Asian Journal of Research in Crop Science

Volume 9, Issue 2, Page 181-191, 2024; Article no.AJRCS.119813
ISSN: 2581-7167

Effects of Pinching on Growth, Yield, and Quality of Watermelon (*Citrullus lanatus*) Varieties in Chitwan, Nepal

Binod Dahal [a*], Dhurba Banjade [b], Aman Shrestha [b], Dipak Khanal [c] and Pratima Regmi [b]

[a] Department of Horticulture, Agriculture and Forestry University, Rampur, Chitwan, Nepal.
[b] Institute of Agriculture and Animal Science, Gauradaha Campus, Tribhuvan University, Nepal.
[c] Department of Soil and Crop Sciences, Texas A&M University, College Station, USA.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajrcs/2024/v9i2279

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/119813

Original Research Article

Received: 18/05/2024
Accepted: 20/07/2024
Published: 21/07/2024

ABSTRACT

An investigation was accomplished at the production farm of Nepal Agrovine Private Limited, Bharatpur-5, Chitwan, from February 2021 to May 2021. Two factorial randomized complete block designs with twelve treatment combinations and three replications were used to set up the experiment. Factor A comprised three watermelon hybrids (Augusta, Sugar Queen, and Super Queen), and factor B comprised four pinching levels treatment (no pinching, fourth node pinching, sixth node pinching, and tenth node pinching). Pinching combinations were placed in each replication. Augusta had the longest main vine and the most nodes, while Sugar Queen had the longest leaves. The number of branches, the number of leaves per vine, and the internodal distance

**Corresponding author: E-mail: dahalbinod.gac@gmail.com;*

Cite as: *Dahal, Binod, Dhurba Banjade, Aman Shrestha, Dipak Khanal, and Pratima Regmi. 2024. "Effects of Pinching on Growth, Yield, and Quality of Watermelon (Citrullus Lanatus) Varieties in Chitwan, Nepal". Asian Journal of Research in Crop Science 9 (2):181-91. https://doi.org/10.9734/ajrcs/2024/v9i2279.*

were not significantly affected by variety. Super Queen had the most female flowers, but Sugar Queen had the highest yield characteristics, such as average fruit weight, yield, and the number of fruits collected per vine. Fruit quality parameters like rind thickness were highest in Augusta, while fruit length, pulp percentage, and total soluble solids were reported to be highest in Sugar Queen. The sixth node pinching level recorded the maximum length of the main vine, number of branches per vine, number of nodes on the main vine, and leaf length, while the fourth node pinching level reported the maximum number of leaves per vine. Days to first, 50% and 100% flowering were lowest in no pinching. In sixth-node pinching, the maximum amount of female flowers, lowest sex ratio, and minimum number of male flowers were recorded. In a similar vein, the yield, average fruit weight, and number of fruits gathered per vine were reported to be the highest in sixth-node pinching. Significantly greater leaf width was reported in Sugar Queen x sixth node pinching, maximum main vine's node count was reported in Augusta x fourth node pinching, greater internodal distance in Augusta x no pinching, Sugar Queen x no pinching, and Super Queen x no pinching. Similarly, the amount and quantity of fruits obtained from each vine were reported to be maximum in Sugar Queen x 10th node pinching. In contrast, the average fruit weight was reported to be maximum in Augusta x sixth node pinching. Thus, it can concluded that the Sugar Queen variety of watermelon can be grown in Chitwan conditions during the late winter to spring season by pinching it at the 10th node for better yield. By implementing the pinching technique at the 10th node, farmers can potentially achieve higher yields, improving overall productivity and profitability.

Keywords: Yield; fruit; watermelon; pinching; sex ratio.

1. INTRODUCTION

The watermelon is a tropical fruit that is xerophytic and a member of the Cucurbitaceae family. It is a warm-season crop in all tropical and subtropical regions of the world. The most extensively grown cucurbit worldwide is watermelon, followed by cucumber, melons, squash, and pumpkin [1]. China shares the largest watermelon production, with 67.6% worldwide, while secondary producers include Iran, Turkey, India, and Brazil [1,2,3,4]. Watermelon is grown in hot and dry climates with mean daily temperatures of 22 to 30 °C, maximum and minimum temperatures for growth of about 35 °C and 18 °C, respectively, and low rainfall of 50–75 mm. Vitamins C, A, B, C-lycopene, minerals, amino acids, and other nutrients are abundant in watermelon. The red pigment lycopene can prevent prostate cancer and cardiovascular disease because it is a highly effective oxygen radical scavenger [5,6,7].

By enhancing the carbon: nitrogen ratio and source-sink connection, pinching promotes secondary and tertiary branches, female flowers, fruit production, and yield [8,9,10,11]. Pruning techniques for watermelon vines improve mechanical harvesting, generate hybrid seeds, make pest and disease control easier, allow for a bigger plant population without reducing output, and result in consistent melons [12]. Pinching undermines the apical dominance of vines by reducing the concentration of Indole Acetic Acid in the tips of narrow plants and lateral branches, which are good sources of female flowers [13].

The effects of pinching treatments on watermelon cultivars' yield, lateral shoot growth, and blossom count have not received much attention [14]. No pinching results in fewer female flowers and fruits and delayed fruit maturity compared to pinching treatments. Various crop management practices may play a vital role in decreasing this yield gap, including pinching and selecting suitable hybrid varieties. The current study examined how pinching affects various watermelon cultivars' quality, yield, and growth.

2. MATERIALS AND METHODS

2.1 Study area

A field experiment was conducted at the farm of Nepal Agrovine Pvt. Ltd., Bharatpur-5, Chitwan, Nepal, from January 2021 to May 2021. The experimental site is located at 27 39'17.7" N latitude and 84 23'37.2" E longitude, with an elevation of 197.1 meters above sea level. In this experimental site, the texture of the soil was sandy loam, and the average soil pH was found to be acidic (5.8) after soil analysis. The experimental site falls under the subtropical humid climatic belts of Nepal. The average temperature during the experimental period

(January to June) was 23.2 °C. During the time of crop growth, 799.8 mm of rain fall.

2.2 Plant Materials and Treatment

With 12 treatment combinations and three replications, the experiment was set up using a two-factorial randomized complete block design (RCBD). In every treatment within a block, there were five observational plants.

Before the vine bears fruit, the watermelon is pinched. In the experiment, there were four different levels of pinching: no pinching and pinching on the fourth, sixth, and tenth nodes. The field was plowed with a disc harrow, followed by a cultivator on February 23, 2021. Farmyard manure of 20 tons per hectare was applied uniformly throughout the field [15]. Following plowing, the experimental field's soil samples were gathered utilizing zigzag techniques, comprising six soil samples; two samples from each replication were sent to the Central Soil Testing Laboratory, Harihar Bhawan, Kathmandu, for soil testing. After that, beds (length 40.0 m, width 90 cm) were raised to 15 cm in height with the help of a tractor-mounted bed maker. The beds were covered with 25-micron silver-black plastic mulch with a width of 1.2 m and a length of 400 m. Holes of 5 cm were made on mulching plastic with the help of an auger at a distance of 1 m within the treatment plots. Transplanting was done to ensure better conditions for the growth and development of seedlings. Seedlings were transplanted on February 26, 2021, at the age of 26 days. Irrigation was supplied manually with rose cans up to 15 days after transplanting.

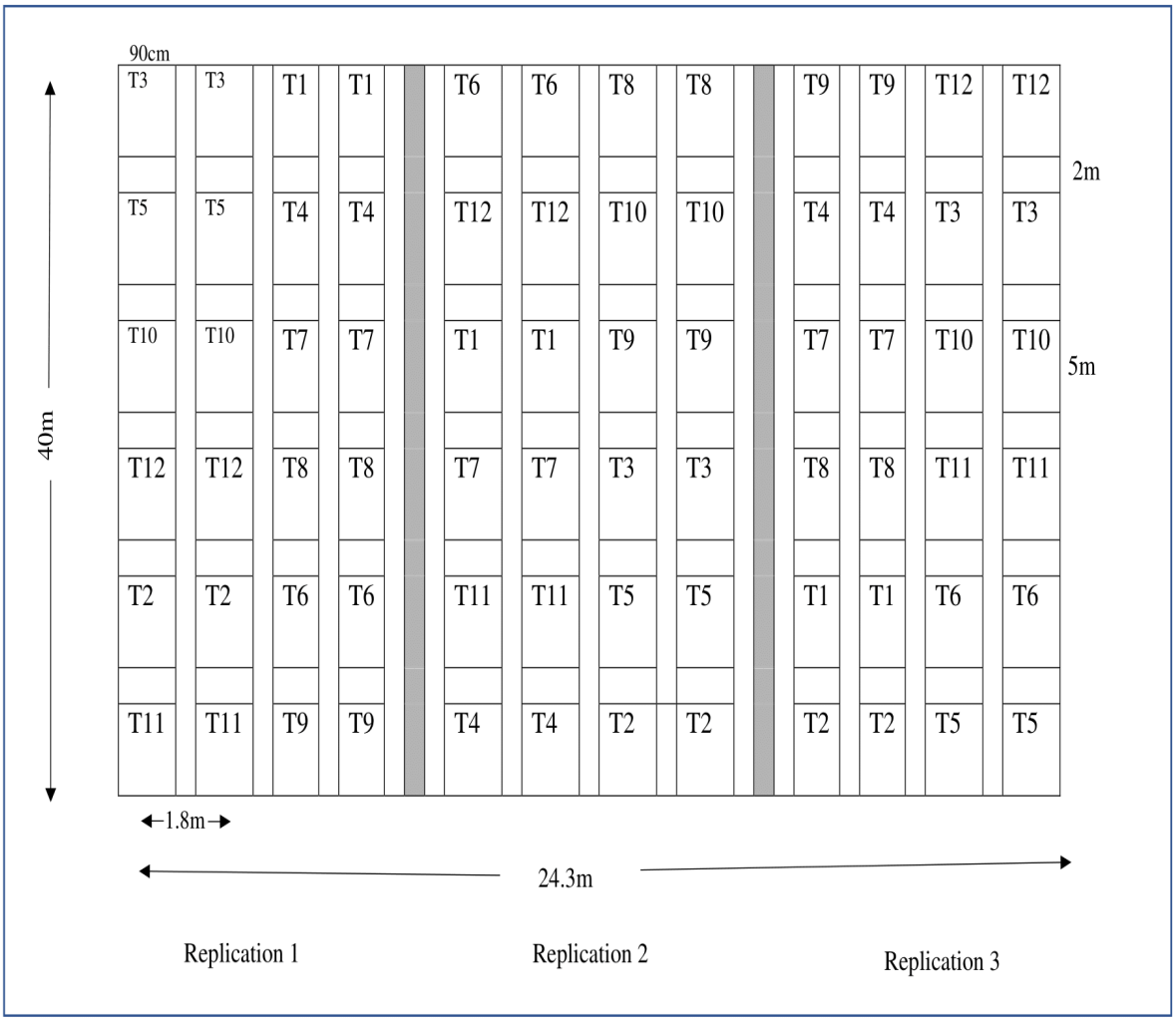

Fig. 1. Layout of the experiment

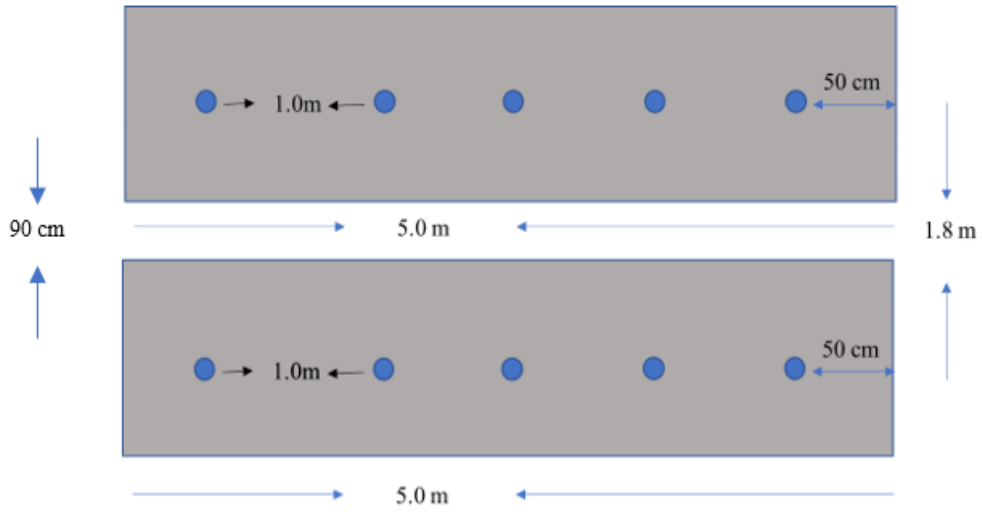

Fig. 2. Layout of an individual plot

Watermelon seeds were sown on January 31, 2021, on plastic trays with 50 holes. Cocopeat was washed three times with tap water, and the media was prepared by mixing one part cocopeat with one part organic fertilizer. Then, one seed per hole was sown. Trays were kept inside the polyhouse. Before transplantation, insecticides Thiamethoxam (Acatara) and fungicides Azoxystrobin and Difenoconazole (Amistar Top) with adjuvant were sprayed on 5-day-old seedlings. Regular field observation was done to monitor the occurrence of pests and diseases and their control. Five marked plants from a plot were harvested multiple times at full maturity because they did not acquire an internal color or increase in sugar content after being cut off from the vine.

The recommended dose of fertilizers used in the experiment was 134.5:134.5:134.5 N: P2O5: K2O kg per hectare [16]. The required amount of organic fertilizer (20 t ha-1) was applied uniformly in all experimental plots. Half a dose of chemical fertilizer was incorporated within the top 15 cm of the soil as a basal dose before placing plastic mulch. The other half of the dosage was administered twice weekly in split doses using multiple 100% water-soluble complex fertilizer sources.

2.3 Plant Growth Parameters

The length of the main vine of each marked plant was measured using thread from the ground level. The thread was measured every 15 days using a meter tape for sample plants. Five sample plants were counted by hand once their leaves were fully mature. Manual counting was done to determine the number of offshoots from the primary vine. The length and width of the largest leaf that could be visually classified were measured using meter tape. Five identified plants were counted manually to determine the number of nodes and internode distance. Days until first flowering, 50% flowering, and 100% flowering were measured from five marked plants following consistent observation at the experiment's flowering beginning. Both male and female flowers were counted manually, and the sex ratio was determined.

2.4 Yield Parameters

The numbers of such fruits were counted manually from 5 marked plants at intervals of 15 days at 30, 45, and 60 day after transplanting (DAT). Fruits were harvested based on different maturity indices since none of the maturity indices correctly judged the maturity of watermelon. The numbers of fruits harvested from the five marked plants were counted, and the average number of such fruits was taken at each harvest. The ratio of the total weight of fruits in kilograms to the total number of fruits from the five designated plants is the average weight of fruit. The formula used for calculating yield is given below:

$$\text{Yield} = \frac{\text{total weights of fruits harvested in kg in a plot x total number of harvested fruits in a plot} * 10000}{1000 \text{ x } 13.5 \text{ (area of a plot)}}$$

The pulp % was then calculated by using the following formula:

$$\text{Pulp (\%)} = \frac{\text{weight of a fruit} - \text{weight of rind}}{\text{weight of a fruit}} \times 100\ \%$$

2.5 Fruit Quality Parameters

After the juice extraction through a muslin cloth, two fruits from marked plants were randomly chosen to determine the Total Soluble Solid (TSS) content in the fruit with the help of a refractometer, and the results were expressed as ◦Brix. The digital PH meter was calibrated, and the electrode was dipped in the juice of the fruits to measure the acidity or alkalinity of the juice. The average vitamin C content of two fruits from five marked plants at different harvests was taken as the value of vitamin C. Two fruits were chosen randomly from five marked plants at each harvest and blended. The titrable acidity was ascertained by dissolving a known sample weight (juice) in distilled water and titrating against 0.1N NaOH while using phenolphthalein as an indicator. Ten milliliters of distilled water and two milliliters of juice were combined, and then three milliliters of phenolphthalein solution were added and titrated against 0.1N NaOH. The average value of titrable acidity of two fruits from five marked plants at different harvests was taken as the value of TA. It was expressed in grams per liter. The following formula calculates it;

$$N_1V_1\,(\text{NaOH}) = N_2V_2\,(\text{Juice})$$

2.6 Statistical Analysis

At a 5% significance level, the effects of variety, pinching, and their interactions on growth, yield, and yield-attributing watermelon characteristics were tested using analysis of variance (ANOVA). Microsoft Excel 2010 was used to compute values, while Duncan's Multiple Range Test (DMRT) and R Studio version 4.2.1 were utilized to study variance.

3. RESULTS AND DISCUSSION

3.1 Effect of Pinching on Growth Parameters

The main vine length of watermelon varied significantly between watermelon hybrids at 45 and 60 days after harvest. Augusta had the longest main vine at both observations, measuring 159.41 and 235.42 cm, respectively. In contrast, Sugar Queen had the shortest at 45 days, measuring 143.42 cm, statistically similar to Super Queen's 143.74 cm. At 60 days, Super Queen had the shortest vine length, measuring 201.41 cm, statistically equal to Sugar Queen's 212.51 cm. Pinching also has a significant impact on the main vine's length. The observations of [9] for bottle gourds, [12] for watermelon, and [17] for cucumbers had similar outcomes.

At 30 DAT, varieties had a substantial impact on the number of branches per vine; at 30, 45, and 60 DAT, pinching had a significant impact as well. Super Queen was the variety with the most branches per vine (5.03), statistically comparable to Augusta (4.94), and Sugar had the fewest branches per vine (4.52). Similar findings have also been obtained [12] in watermelon, [17] in cucumber, [18] in bottle gourd, and [9] in Cucurbita moschata.

While the watermelon cultivars had no significant effect, pinching substantially impacted the number of leaves per vine. The maximum number of leaves per vine in fourth node pinching was found at 45 and 60 DAT (154.53 and 269.58, respectively). This was statistically similar to no pinching at 45 DAT (148.15) and 10th node pinching at 45 DAT (147.42). Sixth node pinching (119.70) at 45 DAT reported minimal leaves per vine; no pinching (222.24) at 60 DAT reported no leaves per vine. The interaction effect of pinching and variety did not significantly alter the number of leaves per vine. Pinching causes the plant to become more physiologically active, which in turn causes it to produce more leaves. This results in an increase in the number of branches.

Variety and pinching had a considerable impact on average leaf length, but they had no significant effect on average leaf width. Sugar Queen had the longest average leaf length (14.40 cm), while Augusta had the shortest (13.26 cm). Super Queen's leaf length (13.75 cm) was statistically comparable to that of both Augusta and Sugar Queen.

The numbers of nodes were significantly influenced by varieties at 45 DAT and 60 DAT while not significantly affected by pinching. The results showed that at 45 DAT and 60 DAT, the maximum number of nodes was recorded in Augusta (25.31 and 35.11, respectively) and the minimum in Sugar Queen (22.60) at 45 DAT and in Super Queen (32.80) at 60 DAT, which was statistically similar to Sugar Queen at 60 DAT. Among pinching levels, a maximum number of

nodes was recorded in the sixth node pinching at 30 and 45 DAT (14.84 and 25.71, respectively) and the minimum in no pinching at 30 and 45 DAT (10.70 and 21.87, respectively). This result is similar to the findings of [17] in cucumber and [14] in carnation.

The internodal distance on the main vine of watermelon was not significantly affected by varieties, but it was significantly influenced by pinching. The maximum internodal distance on the main vine was recorded in no pinching (6.68 cm), statistically similar to 10th node pinching (6.64 cm) at 60 DAT. In comparison, the minimum internodal distance was recorded in sixth-node pinching (6.11 cm). The internodal distance at the fourth node pinching (6.40 cm) was statistically at par with no pinching, 10th node pinching, and 6th node pinching. At 60 DAT, at a 5% significance level, the interaction effect of variation and pinching significantly impacted internodal distance.

Table 1. Effects of pinching on the number of branches per vine of watermelon *(Citrullus lanatus)* varieties in Chitwan, Nepal, 2021

Treatments	Total number of branches		
	30 DAT	45 DAT	60 DAT
Varieties			
Augusta	4.94^{a}	7.240	9.920
Sugar Queen	4.52^{b}	7.342	9.470
Super Queen	5.03^{a}	6.794	9.326
LSD $_{0.05}$	0.421*	NS	NS
SEm±	0.048	0.066	0.078
Pinching			
No pinching	4.16^{c}	5.844^{b}	8.402^{c}
4th node pinching	5.069^{ab}	7.665^{a}	9.784^{b}
6th node pinching	5.36^{a}	7.812^{a}	10.617^{a}
10th node pinching	4.72^{b}	7.180^{a}	9.477^{b}
LSD $_{0.05}$	0.486***	0.585***	0.675***
SEm ±	0.0414	0.058	0.067
Interaction effect (A x B)	NS	NS	NS
Grand mean	4.83	7.125	9.57
CV (%)	10.3	9.70	7.22

Means with the same letter within a column do not differ significantly at p=0.05 by DMRT. ***= Significant at 0.1% (p≤0.001), NS-Non-significant, SEm-Standard Error of Mean, LSD- Least Significant Difference, CV-Coefficient of variance.

Table 2. Effects of pinching on the number of nodes on the main vine of watermelon (*Citrullus lanatus*) varieties in Chitwan, Nepal, 2021

Treatments	No. of nodes		
	30 DAT	45 DAT	60 DAT
Varieties			
Augusta	12.67	25.31^{a}	35.11^{a}
Sugar Queen	12.00	22.60^{b}	33.21^{b}
Super Queen	12.30	23.52^{ab}	32.80^{b}
LSD $_{0.05}$	NS	2.17*	1.75*
SEM ±	0.15	0.24	0.20
Pinching			
No pinching	10.70^{c}	21.87^{c}	33.99
4th node pinching	12.47^{b}	25.07^{ab}	33.80
6th node pinching	14.84^{a}	25.71^{a}	33.60
10th node pinching	11.29^{bc}	22.60^{bc}	33.42
LSD $_{0.05}$	1.52***	2.50*	NS
SEm (±)	0.13	0.21	0.17
Grand mean	12.32	23.81	33.70
CV (%)	12.67	10.77	6.14

Means with the same letter within a column do not differ significantly at p=0.05 by DMRT. *= Significant at 5% (p≤0.05), NS-Non -significant, SEm-Standard Error of Mean, LSD- Least Significant Difference, CV-Coefficient of variance

3.2 Effect of Pinching on Flowering Parameters

Watermelon varieties did not significantly alter days to first, 50%, or 100% flowering; however, pinching significantly affected days to first, 50%, and 100% blooming. The findings indicated that no pinching had the shortest time to the first flower (23.55 days), followed by pinching at the fourth and tenth nodes (24.22 and 24.22 days, respectively). Comparatively, the fourth node pinching recorded the highest number of days to first flowering (27.56 days), which was statistically equivalent to the sixth node pinching. The interaction effects of variety and pinching were not observed to significantly affect the days to first, 50%, or 100% flowering. Pinching has also been shown to cause delayed flowering in bottle gourds [5] and fenugreek [19].

At the 1% significance level, watermelon cultivars were found to have a substantial impact on the number of female flowers per vine. At the 5% significance level, however, the cultivars showed no discernible differences in the quantity of male flowers per vine or in the sex ratio. According to the results, Super Queen recorded the highest number of female flowers per vine (9.61). In contrast, Augusta recorded the lowest number of female flowers per vine (7.97), statistically equal to Sugar Queen's (8.29). Pinching at the sixth node produced the fewest male flowers (40.19), statistically comparable to pinching at the fourth, sixth, and tenth nodes (40.98, 40.19, and 41.86, respectively).

On the other hand, no pinching resulted in a maximum number of male flowers per vine (51.79). The interaction effect of variety and pinching was not shown to significantly impact the number of male and female flowers per vine or the sex ratio. The results of [5,9,20,21], which conclude that lateral branches are good producers of female flowers, are consistent with this conclusion. Pinching practices increase the number of lateral branches, which promotes the production of female flowers while decreasing the number of male flowers.

3.3 Effect of Pinching on Yield Parameters

The amount of fruit obtained per vine was greatly impacted by varieties and pinching. Sugar Queen had the highest quantity of fruits collected per vine (2.56), Augusta had the lowest (1.65), and Super Queen had the highest (2.29). Of the several levels of pinching, the highest number of fruits gathered per vine was found in the sixth node pinching level (2.41) and the lowest in the no-pinching level (1.82). The Sugar Queen x 10th node pinching record for the most fruits picked per vine was 2.98, statistically comparable to Super Queen x sixth node

Table 3. Effect of pinching on the number of days to flowering of watermelon (*Citrullus lanatus*) varieties in Chitwan, Nepal, 2021

Treatments	Days to flowering		
	First flowering	50% flowering	100% flowering
Varieties			
Augusta	24.75	27.92	30.42
Sugar Queen	26.67	29.67	31.67
Super Queen	25.50	28.58	28.75
LSD $_{0.05}$	NS	NS	NS
SEM ±	0.30	0.31	0.28
Pinching			
No pinching	23.55^{c}	26.33^{a}	28.78^{b}
4th node pinching	27.56^{a}	31.00^{b}	32.67^{a}
6th node pinching	27.22^{ab}	30.56^{b}	32.44^{a}
10th node pinching	24.22^{bc}	27.00^{a}	29.33^{b}
LSD $_{0.05}$	3.11*	3.15**	2.88*
SEM ±	0.26	0.27	0.25
Interaction effect (A x B)	NS	NS	NS
Grand mean	25.64	28.72	30.80
CV %	12.40	11.21	9.56

*Means with the same letter within a column do not differ significantly at p=0.05 by DMRT. **= Significant at 1% (p≤0.01), *= Significant at 5% (p≤0.05), NS-Non -significant, SEM-Standard Error of Mean, LSD- Least Significant Difference, CV-Coefficient of variance*

pinching (2.87). By comparison, the Augusta x no pinching minimum quantity of fruits picked per vine was 1.37, which was statistically comparable to the Augusta x 10th node pinching minimum of 1.56%. This could be because the number of leaves and branches per plant increased due to apical shoot pinching at the sixth node. As a result, the number of fruits, leaves, and branches on a watermelon vine are positively correlated [22].

Varieties and pinching highly impacted the average weight of a fruit. Sugar Queen had the highest recorded average fruit weight of 1.99 kg, while Super Queen had the lowest, at 1.55 kg, statistically comparable to Augusta's 1.67 kg. The fruit's average weight was higher in the sixth node pinching level (2.21 kg), while the average weight was lower in the no pinching level (1.38 kg). The pinching technique has also been linked to higher average fruit weight in other vegetables, such as fenugreek [23], okra [24], and cucumber [5]. This conclusion is similar to the one mentioned before.

Pinching and variety were found to have a considerable impact on fruit yield. Sugar Queen recorded the highest output at 50.03 Mt/ha, while Augusta recorded the lowest yield at 31.87 Mt/ha. Comparably, the yield in the fourth node pinching (42.70 Mt/ha) and the tenth node pinching (43.11 Mt/ha) were statistically equivalent. The maximum yield was observed in the sixth node pinching (47.22 Mt/ha) and the smallest in no pinching (31.87 Mt/ha). The interplay between variety and pinching also has a significant impact on fruit yield. The results of [25-30], which all documented notable variations in yield between cultivars of cucurbits and other vegetables regarding varietal treatments, corroborate these findings.

3.4 Effect of Pinching on Fruit Quality Parameters

Watermelon's total soluble solid (TSS) was shown to be strongly altered by variety but not significantly altered by pinching or the combination of the two. The maximum TSS of fruits was recorded in Super Queen (10.86 ◦B), which was statistically similar to Super Queen (10.85 ◦B), while the minimum in Augusta (9.44 ◦B). The potential of watermelon's hydrogen (pH) was not influenced by variety and pinching or the interaction effect of variety and pinching. Vitamin C (ascorbic acid content) and titrable acidity of watermelon were also not found to be significantly influenced by varieties and pinching, nor was the interaction effect of variety and

Table 4. Interaction effects of variety and pinching on the number of fruits, the average weight of fruit, and yield of watermelon (*Citrullus lanatus*) in Chitwan, Nepal, 2021

Treatments	No. of fruits harvested vine^{-1}	Average weight of a fruit (kg)	Yield (Mt/ha)
Variety x pinching			
Augusta x no pinching	1.37^{i}	1.21^{d}	26.45^{h}
Augusta x ^{fourth} node pinching	1.75^{gh}	1.65^{bcd}	30.13^{fg}
Augusta x ^{sixth} node pinching	1.92^{efg}	2.53^{a}	37.08^{ef}
Augusta x 10^{th} node pinching	1.56^{hi}	1.31^{d}	30.13^{gh}
Sugar Queen x no pinching	2.20^{de}	1.72^{bcd}	42.46^{de}
Sugar Queen x ^{fourth} node pinching	2.64^{bc}	2.03^{abc}	51.05^{bc}
Sugar Queen x ^{sixth} node pinching	2.43^{cd}	1.97^{abc}	49.05^{c}
Sugar Queen x 10^{th} node pinching	2.98^{a}	2.25^{ab}	57.57^{a}
Super Queen x no pinching	1.90^{fg}	1.20^{d}	33.81^{ef}
Super Queen x ^{fourth} node pinching	2.24^{d}	1.60^{cd}	43.22^{d}
Super Queen x ^{sixth} node pinching	2.87^{ab}	2.14^{abc}	55.53^{ab}
Super Queen x 10^{th} node pinching	2.15^{def}	1.28^{d}	41.63^{de}
LSD $_{0.05}$	0.27^{***}	0.56^{*}	5.39^{***}
SEm (±)	0.09	0.09	0.15
Grand mean	2.17	1.74	42.06
CV (%)	7.34	18.95	7.57

*Means with the same letter within a column do not differ significantly at p=0.05 by DMRT. ***= Significant at 0.1% (p≤0.001), *= Significant at 05% (p≤0.05), NS-Non significant, SEm-Standard Error of Mean, LSD- Least Significant Difference, CV-Coefficient of variance*

Table 5. Effect of pinching on TSS, pH, vitamin C, and TA of watermelon (*Citrullus lanatus*) varieties in Chitwan, Nepal, 2021

Treatments	TSS (◦B)	p^H	Vitamin C (mg/100ml)	TA (g/l)
Varieties				
Augusta	9.44[b]	5.40	9.10	0.16
Sugar Queen	10.86[a]	5.54	7.95	0.15
Super Queen	10.85[a]	5.43	9.51	0.15
LSD $_{0.05}$	0.83**	NS	NS	NS
SEm (±)	0.09	0.03	0.19	0.04
Pinching				
No pinching	10.00	5.40	8.74	0.17
4th node pinching	10.70	5.39	8.63	0.14
6th node pinching	10.17	5.46	9.29	0.15
10th node pinching	10.67	5.59	8.74	0.15
LSD $_{0.05}$	NS	NS	NS	NS
SEm (±)	0.08	0.02	0.16	0.003
Interaction effect (A x B)	NS	NS	NS	NS
Grand mean	10.38	5.46	8.85	0.15
CV (%)	9.45	5.40	21.95	24.88

*Means with the same letter within a column do not differ significantly at p=0.05 by DMRT. *= Significant at 5% (p≤0.05), NS-Non significant, SEm-Standard Error of Mean, LSD- Least Significant Difference, CV-Coefficient of variance*

pinching. This result is corroborated by the study of [6], which concluded that there were no appreciable variations in TSS, TA, pH, and vitamin C between various pruning techniques in different watermelon cultivars. Fruit by varieties, with the interaction effect of variety and pinching not significantly affecting fruit. The highest pulp percentage of the fruit was reported in Sugar Queen (42.97%), which was statistically similar to Super Queen (41.57%). The lowest pulp percentage was reported in Augusta (32.77%). There were no interaction effects of variety and pinching regarding rind thickness, fruit length, or pulp percentage. This finding is also supported by the findings of [31,32], in which they reported no pruning variety interaction regarding fruit quality parameters.

4. CONCLUSION

The research concluded that better growth performance was found in the Super Queen variety of watermelon. However, yield and quality parameters (TSS, fruit length, and pulp percentage) were superior in the Sugar Queen variety. Yield and yield attributes were superior in sixth-node pinching among different pinching levels. The yield was maximum in the combined effect of the Sugar Queen variety and pinching at the 10th node. Therefore, it can be concluded that the Sugar Queen variety of watermelon pinched at the 10th node can be recommended for maximum yield at Bharatpur, Chitwan. The application of hormones in conjunction with pinching treatments and their evaluation of their effects on flowering and fruiting could be a research area, and multi-location trials on various geographic locations could be carried out to determine the potential of different watermelon varieties. These recommendations are based on the study's empirical findings.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Food and Agriculture Organization of the United Nations. FAOSTAT statistical database. [Rome]: FAO; 2020.
2. BDVVN, Srilakshmi, Kaberi Maharana, N. Amrutha Pavani, Kusuma KK. Studies on the impact of spacing, pinching and growth retardants on vegetative growth and flowering behaviour of salvia. Journal of Experimental Agriculture International. 2024;46(7):558-68.

Available:https://doi.org/10.9734/jeai/2024/v46i72609.

3. Baraily, Prerna, Prahlad Deb. Response of pineapple yield and quality on pinching of crown leaves combined with bagging of fruits. International Journal of Plant & Soil Science. 2022;34 (10):74-84. Available: https://doi.org/10.9734/ijpss/2022/v34i1030925.
4. Ban D, Goreta S, Borošić J. Plant spacing and cultivar affect melon growth and yield components. Scientia Horticulturae. 2006 Jul 21;109(3):238-43.
5. Patel AN, Parmar VK, Nayak SR, Patel NM. Influence of pinching and plant growth regulators on morphological and sex expression of bottle gourd (*Lagenaria siceraria* L.). International Journal of Chemical Studies. 2017;*5*(4):2035-2038.
6. Abdel-Wahab A. Effect of pruning and spraying of ascorbic acid on growth, fruits yield and quality and some physiological attributes of cucumber. J. Hort. Sci. and Ornament. Plants. 2018;10(3):104-109.
7. Anand M, Rohini, N, Sadasakthi, A. Influence of training and pinching on growth, flowering and physiological characters in bottle gourd cv. CBgH1. Trends in Biosci. 2014;7(17):2524-2527.
8. Behera, TK, Jat, G S, Pathak, M. Classical genetics and traditional breeding. In The Bitter Gourd Genome. 2020;91-104. Springer, Cham.
9. Eve B, Tuarira M, Moses, M, Thomas M. The influence of pinching on the growth, flowering pattern and yield of butternuts (*Cucurbita moschata*). Intl. J. Hort. Ornamental Plants. 2016;2(5)19-25.
10. Garg P, Dev R, Raj S, Patel VJK, Singh, VK. Influence of plant growth regulators (PGRs) on growth parameters and sex ratio in cucumber (*Cucumis sativus* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(3):1658-1661.
11. Tswanya, NM, Olaniyi, OJ. Effects of pinching time on growth and fruit yield of three tomato varieties (*Lycopersicon Lycopersicon* Mill) in the southern guinea savanna zone of Nigeria. International Journal of Agriculture. 2016;1(1):30-40.
12. Oga IO, Umekwe, PN. Effects of NPK fertilizer and staking methods on the growth and yield of watermelon (*Citrullus lanatus* L.). International Journal of Science and Research. 2013;23:19-64.
13. Rashid MA, Singh DP. A manual on vegetable seed production in Bangladesh. Gazipur, Bangladesh: AVRDC-USAID-Bangladesh Project, Horticulture Research Centre, Bangladesh Agricultural Research Institute; 2000.
14. Dalal, SR., Nandre, DR., Bharad, SG., Swarupa, U., Shinde, RD, Dhar, PC, Md Abdul Awal. "Effect of plant growth regulators on female flower development and productivity of watermelon plants grown during winter season with low-tech greenhouse." Education 2003; 2000.
15. MOALD. Statistical information on Nepalese Agriculture 2019/20 (2076/77). Government of Nepal, Ministry of Agriculture and Livestock Development, Planning & Development cooperation coordination division, Statistics and analysis section, SInghadurbar, Kathmandu, Nepal; 2020.
16. Boyhan, GE, Connell, SO, Mcneill, R, Stone, S. Variety Trials. 2017;382–388. Available:https://doi.org/10.21273/HORTTECH04199-18
17. Nayak, SR, Parmar, VK., Patel, AN, Suchismita, J, Lathiya, JB, Tandel, YN. Efficacy of pinching and plant growth regulators in enhancing yield characters of cucumber (*Cucumis sativus* L.). Int. J. Chem. Stud. 2018;6(1)1804-1807.
18. Naafe, M, Nabi, G, Irshad, M, Khan, MN, Ali, S, Hayat, R. Influence of pinching on growth and yield of bottle gourd (*Lagenaria siceraria*). Pure and Applied Biology. 2022;11(4):891-901.
19. Sudarshan JS. Influence of apical bud pinching, chemical spray, and physiological maturity on seed yield and quality of fenugreek. An M. Sc. thesis, University of Agricultural Sciences, Dharwad, India. 2004;73.
20. Higashide, T, Gotoh, I, Suzuki, K, Yasuba, K, Tsukazawa, K, Ahn, DH, Iwasaki,Y. Effects of Pinching and Lowering on Cucumber Yield and Yield Components. In Horticultural Research (Japan). 2012; 11(4):523–529. Japanese Society for Horticultural Science. Available:https://doi.org/10.2503/hrj.11.523 https://vegetables.caes.uga.edu/content/dam/caes-subsite/vegetables/docs/trial-
21. Lakshmi J, Gowda R, Narayanaswamy S, Shivanandam VN. Influence of pre-flowering pinching and Maleic hydrazide spray on plant growth, seed yield and

quality attributes in fenugreek. Legume Research: An International Journal. 2015;38(3).
22. Anwar NA, Gad AA, Bardisi A, Zyada HG. Effect of plant spacing and apical shoot pinching on growth and productivity of watermelon plants under sandy soil conditions. Zagazig Journal of Agricultural Research. 2019;46(2):357-365.
23. Bairagi SK. Effect of pinching of apical buds and chemical sprays on yield and quality of fenugreek seed. Annals of Horticulture. 2016;9(2):177-181.
24. Abed AH. Influence of whey foliar spraying and growing point pinching on growth and yield parameters of okra. Iraqi journal of agricultural sciences. 2016;47(4).
25. Thorat, BS, Bhave, SG, Bonde, PJ, Raut, SM, Devmore, JP, Pethe, UB. Genetic Architecture of Watermelon (*L*.). 2020;11:1986–1995.
26. Silva A. Watermelon variety trial evaluation 2019. University of Georgia; 2019. Available:https://vegetables.caes.uga.edu/content/dam/caes-subsite/vegetables/docs/trial-results/2019-Watermelon%20-Varietry-Trial-Results.pdf
27. Narine R, Chandranauth R, Chibi S, Homenauth O. Evaluation of Five Hybrid Watermelon Varieties for Cultivation and Performance in Coastal Guyana South America. Agricultural Sciences. 2019;10(04):538–545. Available:https://doi.org/10.4236/as.2019.104043
28. Gichimu, BM, Owuor BO, Dida MM. Agronomic performance of three most popular commercial watermelon cultivars in Kenya as compared to one newly introduced cultivar and one local landrace grown on dystric nitisols under sub-humid tropical conditions. Journal of Agricultural and Biological Science. 2008;3(5/6): 65-71. Available:http://www.arpnjournals.com/jabs/research_papers/rp_2008/jabs_1108_102.pdf
29. Subedi PP, Sharma MD. Single Stem Cultivation and Performance of Cucumber Cultivars During Winter-Spring Seasons. Journal of the Institute of Agriculture and Animal Science. 2005;26:149-151.
30. Alsadon A, Al-Helal I, Ibrahim A, Abdel-Ghany A, Al-Zaharani S, Ashour T. The effects of plastic greenhouse covering on cucumber (*Cucumis sativus* L.) growth. Ecological Engineering. 2016;87: 305-312.
31. Ndereyimana A, Waweru BW, Kagiraneza B, Niyokuri AN, Rukundo P, Hagenimana G. Effect of vine and fruit pruning on yield attributes of two watermelon (*Citrullus lanatus*) cultivars. Advances in Horticultural Science. 2021;35(3):269-275.
32. Utobo, EB, Ekwu, LG, Ogah, EO, Nwokwu, GN. Growth and yield of cucumber varieties as influenced by pruning at abakaliki agricultural area southeastern Nigeria. CJ Agric. Sci. 2010;4:23-24.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/119813