**PROJECT REPORT**

1. **Describe the problem.**

The effect of dose of mineral nutrition applied to the soil on total chlorophyll content is unknown in purple passion fruit (*Passiflora edulis Sims*) under production cycles.

1. **Methodology**

n a greenhouse of the National University of Colombia in Bogotá, 100 gulupa seedlings were transplanted in the young vegetative phenological stage (less than six internodes). The seedlings were left adapting to the environmental conditions of the greenhouse (25 ° C, 85% RH) for a month. Subsequently, five soil mineral fertilization treatments were applied randomly. Treatment 0 was the absence of the application of nutrients, doses 0.25 and 0.50 were the application of 25% and 50% of the ideal dose, dose 1 corresponded to the application of 100% of the recommended dosage and 1.5 was the application in excess of fertilizer, that is to say 150% of the recommended dose. Each treatment was applied to 25 plants.

The calculation of the doses was made based on the recommendation for 1500 passion fruit plants (Haag *et al,* 1973).

The cycles correspond to the harvest periods of the ripe fruits. In the experiment, only two production cycles were obtained, they were the blocking factor.

The spectral fingerprints were measured in the reproductive phenological state (production of ripe fruit). A leaf exposed to the sun and physiologically mature in fifteen (15) plants was selected. Measurement was performed with a DARWin SP-SR1900 Lawrence, MA USA spectroradiometer.

In order to remotely obtain the chlorophyll detection spectral index (response variable), the spectral fingerprint of the gulupa leaves evaluated by each treatment was constructed and the bands related to the reflectance of chlorophyll a were selected. According to the bibliography, the Lichtenthaler index LIC1 (Mirzaei et al., 2019) is calculated from the following formula:

The R440 band corresponds to the blue spectrum and the R740 band corresponds to the far red of the light spectrum

Values ​​lower than the average value of the readings made indicate a low concentration of chlorophyll, which can be related to low amounts of nitrogen (N) and phosphorus (P), in addition to other anomalies associated with low photosynthesis (Watt et al., 2020).

The experimental design applied to the present experiment was the complete randomized block design. The applied model was:

Where

µ was the effect of the global mean of the LIC1 index.

αi was the incremental effect on the mean caused by the level of interest A, in this case the doses of edaphic application of mineral nutrients (treatments).

βj was the incremental effect on the mean of the block. In this case the production cycles, which were twice.

εij was the error term.

1. **Solution**

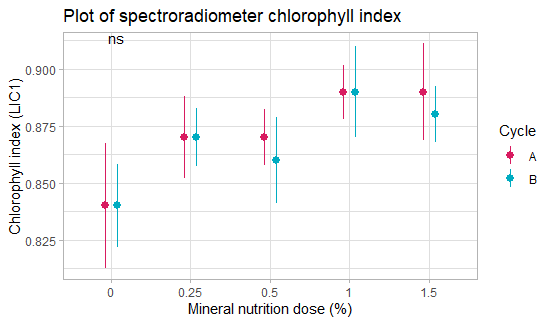
**Summary of data:**

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Cycle | Mean | Standar desvest |
| 0 | A | 0.84 | 0.0274 |
| 0 | B | 0.84 | 0.0181 |
| 0.25 | A | 0.87 | 0.0180 |
| 0.25 | B | 0.87 | 0.0128 |
| 0.50 | A | 0.87 | 0.0125 |
| 0.50 | B | 0.86 | 0.0188 |
| 1 | A | 0.89 | 0.0119 |
| 1 | B | 0.89 | 0.02 |
| 1.5 | A | 0.89 | 0.0212 |
| 1.5 | B | 0.88 | 0.0123 |

**ANOVA OF COMPLETE RANDOMIZED BLOCK DESIGN**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Df | Sum Sq | Mean Sq | F value | Pr(>F) |
| Cycle | 1 | 0.00107 | 0.001067 | 3.316 | 0.0708 |
| Treatment | 4 | 0.03692 | 0.009231 | 28.693 | <2\*10-16 |
| Cycle:Treatment | 4 | 0.00017 | 0.000042 | 0.130 | 0.9714 |
| Residuals | 140 | 0.04504 | 0.000322 |  |  |

* Significance leve lof 0.05.

**\*ns: no significance at α:0.05**

**POST-HOC ANALYSIS LSD t TEST FOR RESPONSE VARIABLE (LIC1 INDEX)**

|  |  |  |
| --- | --- | --- |
| Treatment | Response variable LIC1 | Groups |
| 0 | 0.8233 | a |
| 0.25 | 0.8780 | ab |
| 0.50 | 0.8713 | bc |
| 1 | 0.8630 | c |
| 1.5 | 0.8380 | d |

* **Alpha: 0.05; Df error: 140; Critical value of t: 1.9770**
* **Treatments with the same letter are not significantly different.**

1. **Conclusions**
2. With a significance level of 0.05, there is sufficient statistical evidence that indicates that the edaphic mineral fertilization treatments have an effect on the chlorophyll content, where the treatment of dose 1 had the best performance since the highest value was observed for the LIC1 index (df=4; F value= 28.693; *p<*2\*10-16).
3. The results suggest that the production cycles in interaction with the fertilization treatments do not affect the response of the LIC1 index.
4. **Bibliography**

Mirzaei, M., Marofi, S., Abbasi, M., Solgi, E., Karimi, R., & Verrelst, J. (2019). Scenario-based discrimination of common grapevine varieties using in-field hyperspectral data in the western of Iran. *International Journal of Applied Earth Observation and Geoinformation*, *80*, 26–37. https://doi.org/10.1016/j.jag.2019.04.002

Watt, M. S., Buddenbaum, H., Leonardo, E. M. C., Estarija, H. J. C., Bown, H. E., Gomez-Gallego, M., Hartley, R., Massam, P., Wright, L., & Zarco-Tejada, P. J. (2020). Using hyperspectral plant traits linked to photosynthetic efficiency to assess N and P partition. *ISPRS Journal of Photogrammetry and Remote Sensing*, *169*, 406–420. https://doi.org/10.1016/j.isprsjprs.2020.09.006

1. **Annexes**

**Validation of the assumptions of normality of the residuals and homogeneity of variances.**

Normality of residuals

geary.norm.test(res.m1)

Geary test for normality

data: res.m1

d = 0.74791, p-value = 0.996

Homocedasticity of variance

Levene's Test for Homogeneity of Variance (center = median)

Df F value Pr(>F)

group 4 1.2746 0.2827

145

