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Effect of Organic Farming Practices on Yield and Fruit Quality of Aonla (*Emblica officinalis* Gaertn.)

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1. Introduction:

An important native fruit crop in India, aonla (Indian gooseberry) is prized for its high nutritional and therapeutic qualities, particularly its remarkably high vitamin-C content. Conventional farming methods mainly rely on chemical pesticides and fertilizer's, which can harm soil health, lower fruit quality, and create environmental risks. In order to maintain productivity, increase soil fertility, and improve fruit quality, organic farming places a strong emphasis on using natural inputs and environmentally friendly methods. The growing demand for safe, residue-free fruits has drawn attention to organic aonla cultivation in recent years.

2. Organic Farming Practices in Aonla Cultivation

2.1 By use of Organic Manures

Organic manures are of immense importance in improving the physical, chemical, and biological properties of the soil.

- Farmyard manure (FYM): Enhances soil structure and its capacity to retain water and nutrient supplies.
- **Vermicompost:** Vermicompost most likely helped to boost seed development and germination. It keeps the soil in a healthy homeostatic condition. Additionally, it detoxifies the body by eliminating high levels of heavy metals, such as lead and copper. Vermicompost may encourage seedlings to grow quickly and vigorously. It has been shown to efficiently promote the development of roots, stem elongation, and biomass production.
- **Compost and green manure:** Add organic carbon to the soil.
- **Effects:** Continuous application leads to uninterrupted nutrients release and improvement in tree vigor and yields.

2.2 By use of Biofertilizers

The fertilization method, soil quality, and dietary sources all have an impact on the nutritional content of aonla fruits. Phosphorus

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is often lacking in tropical soils, and when phosphatic fertilizers are applied, nearly 75% of the phosphorus is transformed into a form that plants cannot utilize. By creating organic acids, a variety of bacteria and fungi, including *Azotobacter*, *Penicillium*, and *Bacillus*, solubilize these bound phosphates and transform them into a form that plants can utilize. Biofertilizers are carrier-based products containing beneficial microorganisms, such as Trichoderma, PSB, and mycorrhizae, which enhance nutrient uptake, improve soil microbial activity, and contribute to better fruit yield and quality. Some beneficial biofertilizers are given below.

- Azotobacter / Azospirillum: The application of *Azotobacter* and *Azospirillum*, non-symbiotic, free-living, aerobic organisms, led to a sustained increase in the production of many non-leguminous crops. Many scientists also believed that the production of physiologically active compounds, including cytokinin, auxin, and vitamin B-complex, was linked to *Azotobacter* beneficial effects on fruit quality. *Azotobacter* is one of several free-living, associative microbes that can fix nitrogen from the atmosphere**.**
- Phosphate solubilizing bacteria (PSB): Enhance phosphorus availability
- Vesicular Arbuscular Mycorrhiza (VAM): Enhances the absorption of phosphorus, zinc
- Effect: Biofertilizers can improve root growth, flowering, fruit formation, and productivity of aonla fruit.

2.3 By use of Organic Mulching

Organic materials such as straw, dry leaves, crop residue, and grass are commonly adopted for use in the tree basin.

- Conserves Soil Moisture
- Regulates Soil Temperature
- Suppresses weed growth
- Improves Soil Organic Matter on Decomposition
- Effect: Mulching protects plants from the loss of moisture and hence the loss of fruits.

2.4 By use of Bio-enhancer

Bio-enhancers like Panchagavya, Amritpani and Jivamrit are prepared through the process of fermenting different cow products over a specific period of time. They enhance the quality of fruits and improve the yield attributes of crops. They are also used as an effective tool for pest and disease management, acting as a potent source of all macro- and micronutrients, PGPR's activities, immunity enhancers, and drought resistance. Panchagavya is one of the bio-enhancers prepared from five different natural products: cow dung, cow urine, milk, curd, and ghee.

These natural products are typically obtained from indigenous cows in the Desi region. Panchagavya contains various important microbes, including aerobic heterotrophic bacteria, lactic acid bacteria, yeast, fungi, and anaerobic bacteria, which boost growth and enhance yield. Amritpani is an important bio-enhancer that farmers can easily prepare. The available microorganisms in Amritpani are Actinomycetes, Pseudomonas, phosphorus-solubilizing bacteria, *Azotobacter*, and *Azospirillum.* Jivamrit is also prepared in the same manner as Amritpani, except for the addition of some other ingredients, such as jaggery, pulse flour, and banyan tree soil. The microorganism in Jivamrit is also, to some extent, similar to that in Amritpani.

3. Effect of Organic Farming on the Yield of Aonla

- Organic farming practices have a significant influence on yield parameters in aonla:
- Increased number of fruits per tree
- Average weight of fruits increases
- Increased fruit retention
- Reduced fruit drop

The application of these ORS and BF will ensure the crops receive adequate nutrition as well as the necessary requirements of nutrients, resulting in sustained flowering as well as fruit formation. Organic farming also results in yield levels comparable to, if not more productive than, the conventional methods.

4. Organic Farming vis-a-vis Fruit Quality of Aonla

4.1 Physical Quality Attributes

- Increased weight and size in fruits
- Uniform fruit shape and attractive appearance
- Improved firmness and shelf life

4.2 Chemical Quality Attributes

Organic practices positively influence biochemical parameters:

- Total Soluble Solids (TSS): Higher due to the increased synthesis of carbohydrates
- Ascorbic acid: -significantly higher in organically grown aonla (Vitamin C)
- Total sugars: Increased
- Acidity: Well-balanced; gives a better taste
- Phenolic content: Increased, contributing to antioxidant properties

4.3 Nutritional and Medicinal Quality

Organically produced fruits of aonla have:

- Higher antioxidant activity
- Improved mineral content
- Absence of pesticide residues

Its organic nature makes it more fit for pharmaceutical and nutraceutical industries.

5. Effect on Soil Health and Sustainability

Which of the following are benefits of improvement in long-term productivity of soils

- Increasing soil organic carbon
- Improving microbial biomass and enzymatic activity
- Improving the structure of the soil
- Reducing nutrient losses and environment pollution

It is observed that a healthy soil condition can directly enable a sustained yield along with good fruit quality in aonla orchards.

6. Economic and Environmental Benefits

- Reduced cost of chemical inputs in the long run
- Premium price of organically produced fruits
- Eco-friendly and Sustainable Production System
- Improved biodiversity in the orchard system

7. Conclusion

Organic practices can significantly influence the yield and quality of fruits in aonla cultivation. Organic practices are beneficial in improving the crop yield and quality with the application of organic manures, biofertilizers, mulching, and biological pest control. Organic cultivation of aonla can prove beneficial in improving the fruit quality, yield, nutrition, and value, without any shedding or waste fruits, with the application of sustainable horticulture practice in the coming future.