

**Title** : Determination of Optimum Harvesting Regime in a Latanye Plantation.

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**Antecedents:**

Central to the Latanye Broom Industry is to have a sustainable harvesting system of the leaves. Preliminary observations using a sample of 28 plants on a farmer's holdings at La Pointe Mon Repos (Paulina Ferdinand), indicated that leaves can be sustainably harvested. That plantation was established in 2001, and the first harvest was on 18 March 18 2004. The second harvest was in June 2004, three months later. The farmer used a 40 % harvest of the leaves.

Consequently, an experiment was designed to test the hypothesis that: Latanye leaves can be sustainably harvested every three months.

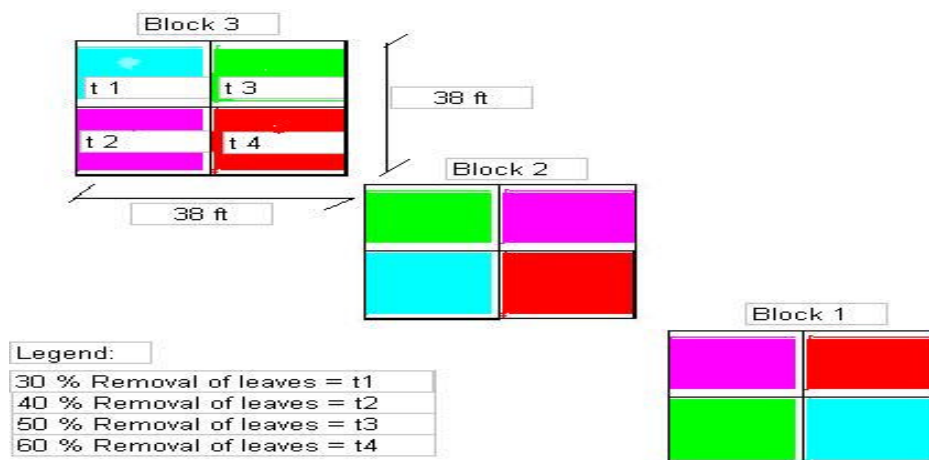
**Objective**

To determine the optimum harvesting regimes for Latanye at Mary Aurilien's holding at Dennerly.

**Methodology:**

The Latanye Plantation was established in 2001, and was used as a research plot to test establishment of a Latanye plantation. The experimental design- random complete block was used to establish the plots to capture the variability of the land in terms of aspect, slope and fertility based on the soil profile. The design and dimensions of the plot are illustrated figure # 1 below.

Figure # 1: Design of Research Plot.



Block one (1) and three (3) are on opposites sides of a slope and Block two (2) is at the top of a plateau. In addition plot one has greater shading caused by the presence of approximately 40% shading of larger trees.

For the first harvest done on September 29 2004, the number of leaves present initially and the number of leaves harvested were recorded. For the second harvest done on the January 31 2005, the same data was recorded.

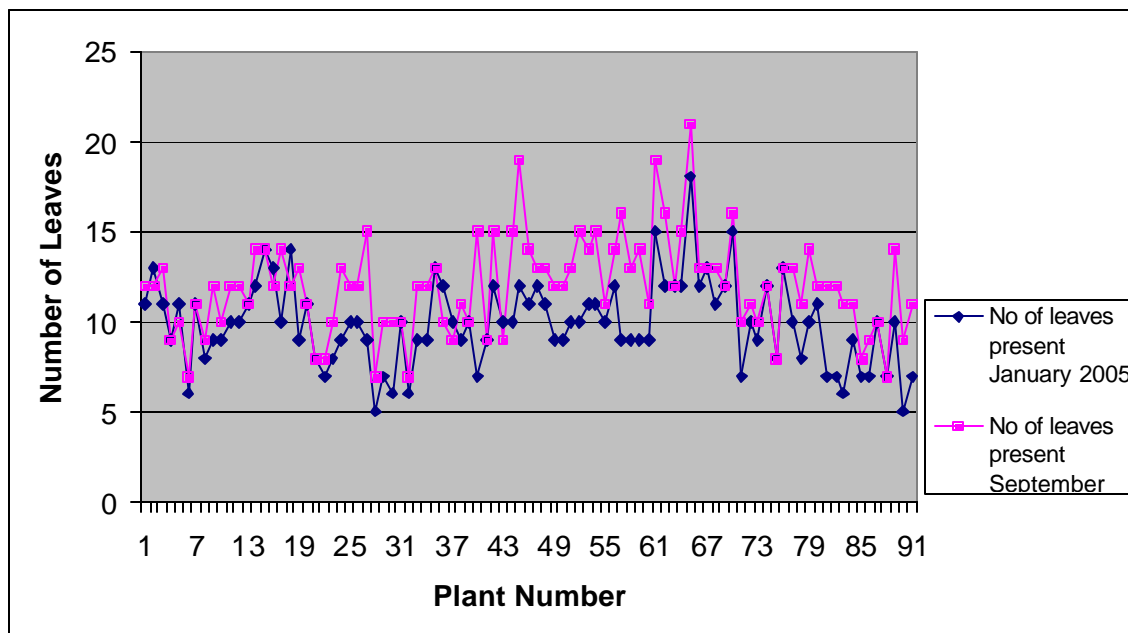
In data analysis, the treatments and blocks were used as independent variables and the dependent variable was the difference between the number of leaves present in September 29 2004 and that present on January 31 2005 (No. of Leaves present September - No. of Leaves present in January 2005). Analysis was also done of interaction between the blocks and treatments. (Table: #7).

The statistical programs used were: SPSS version 10.1, Microsoft Office Excel 2003 and Statistica- release 5.0. Analyses were done of Homogeneity of variance, analysis of variance (ANOVA), and Student-Newman-Keuls (S.N.K.) and Duncan tests to find out the difference and significance of the findings.

### **Results:**

Presented in table # 6 of the appendix, are the results of the number of leaves present in September 2004 and January 31 2005. Figure #2 shows a general distribution of the number of leaves present for the two mentioned periods.

Figure #2: Number of Leaves present Initially for September 2004 to January 2005



Analysis of homogeneity of variance showed that the variances were equal for all groups in both cases of the treatment and the blocks to permit the application of ANOVA, as all values had a significance greater than 0.05. The results are below in table # 1 and 2.

Table # 1: Test of Homogeneity of Variances for Treatments

Levene Statistic	df1	df2	Sig.
<b>.531</b>	<b>3</b>	<b>87</b>	<b>.662</b>

Table #2: Test of Homogeneity of Variances for Blocks

Levene Statistic	df1	df2	Sig.
<b>1.935</b>	<b>2</b>	<b>88</b>	<b>.150</b>

Using treatment and block as independent variables, the analysis of variance (ANOVA) showed that there are significant differences in the number of leaves present from harvesting for the period. A significance of 0.00 was obtained for the Blocks and 0.04 for the treatments. The results are shown below in table #3 and 4.

Table # 3: Test of ANOVA for Treatments

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	53.564	3	17.855	4.732	.004
Within Groups	328.260	87	3.773		
Total	381.824	90			

Table #4: Test of ANOVA for Blocks

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	69.485	2	34.743	9.789	.000
Within Groups	312.339	88	3.549		
Total	381.824	90			

Using the S.N.K. test, the treatments 30%, 40% and 50% form a homogenous group (table #5). At the Latanye plantation studied, this observation was confirmed using Table #6, in which 62% (16) and 50 % (11) 32% (8) of the plants had in January 2005- an equal number of leaves or one (1 +/-) leaf more or less than the quantity of leaves present in September 2004 for the respective treatments.

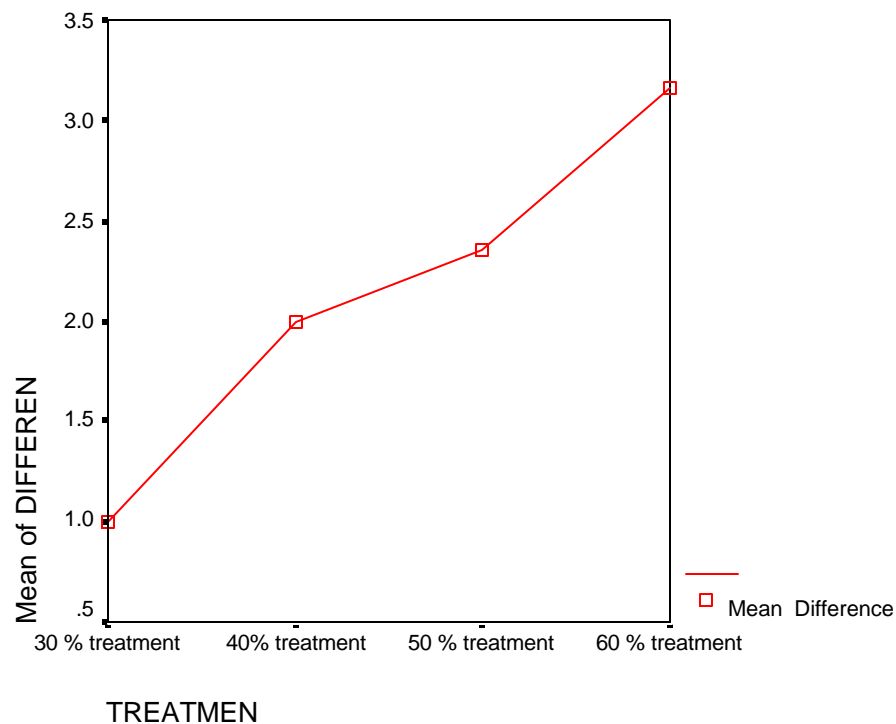
Also noted in table #5 is that the 40%, 50% and 60% treatments also form another homogenous group. Again for the respective treatments at Mary Aurilien's farm this was observed using Table #6, in which 37% (8), 64% (16), and 89% (16) of the plants had in January two or more leaves re-grown January 2005.

One may note the disparity between the number of leaves present initially for the 30% and the 60% treatments, and the similarity in the leaves present initially that of the 40 and 50% treatment. Figure #3 is a graphic representation of the disparity and similarities in the average difference of Latanye leaves present in January 2005.

Table #5: Results of Student-Newman-Keuls for Treatments.

	N	Subset for alpha = .05	
TREATMENT		1	2
30 %	26	1.0000	
40%	22	2.0000	2.0000
50 %	25	2.3600	2.3600
60 %	18		3.1667
Sig.		.056	.117

Figure #3: Variation of the mean of the differences of number of leaves for Treatments



There is also a significant difference between Block one and two (Block 1 and 2), and Block three (Block 3) in terms of the leaves re-grown in January 2005. Table #6 presents the results in the field: for Block 3 all trees measured in January had an equal number or more leaves present initially than in September 2004. This was irrespective of the treatment applied. Block one and two (1 and 2) had values of number of leaves harvested oscillating more and less than initial number of leaves present in September 2004.

Also observed is interaction between the Blocks and treatments: for block1 and 30% treatment, Block 2 and 50 and 60% treatments and Block 3 with the 50% treatment. (Table# 7)

### **Discussion and Conclusion:**

The interaction in Block one may be caused by the shading of larger trees present. Block 1 is the most shaded plot, receiving the least amount of sunlight. With this assumption and mindful that there is no information of soil fertility in this study, one may infer that in shaded conditions that the 60 % harvesting regime resulted in over harvesting of leaves, and the 30% regime resulted in the under harvesting of leaves in Block 1. This explanation is validated reviewing table #6 in which for the 60% treatment, one may observe that none of the plants were able to recuperate to the initial number of leaves present in September 2004; for the 30% treatment the numbers of leaves present in January 2005 were on average the same or one (1 +/-) more or less than the initial number

of leaves present in September 2004. Consequently the 40% and 50% harvesting regimes appear most appropriate for Block 1 as they result in having two (2+/-) leaves on average, or the same number of leaves three months later.

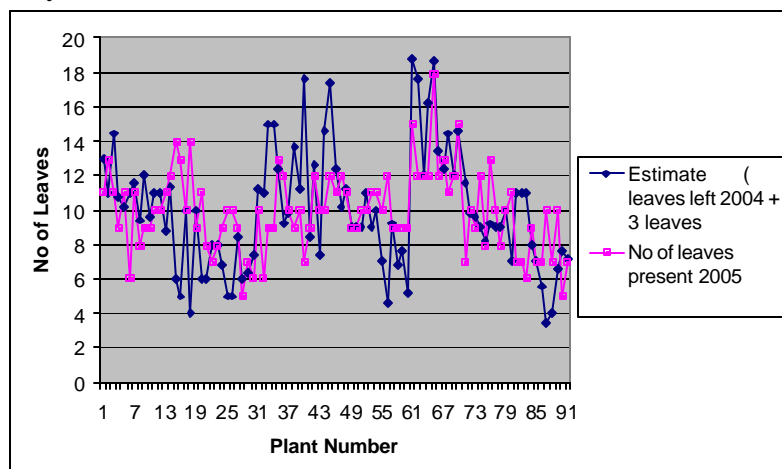
Block 2 is flat and interaction was observed for the treatments 50% and 60%. Block 2 is similar to Block 1 in terms of the 60% and 30% treatments. In Block 2, the 60 and 30 % harvest regimes resulted in over-harvesting and under-harvesting respectively, but, in this case the 50 % treatment also had the result that none of the plants were able to recuperate to the initial number of leaves present in September 2004. For these conditions in Block 2, the 40% treatment appears to be most appropriate for optimum harvesting.

Block 3 was the block with the highest productivity as it was the only block in which the plants were able to recuperate from the four treatments to obtain an equal number or more leaves in January 2005. Block 3 is sloping and has a greater exposure to sunlight. Block 3 appears to be more suited to the growth of Latanye. There is interaction observed for 60% treatment and Block 3. Similar to Block 1 and 2, the 30% treatment resulted in under-harvesting, but unlike them, this all the plants in this block recuperated from harvesting regimes as high 40, 50 and 60%.

The results suggest that it is possible to sustainably harvest Latanye at Mary Aurilien's Latanye plantation with 40% to 50% removal of leaves for the mentioned period- September to January. On average two (2 +/-) leaves re-grew with the 40% and 50% treatment.

Latanye Farmers claim that a Latanye plant produces one leaf per month. This may serve as a plausible explanation for the re-growth of the leaves in Latanye. In table # 8 of the Appendix, three (3) leaves were added to the number of leaves left after harvesting in September 2004, and in Figure #4 is a graphic representation of a comparison between the estimated number of leaves present and actual number of leaves present in January 2005.

Figure #4: Comparison between the Estimated and Actual Number of leaves Regrown in January 2005



## Appendix

Table # 6: Summary of Harvesting Information

Block	Treatment	No of leaves present 2005	No of leaves present 2004	Difference
1	30	11	12	1
1	30	13	12	-1
1	30	11	13	2
1	30	9	9	0
1	30	11	10	-1
1	30	6	7	1
1	30	11	11	0
1	40	8	9	1
1	40	9	12	3
1	40	9	10	1
1	40	10	12	2
1	40	10	12	2
1	40	11	11	0
1	40	12	14	2
1	50	14	14	0
1	50	13	12	-1
1	50	10	14	4
1	50	14	12	-2
1	50	9	13	4
1	50	11	11	0
1	50	8	8	0
1	50	7	8	1
1	50	8	10	2
1	60	9	13	4
1	60	10	12	2
1	60	10	12	2
1	60	9	15	6
1	60	5	7	2
1	60	7	10	3
1	60	6	10	4
2	30	10	10	0
2	30	6	7	1
2	30	9	12	3
2	30	9	12	3

2	30	13	13	0
2	30	12	10	-2
2	30	10	9	-1
2	30	9	11	2
2	30	10	10	0
2	40	7	15	8
2	40	9	9	0
2	40	12	15	3
2	40	10	9	-1
2	40	10	15	5
2	40	12	19	7
2	40	11	14	3
2	40	12	13	1
2	40	11	13	2
2	50	9	12	3
2	50	9	12	3
2	50	10	13	3
2	50	10	15	5
2	50	11	14	3
2	50	11	15	4
2	50	10	11	1
2	60	12	14	2
2	60	9	16	7
2	60	9	13	4
2	60	9	14	5
2	60	9	11	2
3	30	15	19	4
3	30	12	16	4
3	30	12	12	0
3	30	12	15	3
3	30	18	21	3
3	30	12	13	1
3	30	13	13	0
3	30	11	13	2
3	30	12	12	0
3	30	15	16	1
3	40	7	10	3
3	40	10	11	1
3	40	9	10	1



3	40	12	12	0
3	40	8	8	0
3	40	13	13	0
3	50	10	13	3
3	50	8	11	3
3	50	10	14	4
3	50	11	12	1
3	50	7	12	5
3	50	7	12	5
3	50	6	11	5
3	50	9	11	2
3	50	7	8	1
3	60	7	9	2
3	60	10	10	0
3	60	7	7	0
3	60	10	14	4
3	60	5	9	4
3	60	7	11	4

Table # 7: Interaction amongst Blocks and Treatments Using Duncan Test

	{1}	{2}	{3}	{4}	{5}	{6}	{7}	{8}	{9}	{10}	{11}	{12}
Treatments and Blocks	.2857143	1.555556	1.700000	1.428571	2.555556	.8333333	1.333333	3.000000	3.111111	3.166667	3.600000	2.000000
30 1		0.29616	0.25299	0.33493	0.07096	0.60809	0.35841	0.03124	0.02588	0.023957	0.00925	0.171
30 2	0.296157		0.89238	0.90534	0.39923	0.54325	0.84599	0.23399	0.208026	0.198462	0.10496	0.697
30 3	0.252993	0.89238		0.81239	0.45348	0.47711	0.75821	0.2722	0.245103	0.23561	0.12812	0.779
40 1	0.334926	0.90534	0.81239		0.35437	0.60223	0.92895	0.20335	0.178957	0.169672	0.08756	0.631
40 2	0.070961	0.39923	0.45348	0.35437		0.16874	0.32401	0.67722	0.626671	0.607197	0.39101	0.603
40 3	0.608091	0.54325	0.47711	0.60223	0.16874		0.6396	0.08524	0.072687	0.067992	0.03048	0.347
50 1	0.358414	0.84599	0.75821	0.92895	0.32401	0.6396		0.18317	0.159953	0.150884	0.07652	0.585
50 2	0.031241	0.23399	0.2722	0.20335	0.67722	0.08524	0.18317		0.917134	0.884319	0.61376	0.381
50 3	0.02588	0.20803	0.2451	0.17896	0.62667	0.07269	0.15995	0.91713		0.958554	0.66868	0.349
60 1	0.023957	0.19846	0.23561	0.16967	0.6072	0.06799	0.15088	0.88432	0.958554		0.68484	0.338
60 2	0.00925	0.10496	0.12812	0.08756	0.39101	0.03048	0.07652	0.61376	0.668677	0.684842		0.195
60 3	0.170748	0.69725	0.77869	0.63078	0.60291	0.34671	0.58492	0.38074	0.348618	0.337542	0.19512	

Table#8: Comparison between the Estimated and Actual Number of leaves Re-grown in January 2005

Estimate ( leaves left 2004 + 3 leaves	No of leaves present 2005	Difference between Actual and Estimated No of Leaves
13	11	-2
11	13	2
14	11	-3
11	9	-2
10	11	1
11	6	-5
12	11	-1
9	8	-1
12	9	-3
10	9	-1
11	10	-1
11	10	-1
9	11	2
11	12	1
6	14	8
5	13	8
10	10	0
4	14	10
10	9	-1
6	11	5
6	8	2
8	7	-1
8	8	0
7	9	2
5	10	5
5	10	5
8	9	1
6	5	-1
6	7	1
7	6	-1
11	10	-1
11	6	-5
15	9	-6
15	9	-6
12	13	1
9	12	3
10	10	0
14	9	-5
11	10	-1

18	7	-11
8	9	1
13	12	-1
7	10	3
15	10	-5
17	12	-5
12	11	-1
10	12	2
11	11	0
9	9	0
9	9	0
9	10	1
11	10	-1
9	11	2
10	11	1
7	10	3
5	12	7
9	9	0
7	9	2
8	9	1
5	9	4
19	15	-4
18	12	-6
12	12	0
16	12	-4
19	18	-1
13	12	-1
12	13	1
14	11	-3
12	12	0
15	15	0
12	7	-5
10	10	0
10	9	-1
9	12	3
8	8	0
9	13	4
9	10	1
9	8	-1
10	10	0
7	11	4
11	7	-4
11	7	-4
11	6	-5
8	9	1
7	7	0
6	7	1
3	10	7

4	7	3
7	10	3
8	5	-3
7	7	0
	<b>Average</b>	<b>0</b>