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# Influence of color of tree pastes (paints) on the temperature surface of tree trunks

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## Abstract

A study tests tree pastes colors and how their use affects the surface temperature of the tree trunks (temperature amplitudes), according to the assumption that such changes can cause cracks in the tree's bark. The bark temperature of the apple trees was measured by infrared thermometer every month during four seasons: autumn, winter, spring, and summer. The trunks trees used in the trials were left untreated (control variant), were pasted with 20% lime solution with white color and pasted with DIY mixture made from Funguran OH 50 WP (77 % Copper (II) hydroxide active substance), with distinctive blue color. The results show that the surface temperature of the bark of the trees depends on many factors. The air temperature, and parameters such as size of the tree and its canopy size and structure are relatively constant for a particular period of time. However, other factors, such as the presence or absence of wind, surface temperature, and cloud cover, can change within seconds. In this regard, the color of the pastes plays an insignificant role in bark surface temperature. The assumption that the white color of the pastes prevents significant temperature amplitude and, eventually, bark cracking seems irrelevant.

***Keywords***: trees, paste, paint, bark, trunks, temperature

## INTRODUCTION

The tree seals (pastes, paints) are important in pest management in present-day orchard cultivation. By application of different pastes on the tree trunks good protection of the plants can be achieved against many insects, mites and fungal damages plus protection against different herbivorous animals like rabbits, goats, wild boar, deer, etc., especially during the winter season when they cause a lot of damages on the orchard trees by eating the trunk's bark (Judd et al., 2015; Mooney, 2007; Ahmed et al., 2013). The tree seals (or tree paints) also can provide a good level of protection against winter frost and respective cracking of the bark of the trunks. Some pastes can be used to provide some micro minerals to the trees or even antibiotics (Banin et al., 1980; Harries, 1965). The most common and cheap tree paste for trunks is 20-30 % lime ($Ca(OH)_2$) solution. This method of pasting the tree trunks is widely used in the orchard areas, for the treatment of decorative and forest trees made their trunks with distinguished white color (Baines, 1939; Jadeja et al., 2000; Pagán et al., 2012). However, this paste has several disadvantages, the most typical of which is its quick cracking and dropping from treated trunks usually – 2-3 months after application. The lime solution also has little or no repealing properties against rabbits, goats, wild boars and dears. That's why during recent years specific trunk pastes appear on the marker or as a DIY recipe. To overtake the cracking and dropping from the trunks, such pastes include different oils (petrol or plant based) in their content plus some additional components like copper and sulfur fungicides, or there are even practices to mix the lime solution with different kinds of synthetic pesticides (chlorpyriphos, diafenthiuron) which increase the effectiveness of the paste against

fungal and insect pests but also can provide much better repellent properties against herbivorous animals. There are even recipes for mixtures of lime with cow urine and cow dung (Sinha et al., 2022). Another practice is to spray trees with lime – sulfur solution (Delong, 1923). However, such kind of treatments frequently can lead to injuries to the trees (Du Plessis, 1933). Very popular variation of the tree pastes, especially in India and Pakistan, is so called Bordeaux paste. In this paste the lime is combined with copper sulphatepentahydrate ($CuSO_4.5H_2O$) or so called in Bulgarian a "blue stone" (Lokesh & Gangadharappa, 1995; Gade et al., 2006; Rahman and Afroz, 2016). Another peculiar type of such paste is so called "Biodynamic tree paste" or "Maria Thun tree paste" prepared by mixing clay, cow dung, sand, and burying cow horns. According to the biodynamic agriculture concepts, when tree trunks are treated with this paste this protects trees from various pests, strengthens and protects the bark and cambium of the tree to make it healthy, heals wounds and stimulates tree growth (Ram & Kumar, 2019; Ram & Pathak, 2016; von Wistinghausen et al., 2000). There is however one distinctive difference between such kind pastes and the common lime solution. And this is the color. The lime has a white color which is assumed to provide protection of the plants against winter frosts and trunk temperature fluctuations which eventually can cause cracks of the bark. Novel pastes usually have darker colors due to their contents, and many people avoid using them because believing that their darker color will cause more temperature amplitude on the trunks surfaces which eventually is the case more cracking and damaging to the plants.

In this study, field trials were conducted to check this statement – if the color of the paste plays an important role in surface trunk temperature and respectively according to the common perception this preventing the cracking of the bark due to the increased temperature amplitudes.

## MATERIALS AND METHODS

Field tests with apple trees variety "Golden Delicious" were conducted for one year – four seasons: autumn, winter, spring and summer. The tree trunks were treated by brush with:

- common 20% lime solution with white color
- trunk paste prepared by mixing fungicide Funguran OH 50 WP (77 % Copper (II) hydroxide as active substance) with was distinctive blue due to the Funguran OH 50 WP (Weber & Børve, 2021; Rutherford & Phiri, 2006)

The untreated trees were also used as a control variant. Each test variant consists of 5 replicates (trees). An infrared thermometer (model IR-G300) with a temperature range -50 ~ 450 °C and accuracy ± 1.5 °C was used for measurements of the trunk surfaces. The measurements were conducted 10 times each month at the same time (12 am) and in four geographical directions of each tree: South, North, East and West. A One-Way ANOVA analysis was conducted for revealing lack or presence of statistical proven differences between test variants.

## RESULTS AND DISCUSSION

The figures bellow shows the measured temperatures on the untreated with paste tree trunks during autumn season (September, October and November)

The color of the untreated (without paste) tree bark was dark brown. The graphics show completely random values of the measured temperatures on the surface of the trunk's bark ($p<0.05$). Except of course air temperature, a significant influence cause also the presence of wind (even the slightest one), shadows from the canopy and heat emitted from the soil. However in the late summer due to the rising temperatures and sunecliptic, can be seen that temperatures measured in all geographical directions are

almost in the same range. The next figures shows the temperatures measured on the surface of bark treated with tree paste.

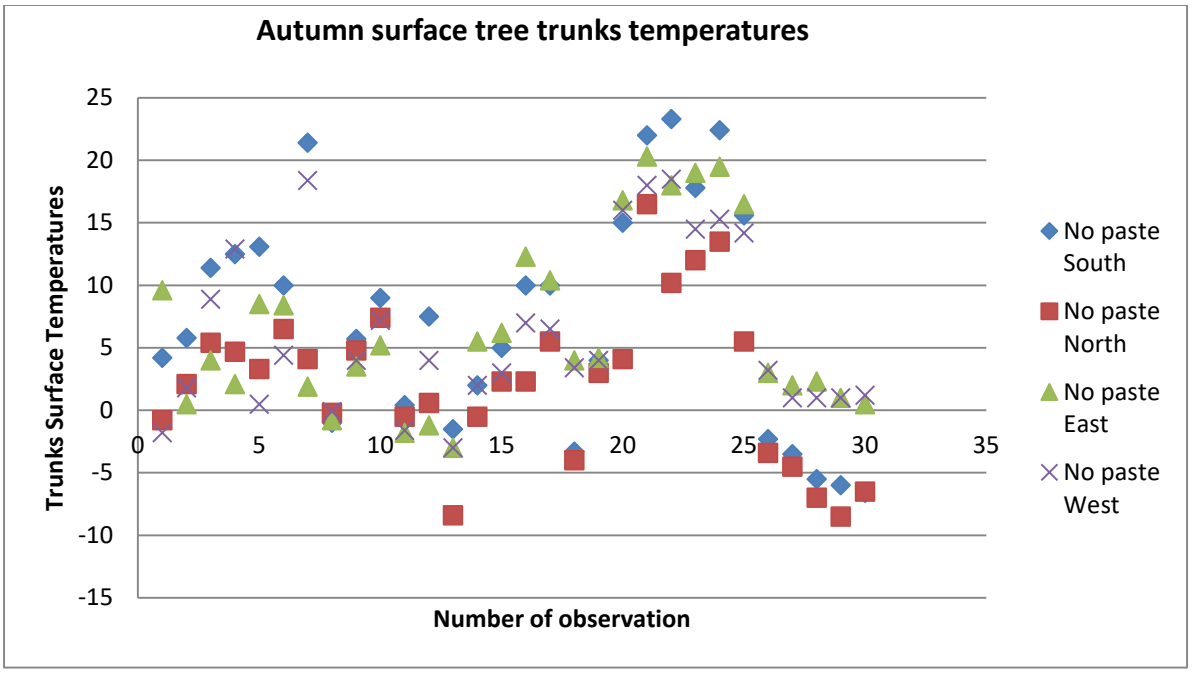


**Figure 1.** Untreated with paste tree trunks (control variant) during autumn season

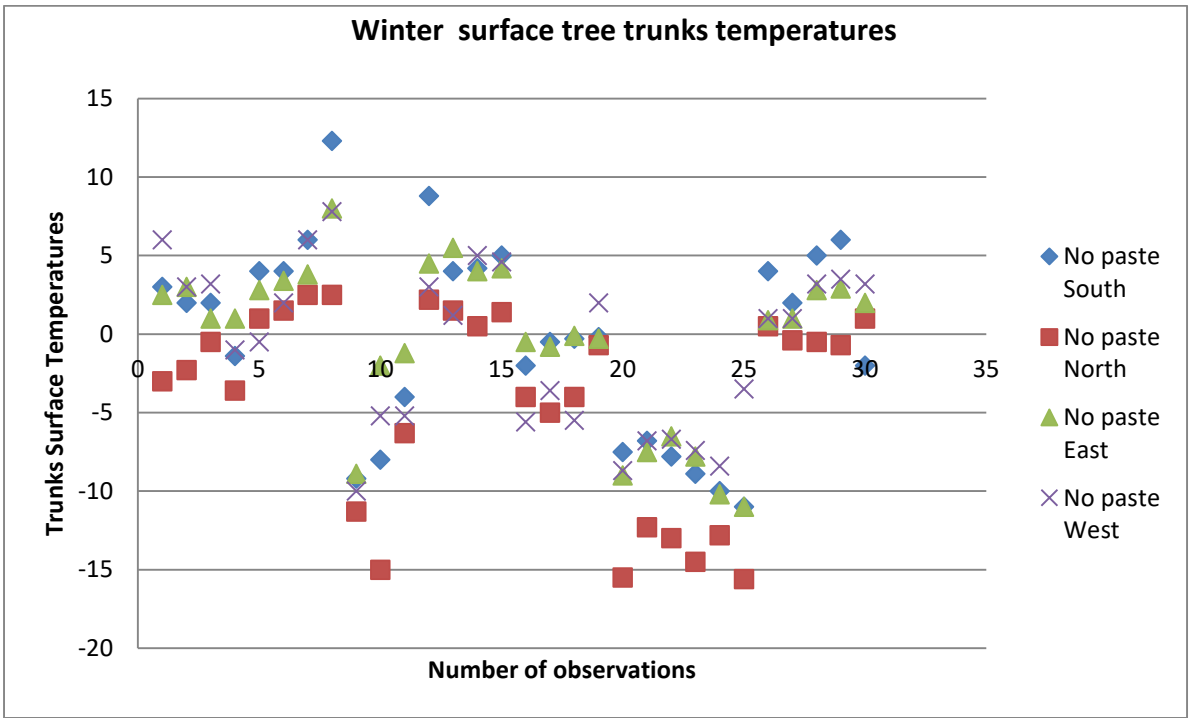


**Figure 2.** Untreated with paste tree trunks (control variant) during winter season

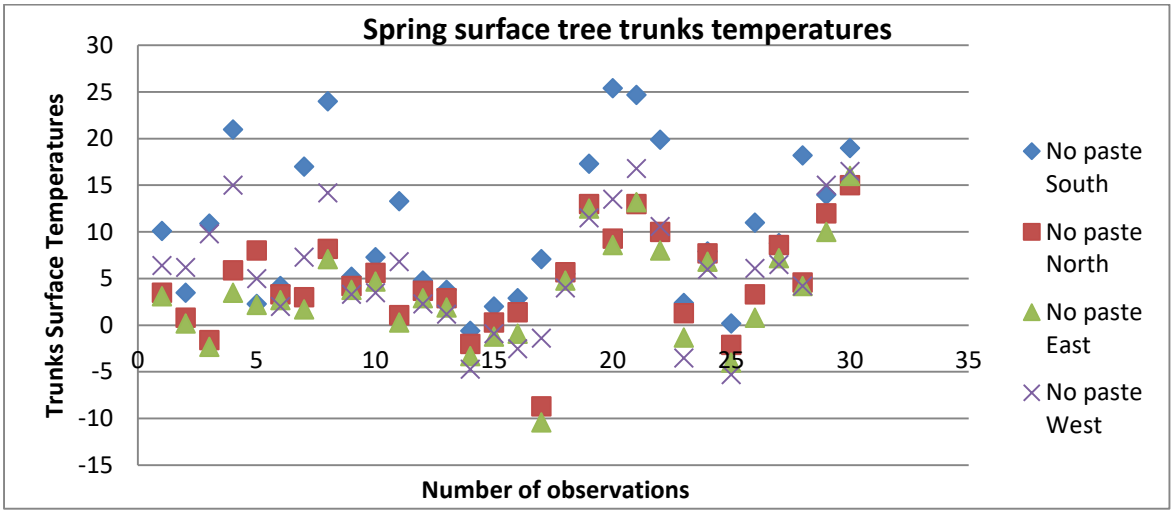


**Figure 3.** Untreated with paste tree trunks (control variant) duringspring season

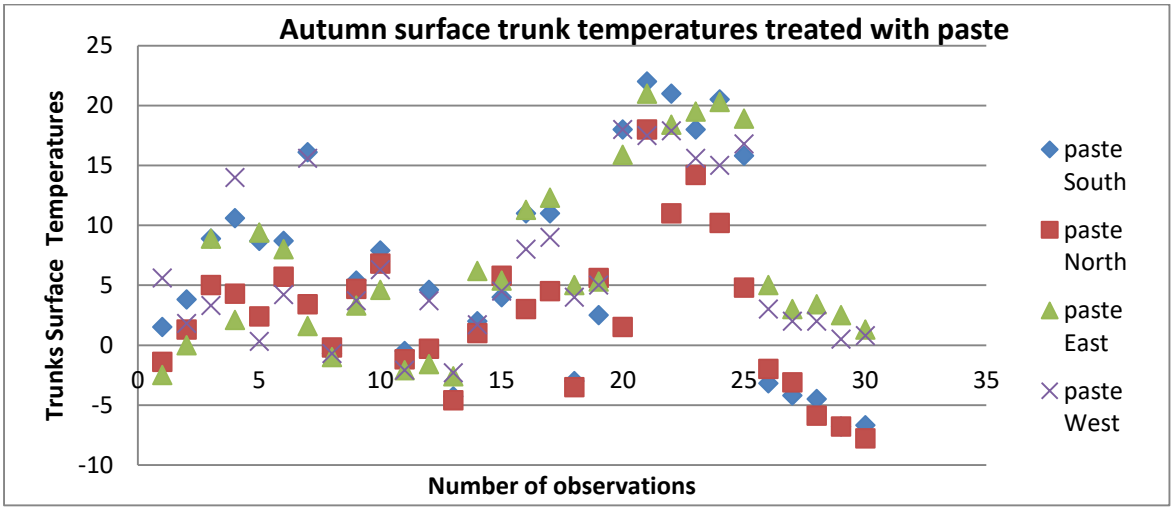


**Figure 4.** Untreated with paste tree trunks (control variant) during summer season

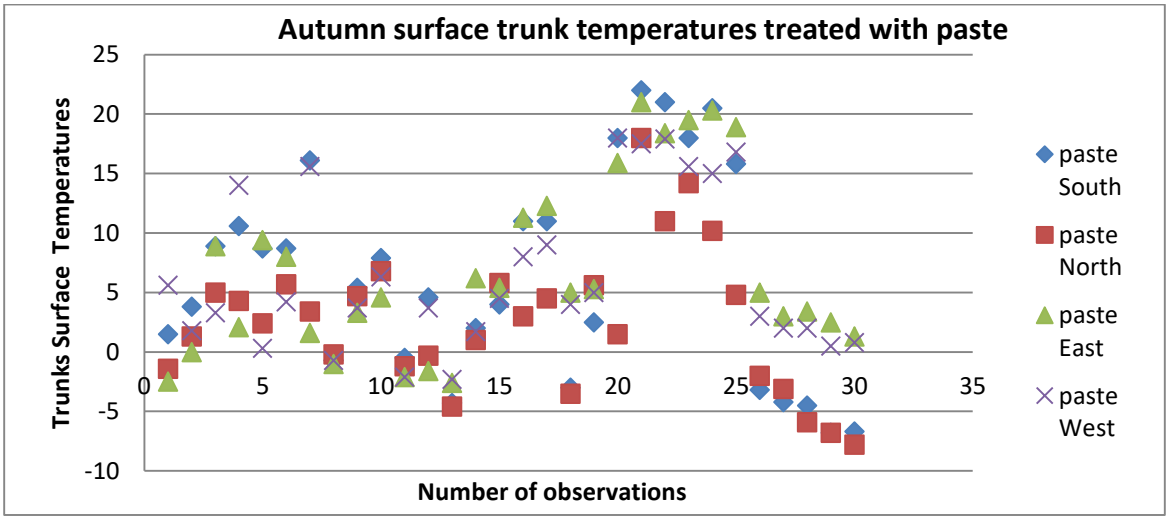


**Figure 5.** Treated with paste tree trunks during autumn season

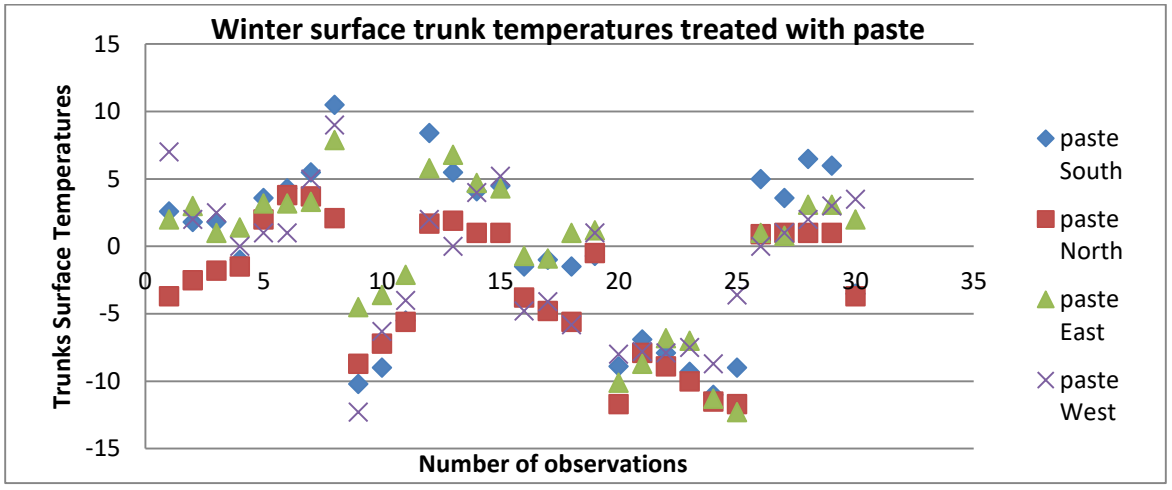


**Figure 6.** Treated with paste tree trunks during winter season

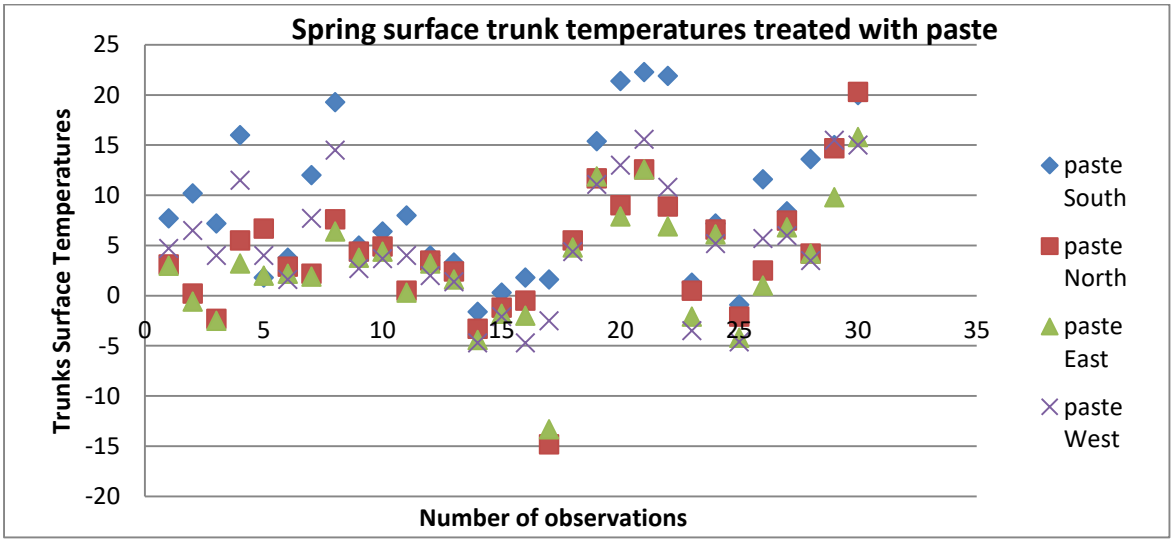


**Figure 7.** Treated with paste tree trunks during spring season

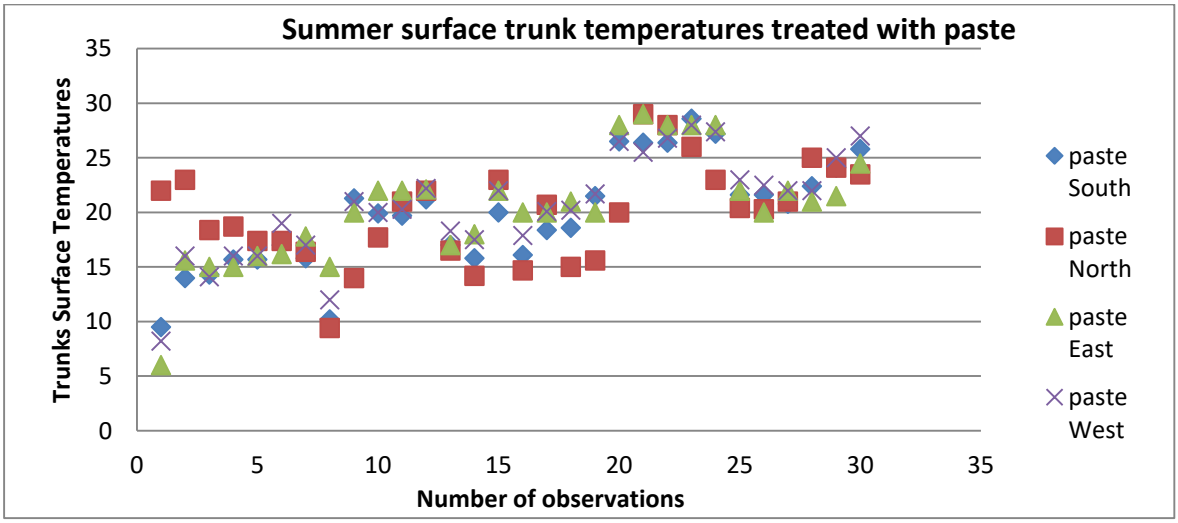


**Figure 8.** Treated with paste tree trunks during summer season

Trials show that once again that according to the trunk surface temperatures, there are chaotic results which can depend as on the air temperature as on other factors such as wind, shadows and heat emitted from the soil ($p<0.05$). Just like in the case of no paste applied to the bark, there is a clearly outlined tendency in the surface temperatures measured during summer. Next are the results obtained from trials in which trunk's bark was treated with 20 % of lime – water solution.

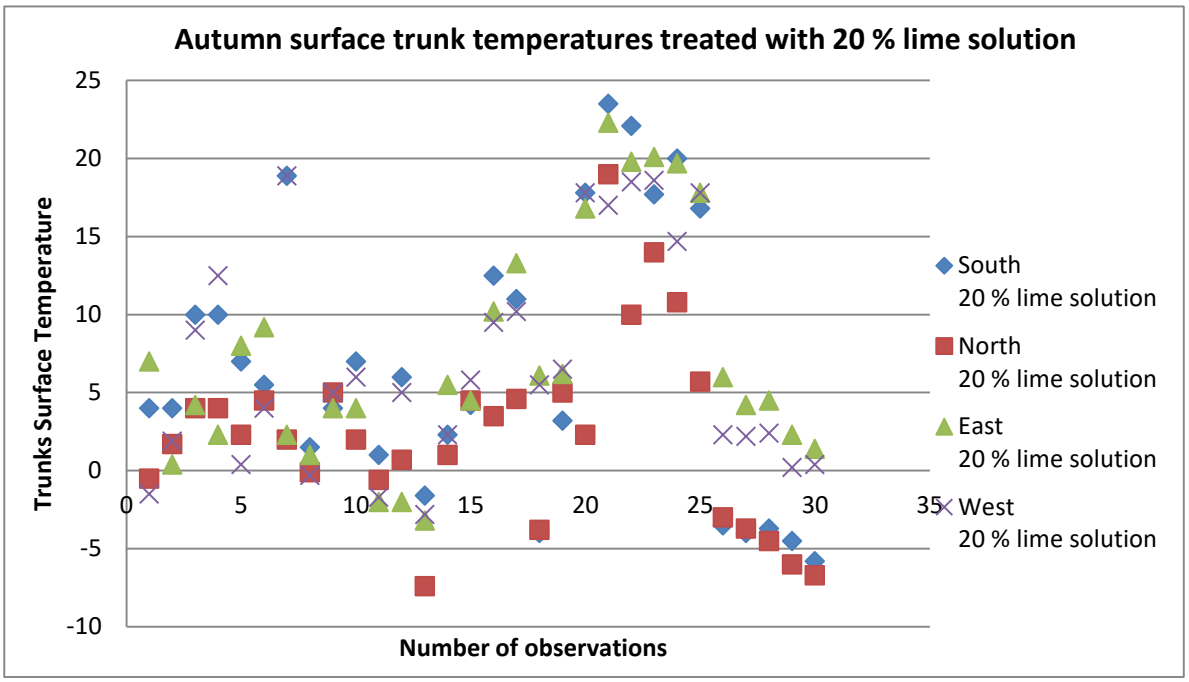


**Figure 9.** Treated with 20 % of lime – water solution tree trunks during autumn season

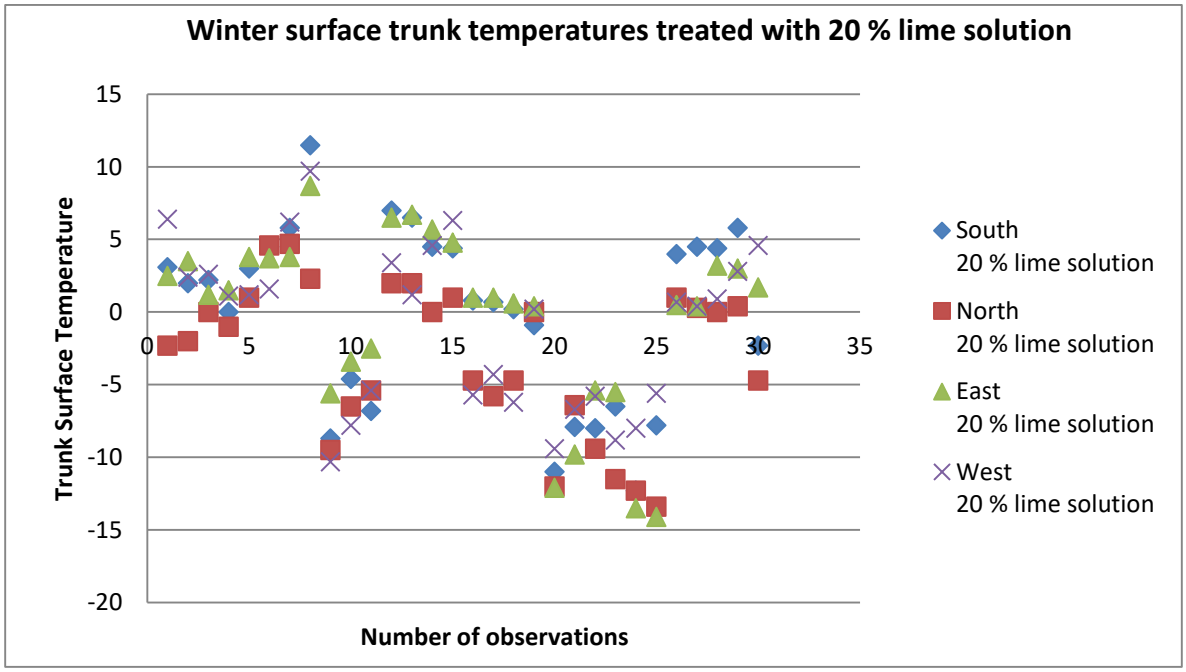


**Figure 10.** Treated with 20 % of lime – water solution tree trunks during winter season

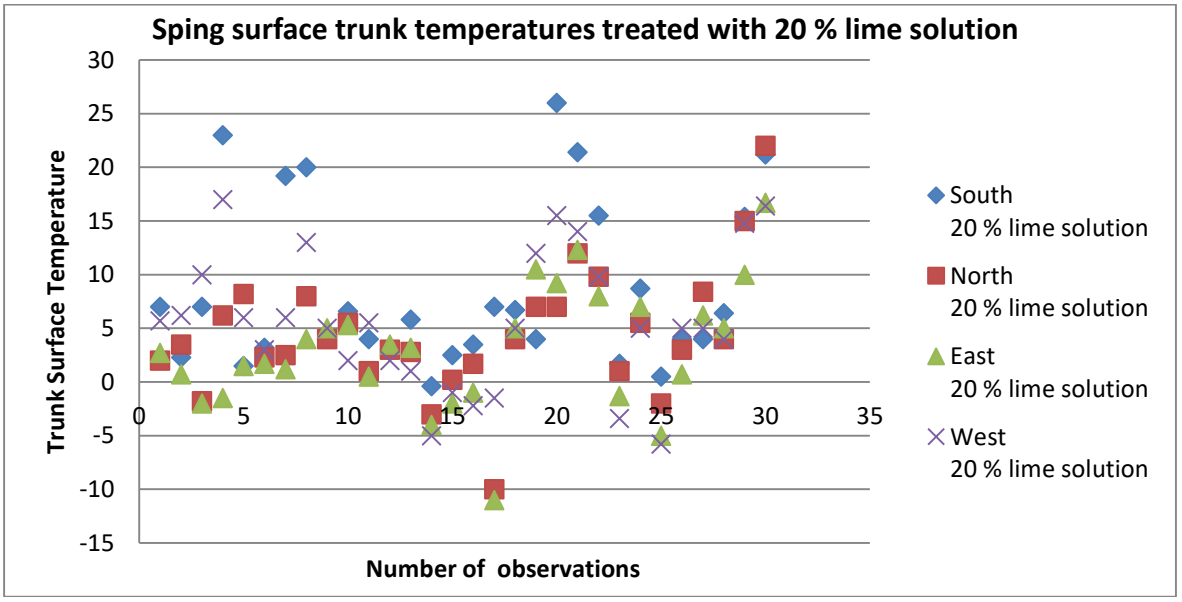


**Figure 11.** Treated with 20 % of lime – water solution tree trunks during spring season

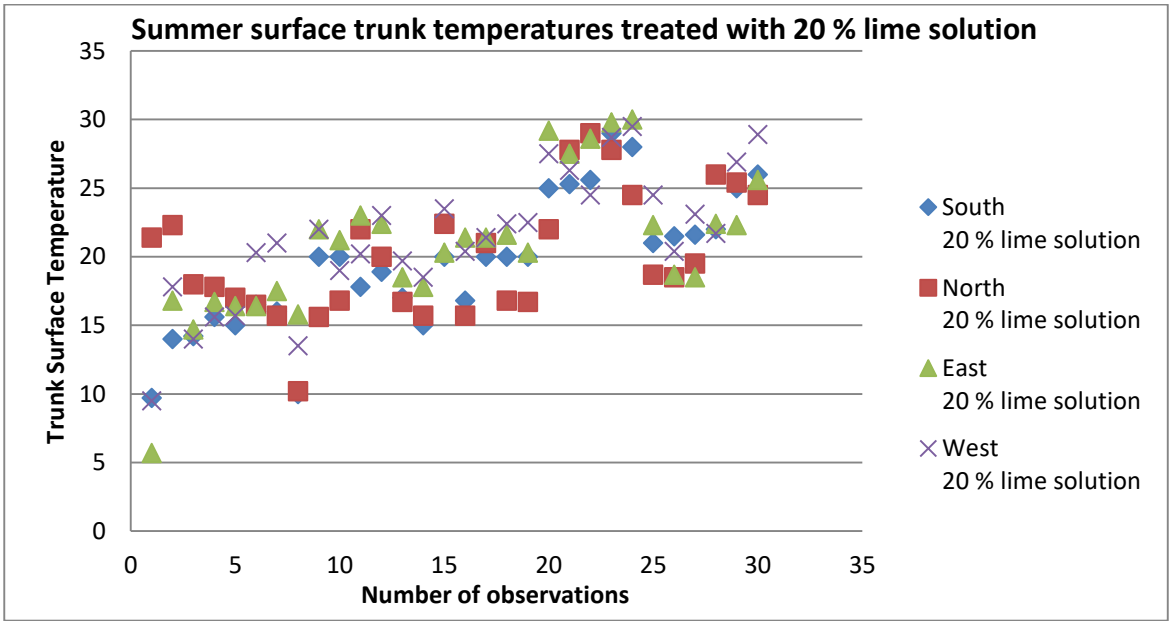


**Figure 12.** Treated with 20 % of lime – water solution tree trunks during summer season

Just like the rest of the results, there is a fully chaotic pattern in the temperature observations and outlined tendency in the surface temperatures measured during summer ($p<0.05$).

The common assumption about the tree seals (paints) is that they must be always white or with pale colors because for preventing the temperature amplitudes on the bark surfaces of trunks of thetreated trees, which eventually can lead to bark cracks and damaging of the trees (Derby & Gates, 1966; Martsolf et al., 1975; Hellmuth et al., 1988). However, from cited literature can be seen that such kind of research is very old and outdated. The field tests performed in the present study reveal that the color of the tree paste (seal or paint) play very insignificant role in temperatures of the treated with them trunk's bark.

## CONCLUSIONS

Conducted tests reveal firstly that the surface temperature of the bark of the trees depends on many different factors expert air temperature as geographical direction, the size and structure of the canopy, the size of the tree, presence, force or lack of wind, surface temperature, clouds on the sky and est. Additionally the values constantly change even for seconds. The distribution pattern of these temperatures is completely chaotic and cannot be predicted. Secondly – the color of the bark surface, respectively presence or lack of the tree paste (seal, paint) or the color of the paste affects surface temperature insignificantly. So, the common perception that the white color of such products prevents big temperature amplitudes and respectively, cracking of the bark is completely incorrect and misleading. This means that there is no matter what color of the paint will be used for trunk treatments. Many producers of such king products are limited in this aspect because cannot create a seal (or pastes or paints) with a white or pale color or put additional chemicals for color correction which is not necessary at all.

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## REFERENCES

Ahmed, K. U., Rahman, M. M., Alam, M. Z., Hossain, M. M., & Miah, M. G. (2013). Evaluation of some control methods against the jackfruit trunk borer, Batocerarufomaculata DeGeer (Cerambycidae: Coleoptera). *Bangladesh Journal of Zoology*, 41(2), 181-187. https://doi.org/10.3329/bjz.v41i2.23320

Baines, R. C. (1939). Phytophthora trunk canker or collar rot of apple trees. *Journal of Agricultural Research*, 59(2), 159-184.

Banin, A., Navrot, J., & Ron, Y. (1980). Tree implanted zinc-bentonite paste as a source of slow-release zinc for 'Delmas' pecan. *HortScience*, 15(2), 182-184.

Delong, D. M. (1923). Results of Spraying and Dusting For The Control of The Red Spider *Paratetranychus pilosus*. *Journal of Economic Entomology*, 16(1), 88-90. https://doi.org/10.1093/jee/16.1.88

Derby, R. W., & Gates, D. M. (1966). The temperature of tree trunks—calculated and observed. *American Journal of Botany*, 53(6Part1), 580-587.

Du Plessis, S. J. (1933). Summer-spray injury to fruit trees. 2. Effects of lime-sulphur and lead arsenate. *Farming in South Africa*, 8(87), 227-229.

Gade, R. M., Bambawale, O. M., Sangale, U. R., & Shinde, V. B. (2006). Chemical management of gummosis in Nagpur mandarin (Citrus reticulata Blanco). *Pesticide Research Journal*, 18(2), 169-172.

Harries, F. H. (1965). Control of insects and mites on fruit trees by trunk injections. *Journal of Economic Entomology*, 58(4), 631-634. https://doi.org/10.1093/jee/58.4.631

Jadeja, K. B., Mayani, N. G., Patel, V. A., & Ghodasara, M. T. (2000).Chemical control of canker and gummosis of citrus in Gujarat. *Journal of Mycology and Plant Pathology*, 30(1), 87-88. https://doi.org/10.22161/ijhaf.4.5.1

Judd, G. J., Bedford, K., & Cossentine, J. E. (2015). Control of the Apple Clearwing Moth, Synanthedonmyopaeformis, with Tree-Trunk Applications of Reduced-risk Insecticides, Nematodes and Barriers. *Journal of the Entomological Society of British Columbia*, 112, 69-83.

Lokesh, M. S., & Gangadharappa, P. M. (1995). Management of *Phytophthora* foot rot and nematode diseases in black pepper (*Piper nigrum* L.). *J. of Spices & Aromatic Crops*, 4, 61-63.

Mooney, K. A. (2007). Tritrophic effects of birds and ants on a canopy food web, tree growth, and phytochemistry. *Ecology*, 88(8), 2005-2014.

Pagán, E., Pérez-Pastor, A., Domingo, R., Conesa, M. R., & Caro, M. (2012). Suitability of trunk diameter reference lines for irrigation scheduling with saline water in late mandarin trees with different crop load. *Agricultural Water Management*, 111, 11-19. https://doi.org/10.1016/j.agwat.2012.04.008

Rahman, M. A., & Afroz, M. (2016). Survey on the diseases of jackfruit and some aspects of control measures for gummosis disease in Bangladesh. *Eco-friendly Agriculture Journal*, 9(02), 10-14.

Ram, R. A., & Kumar, A. (2019). Biodynamic agriculture: An advance stage of organic farming. *Journal of Eco-friendly Agriculture*, 14(1), 34-37.

Ram, R. A., & Pathak, R. K. (2016). Organic Approaches for sustainable production of horticultural crops: A review. *Progressive Horticulture*, 48(1), 1. https://doi.org/10.5958/2249-5258.2016.00001.4

Rutherford, M. A., & Phiri, N. (2006). *Pests and diseases of coffee in Eastern Africa*: A technical and advisory manual. Wallingford, UK: CAB International.

Sinha, R., Kumar, A., Kumar, J., Sinha, B. K., Jamwal, S., & Gupta, V. (2022). *Managing Iceryapurchasi and Planococcuscitri menace in Aonla under rainfed conditions of Jammu subtropics*.

von Wistinghausen, C., Scheibe, W., von Wistinghausen, E., & König, U. J. (2000). *The Biodynamic Spray and Compost Preparations Production Methods*, Booklet 1. SteinerBooks.