Good Agriculture Practices and Integrated Pest Management

Good Agriculture Practices—GAPs

The term Good Agricultural Practices can refer to any collection of specific methods, which when applied to agriculture, produce results that are in harmony with the values of the proponents of those practices. There are numerous competing definitions of what methods constitute "Good Agricultural Practices", so whether a practice can be considered "good" will depend on the standards you are applying.

Description of the UN FAO GAPs

Good Agricultural Practices (or GAPs) are a collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economical, social and environmental sustainability.

Though the term is not new, it has really begun to get wide attention at the end of the 1990s. GAPs may be applied to a wide range of farming systems and at different scales. They are applied through sustainable agricultural methods, such as integrated pest management, integrated fertilizer management and conservation agriculture.

GAPs rely on four principles:

- Economically and efficiently produce sufficient (food security), safe (food safety) and nutritious food (food quality);
- Sustain and enhance natural resources like soil, water, plant and animal diversity;
- Maintain viable farming enterprises and contribute to sustainable livelihoods; and
- Meet cultural and social demands of society.

The concept of GAPs has changed in recent years because of a rapidly changing agriculture, globalization of world trade, food crisis (mad cow disease, Foot & Mouth disease), nitrate pollution of water, appearance of pesticide resistance, and soil erosion and others.

GAPs applications are being developed by governments, NGOs and private sector to meet farmers and transformers needs and specific requirements. However, many think these applications are only rarely made in a holistic or coordinated way.

They provide the opportunity to assess and decide on which farming practices to follow at each step in the production process. For each agricultural production system, they aim at allowing a comprehensive management strategy, providing for the capability for tactical adjustments in response to changes. The implementation of such a management strategy requires knowing, understanding, planning, measuring, monitoring, and record-keeping at each step of the production process. Adoption of GAPs may result in higher production, transformation and marketing costs, hence finally higher costs for the consumer.

GAPs require maintaining a common database on integrated production techniques for each of the major agro-ecological area (or ecoregion), thus to collect, analyze and disseminate information of good practices in relevant geographical contexts.

Good Agricultural Practices related to soil

- Reducing erosion by wind and water through hedging and ditching
- Application of fertilizers at appropriate moments and in adequate doses (i.e., when the plant needs the fertilizer), to avoid run-off.
- Maintaining or restoring soil organic content, by properly composted manure application, use of grazing & crop rotation
- Reduce soil compaction issues (by avoiding using heavy mechanical devices)
- Maintain soil structure, by limiting heavy tillage practices

Good Agricultural Practices related to water

- Practice schedule irrigation, with monitoring of plant needs, and soil water reserve status to avoid water loss by drainage
- Prevent soil salinization by limiting water input to needs, and recycling water whenever possible
- Avoid crops with high water requirements in a low availability region
- Avoid drainage and fertilizer run-off
- Maintain permanent soil covering, in particular in winter to avoid nitrogen run-off
- Manage carefully water table, by limiting heavy output of water
- Restore or maintain wetlands (including watersheds)
- Provide good water points for livestock

GAPs related to animal production production, health and welfare

- Respect of animal well-being (freedom from hunger and thirst; freedom from discomfort; freedom from pain, injury or disease; freedom to express normal behavior; and freedom from fear and distress)
- Avoid nontherapeutic mutilations, surgical or invasive procedures, such as tail docking and debeaking;
- Avoid negative impacts on landscape, environment and life: contamination of land for grazing, food, water and air
- Check stocks and flows, maintain structure of systems
- Prevent chemical and medical residues from entering the food chain
- Minimize non-therapeutic use of antibiotics and hormones
- Avoid feeding animals with animal wastes or animal matter (reducing the risk of alien viral or transgenic genes, or prions such as mad cow disease)
- Minimize transport of live animals (by foot, rail or road) (reducing the risk of epidemics, for example foot and mouth disease)
- Prevent waste run-off (e.g. nitrate contamination of water tables from pigs), nutrient loss and greenhouse gas emissions (methane from cows)

- Prefer safety measures standards in manipulation of equipment
- Apply traceability processes on the whole production chain (breeding, feed, medical treatment) for consumer security and feedback possibility in case of a food crisis (e.g., dioxin).

GAPs related to Integrated Pest Management—IPM

In agriculture as well as vector management, Integrated Pest Management (IPM) is a pest control strategy that uses an array of complementary methods: natural predators and parasites, pest-resistant varieties, cultural practices, biological controls, various physical techniques, and pesticides as a last resort. It is an ecological approach that can significantly reduce or eliminate the use of pesticides.

History of IPM

Shortly after World War II, when synthetic insecticides became widely available, entomologists in California developed the concept of "supervised insect control." Around the same time, entomologists in cotton-belt states such as Arkansas were advocating a similar approach. Under this scheme, insect control was "supervised" by qualified entomologists, and insecticide applications were based on conclusions reached from periodic monitoring of pest and natural-enemy populations. This was viewed as an alternative to calendar-based insecticide programs. Supervised control was based on a sound knowledge of the ecology and analysis of projected trends in pest and natural-enemy populations.

Supervised control formed much of the conceptual basis for the "integrated control" that California entomologists articulated in the 1950s. Integrated control sought to identify the best mix of chemical and biological controls for a given insect pest. Chemical insecticides were to be used in manner least disruptive to biological control. The term "integrated" was thus synonymous with "compatible." Chemical controls were to be applied only after regular monitoring indicated that a pest population had reached a level (the economic threshold) that required treatment to prevent the population from reaching a level (the economic injury level) at which economic losses would exceed the cost of the artificial control measures.

IPM extended the concept of integrated control to all classes of pests and was expanded to include tactics other than just chemical and biological controls. Artificial controls such as pesticides were to be applied as in integrated control, but these now had to be compatible with control tactics for all classes of pests. Other tactics, such as host-plant resistance and cultural manipulations, became part of the IPM arsenal. IPM added the multidisciplinary element, involving entomologists, plant pathologists, nematologists, and weed scientists.

In the United States, IPM was formulated into national policy in February 1972 when President Nixon directed federal agencies to take steps to advance the concept and application of IPM in all relevant sectors. In 1979, President Carter established an interagency IPM Coordinating Committee to ensure development and implementation of IPM practices.
How IPM works

An IPM regime can be quite simple, or sophisticated enough to be a farming system in its own right. The main focus is usually insect pests, but IPM encompasses diseases, weeds, and any other naturally occurring biological crop threat.

An IPM system is designed around six basic components:

- Acceptable pest levels: The emphasis is on control, not eradication. IPM holds that wiping out an entire pest population is often impossible, and the attempt can be more costly, environmentally unsafe, and all-round counterproductive than it is worth. Better to decide on what constitutes acceptable pest levels, and apply controls if those levels are exceeded.
- Preventive cultural practices: Selecting varieties best for local growing conditions, and maintaining healthy crops, is the first line of defense.
- Monitoring: Regular observation is the cornerstone of IPM. Visual inspection, insect traps, and other measurement methods are used to monitor pest levels. Record-keeping is essential, as is a thorough knowledge of the behavior and reproductive cycles of target pests.
- Mechanical controls: Should a pest reach an unacceptable level, mechanical methods are the first options to consider. They include simple hand-picking, erecting insect barriers, using traps, vacuuming, and tillage to disrupt breeding.
- Biological controls: Natural biological processes and materials can provide control, with minimal environmental impact, and often at low cost. The main focus here is on promoting beneficial insects that eat target pests.
- Chemical controls: Considered as an IPM last resort, synthetic pesticides may be used when other controls fail or are deemed unlikely to prove effective. Biological insecticides, derived from plants or naturally occurring microorganisms (for example, BT), also fit in this category.

IPM is applicable to all types of agriculture. Reliance on knowledge, experience, observation, and integration of multiple techniques makes IPM a perfect fit for organic farming (the synthetic chemical option is simply not considered). For large-scale, chemical-based farms, IPM can reduce human and environmental exposure to hazardous chemicals, and potentially lower overall costs.

An Example

In 1954, a new type of aphid was seen in California. At first, organophosphate pesticides were applied but after 5 years, most of the aphid population had become resistant. The pesticides also killed natural predators of the aphid. In the application of IPM, the amount of organophosphate used was lowered to allow the natural predators to live; further predators were also introduced.