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Full Length Research Paper

Comparison of potential pod yield and loss in old and rehabilitated cocoa plots

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A field study was carried out between 1999 and 2001 to comparatively evaluate the potential pod yield and losses in old and rehabilitated cacao plots. Two plots made up of an old and a rehabilitated plots were chosen and four trees were randomly selected as experimental unit at four different locations within each of the plots to serve as the replicates. The experimental units were then laid out in a randomized complete block design. Data on total fruit set (TFS), number of damaged pods (DMP), number of diseased pods (DSP), number of Cherelle wilted pods (CWP) and number of fermentable pods FMP) were collected over two years and subjected to ANOVA and correlation analysis. The result showed that pod loss to cherelle wilt was 34.9% and to diseases 22.3% while the damaged pods amounted to 11.5% in the old plot. In the rehabilitated plot, damage due to mirid infestation was responsible for about 27.4% pod loss followed by cherelle wilt of 25.6% and diseased pods 11.7%. The total number of fermentable pods of 19.8% and 41.6 were obtained in both old and rehabilitated plots respectively. The result showed that TFS was significantly (P<0.01) improved by rehabilitation though damage due to insect infestation and pod loss to cherelle wilt still accounted for the loss of over 50% TFS.

Key words: Cherelle wilt, damaged pods, diseased pods, old plot, rehabilitated plot.

INTRODUCTION

It is known in all cocoa producing countries that only a small percentage of potential pods is ever harvested as healthy pods suitable for processing. Some of the potential pods are lost to pests and pathogenic diseases while many are lost as cherelles in the earlier stages of pod development. Opeke (1982) reported that only about half of the developing pods on a tree actually reach maturity as a result of death of the rest caused by cherelle wilt. Shepherd (1955) considered rehabilitation to be the restoration of the yields to their peak level by the systematic replacement of inferior trees while Wood and Lass (1985) regarded rehabilitation to be the process of restoring yield by improved cultivation and management of existing mature cocoa trees.

Montgomery (1981) reported that highest cocoa yields are achieved between 15 and 25 years and that a profitable life span may be 50 years, but that from the 26th year yields decline gradually and production costs rise steadily.

Olaiya (2001) suggested that plot could only be declared unproductive if the yield has decline to about the quarter of what is obtainable at the peak period or if the average yield / tree/ year in an hectare is less than twenty pods.

Methods of cocoa rehabilitation in producing countries have been mainly classified into two. These are: selective, phased or complete replanting and coppicing for Chupon regeneration or coppicing and bud grafting on the regenerated chupons.

Odegbaro (1972) showed that regenerated Amenlonado trees in their sixth year after coppicing gave a yield of 1,680 kg per hectare which is about four times the national average production of 460 kg per hectare. Olaiya et al. (2003) got similar results on F3 Amazon where coppicing in November performed best in a

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Table 1. Evaluation of pod yield and loss in the old and rehabilitated plots.

Treatments	TFS (pods)	DMP (pods)	DSP (pods)	CWP (pods)	FMP (pods)
Old Plot	63.1	7.3	14.1	22.0	19.8
Rehab. Plot	118.5	32.5	13.5	30.9	41.6
LSD	33.8*	6.8**	ns	8.7*	13.4*

Note
* Significant at p = 0.05
** Significant at p = 0.01
ns Not Significant
DSP – Diseased Pods; CWP – Cherelle Wilted Pods; FMP – Fermentable Pods TFS – Total Fruit Set; DMP – Damaged Pods;

monthly coppicing trial. In another trial, budded and grafted F3 Amazon trees came into bearing faster than the regenerated Amelonado trees and by the sixth year, yield of F3 budded and grafted F3 Amazon was double that of the regenerated amelonado (Odegbaro and Folarin 1974).

Alvares Afonso et al. (1981) showed that total gross margin for the first five years of replanting under old cocoa was three times as large as the total gross margin for clear – felling. The choice of appropriate method of rehabilitation varies and largely dependent on the cause of unproductivity (Olaiya, 2001) and the cost / benefit ratio (Oduwole, 2001). This study was therefore carried out to compare the pod yield and loss obtainable from the old and coppiced plot after seven years of treatment.

MATERIALS AND METHODS

Two plots N2/3 and N2/2 located in the North block of Cocoa Research Institute of Nigeria were selected for this experiment. F_3 Amazon cacao established between 1963 and 1964 were used. The plot N2/3 was rehabilitated through coppicing and chupon regeneration in 1996 while the plot N2/2 contains old trees. The trees are still productive in terms of flowering and pod production.

Two plots made up of an old and a rehabilitated plots were chosen and four trees were randomly selected as experimental unit at four different locations within each of the plots to serve as the replicates. The two plots (old and rehabilitated) represent the treatments. Each plot was partitioned to four blocks in which sample trees were lablelled. Multiple of four trees in each block serves as replicates making two treatments and four replicates. Data were collected on total fruit set (TFS), number of damaged pods (DMP), number of diseased pods (DSP), number of Cherelle wilted pods (CWP) and number of fermentable pods (FMP) by count at fortnightly interval for both main and light crop over two years. All data collected were subjected to analysis of variance ANOVA. Comparison of treatment means was made using least significant difference (LSD). Correlation analysis was carried out to test for association between Total Fruit set and other pod yield parameters.

RESULTS AND DISCUSSION

The analysis of pod yield and loss as shown in Table 1 revealed that cumulative mean for the Total Fruit Set (TFS) in the old plot was 63.06 while that of rehabilitated plot was 118.44. The F- ratio showed that there is a significant increase in total fruit set when cocoa tree is rehabilitated through coppicing and chupon regeneration.

In old plot out of 63.06 TFS, 7.25 was lost to insect damages, 14.06 was lost to black pod diseases and 22.00 lost as cherelles at earlier stages of development, only 19.75 was harvested at healthy fermentable pods which translates to 31% of total fruit set (Figure 1). The same trend was recorded for the rehabilitated plot where 32.5 was lost to insect damages, 13.4 lost to Black pod diseases and 30.8 lost as cherelles. The healthy fermentable pod (41.6) was 36% of the total fruit set (Figure 2). Except for pods attacked by black pod diseases, there were significant difference in all the variables measured (Table 1).

Figure 3 shows the comparative minimum and maximum pod yield obtainable from the old and rehabilitated plots where maximum healthy fermentable pods from rehabilitated plot recorded 100% increase compared to that of old plot. There is strong positive correlation between the total fruit set and the healthy fermentable pods in both plots. (Table 2)

The results also showed that in the old plot, pod loss to cherelle wilt (34.9%) and diseased (22.3%) were significantly higher than the damaged pods (11.5%), while in the rehabilitated plot damaged pod led in pod loss of about 27.4% followed by cherelle wilted pods (25.6%) and diseased pods (11.7%). This showed that total number of pod loss in old plot was 43.3 with biotic factor (pest and diseases) accounting for (49.8%) and cherelle wilt accounting for (50.8%). In the rehabilitated plot, the total pod loss was 76.8 with pest and diseases accounting for (60.4%) and cherelle wilt accounting for 39.5%. This agrees with the finding of Ashiru and Jacob (1971) who found that pod loss due to biotic factor was of greater importance than cherelle wilt in the overall reduction of pod yield. It was also observed that while damaged pods increased in the rehabilitated plots, diseased pods were reduced. This confirms the negative correlation of (-0.103) obtained for these two biotic factors (Table 2). This then suggests that both factors have to be adequa-tely controlled in cocoa field as a decrease in one factor

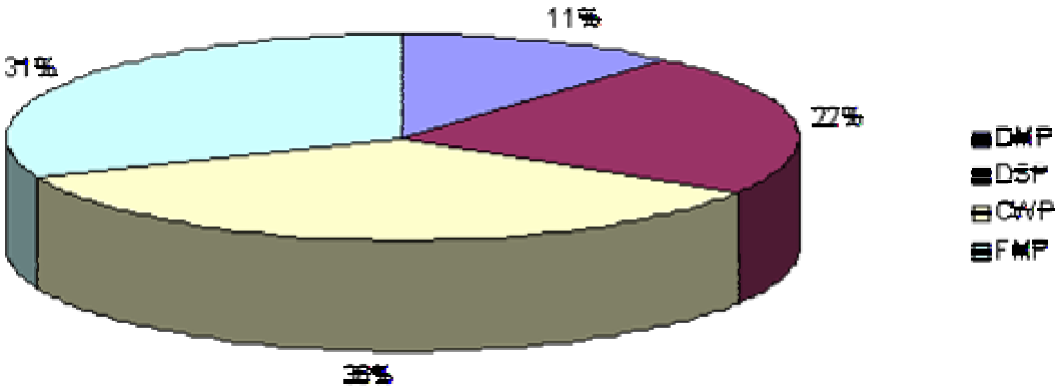
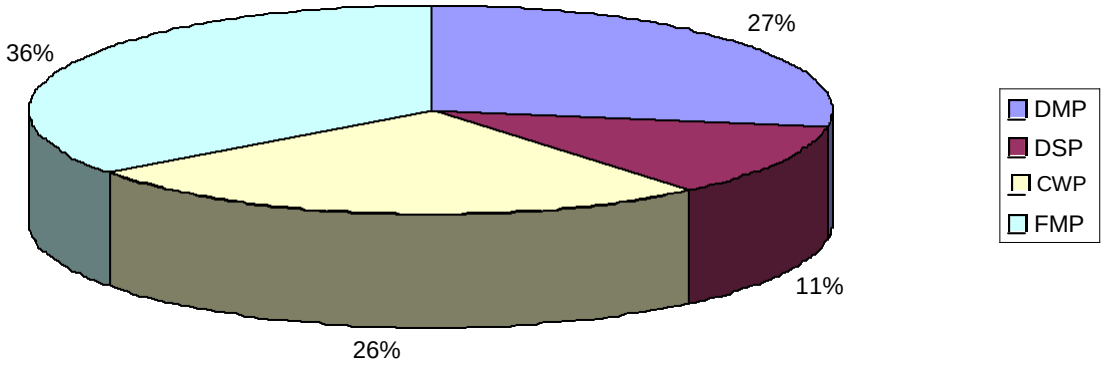


Figure 1. Pie chart showing the pod yield distribution in the old plot.



DMP = Damaged Pod; DSP = Diseased Pod; CWP = Cherelle Wilted Pod; FMP = Fermentable Pod

Figure 2. Pie chart showing the pod yield distribution in the rehabilitated plot.

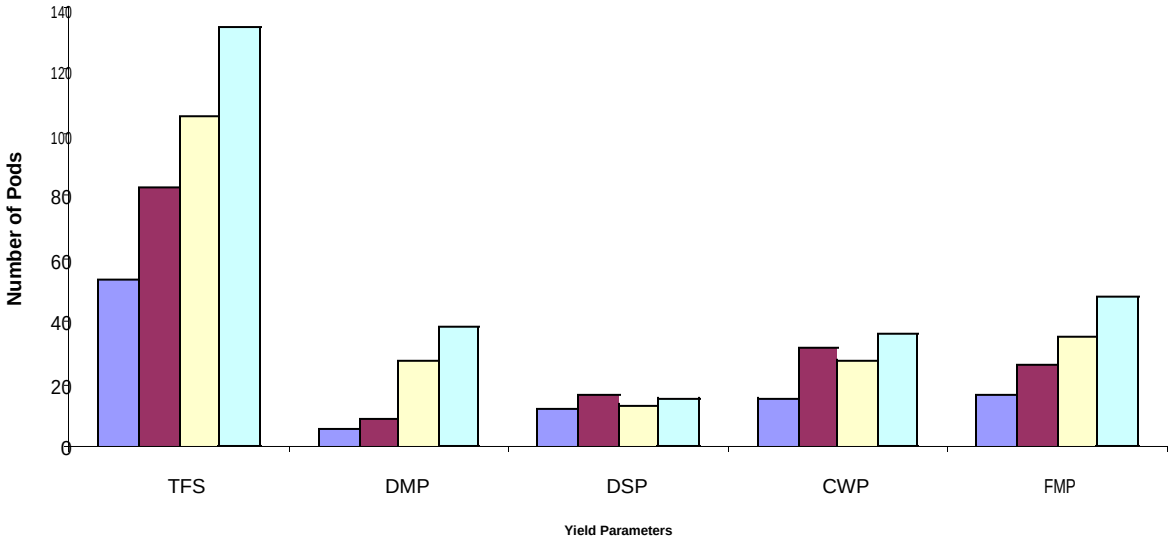


Figure 3. Highest and lowest Pod yield in the Old and rehabilitated plots.

Table 2. Linear correlation relationship between the pod yield parameters.

	TFS	DMP	DSP	CWP
DMP	0.954**			
DSP	0.142^{ns}	-0.103^{ns}		
CWP	0.796*	0.604^{ns}	0.427^{ns}	
FMP	0.985**	0.964**	0.084^{ns}	0.701^{ns}

n – 2 = 6
ns = not significant
* = significant at 0.05
** = significant at 0.01
TFS = Total fruit sets; DMP = Damaged pods; DSP = Diseased pods
CWP = Cherelle wilt pods; FMP = Fermentable pods

can lead to increase in pod loss due to the other. There was no significant difference between old and rehabilitated plots in terms of cherelle wilted pods. Nichols (1965) reported that hand thinning of fruit does not reduce cherelle wilt while Murray (1955) showed that the increase in cacao yield due to fertilizer application was as a result of an increase in the production of cherelle per tree rather than a decrease in the amount of wilt. The increase in damaged pods in rehabilitated plot was due to lack of shade trees and loss of some cacao trees, which predispose the plantation to mirid infestation. Mirid is the most important economic pest of cocoa in West and Central Africa. (Wood and Lass, 1985).

There were strong positive correlation between the total fruit set, damaged pods, and the healthy fermentable pods (p = 0.01) and there was a significant correlation between the total fruit set and cherelle wilted pods (p = 0.05) while there was no significant relationship between the total fruit set and the diseased pods (Table 2). The fermentable pods had also strong positive relationship with damaged pods and insignificantly correlated to the diseased and cherelle wilted pods.

The positive and significant correlation between total fruit set, fermentable pod, damaged pods and cherelle wilted pods showed that these variables are largely dependent on the total fruit set while the diseased pods does not significantly depend on the total fruit set. In a well maintained cacao plantations, a yield of 600 – 900 kg/ha have been taken as average for Africa. The total yield of 514. kg/ha obtained in old plot compared with 1082 kg/ha obtained in rehabilitated plot, showed clearly that apart from pod loss due to biotic and abiotic factors, age contributes significantly to yield reduction in cocoa farms in Nigeria. As is common to all crops, there is a maximum age conditioned by varieties, soils, general plantation management, diseases, insect, and other factors beyond which a plantation ceases to be of economic interest. Krug and Quartey – Papafio (1964) after conducting cocoa survey throughout the growing regions of the world, recommended 30 to 40 years as the average economic life span of a cocoa tree while Montgomery (1981) reported that the highest cocoa yields are achieved between 15 and 25 years.

The yield of 1082 kg/ha obtained from F_3 Amazon in the rehabilitated plot was similar to that one reported by Odegbaro (1972) which noted that regenerated Amelonado trees in their sixth year after coppicing gave a yield of 1680 kg/ha; about four times the national average of 460 kg/ha at that time. Olaiya (2001) suggested that apart from age consideration, a plot could be declared unproductive if the yield has decline to about the quarter of what is obtainable at the peak period of 15 – 25 years.

CONCLUSION

Pod loss is major factor in Cocoa plantations in Nigeria as it has accounted for over 50% of the total fruit set in both old and rehabilitated plots. Low yield and pod loss has render continued management of old plot unprofitable for farmers since management cost rises steadily as the farm enter the fourth decade of establishment. Pod loss to cherelle wilt was higher than that of insect damages and fungal infection in the old plot.

Few permanent trees and temporary shade should be left in rehabilitated plot while missing gap should be replanted within the first year of rehabilitation so as to reduce Mirid infestation which increased pod loss to insect damages in the rehabilitated plot.

The increase in pod yield in rehabilitated plot was largely due to increase in total fruit set (TFS) and not as a result of reduction in pod loss. Rehabilitation through coppicing and chupon regeneration is hereby recommend for old cocoa plot as it attained economic productivity by fifth year after rehabilitation compared to complete replanting which is costly and gives economic productivity after eight years.

Based on the outcome of this study an average age of 40 years could be recommended as the economic lifespan of F_3 Amazon cocoa in South Western Nigeria. Cocoa plantations that are over 50 years are therefore recommended for rehabilitation.

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