Assessment of distribution and Probable Causes of Leaf scorch Disorder and Tapering Disorder in Coconut (*Cocos nucifera*) Palm of Small Holders in Welpalla Coconut Development Officer Range

N.D.C.R KARUNARATHNA [1], M.N.D. FERNANDOPULLE [1]and C.S. HERATH[2]

[1]*Department of Plantation Management, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawilla (NWP)*

[2]*Technology Transfer Division, Coconut Research Institute, Lunuwilla*

ABSTRACT

Leaf scorching disorder and tapering disorder were identified as two major disorders in coconut cultivation of Sri Lanka. The two disorders had resulted heavy losses through low productivity in Coconut cultivations. An attempt was made in the study to identify the probable causes, and the distribution patterns of the two disorders in various soil types in Welpalla CDO range.

The study had shown that all the Coconut palms which were less than 10 years old and which were in the 1st generation had not affected by Leaf Scorch Disorder. These disorders had a relationship with Type of Soil, Nature of Soil, Fertilizer Application, Planting Material and Weed management method. Only Tapering Disorder showed a relationship with mulching.

KEYWORDS: Leaf Scorch Disorder, Tapering Disorder

INTRODUTION

The Coconut palm (*Cocos nucifera*), which belongs to Family Palmae, has become a "Tree of Life" giving invaluable uses to the man. It gives product as well as by product which are very useful in different ways. Coconut cultivation is limited to some parts of the world especially Philippine, Indonesia, Thailand, Sri Lanka, India and Fiji Islands etc.

Sri Lanka is the fourth largest coconut producing country in the world. Coconut is the second largest commercial crop in Sri Lanka. It covers approximately 440,000ha of land. The cultivation has widely spread especially in the three districts Kurunegala, Gampaha and puttlam. It is referred as the Coconut Triangle. It accounts for 65-70% of the total coconut growing areas. Kurunegala district owns the largest area of cultivating coconut (159,846ha). Coconut cultivation is dominated by Small holders (<8ha). They occupy 75% of the total cultivated coconut lands. They contribute only for 60% of the national production (Liyanage, 1999).

The coconut sector plays a major role by contributing 2% of the GDP with an ensured food and nutrition security of the population, contributing 3.4% of foreign exchange earnings annually, providing 22% of the per-capita caloric intake in the diet and providing about 500,000 people with direct and indirect employments (Central bank report 2003).

The current problem is the low production and low productivity, land fragmentation under coconut cultivation, pest and disease problems, minimum use of modern technology, low level of cultural practices, drought and coconut disorders etc. But the extension of land area under coconut cultivation is impossible due to limitation of land. Increasing the productivity is wise worth. Average productivity at present is recorded approximately 7000nuts/ha/year. But it has being found that there is a capacity of 10,000nuts/ha/year.

Leaf scorched decline (LSD), Tapering disorder (TD), Rapid decline and Weak palms, which are recorded as the causes for unproductiveness of the palms. Out of them TD and LSD are responsible for a severe damage in the cultivation. LSD affected plants show a scorching in the tip of the leaflets of lower leaves. Then a withering extends along the leaflets toward the midrib of leaves and progresses from lower to upper leaves as pre symptoms. Scorched leaves tend to remain for a long time in the trunk without falling. It is also accompanied by TD and reduction of yield. Root decay is another considerable symptom (Ekanayeka, 1963).

LSD is caused for a 60% of the reduction in copra production of a healthy palm (Mahindapala,*et. al.*, 1975). Fusarium population in the soil near the decayed root is higher but it is not confirmed whether it is the causal organism (Ekanayeka, 1968).

Tapering disease may happen after LSD attack or as quick tapering. The trunk just below the Crown becomes narrow. It is mainly due to manifestation of malnutrition or unsatisfactory of available plant food by the living plant tissues. But it is revealed that TD is not due to an infected organism or virus (Cooke, *et. al.*, 1950) The LSD and TD is recorded before a century ago. But nobody has found the factors cause coconut disorders. Research studies on coconut disorder may create opportunities to find solution for the specific unproductiveness

METHODOLOGY

Primary and secondary data were used for this analysis. The affecting factors for the growth, development and reproduction of the coconut palm; age, generation, type of soil, nature of soil, type of planting material, fertilizer application, mulching and weed management were collected from secondary data (CRI). A pre-tested, semi structured questionnaire was used to collect primary data. A survey was conducted in Welpalla Coconut Development Officer (CDO)

range in Kurunegala District. Smallholders whose land area under coconut cultivation was less than 20 acres (sampling size 60) were interviewed. Tabular analysis and chi-square analysis were used to analyze data collected.

RESULTS AND DISCUSSION

1. Distribution of LSD and TD palms in different Age groups

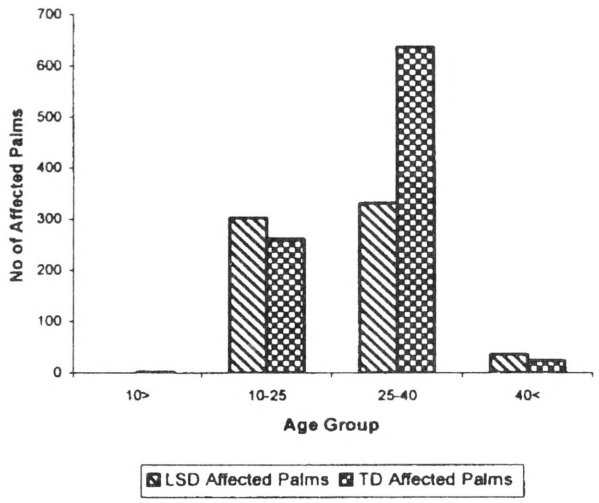

Figure 1: Number of Affected Palms in different Age Groups

According to Figure 1 the highest incidence of disorder was recorded from the age group of 10-25 years and 25-40 years. Young and youth palms were mostly affected of this disorder. The disorders were not recorded in very young palms, less than 10 years old. The disorders did not infect for unbarring palms. The palms at highest yielding stage were tending to be affected by disorders. The 40<years palms had already been destroyed, therefore population of affected palm of oldest palms were less. Therefore more attention was to be given for youth coconut palms.

2. Distribution of LSD and TD palms in different Generations

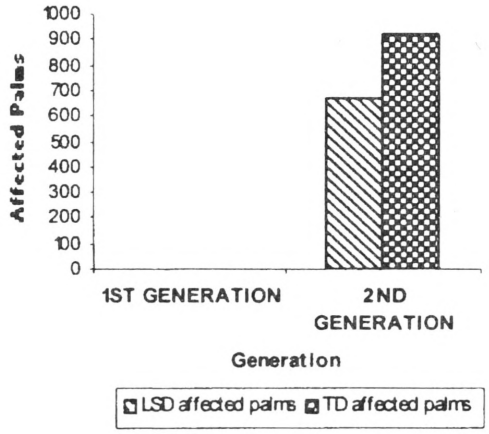

Figure 2. Number of Affected Palm in different Generations

As figure 2 shows all palms affected by disorder, were in the second-generation. But First generation palms had not been recorded as affected. It might be because first generation palms could obtain enough nutrients, and water from soil due to higher fertility level of that soil. But when second generation came after around 60 years, soil had become very infertile and eroded due to lack of maintenance by farmers.

According to table 1, the highest incidence of LSD was recorded from palms in gravel soil (11%). 2nd highest incidence of LSD was recorded from palms, which were in clay soil (7%). Palms which were in sandy loam had affected by LSD was minimum (2%) compared to palms in sandy soil (4%)

3. Distribution of LSD palms in different Type of soil

Sandy loam soil was very rich in nutrient and water. Roots could grow well in sandy loam soil. Therefore absorption was higher. But roots were difficult to grow in gravel soil. Therefore nutrient and water absorption capacity was less. According to probability value (Table 1), there was an association between type of soil and LSD affected palms.

Table 1: presence of LSD in different soil type

	Leaf scorch disorder	
Type of Soil	**Present**	**Not**
Clay	7%	93%
Sandy	4%	96%
Sandy loam	2%	98%
Gravel	11%	89%

Statistic	**DF**	**Value**	**Prob**
Chi-Square	3	278.9887	<.0001
Likelihood Ratio Chi-Square	3	304.8005	<.0001

4. Distribution of LSD palms in different Nature of Soil:

Table2. Presence of LSD in different nature of soil

	Leaf scorch disorder	
Nature of Soil	Present	Not Present
Good	6%	94%
Moderate good	5%	95%
Eroded	22%	78%

Statistic	**DF**	**Value**	**Prob**
Chi-Square	2	287.4301	<.0001
Likelihood Ratio Chi-Square	2	192.1757	<.0001

According to Table 2, highest LSD affected palms were recorded from eroded soil (22%) might be due to lack of nutrients. Good and moderate good soil palms did not show significant difference. That was 6% and 5% respectively. According to probability value (Table 2) there was an association between nature of soil and LSD.

5. Distribution of LSD palms in different Fertilizer application:

According to Table 3, highest LSD affected palms were recorded, when farmers applied only organic fertilizer (20%). But when farmers did not apply any fertilizer (organic or inorganic) it was recorded 16% affected palms. But when applied inorganic or organic fertilizer 5% affect palms were recorded. Therefore applications of both fertilizers were necessary to minimize damages and increase the yield.

Table 3: Presence of LSD with different fertilizer application

Fertilizer application	Leaf scorch disorder	
	Present	Not present
Organic	20%	80%
Inorganic fertilizer	5%	95%
Both fertilizer	5%	95%
No fertilizer	16%	84%

Statistic	DF	Value	Prob
Chi-Square	3	339.8459	<.0001
Likelihood Ratio Chi-Square	3	254.6429	<.0001

According to probability value (Table 3) there was an association between fertilizer application and LSD.

6.Distribution of LSD palms with different Planting Material:

According to Table 4, highest affected palms were recorded (9%) in coconut estates where almost all the seedlings were taken from CCB. Only 3% was recorded from the farmers who used seedlings from their own estates according to the study.

Phenotype = Genotype + Environment,

To get good phenotypic plant it is necessary to find good genotypic plant and should be ideal for their environment. Although CCB was providing highly improved varieties farmers had thought it is not better quality in adaptation for environment of their own estates. According to probability value (Table 4), it showed an association with planting material and LSD.

Table 4: Presence of LSD with different planting material

Planting material	Leaf scorch disorder	
	Presence	Not Presence
From CCB	9%	91%
From own estate	3%	97%
From private nurseries	3%	97%

Statistic	DF	Value	Prob
Chi-Square	2	138.5099	<.000
Likelihood Ratio Chi-Square	2	147.3419	<.0001

7. Distribution of LSD palms in different Weed Management practices:

According to Table 5, highest LSD affected palms (19%) were recorded when no weed management was practiced. But it was around 3%-6% when farmers used other weed management methods. Therefore weed management practices were important in supplying nutrients effectively and efficiently by reducing competition. An association was identified between weed management method and LSD according to probability value (Table 5).

Table 5: presence of LSD with different weed management practices

Weed management method	Leaf scorch disorder	
	Present	Not Present
Chemically	3%	97%
Machinery	3%	97%
Slashing	6%	94%
No weed mgt	19%	81%

	DF	Value	Pro
Chi Square	3	330.8643	<.0001
Likelihood Ratio Chi Square	3	251.1558	<.0001

8. Distribution of LSD palms with Mulching:

According to the probability value (Table 6) no association was identified between mulching and LSD.

Table 6: Presence of LSD with mulching

Mulching	Leaf scorch disorder	
	Present	Not Present
Mulched	6%	94%
Not mulched	6%	94%

Statistic	DF	Value	Prob
Chi-Square	1	0.6581	0.4172
Likelihood Ratio Chi-Square	1	0.6616	0.4160

9. Distribution of TD palms in different Type of Soil:

Table 7: Presence of TD in different soil type

Type of soil	Tapering disorder	
	Present	Not Present
Clay	10%	90%
Sandy	6%	94%
Sandy Loam	3%	97%
Gravel	15%	85%

Statistic	DF	Value	Prob
Chi-Square	3	349.6739	<.0001
Likelihood Ratio Chi-Square	3	376.8907	<.0001

According to Table 7, it was evident that highest palms affected by TD was in Gravel soil (15%). 10% of palms that were in clay soil had affected by TD. But the minimum damages were recorded from palms, in sandy loam soil (3%). Sandy soil was identified as the next best soil to prevent affectation of TD as it recorded only 6% as affected. According to Table 7, an association was portrayed between type of soil and TD.

10. Distribution of TD palms in different Nature of Soil:

According to Table 8, palms which were in eroded soil were highly affected by TD (56%). But palms in good and moderately good soil affected only 6% and 5% respectively.

Table 8: Presence of TD in different natures of soil erosion

	Tapering disorder	
Nature of soil	**Present**	**Not Present**
Good soil	6%	94%
Moderate good	5%	95%
Eroded	56%	44%

Statistic	DF	Value	Prob
Chi-Square	2	1850.0009	<.0001
Likelihood Ratio Chi-Square	2	1032.0132	<.0001

Eroded soil was very infertile and the roots penetrate through tough soil less conveniently. Therefore palms could not absorb enough nutrients. According to probability value (Table 8), there an association was observed between nature of soil and TD.

11. Distribution of TD palms in different Fertilizer application:

Table 9: Presence of TD with different fertilizer application

Fertilizer application	Tapering disorder	
	Present	Not Present
Organic fertilizer	8%	92%
Inorganic fertilizer	8%	92%
Both fertilizer	4%	96%

Statistic	DF	Value	Prob
Chi-Square	3	25.7568	<.0001
Likelihood Ratio Chi-Square	3	25.1416	<.0001

According to Table 9, 13% of the palms were affected by TD where fertilizer application was not done. Even under the application of organic or inorganic fertilizer 8% of the palms were affected by TD. Under the application of both organic and inorganic fertilizer minimum number of palms were damaged by TD (4%). Therefore application of inorganic fertilizer with organic fertilizer highlighted the necessity to prevent TD damage. According to probability value (Table 9) an association was identified between fertilizer application and TD.

12. Distribution of TD palms with different Planting Material:

Table 10: Presence of TD with different planting materials

	Tapering disorder	
Planting material	**Present**	**Not Present**
From CCB	12%	88%
From Own estate	8%	92%
From Private nurseries	4%	96%

Statistic	DF	Value	Prob
Chi-Square	2	192.2395	<.0001
Likelihood Ratio Chi-Square	2	209.2323	<.0001

According to Table 10, highest incidence of TD (12%) was recorded in estates where seedlings were taken from CCB. Seedlings taken from own estates of farmers recorded 8% as affected. Minimum damage (4%) was recorded from estates where seedlings were taken from private nurseries. According to probability value (Table 10) an association existed between planting material and TD.

13. Distribution of TD palms in different Weed Management practices:

Table 11: presence of TD with different weed management practice

Weed mgt method	Tapering disorder	
	Present	Not Present
Chemically	5%	95%
Machinery	3%	97%
Slashing	7%	93%
No weed mgt practices	37%	63%

Statistic	DF	Value	Prob
Chi-Square	3	1221.9857	<.0001
Likelihood Ratio Chi-Square	3	842.2694	<.0001

According to Table 11, highest incidence of TD was recorded under zero weed management. It was 37%. But with usage of any weed management practices the affected percentage of TD was less compared to 37%. It might be the effect of less competition.

14. Distribution of TD palms with Mulching

Table 12: Presence of TD with mulching

	Tapering disorder	
Mulching	**Present**	**Not Present**
Mulched	5%	95%
Not Mulched	11%	89%

Statistic	DF	Value	Prob
Chi-Square	1	111.4029	<.0001
Likelihood Ratio Chi-Square	1	120.7056	<.0001

According to Table 12, 11% of palms were affected by TD, when mulching was not practiced. But with the presence of mulch only 5% palms were affected. According to Table 12 There was an association between mulching and TD.

CONCLUSIONS

Cocos nucifera palms which were less than 10 years old and in the1st generation had not affected by Leaf Scorch Disorder or Tapering Disorder. But both disorders had an association with Type of Soil, Nature of Soil, Fertilizer Application, Planting Material and Weed management method, while mulching had a relationship only with TD but not with LSD. But more research is needed to be carried out.

ACKNOWLEDGEMENTS

Authors wish to thank Mr.H. Nimal Appuhamy, Head, Mr. Sarath Edirisingha, Mr. Jagath Jajawardena Technology Transfer Division, Coconut Research Institute for the valuable assistance given in conducting this study. Sincere thank goes to Dr.N.E.M. Jayasekara, Head, department of plantation management, H.A.W.S. Gunathilaka, Lecture, Department of Plantation Management, Mr. K.H.M.I. Karunarathna, Computer Instructor and staff of the computer unit for the guidance

REFERENCES

Anon (2003). Annual report 2003, Colombo. The central Bank of Sri Lank annual report (2003) Central bank report, (2003)

Cooke, F.C., W.R.N Nathanael and M.De.S Liyanage, (1950) The Tapering disease of coconut. Ceylon coconut quarterly, 1(2):9-15

David Robertson. (1969) Report on Leaf Scorch of coconut. Ceylon coconut quarterly, 20: 168-173

Ekanayeka, U.B.M (1963), Leaf Scorch of coconut- A preliminary note. Ceylon coconut planter's review, 3(4): 81-82

Ekanayeka, U.B.M (1968) Leaf Scorch decline of coconut Ceylon coconut quarterly, 19:183-187

Liyanage, M.De.S. (1999), A guide to scientific cultivation and management of coconut, p.1-2

Mahindapala, R.and A.M. Chandrasena, (1975) Yield and Drupe characteristics of coconut palms affected with Leaf Scorch decline. Ceylon coconut quarterly, 26: 73-76

Pieris, OS, (1968) Studies on Leaf Scorch decline of coconut plalms. Ceylon coconut quarterly, 3:109-115