



Effect of Length Main Stem Pruning Variation on Physiology Character Three Genotype Chilli Pepper (*Capsicum Frutescens* L.) Commercial

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Abstract : The objective of this research is to analyze effect of length main stem pruning variation on physiology character three genotype commercial chillipepper (*Capsicum frutescens* L.). Result of this research show that in qualitatively auxin and cytokinin was found to node samples where measurement indicated that both of these hormones correlated on lateral bud growth. In quantitatively, auxin was high in control and its opposite cytokinin was high in plant where pruning application, indicated that pruning of main stem can be change of auxin-cytokinin ratio to innisiate of lateral bud growth. Morphology character was observed, show that there are effect of main stem pruning to the number of nodes, number of branch, present of branch, but cannot effect to length of branch. Although nodes can be decline because of pruning, but these result can be consederation exact time of pruning..

Key word : main stem pruning, chilli pepper (*Capsicum frutescens* L.), apical dominance.

Introduction

Chilli pepper (*Capsicum frutescens*, L.) is a plant with form dichotomous branching or branch menggarpu two formed after the plants reach a height¹. Branching thus greatly limiting the growth of lateral shoots at the bottom of the division limit of branching. In addition, the branch will concentrate branching twigs that many will form at the top of the plant so that in the cultivation of chillies requires the support by installing a stake in adult plants so as not to fall down. It is considered less effective and efficient because of cost, effort and time. Therefore, it is necessary to cut the main stem.

Pruning physiologically main stem will break the dominance influence growth that occurs in apical buds that impede the growth of lateral shoots. This phenomenon can be explained in three theories, namely direct theory, theory and indirect diversion Nutritive theory. All three are very different theories in explaining the correlation of growth that occurs between the apical buds and lateral buds, but involves the same hormone the hormone auxin. Auxin in high concentrations can inhibit the growth of lateral buds directly with auxin by preventing the formation of lateral shoots himself (direct theory). In addition it also affects the direction auxin transport of nutrients, which will more nutrients are transported toward the apical bud (Nutritive diversion theory) than the lateral buds; and auxin can also affect the existence of other factors that can control the growth of lateral buds (indirect theory) as cytokinin².

Based on these theories, the reduction of auxin by way of pruning the main stem on the plant cayenne different ruasnya will provide a response in the form of changes morphologically and physiologically different.

The physiological changes that occur in the form of changes in the levels of auxin and cytokinin so influential on auxin-cytokinin ratio.

Thus in this study will be several variations of pruning the main stem that is one segment of the tip (R1) and three sides of the tip (R3) at the three genotypes cayenne commercial to analyze their effects on physiological conditions (concentration of auxin and cytokinin and ratios of both).

Materials and Methods

This study uses a completely randomized design (CRD) two factorial with three replications. The first factor is the cayenne commercial consisting of three genotypes (genotypes I, II and III or G1, G2 and G3) and the second factor is the variation in the length of pruning the main stem consisting of two variations and control (variation of one segment of shoots / R1, variations in the three segments of shoots / R3 and control / R0). Thus the total commercial chili sauce used was 27 plants.

The study consists of four stages; 1) Planting; 2) Pruning of main stem; 3) Measurement of levels of auxin and cytokinin. Planting begins with seeding for 29 days, followed by removal of plants into polybags and maintenance. Pruning the main stem (R1 and R3) is done when the plant was 17 days after planting, HST (before the plant form dichotomous branching). When the plant was 14 days after pruning, measured levels of auxin and cytokinin in both the plants trimmed one segment (R1), three segments (R3) and control (R0) for G1, G2 and G3. Samples taken are the main stem nodes with a length of 1 cm, with each treatment plant (R1 and R3) is taken two nodes, whereas the control plants (R0) taken three nodes. Two nodes are taken out of the treatment plant is the second node of the stem (ND) and the first node of the boundary pieces (NU). While the three nodes are taken out of the control plants is a node number two on the base of the stem (ND), the first node of the tip (NU1) and the third node of the tip (NU3).

Measurement of levels of auxin and cytokinin is done by using the method suggested by Unyayar³ the method of thin layer chromatography (TLC) followed by spectrophotometer method. Samples node as much as 0.1 grams of crushed, then mixed with 6 mL of solvent (methanol: chloroform: 2N ammonium hydroxide) with a ratio of 12: 5: 3 v / v / v). The mixture was incubated for 1 h at -20 °C. Results incubation extracted with 2.5 mL H₂O to form two phrases are phrases and phrases chloroform water. The phrase chloroform disposed while the phrase regulated water pH up to 2.5 by adding 1.1 mL 1N HCl. The phrase is then separated from the water by means of methanol evaporated using a rotary evaporator at a temperature of 45°C until the resulting bubbles. The evaporated again extracted with 1.5 mL ethyl acetate three times. Ethyl acetate extracts were collected and evaporated until the remaining 2 mL ago auxin and cytokinin tested qualitatively by TLC method. Phase silencing the form of silica gel plates 60 F₂₅₄ while the motion phase is a mixture of isopropanol: 2N NH₄OH: H₂O (10: 1: 1 v / v / v). As a standard used for auxin IAA and 6- (furfurilamino) -purin or kinetin to cytokines. Results dredged from the TLC plate was then mixed with 2 mL of methanol is then filtered and its absorbance was measured with a UV-VIS spectrophotometer. Auxin absorbance was measured at a wavelength of 222 nm and a cytokinin at a wavelength of 269 nm. Auxin and cytokinin levels were calculated using a standard curve.

Results and Discussion

Qualitative test results auxin and cytokinin

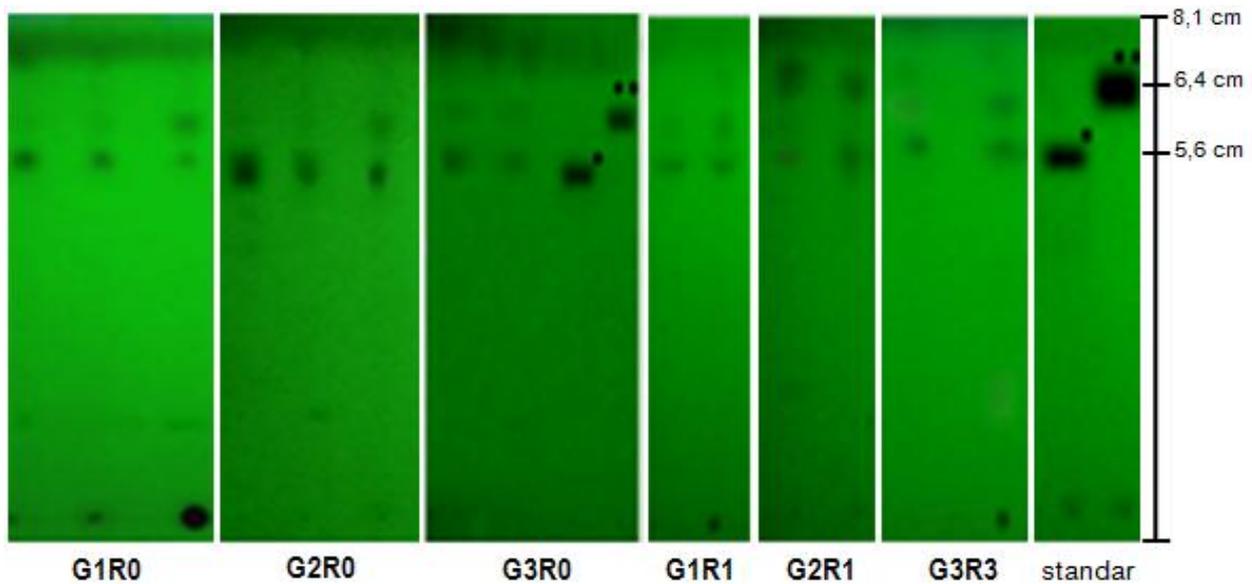


Figure 12. Example of chromatogram visualization ($\lambda = 254 \text{ nm}$) on a sample of cayenne pepper in this order: G1R0 (NU1, NU3, ND); G2R0 (NU1, NU3, ND); G3R0 (NU1, ND); G1R1 (NU, ND), G2R1 (NU, ND); G3R3 (NU, ND). * = IAA, ** = kinetin.

Spotting sample chromatogram formed in the image synonymous with patches of standard solution of IAA and kinetin which shows the value of retardation factor (Rf) of the same, namely 0.69 to 0.79 for the auxin and cytokinin. Chromatogram results Totolan samples also showed that in general between the control plants and the plants are pruned at all three genotypes cayenne shows the intensity of spotting different where patches of cytokinin in the plant control almost invisible or just a smear, except on the node basis, whereas in plants cropped good one segment (R1) and three sections (R3), forming patches of very clear, except the end node (Figure 12). Differences in intensity of these spots indicates the difference quantity auxin and cytokinin. However, overall in both the control plants and the plants are pruned showed auxin and cytokinin on each node samples tested (Table 4.1).

Table 4.1. Qualitative test results on all nodes sample tested by TLC

Node G1	IAA	K	Node G2	IAA	K	Node G3	IAA	K
G1R0ND	✓	✓	G2R0ND	✓	✓	G3R0ND	✓	✓
G1R0NU1	✓	✓	G2R0NU1	✓	✓	G3R0NU1	✓	✓
G1R0NU3	✓	✓	G2R0NU3	✓	✓	G3R0NU3	✓	✓
G1R1ND	✓	✓	G2R1ND	✓	✓	G3R1ND	✓	✓
G1R1NU	✓	✓	G2R1NU	✓	✓	G3R1NU	✓	✓
G1R3ND	✓	✓	G2R3ND	✓	✓	G3R3ND	✓	✓
G1R3NU	✓	✓	G2R3NU	✓	✓	G3R3NU	✓	✓

Note: A checkmark (✓) indicates auxin (IAA) and cytokinin (Kinetin, K)

The presence of auxin and cytokinin on node samples tested showed that auxin and cytokinin are two types fitohormon are correlated in influencing the growth of shoots lateral³. Auxin is a major cause fitohormon apical dominance which inhibits the growth of shoots lateral⁴auxin and cytokinin is otherwise phytohormon that play a role in initiating lateral bud growth⁵ by stimulating division cell^{6,7}.

Levels of auxin and cytokinin

Analysis of the levels of auxin and cytokinin G1, G2 and G3 between the control plants and the plants are pruned in both the ND and NU show that the average level of auxin (Figure 13 and 14) and cytokines (Figure 15 and 16), the highest held by chili cayenne G2 compared to G1 and G3; while between G1 and G3 are not significantly different. Meanwhile, according to the presence or absence of treatment showed that the highest levels of auxin is owned by the control plants (R0) that are significantly different than the plants trimmed (R1 and R3), while higher levels of cytokines found in plants trimmed. The high auxin and cytokinin in G2, indicating that although the three genotypes cayenne is still one type but has distinctive features of each are not only different but also morphologically different physiologically.

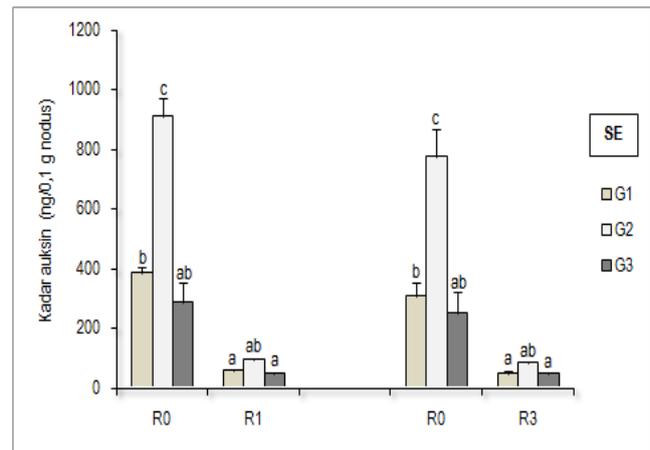
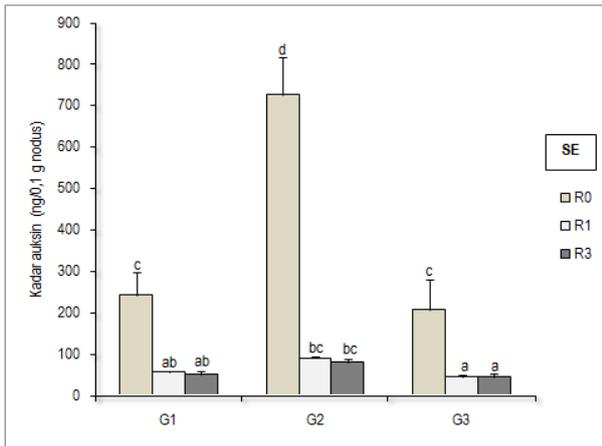


Figure 13. Levels of auxin basic node G1, G2 and G3 at R0, R1 and R3. Notation same letters indicate significant difference at $\alpha = 0.05$.

Figure 14. Levels of auxin end nodes G1, G2 and G3 at R0, R1 and R3. Notation same letters show no significant difference at $\alpha = 0.05$.

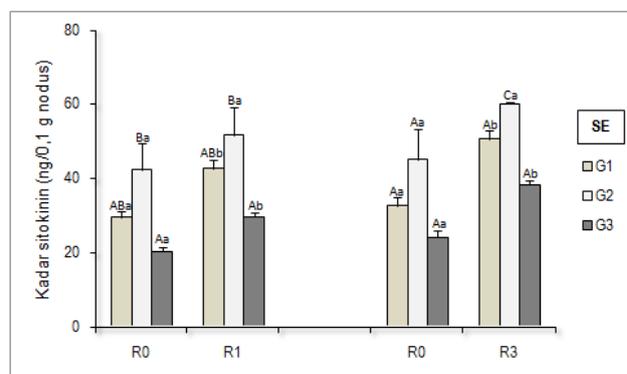
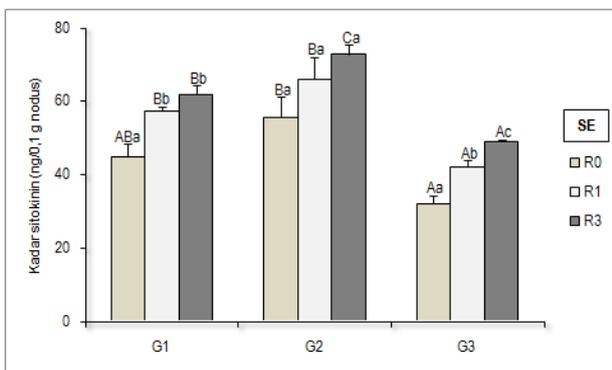


Figure 15. Levels of cytokines base node G1, G2 and G3 at R0, R1 and R3. The same capitalization on the same trimming variation showed no significant difference between genotype and lowercase letters the same at the same genotype showed no significant difference between the variations trimming at $\alpha = 0.05$.

Figure 16. Levels of cytokines end nodes G1, G2 and G3 at R0, R1 and R3. The same capitalization on the same trimming variation showed no significant difference between genotype and lowercase letters the same at the same genotype showed no significant difference between the variations trimming at $\alpha = 0.05$.

Plant morphology condition is influenced by internal and external factors that led to their character differences between varieties or between different genotypes⁸. Morphological characters that show the differences between cayenne G1, G2 and G3 is the shape and size of the fruit and the shape and size of leaves which generally G2 has fruit size and leaf size larger than the G1 and G2. The difference in the three genotypes chili characters are of course in addition influenced by genetic factors, also affected by physiological factors such as hormones. In certain concentrations of hormones can cause a number of genes previously not actively

start of expression, which at the level of the hormone melokuler can control gene regulatory proteins, transcription factors and repressors transkripsi¹⁶. This means that there is a correlation between the amount of hormones and the expression of certain genes so as to encourage the growth and development of the body tumbuhan⁹.

Differences in levels of auxin and cytokinin between the control and treatment plants indicate that pruning can reduce levels of auxin and cytokinin levels increase. This statement is reinforced by several studies that claim that when apical buds are trimmed, the process of reducing auxin (from the shoot apical) began to occur mainly in the node I, II and III of the limits of the pieces and will begin to be detected since the 4-6 hours after dipangkas¹⁰. The process of change decreased the concentration of auxin and cytokinin increased as a response to the pruning is very short and will then return to the original state, especially when the lateral buds begin to grow. This means Auskin and cytokines levels were measured in this study (14 days after pruning) is derived from the auxin and cytokinin lateral meristem derived from the root, which at this stage of the lateral buds begin to grow (Figure 17B).

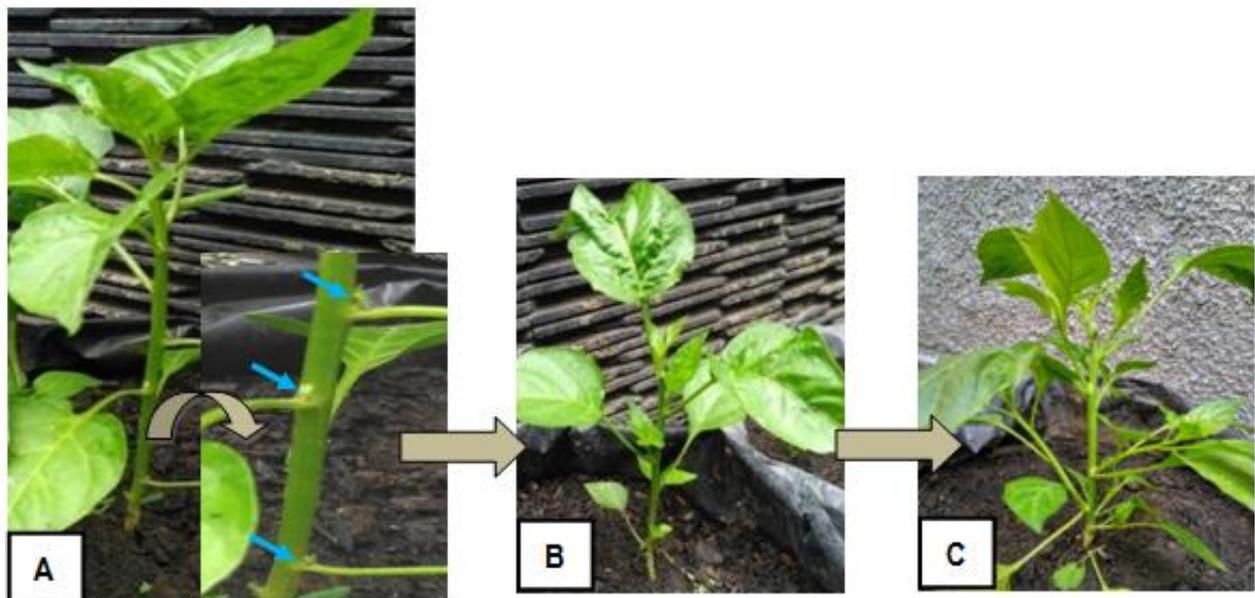


Figure 17. Phase lateral shoot growth at the G2 cayenne pepper. A. The growth of lateral buds before pruning (age 15 HSPT); B. The growth of lateral shoots 13 days after pruning (30 HSPT). C. The growth of lateral shoots 26 days after pruning. The arrows indicate the lateral buds.

The pattern of auxin translocation in plants that have a strong apical dominance tends to decrease from the tip toward the basal plant and vice versa cytokines increased, whereas in plants that are responsive to the growth of lateral buds have fluctuating¹⁰ pattern. In this study the pattern of translocation levels of auxin on each node measured on control plants (Figure 18A) shows the pattern of decreases toward the basal plant represented by NU1 → NU3 → ND and vice versa cytokines is increasing towards the basal both the control plants and the plants are pruned (Figure 19A and 19B).

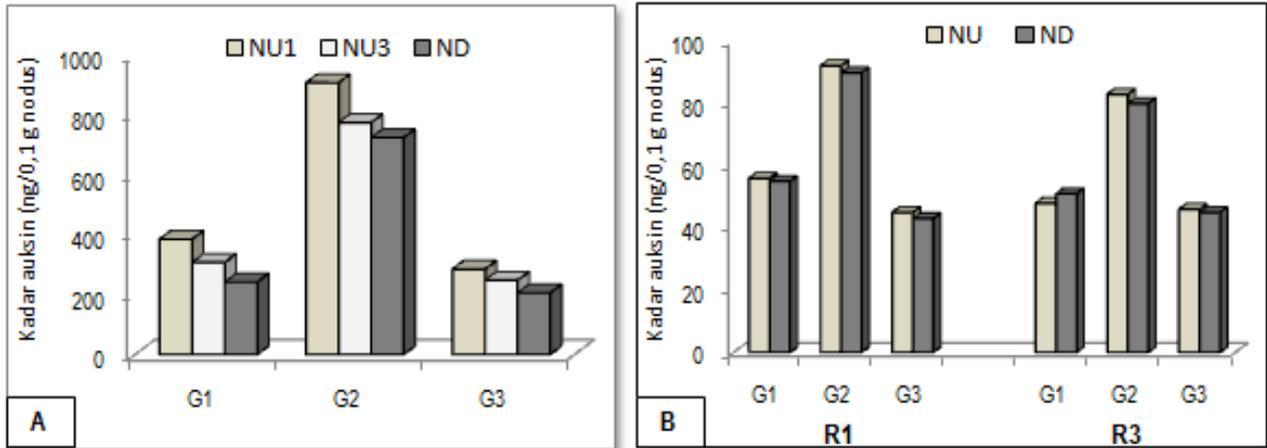


Figure 18.Pattern of auxin translocation cayenne G1, G2 and G3. A. Plant Control (R0), B.Plants were trimmed.

While the plants are pruned showed fluctuating pattern of auxin translocation between NU and ND (Figure 18B). Translocation pattern of auxin in the plant control decreasing toward the basal caused by increasingly far from the main synthesis (apical meristem), auxin will decrease. In contrast to cytokines showed a similar pattern between the control plants and the plants were trimmed due to cytokinins synthesized in the roots, causing further upward, cytokines decreases. The difference is higher pruned plants containing cytokines caused by cytokinin biosynthesis is not hampered by auxin, as a result of low auxin in plants.

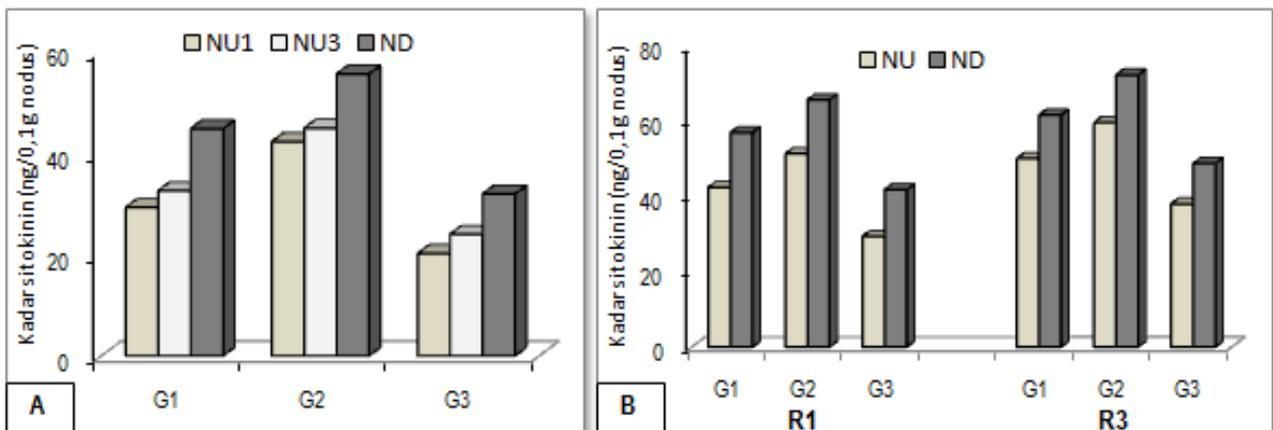


Figure 19.Pattern of cytokinin translocation cayenne G1, G2 and G3. A. Plant Control (R0), B. Plants were trimmed.

The ratio of auxin-cytokinin

Auxin-cytokinin ratio are high can inhibit the growth of lateral buds and vice versa auxin-cytokinin ratio is low can induce growth of shoots lateral19.

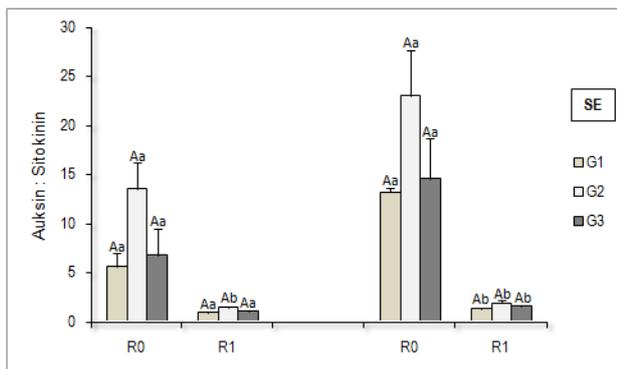


Figure 20. The ratio of auxin-cytokinin G1, G2 and G3 in plants R0 and R1. The same capitalization on the same trimming variation showed no significant difference between genotype and lowercase letters the same at the same genotype showed no significant difference between the variations trimming at $\alpha = 0.05$.

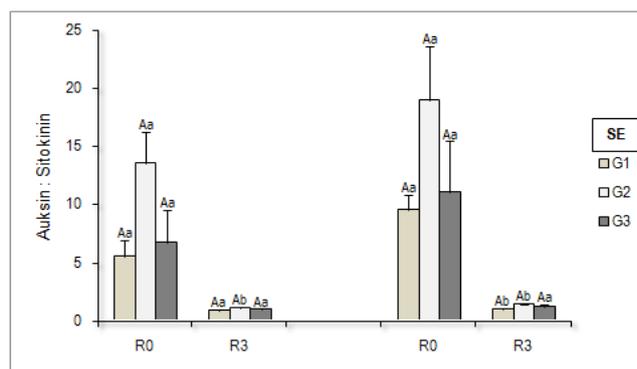


Figure 21. The ratio of auxin-cytokinin G1, G2 and G3 in plants R0 and R3. The same capitalization on the same trimming variation showed no significant difference between genotype and lowercase letters the same at the same genotype showed no significant difference between the variations trimming at $\alpha = 0.05$.

Auxin-cytokinin ratio in the diagram above shows both the comparison between R0 and R1 or R0 and R3, shows that the plant controls have auxin-cytokinin ratio is higher than the plants trimmed (Figures 20 and 21). A high ratio of auxin-cytokinin showed that the growth opportunities of the lateral buds on the control plants (Figure 17A) is lower than the plants trimmed. In contrast to the plants trimmed (Figure 17B) has a lateral bud growth opportunities are higher.

Conclusion

The conclusion of this study is the main stem pruning can reduce levels of auxin and cytokinin levels increase. The change of the levels of auxin and cytokinin effect on auxin-cytokinin ratio thus allowing the growth of lateral buds on cayenne G1, G2 and G3.

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