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Optimizing Okra Yield: A Guide to Effective Cultivation for Enhanced Income and Food Security

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Abstract

Abelmoschus esculentus, commonly known as Lady's finger or Okra, is considered as the most significant vegetable crop that can increase the income of small-scale farmers in the tropical and subtropical regions. Because of its widespread acceptance, ease of cultivation and high nutritional value, it is advantageous for both farmers and sustainable farming methods. This article explores the ways to optimise the production of okra, including integrated pest and disease management, better cultivars, appropriate growing conditions and advanced sowing techniques. In seeking to enhance productivity of okra cultivation, strengthen crop resilience and further the overarching goal of food security and economic viability of rural farming communities, farmers and researchers are offered timely and evidence-based insights. Sustainability practices including efficient nutrient management and irrigation highlight okra's role in both the economic development and environmental sustainability.

Keywords: Disease management, Okra cultivation, Pest control, Yield

Introduction

Lady's finger or Okra (*Abelmoschus esculentus*), is a crucial crop that is grown extensively throughout the tropical and sub-tropical regions of the world. Among these, India stands as the world's largest producer of okra for the year 2023-24 and Gujarat stands as the top producer, contributing approx. 1.132 million tonnes. Because of its shorter growth cycle, capacity to adapt to distinct climates and economic feasibility for smallholder farmers, the crop is highly appreciated in Indian agriculture. India's agricultural economy is supported by a diverse range of crops and okra has been emerged as a most valued product. Following Gujarat, farmers in states like Madhya Pradesh, West Bengal, Bihar, Maharashtra, Andhra Pradesh, Karnataka and Uttar Pradesh, where it is grown all year round, are especially drawn to okra because of its exceptional yields and resilience (Davis, 2022).

Crops like okra (Figure 1) are very crucial for preserving the food security and increasing farmer earnings in India, where more than half of the population works in agriculture. Because of its high demand in both the domestic and the foreign markets, growing okra offers the farmers an opportunity to increase their revenues. It is also a significant component of the Indian cuisine due to its high nutritional value and possible health benefits, which help to prevent malnutrition and chronic diseases. The importance of increasing okra yield through better cultivars, irrigation techniques and fertiliser management strategies is growing nowadays as more study is done on sustainable agriculture practices (Singh and Pandey, 2024). This article elaborates in detail the economic, nutritional and agricultural significance of okra cultivation in India, as well as the key strategies for optimising yield and ensuring sustainable farming practices.

Nutritional Value and Health Benefits of Okra

Okra is commonly found in Indian kitchens, since it is a nutrient-dense vegetable with many health benefits. It has a high nutritional value due to its abundance of vital vitamins and minerals. Okra is particularly rich in:

- *Magnesium*: Mg helps in controlling blood sugar levels and is essential for maintaining normal muscle and nerve function.
- *Folate*: Folate is essential for cell division and DNA

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Figure 1: Okra (*Abelmoschus esculentus*)

synthesis; it is especially important during pregnancy to prevent birth abnormalities.

• *Fiber*: Okra is an incredible source of dietary fibre, aids in blood sugar regulation as well as in weight management and promotes digestion.

• *Antioxidants*: Okra contains strong antioxidants called flavonoids and polyphenols that protect our body from oxidative stress and reduce the chance of chronical diseases.

• *Vitamins A, C and K*: These vitamins are necessary for enhancing blood coagulation, bolstering the immune system and promoting eye health.

The introduction of okra in the regular diet is quite beneficial for individuals with diabetes, heart disease and other chronic conditions, as because, it helps us in managing blood sugar levels, supporting cardiovascular health and providing necessary nutrients for overall well-being (Adelabu and Franke, 2023).

Economic Importance of Okra Cultivation in India

For Indian farmers, especially small-scale growers who generally depend on this commodity for their living, okra production is commercially significant. The crop is a dependable source of revenue due to its high market demand and adaptability to a range of soil types and climates. Okra is a profitable choice for farmers because it is frequently sold at retail prices of up to Rs. 60.00 kg^{-1} (Lokesh *et al.*, 2024).

Because okra grows quickly and may be harvested several times in a single year, its profitability is significantly enhanced. Farmers may cultivate okra year-round in areas with irrigation, guaranteeing a steady income. States like Madhya Pradesh, West Bengal, Bihar, Maharashtra, Andhra Pradesh and Karnataka have lead in okra production due to their favourable growing conditions and market accessibilities. The export potential of this crop has also contributes to its economic value, as India remains a major exporter of okra to several countries like the United Arab Emirates, Saudi Arabia and the United Kingdom.

Moreover, Okra farming works well with sustainable farming methods like organic farming and intercropping, which enable farmers diversify their revenue sources while enhancing soil health and lowering their reliance on chemical inputs. This supports sustainability of the Indian agriculture on both an economic level and environmental level.

Ideal Growing Conditions for Okra Cultivation

To increase the production of okra and ensure high-quality produce, okra cultivation requires specific growing conditions. Okra is a perfectly fit for India's diverse agroclimatic zones because it thrives in tropical and subtropical temperatures.

Climate Requirements

• *Temperature*: Okra seeds require a minimum temperature of 20 °C to sprout, with 29 °C being the optimal germination temperature. In most of the regions of India, the crop can be grown in the spring and summer, but it thrives during the rainy season.

• *Growing Seasons*: Farmers in India can benefit from the various growing circumstances throughout the year by planting okra in both the spring (February to March) and the rainy season (June to July).

Soil Requirements

• *Soil Type*: Although okra can be grown in a variety of soil types, it thrives on light soils with adequate drainage, like sandy loam.

• *Soil pH*: Okra grows better in soil with a pH ranging between 6.0 and 6.8, which promotes healthy root development and maximum nutrient availability.

Improved Varieties for Indian Conditions

The choice of okra variety is crucial for maximizing the yield and ensuring the disease resistance. Research into breeding new varieties has focused on improving yield potential, disease resistance and pest tolerance (Singh and Pandey, 2024). Some okra varieties recommended for Indian conditions are provided in table 1.

Planting Techniques to Increase Yield

During the cultivation of okra, it is crucial to adhere to recommended methods for sowing, which include choosing the right sowing time, seed rate and spacing, in order to maximise the production. Farmers can increase their okra yield by implementing the following suggestions.

Sowing Time

• For spring sowing, seeds are typically planted between February and March, while rainy season sowing occurs in June and July.

Seed Rate

• February sowing: 15-18 kg of seeds $acre^{-1}$.

• March sowing: 8-10 kg of seeds $acre^{-1}$.

• June-July sowing: 4-6 kg of seeds $acre^{-1}$.

Spacing

Okra plants should be spaced 45 cm × 15 cm apart to ensure proper air circulation and sunlight exposure, which are critical for plant health and productivity (Patel *et al.*, 2024).

Pest and Disease Management in Okra Cultivation

Okra production is seriously threatened by pests and diseases, which can result in lower yields if not well

Table 1: Varieties of okra recommended for Indian conditions

Variety	Characteristics	Yield (q ha^{-1})
Kashi Vardaan	Fruits are medium, dark-green, easily cooked, good for both table and export purposes. Variety is resistant to both YVMV and OLCV	140-150 q ha^{-1}
Kashi Lalima	Redish purple fruits, rich in anthocynin and phenolics. Variety is resistant to both YVMV and OLCV.	140-150 q ha^{-1}
Kashi Ageti	Early maturing variety. Resistance to shattering. Tolerant to leaf minor & pod borer.	95- 105 q ha^{-1}
Kashi Shristi	Dark green fruits, medium fruit length. Tolerant to YVMV	180-190 q ha^{-1}
Shitla Jyoti	Fruits are green, 12-14 cm long at marketable stage. Variety is resistant to both YVMV and OLCV.	180-200 q ha^{-1}
Arka Anamika	Fruits lush green, tender and long, free from spines and having delicate aroma. Variety is resistant to both YVMV	180-200 q ha^{-1}
Punjab Suhawani	Medium-long, dark green, tender, five-ridged fruits. Tolerant to yellow vein mosaic.	120-130 q ha^{-1}
Punjab-8	Thin, long, dark green, five-ridged fruits. Resistant to yellow vein mosaic virus, tolerant to jassid and borer.	130-140 q ha^{-1}
Punjab-7	Medium-long, green, tender, slightly furrowed, blunt tip fruits. Resistant to yellow vein mosaic virus.	100-110 q ha^{-1}
Punjab Padmini	Dark-green, thin, long, five-ridged fruits, remain tender longer. Field tolerance to yellow vein mosaic virus.	100-110 q ha^{-1}

controlled. To reduce crop loss and guarantee sustainable production, Indian farmers must adopt integrated pest management (IPM) techniques.

Common Pests

1. Jassid: It is a common pest that causes yellowing and curling of leaf margins. Effective control involves spraying insecticides like Confidor or Malathion.

2. Spotted Bollworms: These pests attack the shoots and fruits, particularly during May to September and can be controlled using Proclaim or Sumicidin.

3. Red Spider Mites: These mites cause yellow spots and fine webbing on the leaves, leading to defoliation. Acaricides like abamectin or natural predators, such as *Phytoseiulus persimilis* are used for control (Adelabu and Franke, 2023).

Common Diseases

1. Yellow Vein Mosaic Virus (YVMV): A significant disease in okra, transmitted by whiteflies, leading to stunted growth and reduced fruiting. In order to control whitefly numbers, farmers are encouraged to plant resistant cultivars, such as Punjab Padmini.

2. Damping-Off: Okra seedlings are impacted by this disease, which results in mortality both pre- and post-emergence. The prevalence of this disease can be decreased by using disease-free seedlings and appropriate irrigation techniques.

3. Cercospora Leaf Spot: This disease results in tiny, brown patches on leaves, which causes them to drop early. This disease can be controlled by removing afflicted plants and applying fungicides on time.

Irrigation and Water Management

In order to maximise the okra yield, effective water management is essential. Throughout its growth, okra requires constant hydration, especially during the flowering and fruiting phases. For okra cultivation, drip irrigation is generally recommended as it ensures the effective water utilisation and reduces the weed growth. According to Lokesh *et al.* (2024), optimal irrigation combined with precise nitrogen application can significantly enhance okra yield. According to their research, nitrogen application @ 167.04-176.13 kg N ha^{-1} combined with irrigation levels of 418.39-441.23 mm produced a peak yield of 28,295 kg ha^{-1} and enhanced water-use efficiency.

Fertilization and Nutrient Management

Balanced fertilization is essential for the growth and development of okra. Fertilisers, both inorganic and organic, are important for providing the crop with vital nutrients.

• *Pre-Planting Fertilization*: Soil fertility can be increased by applying organic manure prior to planting. Furthermore, in accordance with the recommendations of soil tests, a base dose of nitrogen, phosphorus and potassium (NPK) should be applied.

• *Post-Planting Fertilization*: To encourage healthy vegetative growth, nitrogenous fertilisers should be applied on a regular basis in split dosages during the growing season. Additionally, depending on the nutrient levels of the soil, phosphorus and potassium should be added as needed.

However, Patel *et al.* (2024) claimed that 45 cm × 30 cm spacing and nutrient management with a 25% recommended dose of fertiliser (RDF) + 50% recommended dose of nitrogen (RDN) through vermicompost can produce the best production in okra, increasing both yield and financial returns.

Sustainable Practices: Intercropping and Pollination

Sustainable agricultural practices are increasingly being adopted by okra farmers in India. Intercropping, in which okra is cultivated with other vegetables or legumes, is one such technique. This increases soil fertility, decreases pest infestations and maximises land use efficiency. In addition, insect pollination is critical for increasing seed weight and fruit set in okra. According to Adelabu and Franke (2023), optimizing pollination and fertilization practices can significantly enhance okra yield, even in regions with reduced pollinator activity.

Breeding for Improved Varieties

Contemporary breeding efforts in okra focus on developing varieties with higher yield potential, resistance to diseases like yellow vein mosaic virus and tolerance to pests. Singh and Pandey (2024) claimed that by incorporating genomic techniques into breeding programs, okra's resilience to biotic and abiotic challenges is being improved, leading to increased yield and food security.

Conclusion

Okra is very important in Indian agriculture. Its production provides significant nutritional, economic and environmental benefits. To improve on this, farmers need to adopt best management practices, such as planting better varieties, ensuring effective water and fertilizer use as well as employing progressive agriculture practices. The future of okra production appears bright as research continues to develop in areas, such as breeding, irrigation and pest management thereby expanding the role of okra to ensure food security and farmers' income in India.

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