

Good Agricultural Practices (GAP) in Solanaceous Crops

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Good Agricultural Practices (GAPs) play a crucial role in sustainable, safe and high-quality agricultural production. They help maintain food safety by minimizing contamination risks from pesticides, heavy metals and pathogens, ensuring compliance with national and international standards. By promoting sustainable resource use, GAPs enhance soil fertility, prevent erosion and encourage organic cultivation methods that support long-term agricultural productivity.

They also contribute to environmental conservation by reducing chemical pollution, preserving biodiversity and mitigating the effects of climate change.

Economically, GAPs improve farm profitability by optimizing inputs, reducing post-harvest losses and increasing market access through certification and compliance with global standards.

Efficient water management, waste recycling and integrated pest management (IPM) are also key aspects of GAPs, helping to conserve resources and improve overall farm efficiency. Additionally, GAPs prioritize the health and welfare of farm workers by ensuring safe working conditions and responsible agrochemical use. In the context of vegetable cultivation and plant breeding, adopting GAPs can lead to the

development of disease resistant crops, improved organic farming techniques and higher yields, ultimately benefiting both farmers and consumers.

Implementing these practices is essential for achieving long-term sustainability in agriculture while meeting the growing demand for safe and nutritious food.

Solanaceous crops, including tomato, potato, brinjal, chilli and capsicum, hold immense importance in Indian agriculture due to their economic, nutritional and industrial value. These crops form a significant part of the Indian diet, providing essential vitamins, minerals and antioxidants, while also serving as a major source of livelihood for millions of farmers. Tomato and potato, in particular, are staple vegetables widely consumed across the country and are key contributors to the processed food industry, supporting products like ketchup, chips, and dehydrated foods. Brinjal and chilli, being climate-resilient and adaptable to diverse agro-climatic conditions, are cultivated across different regions, ensuring year-round availability. India is one of the largest producers of chilli and contributes significantly to global spice exports, making it a vital foreign exchange earner. These crops also play a crucial role in crop diversification, improving soil health when incorporated into rotational farming systems. Research in plant breeding has led to the development of high-yielding, disease-resistant and climate-resilient varieties, enhancing productivity and profitability for farmers. Given the growing demand for vegetables and processed foods, solanaceous crops continue to be an integral part of Indian agriculture, supporting food security, farmer incomes, and the overall agrarian economy.

Good Agricultural Practices (GAP) ensure the sustainable production of high-quality produce while minimizing environmental impact and ensuring food safety. This article discusses GAP principles in solanaceous crops such as tomato (*Solanum lycopersicum*), brinjal (*Solanum melongena*), chilli (*Capsicum annum*) and potato (*Solanum tuberosum*). The major steps have been mentioned under the following subheads.

Selection of Site and Land Preparation

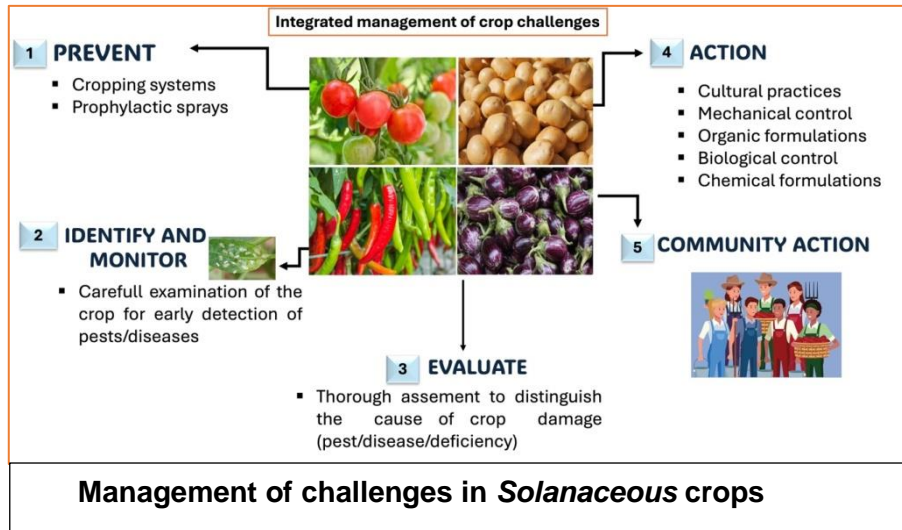
- Choose well-drained sandy loam or loamy soil with good organic content and a pH range of 6.0-7.5.
- Conduct soil testing for nutrient status and pathogen load before planting.
- Practice deep ploughing and levelling to prevent waterlogging and improve root aeration.
- Use raised beds or ridges for proper drainage and aeration.

Seed and Nursery Management

- Use high-quality, disease-free seeds from certified sources.
- Treat seeds with *Trichoderma viride* or *Pseudomonas fluorescens* to prevent seed-borne diseases.
- Prepare raised nursery beds (10-15 cm height) with well-decomposed FYM and sterilized soil.
- Maintain proper spacing in the nursery to prevent damping-off disease.

Transplanting and Spacing

- Harden seedlings by reducing water supply before transplanting.
- Transplant seedlings at 4-6 leaf stage during the cooler hours of the day.
- Maintain proper spacing:
 - Chilli: 45-60 cm (row-to-row) and 30-45 cm (plant-to-plant)



- Tomato: 60-75 cm (row-to-row) and 45-60 cm (plant-to-plant)
- Brinjal: 60-75 cm (row-to-row) and 45-60 cm (plant-to-plant)
- Potato: 60-70 cm (row-to-row) and 20-25 cm (tuber-to-tuber)

Nutrient and Fertilizer Management

- Apply well-decomposed FYM (10-15 t/ha) before transplanting.
- Follow a balanced fertilizer schedule based on soil test recommendations. The recommended dose of fertilisers may vary according to the soil condition thus, to optimise the nutrient supply, soil testing is very essential.
- Use of macronutrients such as nitrogen (N), phosphorus (P), and potassium (K)
 - Chilli: 100:50:50 kg/ha
 - Tomato: 120:60:60 kg/ha
 - Brinjal: 100:50:50 kg/ha
 - Potato: 150:80:100 kg/ha
- Apply micronutrients like zinc, boron and calcium 2g/lit. To prevent deficiencies.
- Use biofertilizers like *Azospirillum*, *Azotobacter* and phosphorus-solubilizing bacteria as seed dip- 200g/10-12 kg seed, set treatment (potato tubers)- 1kg/40-50 lit. of water, seedling dip- 1kg/10-15 of water, soil application – 2-3 kg/ 60 kg of FYM.

Irrigation Management

- Adopt drip irrigation with mulching to conserve moisture and reduce weed growth.
- Maintain proper irrigation frequency:
 - Chilli & Tomato: Moderate but frequent irrigation (every 5-7 days)
 - Brinjal: Regular irrigation (every 4-5 days)
 - Potato: Frequent light irrigation during tuberization
- Avoid overwatering, which can cause fungal diseases like *Phytophthora* blight and root rot.

Weed Management

- Use plastic mulch (20-30 gauge- black coloured) organic mulch (coconut coir, straw, saw dust) or natural cover crops (cowpea, *Calopogonium mucunoides*) to suppress the weed growth.
- Perform shallow hand weeding at regular intervals to avoid crop damage.
- Use pre-emergence herbicides like pendimethalin or oxyfluorfen for effective weed control.

Integrated Pest and Disease Management (IPM & IDM)

The integrated approach to control of pests and diseases includes the practice of mechanical, biological, cultural and chemical means of applications.

These pests not only affect the crop and its produce directly by feeding damage but also act as vectors for various diseases causing further crop damage.

The commonly occurring pests of solanaceous crops

- Chilli: Thrips, whiteflies, aphids, and fruit borers.
- Tomato: Tomato leaf miner (*Tuta absoluta*), fruit borer, and aphids.
- Brinjal: Shoot and fruit borer, jassids, and mealybugs.
- Potato: Aphids, cutworms, and tuber moths.

Pest Management

- Use pheromone traps for monitoring fruit borers and *Tuta absoluta*
- Apply neem-based insecticide (Azadirachtin 1500 ppm) to control sucking pests
- Release natural predators like ladybird beetles and *Trichogramma* parasitoids
- Use of trap crops (Maize, Marigold)

Common Diseases

- Chilli & Tomato: Powdery mildew, bacterial wilt, anthracnose, and viral diseases.
- Brinjal: Bacterial wilt, damping-off, and Phomopsis blight.
- Potato: Late blight, early blight, and black scurf.

Disease Management

- Use resistant varieties (Arka Abhed, Arka Rakshak-Tomato, Arka Neelkanth-Brinjal, Arka Gagan, Arka Dhriti, Arka Nihira- Chilli).
- Practice crop rotation to break disease cycles.
- Apply copper oxychloride or Mancozeb for fungal disease control.
- Maintain proper plant spacing for adequate air circulation.

Harvesting and Post-Harvest Handling

- Harvest at the right maturity stage to ensure good quality and shelf life.

- For chilli, harvest green fruits at the breaker stage and dry fruits after full ripening.
- Handle produce carefully to avoid bruising and mechanical damage.
- Dry chilli under shade to maintain colour and pungency.
- Store potatoes in well-ventilated conditions to prevent sprouting, rotting and other physiological disorders.

Record Keeping and Certification

- Maintain records of all field operations, including input usage, pest control measures, and yields.
- Follow Global GAP or National Horticulture Board (NHB) guidelines for certification.
- Implement traceability systems for better market acceptance and consumer trust.
- Conclusion
- Adopting Good Agricultural Practices in solanaceous crops enhances productivity, ensures food safety and minimizes environmental hazards. Integrated nutrient management, pest control and proper post-harvest handling contribute to sustainable and profitable farming.