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EVALUATION OF MANUAL DEFOLIATION ON SOME YIELD PARAMETERS OF *ANACARDIUM OCCIDENTALE* L. DURING FRUITING SEASON AT CRIN, HEAD-QUARTERS, IBADAN

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ABSTRACT
A field trial was undertaken to investigate the effect of different defoliation treatments on the growth and development of immature cashew nut and apple during the fruiting season at the cashew plantation in CRIN, Ibadan, Nigeria. Some yield parameters were measured to determine the effects of manual leaf defoliation levels of 0%, 25%, 50%, 75% and 100% on growth rate of developing nuts and apples of cashew for nine weeks. Prophylactic treatment with chemical insecticide was applied to prevent insect attack. The results did not show any significant difference in the length of nut, length of apple, taper breadth of nut, taper breadth of apple and broader end of apple among the various defoliation treatments applied. Fruits and nut development were not affected by all the treatments. This might suggest healthy cashew stands have the ability to compensate for these intensities of defoliation during the fruiting period.

KEY WORDS: Keywords: Cashew nut, defoliation, growth, development, fruiting,

INTRODUCTION

The cashew tree, *Anacardium occidentale* is a tropical tree crop. It originated in Brazil and was introduced to Nigeria by the Portuguese traders between the 15th and 16th century (Ohler, 1988). The cultivation of cashew started in the former Eastern region of Nigeria where it was grown for the purpose of checking the menace of erosion and soil degradation. At present, it is grown in almost all the agro-ecological zones in Nigeria. Cashew nut production has been on steady increase from 30,000 metric tonnes in 1990 to 580,761 metric tonnes in 2009 (FAO, 2011).This significant increase has been due mainly to the involvement of private entrepreneurs, Federal and State Governments, Cooperative societies and affluent farmers in cashew cultivation (Aliyu and Hammed, 2008). According to FAOSTAT (2011), total area under cashew presently is estimated at 330,000 ha. Thus, Cashew is a tree crop of considerable economic importance to Nigeria

The leaf plays an important role in the production of food substance through the process of photosynthesis; hence the defoliation of this tissue might be detrimental to the health of the plant especially at fruiting season. Repeated and heavy defoliation of forest trees can lead to tree death (Rongcai *et al*., 2005). Goldschmidt (1999) observed that limiting leaf photosynthates can reduce vegetative growth and fruit development in citrus. Reduced leaf area lowers light interception, resulting in reduced photosynthetic capacity of the plant, loss of leaf-stored material, or shortening of the seed-fill period; ultimately, these factors cause yield loss (Board *et al*., 1994; Sean, 2001). Various pests including insects and diseases attack the cashew plant at different stages of development. In West Africa, the main insect defoliators belong to the orders Coleoptera, Lepidoptera and Orthoptera (Wagner *et al*., 2008). In Nigeria, it is often assumed that the cashew tree is a robust tree crop that requires minimal input, hence it is grown on marginal soil. However, over the years probably due to the changing climatic conditions and other biotic factors, there has been the emergence of new insect pests and assumption of pest status by previously known minor pest such as *Acrocercops syngramma*. The complex of insect defoliators of cashew includes *Parapoderus* spp (Coleoptera: Curculionidae), *Sylepta derogata* F.(Lepidoptera: Pyralidae), *Lema tibialis* (Coleoptera: Crioceridae), *Acrocercops syngramma* Meyrick (Lepidoptera: Gracilariidae), *Zonocerus variegatus* L. (Orthoptera: Pyrgomorphidae). Field observations indicate that most of these defoliating insects are often present throughout the year in cashew plots in CRIN headquarters (Mokwunye *et al*., 2008). Wagner *et al*., (2008) reported that the magnitude of the damage depends on the extent of defoliation, timing of attack, tree species involved and the general vigour of the attacked tree.

Little is known about the effects of defoliation of mature cashew tree during flowering/fruiting stage and no data are available on the effect of defoliation on tree growth and yield. In order to understand the effect of yield loss associated with defoliation in cashew, it was necessary to quantify the injury by way of destructive sampling. Since it is difficult to estimate damage of insect defoliators on the field because insects consume the material, manual defoliation which allows for quantification of the leaf area removed was adopted. It is against this backdrop that this study was conducted to examine the effect of manual defoliation on the yield parameters of cashew.

METHODOLOGY

The study area: The study was conducted on a 5-year old cashew plantation at the CRIN HQ, Ibadan, Nigeria. Ibadan has an annual average rainfall of 2000mm with a bimodal pattern. CRIN is located in the humid rainforest

ecosystem with mean solar radiation of 18mj/m^2/day. It lies between the latitude 7°30'Nand longitude 3° 54'E at an altitude of 200m above sea level. The plot was originally planned to study the field establishment of cashew as affected by nut sizes and planting methods. This trial was conducted on the cashew raised from madras size nut within the fruiting season. They were planted at a spacing of 6m by 6m and arranged in randomised complete block design. Two trees were randomly selected and tagged. And on each tree, five healthy branches at 1.2m high from ground level were selected. Each branch selected terminated in female and hermaphrodite inflorescences or panicle with immature apple/nuts of about two weeks old. This was replicated two times on same tree. Manual defoliation using a pair of scissors was done on the leaflets surrounding each selected panicle at varying defoliation levels of 0%, 25%, 50%, 75% and 100%. This set up was replicated three times. Prophylactic treatment with a standard insecticide was applied to prevent insect attack. Data were taken on the length of nut (cm), length of apple (cm), taper breadth of nut (cm), taper breadth of apple (cm) and broader end of apple (cm) with the use of Vernier calliper and transparent ruler on a weekly basis for nine weeks. Statistical Analysis: Effect of defoliation treatments were tested for significance using Analysis of variance (ANOVA) and comparison of treatment means was subjected to Duncan multiple range test (DMRT). Statistical Analysis Systems Software for PC (SAS Institute Inc. Cary, N.C) was used for all data analyses.

RESULTS

The effect of manual defoliation on the yield parameters of cashew is shown on the following Figures 1-5. Figure 1 shows the effect of the defoliation treatments on the development of cashew nut length for a period of nine weeks. It was observed that the cashew nut length of the various treatments increased progressively for five weeks after which there was downward slide in their development. The following mean values: 2.18cm, 2.55cm, 2.49cm, 2.20cm and 2.19cm were recorded for 0%, 25%, 50%, 75% and 100% respectively at 5weeks. And at the sixth week, the means of the cashew nut length dropped to the following values: 1.73cm, 1.25cm, 1.81cm, 1.39cm and 1.60cm. There were no significant differences among the means of the various defoliation treatments for the entire period of experimentation. However, 25% recorded the highest mean value of 2.73 in cashew nut length at week 4. At week eight, 25% defoliation recorded a mean cashew nut length of 0.0000, while others recorded same at the last week (week nine).

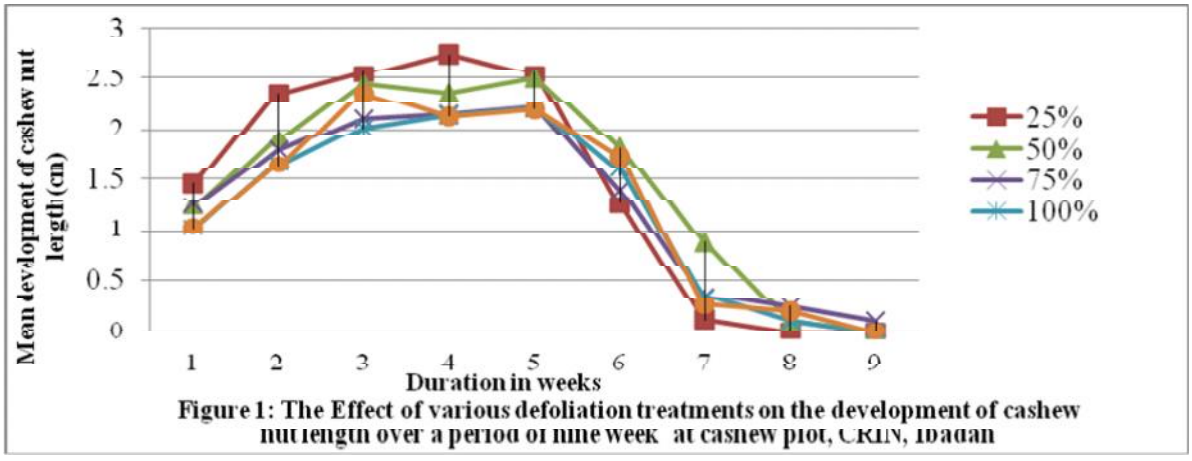

Figure 1: The Effect of various defoliation treatments on the development of cashew nut length over a period of nine week at cashew plot, CRIN, Ibadan

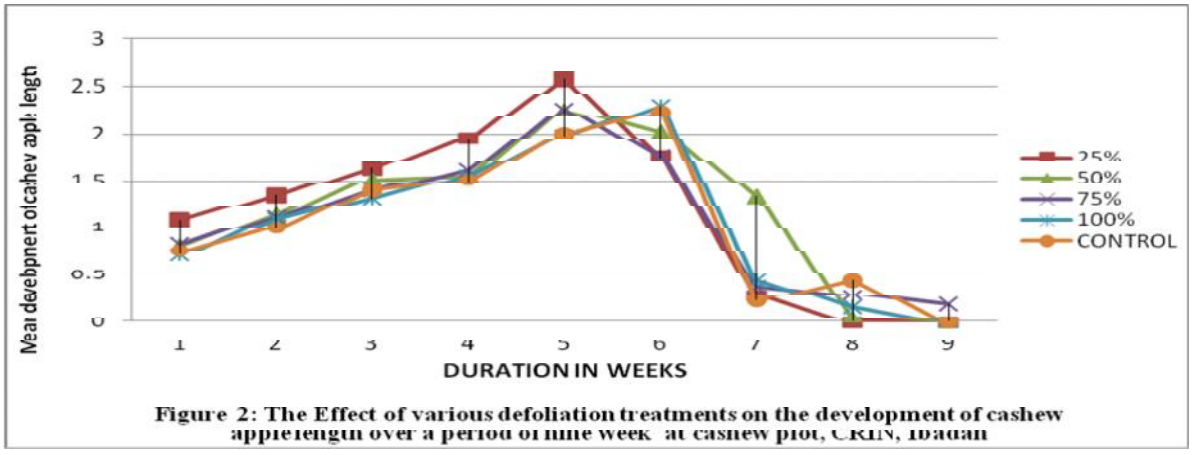

Figure 2: The Effect of various defoliation treatments on the development of cashew apple length over a period of nine week at cashew plot, CRIN, Ibadan

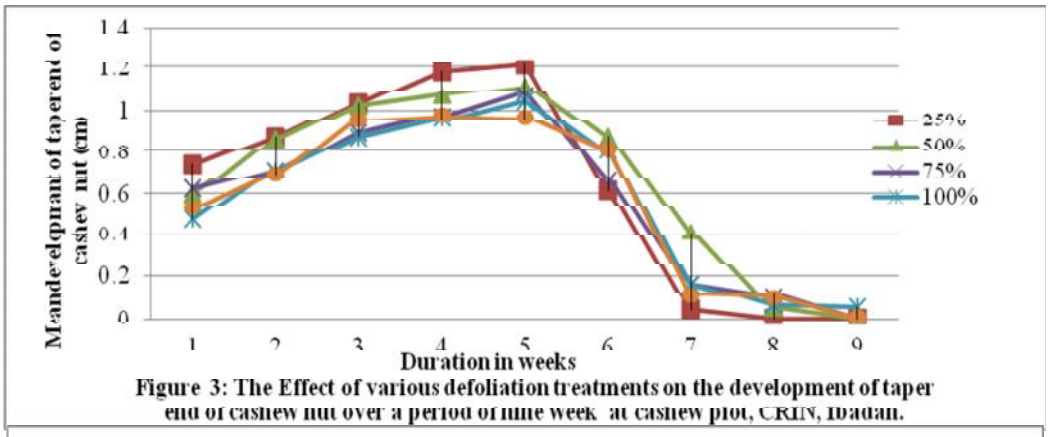

Figure 3: The Effect of various defoliation treatments on the development of taper end of cashew nut over a period of nine week at cashew plot, CRIN, Ibadan.

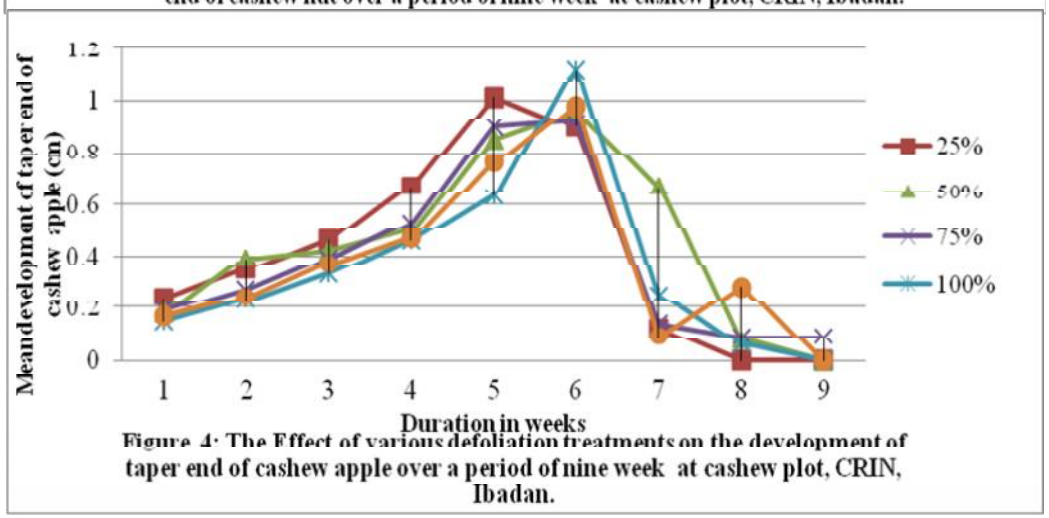

Figure 4: The Effect of various defoliation treatments on the development of taper end of cashew apple over a period of nine week at cashew plot, CRIN, Ibadan.

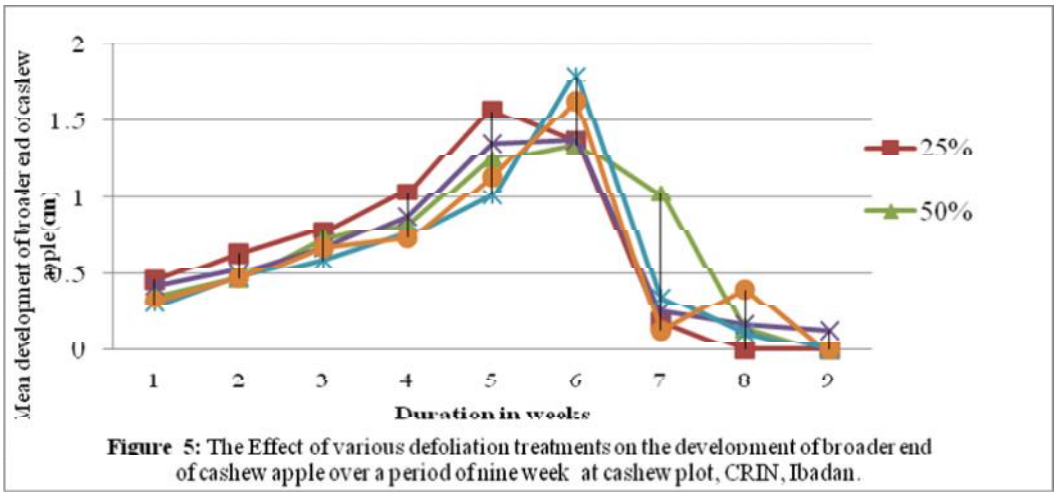

Figure 5: The Effect of various defoliation treatments on the development of broader end of cashew apple over a period of nine week at cashew plot, CRIN, Ibadan.

A similar trend was observed on Figure 2. There was also a progressive development of the apple length in the first five weeks but this started reducing from the fifth and sixth week till the end of experimentation. The highest mean value of cashew apple length was 2.56cm observed on 25% at 5weeks. This was closely followed by 505 and 75% defoliation treatments. However there were no significant differences among the treatment means throughout the period of observation. The effect of defoliation on the taper end of nut, taper end of apple and broader end of apple as presented in Figures 3-5, respectively were not significant throughout the period of experimentation. It was observed that there was development of the broader end of the cashew until the seventh week when it started to reduce in size or dimension. Even though, there was no significant difference among the various defoliation treatments, 100% defoliation was observed to record higher mean values of 1.12cm and 1.8cm respectively for taper end of apple and broader end of apple.

DISCUSSION

Mechanical defoliation practises include hand-picking entire leaflets, holepunching, and cutting leaflets (Sean, 2001). Some researchers indicate that plant stresses caused by mechanical defoliation may not adequately represent actual insect defoliation (Mesa and Fehr, 1984; Baldwin, 1990). Board *et al*., (1994) observed that the trend of most insect defoliation progresses gradually. Higley and Peterson (1996) reported that typical insect consumption rates grow logarithmically by instar so that late instars eat the most plant tissue. On the contrary, mechanical defoliation removes leaf area all at once. Haile *et al*., (1998) opined that if the primary effect of insect defoliators is removal of leaf tissue, mechanical defoliation is justified. In addition, Ostlie (1984) reported no differences in leaf transpiration rates or total water loss when these two methods were compared. According to Sean (2001), the removal of a known amount of leaf area (using hole-punchers) is also easily quantified.

Many reports have confirmed that trees can increase leaf phosynthetic rates in response to crop requirement for photosynthesis (Syvertesen *et al*., 2003). This study indicates that cashew can bear certain intensity of defoliating during the fruiting season. There was a remarkable tolerance of cashew to defoliation. Rongcai *et al.,* (2005) reported that 25% defoliation of orange tree can decrease average leaf size but has little effect on the tree growth, fruit yield and juice quality. Similarly, this work shows that up to 100% defoliation of leaves surrounding the inflorescence can not affect the development of nut and fruit. This probably supposes that healthy cashew tree have excess leaf area that is not required to develop a normal crop load and in addition, the tree can compensate for such levels of leaf removal by increasing photosynthetic rates of remaining leaves. This corroborates the work of Iglesias *et al*.,(2002) that some level of defoliation can be compensated for by increasing photosynthetic rates of remaining trees. According to Flore and Irving (1983), defoliation of up to 20% in apple, 20% in sour cherry had no significant effect on fruit yield.

This study corroborates the work by Poston *et al*., (1976) who observed that cutting the leaflet across the midrib increased photosynthesis. However, the complete removal of the leaflets did not affect the yield parameters and this contradicts the observation by some workers.Talekar and Lee (1988) discovered that cutting along the midrib resulted in the lowest yield loss among the artificial defoliation techniques, while removing the entire leaflet resulted in highest yield losses. Holepunching resulted in significantly greater water loss than removing entire leaflets, and more closely resembled water loss due to actual insect feeding (Hammond and Pedigo, 1981). Whether or not the stem or petiole is removed may be important; however, little or no research has been done on this subject. Hand-defoliation of entire leaflets is the most commonly used mechanical defoliation method (Hutchins et al., 1988), and was shown to be an accurate estimate of the effect of caterpillar defoliation on yield by Thomas (1984). Thomas used the average leaf area consumed throughout the larval development of the cabbage looper (119.4 cm2) to determine the number of larvae per row meter that would cause 6% defoliation; yields from 6% mechanical defoliation and insect defoliation were the same (Sean, 2001). This work is a preliminary study towards providing a better understanding of the effect of leaf loss on cashew fruiting and development.

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