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Integration of organic farming practices in cultivation of Ayurveda herbs: An innovative approach

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Abstract

Farming is the practice of agriculture in an area devoted to agricultural processes usually on the outskirts of a city. It is the domestication of animals, cultivation of plants and other forms of life for food, fiber and medicinal products to sustain and enhance human life. Nowadays farming is done by means of machinery, chemical fertilizers and pesticides. This has created unemployment and diminished the quality of soil and food grains. People are helpless and forced to eat the food available to them, although many are aware that the food they consume is not safe for health. The time has now come to give serious consideration to the growth of ayurvedic herbs by organic means. The present study was carried out to review the concept of organic farming and to create awareness amongst the policymakers about its benefits for the welfare of all.

Keywords: Organic farming, Ayurvedic Herbs, Herbal Cultivation, fertilizers, pesticides.

1. Introduction

India has 15 Agro-Climatic regions and medicinal plants are dispersed across all biogeographic areas, varied surroundings and landscapes^[1]. World Health Organization (WHO) has estimated that approximately 80% of the world population still relies on traditional medicines, which are mostly plant-based drugs. Government of India has notified Good Manufacturing Practices (GMPs) under Drugs and Cosmetics Act, 1940. The eminence of raw-material, however, depends upon the assortment and agriculture practices used for acquirement of medicinal plants. There is a call arising primarily for agriculture stakeholders and research workers with the aim to endow with cultivation techniques which have results standardized, safe & effective herbal medicinal plants production. Organic farming is a form of agriculture that depends on techniques such as crop rotation, green manure, compost, and biological pest control for growing crops both for food and medicine. While conventional agriculture uses synthetic pesticides and water-soluble synthetically purified fertilizers, organic farmers are restricted by regulations to using natural pesticides and fertilizers. Synthetic medicine was being used since years to cure diseases. Recently there has been a shift in universal trend from synthetic to herbal medicine. People prefer to grow herbs by means of organic means to gain high yields. Stevia is being grown nowadays on a large scale for promoting environmental versatility^[2] which is used in the management of diabetes, arthritis, rheumatism and post-natal problems. *Safed Musli* has been used for centuries in the ayurvedic system of medicine as an aphrodisiac^[3].

2. Aims & objectives:

1. To present a review of the field of Herbal Medicines and its cultivation strategies by Organic Farming.
2. To present new, original results or methods of implementation approach in Ayurvedic Pharmacy sector.
3. To propose strategy of Organic Farming that could help in providing quality herbs for Ayurvedic Pharmaceutical sector.

3. Methodology:

A stepwise method was adopted to establish the source of resources for review. The peer-reviewed literature was the major means of data collected about the cultivation of Ayurvedic drugs. Every data was analyzed to collect and present correct information. The researches and Advancements in the field are being presented. The paper is being presented in simple English so that it can be easily understood by readers of all ages and regions.

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3.1 Inclusion Criteria: We included data that discussed farming of herbal drugs by Organic means. Articles were considered for study even if they referred to establishing a link between herbal medicines and Organic farming.

3.2 Exclusion Criteria: We have excluded documents that were without verified data or related evidences and not concerned with Herbal drugs cultivation. The data collected from various sources has been critically analyzed and logical conclusion is being presented at the end.

4. Results

The main methods were found to be crop rotation, green manure and compost, biological pest control, and mechanical cultivation. These measures use natural environment to increase crop productivity: legumes are planted to fix nitrogen in the soil, natural insect predators are encouraged, crops are rotated to confuse pests and renew soil^[4]. Some of the methods have also been taken from conventional agriculture as Integrated Pest Management which uses various organic methods of pest control^[5].

4.1 Organic Certification:

This is a standardization process for producers of organic food and agricultural products. Any business directly involved in food production can be certified, including seed suppliers, farmers and restaurants. Organic methods of farming are internationally regulated and legally enforced by many nations, based on the standards set by the International Federation of Organic Agriculture Movements (IFOAM)

A set of production standards varying from country to country for growing, storage, processing, packaging and shipping have been made as:

1. Avoidance of synthetic chemical fertilizers, pesticides, food additives, irradiation, and sewage sludge; "Pesticides that kill insects, also kill a tiny part of the living element in us. As per Ayurveda, the same principles govern the whole cosmos, and the living (*chetan*) and non-living (*jada*) are made with the five elements, ether or space, air, fire, water and earth. The poison that kills insects also destroys the life-giving nourishment... the earth which is the giver of all, and finally the water which renders fluidity to life."^[6]
"By consuming such food laced with pesticides over the years, we accumulate a lot of toxins in our system. Depending upon the years, individual constitution and fundamental health (*ojas*), people become easy victims to serious disorders like cancer, kidney failure, blood disorders, allergies, asthma and so on."^[6]
2. Avoidance of genetically modified seed.
3. Use of farmland that has been free from prohibited chemical inputs for a number of years (often, three or more) "The farmer must also keep in mind the *ojas* aspects of the earth. The earth that has been subjected to artificial fertilizers, pesticides and fungicides has lost its *pranashakti* or life force. The plants which grow on such soil are obviously weak in their immunity and vitality and are easily attacked by pests. It is easy to understand this if you think of an individual who has been repeatedly taking antibiotics to treat infections. This person becomes very weak is more vulnerable to external attacks of bacterial and virus. Crops and tress grown in soil devoid of *ojas* cannot provide us *ojas*. By eating this kind of food, we gradually become low in *ojas* and vulnerable to ailments due to external (challenges)."^[7]

4. Adhering to specific requirements for feed, housing, and breeding for livestock
 5. Keeping detailed written production and sales records
 6. Maintaining strict physical separation of organic products from non-certified products;
 7. Undergoing periodic on-site inspections.
- Standards also regulate production methods and final output for organic agriculture.^[8]

5. Analysis

5.1 Understanding Systems of Organic farming-

5.1.1 Biodynamic Farming: In this method Preparations made from fermented manure, minerals and herbs are used to restore and enhance the nutrition, quality and flavor of the food being raised.

5.1.2 Do Nothing Farming method: This focuses on a minimum of mechanical cultivation and labor for grain crops.

5.1.3 Holistic Management: This is a whole farm planning system that helps farmers better manage agricultural resources in order to gain sustainable environmental, economic, and social benefits. **Permaculture:** Permaculture is a system of agriculture centered on simulating or directly utilizing the patterns and features observed in natural ecosystems.

5.1.4 SRI (The System of Rice Intensification): This is a low water, organic method that uses young seedlings mainly hand weeded with special tools for increasing the yield of rice produced in farming

5.2 Soil management: Organic farming uses crop rotation, cover cropping, reduced tillage, and application of compost to improve soil fertility. It depends on the natural breakdown of organic matter to replace nutrients taken from the soil by previous crops.

Plants require minerals such as nitrogen, phosphorus and potassium to grow properly. Symbiotic relations with fungi are also needed for them to grow well.^[9] Intercropping, with wider spacing between plants is done to prevent infestation by pests and also to increase soil nutrients. Organic farmers use manure, fertilizers such as plant fibres and fallen down leaves and various mineral such as rock phosphate, a naturally occurring form of potash which provide potassium. Bacteria and fungi break down plant and animal waste matter into productive soil nutrients. They provide fertile soil and healthier crops.^[10]

5.3 Polyculture: Organic farming focuses on polyculture in which multiple crops are grown in the same space).^[11] This helps environments thrive and protects species from becoming extinct.^[12]

5.4 Weed management: Organic farming promotes weed suppression.^[13] In organic farming rotation of annual crops^[14] is done which means that a single crop cannot be grown in the same place without a different, intervening crop. Organic crop rotations frequently involve crops with dissimilar life cycles to discourage weeds associated with a particular crop.^[13] Research is going on to develop methods to suppress the growth or germination of common weeds.^[15]

Practices used to control weeds^[16] are:

- Tillage - Turning over the soil between crops to incorporate crop residues; remove existing weed and prepare a seedbed for planting;

- Mowing and cutting - Removing tops of weeds;
- Thermal weeding – Killing weeds by using heat.
- Mulching - Blocking weed growth with plastic films ^[17]
- Introducing Fish - Some farmers introduce fish to wet paddy fields to eat both weeds and insects. ^[18]
- Using predatory insects- This is done to control pests by eating them.
- Encouraging beneficial microorganisms - This is done to overpower the harmful microorganisms
- Rotation of Crops- This is done from year to year to interrupt pest reproduction cycles.
- Growing Pest Repelling Plants- To discourage pests.
- Using biologic pesticides and herbicides
- Using stale seed beds to destroy weeds before planting ^[19]
- Using hygiene - To remove pest habitat.
- Using insect traps - To control insect populations.
- Using physical barriers

Insecticides used on organic farms include *Bacillus thuringiensis*, pyrethrum, *neem* and rotenone which are naturally derived. Naturally derived fungicides allowed for use on organic farms include the bacteria *Bacillus subtilis*, *Bacillus pumilus*; and the fungus *Trichoderma harzianum*. These are mainly effective for diseases affecting roots. ^[20] Synthetic pesticides allowed for use on organic farms include Bordeaux mixture, copper hydroxide and sodium bicarbonate for managing fungi. ^[21]

5.5 Livestock: Raising animals and poultry, for meat, milk and eggs, is another traditional way of organic farming. Farmers ensure that animals are treated with medicine when they are sick, but drugs cannot be used to promote growth. Their feed must be organic, and they must be pastured.

5.6 Composting: If manure is used as fertilizer then there is risk that food gets contaminated with animal gut bacteria, as pathogenic strains of *E. coli* that cause fatal poisoning from eating organic food. ^[22] To reduce this risk, USDA standards require that If raw animal manure is used, 120 days are made to pass before harvesting if the final product comes into direct contact with the soil. On the other hand 90 days are made to pass before harvest if the product does not come in direct contact with the soil. ^[23]

6. Discussion:

About 6198 species of plants are projected to be used for human and veterinary health care in our country, out of which about 2,700 plants species are reported to be used in the codified Indian Systems of Medicine *viz.* Ayurveda (1800 species), Siddha (500 species) and Unani (400 species). In addition to their use in preparation of Indian system of medicines, the herbal plants are being used in preparation of various pharmaceuticals and health products under the modern system of medicine. ^[1] The safety and quality of therapeutic plant resources and completed harvest depend upon assorted factors like genetic structure, ecological conditions, cultivation practices, crop and post-crop processing, transport and storage practices. ^[24]

Therefore, promotion of authentic, genuine variety of vegetation may be the only way to have raw material of obligatory excellence. The non-availability of appropriate *modus operandi* and bona fide planting material are the major limitations in development of this vegetation. On the basis of results and analysis of data available; production of herbal medicines by organic farming practices may benefit Ayurvedic pharmaceutical sector in the following way-

6.1. Economics: Traditional organic farming in this sector seems labor and knowledge-intensive while conventional farming is requires more energy and manufactured inputs. ^[25]

6.2. Profits: Organic farms have been found to be as profitable as conventional farms. Markets and supermarkets sell organic food at higher prices and gain more profits than non-organic food. ^[26]

6.3. Energy efficiency: Organic system of farming is more energy efficient in case of apple production. ^[27] Organic farming had a higher yield per unit of energy over multiple crops and for livestock. However, conventional farming had higher total yield. ^[28] Organic wheat and corn production was more energy efficient than conventional methods.

6.4. Farmers profits: Farmers selling organic products directly to consumers at farmers' markets achieve higher returns.

6.5. Labor and employment: Organic production is more labor-intensive than conventional production. ^[29] The 2011 UNEP Green Economy Report states that increase in investment in green agriculture is projected to lead to growth in employment of about 60 per cent compared with current levels" and that "green agriculture investments could create 47 million additional jobs compared with BAU2 over the next 40 years." ^[30]

6.6. Soil conservation: Organically managed soil has a higher quality ^[31] and higher water retention. ^[32] Organic farming can build up soil organic matter better than conventional farming, however few studies suggests organic yields are typically lower than conventional yields. ^[33]

6.7. Biodiversity: An average of 30% more species are found to inhabit organic farms. ^[34] Birds, butterflies, soil microbes, earthworms, spiders, vegetation, and mammals are mainly affected. Lack of pesticides and herbicides improves biodiversity fitness and population density. ^[35] Many weed species attract beneficial insects that improve soil qualities. ^[36] Soil-bound organisms often benefit because of increased bacteria populations due to natural fertilizer such as manure, while experiencing reduced intake of herbicides and pesticides. ^[37]

6.8. Environmental protection: Organic farming maintains the fertility of the soil. Crops also remain fresh and healthy because chemical pesticides are not used.

Organic farming strictly restricts the use synthetic fertilizers, pesticides, plant growth regulators as hormones, antibiotic use in livestock^[38] and human sewage sludge ^[39] for reasons including health, and safety. Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony. ^[40] This method is now widely used to grow medicinal plants. The annual global market for medicinal herbs is estimated at around \$ 65 billion. Several methods have been adopted to carry the process of organic farming. These Medicinal plants are not only a major resource base for the traditional medicine & herbal industry but also provide livelihood and health security to a large segment of Indian population. The domestic trade of the AYUSH industry is of

the order of Rs. 80 to 90 billion (1US\$ = Rs.50). As per study commissioned by the Associated Chamber of Commerce and Industry (ASSOCHAM), the Indian herbal industry is projected to double to Rs.15, 000 crore by 2015, from the current 7,500 core business. The supreme goal of organic production is to develop enterprises that are sustainable and amicable with the environment.

7. Recommendations

Authors conclude that there are several ways to promote Organic Farming in Ayurvedic Medicines cultivation:

1. Researches should be done to improve knowledge and relevant methods that will enhance productivity in Ayurvedic Pharmaceutical sector.
2. Common standards in organic agriculture in Ayurvedic Pharmaceuticals should be developed.
3. Local markets and exports should be strengthened.
4. Organic products should be processed at home and marketed by local Ayurvedic Pharmacies.
5. Local NGOs and self-help groups must be formed by government to promote and provide safe herbal medicines cultivation which can give quality to patients.
6. Soil fertility should be enhanced by Ayurvedic and indigenous traditional methods as using cow urine preparations with ferments of tumeric, rotten fruits, nettels, vegetables, cow dung, and essential micro-organisms.
7. In situ and ex situ conservation of medicinal plants, including rare species should be promoted.
8. Technical assistance in establishing herbal gardens should be provided.
9. Training programs in cultivation of medicinal plants should be conducted.
10. Awareness on the importance of medicinal plants within the society should be created.

8. Conclusion

India has a vast and rich resource of herbal raw materials and it can create a front position for itself in the global herbal market if the domestic industry produced quality products of international standards. Adopting Organic farming in medicinal plants cultivation is the need of the day. Whereas on one hand pollution due to advancement in technology is increasing at a great pace, on the other population is also increasing. It is best if the amount of crops grown is increased and the time taken to grow them is reduced but this should not be done at the price of posing health hazards to the public. The present study focused on the methods and benefits of organic farming prevalent nowadays, although more better and profitable techniques can be introduced by carrying out further research in this regard. The medicinal plants are the basic source of raw-material for preparation of Ayurvedic medicines. By implementing good agro-technique and organic farming practices in medicinal plants cultivation, the safety and quality of plant materials and finished products could be assured.

Authors believe that integration of internationally accepted agro-techniques with traditional Indian system of harvesting would help in following Good Agriculture and safe Practices as well as getting certificates.

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