Good Agricultural Practices for more Resilient Agriculture

Guidelines for Producers and Governments

Alejandra Díaz, Luciano Gebler, Lucia Maia, Lourdes Medina, Sacha Trelles

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FOREWORD

Good agricultural practices (GAPs) are an indispensable tool for risk management due to the close relationship between agriculture and climate, as well as the climate variability currently being experienced. The implementation of these tools, however, involves fostering innovation, increasing knowledge and giving stakeholders, small producers in particular, a holistic view, so that they may improve their production systems, increase their resilience, and ensure their sustainability.

GAPs contribute to improving health, ensuring safety, protecting the environment and mitigating the effects of climate change. But little progress can be made if there is no awareness of this on the part of governments, farmers and consumers. Farmers need to know how to implement these practices; and Governments, for their part, require guidelines for designing effective programs and monitoring their implementation.

The indicators provided by this guide cover different dimensions of agriculture, that is, a comprehensive approach to the issue is taken and the role of different certification programs is recognized. These indicators serve, in turn, as a planning and management tool for both the producer and government entities, and ultimately for increasing the resilience of the biome and the population.

The guide includes recommendations from various GAP programs launched in the Americas, as well as reflections from experts who generously contributed their knowledge to regional and national events organized with the support of IICA. Everyone has stressed the importance of all stakeholders working together under a single vision and agreed that this guide should complement national GAP programs and national plans that seek to adapt to and mitigate climate change.

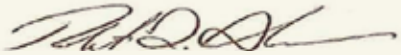
The objectives of the guide are, firstly, to provide a set of indicators that contribute to the knowledge of the problem and to the design of GAP strategies and policies, and secondly, to lay the methodological bases that will enable the continuation of efforts to develop and update these indicators.

This publication is aligned with the mandates and guidelines of the region's ministers of agriculture, who agree on the need to promote an agricultural sector with production systems that are more environmentally friendly, that will meet the demand for food and forage required by the increasing world population, and where risks are addressed in a comprehensive way.

We are deeply grateful to the Brazilian Agricultural Research Company (EMBRAPA) for its technical support and participation in this publication; and also to its authors, whose training and experience has allowed us to create an innovative tool to support the design, evaluation and implementation of Programs and national GAP plans, as well as the formulation of public policies in this area.

Katia Marzall

Leader, Flagship Project on Resilience and Comprehensive Management of Environmental Risks in Agriculture



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1. INTRODUCTION

Agriculture worldwide, and specifically in the Americas, faces the challenge of maintaining and improving productivity growth rates, which also differ significantly among countries and types of agriculture (IICA 2016). Undoubtedly, innovation and the development of technical capacities - in individuals, in organizations and in society generally - are an indispensable component for increasing productivity and being able to fully confront that challenge through collaborative practices, sustainable solutions and comprehensive proposals for adaptation to climate change.

Although there is a growing awareness of the need to generate models that increase agricultural production, while improving agricultural health and food safety and reducing environmental damage, most models continue to adopt a sectoral approach. As a result, they suffer from a lack of articulation between the organizations that promote them, when the complementarity of efforts is the one that leads to better results.

The implementation of good agricultural practices (GAP) is one of those innovations that requires a comprehensive approach and widespread application in order to contribute effectively to the development of sustainable agriculture.

Currently, at the official level, the promotion of GAP is mainly in the hands of the ministries of agriculture and agencies, according to their scope of action - food safety, phytosanitary protection, pesticide residue control or agricultural extension, among others - which in a way contributes to climate change adaptation and mitigation. But in ministries and other public institutions there are also climate change units that promote environmentally friendly practices, generally without regard to their relationship with agricultural health and food safety, for example. This lack of articulation between areas can bring with it duplications or contradictions that are of no benefit to agriculture.

Regarding private standards, GAPs generally have a broader focus and include, in addition to food safety principles, environmental protection, health, safety and well-being of agricultural workers, as well as animal welfare (Díaz 2009). Their application, however, is observed mainly in the export sector.

Climate change affects the ecological relationships of the natural environment and agroecosystem. Identifying and quantifying their effects is complex, as they occur as a result of changes or pressures in the ecological interrelations of the production process.

As part of these systems, producers are also agents that influence agriculture, but given the effects of climate change, they appear to have few options for responding.

When the environmental perspective is included in GAPs, the degree of complexity of the analysis increases because technicians are often not prepared to understand the kind of interrelationships that result from such an approach. This perspective discards simple and linear responses, and realizes that problems impact several dimensions at once. Thus, a safety problem will definitely be associated with environmental or social indicators

In general terms, a GAP program comprises two sets of factors: biotics, which are manifested in cycles of pests and diseases (human, animal or vegetable) and abiotics, which refer to the effects of an action or event on water or soil.

The following is an example of the complexity of the analysis:

a) Socio economic issues overlap with biotic factors, such as pest and disease bio-ecology and the ecological cycles associated with them, the effects of which are difficult to measure. These are more understandable to farmers as these factors materialize in damage to the environment, and production and product quality (direct economic impact), and expenditure to prevent and combat pests and diseases (including the use of pesticides). They also manifest in the possible struggle against animal diseases with the consequent purchase of veterinary drugs, and possibly treatment of diseases in humans, with the consequent purchase of medication, visits to hospitals, and sick leave. All this economic impact can in turn lead to a deterioration in social relations, since the producer may be forced to put aside a traditional practice and adopt a new practice that demands knowledge and workers to which he is unaccustomed.

b) With respect to abiotic factors, extremes are detrimental: an increase in the amount and intensity of rainfall accelerates soil loss; a decrease in rainfall causes unexpected droughts. In both cases, the support capacity of the biome is affected, although over time it can be adapted. In any case, the socio-economic consequences will not be anticipated: to replace soil loss and lack of water, a financial investment will have to be made, and a change in the type of vegetation involves introducing new crops or in any case, learning to cope with new environmental conditions.

Thus, when a productive process is analyzed in a comprehensive way, it is difficult to obtain single and direct answers to a problem: the number of interactions that emerge are usually many and varied.

This document has been structured in such a way that the first part brings together a set of indicators related to GAP that should be satisfied by both producers and government entities (public policies, service provision). Then, using these indicators, an analysis of the current situation and a risk assessment are presented highlighting the strengths and weaknesses of the organization under study (government or farm). The information obtained in the diagnostic phase allows the producer to plan his work according to an established schedule, in order to reduce or eliminate the risks that his property runs. In this way, the producer constructs his own road map, clearly establishes his priorities, the dimension affected, and the manner and moment in which he will solve the identified deficiency.

Governments, in turn, get a picture of the points to watch out for and, by verifying the good progress of GAPs, are able to act more effectively to reduce the impact of climate change.

2. OBJECTIVE

To support the design and implementation of integrated GAP programs or plans that contribute to countries' improvement in health, environmental, economic and social aspects, while promoting climate change mitigation and adaptation.

3. SCOPE

This guide is intended for public institutions, such as agricultural health and food safety services, as well as other organizations that, in promoting GAPs, promote environmental protection and attention to climate change in agriculture.

Farmers are also directed to implement GAP, regardless of the size of the business, the food they produce, and the target market.

The comprehensive vision of the guide seeks to make the different public entities carry out their work according to their competences, while remembering that complementarity is indispensable to ensure the achievement of a more sustainable agriculture.

Finally, the guide enables the carrying out of diagnostics; observation of changes in the behavior of agents; monitoring of the perception of the relationship between food safety, agricultural health, well-being and environmental protection; proposal of management models based on soundly proven techno-economic criteria; setting of priorities and defining the execution of activities. Also, and as part of a process of continuous improvement, the guide allows for evaluation of results and making appropriate adjustments, whether in the official programs or in the plans of the producer.

4. DEFINITIONS

Adaptation: Process of adjustment to the real or projected climate and its effects. In human systems, adaptation seeks to moderate or avoid damage or take advantage of beneficial opportunities. In some natural systems, human intervention can facilitate adjustment to the projected climate and its effects (IPCC 2014).

Biodiversity: Variability among living organisms from terrestrial, marine and other ecosystems. Biodiversity includes the variability of genes, species and ecosystems (IPCC 2014).

Climate Change: Variation of identifiable climate status (eg, through statistical tests) in changes in mean value or in variability of its properties, which persists for long periods of time, usually decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of solar cycles, volcanic eruptions or persistent anthropogenic changes in the composition of the atmosphere or land use. The United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as "a change in climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and adds to the natural variability of the climate observed over comparable periods of time ". The UNFCCC differentiates between climate change attributable to human activities that alter atmospheric composition and climate variability attributable to natural causes (IPCC 2014).

Ecosystem: Functional unit consisting of living organisms, their non-living environment and the interactions between them. The components included in a particular ecosystem and their spatial boundaries depend on the purpose for which the ecosystem is defined: in some cases, they are relatively accurate, while in others they are diffuse. Ecosystem boundaries may vary over time. Ecosystems are organized within other ecosystems, and the scale at which they manifest can range from very small, to the entire biosphere. In the current era, most ecosystems either contain human beings as fundamental organisms, or are influenced by the effects of human activities on their environment (IPCC 2014).

Biotic and abiotic factors: Terms used in the field of ecology, biology, agronomy and other sciences, with a focus on the environment. Biotic factors refer to everything that is alive in a particular place, whether

humans, animals, plants or microorganisms (including the living part of soil and water). Abiotic factors refer to all non-living components of a particular location, such as rocks, weather (rain, wind, sunlight, etc.), soil (the physical part of clay, silt and sand), and water (not counting microorganisms). In nature, in a holistic analysis, it is very difficult to completely separate the biotic factors from the abiotic ones. However, in an impact assessment process and environmental evaluation, they should be kept separate to the maximum extent in order for the task to be fully executed.

Comprehensive risk management: Seeks to minimize the impact of different types of risks (eg production, financial, institutional and market) on agriculture and which affect the quantity and quality of the product, causing postharvest losses and exacerbating the variability of prices. Strategies include risk assessment and prioritization, as well as prevention, mitigation, adaptation, transfer and improved response capacity. In a rural setting, comprehensive risk management means that not only the economic activity itself, but also the whole establishment and often the elements outside its borders (its position in a given catchment area, exposure to the sun and wind, work done by neighbors, etc.) which often escape the direct control of the owner of the property.

Maximum Residue Limit (MRL): The maximum residue concentration of a pesticide (expressed in mg / kg), the use of which is recommended by the Codex Alimentarius Commission to be legally permitted on the surface of or within food products for human consumption and feed. MRLs are based on GAP data and are intended to ensure that food derived from commodities that conform to the respective MRLs are toxicologically acceptable (Codex Alimentarius Commission 2016).

Mitigation (climate change): Human intervention aimed at reducing sources or enhancing greenhouse gas sinks (IPCC 2014).

Pesticide: Any substance intended to prevent, destroy, attract, repel or combat any pest, including undesirable species of plants or animals, during the production, storage, transportation, distribution and processing of food, agricultural products or feed, or which may be administered to animals to combat ectoparasites. The term includes substances intended for use as plant growth regulators,

defoliants, desiccants, agents for reducing fruit density or inhibitors of germination, and substances applied to crops before or after harvest to protect the product against deterioration during storage and transportation. The term normally excludes fertilizers, plant and animal nutrients, food additives and veterinary drugs (Codex Alimentarius Commission 2016).

Resilience: The ability of social, economic and environmental systems to cope with a dangerous phenomenon, tendency or disturbance by responding or reorganizing in order to maintain their essential function, identity and structure while retaining adaptive capacity, learning and transformation (IPCC 2014).

Climate variability: This denotes the variations of the average state and other statistical characteristics (typical deviation, extreme phenomena, etc.) of the climate in all the spatial and temporal scales wider than those of the meteorological phenomena. Variability may be due to natural internal processes of the climate system (internal variability) or variations in external natural or anthropogenic forces (external variability) (IPCC 2014).

5. GENERAL FRAMEWORK

5.1 Agriculture and the Environment

Agriculture plays a fundamental role in providing food to the world. It is undoubtedly the way of life for thousands of families, but it also leaves its mark on the environment: it contributes to soil erosion and depletion of groundwater. Additionally, the use of agrochemicals is not a minor issue as this activity places pressure on biodiversity, which, in turn, creates socio-economic and environmental pressures leading to the impoverishment of the rural environment and the displacement of the population from the countryside to the city.

However, in addition to providing humanity with food, and along with that, health, agriculture also impacts the environment positively. If practiced responsibly:

a) It supports better management of water resources in the countryside and in the city;
b) It contributes to improving air quality;
c) It captures carbon from the air and stores it in the soil as organic matter, which contributes to reducing the impact of global emissions;
d) A plant-covered soil is kept cooler, thanks to the reflectance and evapo-transpiration of the plants.

However, it is impossible to separate agriculture from the environment, since natural resources are the basis of food production. Therefore, we as producers, technicians, governments and society in general, must act responsibly and apply techniques that allow us to cultivate without damaging nature. Hence the importance of adopting good agricultural practices (GAPs).

Agricultural and Environmental Programs must be treated as inseperable

5.2 Good Agricultural Practices in Latin America

The concept of GAP managed by official agricultural health and food safety services refers mainly to the set of principles, standards and technical recommendations that apply to the various stages of agricultural production to ensure the production of safe and healthy food. In other cases, the main objective is phytosanitary protection or control of pesticide residues in production to protect the health of consumers and safeguard access to international markets

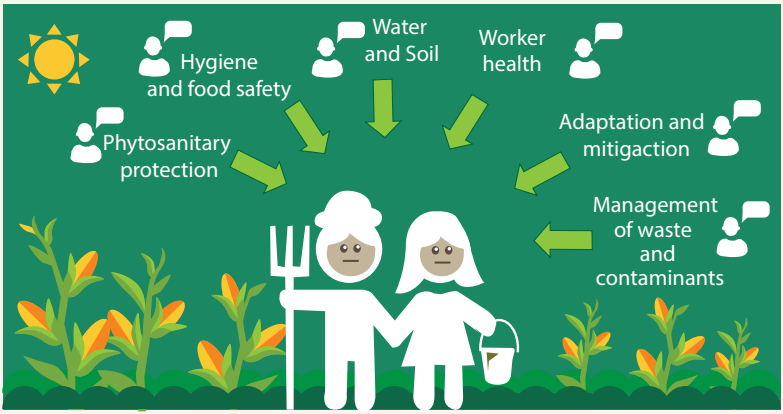
According to the Codex Alimentarius, the Code of Hygienic Practice for Fresh Fruits and Vegetables includes GAP and good hygienic practices in order to control microbial, chemical and physical hazards that may occur at any stage of the chain from primary production to final consumption (Codex Alimentarius Commission 2003).

As can be seen, the objectives of these approaches, based on their areas of action, are basically health -related. Thus, in risk assessment processes, the environment is taken into account in particular to ensure that the presence of vectors of pathogens that endanger the safety of plants is not encouraged. Water is seen as a possible route of food contamination and must be protected to ensure its quality, but the emphasis is not usually on its efficient use in agricultural production. Likewise, wild animals represent a danger of contamination, hence they must be prevented from entering the production area. Regrettably, the implementation of guidelines such as these sometimes goes against the realities of the field or of regulations on biodiversity or environmental protection.

On the other hand, institutions linked to the environment tend to promote agricultural practices that focus on the conservation of natural resources, regardless of their effect on plant safety. Something similar happens with entities that promote the approach to climate change in agricultural production, as they tend to put the practice of adapting to climate change and mitigating its effects over other practices.

However, addressing sanitary, phytosanitary and environmental risk management separately is not very effective, since public policies, as well as technical assistance and training provided by the various institutions to producers, will, in addition to having a fragmented view of agriculture, suffer from a lack of coordination and miss the opportunity to work in a complementary and integrated way (Figure 1).

Figure 1. Fragmented Risk Management on Farms.



Although GAPs tend to be applied with a much more inclusive vision in the private sector, this is especially true for the export sectors, which do so not only to comply with national regulations but also because it is a condition for accessing markets where buyers are much more demanding.

The following checkbox presents the main characteristics of GAP programs being implemented in Latin America.

Checkbox 1. Main Characteristics of Official GAP programs in Latin America*

- ***Institutional Framework***

- Ministries of agriculture or institutions under their authority, head GAP programs, although there are others promoting these methods.

- ***Regulatory Framework***

- GAP regulations are included in other regulations, such as safety or phytosanitary regulations. There are, however, countries like Panama, which have specific GAP laws.
- Official monitoring is limited and focuses mainly on export activities.
- Countries have more general GAP manuals or guides for products that have been chosen because of the opportunity they present or because they are targeted for export. These materials are based mainly on private standards and deal only in a limited way with the environment and climate change.

- ***Scope of GAP***

- GAP programs focus mainly on safety issues and are intended to meet the requirements of external markets. Few countries have focused on their domestic market.
- Argentina and Brazil have experience in applying GAP in the agricultural sector, including methods aimed at reducing the impact of climate change

- ***Coordination***

- There is little coordination between extension agencies and climate change in the ministries of agriculture and other public institutions promoting GAP.
- Countries such as Brazil and Argentina have made progress in thematic integration at the local and regional level.
- There is a greater degree of linkages with institutions that promote exports.

- ***Public-Private Coordination***

- There is generally greater public-private coordination in the export sector.

- ***Certification***

- Private sector certification predominates, particularly for export.
- Some countries, such as Chile, Brazil and Costa Rica, have made progress in official certification initiatives aimed at the domestic market,

- ***Funding***

- Programs depend on the technical and financial capacity of plant health or food safety units
- Although resources and external cooperation have been available for the development of GAP programs, these have been directed primarily at meeting the requirements of external markets.

** Prepared on the basis of results from regional and national GAP meetings organized by IICA, as well as interviews with producers and packers from different countries.*

5.3 Toward a comprehensive approach to good agricultural practices

The implementation of an integrated GAP plan makes it possible to mitigate or even reverse the harmful effects of agriculture on the environment, since plant health, food safety, worker health and environmental health are dealt with together.

The producer, for example, would not be managing only the risks of his property or a specific type of risk (phytosanitary or sanitary, which are the most common because they guarantee access to markets), but would also be paying attention to risks that are generated in the immediate area of his farm and that may affect his quality of life or the quality of his production. Even if the monitoring and analysis process is done by segments (GAP checklist), the result will only be complete if the community manages to reduce socio-economic and environmental impacts to levels deemed safe.

As shown in Figure 2, this holistic approach to the production process seeks to raise the awareness of both producers and government, as both play a key role in food security in their countries and both must assume major responsibility for the environment.

Figure 2. Holistic Vision of GAP.

Therefore, GAP systems, despite being primarily directed at the production of food for commercial purposes, interact with broader issues, such as public health and environmental protection.

Public health is protected to the extent that productive systems provide safe food, consider workers' health and meet recommended technical parameters regarding hygiene practices, use and application of inputs, and management of critical points and hazards in the productive process, etc.).

In the environmental sphere, GAP systems address issues related to food security, since the holistic compression of the production process makes it a sustainable production process.

In addition, this type of management contributes to the adaptation of agriculture to climate change and to the mitigation of its effects and, therefore, environmental sustainability.

Finally, there is the role of certification and quality seals, which are public statements about the company's achievement generally in relation to the safety of a specific product, an issue that is also part of the objectives of a GAP program. However, with some communication and marketing effort, standards such as "safe for the environment" or "this product contributes to reducing the impact of climate change", could also be added, thereby recognizing the producer's effort (Executing Agency) and that of the government (System Organizer), which would open up new profit opportunities for the private sector.

In short, achieving widespread adoption of this approach requires the active participation of both public entities and producers: the first, to dictate policies and make available public goods and services that favor GAP; the second, to implement good production practices.

The concept of good agricultural practice set out in this guide constitutes the application of the knowledge available for the effective management of sanitary, phytosanitary and environmental risks in agricultural production, in order to make it more resilient and sustainable.

5.4 Responsibilities in the implementation of good agricultural practices

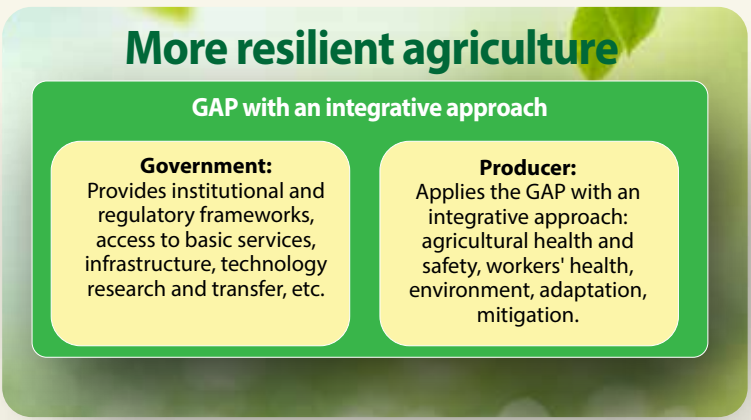
In the GAP implementation process, the producer, as executor of the practices, plays a leading role, while the government bodies are mainly responsible for establishing the regulatory framework and assuming the tasks of monitoring and verification of compliance, and, depending on their capabilities, providing technical assistance and training.

At this point it must be recognized that much progress has been made in establishing criteria and indicators of producer compliance with GAP, both from the public and private standpoint. In other words, checklists have been designed to evaluate the production sector. However, little work has been undertaken on indicators that guide, at the government level, the effective design of national or local GAP programs.

In any case, GAP implementation, as with any innovation, occurs in a specific socio-economic context and depends on certain conditions to be able to thrive. It depends, for example, on the level of internal development of the country, institutional and regulatory frameworks, access to basic services and infrastructural support, the importance attached to research and technology transfer, human resources (provision of knowledge and skills) and access to credit.

Governments are thus faced with the challenge of being able to trigger intensive and permanent processes of GAP implementation, with a holistic approach, in which all actors participate together through a shared vision (Figure 3).

Figure 3. Shared Public-Private Responsibility.



6. ELEMENTS FOR THE DESIGN AND IMPLEMENTATION OF GOOD AGRICULTURAL PRACTICES

Because of the shared responsibility of different actors in the implementation of good agricultural practices (GAP), their progress will undoubtedly depend on the efforts of both the government and the producer sector.

This guide provides a set of indicators that comprise the dimensions of safety, plant health, worker safety and the environment, all key elements for the comprehensive implementation of GAP (Figure 4). The fact that many of the indicators form part of more than one dimension makes it even more necessary to adopt a comprehensive approach to measuring progress in the establishment of good practices.

These indicators should be viewed with some degree of flexibility, since they may vary in number depending on the monitoring capacity, the possibility of obtaining information for their analysis, and other details such as the nature of the crop, the type of producer, etc.

Figura 4. Key features of GAP

6.1 Indicators for the comprehensive management of good agricultural practices

A series of indicators have been identified so that government bodies may have an instrument that allows them to measure the status of GAPs. These indicators have been grouped into two levels depending on the source of the information: those in level 1 obtain information directly from government agencies; those in level 2 obtain information by verifying compliance with GAPs on the part of the producer, after these have been applied to specific populations, eg. in a national census, to a group of producers participating in a project, to a group of producers linked to a given crop (Table 1).

Table 1. GAP Indicators for Government Analysis.

GAP Indicators analyzed by government bodies	
Level 1: Indicators obtained with information coming directly from public agencies.	**Level 2:** Indicators obtained via verification of GAP compliance by the producer.

Both Level 1 and Level 2 indicators, which are illustrated in Table 2, consider the large dimensions of GAP: safety, plant health, worker safety and environmental protection (Table 2).

Level 2 indicators are assessed using a checklist that applies to producers (see Table 3).

One of the advantages of this method is that in cases where a producer is implementing a GAP system, whether commercial or official, previously obtained answers may be used during the evaluation, which eliminates the cost of having to prepare a new questionnaire, and repeating visits and interviews. The metadata of the certification body's questionnaires is simply analyzed.

The questionnaire may be applied directly to the producer or technician through a visit by trained personnel if the country does not have GAP certification systems or interview-based programs.

GAP INDICATORS WITH A COMPREHENSIVE APPROACH

Table 2. GAP Indicators with a Comprehensive Approach.

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
1. History and Management of the Farm			
1.1	**History and management of the farm**		
	Planning works only if the boundaries of the farm are delineated (on land owned or rented). *Borders allow the demarcation of an action space (the boundary of the property), a span of time and a volume of available resources. And this is key to the ability to implement GAP. The official planner, for his part, must take into account the boundaries of the micro watershed or river basin.*	Does the country have a public policy and a legal framework for the mandatory mapping of farms? Is there an official registration system for farms? What is the percentage of registered farms?	What is the percentage of farmers who map their farms?
1.2	**Production Site Management**		
	Every site must be suitable for production and this capability must be supported by a risk assessment that takes into account biological, physical, and chemical hazards, as well as the impact of agricultural activities on the environment.	Is there a legal framework that defines the use of land for agricultural activities?	What is the percentage of producers carrying out risk assessments ? What is the percentage of producers implementing an action plan to manage identified risks?
2. Propagation material and seeds			
2.1	**Health and quality of propagation material and seeds**		
	Pest resistant material from authorized nurseries or hothouses must be used to ensure their health and general condition. In this way, there will be a positive starting point, resulting in good quality products. On the other hand, the use of inappropriate materials may lead to greater use of fertilizers and pesticides.	Are there any officially monitored nurseries?	What is the percentage of producers using approved propagation material and seeds?

KEY FEATURES OF GAPs		LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
3. Management of soil and other substrates			
3.1	**Soil Map**		
	If soil properties are known, better decisions may be made with respect to its use, and environmental protection can be better planned. *It is important to determine the suitability of soils for intensive use and for precision agriculture, to identify areas with risk of erosion, etc.*	Are government-managed soil maps for the agricultural sector available?	What is the percentage of producers making use of information on soil maps?
3.2	**Analysis of soil and substrates**		
	Analysis of the soil reveals a series of initial values that allows for the monitoring of its quality, by observing, for example, the evolution of parameters such as organic matter, availability of phosphorus, nitrates and nitrites, etc. *Similarly, the history of soil analysis enables assessment of the progress of GAP actions on the farm.*	Is there the capacity for analysis of soils and substrates in the country?	On what percentage of farms is the analysis of soils and substrates periodically carried out?
3.3	**Erosion control**		
	Erosion is a problem that goes beyond the loss of fertile soil. It is also responsible for the transmission of contaminants to waterways, and may, eventually, cause a disaster (eg. by shifting huge quantities of earth on mountains). *Erosion must be avoided, not only on farms, but also on local freeways.*	Are there regulatory frameworks?	On what percentage of farms is there erosion control?
3.4	**Ground cover practices**		
	Coverage positively influences soil quality: it ensures the availability of water, controls erosion, and reduces the presence of pests and diseases in plants,etc. *It also increases reflectance during the day, thus reducing the time of emission of night heat. Local alteration by heat is therefore lower.* *Ground cover must correspond to the natural and cultural characteristics of the area*	Are there regulatory frameworks for ground cover management?	On what percentage of farms is ground cover management carried out?

KEY FEATURES OF GAPs		LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
4. Fertilization			
4.1	**Fertilizer quality**		
	Fertilizers restore the nutrients crops need that have been extracted by plants or lost through erosion, washing or retrogradation. *Hence the importance of verifying that these products, whose main function is to nourish the plants and improve the characteristics of the soil, are of good quality. Their agronomic effectiveness and the absence of harmful effects on human, animal, plant or environmental health (which do not contain heavy metals, pathogens, etc.) must be verified.* *The farmer must be aware that fertilizers may be contaminated with heavy metals due to the manufacturing process. It is the government's duty to ensure that fertilizers do not carry that risk and to avoid that type of contamination.*	Are there official programs for monitoring the quality of fertilizers? Does the analytical capacity exist for monitoring the quality of fertilizers? Does the country have regulations that require that fertilizers be purchased in authorized locations with current registration?	What is the percentage of farmers participating in government programs that monitor fertilizer quality?
4.2	**Fertilization Program**		
	Fertilization programs should be tailored to the nutrient requirements of the soil, and this need is determined by soil analysis and following the recommendation of a qualified person (an agronomist or technical personnel). *The application of fertilizers improves the use of water by crops: it increases their resistance to drought, regulates the transpiration of plants and allows them to absorb less water to form dry matter.*	Are there regulations related to specific fertilization for each situation or cultivation technique? Does the technical assistance have sufficient coverage to meet the needs of producers?	What is the percentage of producers who consult a competent advisor to design his/her fertilization program? What is the percentage of producers implementing a fertilization program based on previous analysis?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
4.3	**Storage of Chemical Fertilizers**		
	Fertilizers must be stored in such a way as to avoid risk of contaminating water sources or harvested products.	Are there regulations governing the storage of fertilizers? Are there storage and distribution structures for chemical fertilizers that meet the needs of the region?	What is the percentage of farms with a structure to store chemical fertilizers? What is the percentage of producers storing fertilizers properly to reduce the risk of contamination of water sources?
4.4	**Organic Fertilizers and Biofertilizers**		
	(Substrates derived from biogas plants are included here.) *Before using an organic fertilizer, an environmental and safety risk assessment should be done. The type of fertilizer, the treatment method, the heavy metal content and the time of application, etc. must be evaluated.*	Are there official standards governing the use of organic fertilizers and biofertilizers? Is the use of sewage sludge prohibited?	What is the percentage of producers using organic fertilizers or bio fertilizers based on a risk assessment?
4.5	**Storage of organic fertilizers**		
	This is to prevent the contamination of water sources, the product, harvesting materials and surfaces with which the product comes into contact.	Is there a public policy to support the construction of storage structures for organic fertilizers?	What is the percentage of farms with an organic fertilizer storage structure? What is the percentage of producers storing fertilizers in a way that reduces the risk of contaminating wáter sources?

KEY FEATURES OF GAPs		LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
5. Water Management			
5.1	**Determination of water needs and the efficient use of water**		
	Water is essential for agriculture. *Since climate change influences the distribution of water in a region (melting, rain, surface water and groundwater), its control is essential for the planning of agricultural activities in an area.* *Every planning process begins by specifying available resources, including natural resources, and usage needs. Therefore, in order to design public policies in this area, it is necessary to start establishing a data network on water availability, on the one hand, and consumption needs, on the other. In this way, producers will know how much water they have and will therefore be able to plan the type of activities they will carry out on their property.*	Are there mechanisms (rain gauges, evaporimeters, etc.) that provide data to determine the water needs of producers? Are there government programs designed to train producers and rural extension workers in the management of water resources in farming regions?	What is the percentage of producers trained to calculate the water needs of the crop? What is the percentage of producers using water based on the needs of the crop? What is the percentage of producers providing the necessary maintenance for irrigation equipment? What is the percentage of producers keeping records of water use for irrigation and fertigation?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
5.2	**Water Quality**		
	Water must be of adequate quality for its intended use. ***Irrigation water:*** *The risk of water contamination depends on the type of irrigation. The greatest danger presents itself via sprinkler irrigation because it moistens the edible part of the crop, which can be kept moist for several hours. In addition, the physical force of the water droplet impact may contaminate the protected areas of the leaf / product. Drip irrigation, which does not wet the plant, is the method that represents the lowest risk of contamination, although care must be taken that there is no accumulation of water on the soil surface or in the furrows, so that water does not come into contact with the edible part of the crop.* ***Water for fertilizers and for pest control:*** *Water used for the application of water-soluble fertilizers and for pesticides should be of the same quality as the water used in irrigation and should not present microbial contaminants in quantities that may adversely affect the safety of the plant products, especially if applied directly to the edible parts at the time of harvest. Human pathogens can survive and multiply in many agrochemicals, including pesticides.* ***Water consumed by workers and used to wash produce and surfaces that come into contact with harvested products must be potable.*** *If the quality of water used for human consumption and for preparation of products for consumption is guaranteed, health risks to workers and final consumers are considerably reduced.* *A good water quality policy helps reduce the costs of public health programs and ensures greater permanence of workers in the workplace.*	Does the country have public sanitation policies? Is the availability of drinking water guaranteed for all? Are water quality analysis laboratories available? Have quality standards been established for irrigation water?	What is the percentage of farms with potable water for consumption and for packaging products? What is the percentage of farms with rural sanitation? What is the percentage of producers controlling the quality of irrigation water according to established standards?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
5.3	**Water Storage**		
	Water reservoirs appropriate to the conditions of the place must be installed, and must be maintained to take advantage of periods of abundance and to have water stored for periods of scarcity.	Does the country have public regulations governing the installation of water reservoirs? Are there programs that encourage the collection and storage of water for agricultural use? Are there programs that promote water conservation?	On what percentage of farms do water harvesting activities take place? On what percentage of farms do water storage activities take place? What is the percentage of farms that maintain water storage facilities?
5.4	**Protection of Water Sources**		
	The protection of wells and water sources significantly reduces the risk of contracting waterborne diseases, especially animal diseases, which are triggered when water comes into contact with manure or other waste.	Are there programs that encourage the protection of water sources for agricultural use?	What is the percentage of farms that implement practices to protect water sources? What is the percentage of farms that keep reservoirs or water storage tanks in optimal safety?

KEY FEATURES OF GAPs		LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
6. Crop protection			
6.1	**Integrated pest management**		
	Integrated pest management means less use of pesticides, because they are applied only after the pests have caused a previously established level of harm. *This practice implies providing constant training to producers so that they know exactly why they should apply a pesticide, when to do so and how to do it.*	Is there sufficient coverage with respect to technical assistance in order to meet the demands of the producers? Have the country's pest priorities been defined? Are there plans for monitoring the priority pests?	What is the percentage of producers who have a monitoring plan for pests that are important for their crops? What is the percentage of producers who follow the recommendations of competent technical personnel or advisers when doing the applications?
6.2	**Use of permitted pesticides**		
	Only products permitted by national legislation should be used and these should be specific for each pest and for each crop.	Do the producers have access to an up-to-date list of the approved products? Is there some type of regulation that requires that the pesticides be purchased in authorized locations with current registration? Are there registered pesticides available for all the crops that are of social and economic importance to the country?	What is the percentage of producers who only apply registered products based on the crop? What percentage of producers comply with the break periods established for the products applied?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
6.3	**Mixture preparation and pesticides residue elimination**		
	Mismanagement of pesticide residues (or lack of management) can result in the contamination of soil and water in an entire area, a situation that not only affects the producer and his family, but an entire region, as occurs when a city uses a river as a source of water supply. *Correct elimination of pesticide residues is synonymous with greater safety for the population and accordingly, with less use of the health services.*	Is there some official program that requires that there is some type of structure in order to prepare the mixture and eliminate the pesticide residues?	What percentage of farms have the infrastructure for preparation and elimination of pesticide residues?
6.4	**Calibration of equipment**		
	Many problems relating to pesticide residues in food and in the environment are as a result of product waste due to poor calibration of the equipment or because they have leaks. *The leaks can generate enormous clouds of pesticides, which, once they are displaced by the wind can, in a state of very high concentration, reach both the workers and persons who are far away from the place of application.* *Also, the excess discharge resulting from poor calibration causes a greater amount of pesticides to be released into the environment, which increases the quantity of residues in food and their discharge into rivers and lakes through surface runoff (eg. after a shower of rain).* *Proper calibration means less product waste and less pollution of the environment.*	Does the country have official calibration programs?	What percentage of producers maintain their equipment properly calibrated?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
6.5	**Personal protective equipment (PPE)**		
	The person applying the pesticide runs the risk of being contaminated, and if this person is contaminated, his family will be affected and the health services will also be affected.	Is it compulsory for every case of pesticide poisoning to be reported? Is there any official program that promotes the use of protective equipment? Is there monitoring of the reported cases of poisoning?	What percentage of farms maintain a poisoning registry? What percentage of farms ensure that protective equipment is used?
6.6	**Pesticide storage**		
	Storing pesticides correctly amounts to protecting the environment, to protecting the worker and also the livelihood of the producer. *In the case of the environment, it is important that the pesticides are protected from rain and wind, if the products are in powder form, in order to prevent them from being dispersed and from contaminating unprotected sites and people.* *In the case of workers, safe storage and adequate organization of the products amounts to greater personal safety, since the risks of making mistakes when managing and coming into contact with polluting substances are reduced.* *In the case of the producer, an adequate storage structure makes it possible for him to store the pesticides on the property itself, in order to prevent loss and theft, and thus protect his income.*	Does the country have a public policy that supports the construction of pesticide storage structures? Are there regulatory frameworks for regulating pesticide storage on farms?	What percentage of farms have a structure for pesticide storage on the property itself?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
6.7	**Management of empty pesticide containers**		
	The management of empty containers is an indisputable safety factor for the producer and his/her family: the majority of cases of poisoning of people and animals on the farm are related to the use of pesticide containers for other uses (for example, to transport water and food for humans and animals). Removing containers from the farm considerably reduces this risk.	Is there some official program that promotes the management of empty pesticide containers? Are there other initiatives for the collection of empty containers? How widespread is the collection of containers throughout the country?	What percentage of farms manage empty pesticide containers?
6.8	**Pesticide residues**		
	All the food destined for human or animal consumption should respect the maximum residue level for pesticides. *This measure, in addition to protecting the health of humans and animals, prevents economic losses for the producer, since, if it surpasses the established limits, he will not to be able to market*	Is there an official monitoring program for pesticide residues? What percentage of the program is directed toward products that are sold on the domestic market? Is there a capacity for analysis of pesticide residues in the country? Is there any capacity to authorize/accredit/outsource/delegate the laboratory test services in order to determine the quantity of pesticide residues?	What percentage of producers analyze pesticide residues in relation to their products? What percentage of producers analyze pesticide residues in relation to products that are sold on the domestic market?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
	7. Presence of animals on the farm		
7.1	**Separation of animals in the production area**		
	Animals can be a mode of contamination for crops. Proper management of animal stools is only possible by containing the animals in areas reserved for them, which should be separated from the production areas, especially in the case of fruits and vegetables that are consumed directly. *If traction animals are used on the property in the production areas, the waste should be controlled, and the stool collected and disposed of appropriately.*	Are there official guidelines for animal separation (domestic and wild) in the production areas on the farm?	What percentage of farms control animal access to the production areas?
	8. Hygiene and health		
8.1	**Hygiene procedures**		
	This implies preserving the safety of the product through practices that reduce the risk of contamination that could come from workers who handle vegetables, as well as utensils, materials and surfaces with which the vegetables come into contact.	Does the country have national or municipal provisions that establish requirements for food handlers, and which include harvest and post-harvest activities on the farms?	What percentage of farms adopt effective measures to prevent cross-contamination of vegetables resulting from agricultural inputs, from contact surfaces or from staff who are in direct or indirect contact with the vegetables?
8.2	**Workers' health**		
	This implies prevention of contamination of the product through contact with sick people. This practice reduces the cost of public health programs and reduces the amount of absences through sickness.	Are there laws that protect the health of rural workers?	What percentage of farms monitor the workers' health/ illnesses?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
8.3	**Sanitary structures**		
	The availability of sanitary structures in the field not only meets the needs of the worker, but is a gesture of consideration for the environment. It indicates that waste is being channeled to its correct destination and that biological pollution of vegetables that are cultivated is being prevented on the farm.	Is there public policy for supporting the construction of sanitary structures on the farms? Are there regulatory frameworks for guiding the construction of sanitary structures and treating effluents on the farm?	Which percentage of farms have sanitary structures in the field?
	9. Transport of harvested products		
9.1	**Condition of the modes of transportation**		
	Vegetable products should be transported so that the possibility of microbial, chemical, or physical contamination is reduced to a minimum.	Is there any type of official regulation that authorizes the transportation of food, including the transportation of fresh vegetables?	What percentage of producers use authorized transportation?
	10. Management of residues and polluting agents		
10.1	**Solid waste elimination**		
	Solid waste, as well as empty pesticide containers should be collected in order to avoid foci of diseases caused by vectors such as mosquitoes (malaria, zika, dengue, etc.) that can be exacerbated with climate change. *This practice helps to protect the environment because it reduces physical and chemical contamination of the soil chemistry and of the water. Additionally, sedimentation of the rivers and wildlife death resulting from the consumption of plastic or other detrimental substances are prevented.*	Are there programs and capacity for solid waste collection (non-pesticide) in the rural environment?	What percentage of farms collect and dispose adequately of the residues (non-pesticide)?

	KEY FEATURES OF GAPs	LEVEL 1: GOVERNMENT	LEVEL 2: PRODUCER
10.2	**Waste reduction and recycling**		
	Contamination that residues or waste produces at the point of elimination, known as "concentrated contamination", is much more dangerous than management of contaminants in the field. Each farm should have a plan to get rid of the waste and to collect the liquids that are generated (wastewater and mudslides), and this can be done on the farm or through a public service. *Pesticides are among the principal contaminants, which is the reason why they should be managed and eliminated in a technically proven and approved manner.*	Are there regulations and incentives to avoid, reduce, reuse and recycle the waste that is generated from agricultural activities?	What percentage of farms have a management plan for residues and polluting agents?
	11. Training		
11.1	**Ongoing training program**		
	Ongoing training improves the quality of the services, the safety of the workers and the protection of the environment; at the same time, it reduces expenditure on health and the worker turnover. *Additionally, the workers are more willing to collaborate in programs relating to good practices when they understand their objectives.* *The training programs should be designed to help the staff understand what is expected of them and why. They should take into account any barriers to learning and prepare methods and materials that help overcome those barriers.*	Does the country have programs (public or private) for rural extension and transfer of technology in GAP and climate change?	What percentage of farms are assisted through the programs for rural outreach and transfer of technology in BPA and climate change? Which percentage of farms provide continuous training based on the level of schooling of their workers?

CHECKLISTS FOR COMPLIANCE WITH GAP ON THE FARMS

Table 3. Checklists for compliance with GAP on the farms.

	Aspects to review	Fulfillment	
		Yes	No
1.	*History and management of the farm*		
1.1	Arrangement of the physical space of the farm		
a)	Does the producer have the capacity to read and interpret a map or sketch of the farm?		
b)	Does the producer have at this time a map or sketch that enables him to visualize the farm: production areas, facilities, roads, water resources, forest, etc.?		
c)	If the previous response is no, could the owner design or help to design a map or sketch of the farm that enables him to plan the use of the physical space?		
1.2	Management of the production site		
a)	Does the farm have a risk assessment that shows that the production site is suitable for production, and does it have a management plan to minimize the risks identified?		
2.	Planting material		
2.1	Health and quality of the planting material		
a)	Do the planting materials have health and quality certification?		
3.	Management of the soil and other substrate		
3.1	Soil maps		
a)	Does the producer have access to soil maps of the region?		
3.2	Analysis of soil and substrate		
a)	Have soil analyses been conducted on the farm?		
b)	Does the producer know how to collect soil samples or has the technical assistance to do so?		
c)	Does the producer know how to interpret the results of a soil analysis or has the technical assistance to do so?		
d)	Does the producer follow the recommendations that are derived from the interpretation of the soil analysis?		
e)	Are the soil samples always collected in the same places?		
f)	Does the producer keep documentation and records of the results of soil analyses and fertilization practices?		

Aspects to review		Fulfillment	
		Yes	No
g)	Does the producer analyze the trends in fertilizer application on the soil based on the results of cumulative soil analyses over the years?		
h)	Is treated dung used?		
i)	Is sewerage waste used?		
3.3	Erosion control		
a)	Does the producer know how to identify soil erosion on the farm?		
b)	Does the property have at least one rain gauge that enables it to measure the quantity of rainfall?		
c)	Is erosion observed in the furrows of the crop areas after short, light rainfall (ex. 5 mm/hour)?		
d)	After short, light showers (eg. 5 mm/hour), is there an accumulation of clay on the roads of the property?		
e)	After a light shower (eg. 5 mm/hour), are the rivers that run through the property turbid due to the presence of dirt?		
f)	Does the producer have knowledge of erosion control techniques?		
g)	Are erosion control techniques used on the property?		
h)	Were the roads on the property designed to combat erosion?		
3.4	Soil coverage practices		
a)	Does the producer apply soil coverage practices?		
b)	Is a crop rotation system applied?		
4.	Fertilization		
4.1	Quality of the fertilizers		
a)	Do the fertilizers have quality assurance (does it include heavy metals)?		
4.2	Fertilization program		
a)	Are the fertilizers applied following the indications of a technical `adviser`?		
b)	Is the fertilization equipment calibrated before the applications?		

Aspects to review		Fulfillment	
		Yes	No
4.3	Fertilizer storage		
a)	Is there a covered storage area, completely protected from rain, for storage of chemical fertilizers?		
4.4	Organic fertilizers and biofertilizers		
a)	Is animal dung or biofertilizers used on the property in keeping with the provisions of the pertinent regulations?		
b)	Does the dung used on the property undergo any type of treatment that ensures that pathogens are eliminated?		
c)	Does the producer change clothes after handling animals or dung and before coming into contact with crops or vegetables?		
d)	The producer washes the hands after having handled animals and dung and before coming into contact with crops or vegetables?		
4.5	Storage of organic fertilizer		
a)	Does the property have a covered repository to store organic fertilizers to shield them from rain?		
5.	Water management		
5.1	Determination of water needs		
a)	Has any system for controlling free water been installed on the farm; e.g. a rain gauge, a system to measure the flow of the rivers or the volume of water available in the reservoirs, a system to determine the use of urban water, etc.?		
b)	Is water use monitored on the farm?		
c)	Does the producer know how to calculate the needs for water on the farm or have technical assistance to do so?		
5.2.A	Quality of the irrigation water		
a)	Is the irrigation water used on the property been analyzed in an authorized laboratory (authorized or accredited) in order to determine its quality?		
b)	Does the producer understand the need for using only good quality water on the agricultural crops?		
c)	Does the producer know how to interpret the results of a water analysis or does he have technical assistance to this end?		
d)	Is the irrigation water that is used on the property within the statutory limits permitted for microbiological quality and heavy metals?		

Aspects to review		Fulfillment	
		Yes	No
5.2.B	Quality of the water for drinking and cleaning		
a)	Is there sufficient water for consumption by the people who work on the farm?		
b)	Is the quality of the drinking water that is used on the property analyzed periodically in an authorized laboratory (official or accredited)?		
c)	Does the producer understand the obligation to use quality water for human consumption and to pack the products on the property?		
d)	The water that is used for consumption and packing of products in the property is within the limits permitted quality microbiological and of heavy metals?		
5.3	Water storage		
a)	Is there sufficient water to irrigate the crops on the property throughout the year?		
b)	Are there artificial water reserves for irrigation (reservoirs, tanks, etc.) on the property to meet the needs of the dry periods?		
c1)	• During periods of lack of water for irrigation, is the period lower than 5 days?		
c2)	• During periods of lack of water for irrigation, is the period between 5 and 30 days?		
c3)	• During periods of lack of water for irrigation, is the period longer than 30 days?		
5.4	Protection of water sources		
a)	Have measures been adopted to protect the water sources on the property against external contamination?		
b)	Are the deposits of dung on the property far from the water sources in order to avoid direct and indirect contact (by runoff) between the water and this waste?		
c)	Are the edges of the water sources on the property protected by vegetation in order to guarantee the volume of water?		
d)	Are the areas surrounding the sources and watercourses on the farm protected?		
6.	Crop protection		
6.1	Integrated pest management		
a)	Does the rural producer know how to recognize the main pests and diseases that affect his agricultural activity?		

Aspects to review		Fulfillment	
		Yes	No
b)	Does the producer know how to identify damage caused by pests in his activities?		
c)	Does the property use economic harm as parameter for applying a plant health treatment?		
d)	Does the producer develop his productive processes while respecting the parameters necessary for guaranteeing quarantine safety?		
e)	For pest control, are pesticides which are authorized and in the recommended doses used only?		
f)	With respect to pest control, is the recommended application equipment used?		
g)	Are there records documenting the presence of pests on the crops, the level of harm, the pesticides, and the doses used?		
h)	If records are kept, are these kept for at least 2 years?		
6.2	Use of permitted pesticides		
a)	Does the producer only use the products indicated for the crops that he has on his property?		
b)	Does the producer comply with the "pre-harvest intervals" that should be observed in the application of a product?		
6.3	Mixture preparation and disposal of surplus application mix		
a)	Is the water that is used to prepare the mixture on the property clean, without suspended materials (or with very few), odorless, and colorless?		
b)	Does the producer know what is the pH of the water?		
c)	Is there a habit on the property of checking the pH of the water that is to be used for spraying?		
d)	Is the mixture always prepared in the same place?		
e)	Does the place where the mixture is prepared suitable for residue collection?		
f)	Does the place where the mixture is prepared have sufficient water for proper cleaning following the pesticide management activity?		
g)	Is the residue from the mixture discarded in rivers, streams, or lakes?		

Aspects to review		Fulfillment	
		Yes	No
h)	Is the excess mixture discarded onto the soil, in a single place?		
i)	Does the property have a system for management of pesticide residues based on technical guidelines?		
j)	Does the producer wash the equipment in a fixed place after the application?		
k)	Does the producer dispose of the cleaning water in the same location where the residue from the mixture was discarded?		
6.4	Calibration of equipment		
a)	Does the producer keep the technical manual on the equipment in a safe place and does he understand the instructions?		
b)	Has the producer been trained in the management and calibration of equipment?		
c1)	Does the producer calibrate the equipment before each application?		
c2)	Does the producer calibrate the equipment at least once a month?		
c3)	Does the producer calibrate the equipment at least once during the crop cycle (production)?		
c4)	Has the producer calibrated the equipment at least once since purchasing it?		
6.5	Protective equipment		
a)	Do the owner and the workers have the full equipment for personal protection on the property (boots, gloves, suit, hat made of waterproof material, glasses and protective mask)?		
b)	Does the producer know how to use all items of the personal protective equipment?		
c)	Does the producer know how to identify which part of the protective equipment is related to each stage of pesticide management?		
d)	Is the protective equipment complete, without tears or missing parts?		
e)	Does the producer always use the personal protective equipment during pesticide management?		

Aspects to review		Fulfillment	
		Yes	No
f)	After application, are the clothes and the protective equipment that were used washed and dried apart from other clothes and other instruments?		
g)	When the useful life of the protective equipment is over, are the parts discarded in a similar manner as the containers that contained pesticides?		
h)	Are the workers trained in the use of this equipment?		
i)	Do the workers use the personal protective equipment?		
6.6	Pesticide storage		
a)	Is there a repository on the property that is destined exclusively for pesticide storage?		
6.7	Management of empty pesticide containers		
a)	Are the empty containers washed three times, dried, and perforated before being sent to a collection center for final destruction?		
b)	Are there storage structures for empty containers on the property?		
c)	Are the empty and clean containers collected through an approved collection system by a responsible authority?		
d)	Are the empty pesticide containers used again after being washed?		
e)	Are the empty pesticide containers burned on the property after being used?		
f)	Are the empty pesticide containers buried after being used?		
g)	Are the empty pesticide containers left abandoned after use?		
h)	Are the empty containers collected, still dirty, by the urban garbage collection system or through a similar system?		
i)	Are the empty containers collected, after cleaning, by the urban garbage collection system or through a similar system?		
6.8	Pesticide residue		
a)	Does the producer understand what are pesticide residues?		
b)	Does the producer know how to identify the specified break periods from pesticides that apply to his property?		

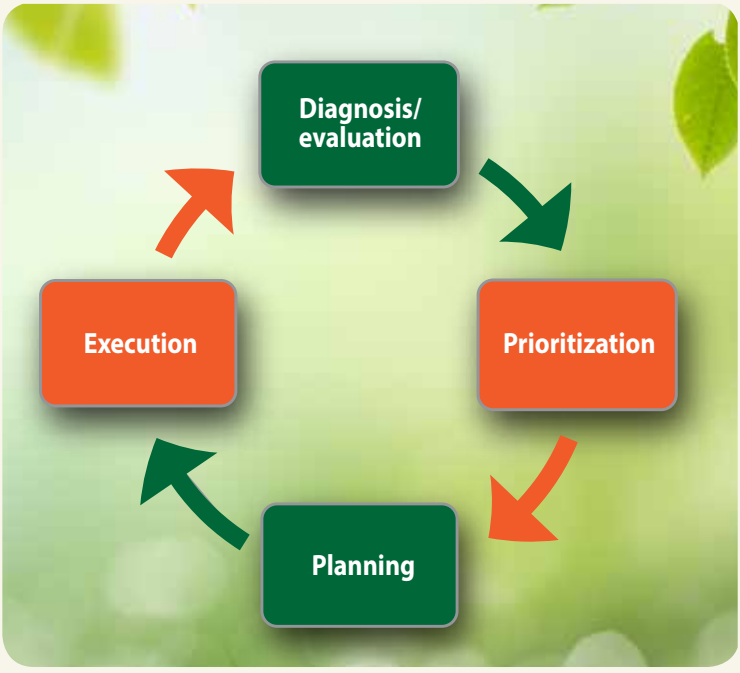
Aspects to review		Fulfillment	
		Yes	No
c)	Does the producer respect the break periods that are indicated on the label and on the pamphlet that accompany the pesticides?		
d)	Does the only producer use the products indicated for the crops that he has on his property?		
e)	Does the producer respect the recommended product dose for his crops?		
f)	Does the producer follow the recommended hygiene measures after conducting work with pesticides and before coming into contact with vegetables?		
7.	Presence of animals on the farm		
7.1	Separation of animals in the production area		
a)	Is contamination by animals (collection of feces) controlled or is there physical separation between the animals and the production points?		
8.	Hygiene and health		
8.1	Hygiene procedures		
a)	Has a vegetable handling protocol been established on the property?		
b)	Have the workers been trained and they follow the protocol?		
8.2	Workers' health		
a)	Do the workers have facilities where they can preserve and consume their food?		
b)	Is the water that the workers consume potable and does it meet the standards established by national legislation?		
c)	Does the farm have disease prevention control plans or programs for the workers?		
d)	Have records been kept over the years on the occurrence of diseases?		
e)	Does the farm have accident control programs for the workers?		
f)	Are records kept on the occurrence of accidents over the years?		

Aspects to review		Fulfillment	
		Yes	No
8.3	Sanitary structures		
a)	Do the farm workers have sanitary structures to which there is easy access?		
b)	Do the sanitary structures have chlorinated water for washing their hands, with soap and towels?		
c)	Do the workers wash their hands after using the restroom?		
d)	Do the workers know why they should wash their hands?		
e)	Are the residual structures provided with a septic tank or some other technically recommended treatment system?		
9.	Transport		
9.1	Transport of harvested products		
a)	Does the producer verify the conditions for transportation before loading his products?		
b)	Are the vehicles authorized to transport food?		
c)	During transportation, are records kept of unforeseen events (delays, equipment failure, loss of coldness, etc.)		
d)	Does the transporter keep a record of receipt and delivery of the product?		
10.	Management of residues and polluting agents		
10.1	Solid waste elimination		
a)	Is the solid waste (with the exception of pesticides) that is generated on the property collected through a system, whether public or private?		
10.2	Waste reduction and waste recycling		
a)	Does the property have an environmental management plan that promotes waste reduction and recycling?		
11.	Training		
a)	Do the workers receive training in good agricultural and environmental practices when they begin to work on the property?		
b)	After the initial training, are the workers trained periodically?		
c)	Are the workers evaluated in order to confirm the effectiveness of their training?		
d)	Are training records kept?		

6.2 Evaluation and monitoring of the application of good agricultural practices

The following figure shows the basic activities related with evaluation and monitoring of GAP:

Figure 5. Elements for the design and application of GAP programs or plans



Diagnosis/evaluation

The design (or adjustment) of programs in GAP by the government, just like the design of plans for the implementation of GAP by the producers should begin with an analysis of the status of the application of such practices for a given population or an individual producer, respectively.

The set of indicators shown in tables 2 and 3 makes it possible to do a qualitative and quantitative evaluation of the degree of application of GAP by the actors in question.

Prioritization

Once the aspects showing a gap, or those that are critical, have been identified, both the government and the producers should begin to prioritize measures to deal with those deficiencies. Prioritization should be done on the basis of the impact of such deficiencies on the targets and goals of the country or the farm.

Planning

Planning means studying, from a technical and economic perspective, options that make it possible to overcome the deficiencies identified, select the best one, and implement it.

Execution

The options selected in the previous step are implemented in accordance with the required administrative and logistical aspects.

Evaluation and adjustment

Once the improvements are made, the results should be evaluated, i.e. the respective monitoring should be done. To this end, the same tool that was used to make the diagnosis is applied, as part of a continuous improvement process.

6.3 Guidelines for completing the verification list

The survey (verification list) may be completed with the producer at his or her office, home, or with the technician responsible for the documentation of the property. The user may collect the information using a computer or a printed survey, once the Excel® form has been drafted.

For educational purposes, a spreadsheet has been attached to this manual and can be downloaded from www.iica.int. It also can be a supplement to the interview form. The interviewer must receive and write down the affirmative answers ("yes") and the negative answers ("no"). Once the data has been entered in the spreadsheet, the positive answers are assigned a value of 1.0, while the negative answers will remain at 0.0.

The system is programmed to record each answer according to the following dimensions of impact:

a) Environmental
b) Worker safety
c) Food safety
d) Economical

When a positive answer is obtained from one of the aspects previously mentioned, a point (1) is recorded. The answers in the spreadsheet are illustrated in a radar chart, and each color represents one of the aspects: green (environmental), blue (worker safety), red (safety), and orange (economical) (figure 6).

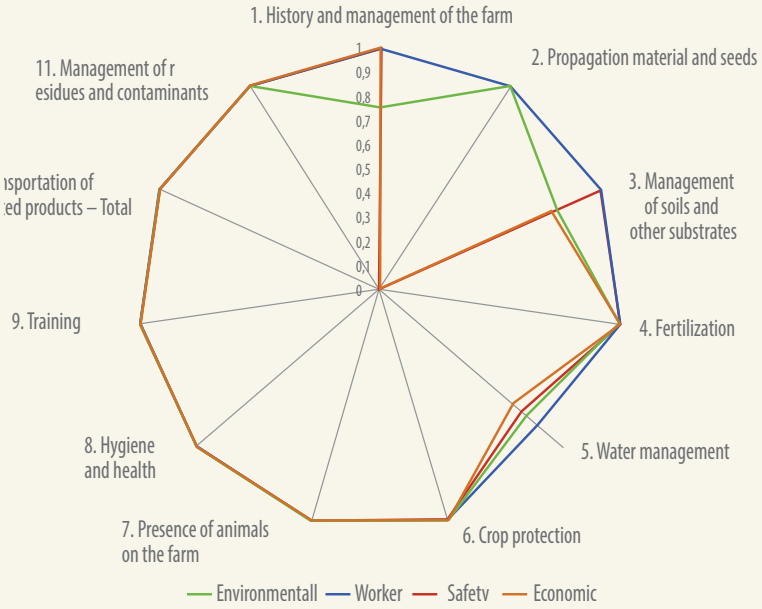
If the producer is using a GAP certification system, official or commercial, the evaluation must take into account the information collected from the surveys of the rating entity (as long as the information is available). This is performed to avoid conducting additional surveys, visits, or interviews. The metadata analysis is simply carried out.

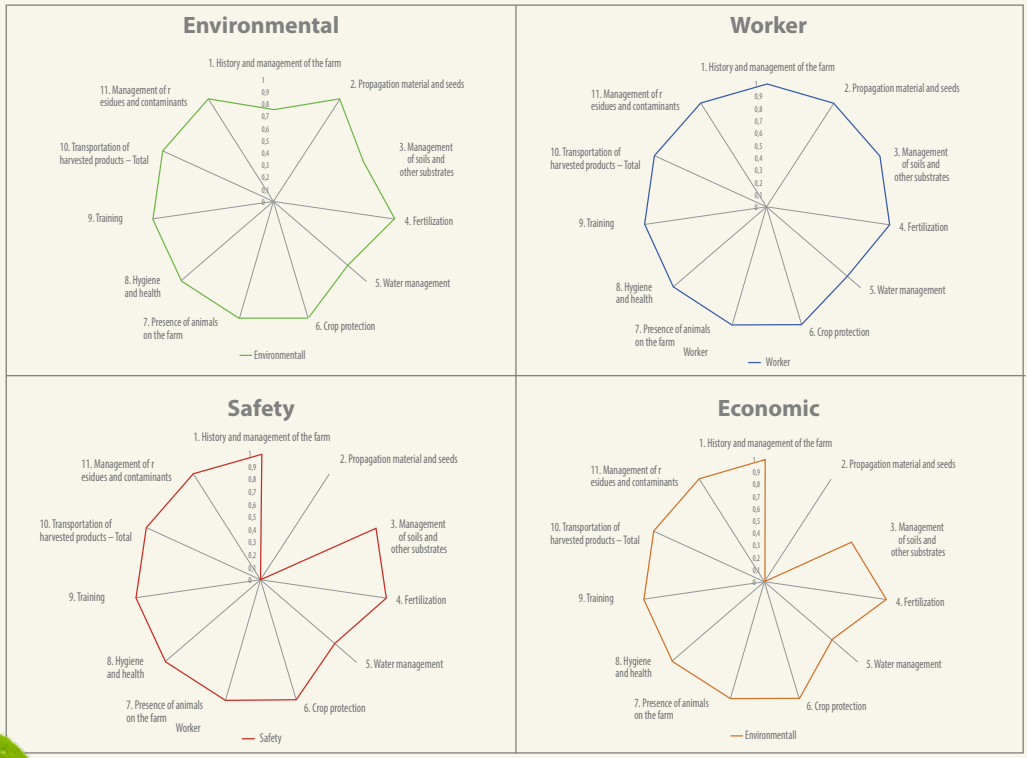
If the previous data is not available (originated from a GAP certification system or based on interviews from previous programs), it is possible to conduct the survey directly with the producer or with the technician in charge of the farm; the trained technician on data analysis could visit the site and conduct the survey.

The graph is organized using two points: a point 0 (point of origin), which reflects the worst GAP condition, and point 1, which reflects the best condition and is located in the outer region of the graph. This means the greater the distance between the lines and the outer border, the greater the problem is in that aspect, and its position on the table must be verified.

Figure 6 shows an array of indicators. The examples serve as a graphic overview of the different groups of indicators and plot a course toward fulfillment of the GAP.

Figure 6. Figures with results of analyses of indicators evaluated via the GAP questionnaire, using an integrated approach.





Information is thus obtained to serve as input for environmental planning of the production units, as well as for planning occupational security, food safety, and the economic security of the owner.

The next step is the planning phase, in which both the official entities and the rural producers and technical personnel participate. The items in the questionnaire that did show an ideal situation are included individually, are analyzed and the factors that prevented their execution are sought. In order to resolve each item or problem one or more actions can be proposed, and this should describe in detail how the goal that was outlined is going to be achieved (figure 7).

It is also important to clarify what factors impeded achievement of the proposed objectives. Each action can bring together more than one problem, which, by itself, will require a smaller corrective action on a feasible scale, which may also take the time scale into consideration, so that the initial problem can be solved. An example of this process can be seen in the figure 7, where the same example of a problem resolved by official entities and by the producer.

Figure 7. Management matrices for the official entities and rural producers.

A) Example of a management matrix for the official entities

Item	Initial problem	Initial action	Problems found (limitations)	Mitigation (including execution time)
1.1-a	The producer is not able to read and interpret a map or sketch of the farm	The producer is not able to read and interpret a map or sketch of the farm	No trained technical team available to provide this type of training	Prepare a technical team to provide this training in the next six months
			Lack of financial resources to execute the project	Allocate resources immediately from other activities or include resources in the budget for next year
			No priority given to a training plan for this type of producer	Establish public - private associations that will continue until the end of the second half of 2020
				Devise a training plan in 2018 for the next 5 years
		Train rural extension technical personnel to carry out this service	Lack of financial resources to execute this project	Allocate resources immediately from other activities or include resources in the budget for next year
			No trained professionals to provide this type of training to technical personnel	Identify or prepare professionals within the country to train the technical team over the next 3 months
			There is no institutional plan for training technical personnel	Devise a training plan in 2018 for the next 5 years
			There is no appropriate site available to promote the training	Establish a center/auditorium/ training room to carry out this program in 2018
				Establish public-private agreements to conduct training in nongovernmental entities in 2018
		Train teachers in the rural areas who will support the producers	There is no agreement with the ministry of education or with another competent institution in order to carry out this activity	Establish an agreement with the competent institutions in 2018 for a period of 5 years
			The teachers have very unequal proficiency levels	Create and give a course in knowledge leveling for teachers, three months before the training
			There is no professional prepared to train the teachers in this topic	Identify or train professionals in the country so that they can train a technical team over the next 3 months

B) Example of a management matrix for the actions of the producers.

Item	Initial Problem	Initial action	Problems found (limitations)	Mitigation (including execution time)
1.1-a	The producer is not able to read or interpret a map or sketch of the farm	Find out where he can learn or receive training in map and sketch reading and interpretation	There is no training available in that aspect of knowledge within the region	Find this type of training or training in locations near to the farm and, if possible, between production cycles
			The producer does not have financial resources to pay for training	Mobilize groups of producers and request training from the corresponding authorities or the association to which they belong
			The producer cannot leave the property for reasons of logistics or lack of labor for carrying out the daily activities	Make an immediate request to the corresponding authorities or to the association to which they belong for training on the property or distance training, if possible

6.4 Importance of evaluation and monitoring of government indicators

Evaluation of the indicators defined for the government will make it possible to identify the need for services and public investment. Monitoring, in turn, will make it possible to measure the impact of policies, plans, and projects that are implemented with respect to safety, well-being of the worker, environmental protection, and sustainable achievement of the country's developmental objectives.

At the same time, the official entities will have information on GAP that is standardized and uniform, which will enable for precise analysis of progress over time.

During the process of implementation of GAP, and even afterwards, new goals can be added and monitored indefinitely.

6.5 Recommendations for the implementation of good agricultural practices

a) Orientations for the team at the producer level:

- ***Phases of the implementation process***

Implementation of GAP on a property is the result of an educational process that should be carried out in stages in order to reduce the cost of the process and the cultural impact on the people involved.

Stage 1. Dissemination: People should be consulted, objectives determined with respect to GAP, and an evaluation of educational and technical levels conducted in order to facilitate the implementation of GAP on the property. Dissemination can be done on a large scale, technical meetings can be held with groups in the community and opportunities created for discussion and clearing up doubts. Each property can also be visited and the topic dealt with in small family groups, which normally favors a greater exchange of ideas. In the first case, the dissemination is quicker, but there is the risk of losing effectiveness, for cultural reasons; in the second case, the system is slower but the probability of success is greater. In many cases, regional culture carries more weight than national culture; hence, dissemination should ideally be the responsibility of a local technician or a person who knows the region well, and who has already interacted with the families in the area.

Stage 2. Training: Work is carried out with groups and with properties that decided to adopt the system. The first step is to prepare supporting material for even the simplest matters, such as how to collect refuse around the house or to ensure that there is no dung where people have to move around. The support material cannot be just a manual or a guide loaded with text. It helps a lot to use posters, illustrations, symbols, and messages that indicate simply and directly whether a procedure is good or bad. In communities where a great number of inhabitants have not had the opportunity to receive formal education and do not know how to read or write, or speak different languages, symbols are an excellent mechanism for dissemination, as they make it possible to associate a figure to an action. In any case, printed material by itself is not sufficient. The presence of extension workers is indispensable to eliminate doubts, provide details, and help achieve results over set periods of time.

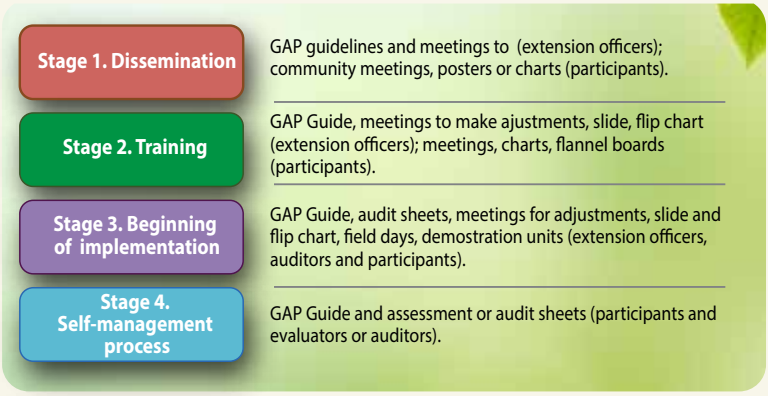
Stage 3. Beginning of implementation: Implementation begins when participants are already aware of the existence of GAP, how they operate and their objectives in the short, medium and long term. In this phase, processes can be started that depend on financial investment, but this would be subject to the proposed objectives. The figure of the extension worker begins to take second place to the greater relevance of the local GAP actors or auditors. The process of self-management can begin in this phase or in the next.

Stage 4. Self-management process: The self-management process begins when the measures envisaged are already under way and the role of the social actors is clearly established. The property can now be submitted for an evaluation or audit.

- ***Work tools:***

Below (figure 8) are some of the tools that can be used in the stages previously described.

Figure 8. Examples of work tools for each stage.



- ***Validation of the process***

Each stage of the process should be validated on a "model" property that will then become an "observation unit" in order to provide training and fine tune the system. For the validation process, tools will be used such as interviews conducted with the techni-

cal personnel and with the target audience, and a checklist of the objectives achieved at each stage, bearing in mind that the final objective is adaptation of the property/community/region to the set of GAP.

As each case study is unique because of the environmental/cultural specificity, the interview questionnaire should contain a group of generic questions with closed answers that can be applied to any situation, and a series of specific questions with open responses.

b) Guidelines for the team with respect to government agencies

Local governments should indicate the desired levels of commitment and the responsible institutions should be present during the process of implementation of GAP. It is suggested that the ministries/secretariats of agriculture and livestock, industry, and trade (or the public institution responsible for control of exports and imports of food), health, education, and the environment be familiar with the program and seek cooperation agreements.

These institutions will be in charge of publishing materials and of training the key persons who will later assume the tasks of extension in the rural area, on the properties, in the schools, and at health care locations (personnel responsible for monitoring health).

- ***Working tools***

Meetings and written material (ex. GAP Guide) to guide the discussions and the training of divulgators.

- ***Validation of the process***

The validation exercise should be conducted along with governmental agents. In order to assess the knowledge acquired, two questionnaires should be used: one at the first meeting with the representatives, and another one later, just before implementing the plan in the field. If the results reveal that the level of training is neither appropriate nor uniform, another training exercise should be conducted, and then a second evaluation, until each and every one of the participants understands all the concepts that they are working with.

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