

Good Agricultural Practices (GAP)

for new avenues in Agribusiness

Sanjay Rawal, Pooja Mankar*, V K Dua and S K Chakrabarti

ICAR-Central Potato Research Institute, Shimla, Himachal Pradesh 171 001

Cautiousness for quality food and environment sustainability has led to the genesis of Good Agricultural Practices (GAP) which have now acquired global acknowledgement for facilitating internal and external trade in agricultural produce and products. Most of the developed economies have already developed their own GAP standards. In such global scenario, India cannot remain aloof, therefore, Quality Council of India (QCI) has developed guidelines for Indian Good Agricultural practices (BasicGAP and INDGAP). This scheme comprises of control points and their compliances for all the crop production components to seek certification from the accredited bodies. Adherence to GAP would help Indian farmers in producing safe and quality food for domestic market and boost their confidence for competing in international arena. In fact, this is the roadmap for enhancing their income in coming decade.

Keywords: Agribusiness, Good Agricultural Practices (GAP), Quality Council of India (QCI)

IMMEDIATELY after independence, India's urgent focus was to increase food production to feed the burgeoning population and the green revolution succeeded remarkably in achieving that target. As a result, today the country is self-sufficient in food production and also exports several agricultural commodities. Food grain and horticulture sector has witnessed a record-breaking production. However, the issues related to environment and food safety are a significant concern of the agri-horticultural production system. Therefore, the real potential of Indian agri-horticulture sector is yet to be harnessed by adopting latest technologies along with a commitment to comply with environmental responsibilities. Further, with improvement in lifestyle and awareness across the globe, it is now high time to shift our focus on quality and safe food production, emphasizing conservation of natural resources and the environment. This would boost the whole rural economy as it will provide opportunities for new

emerging markets.

The concept of GAP is vividly described by the Food and Agricultural Organisation (FAO) as 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 economic, social and environmental sustainability. The notion for GAP started in the late 1990s when several European retailers came together and established a common standard practice for farm management. As this helped satisfy the consumers demand and ease in doing business, further refinements and developments continued for some time. As a result, farm certification slowly and steadily started expanding within and outside Europe and later converted to GlobalGAP. Today several countries have developed country versions of GAP like China GAP, Malaysian GAP, Japan GAP, Korean GAP, Thai GAP etc on the line of GlobalGAP standards.

Good Agricultural Practices (GAP) in India

Following the compelling international advancement, Quality Council of India (QCI) has provided two certification schemes, viz. BasicGAP and INDGAP keeping in view the Indian farming scenarios. Basic GAP is meant for small or marginal farmers or those interested in introducing quality farm production for fresh consumption or processing. This would assist them in the initial phase for adopting GAP standards and thus providing a feasible model for the domestic market. It has its own control points for compliance. Whereas INDGAP is more rigid and is targeted for large farms or farmer groups or any farm unit interested in seeking certification for their farm produce either for fresh consumption or for processing purposes. It includes GlobalGAP standards, best practices, prevalent industry standards and related ISO standards and relevant guidelines. It comprises control points and compliance criteria as per national farming practices and regulatory requirements. In

general, the main sections of GAP are all farm base modules and crop base modules, i.e. crops, fresh fruits and vegetables, combinable crops, tea and green coffee etc. QCI has defined all procedures for accreditation, certification and responsibilities of all stakeholders in the supply chain. Growers can seek certification as an individual or in a group from accredited certification bodies. Though the INDGAP implementation is voluntary and non-discriminatory to growers, adopting this scheme can indeed facilitate augmented national and international trade of national farm commodities.

Key components of Indian GAP

In simple technical terms of agricultural/horticultural production processes, the following points are to be considered either for adhering to BasicGAP or INDGAP:

Site selection: While screening site/farm for the first time, assessment should be done for vicinity to industries, toxic waste, heavy metals, industrial and urban effluents, all possible contaminations, land reclamation, irrigation water quality and drainage etc. This risk assessment will help in adoption of proper crop management practices. Also, previous years' meteorological data should be considered to determine the site's suitability for a particular crop production system.

Soil management: Soil is the basis of all agricultural production systems. So, physico-chemical analysis and mapping of fields for soil status helps to understand farm site's suitability for a particular crop and cropping system. Soil test reports help calculate precise nutrient requirements and soil amendments and accordingly, site-specific management and region-specific recommended package of practices for cultivation and seedbed preparation may be adopted. If soil is prone to erosion, then soil conservation (cultural or mechanical) techniques are adopted.

Field management: Precision in variety-specific planting is an important control point for optimum

seed rate, planting depth and better geometry yield. The practice of crop rotation is an essential strategy to control pests, diseases and weeds with minimum use of permitted chemicals and maintain soil fertility and productivity. The continuous cultivation of the same crops may increase certain diseases and pests in the field, hence a record of the previous year's cropping sequence should be kept.

Seed material: Choice of the most appropriate variety for a particular region is crucial for higher quality yields and optimal use of water, manures and fertilizers, chemicals, and farm machinery. It is better to adopt varieties recommended by the central and state agencies for specific regions and purposes due to their resistance to essential pests and diseases. This further requires the adoption of recommended agro-technologies for the selected variety. Another aspect is the quality of planting material, viz. seed source, seed health, purity, treatment, and all records in compliance with national/state legislation and GAP.

Nutrient management: It should be soil test-based and variety specific, where integration of organic and inorganic sources is compulsory. Apart from macro-nutrients, the grower should ensure that the micro-nutrient requirements of a crop are also fulfilled. The first priority should be given to organics, green manure and recycled material. The use of raw human sewage, municipal and industrial sludge is completely banned. In the case of well-treated/composted material, their risk assessment is necessary for disease transmission, weed seed dispersal and heavy metal content. Therefore, the sources of organic manures must be assured and their nutrient content should be known. Farmyard manure, sheep/poultry manure, oil cakes, or slaughterhouse wastes must be fully decomposed before their field application and green manures can

be used for improving soil fertility. Bio-fertilizer (specifically microbial) should only be applied after a recommendation from a technically competent source. Additional requirements of a crop should be met by judicious use of inorganic products only after utilization of organic sources. Likewise, their source and nutrient contents should be known.

Water management: Efficient irrigation water use is the key in GAP. A water test should be conducted to confirm quality and suitability of water, as per standards required for targeted crop production (irrigation, post-harvest washing and treatment etc). Growers should seek information on the region and variety-specific water requirements and prepare a judicious and efficient water use plan accordingly. Use of untreated sewer water is prohibited in irrigation/fertigation. Risk assessment is done for potential microbial, chemical and physical pollutants in irrigation water. Implementation of adequate measures to prevent the flow of contaminated water into fields is carried out and proper drainage, water harvesting, and conservation methods at the farm site are followed.

Weed management: Adopt crop-specific recommended integrated weed control strategy for minimal use of herbicides. Cultural (crop rotation, hot weather cultivation, green manuring, proper seedbed preparation, precise planting and placement of manures and fertilizers, mulching etc) and mechanical (manual or mechanical inter-cultural operations) weed



Analysis of soil and water quality in laboratory



A weed free potato crop field



Yellow stick trap for aphid management

control measures should be given top priority and these measures must be strictly followed for minimum usage of recommended herbicides with prescribed doses applied at the right stage of crop growth.

Disease and pest management: Recommended integrated pest and disease management practices must be followed. Preparation of a comprehensive crop protection plan and adherence to it for minimal use of chemicals would help in minimizing the risks of exceeding maximum residual limit (MRL) values in produce. Cultural, bio-agents and biological control measures should be preferred, and the use of chemicals should be restricted as a last resort with technical advice and recommendations. Only registered plant protection products recommended for a specific crop should be used. Regular updates from the website of the Ministry of Agriculture and Farmer's Welfare or Directorate of Plant Protection, Quarantine and Storage, or any authorized publications should be taken. Banned chemicals should never be used as plant protection measures. Pre-harvest intervals should be observed for specific plant protection products and spray schedule should not be repeated without any recommendations.

Harvest and post-harvest management: Harvesting at proper physiological maturity determines storability and quality traits of the produce. Therefore, growers must be aware of the maturity period of a particular variety and harvesting should be done

accordingly. Harvest procedure, handling, and storage must be done as recommended. Storage and packing space should be covered, ventilated, maintained clean and contamination-free. The storage area must be kept free from animals and rodents and proper measures for their control must be followed. Similarly, pest control procedures for storage/packing space are followed. Different varieties must be stored separately with proper labels and signs to avoid their mixing. Methods for sorting, washing, grading and drying should be well-defined and equipment should be well synchronized and calibrated. Standards of grading, purity of produce must be strictly followed. Water used in washing should be free from all kinds of contamination and declared safe by competent authorities. Proper norms should be followed for packaging material, weight per packet, handling of farm produce during temporary storage, and container loading.

Storage of agro-inputs: Fertilizers and agrochemicals should always be stored separately from farm produce in a covered, clean and dry place protecting these from spillage, leakage and seepage to avoid surrounding contamination. Mixing of chemicals can be done in a storage facility, if accurate measurement facility for chemicals is provided. Spillage can be dealt by equipping the mixing area with containers of absorbent inert material like sand. A surplus mixture or tank washing should be disposed off at a designated fallow area in the

farm. Empty containers of plant protection products can only be used for the same product at the farm; otherwise, a safety mechanism is to be followed for their disposal to avoid contamination in any form to the environment. Similarly, expired chemicals should be disposed off by following proper procedure.

Personnel: Key resource person at farm (farmer and supervisor) must be familiar with all aspects of crop production. Workers should also have training on specific skills, hygiene and safety aspect. Persons responsible for plant protection measures at the farm must have training for integrated pest and disease management. Workers must be provided with proper gears/safety clothes while applying plant protection products for their safety and health. Supervisor and workers should be well-trained to maintain hygiene and have proper knowledge for handling, sorting, application of chemicals and fertilizers, operating farm machines and equipment, washing, grading and packing produce. Minimum one worker must be trained in first aid assistance and must be present during all farm operations.

Equipment: All machinery used in fertilizer and chemicals application, harvesting and post-harvest handling should be calibrated as prescribed by the manufacturers. Machinery and equipment should be in good condition and maintained at a regular time frame. Cleanliness of these items in general and for equipment parts that are coming in direct contact with produce



Safety measures to be followed while spray of agrochemicals

during harvesting or post-harvest handling must be ensured to avoid contamination. Material (specifically metal) should be of good quality to avoid any contamination to the produce coming in contact with it. Record of their regular maintenance and calibration should be maintained.

Workers' health, safety, and welfare: Farmworkers are the basis for efficient and better quality production, maintenance, safety and conservation of the environment. A farm should have a written risk assessment document for various operations which should be updated periodically. Further, there should be a written policy on health, safety and hygiene which includes risk assessment issues, viz. accident, emergency, hygiene etc. A comprehensive procedure for handling emergencies should be developed in local language and pictorial format at the farm. It should include farm and building map, farm address, contact person responsible for workers welfare, nearest communication point of the phone, essential phone numbers (ambulance, hospital, fire brigade and police), emergency exits, location of fire extinguishers, emergency cut off for electricity, gas, water supply etc. Permanent warning signs should be prepared in readable forms to indicate hazardous sites such as fuel tanks, plant protection storage, workshops, electricity control panel, disposal area for chemicals etc. Electrical installations, plant

protection storage, fuel tanks and risky equipment must have adequate safety measures. Designated areas and clean, hygienic facilities should be provided for hand washing, eating, toilets, etc.

Record keeping and internal inspection: A record of farm-level operations and input use for past two years or more from the date of first/previous external inspection as advised by the certifying agency must be maintained. This aids in internal self-assessment which in turn helps adopt corrective measures during crop cultivation and marketing. Keep a record of all farm operations such as ploughing, sowing, weeding, fertilizers (stock, source, quantity applied and time of application etc.), irrigation scheduling, weed control schedule, plant protection product (chemicals, doses and mode of application etc.), harvesting procedures, handling and storage etc. with exact dates of application. In addition, all the IPM measures such as various approaches adopted for disease and pest management, chemicals including their storage, crop stages and quantity used etc. should be recorded.

Traceability of the produce: Traceability is the process to track the movement of produce from farm to fork and vice-versa. This facilitates fast, accurate and efficient withdrawal/recall of doubtful produce from the supply chain. Each consignment of produce must be legibly marked with details of

variety, month and year of harvest, name and address of grower etc, following trade practice/legal requirements. Likewise, there should be documented identification and traceability system of produce so that products can be traced back to the registered farm, including particular fields and tracked forward to the immediate customer.

Waste and pollution management, recycling and re-use: The grower should prepare a comprehensive, documented strategy after reviewing current practices for minimum wastage during production, recycling and re-use of waste. Grower must identify and list all possible waste products and sources of pollutants. Disposal procedure for non-recyclable materials should exist at the farm and a facility should be developed for organic waste composting for further use as manure. Farm and premises should be kept free of litter and waste to avoid breeding grounds for pests and diseases. The farm must have separately identified areas for storing/decomposing different types of litter and wastes.

Environment and conservation: As farming and environment are inseparably linked, environmental conservation should be prioritized in farm plans, cropping schemes, and individual crop cultivation. The abundance of flora and fauna is beneficial to agricultural activities in several ways. There must be a written action plan for improving habitats and increasing farm

biodiversity. A baseline survey of flora and fauna should be done and their aftereffects on agriculture should be studied to improve the action plan. The main objective must be to set-up compatibility of sustainable agriculture with the surrounding environment having minimum negative impact on it. Unproductive sites (lowlands or unfertile soils) may be identified for conserving natural flora and fauna. Fuel-efficient farm machinery and equipment should be selected to minimize the use of non-renewable energy. Renewable sources of energy like solar energy may be integrated with the power supply plan of a farm. Regular maintenance and servicing should be done for better efficiency of energy consumption. Finally, maintaining a record of all the activities for external audit.

Complaints: Providing complaints is the right choice for better GAP compliance and strengthening confidence among stakeholders in the supply chain. Complaint procedure must be in place and made available on request for GAP-related issues. This should have an appropriate recorded follow-up action. Finally, a documented recall procedure for produce from the market should be adopted and the person responsible for making decisions must be identified. Recall procedure must be speedy, transparent and accurate. For this, GlobalGAP traceability and recall standards may be followed.

Recognition of scheme

The Agriculture and Processed Food Export Promotion Scheme of APEDA for the Medium Term Expenditure Framework (2017–18 to 2019–20) have subsidized the IndGAP certification cost (<http://apeda.gov.in/apedawebsite/Announcements/SchemeGuidelinesMTEF27042018.pdf>) and the Ministry for Integrated Development of Horticulture has subsidized the IndGAP certification cost (<https://midh.gov.in/PDF/midh> (English).pdf). The financial assistance is encouraging the promotion and adoption of GAP in Indian farming scenario.

Economics and sustainability of agricultural production system through GAP

Basic principle of GAP is to maintain sustenance of an agricultural production system which also makes it more efficient economically. First emphasis goes for most appropriate variety or planting material for an agro-ecology followed by soil test based integrated nutrient management. Cheaper farm-based waste, crop residues and by-products are to be recycled for further use in crop nutrition. Likewise, integrated weed, disease and pest management must be followed. Ample stress has been given on more crops per drop for water management. Use of chemicals and non-recyclable inputs is last option in GAP for optimizing the productivity of a given genotype. This whole concept makes cultivation cost cheaper and favourable for environmental conservation. GAP based agricultural production system shall thrive better in long run under changing climate scenario.

Gap in knowledge, implementation and future prospects

There is no doubt that a wide gap exists in developing GAP based agro-technologies at macro and micro level. Coordinated efforts are required by all research and development, and extension agencies in refining current recommendations for complying the GAP control points. Further, farmers and other stakeholders of supply chain are made aware for this aspect at a larger scale by using all means of extension and communication including the mobile based apps and social media. As consumers are more aware now, they demand quality trusted products. Thus, production system and supply chain should be more robust for facing future challenges of trading and marketing in domestic and global arena. Also, good quality will fetch better prices and greater farm profits.

This brief introduction of Indian Good Agricultural Practices (GAP) will help all agricultural production and consumption chain partners understand the concept of this

certification scheme. For detailed information on BasicGAP and INDGAP, the website of QCI (<http://qcinqin.org/india-good-agriculture-practices.php>) may be visited and further guidance may also be sought from the Director, ICAR-Central Potato Research Institute.

SUMMARY

Good Agricultural Practices (GAP) has acquired global recognition due to increasing cautiousness for quality food and environmental sustainability. GAP is a collection of principles applied during on-farm production and post-production processes for safe food and non-food agricultural production. Most of the developed economies have already developed their GAP standards; however, the application of GAP is in a nascent stage in India. GAP has gained worldwide recognition for facilitating internal and external trade in agricultural produce and products. In line with the global trend, the Quality Council of India (QCI) has developed guidelines for Indian Good Agricultural practices (BasicGAP & INDGAP). This scheme comprises control points and compliances for all the crop production components to seek certification from accredited bodies. This accreditation body identifies the certification agencies to help farmers comply with GAP requirements, which start right from site selection until the produce reaches consumers. The grower needs to follow the control points and their respective compliances for seeking certification. Adherence to GAP will help Indian farmers produce safe and quality food for the domestic market and boost their confidence in competing internationally. GAP compliance is the roadmap for enhancing farmers income in the coming decade and provide a new opportunity for Agribusiness.

*Corresponding author's e-mail: poojamankar3217@gmail.com
