*__Original Research Article__*

# Effect of vine management on morpho-physiological characters and yield of pumpkin

## ABSTRACT

The present study was carried out at the Instructional cum Research Farm, Department ofHorticulture, Biswanath College of Agriculture, Assam Agricultural University, BiswanathCharialiwithanaimtostudythemorpho-physiologicalcharactersand yield as influencedbyvinemanagement. The treatments were: $T_1$(Trimming of growing tip of the primary vine at 8$^{th}$nodestage),$T_2$(Trimmingof growingtipof theprimaryvineat10$^{th}$nodestage),$T_3$(Trimming of growing tip of the primary vine at 12$^{th}$ node stage), $T_4$(Trimming of growingtip of the secondary vine at 6$^{th}$ node stage), $T_5$(Trimming of growing tip of the secondaryvine at 8$^{th}$ node stage), $T_6$(Removal of all tertiary vines), $T_7$(Retention of two tertiary vines)and $T_8$(control without pruning). The study revealed that among the treatments, $T_4$recordedthe highest primary vine length and inter-nodal length of primary vine at 60, 90 DAS and at 1$^{st}$ harvest. Number of primary vine was found to be highest under $T_5$ while$T_3$recorded maximum number of secondary vines, inter-nodal length of secondary vines, the highest total leaf chlorophyll content, relative leaf water content, leaf area index and maximum fruit yield. Therefore, trimming of growing tip of the primary vine at 12$^{th}$ node stage can be used as a vine management technique in pumpkin to get maximum yield.

***Keywords:trimming,nodestage,vine, pumpkin,morphological, physiological,yield.***

## 1. INTRODUCTION

The ancestors of pumpkin (*Cucurbita moschata*) are from Mexico and Peru. The crop canthrive in both hemispheres' tropics and is tolerant to warm weather. According to botany, thepumpkin's fruit is a variety of berry called a pepo and is regarded as extremely valuablevegetable. With chromosomal number 2x=40, pumpkin is an allopolyploid [1]. A relatively fertile, well-drained soil is necessary for growing pumpkin. Medium-textured soils with good internal drainage and a high water-holding capacity produce thehighest yields. They can be grown on a variety of soils, though it is not advised to use heavyclay soils. Although they are delicate to salinity and acidity, they can thrive in soils that rangefrommildlyacidic(pH 6.8)tomoderatelyalkaline(pH8.0).

Pumpkins are hardy, so even if a large number of leaves or a significant piece of the vine arelost, injured or removed, the plant will quickly sprout new secondary vines to replace thosethat were lost [2]. Although the productivity and quality of fruits depends ondifferent factors but proper vine management of the crop have positive influence of differentmorpho-physiologicalqualitieswhich inturnincrease theyieldand qualityofthefruits.

Aplant'sfunctionisimpactedby pruningsinceithasanimpactontheplant'sabilitytobearor produce fruit. It establishes and improves the plant's ability to produce fruits. By pruning,the plant or vine is forced to produce fruits of higher quality by having the sap flow driven ordirected towards the part of the plantthatbearsfruit.Due to the farmers' poor informationandlimitedknowledge,thepruningtechniqueanditsapplicationsinpumpkinarever yrare.Keeping in view that no systematic research work on effect of vine management on growth and yield of pumpkin have been carried out in Assam condition the present investigation was conducted.

## 2. MATERIALSANDMETHODS

The investigation was conducted at the Instructional cum Research Farm, Department ofHorticulture, Biswanath College of Agriculture, Assam Agricultural University, BiswanathChariali (26.7° N latitude and 90.5° E longitude and at 105 m above MSL) from October,2021toApril,2022.Theexperimentwaslaidoutonrandomizedblock design consisting of8 treatments with 3 replicationssuch as $T_1$(Trimming of growing tip of the primary vine at8$^{th}$ node stage), $T_2$(Trimming of growing tip of the primary vine at 10$^{th}$ node stage), $T_3$(Trimming of growing tip of the primary vine at 12$^{th}$ node stage), $T_4$(Trimming of growingtip of the secondary vine at 6$^{th}$ node stage), $T_5$(Trimming of growing tip of the secondaryvine at 8$^{th}$ node stage), $T_6$ (Removal of all tertiary vines), $T_7$ (Retention of two tertiary vines)and $T_8$ (control without pruning) by using the same variety of pumpkin. Pruningwasdonewhentheplantsreachedtheirpruningstageaccordingtodifferenttreatment using secateurs and wascutabovethenodeto avoid any injury to the node.In order to ensure ahealthy crop stand standard cultural practices were performed starting with the preparation ofexperimental plot by thorough ploughing followed by harrowing and levelling. Then thewhole plot was divided into 24 numbers of plots with 3 replications having 8 plots each. Eachplot/bed was prepared maintaining a size of 9 m x 4.5 m. Then pits were dug of size 30 cm$^3$and werefilled with mixture of cow dung and top soil.Seeds were sown in the pits with spacing of 3m x 1.5 m. Atfirst2-3 seeds were sown in eachpitandlateronthinningwasdone andthe healthiestplantwaskeptineachpit.

Morphological parameters such as length of the primary vine (cm), inter-nodal length of theprimary and secondary vine (cm), number of primary and secondary vines at 60, 90 days aftersowing (DAS)andat1$^{st}$harvestwererecorded.Forthephysiologicalparameterstotalleafchlorophyll content (mg g$^{-1}$fw), relative leaf water content (%) and leaf area index at 60 and90 DAS were recorded. Yield parameters such as fruit yield per plant and fruit yield per hectare were recorded**.** Observation made during field experimentation and dataobtainedfromlaboratory determinationsweresubjectedtoanalysisofvariance.Significance or non-significance of the variance due totreatments was determined by calculating the respective 'F' values by following the methoddescribedby [3].The significanceof differencebetweenmeanvalues of the parameters of the treatment was tested by computing critical difference (CD at5%)estimates.

## 3 RESULTS AND DISCUSSION

## 3.1Effect of vine management on morphological parameters

### 3.1.1 Length of primary vine

The findings presented in Table1show that pruning had significant effect on length of primary vine. The highest primary vine length (262.67, 361.56 and 438.89 cm) at 60, 90 DAS and at 1$^{st}$ harvest respectively was found under the treatment $T_4$while the lowest was recorded under the treatment $T_1$ (112.42, 115.42and114.50 cm)atall thethreestages *i.e*60,90 DASand at1$^{st}$harvest.The highest primary vine length in$T_4$ (trimming of growingtip of the secondary vine at 6$^{th}$ node stage)which could be explained by the plants absorbing enough nutrients and lightto enable healthy growth and development, thus increasingthelength. In eggplant [4] reported similar findings. According to [5] themaximumvinelengthmayalsobeascribedtoanincreaseincelldivisionandcell enlargement which might be another factor that promotes a larger inter-nodal length and, inturn, a longer vine length. The shortest primary vine length in $T_1$(trimming of growing tip of the primary vine at 8th node stage) might be plausible as a result of the vines' decreased auxin concentration [6]. Auxin,a hormone which promotes growth,isin charge of apical dominance,which encourages apical growth in plants. However, when pruning operations are carried out,apical dominance breaks down which reduces apical growth and encourages the growth oflateralbranches.Removingtheapicalbudalsoencouragedgrowthanddevelopmentinokra [7]. In long melon, the maximum length of primary vine was recorded when pruning was done byremoval of all lateral branches as flow of nutrients will be available only to the main vine asreported by [8]. When the main stem is pruned, concentration of auxin fallswhileconcentrationofcytokininrises.Theexpansionoflateralshootsisinducedbycytokinin.

### 3.1.2 Inter-nodal length of primary and secondary vine

The inter-nodal length was also affected due topruning(Table 1). The highest inter-nodal length of the primary vine was recorded by $T_4$(14.62 cm) at 60 DAS while $T_1$recorded the lowest (13.13 cm) inter-nodallength of primary vine.Similarly, $T_4$recorded the highestinter-nodal length of the primary vine (16.20 cmand 17.71 cm, respectively) at 90 DASand at 1st harvestand $T_1$ recorded under the lowest (14.42 and 14.69 cm at90 DAS and 1st harvest), respectively. By limiting the growth of unproductive plant parts, pruning operations promote regulatedgrowth by enhancing photosynthetic efficiency, which in turn promotes cell expansion inother plant parts. This is in close proximity with the findings of [9], [10], [11], [12], [6].

While measuring inter-nodal length of secondary vine, the highest (13.74 cm) was recorded by the treatment $T_3$at 60 DASwhich was statistically at parwith $T_5$(13.62 cm) and $T_2$(13.35cm).Similarly,at 90 DASand at 1st harvest the treatment $T_3$ recorded thehighest(15.18 cm and 16.4 cm respectively)while retention of two tertiary vines ($T_7$) resulted in the lowest inter-nodal length of secondary vine(10.68, 10.93 and 11.26 cm) at60,90 DAS and at 1st harvest, respectively .The highest inter-nodal length of the secondary vine under $T_3$might beattributed to larger cytokinin concentration that encouraged more cell division,which resulted in longer length of secondary vine. This supports the findings of [11]whichexplainedthatbyinhibitingauxinconcentration,cytokininconcentration increased and extension of secondary vines was subsequently improved.

**Table1. Effect of vine management on length of primary vine, inter-nodal length ofprimaryandsecondaryvineat60,90DASandat1st harvest.**

| Treatment | Lengthoftheprimary vine(cm) | Inter-nodal length ofprimaryvine(cm) | Inter-nodal length ofsecondaryvine(cm) |
|---|---|---|---|

| | 60 DAS | 90 DAS | At 1st harvest | 60 DAS | 90 DAS | At 1st harvest | 60 DAS | 90 DAS | At 1st harvest |
|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 112.42 | 115.42 | 114.50 | 13.13 | 14.42 | 14.69 | 11.30 | 13.85 | 14.44 |
| $T_2$ | 131.38 | 134.64 | 132.71 | 13.59 | 15.90 | 15.96 | 13.35 | 14.37 | 15.59 |
| $T_3$ | 161.24 | 163.47 | 162.33 | 14.17 | 15.14 | 16.10 | 13.74 | 15.18 | 16.40 |
| $T_4$ | 262.67 | 361.56 | 438.89 | 14.62 | 16.20 | 17.71 | 12.54 | 13.54 | 13.51 |
| $T_5$ | 245.99 | 355.00 | 418.14 | 13.33 | 14.81 | 15.35 | 13.62 | 13.48 | 14.62 |
| $T_6$ | 237.75 | 348.75 | 427.51 | 14.52 | 15.54 | 16.47 | 12.02 | 12.62 | 14.41 |
| $T_7$ | 250.70 | 344.73 | 421.73 | 14.28 | 15.65 | 15.95 | 10.68 | 10.93 | 11.26 |
| $T_8$ | 221.27 | 336.53 | 406.53 | 13.15 | 14.69 | 15.63 | 11.28 | 12.76 | 12.83 |
| S.Ed± | 0.45 | 0.55 | 0.56 | 0.06 | 0.20 | 0.23 | 0.36 | 0.32 | 0.26 |
| C.D.(P=0.05) | 1.12 | 1.18 | 1.21 | 0.13 | 0.42 | 0.50 | 0.77 | 0.69 | 0.56 |

$T_1$: Trimming of growing tip of the primary vine at 8th node stage, $T_2$: trimming of growingtip of the primary vine at 10th node stage, $T_3$: trimming of growing tip of the primary vine at12th nodestage, $T_4$: trimmingofgrowingtipofthesecondaryvineat6th nodestage, $T_5$: trimming of growing tip of the secondary vine at 8th node stage, $T_6$: removal of all tertiaryvines, $T_7$: retentionoftwotertiaryvinesand $T_8$: controlwithoutpruning.

### 3.1.3 Number of primary and secondary vine

Table 2 revealed that the number of primary vines and secondary vinesexhibited significant variation among thedifferent pruning treatments. At 60, 90 DAS and at 1st harvest the highest (5.47, 5.77 and 6.30) number of primary vines was recorded by $T_5$. On the other hand,lowest (3.30, 4.61 and 5.39) number of primary vines was recorded by $T_8$ at 60, 90 DAS and at 1st harvest, respectively. $T_3$at 60, 90 DAS and at 1st harvest recorded the highest (7.63,8.59 and 8.90) respectively,while the lowest (3.70, 4.06 and 5.22) secondary vine number was recordedby $T_8$at 60,90DASand at1stharvest. As forthe number of primary vines, maximum was recorded by the treatment $T_5$while $T_8$recordedthe minimum at all the three stages .Since pruningprevents the growth of apical buds and promotes the development of secondary vines, it alsohas an effect on the number of lateral branches. Pruning of the primary vine was performed in treatment $T_3$,which might have resulted in increasing number of secondary vines as apical dominance wasinhibited because pruningsuppressesapicaldominance[13].

**Table2.Effectofvinemanagementonnumberofprimaryandsecondaryvinesat60, 90DASandat1stharvest.**

| Treatment | Numberofprimaryvines | | | Numberofsecondary vines | | |
|---|---|---|---|---|---|---|
| | 60DAS | 90DAS | At1$^{st}$h arvest | 60DAS | 90DAS | At1$^{st}$h arvest |
| $T_1$ | 3.42 | 4.66 | 5.86 | 6.74 | 7.73 | 8.63 |
| $T_2$ | 5.23 | 5.60 | 5.91 | 5.48 | 7.16 | 7.46 |
| $T_3$ | 4.54 | 5.69 | 6.07 | 7.63 | 8.59 | 8.90 |
| $T_4$ | 3.86 | 4.68 | 4.95 | 4.34 | 5.41 | 6.35 |
| $T_5$ | 5.47 | 5.77 | 6.30 | 4.47 | 4.94 | 5.81 |
| $T_6$ | 3.68 | 5.10 | 5.30 | 4.52 | 5.09 | 5.50 |
| $T_7$ | 5.15 | 5.38 | 5.78 | 5.22 | 6.06 | 6.95 |
| $T_8$ | 3.30 | 4.61 | 5.39 | 3.70 | 4.06 | 5.22 |
| SEd± | 0.30 | 0.22 | 0.26 | 0.33 | 0.44 | 0.27 |
| C.D. (P=0.05) | 0.64 | 0.47 | 0.56 | 0.71 | 0.94 | 0.59 |

$T_1$: Trimming of growing tip of the primary vine at 8$^{th}$node stage, $T_2$: trimming of growingtip of the primary vine at 10$^{th}$ node stage, $T_3$: trimming of growing tip of the primary vine at12$^{th}$nodestage,$T_4$: trimmingofgrowingtipofthesecondaryvineat6$^{th}$nodestage,$T_5$: trimming of growing tip of the secondary vine at 8$^{th}$ node stage, $T_6$: removal of all tertiaryvines,$T_7$: retentionoftwotertiaryvinesand$T_8$: controlwithoutpruning

## 3.2 Effect of vine management on physiological parameters

### 3.2.1 Total leaf chlorophyll content

A perusal ofdata presented in Table 3indicatedthat thetotal leaf chlorophyll content was significantly affected by different pruning treatments.After 60 days of sowing $T_3$recordedthe highest (1.83 mg $g^{-1}$fw) total leaf chlorophyll content which was significantly at par with $T_6$ (1.79 mg$g^{-1}$fw). The superiority was maintained by $T_3$ at 90 DAS also with the highest (2.08 mg $g^{-1}$fw) total leafchlorophyll content followed by $T_6$ (1.95 mg $g^{-1}$fw) and $T_2$ (1.94 mg $g^{-1}$fw) while$T_8$recorded the lowest (1.44 and 1.71 mg $g^{-1}$fw) at 60 and 90 DAS. Similarfindings were reported by [14] in tomato and [15] in pointed gourd where maximum chlorophyll content was found under pruned plants ascompared to the unpruned plants. The green leaves are themajor factor contributing in photosynthesis, according to [16]. The vegetative growth is limited under pruning operations which makes light to penetrate easily in the innercanopy leading to more dry matter production which in turn increases the photosyntheticefficiency [17].

### 3.2.2 Relative leaf water content

Significant difference was noticed forrelative leafwater content(Table 3).The highest relative leafwater content was recorded by $T_3$ (78.11%) followed by $T_2$ (75.62%) and $T_1$ (73.28%) whilethe lowest (69.69%) was by $T_8$at 60 DAS. Similarly, $T_3$recorded thehighest (86.15%) relative leaf water content at 90 DAS whereas, $T_8$recorded the lowest (73.78 %) relative leaf water content with $T_6$ (74.23%) at par. Therelativeleafwatercontentisoneofthemaindeterminantsof thewater condition of the plant body. It maintains equilibrium between a plant's water intake and transpiration rate [18]. [17] opined that pruning can reduce vegetative growthand increase light penetration into the inner canopy, but it also raises the temperature, which results inwater loss. However, it was discovered from the current investigation that because of pruningon the main stem, $T_3$resulted in more number of secondary vines and more number of leaves,which might have resulted in a dense canopy and less light penetration, resulting in higherrelative leaf water content. The economic yieldwassubstantiallyimpactedbyrelativeleafwatercontent as reported by [19].

### 3.2.3 Leaf area index

Leaf area index which was measured at 60 and 90DAS also revealed to be significantly affected by different pruning treatments (Table 3). Maximumleaf area index was recorded in $T_3$(1.87 and 1.96) while the minimum (1.35 and 1.46) was recorded in $T_8$ at both 60 and 90 DAS.Higher number of leaves results in higher leaf area index as leaves are the key componentcontributing to photosynthesis as they contain stomata. These findings are consistent with thepresent investigation. The highest leaf area index was recorded by treatment $T_3$at both 60 and 90 days after sowing. Inbottle gourd more number ofleaves, total leaf area and leaf area index was recorded highest when pruning was done onsecondary branch at 6$^{th}$ node stage [20]. [21] and [6] also reported similar results in cucumber as they foundthat the plants which were pruned on main stem recorded highest number of leaves. Highest number of secondary vines under$T_3$might be the reason for increase in number of leaves per vine in the current investigation. As reported by [22] when leaf-fruit ratio is increased, it simultaneously results in highernumberoffruitsandmorecarbohydratecontent. Pruning helps in controlling the plant growth, number of vines, leaves *etc.* which is helpful for the plant in yielding better and also checks the plant's health but when plants are kept in theirnatural state they show uncontrolled growth and alsothere is decrease in yield [11].

**Table 3. Effect of vine management on total leaf chlorophyll content, relative leaf water content and leaf area index at 60 and 90 DAS.**

| Treatment | Total leaf chlorophyll content (mg $g^{-1}$fw) | | Relative leaf water content (%) | | Leaf area index | |
|---|---|---|---|---|---|---|
| | 60 DAS | 90 DAS | 60 DAS | 90 DAS | 60 DAS | 90 DAS |
| $T_1$ | 1.55 | 1.84 | 73.28 | 83.99 | 1.64 | 1.82 |
| $T_2$ | 1.76 | 1.94 | 75.62 | 85.56 | 1.75 | 1.85 |
| $T_3$ | 1.83 | 2.08 | 78.11 | 86.15 | 1.87 | 1.96 |
| $T_4$ | 1.54 | 1.85 | 71.39 | 79.37 | 1.54 | 1.59 |
| $T_5$ | 1.63 | 1.91 | 72.25 | 80.99 | 1.63 | 1.74 |
| $T_6$ | 1.79 | 1.95 | 70.29 | 74.23 | 1.61 | 1.66 |
| $T_7$ | 1.59 | 1.86 | 72.49 | 77.29 | 1.43 | 1.58 |
| $T_8$ | 1.44 | 1.71 | 69.69 | 73.78 | 1.35 | 1.46 |
| SEd ± | 0.02 | 0.02 | 0.40 | 0.42 | 0.05 | 0.11 |
| C.D. (P=0.05) | 0.06 | 0.05 | 0.87 | 0.91 | 0.12 | 0.25 |

$T_1$: Trimming of growing tip of the primary vine at 8$^{th}$node stage, $T_2$: trimming of growingtip of the primary vine at 10$^{th}$ node stage, $T_3$: trimming of growing tip of the primary vine at12$^{th}$nodestage,$T_4$: trimmingofgrowingtipofthesecondaryvineat6$^{th}$nodestage,$T_5$: trimming of growing tip of the secondary vine at 8th node stage, $T_6$: removal of all tertiaryvines,$T_7$: retentionoftwotertiaryvinesand$T_8$: controlwithoutpruning

## 3.3 Effect of vine management on yield per plant and per hectare

As depicted in Table 4,pruning had significantinfluence over fruit yield per plant (kg) and fruit yield per hectare (t/ha). Among the treatments, $T_3$ recorded the highest fruit yield per plant (15.47 kg) and fruit yield per hectare (27.88 t/ha) while $T_8$ recorded the lowest fruit yield per plant (8.57 kg) and fruit yield per hectare (15.48 t/ha). The highest production seen under the pruned plants may have been caused by larger or more number of fruits. This is consistent with the research done on cucumber by [23]. By allowing plants adequate light exposure, pruning boosted photosynthesis, which in turn increased source to sink ratio and raised the yield. Tomato and bitter gourd plants that had been pruned produced more fruit than the unpruned ones [24], [25] respectively. According to [26]pruning led to a reduction in the amount of wasted fruit, which raised the marketable yield of eggplant. When plants were pruned to four stems in greenhouse grown sweet pepper, fruit yield increased as compared to unpruned plants [27]. Similar results were found in capsicum by [28] and in chilli by [29].

**Table 4. Effect of vine management on fruit yield per plant (kg) and fruit yield per hectare (t/ha)**

| Treatments | Fruit yield (kg/plant) | Fruit yield (t/ha) |
|---|---|---|
| $T_1$ | 13.40 | 24.19 |
| $T_2$ | 11.85 | 21.36 |
| $T_3$ | 15.47 | 27.88 |
| $T_4$ | 12.61 | 22.78 |
| $T_5$ | 11.16 | 20.18 |
| $T_6$ | 11.10 | 20.05 |
| $T_7$ | 10.28 | 18.55 |
| $T_8$ | 8.57 | 15.48 |
| SEd ± | 0.03 | 0.02 |
| C.D (P=0.05) | 0.06 | 0.05 |

$T_1$: Trimming of growing tip of the primary vine at 8thnode stage, $T_2$: trimming of growingtip of the primary vine at 10th node stage, $T_3$: trimming of growing tip of the primary vine at12thnodestage,$T_4$: trimmingofgrowingtipofthesecondaryvineat6thnodestage,$T_5$: trimming of growing tip of the secondary vine at 8th node stage, $T_6$: removal of all tertiaryvines,$T_7$: retentionoftwotertiaryvinesand$T_8$: controlwithoutpruning

# 4 CONCLUSION:

The study revealed that different pruning treatments significantly affected the morpho-physiological characters and yield of Pumpkin.Trimming of growing tip of the primary vine at 12th node stage ($T_3$) produced maximum yield with better physiological condition of the plant.

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