions/countries which permit the use of pyrethroids and/or endosulfan must have an active research programme to identify more favourable alternatives.

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

Spray applications should be localised to parts of orchards where damaging infestation is present.

### **10.1 Additional requirements for integrated plant protection on strawberry**

Naturally-occurring phytoseiid predatory mites reduce populations of spider mites, tarsonemid mites and thrips and must be conserved. Use of pesticides harmful to them must be avoided. Where application of a harmful pesticide cannot be avoided, effects may be alleviated by downward-directed spraying to reduce deposits on the undersides of leaves where the predatory mites occur mainly.

The predatory mite *Phytoseiulus persimilis* or another appropriate species must be introduced for biological control of two-spotted spider mite on protected crops (in tunnels etc.).

*Orius* spp. or other suitable predatory mirids should be used to control western flower thrips on protected crops.

Entomopathogenic nematodes, where available, should be used to control vine weevil on protected crops.

## 10.2 Additional requirements for integrated plant protection on cane fruits

As for strawberry, predatory mites must be conserved in field crops and *P. persimilis*, or another suitable species, used for biological control in protected crops.

*Byturus tomentosus* must be monitored regularly by using white sticky traps.

The raspberry clearwing moth, *Synanthedon hylaeiformis*, must be monitored with pheromone traps. Infested shoots must be pruned and removed from the plantation.

To prevent the development of cane diseases the following cultural methods should be applied 1) early removal of superfluous fruiting canes 2) removal of fruiting canes immediately after harvest 3) reduction of Nitrogen fertiliser rates.

## 10.3 Additional requirements for integrated plant protection of bush fruits

The currant clearwing moth, *Synanthedon tipuliformis*, must be monitored with pheromone traps. Infested shoots must be pruned and removed from the plantation.

Black currant crops must be closely inspected for black currant gall mite galls during the dormant period when they are easily visible and all infested plant material must be removed from the plantation and destroyed. Branches infected with *Nectria cinnabarina* should also be removed. Crops must also be inspected for symptoms of reversion disease immediately before flowering and all infected bushes must be grubbed and destroyed.

## 11. Efficient and Safe Spray Application Methods

Radial flow air assisted sprayers traditionally used for tree and bush fruit spraying are often 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. It is advisable to protect non-cropping areas from contamination by spray drift by planting windbreaks as barriers. Statutory buffer zones specified on pesticide labels must, in any event, be observed.

Sprayers must be regularly serviced and calibrated. The size and shape of the spray plume generated by the sprayer should be set to match the tree target. The trajectory of the spray must be optimised to achieve an even deposition throughout the plant with minimal environmental or operator contamination.

Wherever possible, tractors must be fitted with a cab.

## 12. Harvesting, Post-Harvest Handling, Storage and Fruit Quality

Fruit must be harvested at the correct time according to the cultivar and for the purpose intended. For strawberries and cane fruits, picking should be done early in the day while fruit is cool. Fruit should be transferred swiftly to cold stores. 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.

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 condition if possible). A

representative sample of fruit of each major variety (or cultivar group) must be assessed for fruit quality before marketing.

### **13. Post-harvest chemical treatments**

No post-harvest chemical treatment of fruit is permitted.

### **14. Mode of Application, Controls, Certification and Labelling**

- A grower or organisation who wishes to practice Integrated Fruit Production and seek certification that regional or national guidelines and standards have been met must sign a prior declaration and undertaking to observe the guidelines at his own risk, permit all scheduled controls, and accept the decision of the controller and the local working committee.
- The whole soft fruit farm must be involved in Integrated Fruit Production, but a transition phase of not more than 3 years is permitted. Where individual plantations or parts of farms are entered they, and all the fruit produced in them, must be clearly identifiable at all times. National or regional guidelines must specify clear rules for the case by case exclusion of soft fruit fields.
- Control procedures must be objective, reliable and representative. A representative sample of at least 20% of farms must be visited at least once during the growing season by the controlling officer representing the local working committees/controlling organisation. In regions with numerous very small farms (average area < 1ha), the percentage of farms visited may be reduced to a minimum of 10% provided the IP organisation gives intensive advice to new members and has exploited all possibilities to rationalise inspection procedures. At least one plantation per farm, and in the case that more than one soft fruit crop species is grown, at least two plantations, selected at random, must be thoroughly inspected to ensure compliance with every aspect of the regional or national guidelines. A complete checking procedure must be established.

All records must be made available by the grower for inspection by the controller. Regional or national guidelines must require the grower to keep up-to-date records for each plantation or group of plantations and that this is signed by the grower at the end of the growing season. The records kept by the farms must be inspected. Samples of plant material or soil should be taken on a discretionary basis and analysed to ensure pesticides not permitted are not being used.

A representative sample of fruit handling facilities and packhouses must also be visited at least once per annum during harvest by the controlling officer, to ensure correct handling, grading, storage, packaging, quality controls and labelling are being observed.

Where the controller of the national or regional organisation is satisfied that guidelines and standards are being met a certificate may be issued by the organisation, to the respective member. Fruit meeting the required standard may also be entitled to display a label with the words 'Integrated Production' together with a logo or trade mark. Sanctions for transgressions of the regional and national guidelines are at the discretion of the controlling officer and/or local guidelines committee and must be defined in the checking procedure.