International Journal of Plant Breeding and Crop Science IJPBCS
Vol. 7(2), pp. 851-864, September, 2020. © www.premierpublishers.org, ISSN: 2167-0449

Research Article

Soil Temperature Changes of (1970-2019) Ulukışla District in Turkey by Trend Analysis Methods

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This research was carried out in the context of evaluating the temperatures at different soil depths observed as monthly between 1970-2019 in Ulukışla district of Nigde province in Turkey. In the study, maximum, minimum and average soil temperatures at soil depths of 10, 50 and 100 cm were investigated. Sperman's Rho, Mann-Kendall and Sen's slope method tests on soil temperature data were applied. According to trend analysis results; The general average of maximum soil temperatures of 10 cm depth was 22.0°C, minimum soil temperature values were 6.9 °C and average soil temperatures were calculated as 14,0 °C. The general average of the maximum soil temperature values in 50 cm soil depth was calculated as 16.1 °C, minimum soil temperature values were observed as 11.5 °C. The general mean of average soil temperatures were determined as 13,8 °C. The general average of the maximum soil temperature in 100 cm soil depth was determined as 15.4 °C, minimum soil temperature values were calculated as 12.6 °C, average soil temperature values were observed as 14.0 °C. According to the changes in soil temperatures in different soil depths; It was determined that there was an increasing trend in maximum, average and minimum soil temperature values in spring, winter, autumn and summer.

Key words: Soil Temperature, Trend Analysis, Ulukışla District, Niğde Province, Turkey

INTRODUCTION

The soil layer of the earth is critical for maintaining plant life, providing mechanical support and providing water and nutrients. Soil functions as a large heat storage mechanism that collects energy throughout the day and releases heat during the night. For a year, the soil retains energy in the warmer seasons and gives heat to the air in the colder seasons (Hanks and Ashcroft, 1983). Soil temperature has a special importance in soil variables. First of all, it directly affects plant growth. In other words, when soil temperatures are below 9 °C and above 50 °C, almost every plant slows down its growth. Photosynthesis, respiration, growth of roots and absorption of nutrients are affected by soil temperature. In addition, germination of seeds from different plants requires different soil temperature ranges. If the soil temperature is too low, the seeds will either not germinate or germinate too weakly. On the other hand, seeds are also damaged in very hot soils (Kirkham, 2004).

Soil temperature indirect or direct; It plays a major role in many important events, from the composition of the soil, its quality, the diversity of living creatures on and in it, to the selection of plants for agricultural production. Daily and annual changes in soil temperature affect the biological and chemical process, such as soil formation, decomposition of organic matter and CO_2 release. In addition, daily changes directly affect all chemical and biological events in the soil (Paul *et al*., 2004). Soil temperature; soil science, meteorology, ecology, hydrology, geo-technology, agriculture and the environment is a very important variable that is needed and therefore must be investigated (Jackson *et al*., 2008).

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In order to ensure high productivity in agriculture, the maximum and minimum soil temperature requirements of the plants planned to be cultivated should be taken into consideration. For example, very high soil temperatures in tropical climates can lead to plant deaths due to very high water consumption and various plant diseases (Tenge *et al*., 1998). The presence of water in the soil, its movement, evaporation, ability to breathe, weathering, microbiological activities, vegetative activities, root breathing, etc. events are under the influence of soil temperature (Anonymous, 2012).

Soils reach the highest temperature in the summer and in the middle of the day. In general, wet or moist soils show slower heating and slower cooling than dry ones (Bayraklı, 1993). Soil temperature; It is a parameter that varies depending on the type of soil, the diameter of the pores in the soil, and the water and air rates in the soil (Anonymous, 2012).

Similarly, in another study conducted in the center of Niğde, soil temperatures at different depths were evaluated by trend analysis. It was determined that there was a significant increase especially in soil temperatures (Bağdatlı and Ballı, 2020).

With this research, changes in the maximum, minimum and average soil temperature values of different depths (10, 50 and 100 cm) observed in Ulukısla district of Niğde province in Turkey between 1970-2019 were determined. In addition, soil temperature data has been evaluated with trend analysis and whether there is a significant trend has been revealed.

MATERIAL and METHOD

The study area is located in Nigde province in Anatolia region of Turkey is Ulukışla district. In this study, the maximum, average and minimum soil temperature values in different soil depths (10, 50 and 100 cm) for many years (1970-2019) belonging to Ulukısla district of Nigde province were used as materials in the study. Long term soil temperature data were taken from the climate observation station in Ulukışla district of Niğde province (Anonymous, 2019).

The location of Ulukısla district in Nigde province subject to the research are shown on the map given in Figure 2.1.

Figure 2.1. The Location of Research Area

In the study, monthly changes of soil temperature values at different depths (10, 50 and 100 cm) of the climate station in Nigde province Ulukısla district were used (Anonymous, 2019). It was evaluated with a total of 600 months trend analysis between 1970-2019. Parameters values are statistically presented as graphs and tables.

For the evaluation of the data, Mann-Kendall and Sperman's Rho and Sen's Slope method were used. All evaluations were made within the 95% confidence level (Mann 1945; Kendall 1975; Sen 1968).

In the study, a software called "Trend Analysis for Windows", which uses Spearman's Rho test, Mann-Kendall Order Correlation test and Sen's Trend Slope method to the data and gives the result as graphics and text (Gümüş and Yenigün, 2006).

RESEARCH FINDINGS

Trend analysis results for maximum, average and minimum soil temperature values at different depths are presented in detail below.

The Changes of Maximum Soil Temperature in 10 cm depth

Maximum soil temperature values in 10 cm depth were evaluated seasonally (spring, autumn, summer and winter months) by trend analysis. The change of maximum soil temperature values in 10 cm depth for 50 years are presented as detail in Figure 3.1.

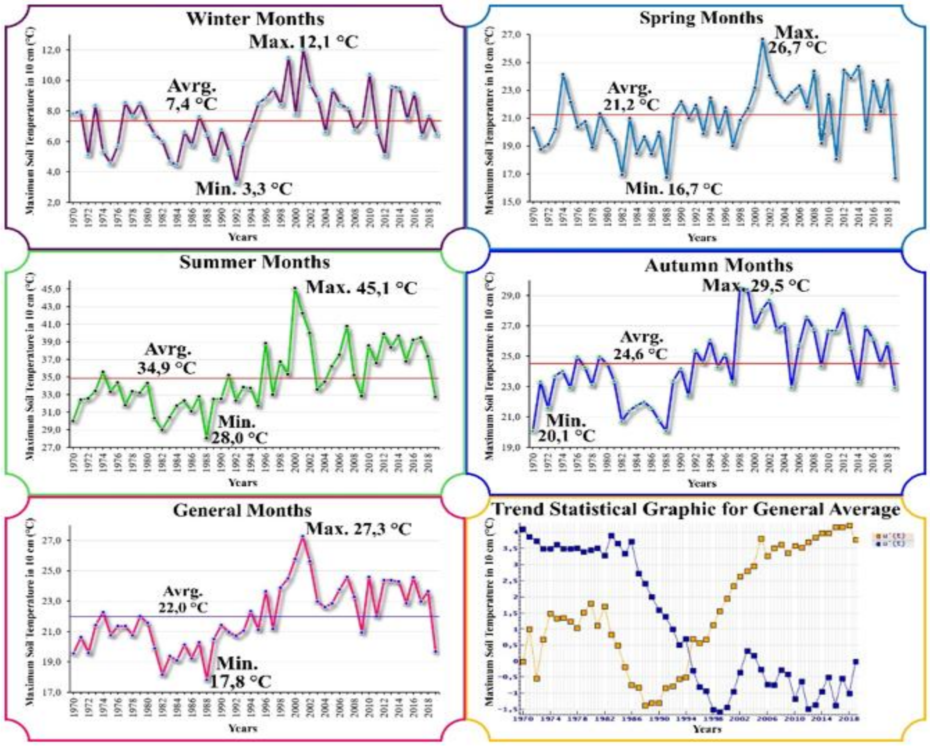

Figure 3.1. The Changes of Maximum Soil Temperature in 10 cm Depth

The highest value of the maximum soil temperatures in 10 cm depth for winter months were 12,1 °C in 2002, the lowest value was 3,3 °C in 1992 and the average soil temperature value was 7,4 °C.

In the spring months, the highest value of the maximum soil temperatures were recorded as 26,7 °C in 2002 and the lowest value was 16,7 °C in 1988 and the average soil temperature value was recorded as 21,2 °C.

The highest value of the maximum soil temperatures for summer months were 45,1 °C in 2000, the lowest value was 28,0 °C in 1988, and the maximum temperature average was 34,9 °C.

The highest soil temperature for autumn months were 29,5 °C in 1999, the lowest soil temperature was 20,1 °C in 1970 and the average soil temperature was 24,6 °C.

In the general of all seasons, the highest maximum soil temperature was observed in 2001 with 27,3 °C, the lowest maximum soil temperature was 17,8 °C in 1988 and The average of long years were recorded as 22,0 °C.

Seasonal trend analysis results of the maximum soil temperature values in 10 cm depth for many years are shown in Figure 3.2.

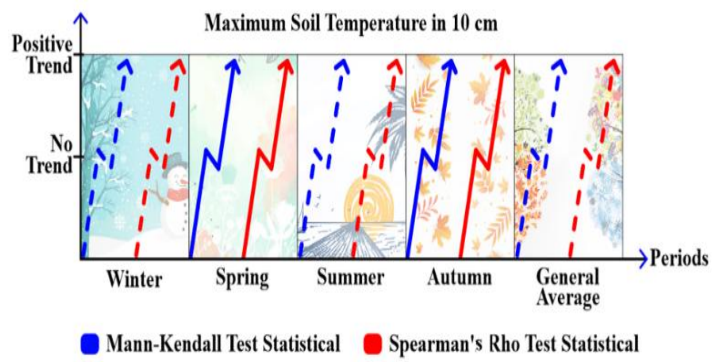

Figure 3.2. Trend analysis results of maximum soil temperature values in 10 cm depth

According to the results of the trend analysis, it was seen that there was a significant trend increasing in summer, autumn, winter months and general average of long periods (50 year)

The Changes of Maximum Soil Temperature in 50 cm depth

Maximum soil temperature values in 50 cm depth were evaluated seasonally (spring, autumn, summer and winter months) by trend analysis. The change of maximum soil temperature values in 50 cm depth for many years are shown in detail in Figure 3.3.

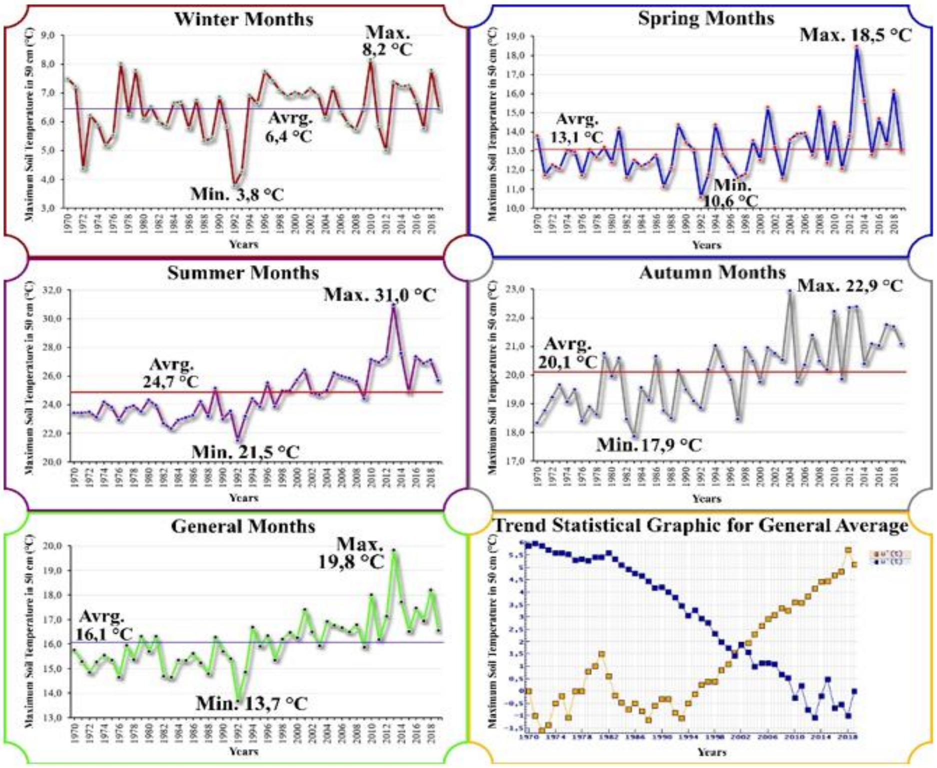

Figure 3.3 The Changes of Maximum Soil Temperature in 50 cm depth

The highest value of the maximum soil temperatures in 50 cm depth in the winter months were 8,2 °C in 2010, the lowest value was 3,8 °C in 1992 and the average soil temperature value was 6,4 °C.

The highest value of the maximum soil temperatures in the spring months were recorded as 18,5 °C in 2013, the lowest value was 10,6 °C in 1992 and the average of all value was 13,1 °C.

In summer months, the highest value of maximum soil temperatures was observed as 31,0 °C in 2013, the lowest value was 21,5 °C in 1992 and the maximum soil temperature average was 24,7 °C.
Highest value of maximum soil temperatures in autumn months were 22,9 °C in 2004, the lowest value was 17,9 °C in 1983 and the average maximum soil temperature was 20,1 °C.

According to the general average of all seasons; The highest value of the maximum soil temperature in 50 cm depth was recorded as 19,8 °C in 2013, the lowest value was 13,7 °C in 1992 and the average value was 16,1 °C.

Maximum soil temperature values in 50 cm depth were seasonally evaluated by trend analysis. Trend analysis results are shown in the chart given in Figure 3.4.

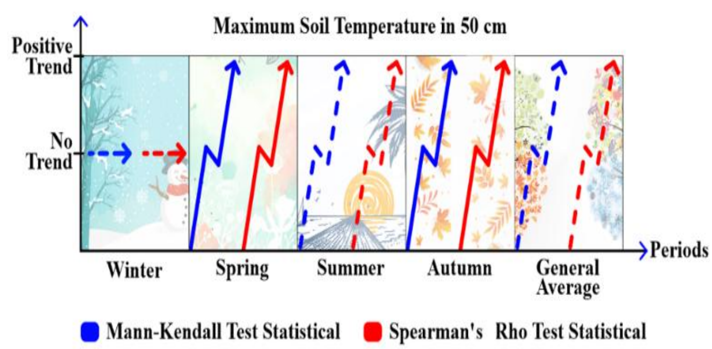

Figure 3.4. Trend analysis results of maximum soil temperature values in 50 cm depth

According to trend analysis results of maximum soil temperatures in 50 cm depth; There was no significant trend in the winter months. It was observed that there was an increasingly significant trend in spring, summer, autumn and general average.

The Changes of Maximum Soil Temperature in 100 cm depth

Maximum soil temperature values in 100 cm depth were evaluated seasonally (spring, autumn, summer and winter months) by trend analysis. Maximum soil temperature changes in 100 cm depth of for long years are given in Figure 3.5.

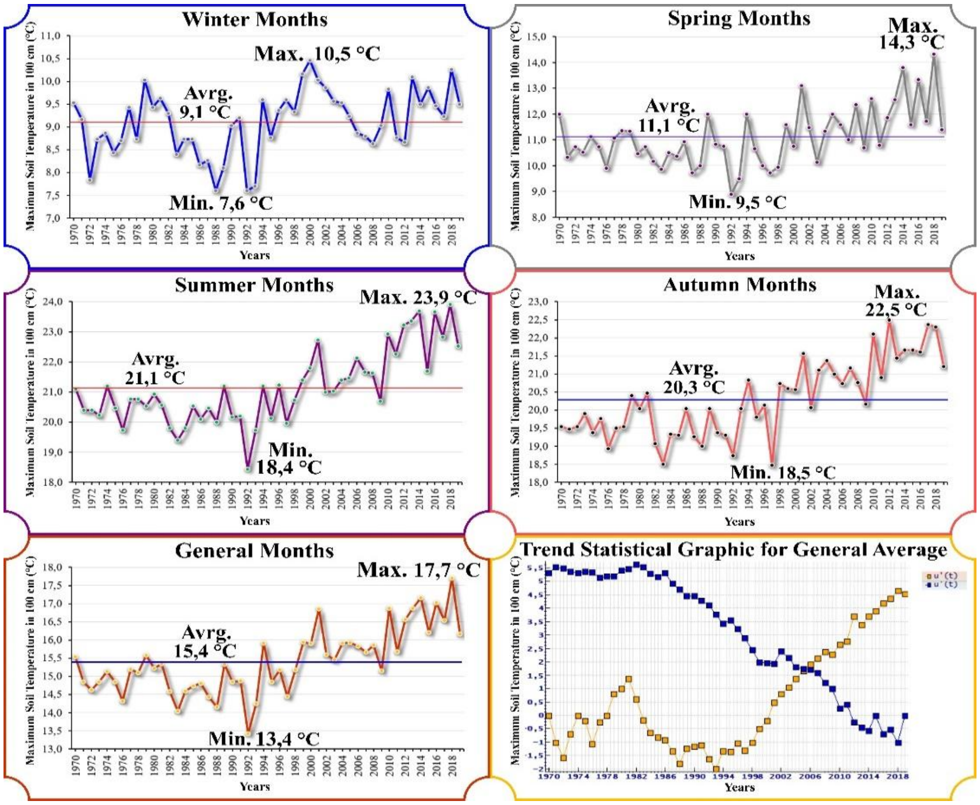

Figure 3.5. The Changes of Maximum Soil Temperature in 100 cm Depth

The highest value of the maximum soil temperatures in 100 cm depth for winter months were 10,5 °C in 2001, the lowest value was 7,6 °C in 1988 and the average value was 9,1 °C.

In spring months, the highest value was calculated as 14,3 °C in 2018, the lowest value was 9,5 °C in 1992 and the average value was 11,1 °C.

In summer months, the highest value was observed as 23,9 °C in 2018, the lowest value was 18,4 °C in 1992 and the average was 21,1 °C.

In autumn months, the highest value was 22,5 °C in 2011, the lowest value was 18,5 °C in 1997 and the average value was 20,3 °C.

Looking at all seasons; the highest value was recorded as 17,7 °C in 2018, the lowest value was 13,4 ° C in 1992 and the average value was 15,4 °C.

Trend analysis test results for maximum soil temperature values in 100 cm depth are shown in Figure 3.6.

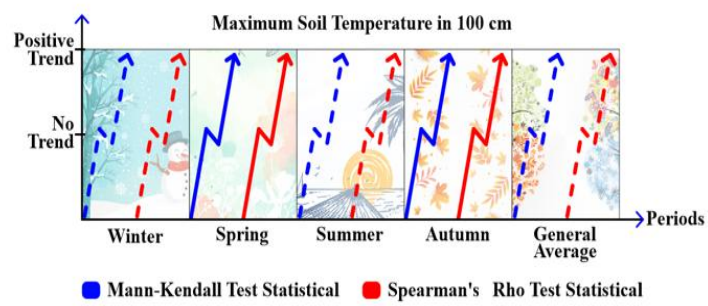

Figure 3.6. Trend analysis results of maximum soil temperature values in 100 cm depth

It had been determined that there was an increasing trend in spring, summer, autumn, winter months and general average in maximum soil temperature values for 100 cm depth

The Changes of Average Soil Temperature in 10 cm depth

The Average of soil temperature values in 10 cm depth were evaluated seasonally (spring, autumn, summer and winter months) by trend analysis. The change of average soil temperature values in 10 cm depth for long years is presented in Figure 3.7.

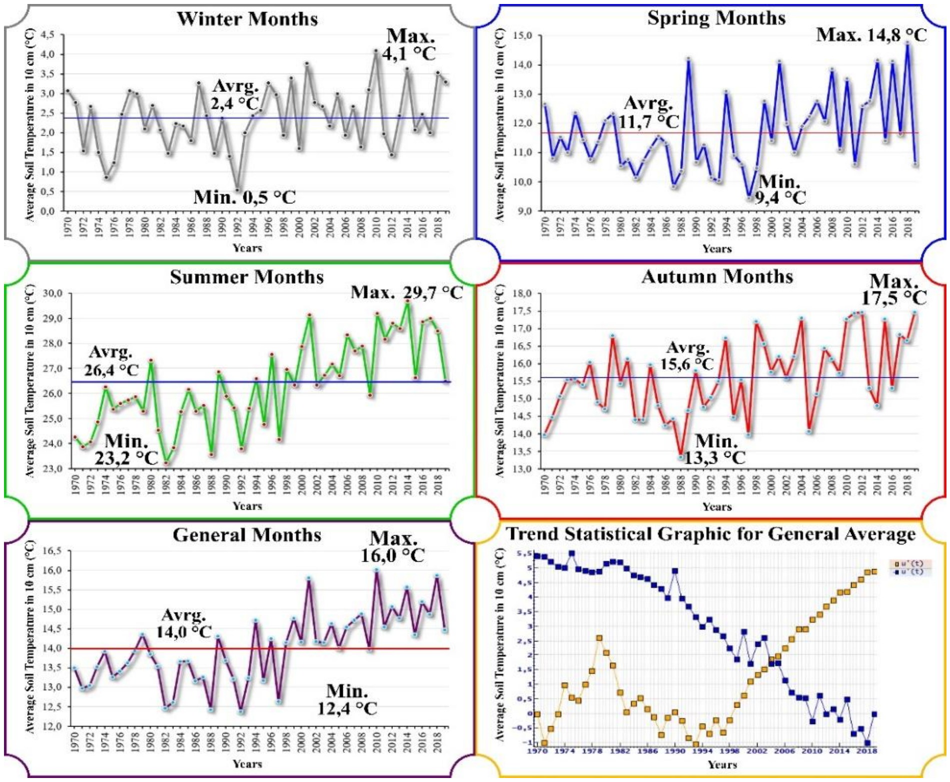

Figure 3.7. The Changes of Average Soil Temperature in 10 cm Depth

In winter, the highest value of the average soil temperatures in 10 cm depth was found as 411 °C in 2011, the lowest value was 0,5 °C in 1992 and the average soil temperature was 2,4 °C.

In spring, the highest value was found as 14,8 °C in 2018, the lowest value was 9,4 °C in 1997 and the average value was 11,7 °C.

In summer, the highest value was observed as 29,7 °C in 2014, the lowest value was 23,2 °C in 1982 and the average was 26,4 ° C.

The highest value in autumn months was 17,5 °C in 2012, the lowest value was 13,3 °C in 1988 and the average value was 15,6 °C.

According to the general average of all seasons of the average soil temperature; the highest value was recorded as 16,0 °C in 2010, the lowest value was 12,4 °C in 1992 and the average value was 14,0 °C.

For many years, the average soil temperature values in 10 cm depth were seasonally evaluated by trend analysis. Trend analysis results are shown in the graph in Figure 3.8.

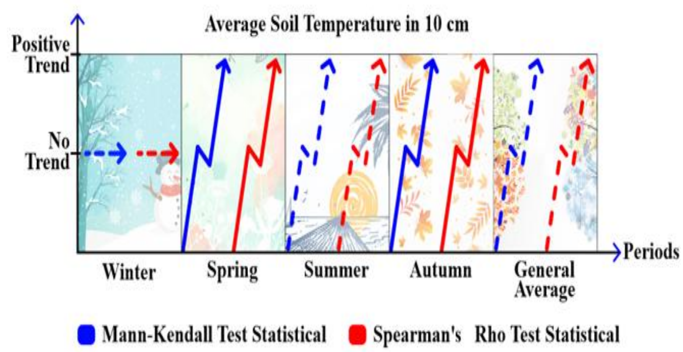

Figure 3.8. Trend analysis results of average soil temperature values in
10 cm depth

There was no significant trend in the Winter, spring, summer, autumn months and overall averages had been found to be an increasingly significant trend.

The Changes of Average Soil Temperature in 50 cm depth

Average soil temperature values in 50 cm depth were evaluated seasonally (spring, autumn, summer and winter months) by trend analysis. The change of average soil temperature values in 50 cm depth for long years (1970-2019) is presented in Figure 3.9.

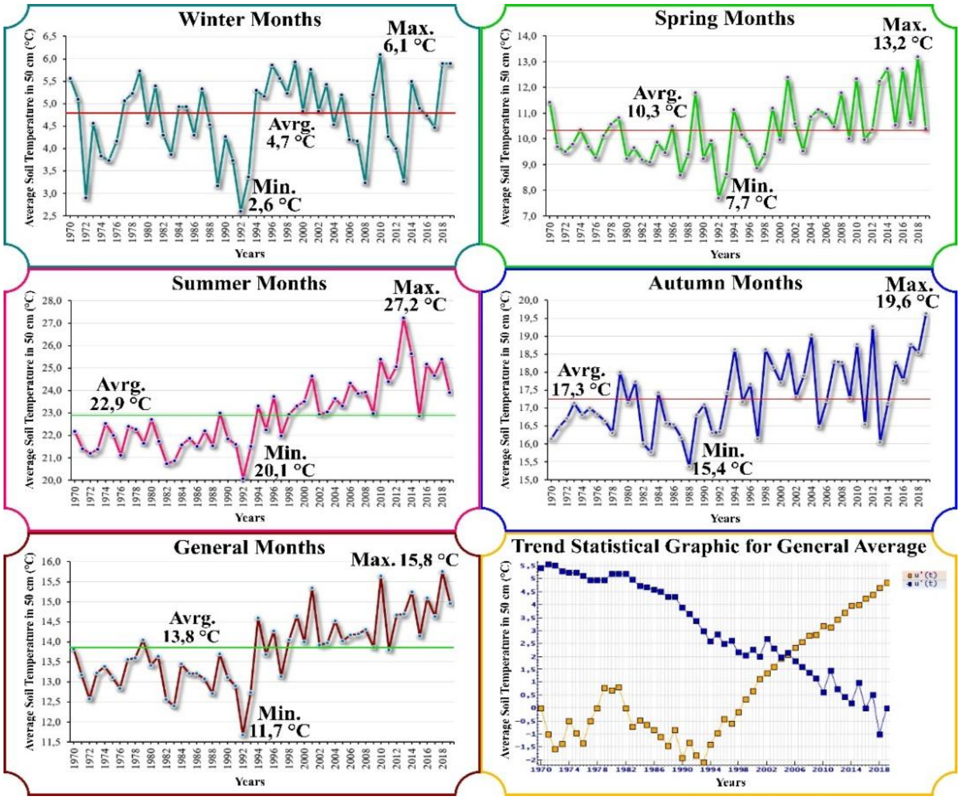

Figure 3.9. The Changes of Average Soil Temperature in 50 cm Depth

The highest value of the average soil temperatures in 50 cm depth for winter months were 6,1 °C in 2010, the lowest value was 2,6 °C in 1992 and the average value was 4,7 °C.

In spring months, the highest value was determined as 13,2 °C in 2018, the lowest value was 7,7 °C in 1992 and the average value was 10,3 °C.

In summer months, the highest value was observed at 27,2 °C in 2013, the lowest value was 20,1 °C in 1992 and the average was 22,9 °C.

In autumn months, the highest value was 19,6 °C in 2019, the lowest value was 15,4 °C in 1988 and the average value was 17,3 °C.

According to the general average of all seasons, the average soil temperature at 50 cm depth; the highest value was recorded as 15,8 °C in 2018, the lowest value was 11,7 °C in 1992 at and the average value was 13,8 °C.

For many years, the average soil temperature values in 50 cm depth were seasonally evaluated by trend analysis. Trend analysis test results are shown in the chart in Figure 3.10.

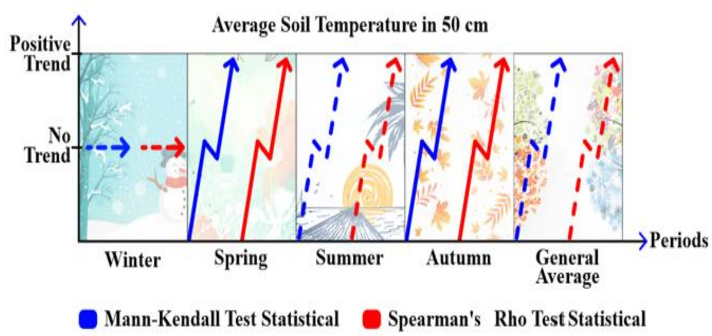

Figure 3.10. Trend analysis results of average soil temperature values in
50 cm depth

According to the trend analysis results; There was no trend in the winter months, it was concluded that there was an increasing trend on the basis of spring, summer, autumn and general average.

The Changes of Average Soil Temperature in 100 cm depth

Average soil temperature values in 100 cm depth were evaluated seasonally (spring, autumn, summer and winter months) by trend analysis. The change in the average soil temperature values in 100 cm depth for long years (1970-2019) is presented in detail in the graph given in Figure 3.11.

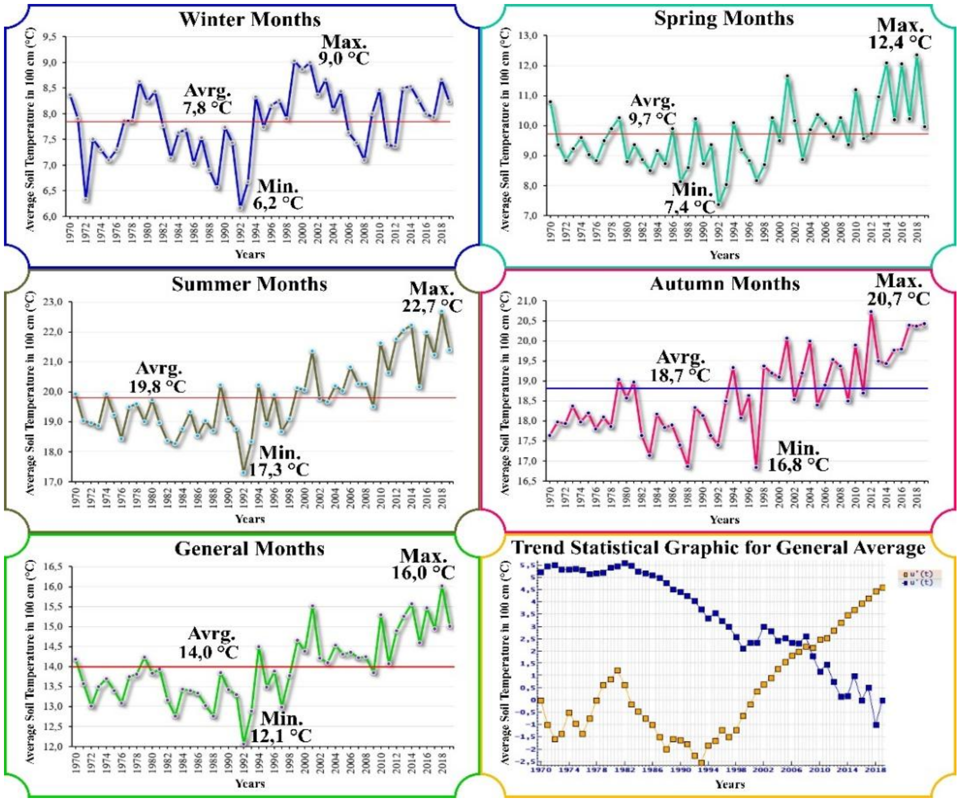

Figure 3.11. The Changes of Average Soil Temperature in 100 cm Depth

In the winter months, the highest value of the average soil temperature in 100 cm depth was seen as 9,0 °C in 2000, the lowest value was 6,2 °C in 1992 and the average soil temperature was 7,8 °C.

In spring months, the highest value was recorded as 12,4 °C in 2018, the lowest value was 7,4 °C in 1992 and the average value was 9,7 °C.

In summer months, the highest value was observed as 22,7 °C in 2018, the lowest soil temperature was 17,3 °C in 1992 and the average value was 19,8 °C.

In autumn months, the highest value was 20,7 °C in 2013, the lowest value was 16,8 °C in 1997 and the average value was 18,7 °C.

Looking at the general average of all seasons; the highest value was recorded as 16,0 °C in 2018, the lowest value was 12,1 °C in 1992 and the average value was 14,0 °C. The average soil temperature values in 100 cm depth for many years were analysed as seasonally. The test results are shown in the chart given in Figure 3.12.

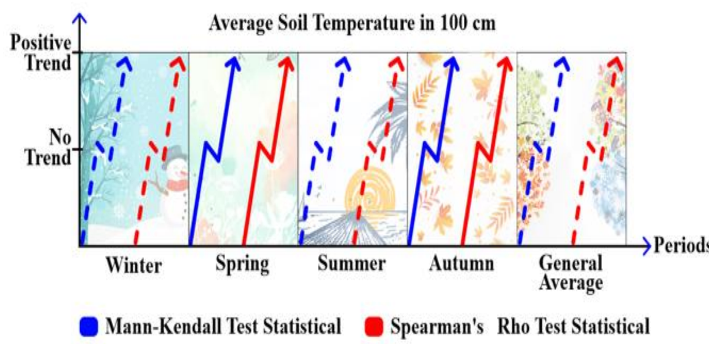

Figure 3.12. Trend analysis results of average soil temperature values in
100 cm depth

According to the results of the trend analysis on the average soil temperature in 100 cm depth; It was concluded that there was an increasingly significant trend on the basis of spring, summer, autumn, winter months and general average.

The Changes of Minimum Soil Temperature in 10 cm depth

Minimum soil temperature values in 10 cm depth were evaluated as seasonally (spring, autumn, summer and winter months) by trend analysis. The change in the minimum soil temperature values in 10 cm depth for long years (1970-2019) is also shown in detail in the graph given in Figure 3.13.

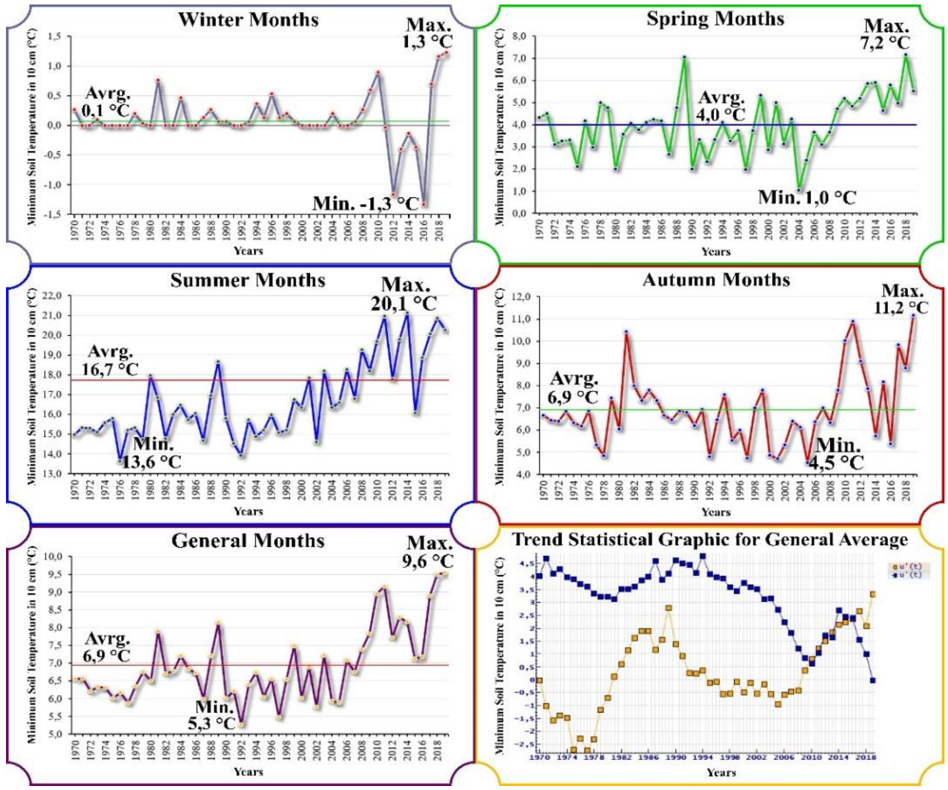

Figure 3.13. The Changes of Minimum Soil Temperature in 10 cm Depth

The highest value of the minimum soil temperature in 10 cm depth in winter months were 1,3 °C, the lowest value was -1,3 °C and the average value was 0,1 °C.

In spring months, the highest value was 7,2 °C, the lowest value was 1,0 °C and the average value was 4,0 °C.

In summer months, the highest value was observed as 20,1 °C, the lowest minimum soil temperature was 13,6 °C and the average value was 16,7 °C.

In autumn months, the highest value was 11,2 °C, the lowest value was 4,5 °C and the average value was 6,9 °C.

Looking at the general average of all seasons; the highest value was recorded as 9,6 °C, the lowest value was 5,3 °C and the average value was 6,9 °C.

The minimum values of soil temperature in 10 cm depth for many years were seasonally tested for trend analysis in Ulukışla district of Nigde province. The test results are shown in the chart given in Figure 3.14.

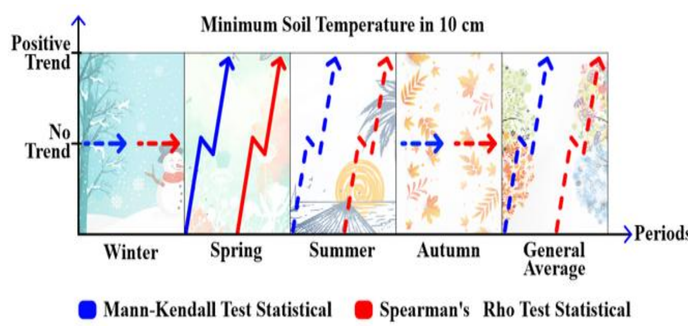

Figure 3.14. Trend analysis results of minimum soil temperature values in 10 cm depth

According to the results of the trend analysis; There was no significant trend in autumn and winter. It was concluded that there was an increasing trend in spring, summer and general average.

The Changes of Minimum Soil Temperature in 50 cm depth

Minimum soil temperature values in 50 cm depth were evaluated as seasonally (spring, autumn, summer and winter months) with trend analysis. The change in the minimum soil temperature values in 50 cm depth for long years (1970-2019) is also shown in detail in the graph given in Figure 3.15.

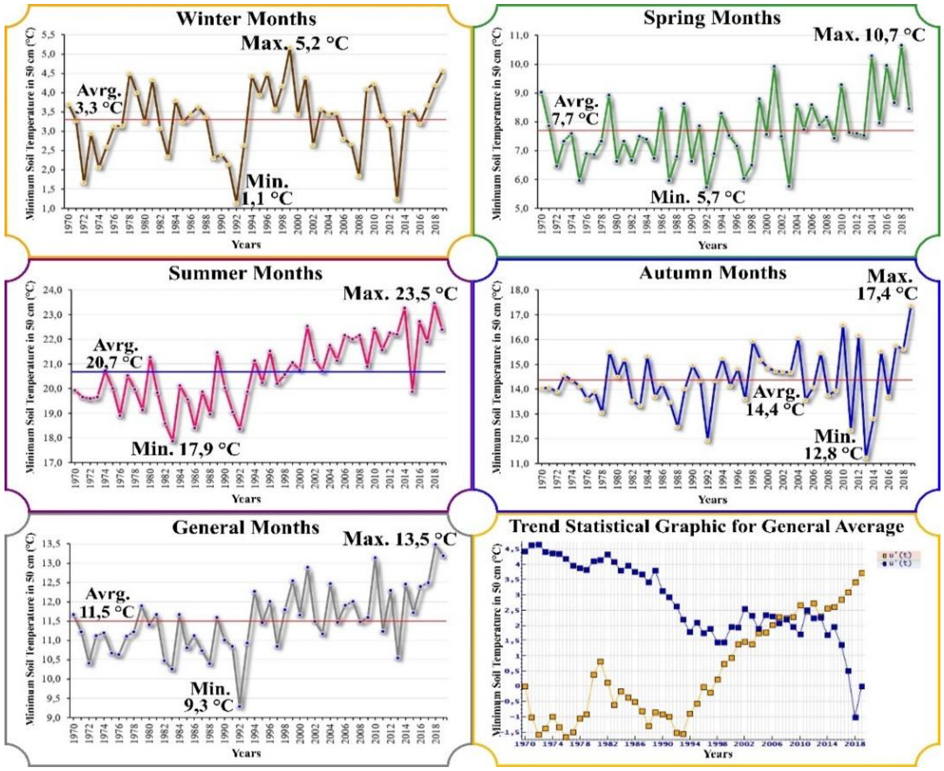

Figure 3.15. The Changes of Minimum Soil Temperature in 50 cm depth

The highest value of the minimum soil temperature in 50 cm depth for winter months were 5,2 °C, the lowest value was 1,1 °C and the average value was 3,3 °C.

In spring months, the highest value was recorded as 10,7 °C, the lowest value was 5,7 °C and the average value was 7,7 °C.

In summer months, the highest value was 23,5 °C, the lowest minimum soil temperature was 17,9 °C and the average value was 20,7 °C.

In autumn months, the highest value was 17,4 °C, the lowest value was 12,8 °C and the average value was 14,4 °C.

Looking at the general average of all seasons; the highest value was recorded as 13,5 °C, the lowest value was 9,3 °C and the average value was 11,5 °C.

The minimum soil temperature values in 50 cm depth for many years were seasonally trending analyzed in Ulukışla district of Nigde province. The test results are shown in the chart given in Figure 3.16.

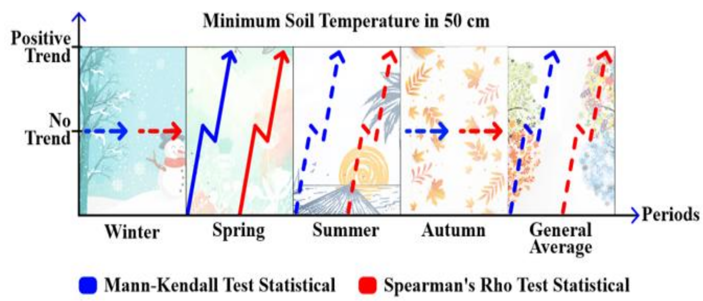

Figure 3.16. Trend analysis results of minimum soil temperature values in 50 cm depth

There was no significant trend in autumn and winter, but an increasing trend was found in spring, summer and general average.

The Changes of Minimum Soil Temperature in 100 cm depth

Minimum soil temperature values in 100 cm depth were evaluated seasonally (spring, autumn, summer and winter months) by trend analysis. The change of minimum soil temperature values in 100 cm depth for long years (1970-2019) is also shown in detail in the graph given in Figure 3.17.

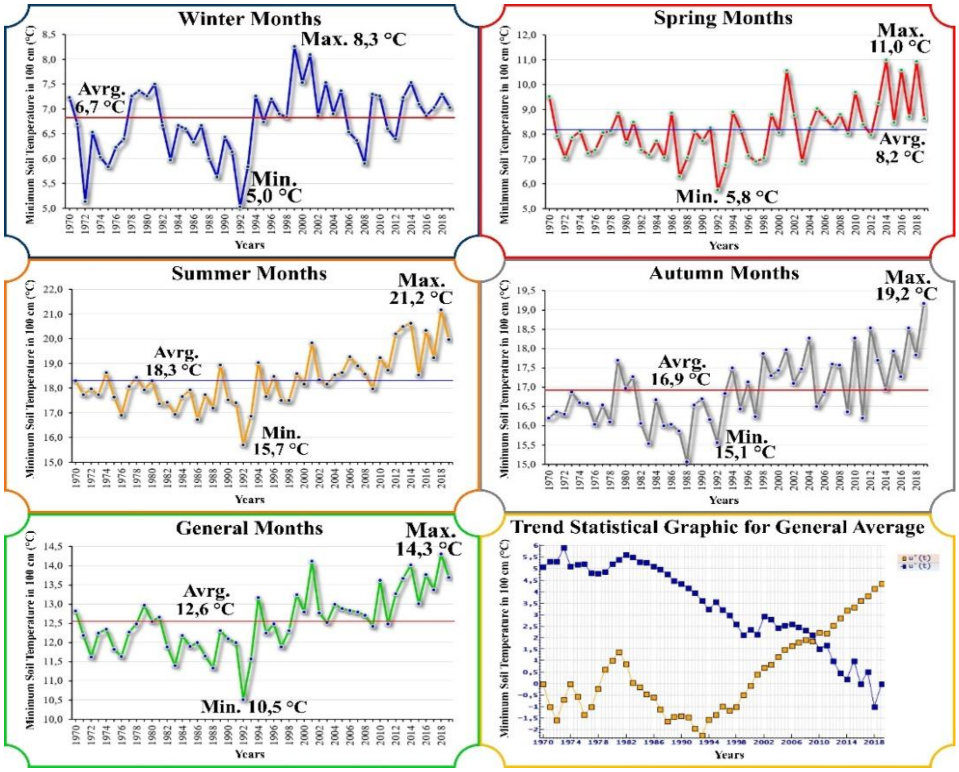

Figure 3.17. The Changes of Minimum Soil Temperature in 100 cm depth

The highest value of the minimum soil temperature in 100 cm depth for winter months were 8,3 °C, the lowest value was 5,0 °C and the average value was 6,7 °C.

In spring, the highest value was recorded as 11,0 °C, the lowest value was 5,8 °C and the average value was 8,2 °C.

In summer months, the highest value was 21,2 °C, the lowest minimum soil temperature was 15,7 °C and the average value was 18,3 °C.

In autumn months, the highest value was 19,2 °C, the lowest value was 15,1 °C and the average value was 16,9 °C.

Looking at the general average of all seasons; the highest value was recorded as 14,3 °C, the lowest value was 10,5 °C and the average value was 12,6 °C.

For many years, the minimum soil temperature values in 100 cm depth was evaluated with trend analysis as seasonally. The test results are shown in the chart given in Figure 3.18.

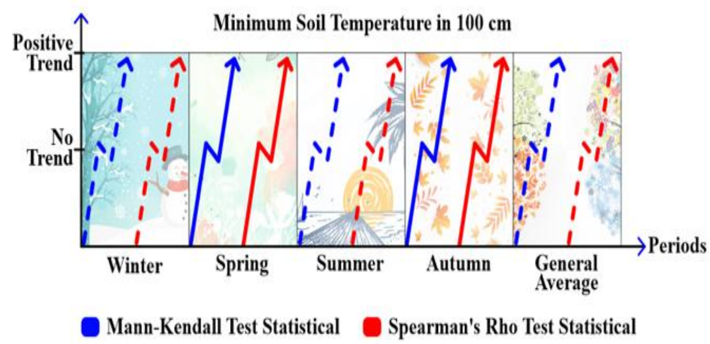

Figure 3.18. Trend analysis results of minimum soil temperature values in 100 cm depth

According to the trend analysis results regarding the minimum soil temperature in 100 cm depth; It had been determined that there was an increasingly significant trend in spring, summer, autumn, winter and general average.

The Average of soil temperature values in different depths for January, April, July and October months

The average values of soil temperature values in different depths (10, 50, 100 cm) for long years (1970-2019; 50 years, 600 months) are summarized by average values of January, April, July and October in Figure 3.19

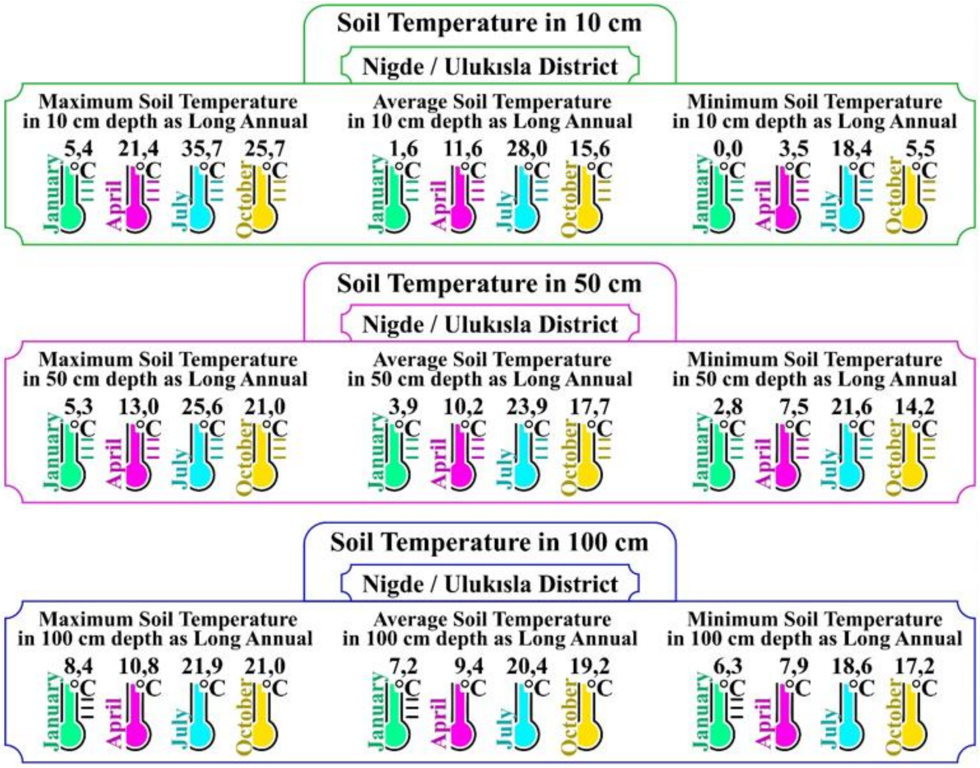

Figure 3.19. Distribution of Maximum, Minimum and Average of soil temperatures in 10, 50, 100 cm depths for January, April, July and October

The maximum soil temperature in 10 cm depth was 5,4 °C in January, 21,4 °C in April, 35,7 °C in July, and 25,7 °C in October. Average soil temperature was determined as 1,6 °C in January, 11,6 ° C in April, 28,0 °C in July and 15,6 °C in October. The minimum soil temperature was set at 0,0 °C in January, 3,5 °C in April, 18,4 °C in July and 5,5 °C in October.

The maximum soil temperature in 50 cm depth was 5,3 °C in January, 13,0 °C in April, 25,6 °C in July and 21,0 °C in October. The average soil temperature was determined as 3,9 °C in January, 10,2 °C in April, 23,9 °C in July and 17,7 °C in October. The minimum soil temperature was determined as 2,8 °C in January, 7,5 °C in April, 21,6 °C in July and 14,2 °C in October.

The maximum soil temperature in 100 cm depth was 8,4 °C in January, 10,8 °C in April, 21,9 °C in July, and 21,0 °C in October. The average soil temperature was 7,2 °C in January, 9,4 °C in April, 20,4 °C in July and 19,2 °C in October. The minimum soil temperature was determined as 6,3 °C in January, 7,9 °C in April, 18,6 °C in July and 17,2 °C in October.

CONCLUSION and SUGGESTIONS

Considering the soil temperature values in 10 cm depth, the average of the maximum soil temperature values were 7,4 °C for winter months, 21,2 °C for spring months, 34,9 °C for summer months, 24,6 °C for autumn months and the general average was determined as 22,0 °C.

The mean value of the average soil temperature values were 2,4 ° C for the winter months, 11,7 °C for the spring months, 26,4 °C for the summer months, 15,6 °C for the autumn months and the overall average was 14,0 °C. The average of minimum soil temperature values were 0,1 °C for winter months, 4,0 °C for spring months, 16,7 °C for summer months, 6,9 °C for autumn months and 6,9 °C for general average.

According to the soil temperature values in 50 cm depth; The average of maximum soil temperature values were 6,4 °C for winter months, 13,1 °C for spring months, 24,7 °C for summer months, 20,1 °C for autumn months, and 16,1 °C for general average. It was observed that the mean value of average soil temperature values were 4,7 °C for winter months, 10,3 °C for spring months, 22,9 °C for summer months, 17,3 °C for autumn months and 13,8 °C for general average The average of minimum soil temperature values were 3,3 °C for winter months, 7,7 °C for spring months, 20,7 °C for summer months, 14,4 °C for autumn months and 11,5 °C for general average.

Looking at the soil temperature values in 100 cm depth; Average of maximum soil temperature values were 9,1 °C for winter months, 11,1 °C for spring months, 21,1 °C for summer months, 20,3 °C for autumn months and 15,4 ° for general average.

Average soil temperature values were 7,8 °C for winter months, 9,7 °C for spring months, 19,8 °C for summer months, 18,7 °C for autumn months and 14,0 °C for general average.

The average of minimum soil temperature values were 6,7 °C for winter months, 8,2 °C for spring months, 18,3 °C for summer months, 16,9 °C for autumn months and 12,6 °C for general average.

In another study conducted similar to this study in the center of Niğde province, soil temperature at different depths was evaluated by trend analysis. In the research conducted, the maximum, minimum and average soil temperatures for many years have been evaluated with trend analysis. In general, it was observed that there was an increasingly significant trend at maximum temperatures of 10 cm depth. According to the Mann-Kendal facility, a significant increase trend was observed in minimum soil temperatures in spring, winter and summer except for the months of autumn. It was observed that there was an increasingly significant trend at maximum temperatures in 50 cm of soil depth. A significant increase trend was observed in minimum soil temperatures in all seasons except autumn months. It had been observed that there was a significant trend in the maximum and minimum soil temperatures in 100 cm depth (Bağdatlı and Ballı, 2020).

Most of the organisms in the soil can grow at 25-35 °C and decompose organic matter. Therefore, nitrification, one of the most important mechanisms in the nitrogen cycle, requires a soil temperature of 32 oC (Hanks and Ashcroft, 1983). As the temperature rises, the decomposition of organic matter, which is necessary for the release of nutrients, especially nitrogen in soluble form, is accelerated. As a result, soil temperature; ventilation also affects soil moisture content and the availability of plant nutrients (Hillel, 2003).

The higher the temperature, the faster the decomposition of organic matter. Thus, substances in organic matter that are absorbed by the plant and in soluble form, especially nitrogen, are released. Therefore, soil organic matter content depends on annual average soil temperature (Weil and Brady, 2017).

The importance level of the relations between the climatic parameters other than the average humidity and the soil temperatures generally increased to a depth of 20 cm from the surface and decreased after this depth. On the other hand, the significance level of the relations between average humidity and soil temperatures decreased to a depth of 20 cm from the surface and increased after this depth (Campbell, 1985).

Freezing and thawing of each other in the soil causes the roots of the plant to be removed. This phenomenon is known as frostbite. The roots are broken by this phenomenon. However, alternative freezing and thawing will improve the structure of the peat soil if it contains moderate moisture, but if the soil contains excess moisture, it destroys the soil structure (Hillel, 2003).

Compared to the subsoil, soil temperature variation is higher in the upper soil. In the temperate regions, the upper layer of soil is warmer than the lower layer in summer. In the winter season, the upper layer of the soil is colder than the lower layer (Ergene, 1982).

Soil temperature has a positive effect on the roots of plants up to a certain level. The movement of water from the soil to the root zone decreases in parallel with the decrease in soil temperature and negatively affects the metabolism activities. It is important to know the temperature distributions in soil layers in order to understand the stress events that plants are exposed to at different developmental stages (Sarıyev *et al*., 1995).

Overheated soil; It will reduce the amount of moisture contained in it and cause the plant to not get enough water. This situation will make the soil inefficient. As the soil temperature decreases, plants that are not suitable for climatic conditions and resistant to cold will be affected by root and cause drying. As a result, a constantly increasing soil temperature will adversely affect plant life. It will decrease the efficiency. It will negatively affect your living life.

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Accepted 15 September 2020

Citation: Bağdatlı MC, Ballı Y (2020). Soil Temperature Changes of (1970-2019) Ulukışla District in Turkey by Trend Analysis Methods. International Journal of Plant Breeding and Crop Science, 7(2): 851-864.