International Journal of Environmental & Agriculture Research (IJOEAR)
ISSN: [2454-1850]
[Vol-12, Issue-9, September- 2026]
Website: www.ijoear.com
Journal DOI: 10.25125/agriculture-journal

Effect of different generation cutting on growth, sex expression, yield and quality attributes of cucumber (*Cucumis sativus* L.) in Godawari munacipility, Kailali, Nepal

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Received:- 10 August 2026/ Revised:- 18 August 2026/ Accepted:- 01 September 2026/ Published: 15-09-2026

Abstract— *Cucumber (Cucumis sativus L.) is the seventh most important crop in terms of area in Nepal, with the capability of providing abundant minerals and vitamins. The productivity of this crop is less than half the world's average productivity, which is associated with imbalance in male-to-female flower ratio. To address this issue, a field experiment was carried out at the farmers' field of Godawari municipality, Fakalpur, Kailali, Nepal during the summer season of 2023/24 to evaluate the effect of different generation cutting on growth, sex expression, and yield of cucumber cv. Malini. The experiment was laid out in Completely Randomized Block Design (RCBD) with three treatments viz; T1 (No cutting: Control), T2 (First generation cutting: 2G), T3 (Second generation cutting: 3G), and six replications. Each plot consisted of 2 rows and each row consisting of 5 plants with spacing 100 cm × 100 cm. Each replication size was 40 m² so total field size for research was 240 m² consisting of 18 plots each of size 5 m × 2 m. The results indicated that treatment T3 (Second generation cutting: 3G) had a significant effect on phenological parameters, mainly male and female flowers of primary and secondary branches, female flowers on tertiary branches, and male-to-female flower ratio of primary, secondary and tertiary branches. Similarly, yield parameters, mainly number of fruits per plant (6.05) and yield per hectare (21.48 mt/ha) were found to be significantly superior under treatment T3 (Second generation cutting: 3G). Among the different generation cuttings, treatment T3 (Second generation cutting: 3G) was found to be significant over control. It can be concluded that the second generation cutting (3G) can be judiciously used for increasing the sex expression and yield attributes of cucumber.*

Keywords— 3G cuttings, Male flower, Female flower, Sex ratio.

I. INTRODUCTION

Cucumber (*Cucumis sativus* L.), an important vegetable crop, is mainly used as salad and pickles in Nepal. Among the cucurbits, cucumber is a precious vegetable crop grown for consumption of its immature fruits. It is believed to have originated in the hilly areas of Nepal. It has been cultivated in Nepal since ancient times. Currently, it has taken a commercial form as a cash-generating business. Its commercial cultivation is done from the plains to the mountains or in areas with communication and market facilities. In Nepal, its cultivation is done as a seasonal crop in March/April and fruits are harvested till August/September. Cucumber is useful for people suffering from jaundice, kidney problems, constipation, indigestion, and its oil is considered good for the brain and body (Gautam et al., 2021). In Nepal, it is the seventh most important vegetable crop in terms of area. The area, production and productivity of cucumber in Nepal is 9,978 ha, 1,52,862 mt and 15.32 mt/ha respectively (MoALD, 2023). The productivity of cucumber is very low in Nepal as compared to Asia (49.61 mt/ha) and the world average productivity (39.34 mt/ha) (FAO Stat, 2021).

Cucumber is a vine crop. Depending on the variety, its length of vine extends from 2-3 meters to 8-10 meters, and the height of the branches also varies according to the variety. Cucumber vine can be divided into three parts according to gender characteristics, according to which, male flowers grow in the lower part of the vine, male and female flowers grow in the middle or one after the other, and female flowers grow in the upper part of the vine. When cucumbers are planted in winter months, the length of the day is short and the temperature is low, the production of male flowers is low and the production of female flowers is high, while the production of male flowers is high and the production of female flowers is low in cucumbers planted in summer. The main vine of cucumber planted in normal season produces many female flowers. If cucumbers are planted in summer season, after 4-6 nodes of flowering, male flowers appear for 5-6 nodes and then female flowers appear, while in winter season cucumbers, female flowers appear after 2-3 nodes of flowering, but this process can vary depending on the variety. The ratio of male and female flowers should be low for maximum production and quality of cucumbers (Gautam et al., 2006). There is an increasing problem of low fruit set and if there is fruit set, very small fruits are developed that are deteriorated on the mother plant. Imbalance of sex ratio is the main problem of declining production in Nepal and influences the male and female ratio by various biotic and abiotic factors, environmental issues, disease and pest, and many other factors.

According to research studies, the 1st and 2nd generation branches comprise a majority of male flowers rather than female, leading to a very small ratio of 14:1 (Male: Female) flowers in the branch that creates a false illusion of heavy flowering but with very low fruiting (Chaurasiya et al., 2020). Thus, 3rd generation branches flush with a majority of female flowers. The main aim should be focused on keeping 3rd generation branches rather than others. Normally, there is an unequal male-to-female flower ratio in cucumber, with a greater number of male flowers than female flowers. If we use these techniques, the number of female flowers increases, which triggers increased productivity.

The physiological basis for the observed effects of generation cutting on sex expression lies in the manipulation of plant hormone balance and carbohydrate allocation. Pruning alters the source-sink relationships within the plant, redirecting assimilates from vegetative growth to reproductive development. This redirection influences the levels of endogenous plant hormones, particularly gibberellins, auxins, and cytokinins, which play a critical role in sex determination in cucurbits. Gibberellins are known to promote male flower formation, while cytokinins and ethylene promote female flower development. By removing apical dominance through cutting, the distribution of these hormones is altered, favouring female flower production on the tertiary branches. Additionally, pruning improves light penetration and air circulation within the canopy, enhancing photosynthetic efficiency and carbohydrate availability, which supports the development of female flowers and fruits. This mechanistic understanding provides the theoretical foundation for the observed agronomic benefits of 3G cutting.

The present study was therefore undertaken with the following objectives:

1) To evaluate the effect of different generation cuttings on growth, sex expression, and yield of cucumber.
2) To identify the optimal generation cutting practice for maximizing cucumber productivity in the Godawari municipality area.

II. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was conducted at farmers' fields of Godawari municipality, Fakalpur, Kailali, Nepal during the summer season of 2023/24 to evaluate the effect of different generation cutting on growth, sex expression and yield of cucumber. The experiment field is located in the tropical region at an elevation of 200 m, having 28°46'45.4"N (28.7792800°) latitude and 80°36'00.5"E (80.6001400°) longitude. Phakalpur is located in the region of Sudurpashchim Pradesh. The distance from Phakalpur to Nepal's capital Kathmandu is approximately 478 km.

2.2 Soil Properties of Study Area

Soil samples were collected randomly at a depth of 0-20 cm by using a sampling auger. The collected soil samples were analysed at the soil and fertilizer testing laboratory, Sundarpur, Kanchanpur. The soil properties of the study area are shown in Table 1.

TABLE 1
SOIL PROPERTIES OF STUDY AREA

Parameter	Value
Soil pH	7.32
Bulk Density	1.37
Particle Density	2.14
Water Holding Capacity	53.84
Porosity	35.5
Organic Matter (%)	0.71
Available Nitrogen (%)	0.04
Available Phosphorus (%)	12.58
Available Potassium (%)	88.15
Soil Texture	Sandy clay loam soil

2.3 Experimental Material

Different generations of vine i.e., first and second generation cuttings were used to evaluate the vegetative, flowering and yield attributes. We used the Malini variety of cucumber, which is a hot temperature tolerant variety and good in taste compared to other varieties. Seeds were sown in polybags in February by filling vermicompost and soil in a 2:1 ratio. Seedlings were transplanted when 3-4 true leaves emerged, one month after seed sowing.

2.4 Experimental Design and Treatment Details

The experiment was laid out in Completely Randomized Block Design (RCBD) with 3 treatments viz; T1 (control), T2 (First branch cutting: 2G), T3 (Second branch cutting: 3G), and 6 replications. Each plot consisted of 2 rows and each row consisting of 5 plants, so the total number of plants per plot was 10, with spacing 100 cm × 100 cm. Each replication size was 40 m² so the total field size for research was 240 m² consisting of 18 plots each of size 5 m × 2 m.

2.5 Treatment Application Method

The treatment application method was as follows:

T1 (Control - No Cutting): The main stem (primary branch) was allowed to grow freely without any cutting or pruning intervention throughout the growing period.

T2 (First Generation Cutting - 2G): The main stem (primary branch) was allowed to grow freely until it reached approximately 6-8 feet in height. No side branches were allowed to develop until 5 leaves from the main stem; if any developed, they were pinched out. The tip of the secondary branch was removed when it reached 2-3 feet in height to promote tertiary branches, which were then allowed to grow freely.

T3 (Second Generation Cutting - 3G): The main stem (primary branch) was allowed to grow freely until it reached approximately 6-8 feet in height. No side branches were allowed to develop until 5 leaves from the main stem; if any developed, they were pinched out. The tip of the secondary branch was also removed when it reached 2-3 feet in height to promote tertiary branches. Then, the tertiary branch was allowed to grow without any further cutting.

2.6 Sampling Techniques

A random sampling method was used where all units had the same chance of selection for the sample. Eighty plants were selected from two hundred and forty plants for sampling from the whole research area. Sampling was done on two plants from every row, that is, four plants from a single plot.

2.7 Data Collection

Vegetative characteristics, flowering and yield behaviours were recorded. The data on internodal length of primary branch, internodal length of secondary branch, stem diameter of primary and secondary branches, male and female flowers of primary, secondary and tertiary branches, number of fruits, fruit length, fruit diameter, fruit weight, and yield per hectare were recorded. Quality parameters including TSS (°Brix), titratable acidity (TA), TSS/TA ratio, colour, size, appearance, and taste were also assessed using the 1-3 scale method (Subedi et al., 2024). Plant protection measures were applied as needed following recommended practices, including the application of fungicides (mancozeb) and insecticides (cypermethrin) at recommended doses to manage pests and diseases. Harvesting was done when fruits reached marketable size (approximately 15-20 cm length) and was carried out at 3-4 day intervals throughout the harvesting period.

2.8 Statistical Analysis

The data were subjected to one-way Analysis of Variance (ANOVA), and significant means were separated using the Least Significant Difference (LSD) test at 1% or 5% level of significance (Gomez & Gomez, 1984). All statistical analyses were done in R Studio version 4.0.2 using the DoE bioresearch package.

III. RESULTS AND DISCUSSION

3.1 Effect of Different Generation Cutting on Growth Parameters of Cucumber

All the growth attributes of cucumber taken at the maturity stage in the study, viz. internodal length of primary and secondary branches, stem diameter of primary and secondary branches, are shown in Table 2. There is no significant difference in internodal length and stem diameter of primary and secondary branches among the different generation cuttings of cucumber. Internodal length determines the height and number of nodes per plant, but 3G cuttings showed no significant differences in internodal length of cucumber. Similar findings were also reported by Kumar et al. (2008) and Dogra (2012). By limiting the growth of unproductive plant parts, pruning operations promote regulated growth by enhancing photosynthetic efficiency, which in turn promotes cell expansion in other plant parts. This is in close agreement with the findings of Yu et al. (2013), Jat et al. (2011), Coggins et al. (2014), and Singh et al. (2016).

TABLE 2
INTERNODE LENGTH AND STEM DIAMETER OF DIFFERENT GENERATION CUTTINGS OF CUCUMBER

Treatment	Internode Length (cm)		Stem Diameter (cm)	
	Primary Branch	Secondary Branch	Primary Branch	Secondary Branch
T1 (Control)	6.10a	8.67a	8.98a	4.31b
T2 (2G)	5.70a	8.50a	8.84ab	4.94a
T3 (3G)	5.82a	8.91a	8.45b	4.78ab
$LSD_{0.05}$	0.55	0.6002	0.44	0.54
SEm(±)	0.17	0.18	0.13	0.16
F test	NS	NS	NS	NS
CV %	6.49	4.73	3.45	8.014
Grand Mean	5.87	8.69	8.76	4.68

Note: Means followed by same letter(s) in a column are not significantly different at $p \leq 0.05$.

3.2 Effect of Different Generation Cutting on Flowering Parameters of Cucumber

The study assessed the impact of different generation cuttings on the growth, sex expression and yield attributes of cucumber. The results showed that T3 (second generation cutting: 3G cutting) had the most favourable outcomes across the various parameters. The effect of different generation cutting was found to be significant on the number of male and female flowers, as shown in Table 3. The results revealed that T1 (Control) showed statistically maximum number of male and female flowers in the primary branch of the cucumber plants (23.40), whereas treatments T2 (2G: first generation cutting) and T3 (3G: second generation cutting) observed minimum number of male and female flowers, with T2 being statistically at par with T3. In contrast to this, 2G and 3G cutting recorded the lowest number of male and female flowers in primary branches. Similar results of male flowers in primary branches were also reported by Verma et al. (2023). The first-generation branches induced more male flowers than female flowers in a high ratio of 14:1, giving a fallacious conception of heavy flowering with very few numbers of fruiting.

Analysis of secondary branches indicated that treatment T1 (Control) and T2 (2G) had the highest number of male flowers (11.13 and 9.49, respectively), while T3 (3G) had the lowest (4.45) male flowers. Whereas the highest number of female flowers were observed in treatment T3 (1.78) and T2 (1.75), while the lowest number of female flowers were recorded in the control treatment. Similar results were also reported by Singh et al. (2021). Second-generation branches of the Cucurbitaceae family tend to produce more male flowers than female flowers.

In tertiary branches, there were no significant differences in the number of male flowers among the treatments, but the highest number of female flowers (1.99) was recorded in 3G cuttings and the lowest number of female flowers (1.06) was recorded in no-cutting branches. Similar results were also reported by Chapagain et al. (2022). Due to the modulation of hormonal levels in plants, 3G cutting induces tertiary branches which are responsible for the production of female flowers by dominating male flowers.

TABLE 3
MALE AND FEMALE FLOWERS OF DIFFERENT GENERATION CUTTINGS OF CUCUMBER

Treatment	Primary Branch		Secondary Branch		Tertiary Branch	
	Male Flower	Female Flower	Male Flower	Female Flower	Male Flower	Female Flower
T1 (Control)	23.40a	3.15a	11.13a	1.32b	4.92	1.06c
T2 (2G)	12.90b	1.15b	9.49a	1.75a	5.15	1.42b
T3 (3G)	12.95b	1.45b	4.45b	1.78a	5.03	1.99a
$LSD_{0.05}$	1.83	0.41	1.69	0.31	0.39	0.19
SEm(±)	0.56	0.12	0.51	0.09	0.12	0.05
F test	***	***	***	*	NS	***
CV %	7.66	14.96	13.903	13.18	5.41	8.87
Grand Mean	16.41	1.91	8.35	1.62	5.03	1.49

Note: Means followed by same letter(s) in a column are not significantly different at $p \leq 0.05$. NS = Non-significant; * = Significant at $p \leq 0.05$; *** = Significant at $p \leq 0.001$.

Data presented in Table 4 show that different generation cuttings had a highly significant effect on the male-to-female flower ratio of cucumber. The results revealed that the maximum ratio (11.72) was recorded in treatment T3 (second generation cuttings: 3G). No cutting and first generation cutting had no significant differences in flower ratio of cucumber, whereas the minimum ratio (7.46) was recorded in treatment T1 (no cutting: control) in primary branches. The findings of the present study are in accordance with the studies of Rajalingam et al. (2017) and Hirama et al. (2011).

In the case of secondary branches, the higher ratio (6.23) and (5.51) was recorded in no cutting and first generation cutting, respectively, whereas the minimum ratio (3.41) was recorded in second generation cutting. No cutting of branches has been shown to increase the incidence of various diseases and pests that lead to decreasing yield by production of non-productive flowers (Premalatha et al., 2006; Ekwu et al., 2012; Khoshkam, 2016).

Analysis of tertiary branches indicated that the maximum ratio (4.75) was recorded in the control treatment (no cutting) followed by first generation cutting (3.69), whereas the minimum ratio (2.52) was recorded in second generation cuttings. Our results are in accordance with Thakur et al. (2018) and Chapagain et al. (2022). They studied that the ratio of male and female flowers should be low for maximum production and quality of cucumbers (Gautam et al., 2006).

TABLE 4
MALE-TO-FEMALE FLOWER RATIO OF DIFFERENT GENERATION CUTTINGS OF CUCUMBER

Treatment	Ratio of Male and Female Flowers		
	Primary Branch	Secondary Branch	Tertiary Branch
T1 (Control)	7.46b	6.23a	4.75a
T2 (2G)	9.36ab	5.51a	3.69b
T3 (3G)	11.72a	3.41b	2.52c
$LSD_{0.05}$	2.45	1.07	0.91
SEm(±)	0.75	0.32	0.28
F test	*	***	**
CV %	17.64	14.56	17.18
Grand Mean	9.52	5.05	3.65

Note: Means followed by same letter(s) in a column are not significantly different at $p \leq 0.05$. * = Significant at $p \leq 0.05$; ** = Significant at $p \leq 0.01$; *** = Significant at $p \leq 0.001$.

3.3 Effect of Different Generation Cutting on Yield Attributing Parameters of Cucumber

Based on the analysis of variance, there is an effect of different generation cuttings on yield attributing parameters of cucumber. Different generation cutting highly affected the fruit number, fruit weight per plant, fruit length, fruit diameter and yield, presented in Table 5. Results indicated that there are no significant differences in weight, length, and diameter of fruit among different generation cuttings of cucumber. Duong (1999) recorded that 3G cutting had no significant impact on the length and fruit weight of cucumber. According to Mir et al. (2019), different generation cutting stimulated the process of photosynthesis that leads to improvement of fruit characters by enlargement of cells. In our findings, there are no significant differences in fruit characters, especially fruit length, diameter and weight of cucumber.

But results observed that the fruit number per plant was positively influenced by different generation cuttings. The greater number of fruits (6.05) per plant was recorded in 3G cutting followed by 2G cutting (5.60), whereas the minimum number of fruits per plant (5.10) was recorded in no cutting treatment. Similar results were obtained by Shah et al. (2020). The findings are in accordance with the findings of Mir et al. (2019) who observed that an increase in the number of female flowers due to generation cuttings might have increased the number of fruits in each plant. Eifediyi and Remison (2009) observed that 3G cutting reduces the diseases and insect pests by uniform circulation of air around the plant canopy that enhances the marketable yield of cucumber.

3G (second generation cuttings) in cucumber produced significantly higher production (21.48 ton/ha) followed by 2G (20.03 ton/ha), while the lowest production (18.18 ton/ha) was recorded in no cutting (control) treatment. This is because different generation cuttings maintain a balance of vegetative growth and reproductive growth, especially the number of fruits on branches, which triggers increased production of cucumber (Humphries and Vermillion, 1994).

The highest production recorded under the 3G cutting plants may have been caused by a larger number of fruits. This is consistent with the research studied on cucumber by Shivaraj et al. (2018). By allowing plants adequate light exposure, pruning boosted photosynthesis, which in turn increased the source-to-sink ratio and raised the yield. Due to the effect of different generation cutting, it helps in cell enlargement, separation, synthesis of protein with maintained auxin concentration. So that contributes to good vegetative growth of side branches and increased number of female flowers which ultimately increased yields. Devi et al. (2016); Chaurasiya et al. (2020); Mardhiana et al. (2017); and Mardhiana et al. (2017) studied that different generation cutting facilitates CO_2 level with optimum use of sunlight, better photosynthesis, and air circulation within the canopy by preventing unnecessary vegetative growth of cucumber which ultimately increases yield. Whereas no cutting branches increases male flowers by slow and dense vegetative growth that decreases yield due to high incidence of various diseases and insect pests (Khoshkam, 2016; Ekwu et al., 2012; Premalatha et al., 2006).

TABLE 5
YIELD AND YIELD ATTRIBUTE TRAITS OF DIFFERENT GENERATION CUTTING OF CUCUMBER

Treatments	Fruit Number	Fruit Weight per Plant (g)	Fruit Length (cm)	Fruit Diameter (cm)	Yield (ton/ha)
T1 (Control)	5.10c	356.63	20.95	5.27	18.18c
T2 (2G)	5.60b	358.03	20.55	5.29	20.03b
T3 (3G)	6.05a	355.23	20.24	5.24	21.48a
$LSD_{0.05}$	0.36	17.63	0.89	0.21	1.29
SEm(±)	0.11	5.4	0.27	0.06	0.39
F test	**	NS	NS	NS	**
CV %	4.44	3.39	2.98	2.74	4.47
Grand Mean	5.58	356.63	20.58	5.27	19.9

Note: Means followed by same letter(s) in a column are not significantly different at $p \leq 0.05$. NS = Non-significant; ** = Significant at $p \leq 0.01$.

3.4 Effect of Different Generation Cutting on Quality of Cucumber

The effect of different generation cutting on the quality of cucumber is shown in Table 6 and Table 7. The results revealed that there are no significant differences in TSS, TA and TSS/TA ratio, colour, size, appearance and taste among different generation cuttings of cucumber. Das et al. (2018) and Kumari & Topno (2023) also reported that Malini had similar TSS, TA, TSS/TA, colour, size, appearance and taste even in different generation cuttings. These findings are in agreement with the results reported by Kumar et al. (2014). The redirection of nutrients and carbohydrates could theoretically increase sugar accumulation (TSS) in fruits, though no direct TSS data is reported in studies on 3G cutting (Verma et al., 2023; Kumar et al., 2025). Different generation cutting induces mild stress, potentially activating defense mechanisms and ROS metabolism that could stabilize TSS (Madhumala et al., 2024). A study on fresh-cut cucumbers (mechanical stress) noted ROS-related metabolic shifts but did not report significant TSS changes (Guan et al., 2023).

The absence of significant reports on titratable acidity in these studies, despite explicit measurement of quality attributes in some cases, supports the conclusion that different generation cutting does not significantly influence cucumber TA. The emphasis across the 3G cutting literature is on flowering and yield impacts rather than biochemical quality parameters like TA. Kumar, Mishra & Sher (2025) investigated the influence of 3G cutting on cucumber titratable acidity, but it was not highlighted as significantly affected by different cutting levels, indicating that generation cutting did not materially alter acidity levels in cucumber fruit compared to yield and other attributes.

TABLE 6
EFFECT OF DIFFERENT GENERATION CUTTING ON QUALITY OF CUCUMBER

Treatments	TSS (°Brix)	TA (% Malic acid)	TSS/TA
T1 (Control)	2.5	0.165	15.118
T2 (2G)	2.5	0.169	15.794
T3 (3G)	2.683	0.171	15.638
$LSD_{0.05}$	0.29	0.21	0.17
SEm(±)	0.19	0.35	0.48
F test	NS	NS	NS
CV %	7.3	3.93	6.33
Grand Mean	2.64	0.17	15.41

Note: NS = Non-significant.

TABLE 7
EFFECT OF DIFFERENT GENERATION CUTTING ON QUALITY OF CUCUMBER

Treatments	Colour (1-3 scale)	Size (1-3 scale)	Appearance (1-3 scale)	Taste (1-3 scale)
T1 (Control)	2	2.63	2.33	2.25
T2 (2G)	2	2.6	2.3	2.3
T3 (3G)	2	2.65	2.28	2.33
$LSD_{0.05}$	0.27	0.12	0.11	0.24
SEm(±)	0.92	0.44	0.93	0.28
F test	NS	NS	NS	NS
CV %	9.58	4	4.27	7.84
Grand Mean	1.93	2.02	1.86	2.06

NOTE: 1-3 scale, where 1 = less acceptance value and 3 = high acceptance value (Subedi et al., 2024). NS = Non-significant.

Different generation cutting in cucumber generally does not produce significant changes in external fruit colour characteristics, as the existing agronomic studies predominantly report effects on flowering and yield traits rather than on fruit colour, and available data do not show consistent effects of different generation cutting treatments on colour attributes. Independent of cutting, cucumber fruit skin colour is strongly determined by pigment genetics, mainly chlorophyll and flavonoid content, regulated by specific genes rather than horticultural practices like generation cutting (Peng et al., 2010). Fruit colour formation is controlled largely by chlorophyll and pigment gene expression, indicating that colour is mainly genetically determined and less responsive to pruning practices (Wang et al., 2019).

Forss et al. (1962) reported that effects of generation cutting on morphological and yield traits and some basic quality parameters do not identify significant or consistent changes in sensory quality traits (such as taste) attributable to different cutting treatments. Cucumber flavour and taste are complex traits influenced by genetic background and volatile and soluble metabolite profiles rather than pruning alone; available research emphasizes that pruning/cutting effects on biochemical quality like soluble solids or acidity do not consistently translate into noticeable taste differences (Zhang et al., 2004).

IV. DISCUSSION

The results of this study demonstrate that different generation cutting practices significantly influence the sex expression and yield of cucumber, with the second generation cutting (3G) showing superior performance across most parameters. The improved sex expression under 3G cutting can be attributed to the manipulation of plant hormone balance and carbohydrate allocation. Pruning removes apical dominance, altering the distribution of endogenous plant hormones. Gibberellins, which promote male flower formation, are reduced, while cytokinins and ethylene, which promote female flower development, are relatively increased. This hormonal shift favours the production of female flowers on the tertiary branches, leading to a more favourable male-to-female flower ratio.

The significant reduction in the male-to-female flower ratio under 3G cutting (from 7.46 to 11.72 on primary branches, and from 6.23 to 3.41 on secondary branches) is particularly noteworthy. This indicates that 3G cutting effectively promotes female flower production while suppressing male flower production. The higher number of female flowers translates directly into higher fruit set and ultimately higher yield. The 18.15% increase in yield under 3G cutting compared to the control demonstrates the practical significance of this finding.

The lack of significant effects on fruit quality parameters (TSS, TA, colour, size, appearance, taste) suggests that generation cutting primarily affects yield-related traits rather than fruit quality. This is consistent with the findings of previous studies (Kumar et al., 2014; Das et al., 2018; Kumari & Topno, 2023). The stable quality parameters across treatments indicate that farmers can adopt 3G cutting without compromising fruit quality, making it an attractive option for improving productivity.

The findings of this study have important practical implications for cucumber growers in Nepal. The adoption of 3G cutting can significantly increase cucumber yield by improving sex expression and fruit set. The technique is relatively simple and can be easily adopted by farmers with minimal training. However, the additional labour required for pruning should be considered in the economic analysis. Future research should focus on the economics of different cutting practices, the integration of cutting with other management practices, and the validation of these findings across different locations, seasons, and cultivars.

V. CONCLUSION

The study demonstrates that different generation cutting practices have varying impacts on cucumber growth, flowering, yield, and quality. Specifically, the second-generation branch cutting (3G) showed superior performance in terms of phenological and yield parameters. The ratio of male and female flowers was significantly lower in second-generation branch cutting by 3G cutting with 78.50% and 26.10% over primary and secondary branches, respectively. Similarly, the fruit yield was significantly higher by 3G cuttings with 7.24% and 18.15% increase in yield over 2G and no cutting. In quality parameters, there was similar taste among the different treatments. Thus, for optimizing cucumber production and profitability in similar agro-meteorological conditions, adopting the second-generation branch cutting practice is recommended.

Limitations of the Study: The study was conducted at a single location (Godawari municipality, Kailali) over a single season (summer 2023/24) using a single cultivar (Malini). The results may vary under different agro-ecological conditions, seasons, or with other cultivars. The additional labour requirements for 3G cutting were not quantified, and an economic analysis was not performed. Future research should include multi-location trials across different seasons, evaluation of different cultivars, economic analysis of the cutting practices, and investigation of the physiological mechanisms underlying the observed effects.

ACKNOWLEDGEMENTS

This manuscript has been taken from the project "International Centre for Integrated Mountain Development (ICIMOD) for improved yield and quality of cucumber in ICIMOD command areas of Godawari municipality, Fakalpur, Kailali." The farmers of Fakalpur, Kailali are thanked very much for providing their support in making the project accomplished. The Far Western University, FoA faculty members and students were the source of inspiration to accomplish the on-farm research work with grant success.

AUTHORS' CONTRIBUTIONS

- B.R. Bhattarai - Accomplished research on cucumber as a principal researcher.
- *Bohara - Worked as a research assistant.*
- *Rajbanshi - Worked as a research assistant.*

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest pertaining to the publication of this paper.

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