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Good Agricultural Practices (GAP) for Sustainable Development

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ARTICLE ID: 28

Abstract:

The term "good agricultural practices" (GAP) refers to a set of guidelines for the sustainable and safe raising of animals and crops. It attempts to minimize production costs and environmental effect while assisting farm owners in maximizing yields and streamlining company operations. Adhering to Good Agricultural Practices facilitates producers in meeting store demands for high-quality products and consumer preferences. The U.S. Department of Agriculture (USDA) may audit GAP compliance upon request to make sure that regulations set out by the Food and Drug Administration (FDA) are being followed. The use of agrochemicals is growing, which poses a threat to the sustainability of agriculture, which is the vital economic sector of the nation. Low Soil Organic Matter (SOM) leads to decreased agricultural output, higher risks to food safety, and detrimental effects on the environment and public health. In order to solve the concerns of food safety, commerce, and sustainability, Nepal implemented the Good Agricultural Practices (GAP) concept in 2018. Because GAP is still vague and wide, it is challenging to utilize and apply. The GAP has the ability to raise agricultural output by up to 36%, lower the usage of agrochemicals by 31%, raise SOM from a mean of 3.32% to 3.77%, and generate more than 100% more revenue for farmers.

Keywords: Food safety hazard, Good agricultural practices, Soil organic matter

Introduction:

The ability of agriculture to consistently supply food and other resources to an expanding global population is essential to human survival. However, a number of issues, such as climate change, a high rate of biodiversity loss, land degradation due to compaction, erosion,

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pollution, and salinization, depletion and pollution of water resources, rising production costs, a steadily declining number of farms and, associated with that, poverty and a decline in the rural population, threaten agriculture's ability to meet human needs both now and in the future. However, by using the right post-harvest processing and crop production technologies, as well as by enhancing quality, current traditional farming may be made more profitable and long-lasting. The search for an alternative, low-input, resource-use efficient, and sustainable agro-management has accelerated recently due to economic pressure on farmers and climate change. Sustainable agriculture is the effective management of resources to fulfill changing human needs while maintaining the quality of the environment and conserving natural resources. This involves conservation of crop diversity, conservational tillage, efficient water management, integrated management of nutrients, weeds, and pests with crop diversification. For centuries, India's agriculture relied on local resources, such as local indigenous varieties and knowledge, which were gained through sustained interaction with the environment (Umaraniet al., 2000). Sustainable agriculture is a farming practice that is based on ecological principles, or the relationships between organisms and their environment. It leverages a holistic management of belowground interactions rather than off-farm inputs, which are a trademark of industrial agriculture, in order to achieve efficiency and resilience (Altieri, 1995). Adoption of proper farming methods is required in this situation. A few of the methods include summer plowing, crop rotation, planting crops in the proper quantities and shapes, using pest- and disease-resistant cultivars, using high-quality organic and green manure crops, and applying some Indigenous technical knowledge (ITK).

GAP Techniques:

1. **Summer ploughing:** To replenish the soil profile, carry out extensive summer plowing (off-season tillage) in conjunction with pre-monsoon precipitation in May. It makes it easier to plant crops as soon as the southwest monsoon begins. Off-season tillage lowers runoff while raising the water content of the soils. Additionally, it lessens weed and pest infestation. The strength of the weeds determines how many and how deep to plough. Before the onset of the monsoon, two summer ploughings are, at most, completed at intervals of fifteen to twenty days. A cultivator or harrow can be used for a single third plowing to assist break up the soil and prepare field beds for planting or sowing shortly after the first monsoon rain.

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2. **Crop rotation:** One of the earliest agronomic techniques used by farmers to manage nutrient and water balances, weed, pest, and disease infestations, and risk exposure is rotating crops in a variety of intricate patterns. This practice also helps to improve system resilience and meets the needs of humans and livestock for food and feed (Castellazzi et al., 2008, Chongtham et al., 2017). Diversified rotations are crucial to designing more sustainable agricultural systems because they have a significant influence on the functioning of agroecosystems as well as the economic, environmental, and cropping system outcomes and performances (Schönhart, et al., 2011).
3. **Sowing of crop at right time & right geometry:** It's a crucial technique that all farmers ought to do. Some of the most significant techniques used in these diverse ways are broadcasting, dibbling, planting behind the country plow (both mechanical and manual drilling), seed drilling, and nursery transplanting. For crop production, there are several crop geometries available. Among them are: Television, produces unpredictable geometry, does not preserve equal space, and either overuses or underuses resources. Plants are planted using the square technique, also known as square geometry, with equal spacing between each plant. Tree crops are cultivated using the square method and are primarily perennial crops. This is a rectangular sowing method where the plants are spaced apart by a greater distance between rows and columns. This mostly involves three planting techniques: skip row (a row of planting is skipped), paired row arrangement (a rectangular arrangement, crop requires 60 cm x 300 m spacing and if paired row is to be adopted, the spacing is altered to 90 cm instead of 60 cm in order to accommodate an intercrop), and solid row (each row will have no proper spacing between the plants).
4. **Control of disease and insect-pest:** Because preventative tactics are based on environmentally safer management techniques rather than curative ones, organic farming's alternatives for managing pests and diseases mostly rely on preventive measures (Haldhar et al., 2017). Several strategies that may be employed to manage the quantity and frequency of insect pests include: Utilizing resistant varieties (a) The result of insect crop colonization depends on a variety of factors, including plant size, shape, color, leaf hairs, and natural compounds that function as both attractants and repellents. The incidence of illness has decreased with the use of resistant varieties. Farmer needs

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to go for improved varieties over regular varieties that he/she is using for crop production. b) Integrated Pest Management (IPM): Among its techniques are the following: choosing crops with comparatively few pest issues, choosing the ideal planting period to prevent bug population peaks, Use resistant cultivars wherever feasible, engage in crop rotation, and get rid of old crop residue as soon as the last harvest is completed. Before planting, get rid of weeds and continue to control them while crops are in the field. This helps keep a variety of insect pests under control, such as slugs, crickets, cutworms, fake chinch bugs, and vegetable weevils. Yellow sticky plates can be used to manage insects, and yellow sticky traps are a useful tool for managing whiteflies in greenhouses. The majority of pheromone traps draw males, who are oblique signs of possible pest issues. Furthermore, females have the potential to lure males more successfully than traps when they are nearby. Additionally, pheromone traps are a useful tool for tracking population levels of pesticide resistance (Riedl et al., 1985). As a whitefly barrier, border crops such as taller non-host border crops like maize, sorghum, and pearl millet might be employed (KrishinaMoorthy et al., 2006). In contrast, trap crops draw pest species into a designated area where they may be eliminated rather than the cash crop that has to be safeguarded.

5. **Use of good quality organic manure**: To improve water retention and speed up the fermentation process, it is typically used with straw or crop leftovers (Omariet al., 2016). One of the most common types of manures is cow dung; other manures from poultry are quite heavy in potassium, phosphate, and nitrogen. Compost, which is primarily trash or the leftovers of other operations, has a significant impact by raising the carbon, useable nitrogen, and/or phosphorus concentrations. Because of its high C/N ratio, biochar application can be a useful instrument in the shift from conventional to sustainable and ecological systems, enabling us to quickly raise the proportion of organic matter. Many crops, mostly legumes, are grown as green manures either during or after the primary crop's regular growing season (Flores-Félix et al., 2019). The purpose of crops employed as green manures (Table.1) is to return the land to its natural state without collecting any vegetal matter or at least airborne biomass (Talgreet al., 2012). These crops are particularly helpful in shielding plant roots from extremes of temperature. Mulch is applied to the soil surface surrounding the plants to foster

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favorable development conditions. This might involve controlling weeds, lowering salinity, and regulating temperature (Kumar et al., 2012). Due to its substantial advantages in terms of yield growth and water saving, plastic mulching has become quite popular (Haque et al., 2018). The following are the main sources of manures: a) cow dung, urine, and slurry from biogas plants; b) wastes from human habitation; night soil, human urine, town refuse, sewage, sludge, and sullage; c) poultry jitter; d) wastes from fish wastes; e) byproducts of the agro industries; such as soil cakes, press mud, and wastes from fruit and vegetable processing. f) green manure crops and green leaf manuring material; g) Water hyacinth, weeds, and tank silt; and h) Crop wastes, including sugarcane trash, stubbles, and other related material.

6. **Concentration on livestock:** Systems of farming centered around livestock can play a significant part in mitigating environmental issues such diminishing soil fertility, soil erosion, and contaminated water (Baker et al., 1990). There is little doubt that ruminants will remain an important component of sustainable agriculture systems. According to Oltjenet al. (1996), they are especially helpful in turning large amounts of renewable resources from rangeland, pasture, agricultural leftovers, and other byproducts into food that is fit for human consumption. Relatively poor use of resources can be said to characterize ruminant systems in underdeveloped nations. Due to the large yield disparities in the majority of these production systems, there is a significant potential for research and development to help create more sustainable solutions by enhancing the livestock sector's efficiency through sustainable intensification strategies (Herrero, et al., 2013).
7. **Indigenous technical knowledge (ITK):** For the people who created these systems in the past, developing indigenous technical knowledge (ITK) systems—which include environmental management—has been essential to their survival (George et al., 2000). The ITKs are generally divided into three categories: (a) Cultural practices, which help prevent, suppress, or eradicate pests, include field sanitation, appropriate seed and variety selection, proper seedbed preparation, planting date, row spacing, seeding rate, fertilization, water management, crop rotation, planting of trap crops and hedge rows, companion planting, and intercropping. (a) Using mechanical and physical techniques (aphids, thrips, and whiteflies are monitored and managed with bright yellow sticky

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traps). As per Bissdorf (2008), bright blue traps are specifically designed to monitor thrips, while bright white sticky traps are meant to catch flea beetles. Additionally, the use of botanicals is recommended, with Aloe vitex extract being effective against armyworm, hairy caterpillar, rice leaf folder, rice stem borer, semi-looper, bacterial, and fungal diseases, Coriander (Coriandrum sativum) for mite control, and marigold and chilli extract for managing most agricultural pests.

Conclusion:

Currently, there is enough food produced in agriculture to meet demand. To maintain farming's expansion and advancement, sustainable agricultural techniques are essential. Given that soil continues to be the most important component of production, it is necessary to sustain output while preserving the health of the soil. By implementing various cultural operations such as field sanitation, appropriate seed and variety selection, planting date, row spacing, seeding rate, fertilization, water management, crop rotation, planting of trap crops and hedge rows, companion planting, and intercropping, adoption of these practices has made it easier to produce high-quality produce that is chemical-free or uses no chemicals at all. Farmers should profit from a bundle of activities that are made easier, and timely information updates should be given on a regular basis. The foundation of sustainable agriculture should be cattle, as they give the cow dung and other compost materials needed to prepare FYM and other organic matter, as well as the urine needed to make insect and pest repellents. Ultimately, these farmers must be the center of attention for promoting the adoption of sustainable agricultural techniques in order to lower farming's externalities.

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