

PINCHING EFFECT ON PLANT GROWTH, YIELD, AND QUALITY OF DIFFERENT VARIETIES OF OKRA

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Abstract

Abelmoschus esculentus L. (Moench), sometimes known as okra, is a very significant crop that is grown all over the world in tropical, subtropical, and warm temperate climates. (2022; Chauhan et al. Their leaves are long-petiolated, 10–20 cm long, and have five to seven lobes. Flowers are axillary and range in size from 4 to 8 cm in diameter. They produce elongated fruits with a diameter of 1.5 to 3 cm and a length of 10 to 25 cm. (Ali 2022). Okra growth and yield are significantly influenced by pinching technique. (Sahu and Biswal 2020). Early herbage cutting encourages uniform growth, flowering, and seed germination. The "Effect of pinching on plant growth, yield, and quality of different varieties of okra" is the topic of this study. The practice of pinching, which involves the removal of terminal shoot tips, has been explored as a cultural technique to enhance plant growth, yield, and produce quality in different varieties of okra. This review article aims to provide a comprehensive overview of the effects of pinching on plant growth parameters, yield components, and the nutritional and sensory quality of various okra varieties. The review encompasses an in-depth analysis of the underlying physiological and morphological changes induced by pinching across different okra varieties. A synthesis of recent studies highlights the potential benefits and limitations of pinching in okra cultivation, considering the variability in results across different varieties and growing conditions. This review article systematically examines the effects of pinching on diverse varieties of okra with a focus on their growth patterns, yield attributes, and final harvest quality.

Keywords: Pinching Treatments, Growth, Yield, Okra

INTRODUCTION

Description

Biological Name: *Abelmoschus esculentus*

Scientific Classification

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

(Unranked): Rosids

Order: Malvales

(Kumar et al. 2010)

Okra (*Abelmoschus esculentus* L.):

The family Malvaceae includes okra. In the Indo-Pak region, it enjoys enormous popularity. (Kumar et al. 2010)

The plant is grown around the world in tropical, subtropical, and warm temperate climates. (Singh et al. 2014). This veggie is wholesome. Okra is also referred to as lady's fingers in many English-speaking nations, as well as bhindi, kacang, bendi, and bhindi in South East Asia. It is a significant part of the human diet and a very good source of vitamins, minerals, proteins, enzymes, and calcium and potassium. (Singh et al. 2014)

In 100 g of edible okra, the green, soft fruit has 66 mg of calcium and 0.2 mg of iodine. Okra seeds contain both vegetable oil and protein. Roasted seeds can occasionally be used in place of coffee. Fruit stems and husks are used to produce paper because they contain coarse fibre. (Chauhan et al. 2022)

Although it is a crop with multiple uses, its green, fragile fruits are typically eaten as vegetables in a number of ways. Vitamins, calcium, potassium, and other minerals are abundant in these fruits. The grown okra seed has a high nutritional value and is a rich source of protein and oil. Unsaturated fatty acids like linoleic acid, which are crucial for human nutrition, are abundant in okra seed oil. Crude fibre from its ripened fruit and stems is utilized in the paper industry. (Mishra Babasaheb Bhimrao et al. 2017)

Structure of Okra Plant

Okra is a delicate annual plant, yet it can live for two years in areas without freezing temperatures. In regions where it can grow, the plant matures quickly; it takes just two months from sowing to the first pods being harvested. Given that both are members of the Malvaceae family, its shape and branches mimic that of the cotton plant, Okra plants grow anywhere from three to six feet tall, are branching, strong, and woody. The cylindrical stems eventually turn woody as they age. A number of lateral branches start to grow from the main axis' base and stand fairly upright. Stem elongation is prevented when the tip of the bud is eliminated by the formation of terminal shoots from the top of the stem. The leaves are oval in shape and have several lobes; they are covered in stiff hairs that are quite uncomfortable for pickers' hands. Each leaf axil on the centre of the stem and branches has a single bloom. When the plants are developing quickly, they develop on each stem at a pace of one per day, working their way up from the base to the top. They are big, showy, flawless, and generally self-fertile, though some crossing happens when insects visit. Along their whole length, the stamens are antherous and form a column around the pistil. The fruit is a hairy, elongated pod with ribs. At maturity, the pods grow to be between four and twelve inches long and hard and woody. When they are dried, they split along the sutures, dispersing the seed. In different types, the colour of the young pods ranges from dark green to almost white, and the amount of ribbing also differs. Pea-green colour is preferred for freezing, the brining process, and canning. Okra loses its green colour when kept in hampers without chilling for more than a day, turns black along the edges and around the bottom and tips of the pods owing to bruises, and becomes brown when preserved warm, with insufficient salt, or frozen without adequate blanching.

Okra Cultivation

Climate:

It needs warm, moist conditions for healthy growth. It can be damaged by very low temperatures. It can be successfully cultivated at temperatures between 25 and 30 degrees Celsius. In comparison to the hot summer, the okra plants develop faster during the wet season. The ideal soil temperature for seed germination is between 25 and 35 degrees Celsius, with 35 degrees C showing the fastest germination. Below 17°C, seeds are unable to germinate. Most varieties' flower buds may desiccate and crop, reducing yields, with temperatures above 42°C. (Chittora, Singh, and Singh 2016)

Soil:

Sandy to clay soils can be used to grow okra as long as they are well manured, have enough organic matter, and have good drainage. Because most cultivars have the highest possible rate of nitrogen uptake through roots, the ideal soil pH range for greatest yield is between 6.0 and 6.8. (Chittora, Singh, and Singh 2016)

Plant Growth Regulators:

Okra is impacted by plant growth regulators in a variety of ways, including improved germination, early blooming, growth promotion, and improved fruit yield and quality. While 400 ppm CCC spraying promoted early flowering and higher fruit chlorophyll content, 200 ppm NAA spraying the plants at between thirty and forty-five days after sowing increased fruit output. (Chittora, Singh, and Singh 2016)

Spacing:

Summer and spring are the slowest seasons for vegetative growth, thus a spacing of 45 into 25 cm is advised. For sowing in May and July, the ideal spacing is 23–30 cm between plants and 45–60 cm between rows. (Chittora, Singh, and Singh 2016)

Irrigation:

When the earth is damp, seed should be sown. When the first real leaf emerges in the spring or summer and grows during the kharif (rainy) season, irrigation is necessary for the first time. Water consumption becomes crucial once fruit has set. Plant wilting or flooding should be prevented. Drip increases production significantly while reducing irrigation water use by 70–80%. (Chittora, Singh, and Singh 2016)

Importance of Plant Management Technique in Okra Cultivation

In the current context, processing plants frequently use plant management systems to increase profitability. Techniques for managing plants may offer advantages as well as disadvantages. Economic, environmental, and technical constraints must be taken into account while choosing management strategies. (Mp– and Madsen 2000) Maintenance's goals include maximizing equipment performance, ensuring that it operates regularly and effectively, and averting malfunctions or failure. Between 40% and 50% of operational budgets may go towards its expense. (Mp– and Madsen 2000)

Factors Affecting the Okra Plant Growth**Sunlight:**

Sunlight is crucial for plant growth because plants use pigment in their leaves for absorption of sunlight. Conversely, in some areas, shaded plants may experience a reduction in flowering and growth. (Budania, Khichar, and Dhaiya 2018; Brandenberger and Damicone 2018; Dilani, Gunawardhana, and Silva 2012; Wright 2022)

Irrigation:

Okra will yield the most if additional irrigation is employed to maintain soil moisture. Okra can withstand both drought and extreme heat. Seed germination and plant establishment require irrigation. When there is inadequate water availability to meet more demanding requirements, drip irrigation is applied. (Brandenberger and Damicone 2018)

Spacing Effect of Okra Yield and Growth:

With increased plant spacing, the production of okra drops. (Maurya 2013)

They came to the conclusion that plant's height and output increased with closer spacing. The fruits' largest lengths, diameters, fresh weights, and dried weights per plant were noted.

Rationale:

To educate farmers on correct pinching techniques and varietal selection in order to get the most out of their limited resources.

Pinching as a Horticultural Practice and Mechanism

In the pinching technique, the stem's terminal portion is shortened to improve the lateral branches. This method is frequently employed in cucurbit cultivars as well as some okra cultivars in other nations. (Ali 2022) With their fingers, a gardener pinches the main branch of a stem, causing two branches to emerge from the node. The reason for this is the redirection of carbohydrates to the auxiliary buds that are situated below the compressed area. (Thakare et al. 2020) Pinching entails removing a sprout and a couple of its leaves. A young plant's growing shoot is clipped using the fingers, leaving around 1-2 cm behind. (Thakare et al. 2020)

Effect of Pinching on Plant Growth

Pinching has a profound impact on the overall growth of okra plants. The removal of the apical meristem stimulates the development of lateral branches, leading to a more compact and branching growth pattern. Consequently, the increase in branching enhances the total leaf area, leading to improved photosynthetic efficiency and higher biomass production

Pinching Effect on Okra and Benefits**Effect:**

The hormone auxin, which plants generate in their apical regions, is removed by pinching and directed to buds instead, which causes the growth of lateral branches and a reduction in plant height. (Chauhan et al. 2022)

In addition to delaying blossoming, pinching reduces floral size. The procedure of pinching is expensive and time-consuming. Pinching also shortens stem length. (Cheema 2018)

Benefit:

Pinching in okra enhances branching, leading to increased fruit production and improved air circulation, reducing disease risk. This practice also maintains a compact shape for easier harvesting, fosters better sunlight penetration, and encourages stronger stem growth, resulting in more resilient and productive plants.

In addition to producing a bushy growth, it promotes branching to develop buds of flowers on the branch. (Hasan 2023)

Quality Attributes

The application of pinching can influence various quality attributes of okra pods. Increased branching may lead to smaller-sized pods, potentially altering the marketable yield. However, pinching has also been associated with improved pod uniformity and tenderness, making it more desirable for consumers. Furthermore, pinching can potentially affect the nutritional composition of okra pods, emphasizing the need for additional research in this area.

Genotypic Variability in Response to Pinching

The response of different okra varieties to pinching can vary significantly. Some varieties may exhibit vigorous branching and enhanced productivity, while others may not respond as favorably. Genetic factors play a crucial role in determining the plant's response to pinching, necessitating a tailored approach to cultivation practices based on varietal differences.

Pinching and Pest Management

The alterations in plant structure resulting from pinching can indirectly influence pest and disease management in okra cultivation. A more compact and bushier plant architecture may create a microenvironment conducive to the development of certain pests and diseases. However, proper spacing, pruning, and integrated pest management practices can help mitigate these potential risks.

Sustainable Agriculture and Pinching

Sustainable agriculture emphasizes practices that maximize resource-use efficiency and minimize environmental impacts. Pinching aligns with these principles by reducing the reliance on chemical growth regulators and promoting lateral branching, leading to increased photosynthetic capacity and potentially higher yields without additional inputs.

Pinching and Yield

The influence of pinching on okra yield has been a topic of debate in the scientific community. Some studies have reported increased yields following pinching due to an increase in the number of flower buds and fruiting sites resulting from enhanced branching. However, other studies have documented reduced yields, attributed to delayed flowering and fruiting caused by the recovery period after pinching.

The variation in outcomes may be attributed to factors such as okra variety, environmental conditions, and the timing of pinching.

Effect of Pinching on Various Parameters

Plant Height:

As the number of pinching treatments increases, plant height declines. (Krishnaveni et al. 2014) The inhibition of apical dominance is the cause of the decrease in plant height.

Number of Branches:

Up until a single pinching or cutting, the number of branches rises; it thereafter falls with each succeeding pinching. (Krishnaveni et al. 2014)

Increased branching brought on by the suppression of vertical development results in the translocation of photosynthetic materials from the leaf axil, which promotes lateral branches. (Ali 2022; Sahu and Biswal 2020)

Number of Flowers per Plant:

More pinching results in more flower production. (Ehsanullah et al. 2022)

Number of Leaves per Plant:

In comparison to unpinned plants, pinched plants have more leaves. (Ali 2022)

Number of Pods per Plant:

More pods are produced per plant in pinched plants. (Ali 2022)

Pod Weight per Plant:

Varying pinching techniques result in varying weights of pods per plant. Unlike T2 and T3, T1 provides the highest pod weight. (Kattel, Gajurel, and Thapa 2023)

Pod Length:

Treatments that include pinching affect pod length as well. The T3 pod is the shortest, and the T4 pod is the longest in length. (Sahu and Biswal 2020)

Fruit Weight:

When okra is subjected to various pinching techniques, the weight of the okra fruits increases when compared to plants that aren't pinched. (Eve et al. 2016)

Germination Percentage:

To calculate the germination percentage, the number of seeds that successfully germinated in each treatment was counted. A predetermined number of seeds were distributed to each plot, and after a predetermined period of time, the number of seeds that sprouted and developed into seedlings was counted. The germination percentage was obtained by dividing the number of seeds that germinated by the total number of seeds planted, and then multiplying the result by 100. (Kattel, Gajurel, and Thapa 2023)

Average Flowering Days:

The number of days was recorded from the date of seeding till the first flower appeared in each plot. This required monitoring the plants carefully and recording the day the first flower appeared. The average number of days was calculated by counting the number of flowering days on each plot. (Kattel, Gajurel, and Thapa 2023)

Yield of Okra

Okra production is incredibly unpredictable. When to plant, what type to use, how much culture and fertilizer to use, how fertile the soil is, and how much rain or irrigation is used during the growth season are all determining factors. If pods are harvested while still young for table consumption, each stem will yield from between 25 and 40 pods in a season as opposed to 12 to 20 pods per stem if pods are left to stay on the plant for the development of seeds. Yield gradually declines until there is a frost, at which point the entire plant dies.

Perkins, Miller, and Dallyn conducted an investigation using three different okra cultivars—Louisiana Green Velvet, Louisiana Market, and Gold Coast—to learn more about how the technique of harvest affected both the plant's overall yield and its vegetative reproduction. Their findings provide a vivid illustration of the alternating bearing phenomena as it manifested itself in the plots intended for mature harvest. Early in the season, all three kinds' plants bore strongly for a brief period of time, followed by a period of almost no pod production, a brief period of heavy yield, and then another stretch of no output. The findings show that the developed seedpods were the cause of the distinct type of burden on the final harvest plots. Evidently, while the seed is developing, this function uses the majority of the plant's growth potential, as evidenced by the fact that very few, if any, fresh flowers are produced.

Since there was no period for seed development in the area where immature pods were harvested, the plants' growth and flowering were unaffected. Long after the mature harvest area's plants attained their first peak production, their yield persisted. It is obvious how crucial it is to regularly and completely harvest okra for the market for fresh produce. The manner of harvesting had a significant impact on plant height as well. The developing seed pods severely stunted all three kinds. In this regard, there was evidence of some varietal variation because Gold Coast experienced a proportionally smaller loss in height than the other varieties.

The investigation's findings can be summed up as follows:

1. Okra plants picked every four days produced three times the number of pods as plants where the pods were given time to develop.
2. Plant growth was severely hampered due to seed maturation.
3. Plants that were regularly plucked bore constantly, but those whose pods were left to develop showed alternate bearing.
4. It was emphasized the need of okra harvesting on a regular and thorough basis for the fresh market. (Angadi 1961)

Different Varieties of Okra

Different varieties of okra are following:

1. Clemson Spineless
2. Emerald
3. Gold Coast
4. Blondy
5. Burgundy
6. Annie Oakley
7. Cejun Delight
8. Alabama Red
9. Perkins long pod
10. Star of David

Quality of Different Varieties of Okra

Clemson Spineless:

It is a 4-5 foot long, spineless variety with average foliage. They have ridges, are spineless, straight, and taper towards the tip. They are of good quality and are green in colour. This type is currently the most popular and is used as the baseline for comparison.

(Angadi 1961)

Emerald:

It is an attractive dark green cultivar. It is of the velvet type, which is particularly desirable for freezing or canning. Plant is 2.5 to 3 feet tall, solid, and has many branches. Pods are about 8 to 9 inches long and have no spines. These are excellent productive plants, and the pods grow to be 2-3 times longer than those of most types before hardening. (Angadi 1961)

Gold Coast:

These plants can withstand the heat and produce fruit for a long time. They have short, spherical pods that are 3-6 inches long, dark green, and spineless, and they are 3-4 feet tall. They feature long petioles and semi-cut leaves that make harvesting simple.

(Angadi 1961)

Conclusion

The practice of pinching has shown considerable promise in influencing the growth, yield, and quality of different varieties of okra. Its impact on okra plants is multifaceted and influenced by various factors, including genetic variability, environmental conditions, and the timing of application. All the growth and yield parameters of okra responded well to all the treatments of pinching except plant height. It is also concluded that okra doesn't response well to high and moderate pinching but responds positively to light pinching. To optimize its benefits, growers must consider the specific characteristics of their chosen okra variety and tailor the application of pinching to suit local conditions and cultivation goals.

Pinching can lead to desirable outcomes such as enhanced branching, increased flowering, and potentially higher yield, its effects are heavily dependent on factors such as the specific okra variety, environmental conditions, timing of pinching, and overall management practices. Different okra varieties exhibit varied responses to pinching, with some displaying heightened sensitivity to the technique, resulting in improvements in yield and fruit quality, while others may experience negative impacts, such as delayed flowering or stunted growth.

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