Greener Journal of Agricultural Sciences
Vol. 11(3), pp. 114-122, 2021
ISSN: 2276-7770

https://gjournals.org/GJAS

Effects of Leaf Harvesting Frequencies on Yield and Quality of African Eggplant (*Solanum macrocapon*) Seeds

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ARTICLE INFO

Article No.: *071521067*
Type*: *Research

Accepted: *15/07/2021*
Published: *31/07/2021*

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Keywords: *Leaf Harvesting; crop yield; crop quality; African Eggplant; Solanum macrocapon; seeds.*

ABSTRACT

The experiment was conducted to investigate the effect of leaf harvesting on yield and quality of African eggplant (*Solanum macrocapon*) seeds. The study was conducted during the 2019 cropping season both at the Teaching and Research Farm and Seed Science laboratory of Federal University of Agriculture, Makurdi. A single factor experiment was laid out in a Randomized Complete Block Design (RCBD) on the field, while the laboratory experiment was laid out in Completely Randomized Design (CRD) in three replications. Germination test was conducted using sand method in plastic containers. One hundred seeds were sown in each container to represent a replicate and covered with fine sand. The treatments are: No leaf harvest throughout the life cycle of the crop; Leaf harvest, once at 4 weeks after transplanting; Leaf harvest at 4 and 6 weeks after transplanting and Leaf harvest at 4, 6 and 8 weeks after transplanting. Data were collected on the following parameters; Fruit diameter, Number of fruit per plant, Number of seeds per fruit and 1000-seed weight. The data collected was subjected to analysis of variance (ANOVA). Treatment means were separated using Fisher Least Significant Difference (FLSD). The result showed that leaf harvesting frequency significantly reduced number of fruits per plant, 1000-seed weight and germination rate. However, it does not affect fruit size, number of seeds per fruit and germination percentage. It is therefore concluded that African eggplant could be harvested as vegetable leaves up to 8 weeks after transplanting without reducing yield and quality of the seeds.

INTRODUCTION

Solanum macrocarpon otherwise known as the African eggplant is of the family *Solanaceae*, it is a tropical perennial plant that is closely related to the garden egg (Ojo and Olufolaji, 1997). They are perennials that are grown commercially as an annual crop. There are about 25 species of eggplants in Nigeria. Prominent among these are the S. aethiopicum L. (Ethiopian eggplant) and S. *macrocarpon* L. (Gboma eggplant), which are widely cultivated in Nigeria and across the African continent (Bonsu *et al*., 2002; Grubben *et al*., 2004).

*Solanum macrocarpo*n is one of the indigenous underutilized vegetables consumed by the resource poor in Nigeria to meet daily vegetable requirements for minerals, vitamins and protein nutritious food items as a substitute to egg, meat and milk (Idowu *et al.,*2014). The moisture, crude protein, crude fat and crude fibre contents of *S*. macr*ocarpon* were 92.00 ± 0.43, 0.52 ± 0.02, 0.15 ± 0.02 and 2.50 ± 0.02% (Eltta *et al*., 2017).

In West Africa both leaves and fruits are eaten. Fresh leaves and young stems of *S. macrocarpon* are widely consumed in West Africa and Central Africa. Leaves can be harvested over a number of seasons and sometimes for more than a year when not interrupted by a dry season (Animashaun *et al.*, 2019).

High quality seeds produce normal seedlings with adequate photosynthetic apparatus for production and assimilation through the leaves. Leaves play an important role in determining photosynthetic potential and have significant effect on yield responses (Lawlor, 2001). In general, African egg plant with indeterminate growth and flowering habit continues to have vegetative growth even at reproductive phase. Plucking of some green leaves for vegetable purpose and leaf damage due to insect attack also reduce the source production and alters the source sink ratio on the plants (Lawlor, 2001). Removal of early formed leaves to certain extent and retention of some of them for photosynthesis purpose may result in production of more shriveled, undersized and wrinkled seeds as the source percentage are reduced. However, none harvesting of green leaves may only help to increase the seed size due to higher availability of source (Lawlor 2001).

The manual removal of leaves can provide some economic benefit to the farmers by selling green leaves as vegetable and by doing so the farmer gets some additional income without much reduction in the seed yield and quality and this practice can be advocated for seed production.

Despite its nutritional and medicinal importance, production of the *S. macrocarpon* falls short of demand throughout the year (Teslim *et al*., 2019). This is due to a number of constraints such as lack of quality seed, competition from exotic vegetables, low market demand, pests and diseases infestation and slow growth. Lack of quality seed has been a major hindrance to sustainable production and utilization of *S*. *macrocarpon.* So there is the need to create awareness among farmers for effective means of improved seed production and distribution to replace the farmer-to farmer seed exchange and conservation of germplasm so as to improve production and income.

Though the crop is used, both as source of medicine and nutrition, there is a scanty data on the effect of leaf harvesting on the fruit and quality of *S. macrocarpon* seeds. There is the need to investigate the effect of leaf harvest that will not pose a threat to seed yield and quality on African eggplant in Benue state Nigeria. The experiment was conducted to find out the critical leaf harvesting frequency and its influence on seed yield and quality in African eggplant.

MATERIALS AND METHODS

Planting Material

Seeds of *S. macrocarpon*, African eggplant were obtained from the local farmers around University of Agriculture; Makurdi.

Experimental site

The field experiment was conducted during the 2019 cropping season at the Federal University of Agriculture Makurdi, Teaching and Research Farm (7.76°N and longitude 8.62°E, and at the elevation of about103 m above sea level). The soil at the site is well drained sandy loam.

Experimental Design and Treatments

A single factor experiment was laid out in a Randomized Complete Block Design (RCBD) on the field, while the laboratory experiment was laid out in Completely Randomized Design (CRD. Both experiments were replicated three times with the following leave harvesting frequencies as treatments:

The treatments are. 1. No leaf harvest = No leaf was not harvested; 2.One leaf harvest frequency = Leaves were harvested only once at 4 weeks after transplanting; 3.Two leaf harvest frequency = Leaves were harvested twice at 4 and 6 weeks after transplanting; and 4.Three leaf harvest frequency = Leaves were harvested thrice at 4, 6 and 8 weeks after transplanting

Agronomic Practices

Seedlings were raised in a standard nursery before transplanting to the field. The land was first sprayed with Glyphosate and later ridged manually. Transplanting was done and NPK 15:15:15 fertilizer was applied at the rate of 100kg/ha at seven days after transplanting. Hand weeding was done at flower bud initiation to keep the field clean. Leaf harvesting was done manually with knife by cutting the leaves at the point of attachment to the main stem. Pod harvesting was done when the entire pod turn yellow. Seeds were extracted from the harvested pods manually, washed and shed dried. Dried seeds were stored for seed quality tests.

Germination test was conducted using sand method in wooden boxes. The sand was washed and heat sterilized to kill soil microbes and foreign seeds before use. One hundred (100) seeds were sown in each box to represent a replicate and covered with fine sand. Sown seeds were kept moist till the experiment. Germinated seeds were counted daily to allow analysis of germination index as a parameter for seed vigour.

Germination percentage and Germination rate were determined as described by Abdul-Baki and Anderson (1973) as follows:

$$\text{Germination percentage} = \frac{\text{No of normal seedlings that germinated}}{\text{Total no of seeds planted}} \times 100 \quad \text{(ISTA, 2020)}$$

$$GI = \frac{\sum(Nx)(DAP)}{\text{Total no of normal seedling that emerged on the final day}} \quad \text{(Akande, 2012)}$$

High values obtained using this expression mean higher seedling vigour of one sample in relation to another (Al-Mudaris, 1998).

Data collection

Data were collected on the following parameters; Germination percentage and Germination rate, Fruit diameter (cm), Number of fruit per plant, Number of seeds per fruit, and thousand (1000) seed weight.

Data Analysis

The data collected were subjected to analysis of variance (ANOVA). Significant treatment means were separated using Fisher Least Significant Difference (FLSD). All data analysis was carried out using GenStat Statistical Software, 17 Edition

RESULTS

The result shows that leaf harvesting frequency did not significantly affects fruit diameter, number of seeds per fruit and seed germination percentage (fig1). However, there were highly significant differences among the leaf harvesting frequencies with respect to number of fruits per plant, 1000 seeds weight and germination rate. Nevertheless, the mean values showed decreases in fruit size as the leaves were frequently harvested with mean values 23.24cm, 22.70cm, 22.29cm and 21.73cm, respectively across the treatments. However, where leaves were not harvested had the highest number of fruits per plant and decreases as cross the harvest frequency increased with the following mean values of 8.36, 3.60, 2.34 and 1.20.

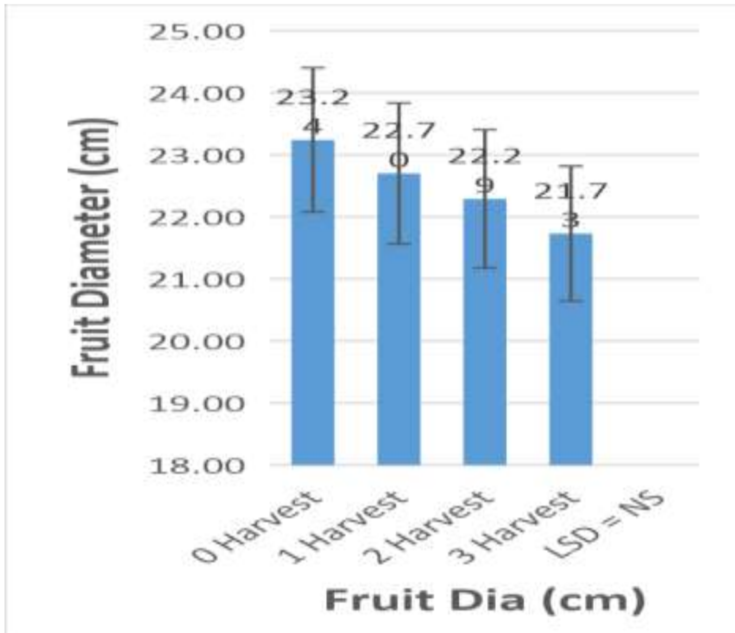

Figure 1. Effects of Leaf Harvesting Frequency on Fruit Diameter of African Eggplant leaf

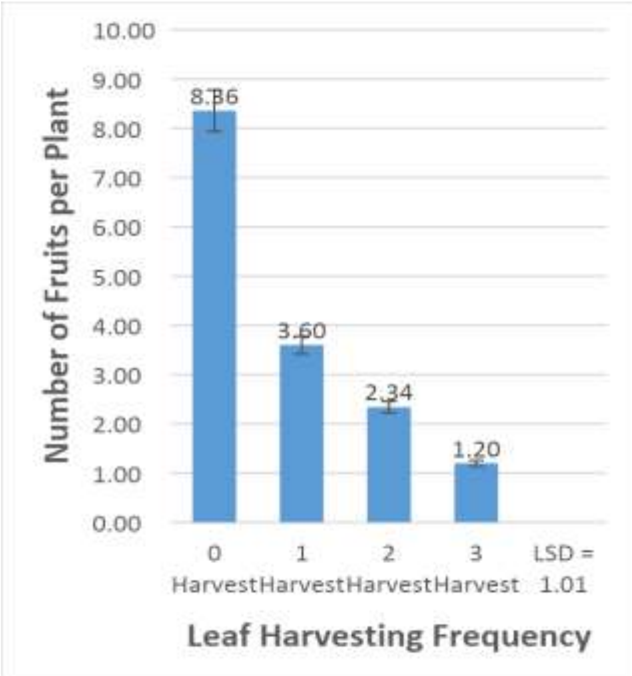

Figure 2 Effects of Leaf Harvesting Frequency on Number of Fruits Plant of African Eggplant leaf

The mean numbers of seeds per fruit obtained from the different leaf harvesting frequencies were not statistically different (Figure 3). Meanwhile, the treatment where leaves were not harvests had the highest number of seeds per fruit and where leaves were harvested three times up to the eight week after transplanting had the least number of seeds per fruit with mean values of 814.37 and 752.12 seeds, respectively.

The smean effects of leaf harvesting frequency on 1000 seeds weight are presented in figure 4 below. The result showed that treatment without leaf harvests had higher 1000 seed weight with mean value of 4.65g which was significantly different from other treatments with mean values of 3.80g, 3.50g and 3.17g, respectively. Also, where leaves were harvested at 4 and 6 weeks, the 1000-seed weight was not different from where leaves were harvested once at 4 weeks or thrice at 4, 6, and 8 weeks.

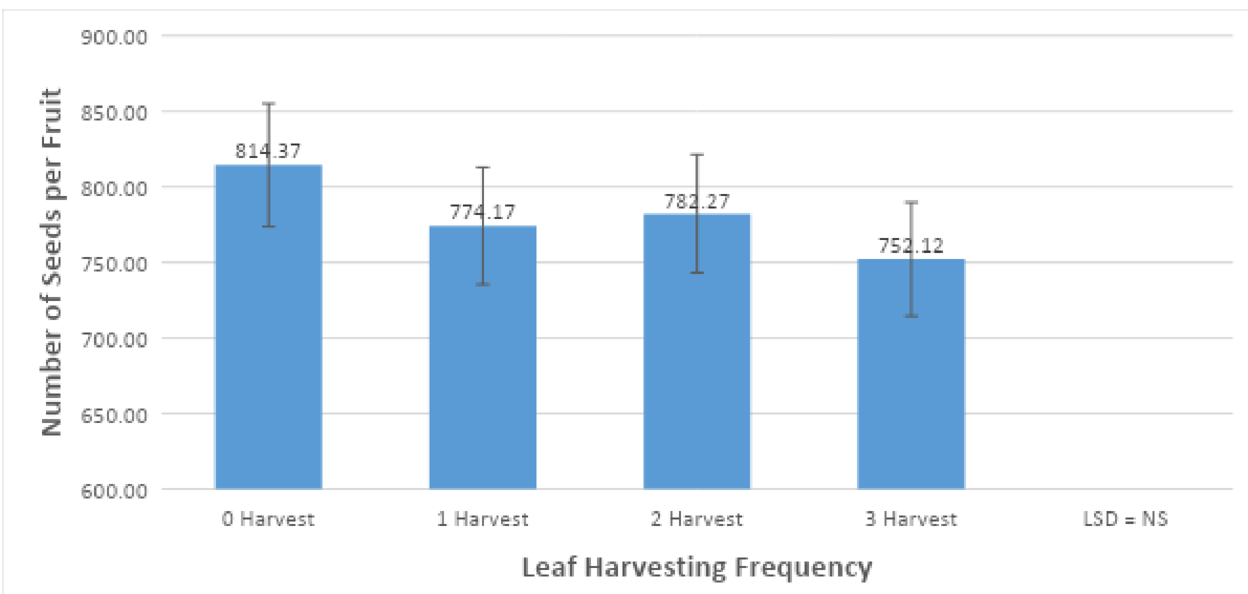

Figure 3. Effects of Leaf Harvesting Frequency on Number of Seeds per Fruit of African Eggplant leaf

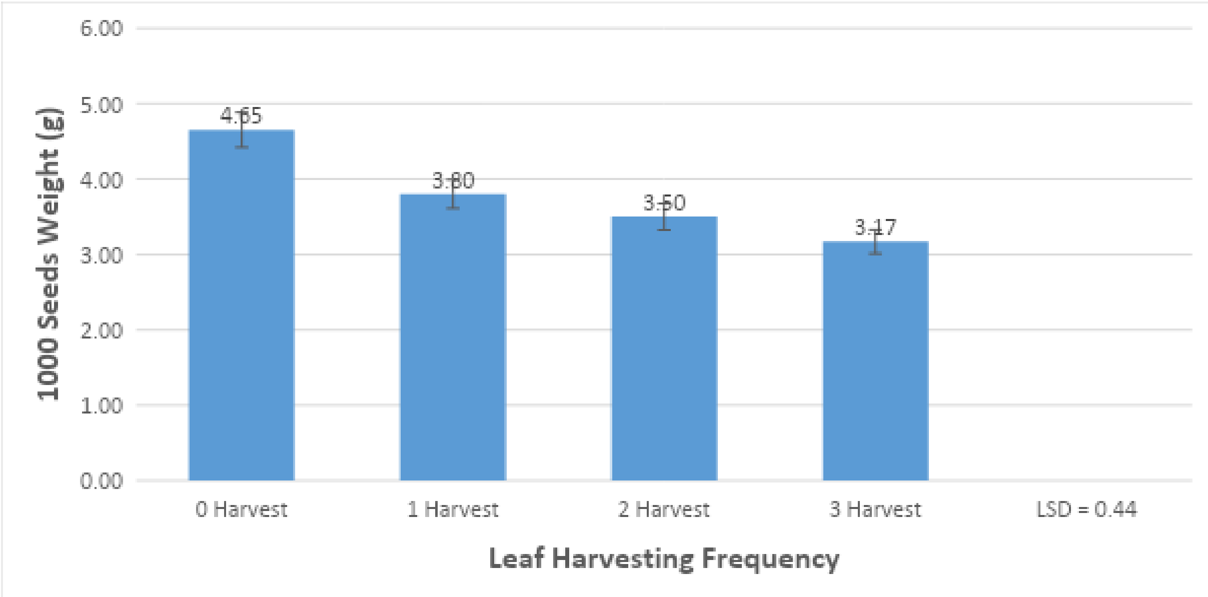

Figure 4 Effects of Leaf Harvesting Frequency on 1000 Seeds Weight of African Eggplant leaf

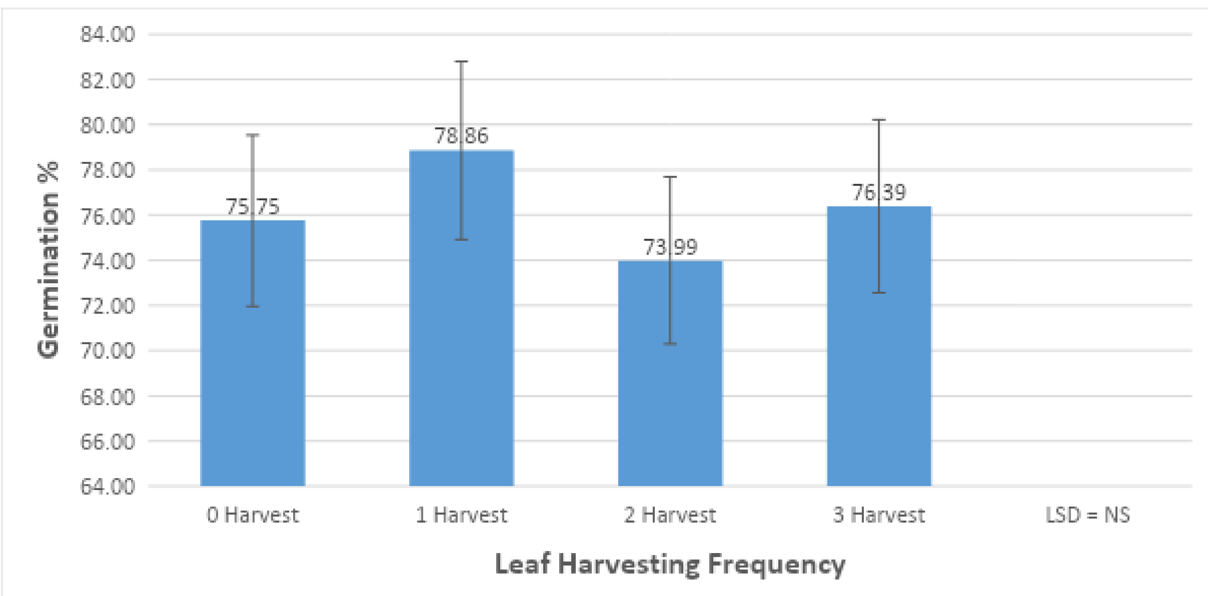

Figure 5 Effects of Leaf Harvesting Frequency on Germination Percentage of African Eggplant leaf

For germination percentage, the treatment were leaves were harvested once had the highest germination percentage while the treatment where leaves were harvested twice had the lowest germination percentage with mean values of 78.86% and 73.99%, respectively.

The mean effect of leaf harvesting frequency on germination rate is presented in figure 6 below. The result showed that the treatment without the harvest of leaves had higher germination rate with mean value of 7.97 seeds per day and was significantly from seeds of treatments where seeds were harvested once, twice and three times with mean values of 7.00, 6.24 and 4.54 seed per day, respectively. The result also showed that seeds of the treatment where leaves were harvested once and twice were not significantly different with each other in respect to seed germination rate but, these had higher germination rate than seeds of the treatment where leaves were harvested three times.

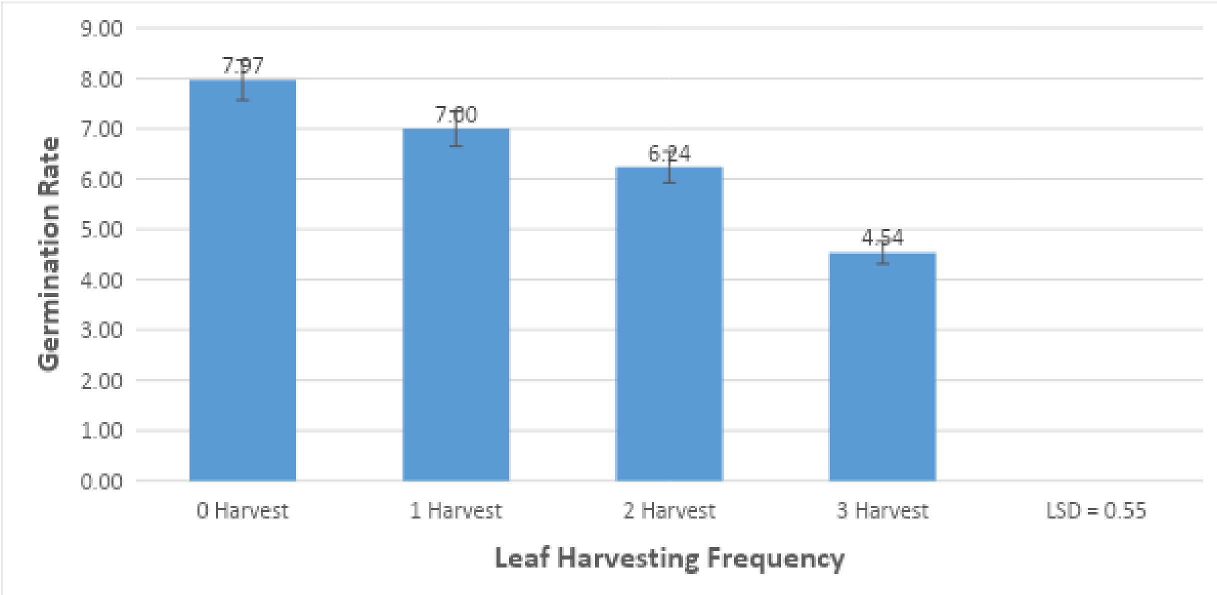

Figure 6 Effects of Leaf Harvesting Frequency on Germination Rate of African Eggplant leaf

The results presented in Table 1 showed that fruit diameter had no significant correlation with number of fruits per plant (0.240), 1000 seeds weight (0.169), germination rate (0.261), number of seeds per fruit (-0.039) and germination percentage (-0.147). The results also showed that number of fruits per plant was highly significant and positively correlated with 1000 seeds weight (0.846) and germination rate (0.772). However, it showed positive and non-significant correlation with number of seeds per fruit (0.196) and negative and non-significant correlation germination percentage (-0.229). The correlation coefficient result on number of seeds per fruit showed a significant and negative correlation with germination percentage (-0.548) while it showed a positive and non-significant correlation on 1000 seed weight (0.441) and germination rate (0.104). In a similar manner, the result showed that 1000 seeds weight significantly and positively correlated with germination rate (0.829). However, it showed negatively and non-significant correlation with germination percentage (-0.206).

Table 1. Pearson Correlation coefficients of fruit yield and seed yield plant-1 with Seed quality characters of African eggplant leaf in Makurdi

	Fruit Diameter	Fruits/plant	Seeds per fruit	1000 Seed Weight
Fruits/plant	0.240ns			
Seeds per fruit	-0.039ns	0.196ns		
1000 Seed Weight	0.169ns	0.846**	0.441ns	
Germination %	-0.147ns	-0.229ns	-0.548*	-0.206ns
Germination Rate	0.261ns	0.772**	0.104ns	0.829**

Ns = not significant @ 0.05%, ** = highly significant @ 0.01% and * = significant difference @ 0.05% probability levels

DISCUSSION

Where leaves were not harvested plants had more photosynthetic activities which lead to more accumulation of assimilates that was available for fruit formation. Ibrahim *et al*. (2010) reported that the higher the intensity of defoliation, the fewer the number of flowers formed. Where leaf harvesting frequency did not influence fruit diameter could be due to the reduction in fruit number per plant along the leaf harvesting frequency that reduces competition in the treatments with less number of leaves which in turn improve the fruit size. This result corroborates study conducted in cowpea (Moura *et al*., 2014) and they said that defoliation during vegetative phase did not influence the production components evaluated.

The decrease in number of fruits per plant with respect to increase in leaf defoliation could be due to the reduction in food supply due to less photosynthetic activities in the treatments with higher frequency of defoliation. This result disagreed with the findings by Quintela (2009) who stated that there was no significant alteration to the number of pods, seeds per pod, and 100 seed weight for removal of the leaf area at different levels in the main leaves of the common bean.

The number of seeds per fruit was not influence by leaf harvesting frequencies; this could be due to genetic effects, that number of seeds per fruit is genetically controlled and not environmental. However, the result does not conform to Moura (1999), in a study conducted on common bean (*P. vulgaris*), where he reported that the loss of leaf area affects the yield components. Also Bahry *et al*. (2013) and Fontoura, *et al*., (2006), defoliation levels and the time of leaf harvest influence negatively the number of seeds and seeds per plant. In maize, Heidari (2015) showed that complete defoliation severely reduced seed yield, row number per ear, seed number per ear, cob length, cod weight and ear weight and that Defoliation treatments had minor effect on produced seed germination traits

1000 seed weight increase could be as a result of source sink relationship in the treatments with less leaf harvesting frequencies. Leaves play an important role in determining photosynthetic potential and have significant effect on yield responses according to (Lawlor 2001). The result agreed with Moura *et al*. (2014) who carried out a study on defoliation in cowpeas and concluded that there was a significant difference in the 100 seed weight with respect to leaf defoliation; and that at 25 DAS, plants with 25% defoliation had heavier seeds and defoliations at 100% had lighter seeds. They also said that when defoliations occurred at 40 DAS, plants with 25% of defoliation produced smaller seeds and defoliations of 75 and 100% produced seeds of smaller weight. Similarly, Ahmed *et al*. (2015) said garlic defoliated at seedling and reproductive stages produced similar and higher garlic in terms of growth and yield performance than that defoliated at vegetative stage.

Irrespective of leaf harvesting frequency up to eight weeks after transplanting *Solanum Macrocapon*) seeds were able to attain germination ability that is, the seeds reached a physiological state that enabled the germination of the seeds. Germination test was not able to dictate the difference in the physiological quality of these seeds. However, germination rate which is a vigour test was able to dictate these differences. The result agreed with Koptur *et al*., (1996) who reported similar germination percentage in common vetch (*Vicia sativa*), seeds produced under different leaf defoliation.

The influence of leaf defoliation on germination rate could be as a result of higher 1000 seed weight which translates to more food reserves in the seeds and this implicates seed vigour. In common vetch (*Vicia sativa*), defoliation treatments on maternal plant did not have significant effect on days to germination (Koptur *et al*., 1996). In addition to that Heidari, (2015) reported that defoliation of leaves at different levels had no significant effect on seedling weight and vigour; and that defoliation treatments had minor effect on produced seed germination traits. Contrastingly, this study showed that leaf defoliation influences vigour.

Correlation indicates that number of fruit per plant in African egg plant could determine 1000 seed weight and germination rate. Significant positive correlation of number of pods per plant and a high but non-significant positive value of number of seeds per pod was also reported by Ghobary (2010) in vegetable pea. Pal and singh (2012) have reported positive and significant association of pod yield per plant with number of pods per plant, pod length and pod weight. Heidari, (2015) reported in an experiment conducted on maize that Cob length and weight had a positive and significant correlation with all traits except 100 seed weight. A similar result was observed in 1000 seed weight which positively determines germination rate but not germination percentage. Heidari, (2015), reported that seed germination percentage had a positive and significant correlation with seed vigor based on weight in common vetch (*Vicia sativa*), and leaf defoliation on maternal plant did not have significant effect on days to germination (Koptur *et al*., 1996).

CONCLUSIONS

This study showed that leaf harvesting frequency influences yield and seed quality parameters of African eggplant. It could concluded that African eggplant (*S. macrocarpo*n) seed producers can actually harvest the vegetable leaves up to 8 weeks after transplanting (three times) without reducing seed yield and quality.
Recommendations African eggplant could be produced for both vegetables and seed

REFERENCES

1. Ahmed, H. G., Saidu, Y. I., Aliyu, U., and Bello, M.T. (2015) Effects of Defoliation Stages and Defoliation Intensity on Growth and Yield of Garlic (Allium sativum L.) in Sokoto, Nigeria. *Journal of Agriculture and Veterinary Science* 8 (12) PP 96-99.
2. Akande, S. R., Olakojo, S. A., Ajayi, S. A., Owolade, O. F., Adetumbi, J. A., , O. N., Ogunbodede, B. A. (2012). Planting date effects on cowpea seed yield and quality at Southern Guinea Savannah of Nigeria. Seed Technology 34:979-988. https://stjournal.org/volume-34-no-1-2012/.
3. Al-Mudaris MA (1998). Notes on various parameters recording the speed of seed germination. Journal of Agriculture in the Tropics and Subtropics 99 (2):147-154 https://www.jarts.info/index.php/tropenlandwirt/article/view/1495
4. Animashaun, T. T., Oluwaghemi, O., Okewale M. O.and Opabode, J. T. (2019). Response of African

eggplant (*Solanum macrocarpon* L.) to foliar application of 6-benzylaminopurine and gibberellic acid. Asian Journal of Biological Science, 12: 911-916.
5. Bahry, A. S., Yahya M. Al-wahaibi, Adbulkadir Elshafie and Ali Al-Bemani (2013) biosurfactant production by bacillus subtills B20 using Date molasses and its application in enhance oil recovery. Doi:10.1016/j.ibiod.2012.01.006.
6. Bahry, C. A., Venske, E., Nardino, M., Zimmer, P. D., Souza, V. Q. S. and Caron, B.O. (2013). Agronomic performance of soybean as a function of defoliation in vegetative stages. *Tech. Science Agropec.* 7(4):19-24.
7. Bonsu, K. O., Fontem, D. A., Nkansah, G. O., Iroume, R. N., Owusu, E. O., Schippers, R. R. (2002). Diversity within the Gboma eggplant (Solanum macrocarpon), an indigenous vegetable from West Africa. *Ghana Journal of Horticulture*, 1:50–58.
8. Eletta, O. A. A; Orimolade, B. O; Oluwaniyl, O. O; DOSUMU, O. O. (2017). Evaluation of Proximate and Antioxidant Activities of Ethiopian Eggplant (*Solanum aethiopicum* L) and Gboma Eggplant (Solanum macrocarpon L). *Journal of Applied Science, Environment and Management*. Vol. 21 (5) 967-972
9. Fontoura, T. B, Costa, J. A. and Daros, E. (2006). Effect of levels and epochs and defoliation on yield and yield components of soybean grains. *Science*. 7:49-54.
10. Ghobary, H. M. M. 2010. Study of relationship between yield and some yield components in garden pea (*Pisum sativum* L.) by using correlation and path analysis. J. Agric. Res. 36, 351–360.
11. Grubben, GJH; Denton, OA (2004). Plant Resources of Tropical Africa II: Vegetables (Leiden, Wageningen: Backhuys Publishers) 35-198.
12. Heidari (2013). Effect of irrigation with contaminated water by cloth detergent on seed germination trait and early growth of sunflower (Helianthus Annuus L.) *Notulae Scientia biologicae* 5(1) Doi:10.15835/nsb.5.1.9003
13. Heidari, H., 2012. Effect of defoliation intensity on maize yield, yield components and seed germination. Life Science Journal, 9 (4): 1587-1590.
14. Heidari, H., 2013. Yield, yield components and seed germination of maize (*Zea mays* L.) at different defoliation and tassel removal treatments. Philippine Agricultural Scientists, 96 (1): 42-47.
15. Heidari, H., 2015. Effect of defoliation based on leaf position on maize yield, yield components and produced seed germination. Bulg. J. Agric. Sci., 21 801–80.
16. Heidari, H., S. Bahraminejad, G. Maleki and A. H. Papzan, 2009. Response of cumin (*Cuminum cyminum* L.) to sowing date and plant density. Research Journal of Agriculture and Biological Sciences, 5 (4): 597-602.
17. Ibrahim, U., Auwal, B.M., Udom, G. N. (2010). Effect of Stage and Intensity of Defoliation on the Performance of Vegetable Cowpea (*Vigna unguiculata* (L.) Walp). *African J. Agric. Res*. 5(18): 2446-2451.
18. Idowu, M. K., Oyedele, D. J., Adekunle, O. K.; Akinremi, O. O. and Eilers, B. (2014). Effects of Planting Methods and Seed Density on Vegetable Yield and Nutrient Composition of *Solanum macrocarpon* and *Solanum scabrum* in Southwest Nigeria. *Food and Nutrition Sciences*. 5, 1185-1195 http://www.scirp.org/journal/fns http://dx.doi.org/10.4236/fns.2014.513129.
19. ISTA (2020). International Rules for Seed Testing. The Germination tests. Volume 2020(1):1-14 https://doi.org/10.15258/istarules.2020.05.
20. Koptur, S., Smith, C.L.,and. Lawton, J. H. (1996) Effects of artificial defoliation on reproductive allocation in the common vetch Vicia sativa (fabaceae; papilionoideae). *American Journal of Botany,* 83 (7): 886-889.
21. Lawlor, D. W. (2001) Annals of botany photosynthesis. 3rd ed. 386 PP. Oxford: Bio 22.99 (soft back). Issue 6, June 2001 pages 852-853. https://doi.org/10.1000/anbo.2001.1418.
22. Moura, A., Nielsen, C. A. S., Bilstrup, J., & Jose, V. M. M. (2014). Recent diversification of a marine genus (tursiop Spp) tracks habitat preference and environmental change systematic biology. 62(6) Doi:10.1093/sysbio/syt051.
23. Ojo, O.D., Olufolaji, A.O. (1997). Optimum NPK fertilizer rates for growth and yield of *Solanum macrocarpon*. Journal of Vegetable Crop Production, 3(1), 73-77.
24. Pal, A. K. and Singh, S. (2012). Correlation and path analysis in garden pea (Pisum sativum L. var. hortense). *The Asian Journal of Horticulture.* 7(2): 569-573.
25. Quitela (2009) Genetic analysis redraws the management boundaries for the European sprout. 3 March, 2020. https//doi.org/10.1111/eva12942.

Cite this Article: Okoh, JO; Iyorkaa, N; Etta, BO (2021). Effects of Leaf Harvesting Frequencies on Yield and Quality of African Eggplant (*Solanum macrocapon*) Seeds. *Greener Journal of Agricultural Sciences* 11(3): 114-122.