ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645
Indian Journal of Science and Technology, *Vol 12(27), DOI: 10.17485/ijst/2019/v12i27/145731, July 2019*

Effect of Topping Schedules on the Growth and Yield Parameters of Lady's Finger (*Abelmoschusesculentus*)

Josephine M. Bagasol*, Fredison B. Bistayan and Shildon D. Busiguit

College of Agriculture, Cagayan State University, Sanchez Mira, Cagayan, Philippines; josephine_bagasol@yahoo.com, fredison_bistayan@yahoo.com, shildon_busiguit@yahoo.com

Abstract

Objectives: This study was conducted to determine the optimum schedule of topping lady's finger to enhance its growth and yield parameters. **Methods/Statistical Analysis:** The treatments (20 DAE (Days after emergence), 30 DAE, 40 DAE and without topping (control)) were arranged in RCBD using three replications. Growth parameters, viz., a number of branches and leaf area at maturity and yield parameters, viz., the length and weight of fruits, projected yield per hectare and Marginal Benefit-Cost Ratio (MBCR) were observed. Data were subjected to Analysis of Variance (ANOVA) and Least Significant Differences (LSD) using the Randomized Complete Block Design (RCBD). **Findings**: Results revealed that topping the lady's finger at 20 DAE, 30 DAE and 40 DAE did not significantly affect the length of fruits and leaf area of plants, however, topping the lady's finger at 20 DAE significantly increase the number of branches, the weight of fruits, number of fruits and projected yield. On the basis of economics using the marginal benefit-cost ratio, topping the lady's finger at 20 DAE gained an 18% benefit while topping beyond this schedule resulted in a loss of 7.5%. Results indicate that the growth and yield decrease when topping is done beyond 20 DAE.The result of the present study is in conformity with the result of previous studies on the effect topping technology to crops, further it determines the optimum schedule of topping lady's finger to help enhance the production of lady's finger. **Application/Improvement:** The optimum schedule for topping crops could help increase the production of crop yield from a limited or from shrinking agricultural land.

Keywords: Growth, Lady's Finger (okra), Topping Schedule, Yield Parameters, MBCR

1. Introduction

Concerns on food security are now the focus of research[1] nowadays considering the challenge of increasing food production from a decreasing arable land for production. Planting of vegetables in the Philippines is one way of generating income among farmers.

Lady's finger commonly known as Okra (*Hibiscus esculentus*) is a vegetable in the mallow family. It is a tall growing, warm season and annual vegetable crop. It is a popular and profitable vegetable in the country[2]. It is valued for its edible green seed pods. The young and tender fruits can be prepared as salad, boiled, broiled or fried and can be mixed in many meat and fish dishes.

It is also an important vegetable mix of the famous Ilocano dish, pinakbet. Okra is rich in vitamins A, C and B complex, protein, calcium, fats, potassium, phosphorus, iron and carbohydrates. Generally, okra is planted for home consumption. But planting this crop extensively can give a year-round income for a farm family.

**Author for correspondence*

Despite having many valuable uses, farmers have felt difficulty of growing this vegetable as primary source of income[3]. Abundant researches have been made to enhance the production of okra like rejuvenation[3]; Rejuvenation is a technology that reduces the inputs of cultivating okra. This technology is a regrowth cropping system from the cut stalks of previous crop while conventional methods a cropping practice of planting/growing one after another of the same kind in an area throughout the year[4]. Another technology is the apical topping. Apical topping breaks the apical dominance and induces development of lateral branches thereby increase the site for pod development. The practice of topping has proved to be effective in increasing the yield levels of different crops[5–8]. However, the proper timing for apical topping for okra has never been considered. Keeping these points in view the present investigation was carried out to study the effect of Schedules on the Growth and Yield Parameters of Lady's Finger (okra).

2. Materials and Methods

An experiment was carried out to study the effects of topping schedules on the growth and yield of lady's finger and evaluated the marginal benefit-cost ratio of applying the different topping schedules (that is the number of Days After Emergence or DAE) at the instructional area of the Cagayan State University, Sanchez Mira, Cagayan, keeping an area of 215 m^2. The experiment was laid out in RCBD with three replications having four treatments including the control. The treatments were T_0 (control-no topping applied), T_1 (topping at 20 DAE), T_2 (30 DAE) and T_3 (40 DAE). Seeds of lady's finger (var. Smooth green) were sown in a soil media composed of 1 part vermin compost and 1 part garden soil. The crop was transplanted in the experimental area 7 Days After Sowing (DAS) at the rate of 1 seedling per hill at a planting distance of 60 x 45 cm. Chicken dung organic fertilizer was used as basal fertilizer for the crop at a rate of 300 grams per hill and was applied one week prior to transplanting. Side dressing was applied using urea fertilizer 30 Days After Transplanting (DAT) at a rate of 10 grams per hill. The tops of the lady's finger were removed at 20 DAE, 30 DAE, and 40 DAE.

Observations were made on ten randomly selected plants from each treatment. The data on growth parameters like a number of branches and leaf area at maturity and yield parameters like length of fruits, the total number of fruits, and the weight of fruits and computed yield per hectare was recorded. Analysis of variance was performed using the Statistical Tool for Agricultural Research (STAR) and the significance of differences among treatment means was performed using the Least Significant Difference (LSD).

3. Results and Discussion

3.1 Growth Parameters

The number of branches produced by the crop as affected by the different topping schedules is shown in Table 1 and the analysis of variance (ANOVA) is given in Table 2. Results revealed that the crops that were topped 20 DAE registered significantly more branches compared to the control. However, crops that were topped at 30 DAE and at 40 DAE registered a comparable number of branches with the control. This means that topping lady's finger beyond 20 DAE could lead to lower production of branches by the plant. This could be due to the fact that the side branches are given enough time to develop since the apical buds are removed at the early age of the plants and the concentration of auxin (an acidic organic substance that promotes cell elongation in plant shoots and usually regulates other growth processes) is at the lateral branches.

This result is in agreement with the findings that early topping significantly increases the number of branches produced by the plant. Similar result was obtained in a study on topping Sesbaniaon 45 DAS registered number of branches[9]. Parallel result was that the number of sweet potato cutting per plant is significantly related to the time of topping[10]. Similar results on the effect of topping on the number of branches recorded by the sunnhemp[11].

Table 1. Effect of topping at different schedules on the growth and yield parameters of lady's finger

Treatments	Number of Branches	Leaf area (cm^2)	Length of fruits (cm)	Total number of fruits	Weight (g) of fruits	Projected yield (ton/ha)
T_0 (control)	34[a]	768.8	9.3	186.0[a]	694.3[a]	4.75[a]
T_1 (20 DAE)	43[b]	551.0	8.6	268.3[b]	807.2[b]	5.98[b]
T_2 (30 DAE)	33[a]	603.2	9.2	174.3[a]	647.5[a]	4.54[a]
T_3 (40 DAE)	34[a]	578.2	9.0	175.3[a]	651.2[a]	4.62[a]
ANOVA	*	ns	ns	**	*	**
LSD	5.8	-	-	62.54	88.77	1.10
CV	8.07	13.42	7.43	10.28	6.35	7.25

The leaf area of the plants as affected by different topping schedules is shown in Table 1 and the Analysis of Variance (ANOVA) in Table 2. The leaf area of the plants in the control is 768.8 cm^2 and is higher than the leaf area of the de-topped plants. However, results revealed that the size of leaves of the plants was not affected significantly by the different de-topping schedules. The leaf size of the control is comparable with the leaf size of the de-topped plants. Although the effect is insignificant, there are reasons to believe that de-topping the plants negatively affected the leaf size of the plants as manifested by the lower leaf area of 551cm^2, 603.2 cm^2 and 578.17 cm^2 for T_1, T_2,and T_3, respectively. This result on the insignificant effect of the treatment on the leaf size the plants is in conformity to the work that was reported that leaf characteristics of plants is fixed genetically and cannot be easy altered by physical treatment on plants[12].

3.2 Yield Parameters

The size of the fruit of the plant as affected by the different topping schedules is shown in Table 1 and the Analysis of Variance (ANOVA) in Table 2. The result shows that longer fruits were recorded in the control followed by fruits in T_2 and T_3 and shorter fruits were recorded in T_2. However, the analysis of variance revealed that topping the lady's finger at different schedules did not affect significantly the length of fruits of the crop. Although the effect is insignificant, there are reasons to believe that topping negatively affects the fruit length of fruits as manifested by the decrease in size. The size of fruits could be associated with the number of branches of the plant. Since T_2 had the most number of branches to bear fruits, it goes that the plant has more branch and fruit to maintain. Thus, it resulted in a quit smaller in fruit size. The length of fruit is affected by season and environmental factors and crop physiology[13].

The total number of fruits of lady's finger as affected by different topping schedules is presented in Table 1 and the Analysis of Variance (ANOVA) is presented in Table 2. It was observed that T_1 produced the most number of fruits followed by T_0 and T_3 and the least is obtained by T_2. Analysis of variance revealed that there were significant differences between and among treatment means. Least significant difference test reveals an insignificant difference between and among T_0, T_2, and T_3. Treatment one was significantly higher than the three other treatments. This means that the different topping schedules significantly affect the fruiting of the crop in producing fruits. Topping at 20 DAE produced the most number of fruits and this could be due to the more productive branches of the plant. This result is in conformity with the study conducted with a finding

Table 2. Analysis of Variance (ANOVA) calculated for measured parameters

Parameters	SOV	DF	SS	MS	F	P
Number of Branches	Blocks	2	86	43	5.03^{ns}	0.016966
	Treatments	3	200.92	66.97	7.83*	0.052224
	Exp. Error	6	51.33	8.56		
Leaf area (cm^2)	Blocks	2	4657.51	2328.77	0.33^{ns}	0.067078
	Treatments	3	86468.1	28822.7	4.09^{ns}	0.730674
	Exp. Error	6	42240.4	7040.07		
Length of fruits (cm)	Blocks	2	0.35	0.17	0.39^{ns}	0.595306
	Treatments	3	0.92	0.31	0.68^{ns}	0.695424
	Exp. Error	6	2.69	0.45		
Total number of fruits	Blocks	2	518	259	0.61^{ns}	0.003814
	Treatments	3	18386	6128.67	14.35**	0.606557
	Exp. Error	6	2562	427		
Weight (g) of fruits	Blocks	2	10139.4	5069.7	2.57^{ns}	0.014203
	Treatments	3	50023.0	16674.35	8.45*	0.156406
	Exp. Error	6	11844.9	1974.14		
Projected yield (ton/ha)	Blocks	2	0.45	0.23	1.73^{ns}	0.008267
	Treatments	3	4.17	1.39	10.57**	0.25570
	Exp. Error	6	0.79	0.13		

that topping breaks the apical dominance and induces the development of lateral branches thereby increase the site for pod development[7,8].A positive influence of topping on the yield of sweet pepper under less favorable conditionwas obtained[14,15]. The practice of topping has proved to be effective in increasing the yield levels of different crops. However, topping the crop beyond 20 DAE could significantly decrease the yield. This result is in agreement with the result of study conducted on topping tomatoes wherein significantly reduced its yield/ plant was observed[16].

The weight of fruits harvested as affected by the different topping schedules is given in Table 1 and the Analysis of Variance (ANOVA) is shown in Table 2. The result showed that T_1 produced heavier fruits compared to the weight of fruits in T_0 (control), T_2 and T_3. The analysis of variance revealed that the weight of fruits produced in T_1 is significantly heavier compared to the weight of fruits in the control, in T_2 and in T_3.

However, the weight of fruit in T_2 and T_3 are comparable with the weight of fruits in T_0 (control). This means that de-topping lady's finger at 20 DAE significantly increases the weight of harvested fruits. This could be attributed to the fact that plants in T_1 produced more fruits than the control and the two other treatments. This result conforms to the study[7] and[8] that de-topping breaks the apical dominance and induces the development of lateral branches thereby increase the site for pod development.

Table 3. Marginal Benefit Cost Ratio (MBCR) of topping Lady's finger at different schedules

Treatment	Total Weight (kg)	Gross benefit (Php)	An added benefit (Php)	Added Treatment Cost (Php)	Net benefit (Php)	MBCR
T_0 (control)	0.694	20.82	-	-	-	-
T_1 (20 DAE)	0.807	24.21	3.39	19	5.21	0.18
T_2 (30 DAE)	0.647	19.41	-1.41	19	0.41	-0.075
T_3 (40 DAE)	0.651	19.53	-1.29	19	0.53	-0.07

The practice of topping has proved to be effective in increasing the yield levels of different crops. Parallel result has reported[17] that topping had a significant effect on weight of fresh vines and leaves of sweet potato.

3.3 Projected Yield (ton/ha)

The yield of the crop when topping technology is applied in a hectare basis is presented in Table 1 and the Analysis of Variance (ANOVA) is presented in Table 2. The result shows that the yield in T_1 is significantly higher than the yield in T_0 (control), T_2 and T_3 as revealed by the analysis of variance. This result could be associated with the fact that T_1 produced more fruits than the other treatments and the plants in T_1 had more productive branches to produce fruits. This means that de-topping the plant at 20 DAE could increase yield. This result conforms to the study[7] and[8] that de-topping breaks the apical dominance and induces the development of lateral branches thereby increase the site for pod development. The practice of topping has proved to be effective in increasing the yield levels of different crops[5–8].

3.4 Marginal Benefit Cost Ratio (MBCR)

The marginal benefit-cost ratio of de-topping Lady's finger at different schedules is presented in Table 3. The plants that were de-topped at different schedules have the same added treatment cost of Php 19.00. De-topping the crop at 20 DAE attained the highest weight of 0.807 kg and gained an added benefit 3.329, while the crops that were de-topped at 30 DAE and 40 DAE incurred a loss of Php 1.41 and Php 1.29, respectively. The results show that for every peso cost invested in de-topping the crop at 20 DAE gained a benefit 0.18, while the crops de-topped at 30 DAE and 40 DAE incurred a loss of 0.075 and 0.07, respectively.

4. Conclusion

Based on the result of the present study, the following conclusions were drawn;

1. Topping lady's fingers at 20DAE produced the highest number of branches, fruits, the weight of fruits and projected yield.
2. The leaf area and the length of fruits of the crop de-topped from 20 DAE to 40 DAE are comparable with the leaf area and length of fruits produced by the control group.
3. Topping the crop beyond 20 DAE could lead to economic loss as manifested by the decrease in the growth and yield parameters and marginal benefit-cost ratio.

5. Acknowledgment

The researchers would like to acknowledge the people whom in a way helped during the conduct of this research work.

6. References

1. Food demand to 2050: Opportunities for Australian agriculture. Available from: http://www.agriculture.gov.au/SiteCollectionDocuments/abares/publications/Outlook2012FoodDemand2050.pdf.
2. Department of Agriculture Region 2. Available from: https://www.facebook.com/Department-of-Agriculture-Regional-Field-Office-No-02-460028544044393/.
3. Sumagaysay CL. Enhancing the productivity of okra (Hibiscus esculentus). International Journal of Education and Research. 2014; 2(1):1-8.
4. Flauta EF. Resource unit in horticulture 236. Agricultural Production Technology II. 1984; 250.
5. Bhattacharjee AK, Mitra BN. Jute seed productivity and its quality as influenced by suppression of apical dominance. Jute and Allied Fibres: Agriculture and Processing. 1999; 177-185.
6. Sajjan AS, Shekaragouda M, Badanu VP. Influence of apical pinching and pod picking on growth and seed yield of okra. Karnataka Journal of Agricultural Sciences. 2002; 15(2):367-72.
7. Jagannatham J, Rajendra KB, Sreelatha T, Rajabapa RV. Effect of topping on seed yield and fibre yield of mesta, sabdariffavscannabinus. Abstracts of Papers: International Symposium on Jute and Allied Fibres Production; 2008. p. 121-30.
8. Singh F, Kumar R, Kumar P, Pal S. Effect of irrigation, fertility and topping on Indian mustard (Brassica juncea). Programming Agriculture. 2011; 11(2):477-8.
9. Gopal M, Durairaj SN, Kumar RS, Marimuthu S. Influence of topping and nutrient management practices on growth and seed yield of dhaincha (Sesbania aculeate). Agricultural Science Digest. 2016; 36(4):315-8. https://doi.org/10.18805/asd.v0iOf.11440.
10. Effect of time and frequency of topping on storage root and cutting production of a bushy sweet potato cultivar. Available from: http://agris.fao.org/agris-search/search.do?recordID=PH19900082635.
11. Tripathi MK, Chaudhary B, Singh S, Bhandar HR. Growth and yield of sunnhemp (Crotalaria juncea L.) as influenced by spacing and topping practices. African Journal of Agricultural Research. 2013; 8(28):3744-49. https://doi.org/10.5897/AJAR12.6919.
12. Kerby TA, Cassman KG, Keeley M. Genotypes and plant densities for narrow-row cotton systems. II. Height, nodes, earliness, and location of yield. Crop Science. 1990; 30:644-9. https://doi.org/10.2135/cropsci1990.0011183X00300003 0034x.
13. Franco AD, Morales AO, Gallardo JL. Fruit characteristics and yield of new okra hybrids. Subtropical Plant Science. 1997; 49:8-11.
14. Buczkowska H. Effect of plant pruning and topping on yielding of eggplant in unheated foil tunnel. Actascientiarum Polonorum Hortorumcultus. 2010; 9(3):105-15.
15. Effect of plants topping on the yield of three sweet pepper cultivars. Available from: http://agris.fao.org/agris-search/search.do?recordID=PL2004000564.
16. The effect of topping, spacing and pruning on the crop duration, fruit yield and quality of tomatoes (Lycopersiconesculentm Mill). Available from: http://agris.fao.org/agris-search/search.do?recordID=GH8800093.
17. Mulungu LS, Mwailana DJ, Reuben SSOW, Tarimo JPA, Massawe AP, Makundi RH. Evaluation on the effect of topping frequency on yield of two contrasting sweet potato (Ipomoea batatas L.) Genotypes. Journal of Applied Sciences. 2006; 6(5):1132-7. https://doi.org/10.3923/jas.2006.1132.1137