

Qualitative and Quantitative aspects of Pitaya with the use of low doses of a Compound based on Remineralizer and Organic Fertilizer.

L.C. Carlesso¹, R.M. Lazaroto², C.R. Lajus², F. Dalcanton³, G.D. Luz², R. Barrichello², F.J. Busnello², M.A. Moretto², L.D.A. Bellé²

¹Community University of Chapeco Region - Unochapeco, Ciencias da Saude Area, liziane-cc@unochapeco.edu.br, Chapeco- Santa Catarina, Brazil.

²Community University of Chapeco Region - Unochapeco, Postgraduate program in technology and innovation management, Chapeco- Santa Catarina, Brazil.

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Abstract— The validation of the compost developed based on organic fertilizer and remineralizer makes it possible to add value for both organic fertilizers and crushing companies. The use of national raw material and the potential for demands for organic products, with low cost due to the use of industrial waste, contributing to the environment in the reduction of contaminants and sustainable management. Given the above, the work aimed to characterize and evaluate the viability of Pitaya with the use of low doses of a remineralizer compound and organic fertilizer. The research was developed and applied to a rural property located in the Alto da Serra district, Chapecó-SC. The experiment was conducted with Pitaya, in a randomized block design (DBC), 3 replications and 7 treatments. The plots were distributed by lot, totaling 21 plots, the plants were fertilized with compost based on organic fertilizer and remineralizer. The treatments have the following compositions: T1-0% control (without fertilization); T2-100% remineralizer (2kg); T3-100% organic fertilizer (2kg); T4-50% remineralizer (1kg) + 50% organic fertilizer (1kg); T5-25% remineralizer (0.5kg) + 75% organic fertilizer (1.5kg); T6-75% remineralizer (1.5kg) + 25% organic fertilizer (0.5kg) and T7-poultry litter (2kg). The collected data were submitted to Analysis of Variance by the F Test and the differences between the means were compared by the Tukey Test ($p \leq 0.05$). The use of the soil remineralizer with the fertilizer provides increased productivity and fruit revenue, with 2 T / ha being more productive. The treatment with the compost with 50% organic fertilizer and 50% remineralizer obtained the highest number of flowers and fruits per plot, highest productivity and the highest financial return, and already in the second year of implantation, the first crop of the crop is paid for. all production and investment costs, showing technically feasible. The treatments do not influence the physical and chemical characteristics of Pitaya fruits. The culture of Pitaya managed with low doses of the compost presents technical and economic viability and shows a promising fruit due to its rusticity, productivity and functional and nutraceutical properties.

Keywords— Agroecology. Technical viability. Economic viability.

I. INTRODUCTION

In 2018, according to data from the National Fertilizer Diffusion Association (2019), Brazil consumed around 35 million tons of NPK fertilizers (Nitrogen, Phosphorus and Potassium), 80% of which was imported,

nitrogen increased by 86%, highlighting the country as one of the largest producers and exporters of agricultural products in the world and an important consumer market for fertilizers.

Agrominerals and soil remineralizers can overcome the country's dependence on inputs for agriculture, especially in the import of potassium. In addition to the sustainable use of this material in agriculture, adding value to the miner, reducing costs in agriculture, promoting local cooperation networks and generating income in the region where it is located (LICHES *et al.*, 2019).

The search for alternative sources of agricultural fertilization addresses one of the bottlenecks in the fertilizer sector, which is the unavailability of basic raw materials, logistics, tax and environmental issues (BNDES, 2012). The study was carried out thinking of a joint solution both for the environmental problem caused by the waste dust from the quarries, as well as its use as a remineralizer of the plants. Its use facilitates the performance and dynamics of mycorrhizal fungi, promoting a better absorption of nutrients available to the soil, generating a beneficial symbiosis for plants. The remineralizer can supply the demand of organic producers in the production of healthier food produced with less impact on the environment (BERGAMAN *et al.*, 2014).

Brazil is the world's third largest fruit producer, after China and India, with around 45 million tons a year, of which 65% are consumed domestically and 35% are destined for the foreign market (EMBRAPA, 2019). The edaphoclimatic conditions are favorable for fruit growing, especially tropical ones, and the cultivation of Pitaya in aroused interest by farmers for its rusticity, precocity, good productivity and added value. Fruit that is exotic is also called "dragon fruit" on the foreign market, with good acceptance by consumers, for its nutritional quality and organic production (CHAVES, 2016).

Pitaya has potential for both the domestic and foreign markets, which makes its cultivation promising from an agronomic and economic point of view (JUNQUEIRA *et al.*, 2002). It is marketed as an ornamental plant in European countries and in the United States, but its greatest use is in the food industry because it has functional properties due to the presence of bioactive compounds (MELLO, 2014).

The validation of the compost developed based on organic fertilizer and remineralizer makes it possible to add value for both organic fertilizers and crushing companies. The use of national raw material and the potential for demands for organic products, with low cost due to the use of industrial waste, contributing to the environment in the reduction of contaminants and sustainable management.

Given the above, the work aimed to characterize and evaluate the viability of Pitaya with the use of low doses of a remineralizer compound and organic fertilizer.

II. MATERIALS AND METHODS

The research was developed and applied in a rural property located in the Alto da Serra District, Chapecó-SC. For the development of the compost, organic fertilizer and remineralizer were used, formulated in the proportions of 25%, 50%, 75% and 100% for each product. The Remineralizer used in the compost was obtained from the extraction of basalt by the grinding process resulting in powder and passed through a 200 sieve to obtain the remineralizer. After the sample was collected and sent to the Laboratory of Development and Characterization of Materials of FIESC, SENAI / SC in Criciúma-SC, to carry out the chemical analysis and verification of the amounts of macro and micronutrients. The experiment was conducted with Pitaya, in a randomized block design (DBC), 3 replications and 7 treatments. The plots were distributed by lot, totaling 21 plots, the plants were fertilized with compost based on organic fertilizer and remineralizer. According to soil analysis performed a sample per block, and interpreted according to the Soil Chemistry and Fertility Commission - RS / SC (2016), there were high levels of macro and micronutrients.

To verify the response regarding the effect of the remineralizer, 2 kg per plant was added, with 2 tons per hectare of the compost based on rock powder and organic fertilizer in the proportions of 25%, 50% and 100%. The treatments in the experiment have the following compositions: T1- 0% control (without fertilization); T2- 100% remineralizer (2 kg); T3 - 100% organic fertilizer (2 kg); T4- 50% remineralizer (1kg) + 50% organic fertilizer (1kg); T5- 25% remineralizer (0.5 kg) + 75% organic fertilizer (1.5 kg); T6- 75% remineralizer (1.5kg) + 25% organic fertilizer (0.5kg) and T7- poultry litter (2kg). The T7 poultry litter treatment was analyzed in the recommendations for poultry litter (5 to 8 lots), according to the Soil Fertility and Chemistry Commission - RS / SC (2016). The applications were divided between the vegetative and reproductive stages. The fruits were harvested on March 28, 2019, 36 days before anthesis. The crop yield was determined from the random sampling of one fruit per treatment, considering the fruit count for the production estimate (kg / ha) . Between the phenological period, the flower counting was carried out, percentage of revenge being carried out a sample of three plants per block in the treatments between the months of December to March. The months factor yield was analyzed by counting the number of flowers (NFLT), fruits (NFRT)

and percentage of revenge (V%) during the phenological period that comprised the months of December / 2018, January, February and March / 2019) to identify the highest occurrence. Economic viability was determined by surveying the necessary investments for the implantation of the orchard, projecting revenues, operating costs and economic indicators for each treatment, according to Krupp (2015).

To determine the physical-chemical characterization, the following analyzes were performed: pH with reading in a digital pot; soluble solids expressed in brix degree (°BRIX) as a percentage; total acidity determined by volumetry with NaOH (sodium hydroxide) 0.1N with 0.1% phenolphthalein indicator and the Total Acidity (AT) / Soluble Solids ratio (°BRIX), all methods described according to Instituto Adolfo Lutz (2008). The collected data were submitted to analysis of variance (ANOVA) by the F test and the differences between the means were compared by the Tukey test ($p \leq 0.05$), with the aid of the statistical analysis program SISVAR (FERREIRA, 2011).

III. RESULTS AND DISCUSSION

The analysis of variance shows that there was a statistical difference between the treatments used for the characteristic fruit weight and production kg / ha, a significant effect ($p \leq 0.05$) of the compound factor (rock powder and organic fertilizer) in relation to the variable responses to fruit weight per plot (g) and production (kg / ha). Regarding the weight of the fruits per plot, it appears that in the T6 treatment (75% remineralizer and 25% organic fertilizer), 329.28 greater weight of the fruit was obtained. And higher production was in the T4 treatment (50% remineralizer + 50% organic fertilizer) with 8,997.98kg / ha, differing statistically from the other treatments, followed by T3 (100% organic fertilizer) and T2 (100% remineralizer) with 6,549, 60.

Studies carried out by Marques (2010) verified associated manure of bovine and chicken with bioclastic granules, obtained greater productivity, fruit quality and financial return. For Santos and Mendonça (2000), the use of rock powder had positive effects on the production and productivity components of the potato crop, the highest total potato production was 11.07 T / ha, achieved with the dose of 2, 33 T / ha of rock dust, 13.28% in relation to unfertilized treatment. It is believed that the highest total potato productivity is due to the solubilization of rock powder (MB4) and the release of its nutrients present as phosphorus (formation and production of tubers), potassium, calcium, magnesium and micronutrients.

The analysis of variance revealed a significant

effect ($p \leq 0.05$) of the compound factor (rock dust and organic fertilizer) in relation to the variables responses: number of flowers per plot (NFLT), number of fruits per plot (NFRT) and revenge (%).

Regarding the percentage of flowers per treatment, the T4 treatment (50% remineralizing and 50% organic fertilizer) obtained the highest number of flowers with 15.50, followed by the T3 treatment (100% organic fertilizer) with 12.17 flowers and T5 (25% remineralizer and 75% organic fertilizer) with 10.83 flowers. Treatment T7 (100% poultry litter) of 4.0 flowers per plant was limited in the applied dosage. The same observed in Marques (2010). The same plant can present flower buds at an early stage, development, green fruits and ripe fruits in the same reproductive period. These periods were verified in the beginning in the summer and in the autumn, the high temperatures influencing the reproduction. Regarding the percentage of fruits per treatment, the T4 treatment (50% remineralizer and 50% organic fertilizer) obtained the highest number of fruits with 13.0, followed by the T3 treatment (100% organic fertilizer) with 10.75 fruits and T2 (100% remineralizer and 75% organic fertilizer) with 8.50 flowers. Treatment T7 (100% poultry litter) of 2.83 fruits per plant was limited in the applied dosage. The period of fruiting evaluated from anthesis until the end of the period of complete maturation varied from 35 to 45 days, with average temperature and precipitation, of 26°C and 40 mm respectively.

For Marques (2010) the maturation period was 30 to 40 days. Lima (2013) found that the complete maturation varied from 35 to 45 days, with average temperature and precipitation, of 21.8 °C and 150.6 mm, respectively. For Silva (2011), the development of red pitaya fruits is dependent on the conditions of the growing place (temperature and precipitation). Regarding the percentage of revenge per treatment, the T4 treatment (50% remineralizing and 50% organic fertilizer) was higher with 67.33%, followed by the T2 treatment (100% remineralizing) with 59.16 and T1 (without fertilization) with 58.58%. Treatment T3 (100% organic fertilizer) 42.67.

As for the quantitative analysis in relation to the period of greatest occurrence, the flowering and fruiting months factor, the analysis of variance revealed a significant effect ($p \leq 0.05$) of the flowering / fruiting months factor in relation to the variables responses number of flowers per plot, number of fruits per plot and revenge (%). From the technical data of production of each treatment in the experiment it was possible to verify the productivity, it can be observed that the highest production and productivity was obtained in the T4 treatment (50% remineralizer + 50% organic

fertilizer) with 8,997.98 kg / ha and 4.49 kg per plant, followed by treatment T3 (100% organic fertilizer) with 7,126.30 kg / ha and 3.56 kg per plant and T2 (100% remineralizer) with 6,549.60 kg / ha and 3, 27 kg per plant. The treatment with 50% dosage of remineralizer and organic fertilizer obtained greater production and productivity per plant.

The average unit cost and profit margin, where the lowest cost was in the T4 treatment (50% remineralizer + 50% organic fertilizer) of R \$ 2.32 of average unit cost and R \$ 12.68 followed by the T3 treatments (100 % organic fertilizer) R \$ 2.94 average unit cost and R \$ 12.06 profit margin and T2 (100% remineralizer) of R \$ 3.04 average unit cost and R \$ 11.96 profit margin. The economic indicators used for feasibility analysis can be concluded that the T4 treatment (50% remineralizer + 50% organic fertilizer) compared with the other treatments was the one that had the highest production per area with 8,997.98 kg / ha and highest productivity per plant 4.49 kg. As well as the highest revenue per hectare of R \$ 134,969.70, the best net result of R \$ 114,138.93, the lowest average unit cost per kg of fruit produced by R \$ 2.34 and the highest profit margin R \$ 12.68 . It achieved a better profitability of 85%, a profitability of R \$ 228%, a shorter return on investment with 0.43 years, requiring a total of or R \$ 20,830.77 equivalent to 15% of the total revenue, values described in the breakeven point . Marques et al. (2011) found greater productivity and greater financial return after three years of implantation of the orchard with fertilizers with bovine manure added to chicken litter. Regarding the physical characteristics, it can be concluded that no significant differences were found between the treatments, and the treatments with the compost with remineralizer and organic fertilizer did not influence the quality of Pitaya fruits. The longitudinal and transverse diameters varied. For the longitudinal diameter the smallest was in the treatment at T7 (100% poultry litter) with 8.80 cm and the largest in T5 with 9.96 cm. And the smallest transverse diameter was in treatment T4 (50% rock dust and 50% organic fertilizer) with 6.37 cm and larger in treatment T1 (control, without fertilization) with 7.42 cm.

For the characteristics of soluble solids, titratable acidity, soluble solids and SS / AT ratio, no significant differences were found between treatments, and it can be inferred that treatments with remineralized organic fertilizer compound did not influence the quality of Pitaya fruits. The same observed by Costa (2012) who demonstrates that the type of fertilization does not interfere with the chemical characteristics of the fruit, and may be influenced by the fruit's maturation stage. The pH obtained

variations between treatments, the lowest pH was in T7 (100% poultry litter) with 4.99 and the highest was in T1 (control, without fertilization) and T6 (75% rock powder and 25% organic fertilizer) with 5.11. Magalhães (2017) obtained variations from 3.16 to 5.52, with a sharp drop between the 21st and the 28th, the pH reduction occurs due to the accumulation of organic acids, and the increase due to the consumption of these organic acids in the breath.

IV. CONCLUSION

Under the conditions in which the present research was conducted, the results obtained allow us to conclude that: Pitaya culture managed with low doses of the compound presents technical and economic viability. The use of the soil remineralizer with the fertilizer provides increased productivity and fruit revenue, with 2 T / ha being more productive.

According to the results, the largest flowering period occurs in the months of December and January and for fruiting and percentage of avenging the highest occurrence is in the months of January and February, and the treatment with the compost with 50% organic fertilizer and 50% remineralizer obtains the largest number of flowers and fruits per plot. The application of 50% organic fertilizer + 50% remineralizer is the treatment that provides the highest productivity and the highest financial return, and already in the second year of implantation, the first crop of the crop pays all production and investment costs, showing technically feasible.

The treatments do not influence the physical and chemical characteristics of Pitaya fruits. Pitaya's culture shows a promising fruit due to its rusticity, productivity and functional and nutraceutical properties.

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