**IOBC – WPRS**
**Commission IP Guidelines**

# INTEGRATED PRODUCTION

# IOBC-WPRS OBJECTIVES AND PRINCIPLES

**Edited by: Frank Wijnands, Carlo Malavolta, Aude Alaphilippe,**
**Baerbel Gerowitt and Robert Baur**
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# 1. INTRODUCTION

The concept and strategy of Integrated farming systems was developed end of the seventies In Europe, as a strategy for developing sustainable farming systems adapted to local conditions.

Integrated production is based on agro-ecology principles and a system approach to minimise external inputs, optimise internal interactions in the system and overcome the problems associated with the intensification of agriculture.

IOBC-WPRS always has been the *keeper* and treasurer of this approach as it originates from its work on Integrated Pest Management (IPM) and constitutes the optimal context for an effective and integral implementation of the concepts of integrated and biological control.

Based on the experience of the scientific community of the IOBC-WPRS and early pioneers in farming systems research, the first concept of IPM was developed and described. It was felt that these concepts should be worked out in more detail, constituting guidelines to give support to the research and farming community as to what is possible and desirable when it comes to Integrated Production.

> *The overall aim of IOBC-WPRS guidelines on Integrated Production is to provide inspiration for a consistent and integral application of Integrated production principles in different production systems. These guidelines offer a framework for the formulation of regional or national guidelines and standards and facilitate harmonization of these concepts and guidelines at an international level.*

This publication describes Integrated Production (IP), its objectives and principles. From this framework the IOBC-WPRS General technical guidelines for the Integrated Production of annual and perennial crops are elaborated. For specific crops these general guidelines are accompanied by crop specific IP guidelines. The three levels in the guidelines belong together and should be considered and applied integrally.

- **IP objectives and principles:**
  are the framework for Integrated Production: definition, objectives and principles. This publication.
- **General technical guidelines for IP production of annual and perennial crops**: provides the general agronomic rules and minimum requirements, clearly defined as mandatory to be met by all farmers participating in IP programs. Recommendations are given, whenever needed, to point out optional solutions that go beyond the mandatory minimum and to indicate desirable directions of improvements.
- **Crop Specific Guidelines**;
  are prepared on the basis of the IP objectives and the General technical guidelines for IP production and specify the minimum requirements and recommendations in individual crops. In principle, they do not specify in detail those aspects that can only be defined taking into account the specific regional situation. However, they do

indicate the precise points where guidelines have to apply clear and precise rules taking into account the specific conditions.

All guidelines are published on the IOBC-WPRS website (http://www.IOBC-WPRS-wprs.org/ip_ipm). The IOBC-WPRS Commission on IP guidelines is responsible for these publications. They are elaborated with the help of the IOBC-WPRS Community notably the members of the different working and study groups of the IOBC-WPRS and/or ad hoc expert panels (see references in the editor lists of each publication). The different publications are updated regularly. This publication on the IP objectives and principles replaces together with the earlier mentioned "General technical guidelines for IP" the 2004 publication "Guidelines for Integrated Production – Principles and technical guidelines" (Boller et al. 2004). The Commission thanks all members of the IOBC-WPRS Executive Committee and Council for their constructive co-operation and support during the preparation and final approval of this document.

In this publication we introduce IP in its historical context (chapter 2), give some definition and objectives and detail the principles (chapter 3) and ends with an outlook to the future (chapter 4).

## 2. INTEGRATED PRODUCTION: FROM THE ORIGIN TO THE CHALLENGES OF TOMORROW

Intensification of agriculture after the second world war based on rationalisation (scale enlargement, mechanisation, land improvement etc.), agrochemicals and high productive cultivars, did not only lead to a high degree of self-sufficiency in food production, it also directly led to a complex set of problems. The key issues of these problems were and still are the endangered quality of the abiotic environment, mainly caused by over-use of pesticides and fertilisers and the decline of biodiversity and landscape caused by rationalisation, agrochemical use and scale enlargement in farm structure and the management practices. These problems lead to increasing environmental and social costs of agricultural production. In the last few decade question and concerns around our animal husbandry systems (animal health and welfare: zoonoses) and food safety, even intensified the discussion further. The concerns on Climate Change and Greenhouse Gas emissions from agriculture are the latest in this long list.

The downside of this intensification process became more general visible around the end of the seventies, beginning of the eighties. Environmental protection groups and a number of scientists worldwide pointed at the problems. For them it was evident that agricultural strategies had to be adjusted. New, more sustainable farming systems were needed that were able to accommodate pertinent but "new" objectives such as quality of products and production methods, quality of the abiotic environment, biodiversity and landscape, agronomic sustainability and animal welfare. This demand created renewed interest in the concepts of Organic Farming.
In the research community, the concept of Integrated Farming or Integrated Production (IP) was developed. The term Integrated is referring to both integration of objectives as to integration of methods and means instead of solely relying on agrochemicals. This approach

is based on agro-ecological principles taking the farm in its *entirety* as a basic unit. The concept evolved from the application of Integrated Crop Protection (internationally known as Integrated Pest Management (IPM), in spite of the restrictive meaning of the word pest) on a farm scale in fruit orchards (IOBC-WPRS working group, Steiner 1977). Integrated Production was a logical progression from Integrated Pest Management, especially since IPM can only be optimally implemented in the full context of the farm, hence in an Integrated Farming system (Vereijken 1989).

The organic and integrated systems approach rapidly gained serious interest in the international research community. The first experimental farms started developing these systems on a semi-practical scale notably the Lautenbach farm in southern Germany (El Titi and Landes 1992) and the Development Farming Systems (DFS) farm in Nagele (Vereijken, 1989), The Netherlands, where organic and integrated farming systems were developed and compared to a conventional approach. The research focused on increasing the performance of farming systems, developing and testing new approaches to overcome old problems and unwanted side-effects. The IOBC-WPRS offered this movement an international platform in a study and working group on farming systems research (since 1986: Vereijken et al. 1986, Vereijken and Royle 1989, see for history Wijnands, 2006). Substantial research efforts followed all over Europe to develop Integrated Production for different crop groups / farming systems.

The development and implementation of ecosystem-based approaches in plant protection have always been important objectives of the IOBC-WPRS since its foundation in 1956. IOBC-WPRS has become a leader in this field and in the field of environmentally sound production strategies in agriculture as a result of pioneering research and development activities of IOBC-WPRS Working Groups during the last five decades. The evolution from biological control concepts to Integrated Pest Management (IPM) and finally to a holistic systems approach in Integrated Production was certainly not accidental since it logically results from the concern for sustainable farming practices, safeguarding biodiversity and environment.

The IOBC-WPRS-WPRS Council reactivated in 1990 the IOBC-WPRS Commission on "IP Guidelines and Endorsement" (hereafter called "Commission"). The Commission had the task of establishing a framework of general IP standards to comply with the official IOBC-WPRS principles set down in the declarations of "Ovronnaz" (1976) and "Veldhoven" (1991). This task covered philosophy, strategy and technical requirements for implementation, inspection and certification of production.

The IOBC-WPRS published subsequently the conceptual framework of Integrated Production (IP) in 1993 (El Titi et al 1993) and updated it in 2004 (Boller et al.). The present publication (2018) is the third update.

# 3. INTEGRATED PRODUCTION: OBJECTIVES AND PRINCIPLES

## Definition

**IP (Integrated Production)** is a concept of sustainable agriculture based on agro-ecology and a system approach that aims at contributing to sustainable, resilient, profitable and robust farming systems
**IPM (Integrated Pest Management)** is the part of IP focusing on pests, pathogens and weeds

## Principles

- IP is an **agro-ecology** approach:
  that starts from the notion that a farm is an agro-ecosystem. IP focusses on managing ecological processes and their interactions within the farm and its related context (landscape and region), to optimise the use of internal farm resources, to minimise the need for external inputs and to avoid or minimise the effect of farming practices on the direct environment, future generations or conditions elsewhere in the world.
- IP is based on a **system approach**:
  taking the farming system as a basic unit: the full potential of an agro ecology approach can only be realized when all interactions between different elements of farming are utilized. Synergy between objectives might be realized.

## Objectives

### Sustainable

Sustainability refers to a wide range of topics. Improving the performance of a farm on a multitude of objectives is a difficult task. Conflicts of objectives will occur and will have to be addressed, overcome or at least balanced. Many times this calls for new approaches.
However, aiming at overall sustainability prevents that an optimal performance on one aspect is realized at the cost of another objective (maintaining or creating unsustainable practices).
The issues of sustainability are always time and space bound. At present the following issues are considered as highly relevant:

- Farm biodiversity, also in relation to landscape management;
- Water quality and water use;
- Use of scarce resources (fossil energy, P);
- Emissions of nutrients, pesticides and greenhouse gasses as result of the production process itself as well as attributed to the production of inputs;
- Mitigation and adaptation of and to climate change.

Sustainability relates to:

- On farm production – bio physical production capacity of the agro-ecosystem;
  Systems are sustainable when they can maintain their production over a long period of time without depleting natural resources or causing new problems or allowing old ones to aggravate.

- On farm production – ecological and environmental impact;
  Systems are more sustainable when the ecological and environmental impact of the production process is lower.

These two aspects of sustainability are largely linked through the careful and smart management of all farming methods and their interaction and by harnessing ecological processes, so that resource use efficiency is improved, external inputs are limited and emissions and losses minimized. Key factor on the long term is the maintenance or improvement of the soil fertility and the biodiversity on the farm. See also the description of the objectives resilient and robust.

IP aims at maintaining the productive capacity of the agro-ecosystem and minimising its negative environmental and ecological impact

The following component of overall sustainability;

- Health and food safety (residues, emissions: workers, bystanders, public consumers),
- Labour and social conditions,
- Fair trade and income,

are quite different from the previous aspects. Labour conditions are regulated by national/FAO guidelines. Additional demands are formulated in hygiene codes, food security schemes and market certifications (like Global-GAP). Fair Trade and income lies beyond the technical content of IP and will not be worked out as such in this basic publication on IP objectives and principles.

**Resilient**

Resilience is a scientific term for the ability of systems to cope with disturbances, in nature differing from abrupt shocks to extended stress. The resilience can lead to buffering an existing situation after a disturbance; it can also mean that the system adapts to a new situation by another balance in the ecosystem functions. Finally the system could have the ability to transform into another set of activities, still equally productive as before, this is called transformability (Darnhofer, 2014). To increase the resilience of production systems for disturbances additional efforts in the management of the farm have to be developed and implemented. A key factor for resilience of the production systems is the condition of the soil and the (bio) diversity on the farm. Diversity and resilience are directly connected. Diversity in crops is a key factor. This is equally true for adaptation to climate change.
Farming systems are resilient to climate change when they can cope with the biotic and abiotic disturbances that are the consequence of the global climate change. This can refer to the expected increased occurrence of erratic weather, as well as to the introduction of new (dynamics in) pest and disease species.

IP aims at increasing the resilience of the agro-ecosystems to be able to cope with disturbances resulting from climate change.

**Profitable**

Farming systems are profitable when over the years the total output (in monetary terms) is substantially higher than total cost of production (variable and fixed cost).

IP aims at a feasible state of the art approach towards economic sustainable farming system. IP is de facto always a dynamic optimum between sustainability objectives including economic aspects.

**Robust**

We use here the term robust for the ability of a farm to maintain the farming operation as a business over time without strong fluctuations in income. It also could be seen as the socio economic variant of resilience. This robustness can be found in a dynamic and adaptive management of a farm specific mix of activities, fulfilling **functions** in the social (societal) and physical landscape, ranging from supporting biodiversity and **ecosystem services** over food/fodder and resource production. To be robust on farm level farmers need a **diversified income**, i.e. to not rely on the performance of one specific activity. This spread of risk is achieved through appropriate diversification of farm activities. Every farm will find its own mixture, this diversifies a region.

IP aims at maintaining the vitality of the ecosystems services at stake while realizing an appropriate farm specific optimum as basis for sufficient robustness.

## 4. Outlook

IP production is a dynamic concept that has to integrate new upcoming concerns about farming and ecology in to its approaches. Much new knowledge and many innovations are needed to optimize the overall performance of farms and to overcome the (potential) conflicts between different objectives. The themes and issues involved in sustainability will evolve over time. Innovation and new knowledge are the drivers of progress along this evolution.
IP always seeks to integrate new techniques and approaches that might contribute to an overall better performance of the system into the farming systems as they come up from basic and applied research. There are promising new developments in the precision and smart agriculture and new forms of decision support systems and biological control techniques.
In the present update of the IP objectives and principles the climate change aspect was introduced. IP can and should contribute to mitigation of Greenhouse Gas emissions (GHG) as well as to the adaptation to the climate change itself, providing for robust and resilient systems. The actual recommendations however will still have to be developed over time for the different production systems. The guidelines call for that.
IP is a concept, based on agro-ecology and a system approach that not only allows to develop more integral sustainable systems adapted to the local agro-ecological conditions, but also offers an ideal approach for sustainable intensification in cases where agricultural production still is developing or needs to improve its production and / or performance. It clearly holds the key to optimize resource use (internal and external), and overall farm performance.

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