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Effect of Defoliation on the Growth and Yield of Some Cowpea Varieties (*Vigna Unguiculata* L. Walp)

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ABSTRACT: Cowpea which is value mainly depends on high Protein contain and resistance to droughts, its production worldwide faces a lot of challenges among which is defoliation caused mainly by farm animal and some insects. The present study is aimed at studying the effect of defoliation on the growth and yield of some cowpea varieties. The research was conducted in IITA research station located at Latitude 12^0, 03^1 N and Longitude 08^0 32^1E, from May to November 2009. Two varieties of cowpea were used and arranged in randomize block design (RBD) with three replications. The treatment imposed are 0%, 50% defoliation at vegetative stage, 50% defoliation at flowering stage, 75% at vegetative stage, and 75% at flowering stage. The data taken during the study were plant height, date of first flowering (DFF), date of 50% flowering (DTF), date of harvest, pod number (PN), pod weight (PW), seed number (SN), and seed weight (SW). The result revealed that defoliation at 75% vegetative growth stage cause considerable reduction in yield components, while 50% vegetative reproductive growth stage revealed insignificant reduction in yield of cowpea which in conclusion, the experiment revealed that 75% defoliation at vegetative stage significantly reduce the yield of cowpea.

Keywords: Cowpea (*Vigna unguiculata* L Walp). Defoliation; Growth; Treatment; Yield.

INTRODUCTION

Cowpea, (*Vigna unguiculata* L. Walp) is a grain legume grown mainly in the Savanna regions of the tropics and subtropics. The value of cowpea lies in its high protein content, and its ability to tolerate droughts. As legume cowpea also fixes atmospheric nitrogen, allowing it to grow on, and improve poor soils[1]. All the parts of cowpea that are used for food are nutritious, providing protein, vitamins, and minerals. Cowpea grain contains about 25% protein, making it extremely valuable, where many people cannot afford protein foods such as meat and fish. About 7.57 million tones of cowpea are produced world wide annually about 12.76 million hectares. Sub-Saharan Africa accounts for about 70% of total world production[2]. Defoliation can be defined as the complete or partial removal of Leaves from a plant[3]. Cowpea production is beset by an array of pests and disease that can cause serious devastation, thus leading to reduced yield and low profitability. Several foliage defoliators chiefly among which includes Acrididae has been reported to cause severe defoliation of cowpea[4]. A considerable number of lepidopteran larvae have been reported feeding on cowpea leaves skeletonizing and sometimes defoliating the plant. Other major defoliators belong to the family Chrysomelidae[4]. The effects of the defoliators can cause reduced seed yield depending on the stage and growth of the crop2.Therefore, quantifying yield decrease resulting from defoliation may play an important role in predicating yields, establishing threshold for pesticide treatment or assessing direct damage caused by pest. Among all legumes, cowpea is the most widely cultivated throughout the world and is found practically in every market in Nigeria. Nigeria has for long been among the leading producers of cowpea in the world contributing about 70% of the world's cowpea production[5]. Cowpea is grown primary in the third world for its cheap source of dietary protein, lysine[6] and as supplement for meat [6&7]. The crop is also use for forage for farm animals,

hay, Silage, pasture[8], soil cover and green manure for maintaining the productivity of soils[5]. The young leaves and shoots are consumed as spinach and provide one of the most widely used potherbs in tropical Africa[8]. In Nigeria, the dried seed is valued for its flavour and short cooking time. Virtually all the components of the crop are important sources of food. Apart from the use of its grain as sources of food for human and animal feed, the practice of feeding cowpea vegetative parts to livestock is popular among peasant farmers and of increasing economic significance[9&10]. The present Study was aimed at finding out the effects of different defoliation intensities on growth and yields some cowpea varieties.

MATERIAL AND METHODS

The experiment was conducted at the screen house of International Institute of Tropical Agriculture Kano state, located at Latitude 12^0, 03^1 N and Longitude 08^0 32^1 E. Two cowpea varieties are used for the study. Thirty pots (30) were used in the experiment, soil was sterilized and pots were filled with 3kg of soil. The experimental pots were arranged in randomized block design (RBD) with 5 treatments. The treatment included defoliation at 50%, and 75% at vegetative growth stage, defoliation at 50% and 75% at flowering stage and 0% defoliation as control with three replications. Data were collected on plant height, phenology, pod number (PN), pod weight (PW), seed number (SN), and seed weight (SW). The data taken were subjected to statistical analysis of variance (ANOVA) using GENSTAT 3rd Edition, where the means were separated using least significant difference at 5%.

RESULTS AND DISCUSSION

Effect of Defoliation on the Growth of cowpea: Mean data for plant height are presented in Table 1. The present study revealed that defoliation intensity at 50% and 75% during reproductive growth stage decrease the plant height of all the varieties. There was an increase in plant height with increase in number of days after sowing. Significant difference in height is observed between control plant and those defoliated at various stage and various frequency the greatest high was observed in control and vegetative plant defoliated at flowering stage as shown in Table1. This result has contradicted with the result of Enyi[9] were he explained that leaves are very important in the growth of plant as the assimilate product are mainly used for the development of main plant or leaves. Though the result agreed with another research which that individual area of cowpea variety defoliated at early stage is reduce[9].

Table 1: Effect of defoliation on plant height of cowpea at vegetative and flowering stages subjected to different defoliation frequency

	plant height at vegetative stage (cm)						plant height at flowering stage			(cm)
Genotype	50%flw	50%vgt	75%flw	75%vgt	0%	50%flw	50%vgt	75%flw	75%vgt	0%
ITD96-610	11.42	12.17	10.3	12.25	13.83	13.88	13.59	11.83	14.22	16.77
ITK97-499-35	11.63	14.82	10.01	11.97	14.25	13.33	14.58	10.08	13.08	14.25
Mean	11.52	13.49	10.16	12.11	14.04	13.61	14.09	10.96	13.65	15.51
s.e.d.	0.951	3.48	1.447	2.21	3.98	0.401	2.24	0.98	0.65	3.48
l.s.d.	NS	NS	NS	NS	NS	1.726	9.62	1.218	2.795	NS

Flw: Flowering stage, vgt: vegetative stage, l.s.d.: least significant difference at 5%, s.e.d.: standard error of differences of means

Effect of Defoliation on the plant vigor of Cowpea: Mean for plant vigor are presented in Figure 1.The present study revealed that reduction in plant vigour was observed in plant defoliated at 50% and 75% vegetative growth stage of the both varieties. The result also showed that defoliation at 75% and 50% vegetative recorded reduction in their plant vigour when compared with the control. and those defoliated

at 50% and 75% flower as shown in Figure 1, these has agreed with the report that defoliation during early stage of development can influence growth and survival of the plants[11], these also in line with another finding that the higher the number of leaves produces the higher the photosynthesis rate, thereby increasing the energy substrate, hence the overall productivity of plant[12].

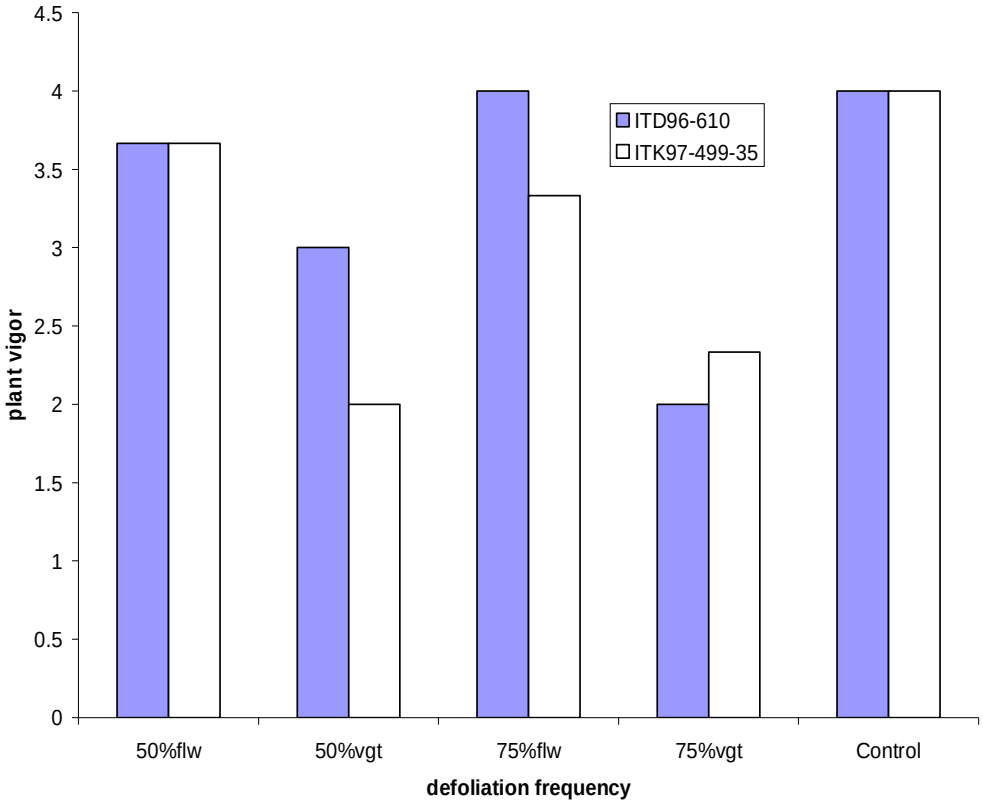

Figure 1: Effect of defoliation on the plant vigor of cowpea subjected to different defoliation intensity

Effect of Defoliation on the Phenology of cowpea: The results for defoliation at days to 50% flowering and number of days to maturity are presented in Table 1. The present study revealed that defoliation intensity at 50% and 75% during reproduction growth stage increase the days to 50% flower and days to maturity of the both verities ITK97-499-35, ITD96-610. The cowpea varieties defoliation at 50% and 70% defoliation flowering stage were greatly affected by defoliation by virtue of their increase in days to maturity. As shown in table1.These has agreed with finding that photosynthesis rate was reduced by removing essential part of the plant (Leaves) [14].

Hence the proportion of assimilate which would have been used for maintenance of vegetative part were reduced. Thus subsequently reduce the net productivity of the plant. Whilst in terms of dt50% flower the plant defoliated at 50% and 75% vegetative were affected as shown in the table I which correspond with the result of which found out that the removal of leaves at early state increase the mean time required for subsequent emergence of leaves when compared with the control plant[12&14].

It was also found out that re-emergence of subsequent leaves was delay in the areas were the individual leaves were reduced[12].The result also agreed with another finding that individual area of defoliation cowpea leaves at state reduced[10].

Table 2: Effect of defoliation on the Pod and Seed weight of some cowpea subjected to different defoliation frequency

		pod weight (g/plant)				seed weight (g/plant)			
	50%flw	50%vgt	75%flw	75%vgt	0%	50%vgt	75%flw	75%vgt	0%
ITD96-610	3.99	0.94	1.43	1.32	4.77	0.90	1.32	0.93	3.25
ITK97-499-35	4.90	4.09	2.96	2.66	5.08	2.84	2.05	1.96	3.11
Mean	4.44	2.52	2.197	1.99	4.92	1.87	1.69	1.45	3.18
s.e.d.	0.24	1.203	0.1686	1.217	0.539	0.748	0.384	0.887	0.339
l.s.d.(5%)	1.033	NS	0.7252	NS	2.318	3.22	1.654	NS	1.46

Flw: Flowering stage, vgt: vegetative stage, l.s.d.; least significant difference at 5%, s.e.d.: standard error of differences of means

Effect of Defoliation the Yield of Cowpea: Mean data for yield components are presented in Figures 2 and 3. The present study revealed that defoliation at 75% vegetative stage caused reduction in yield components. The result also shown that defoliation at 75% & 50% vegetative have their plant vigour affected when compared with the control and those defoliated at 50% & 75% flowering stage as shown in figure 1. These have agreed with research that during early stage of development defoliation can influence growth and survival of the plants[15]. It's also in line with a report that the higher the number of leaves produces the higher the photosynthesis rate, thereby increasing the energy substrate, hence the overall productivity of the plant[16&17].

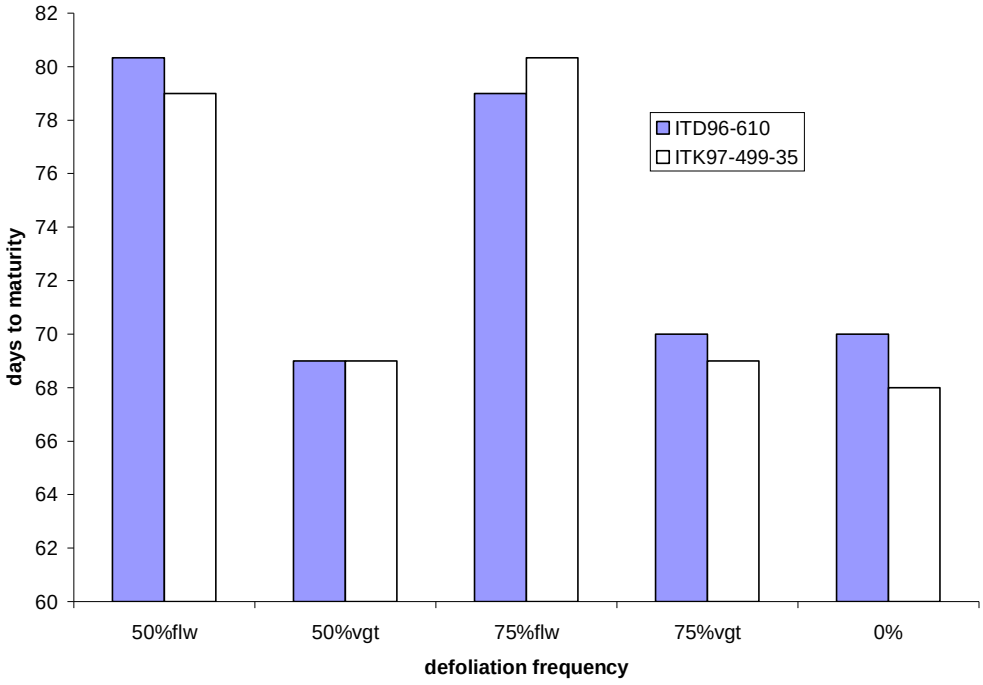

Figure 2: Effect of defoliation on the number of days to maturity of cowpea subjected to different defoliation intensity

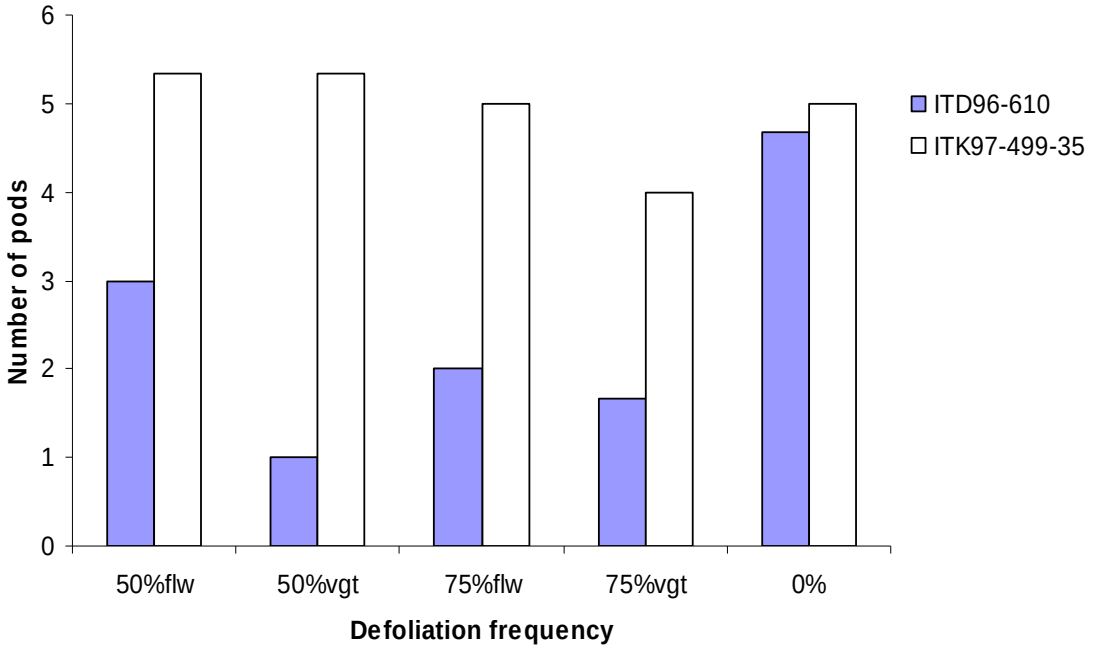

Figure 3: Effect of defoliation on the number of pods of cowpea subjected to different defoliation intensity

As shown in these result in Figures 2 & 3 high yield was observed in 50% & 75% flowering followed by control with lesser yield in 50% & 75% vegetative stage though there is no significant different between 50% flowering and 50% vegetative of yield components. The result has agreed with a report that explains that defoliation during vegetative stage significantly reduces the yield of cowpea[11]. This because at vegetative stage as the number of leaves were reduces it reduces the number of pod per plant and hence seeds per pods. At vegetative stage removal of leaves may also reduces the photosynthesis process and nitrogen intake of the plant hence reduce the entire productivity of the plant[18]. The result agreed with another finding which observes that defoliation of cowpea in vegetative stage significantly decrease grain yield of both varieties[19]. It corresponds with report that shows intensity of defoliation at 50% flower gave the higher yield which is significantly different from other stage of defoliation [18&19].Though some variety has performed very well at 50% vegetative stage (ITK197-499-35). As shown in the figure 2 & 3. This also explained reduction of yield at vegetative stage depends on the intensity and magnitude of defoliation thus defoliation at 75%vegatative result in significant reduction on yield components. The result has also agreed with finding that plant defoliation at vegetative stage alter the source sink ratio, partial or total shading of the foliage, light and CO2 enrichment[20].However, another researcher reported that defoliation alter hormone balance. Starch sugar, protein and chlorophyll concentration of source leaves as well as stomatal resistance and senescence rate[21]. The effect of defoliation depends however, on the foliar surface area eliminated and on the growth at which this takes place. This also agreed with a finding that limited defoliation at flowering stage did not reduce of cowpea significantly[22&23].

CONCLUSION

The present result indicates that limiting growth by defoliation reduce the yield of cowpea. And the magnitude of yield reduction was depended on stage and degree of defoliation. 75% defoliation at vegetative stage significantly reduces the yield of cowpea, the plant vigour of the both cowpea varieties (ITK97-499-35 ITD96-610). The result also indicates that defoliation at 50% and 75% flowering increase

the days to maturity of the both variety. It also indicates that defoliation at 50% and 75% flowering stage reduce the overall plant height. It's recommended that more research shall be encouraged to identify more cowpea varieties that are resistant to defoliation.

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