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Effect of Tendril Pruning on the Growth and Yield of Cucumber (*Cucumis sativum* L.) in Owo, Southwest Nigeria

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Abstract - Cucumber (Cucumis sativus* L.*) is an important accessory fruit which is also perceived and eaten as vegetable. Despite its agricultural importance, the practice of tendril pruning as an agronomic technique in cucumber cultivation has received limited research attention. This study investigated the effects of tendril pruning on the growth and yield of cucumber at the Teaching and Research Farm of Rufus Giwa Polytechnic, Owo (latitude 7°12'N, longitude 5°35'E, 345 m above sea level), situated in the rainforest zone of southwestern Nigeria. The experiment was arranged in a Randomized Complete Block Design (RCBD) with three replicates, comprising two treatments: unpruned (control) and pruned tendrils. Tendril pruning was initiated at the onset of flowering using a ballot method for treatment allocation. Results indicated that tendril pruning significantly enhanced vegetative growth. The number of female flowers per plant was higher in plants with pruned tendrils (4.67) compared to unpruned plants (4.12), while the number of male flowers was greater in plants with unpruned tendrils (control) (8.48) than in pruned plants (5.39). Additionally, pruned tendril plants exhibited significant improvements in number of fruits, fruit length, fruit diameter, fresh fruit weight, and total fruits weight per plant. These findings suggest that tendril pruning positively influences cucumber productivity. Further investigation is therefore recommended to determine the optimal timing for tendril pruning. Moreover, breeding cucumber varieties without tendrils may offer a promising strategy for enhancing yield while reducing agronomic stress.

Key-word: Tendril, pruning, agronomic technique, growth, yield

I. INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a warm season, herbaceous, monoecious annual plant with sprawling vine, large leaves, having some main stems from which the tendrils branch (Long, 2015). It is a cultivated creeping plant in the Cucurbitaceae family that bears usually cylindrical fruits, which are used as culinary vegetables (Long, 2015; Felix, 2021).

Cucumber has a long history of cultivation with record of 3,000 years in Asian agriculture (Long, 2015). It originated from India, where a great many varieties have been found (Long, 2015). There are three main types/varieties of cucumber viz slicing, pickling, and seedless within which several cultivars have been created (Long, 2015; Felix, 2021).

In Nigeria cucumber is grown across agro-ecological zones from the rainforest to the savannah, with different production patterns, leading to varying yield (Ndubuisi and Yaduma, 2021).

Adeoye and Balogun (2016) listed the leading producing northern states as Plateau, Kaduna, Katsina, Kano, and Benue, while other southern states with high production include Enugu, Ebonyi, Akwa Ibom, Oyo, Cross River, Rivers, and Nassarawa. In recent time cucumber is ranked as a major horticultural crop cultivated in Nigeria due to its health benefits (Ndubuisi and Yaduma, 2021).

Cucumbers have a mild, refreshing taste and high water content with potential that relieve dehydration and pleasant to eat in hot weather (Ware, 2019). The juice has been described as a repellent against wood lice and fish-moths (WIKI, 2023). It is also used in some industries in producing beauty product (Ware, 2019; Wilcox *et al.,* 2015).

To meet growing local demand cucumber farmers are still faced with a lot of problems which has to do with production techniques like pruning and staking, which influence its production in terms of yield and fruit quality (Ndubuisi and Yaduma, 2021; Ekwu and Utobo, 2011). Pruning is a cultural technique in

agriculture employed to facilitate both crop yield and fruit quality by manipulating plant resource allocation to enhance yield (Ndubuisi and Yaduma, 2021). It has been observed that the main stem laterals and particularly, tendrils grow fast, thereby demanding more sink (Haifa, 2022).

The un-branched tendril grows from the base of the petiole, helping the stems, which cannot twist themselves, to climb over other plants or objects (Haifa, 2022). A tendril tip, upon touching a support coils around it, pulling the whole plant towards the support (Vedantu, 2023). Apart from this task, tendril is also considered to be weak source organ, due to its green nature, at tender stage (Vedantu, 2023). Extensive researches carried out confirm that pruning lateral branches had effect on growth and yield of cucumber (Mardhiana *et al.,* 2017). The essence is to redirects plant resources, primarily sugars from photosynthesis towards fruit development on the main stem or selected branches, at the expense of vegetative growth (Mardhiana *et al,* 2017). Scientific investigations and gardening systems discuss tendril potential benefits and use, even though recommendations on how to handle tendrils pruning vary (Zezhou *et al*., 2023)

The extent to which tendril pruning contributes to growth, development and fruit yield of cucumber has not been fully annexed. Pruning of tendrils from cucumber stem during growth as agronomic practice during cultivation needs to be adequately evaluated. This knowledge will allow researchers and gardeners to optimize specific plant traits, better manage genetic resources, and ensure sustainable use of plant diversity. This study was carried out to evaluates the effect of tendril pruning on the growth, fruit yield and quality of cucumber in the study area.

II. MATERIALS AND METHODS

Description of Study Area and Soil Evaluation of Project Site

Field experiment was carried out at Rufus Giwa Polytechnic Teaching and Research Farm located on latitude 7^0 14’ 37”^{N} and longitude 5^0 30’ 36”^{E}, Owo, south-west, Nigeria. The area has an elevation of 345m above sea level and is characterized by a bimodal rainfall pattern with mean annual rainfall of 1800mm. The temperature typically varies from 18^0C to 32^0C and is evenly distributed throughout the year. Relative humidity is high, up to 86% during wet season (Weatherspark, 2023).

Prior to bed preparation, initial nutrient status of soil was determined by taking samples for laboratory analysis. The soil samples were collected using auger from 10 points across the plots to have a representative sampling, at 0-25 cm and then bulked together and was made to pass through a 2 mm sieve in order to have composite sample. The composite samples were prepared using standard procedures and analyzed for physical and chemical properties.

Total organic carbon was measured using modified Walkley-Black chromic wet chemical oxidation and spectrophotometric method (Ibitoye, 2008). Total nitrogen (total N) was determined using the micro-Kjeldahl digestion method (Ibitoye, 2008). Soil pH (S/W ratio of 1:2) in water was measured using the glass electrode pH meter and particle size distribution using the hydrometer method (Ibitoye, 2008). Available phosphorus, available sulphur, exchangeable cations (K, Ca, Mg and Na) and micronutrients (B, Cu, Mn, Fe, and Zn) were analyzed based on Mehlich 3 extraction procedure (ibitoye, 2008) and reading with Microwave Plasma-Atomic Emission Spectrometer (MP-AES, Agilent Devices, US). Exchangeable acidity (H+ + Al3+) was determined by shaking the soil with 1N KCl and titration with 0.5 N NaOH (Ibitoye,). Cation exchange capacity (CEC) was calculated as the summation of exchangeable cations (K, Ca, Mg and Na) and exchangeable acidity (H+ + Al3+). The soil order is also alfisoil classified as Toxic Tropuldalf (USDA) derived from quality, gnesisi and schist (Agbede 2006).

Materials sources

The variety of Cucumber planted is Ashley variety, an early maturing type obtained from Let Farm Agro Input and Supplies, Akure, Ondo State, Nigeria. Pruning knife was purchased from Oba market, Akure. Rope and pegs for marking out plots were obtained from Oba market, akure, Ondo State, Nigeria.

Land preparation, Manure application and Planting

The land was mechanically ploughed. Two weeks before harrowing, pig manure was worked into the soil, and then harrowed. The blocks and plots were laid out using line and pegs.

Seeds were sown 2 per stand at spacing of 80cm X 80cm apart. At four weeks after planting, seedling were randomly sampled and tagged for treatment imposition.

Experimental Design

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The treatment; T0 {Control (unpruned)}, T1 (Pruned) were randomly allocated to plots by balloting methods. There were four replicates per plot. Each block measures 8m X 8m with lm work space between plots, Seed were sown at spacing of 80cm x 80cm, giving population of 15,625 stands.

Agronomic Practices

Weeding

Weeds were manually removed from plot by simple hand hoe to reduce competition with cucumber plants. The first weeding was carried out 3 WAP (weeks after planting). Subsequent weeding were done as deemed necessary on the plots.

Data Collection

Data were collected on vegetative parameters (vine length, number of leaves, number of lateral branches, leaf length and leaf width) and yield parameters (number of female flower, number of male flower, number of fruit / plant, fruit length, fruit girth, fruit weight / plant and fruit yield (kg)/ ha from the tagged plants sampled from plants with pruned tendril and plant samples of unpruned tendril. The data collected were subjected to analysis of variance and treatment means were compared using LSD ($p<0.05$).

III. RESULT

Weather and Vegetative Growth

Weather scenario during the period of cultivation of cucumber in the study area is shown (Table 1). Rainfall was at its peak in June (367.9mm) while August recorded the least amount (19.0mm). Total rainfall recorded between May – October, 2022 was 973.4cm and was fairly distributed throughout the growing period. Lowest temperature (28.6^0c) was recorded in August and the highest was in May (33.0^0c). Relative humidity was 72%. August recorded the highest (90%) and the lowest was in May (60%).

Effect of tendril pruning of cucumber to vegetative growth (Table 3)

Cucumber vine length increased linearly from seed emergence to 50% flowering stage under both pruned and unpruned (control) treatments. Mean vine length was 64.40cm for plant with pruned tendril while the mean vine length for plant with unpruned tendril was 63.65cm. The values were significantly different ($p < 0.05$).

The mean number of lateral branches produced by plants with pruned tendril was 5.76 while plants with unpruned tendril recorded 3.21. The values were significantly ($p < 0.05$) different . Mean leaf length and mean leaf width of 52.55cm and 17.48cm in plants with pruned tendril was significantly different from mean leaf length and mean leaf width of plant with unpruned tendril of 40.10cm and 13.20cm respectively. Mean value for leaf area index (LAI) of pruned tendril was 225.61 and was significantly different ($p < 0.05$) from unpruned tendril with mean value of 154.48. Plants with unpruned tendrils have higher mean number of leaves of 40.58 while plants with pruned tendril recorded 32.32. The difference was not significantly ($p < 0.05$) different.

Effect of tendril pruning of cucumber to Yield and yield component (Table 4)

Tendril pruning significantly influenced flowering, yield and yield components of cucumber at flowering and fruit harvest of cucumber. Significantly lower mean number of female flowers (4.12) was recorded in plants with unpruned tendril as compared with higher mean number of female flower (4.67) obtained in plant with pruned tendril. Similarly, the mean number of male flower was significantly higher in plant with unpruned tendril (8.48) than in plants with pruned tendrils (5.39). Average number of fruits per plants (2.47), average fruit yield per plant (5.19), average fruit weight (1.67) and yield per hectare (36,468.36kg/ha) of plant with pruned tendril were significantly ($p<0.05$) enhanced as compared with the plants with unpruned tendril which recorded lower mean number of fruits per plants (2.06), average fruit yield per plant (3.39), average fruit weight per plant (1.27), and yield per hectare (22,055.64kg/ha).

Table 1: Physical and chemical properties of soil at the experimental site

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Samples	Composition
pH 1:2 (H_2O)	5.48
Sand (%)	64.30
Clay (%)	41.50
Silt (%)	14.95
Textural class	Sandy-clay-loam
Organic carbon (%)	1.59
Organic matter (%)	2.74
Nitrogen (mg/kg)	0.29
Phosphorous (mg/kg)	12.62
Potassium (mg/kg)	0.37
Sodium (cmol/kg)	0.52
Calcium (cmol/kg)	3.20
Magnessium (cmol/kg)	0.29

Table 2: Climatic Data during the Growth Period of Cucumber in year 2022

Month	Rainfall (mm)	Temperature (^{0}c)		Relative Humidity (%) 0900hrs.	
		Max	Min.	1500hr	
May	99.0	33.0	22.7	81	60
June	367.9	31.7	22.1	87	66
July	226.1	29.6	21.4	88	72
August	19.0	28.6	21.7	90	74
September	59.7	30.0	21.9	88	64
October	201.7	31.1	22.9	88	65
Total	973.4	164	132.7	502	406

Source – Rufus Giwa Polytechnic Meteorological Station, 2022

Table 3: Effect of Tendril Pruning on Vegetative Growth of Cucumber (*Cucumis sativum* L.) at 50% flowering stage

S/N	Parameter	Prune	Unprune	LSD 5%
1	Vine Length (cm)	64.40*	63.65	0.774
2	No of Branches/plant	5.76*	3.21	0.148
3	Leaf Length/Plant	15.55*	14.10	0.770
4	Leaf Width/Plant	17.48*	13.20	3.880
5	Leaf Area Index (LAI)	225.61*	154.48	4.680
6	No of Leaf/Plant	32.32ns	40.58	0.017

*= Significant at LSD, ns= Not Significant at LSD

Table 4: Effect of Tendril Pruning on Yield of Cucumber (*Cucumis sativum* L.) at Flowering and Harvest

S/N	Parameter	Pruned	Unpruned	LSD 5%
1	No. of Female flower	4.67*	4.12	0.550
2	No. of Male Flower	5.39	8.48*	0.006
3	Fruit yield/ plant	5.19*	3.93	0.111
4	No. of Fruit/Plant	2.47*	2.06	0.077
5	Fruit Weight/Plant (kg)	1.67*	1.27	0.215
6	Fruit yield / hectare (kg)	36,468	22,055	6.450

*= Significant at LSD, ns= Not Significant at LSD

IV. DISCUSSION

Plant growth and development were influenced greatly by favourable weather conditions occasioned by rainfall prevalent at the time of the experiment. The rainfall was fully established, providing adequate moisture, in combination with other climatic factors, which enhance germination and growth of cucumber (Odhiambo1 and Aguyoh 2022). This study established that cucumber with pruned tendril show best growth and vigour within optimum range of ecological amplitude, as compared to unprunned tendril plants. Utobo (2010), in a similar study noted that pruning influenced growth and yield of cucumber varieties at Abakaliki agricultural area, Southeastern Nigeria.

Vegetative growth of cucumber was significantly influenced by tendril pruning in this study. The positive response of this could be linked to the mobilization of sink partitioned for tendril to other organs of the plant, while unpruned tendril, in competition with other organs, reduce resources allocation thereby leading to slow growth. In a study highlighted by Ekwu *et al*. (2012), it was noted that no-pruning of lateral stem reduced the rate of growth of cucumber, leading to low yield of fruits . The general mechanism controlling growth and sizes of tendril is driven by inherent and abiotic factors (Mizukami and Fischer, 2000). This study posits that other organs sharing similar inherent driven hormone responsible in growth pathways facilitates more of the sink and hormones at the time of tendril pruning, in favour of cucumber growth and development.

Cucumber plants responded favourably to tendril pruning in facilitating higher number of female flower as compared to more male flower obtained in unpruned tendril in this study. The higher female flower production could be related to combined effect of increased sink and hormonal released when tendril was pruned.However, tendril pruning did not favour equal proportion of male flower production. This could be linked to variation in hormonal requirement of different flower.In a study conducted by Golabadi *et al*. (2018) on cucumber plants , it was noted that different concentrations of hormones had significant effects on the sex expression in cucumber.The pruning of tendril probably might have induced the surge of hormone that favour female flower production, thereby enhancing its increase. Further to this, production of more female flowers situates increase fruits production and improved yield.

Cucumber is a monoecious, entomophilous plant, meaning that it has both male and female flowers on the same plant and depends on insects for pollination (Seminis, 2017). Reports Seminis (2017), indicated that increasing the number of female flowers is a key factor in boosting fruit production in cucumber plants (Seminis, 2017). This value is the basis for many horticultural practices aimed at maximizing yield.
Several factors and agricultural practices have implications on the female to male ratio, which influences yield. According to Boulan and Leopold (2021) a corrdinated reduction in most body parts is observed under nutritional restriction, highlighting that systemic hormonal relays play a key role in adjusting organ and body growth in response to nutrient availability. Tendril pruning in this study showed higher hormonal shift influencing transfer materials for vegetative growth and development, enhancing yield in cucumber.

V. CONCLUSION

This study showed that tendril pruning influences growth and yield of cucumber in the study area. The result revealed that nutritional limitation of body parts decrease in a matching display, which emphasizes the crucial role of systemic hormonal signaling in adapting both organ and overall body growth to the availability of nutrients. Tendril pruning in this study showed higher hormonal effectiveness that facilitated vegetative growth of cucumber, enhancing allocation of growth resources meant for tendril growth and development to facilitate photosynthesis, hormone signaling and secondary metabolism to favour increase leaf area, number of female flower and eventually, increase yield.

VI. RECOMMENDATION

Based on the finding of this study, it is recommended that tendril pruning be adopted as cultural practices in cucumber production for enhanced fruit yield. Tendril pruning could be demanding and tasking, which may lead to increased cost of production. Therefore, plant breeder can develop cucumber hybrids without tendril in order to bypass the cost implication of pruning during production.

REFERENCES

[1] Adeoye, I. B., & Balogun, O. L. (2016). Profitability and efficiency of cucumber production among smallholder farmers in Oyo State. *Journal of Agricultural Science*, 61(4), 387-398.

[2] Agbede, T. M. (2006). Effect of tillage on soil properties and yam yield on an Alfisol in Southwestern Nigeria. *Soil and Tillage Research*, 86, 1-8. https://doi.org/10.1016/j.still.2005.01.012

[3] Boulan, L. and Léopold, P. (2021). What determines organ size during development and regeneration? Development. 148 (1): dev 196063. Doi: 10.1242/dev.196063. Retrieved 9/ 9/ 23

[4] Ekwu, L. G., & Utobo, E. B. (2011). Effect of staking and pruning on the growth and yield of cucumber (Cucumis sativus L.). *International Journal of Agriculture and Rural Development*, 13(2). https://doi.org/10.4314/ijard.v13i2.67415

[5] Ekwu, L. G., Nwokwu, G. N., & Utobo, E. B. (2012). Effect of mulching materials and pruning on growth and yield of cucumber (Cucumis sativus L.). *International Journal of Agriculture and Rural Development*, 15(2), 1014-1021.

[6] Felix. (2021). Cultural practices for growing cucumber. *Agrigist*. https://www.agrigist.com/cultural-practices-for-growing-cucumber

[7] Golabadi, M., Golkar, P., & Eghtedary, A. R. (2012). Assessment of genetic variation in cucumber (Cucumis sativus L.) genotypes. *European Journal of Experimental Biology*, 2(5), 1382-1388.

[8] Haifa (2023). Crop Guide: Growing Cucumber (*Cucumis sativa L*). www.haifa.group.com/cucumber-fertilizer/crop-guide-growing-cucumber. Retrived 13/11 2023

[9] Ibitoye A.A. (2008). Laboratory Manual On Basic Soil Analysis. Third Edition. Foladave Nigeria Limited, 1, Fanibi Junction, Ondo Road, Akure, Ondo State. ISBN-978-38456-2-3

[10] Long An. (2015). Cucumis sativus - Cucumber. *The Worldwide Vegetables*. http://theworldwidevegetables.weebly.com/cucumis-sativus-cucumber.html

[11] Mardhiana S, Ankardiansyah P. P, Muh A, Kartina K, Dwi S, Rizza W, and Anas M (2017). Effects of pruning on growth and yield of cucumber (Cucumis sativus) Mercy variety in The acid soil of North Kalimantan, Indonesia. Cell Biology and Development 1(1):13-17 DOI: 10.13057/cellbioldev/v010103

[12] Mallick, P. K. (2022). Evaluating potential importance of cucumber (Cucumis sativus L. - Cucurbitaceae): A brief review. *International Journal of Applied Sciences and Biotechnology*, 10(1), 12-15. https://doi.org/10.3126/ijasbt.v10i1.44152

[13] Megan, W. (2019). Health benefits of cucumber. *Medical News Today*. https://www.medicalnewstoday.com/articles/283006

[14] Mizukami, Y., & Fischer, R. L. (2000). Plant organ size control: AINTEGUMENTA regulates growth and cell numbers during organogenesis. *Proceedings of the National Academy of Sciences of the United States of America*, 97(2), 942-947. https://doi.org/10.1073/pnas.97.2.942

[15] Ndubuisi O.B and Yaduma J (2021). Soil and Agronomic Management for Cucumber Prodiction in Nigeria. Intechopen.doi: 10.5772/intechopen.96087 www.intechopen.com/chapters/75197. 9/ 11/ 23

[16] Odhiambol J.A and Aguyoh J.N (2022). Soil moisture levels affect growth, flower production and yield of cucumber. Agricultura Tropica et Subtropica, 55 OV, 1-8. DOI:10.2478/ats- 2022-0001.

[17] Seminis (2017). Understanding Flowering Habit In Cucumber. www.vegetables.bayer.com/ca/en-ca/resources/agronomic-spotlight/understandingflowering-habits-cucumbers. Retrieved Nov. 2023

[18] Utobo E. (2010). Growth and Yield of Cucumber Varieties As Influenced By Pruning at Abakaliki Agricultural Area, Southeastern Nigeria. Zenodo. doi: 10.5281/ZENODO.810516.

[19] Vedantu (2023). Tendril- Definition, function and examples. www.vedantu.com/biology/tendril. Retrieved 7/ 11/ 23.

[20] Weatherspark (2023). Weather of Owo. Weatherspark.com/y/51416/Average-Weather-in-Owo-Nigeria. Retrieved 9/ 9/ 23

[21] Wilcox G. I., Offor U. S. and Omojola J. T (2015). Profitability of Cucumber (Cucumis sativa L) production in Tai Local Government Area of Rivers State. Journal of Advanced Studies in Agriculture, Biological and Environmental Science 2(3): 1-6.

[22] WIKI, (2023). Cucumis. Wikipedia, the free encyclopedia. https://en.wikipedia.org/wiki/Cucumis. Retrieved 25/ 11/ 23

[23] Zezhou H, Xinrui W, Zipei F, Jiahao W. Aiyi Y, Guochao Y, Yong H, Huasen W, Zhujun Z, Yunmin X (2023). The intrinsic developmental age signal defines an age-dependent climbing behaviour in Cucumber (Cucumis sativa L), Horticultural Plant

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0141, https://doi.org/10.1016/j.hpj.4/10/23