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Analysis of Rubber Clones According to Agro-Climatic Variability of Sri Lanka

Pabasara M. Wickramasinghe[1], Oshadi P. Panahatipola[2] and Niranga Dinushi[3]

[1,2,3] Department of Mathematical Sciences, Wayamba University of Sri Lanka Srilanka

Abstract

This study has been carried out to identify the adaptability and stability of the rubber clones according to the agro-climatic environments in Sri Lanka. Ten rubber clones, which genetically different to each other were evaluated at eight different climatic locations. The secondary data were collected. Girth measurement of each tree after ten years of planting was measured and used for the analysis. A combined analysis of variance (ANOVA) was carried out for the Girth measurement and it is found that there was an interaction between the type of the clone and the location. The slope of regression of clone on the productivity index along with a ranking for the varieties based on the index was considered to identify the stability and the adaptability of the clones to locations. The Wricke's ecovalance parameter (W_i^2), which is a stability index with lower values implying more stable, is used for ranking varieties. RRIC 130, RRISL 201, RRISL 205, RRISL 206, RRISL 210, RRISL 218 and RRISL 220 are found to be stable and can be adapted to any environment. RRISL 215, RRISL 217 and RRISL 219 are identified as highly stable clones and can be adapted to poor environments.

Keywords: *Genotype-Environment interaction, stability, adaptability, ranking index*

1. Introduction

Rubber is an economically important crop in the humid tropics and it is a versatile product with multiple usages. It is grown in various countries worldwide and plays a crucial role in Sri Lankan economy. Sri Lanka is one of the leading rubber producers in the world.

Rubber tree is a crop having nature which shows the differential response of genotypes to changing environmental conditions. Therefore performance of a crop varies with the environment and environment affects the crops growth and yield. Most of the crops have been adapted to the environmental conditions in which they have been developed. Rainfall, sunshine, wind, humidity, temperature and soil are the environment conditions which are affected to the growth of rubber tree. This study is focused to identify the adaptability and stability of rubber clones for particular environmental conditions.

2. Materials and Methods

An analysis of variance (ANOVA) was carried out for the girth measurement after ten year period for ten rubber clones over eight locations (Table 1). The data was provided by the Rubber Research Institute, Agalawatta, Sri Lanka.

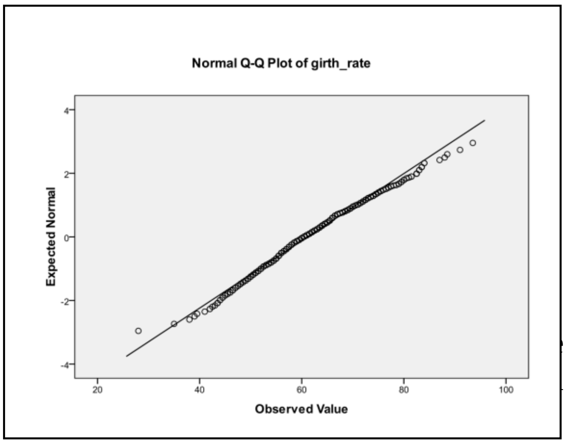
Table 1: Details of Clone and location

Clone	Locations
RRIC 130	Atala
RRISL 201	Baddegama
RRISL 205	Ganepalla
RRISL 206	Pelmadulla
RRISL 210	Muwankanda
RRISL 215	Sorana
RRISL 217	Palmgardden
RRISL 218	Bible
RRISL 219	
RRISL 220	

When the clone × location interaction exists, a 2-way table of means over the locations is computed and the clone means are averaged over all locations to obtain a productivity index. Then, each clone is regressed on the above index. The slope of each regression is checked by using t-test. The slopes of these regressions are used to categorize the clones in to adaptability groups .A clone with slope (β) = 1 is most stable. The clones with slope (β) > 1 are highly sensitive to environment changes and are adapted to good environments. The clones with slope (β) < 1 are stable and adapted to poor environments. The Wricke's ecovalance parameter (W_i^2), is used for ranking clones, which is a stability index with lower values implying more stable.

3. Results and Discussion

The normal probability plot of girth rate of rubber clones is shown in Figure 1.



A summary of the analysis of variance is shown in Table 2.

Table 2: Summary of Two Way ANOVA

Source	df	Sig. value
Environment	7	.000
Genotype	9	.000
Environment* Genotype	63	.000

According to the Table 2, the interaction between the clone and the location is significant. Therefore, it is necessary to carry out further analysis to identify the stability and adaptability of the clones. The slope of regression of the clone on the productivity index and the ranking of the clones based on the index W_i^2 is shown in Table 3.

***Table 3: Regression Coefficient and Ranking Based on* W_i**

Varieties	Result	(W_i^2)	Rank
RRIC 130	$\beta_1 = 1$	14.444	9
RRISL 201	$\beta_1 = 1$	11.628	7
RRISL 205	$\beta_1 = 1$	8.887	4
RRISL 206	$\beta_1 = 1$	11.126	6
RRISL 210	$\beta_1 = 1$	10.7	5
RRISL 215	$\beta_1 < 1$	7.706	2
RRISL 217	$\beta_1 < 1$	8.561	3
RRISL 218	$\beta_1 = 1$	14.189	8
RRISL 219	$\beta_1 < 1$	6.279	1
RRISL 220	$\beta_1 = 1$	15.877	10

4. Conclusion

The clones RRIC 130, RRISL 201, RRISL 205, RRISL 206, RRISL 210, RRISL 218 and RRISL 220 are stable and can be adapted to any environment. RRISL 215, RRISL 217 and RRISL 219 are highly stable and can be adapted to poor environments. According to W_i^2, RRISL 219 is the most stable clone followed by RRISL 215, RRISL 217. RRISL 220 and RRIC 130 are the most unstable clones.

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