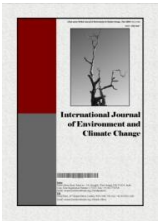

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Effect of Lockdown amid COVID-19 Pandemic on Weather Parameters of Mid Hill Region of Jammu District of J&K, UT

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Authors' contributions

This work was carried out in collaboration among all authors. Author MS edited and made necessary corrections in the manuscript. Author VV designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author CS managed the data and author RS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aim: A study was conducted in mid hill region of Jammu district, J&K to analyze the impact lockdown amid covid-19 pandemic on weather parameters so as to define it as a tool to mitigate the pace of climate change.
Methodology: Day and night temperature readings were recorded fortnightly during 22nd March to 10th June 2020 from maximum and minimum thermometer, relative humidity from dry and wet bulb thermometers in stevenson screen, rainfall values from ordinary rain gauge, evaporation readings from pan evaporimeter and soil temperature at different depth from soil thermometers.
Results: After analyzing the data statistically using "Descriptive statistics" in MS-Excel 2010, it was observed that after the implementation of lockdown and with the beginning of unlock down the change in day temperature was -8.07% from normal mean value, night temperature was -4.44% from normal mean value, rainfall pattern was 30.00% more from normal mean value, Relative Humidity (morning) pattern was 6.94% more from normal mean value, relative humidity (evening) pattern was 20.94% more from normal mean value, evaporation pattern was 7.66% more from

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normal mean value. The average change in soil temperature in morning at 5 cm, 10 cm and 20 cm depth was -3.46%, -3.84% and -7.23% as compared to year 2019 (22nd March to 10th June 2019) mean value and the change in soil temperature in evening at same depths was -7.69%, -6.31% and -4.14% from year 2019 (22nd March to 10th June 2019).

Conclusion: With the variable significant pattern observed in almost all parameters, it can be concluded that lockdown might be an effective tool in mitigating pace of climate change in future.

Keywords: Day and night temperature; rainfall; relative humidity; evaporation rate; soil temperature.

1. INTRODUCTION

World has been moving faster with economical aspect since industrialization and urbanization factors in association with globalization has led to great achievements in science and technology. As impact on environment and weather events was least considered in beginning of the era, the drastically changing climatic parameters especially temperature and CO_2 became a serious cause of concern in 21st century. If we consider the trend of CO_2 in air of last decade, 1% increase has been noticed over previous decade [1,2]. Despite increase in awareness among the usage of renewable resources, the fossil energy usage is still in dominating position in relation to surface, air or water transport [3]. In another aspect, the population density in India over last two decades has increased with a growth rate of 37.60%, thereby having a direct impact on demand supply ratio, e.g. it has been noticed that sales of vehicle since 2008 has been increased with at least 15% per annum and in relation to this, the transport demand is expected to rise by 200% between 2015-2030 [4,5]. So, the sure consequence of the rise of demand supply ratio is going to impact the weather quality in the entire country and Himalayas region in a negative aspect [6].

COVID-19 is a highly contagious disease and was first identified in December, 2019 in Wuhan, China. The WHO declared COVID-19 pandemic on 11th March 2020 [7] and as a result of which on 24th March 2020, India imposed nationwide lockdown in different phases. By this reaction, almost every industrial sector and public transportation movement was prohibited ultimately having a dramatic impact on weather and pollution parameters of Shivaliks and mid hill region of J&K. Therefore, lockdown presumes to be an effective alternative measure to control climate change and the present work is intended to explore the degree of change in weather parameters from lockdown to current situation with respect to normal readings of weather parameters of Jammu region.

The impacts of lockdown are likely to have significant role on restoration of water, air and soil quality in addition to weather parameters. Nationwide lockdown amid the COVID-19 pandemic provides a unique opportunity to work in this direction. Consequently, quantitative appraisal of changing weather parameters or climate change desired to be carried out so as to understand the upshot of lockdown measures on climate change particularly when there is a need to implement such alternative control actions. The present study is an effort in this direction to assess the usefulness of the lockdown as an alternative strategy for diminution of changing climatic pattern in Jammu district of J&K U.T. The objectives of the study:

- To compare the weather parameter change in Jammu during the lockdown periods in fortnightly manner with normal weather data,
- To quantify the magnitude of variation in temperature and moisture of mid hills of Jammu due to the implementation of lockdown regulation during Lockdown period and
- Correlate the weather parameters fortnightly from lockdown initiation to beginning of unlock down

Focusing on the Jammu district, the study is thought to be a conceivable addition to the scientific community and policy makers not only to assess the impacts of lockdown on weather parameters, but also its efficiency as an easy alternative action plans for upgrading changing climatic pattern within the region with public involvement in upcoming years.

2. MATERIALS AND METHODS

Jammu occupies an area of about 3097 sq. kms and lies in between 32°39'35.5"N latitude and 74°47'35.0"E longitude at an elevation of 332 meters above the mean sea level in site the Shivalik foothill plains of North-Western Himalayas and is the winter capital of Jammu

Kashmir. It is largest populated District of the state and second largest in terms of population density. In order to analyze the change in the entire experimental area, weather parameters were analyzed fortnightly from beginning of lockdown i.e. 22nd March 2020 towards beginning of unlock-down 1.0 up to 10th June. Day and Night Temperature, Relative Humidity I (Morning) and Relative Humidity II (Evening), Rainfall, Evaporation were the parameters observed, analyzed and were compared with normal data which is compiled from weather data of past 35 years. However, the soil temperature at different depths (5, 10, 20 cm) in Morning and Evening was noted and compared with year 2019 data from 22nd March to 10th June 2019.

Day and Night temperature readings were recorded from Maximum and Minimum thermometer, Relative Humidity readings from Dry and wet bulb thermometers in Stevenson screen, Rainfall values from ordinary rain gauge, evaporation readings from Pan Evaporimeter and Soil Temperature at different depth from Soil Thermometers. All the instruments have been installed at Agrometeorology Observatory, SKUAST JAMMU.

In order to have a representation of entire population, Descriptive statistics method was opted to find the Highest, Lowest, Mean, Standard Error, Standard Deviation, Coefficient of Variation, Kurtosis and Skewness values and was run in MS-Excel 2010 along with Pearson Correlation in SPSS 16.0 to find out the significant values and impact of one parameter over another. Deviation percentage among mean values of lockdown vs. normal was calculated for each parameter.

3. RESULTS AND DISCUSSION

After the successful collection of readings, the results were analyzed statistically and are presented below:

3.1 Variation in Temperature

3.1.1 Effect on day and night temperature

As the lockdown began, the day temperature started easing down and decreasing pattern was observed (Fig. 1) from 1st to 81st day as compared to normal (Table 1). In 1st fortnight of lockdown, lowest and highest values were 19°C and 29.6°C and in case of normal data the lowest and highest values observed were 27.19°C and 30.44°C. So, the significant impact of lockdown was observed in 1st fortnight as day temperature was -11.00% from normal mean value. The standard deviation calculated was 2.90 in lockdown and 0.92 in normal data. The 2nd fortnight observation in lockdown period depicted lowest and highest values of 24.8°C and 35.6°C and in case of normal; the lowest and highest values observed were 30.6°C and 29.6°C thereby significantly expressing -4.00% variation from normal mean value. The standard deviation calculated was 2.90 in lockdown and 0.92 in normal. Again, in 3rd fortnight observation of lockdown, the lowest and highest values were 29.6°C and 37°C whereas in normal the lowest and highest value observed were 34.83°C and 37.22°C significantly depicting -7.81 % variation from normal mean temperature value. The standard deviation calculated was 2.23 in lockdown and 0.65 in normal data. Following data collection in 4th day in lockdown, lowest value was 26°C and highest value was 36.64°C whereas in normal the lowest and highest values observed were 36.64°C and 38.99°C illustrating -4.48% significant change from normal mean value. The standard deviation calculated was 3.83 in lockdown and 0.66 in normal. From 5th fortnight of lockdown and beginning of process of unlock down, lowest and highest values were 26.8°C and 42.8°C whereas compared to normal lowest and highest values observed was 39.04 °C and 40.47°C depicting significant impact of 12.41% from normal mean value. The standard deviation calculated was 4.47 in lockdown and 0.42 in normal data. In cumulative analysis of 81 days data, lowest and highest values observed were 19°C and 42.8°C in lockdown and 27.19°C and 40.47°C in case of normal. The change in day temperature was still -8.07% from normal mean value. The standard deviation calculated was 4.86 in lockdown and 3.87 in normal. In cumulative analysis, highest value of day temperature of lockdown had exceeded the normal and can be correlated towards the unlocking effect that again pushed the CO_2 and GHG concentration in atmosphere.

Night Temperature values were seen distinct from normal data (Table 2). Comparatively a significant pattern was observed in night temperature values as time moved from complete lockdown to unlock down 1.0 (Fig. 2). During 1st fortnight observation of lockdown, lowest and highest values observed were 10.6°C and 17.8°C and in case of normal the lowest and highest values observed were 12.89°C and 15.74°C. So, the significant impact of lockdown

was observed in 1st fortnight as night temperature was -4.75% than normal mean value. The standard deviation calculated was 2.03 in lockdown and 0.83 in normal. The 2nd fortnight observation of lockdown period depicted lowest and highest value of 12.2°C and 22.5°C and in case of normal data, the lowest and highest values observed were 15.22°C and 18.18°C thereby expressing 0.29% more night temperature than normal mean value. The standard deviation calculated was 2.55 in lockdown and 0.90 in normal. Again, in 3rd fortnight observation of lockdown, lowest and highest values observed were 16.6°C and 23.5°C whereas in normal the lowest and highest values observed were 18.61°C and 21.19°C depicting-4.35% significant change from normal mean temperature value. The standard deviation calculated was 1.78 in lockdown and 0.83 in normal data. Following data collection in 4th fortnight of lockdown, lowest value was 16.4°C and highest value was 23.6°C whereas in normal data the lowest and highest values observed were 20.7°C and 22.44°C illustrating-8.55% significant change from normal mean value. The standard deviation calculated was 2.23 in lockdown and 0.64 in normal data. From 5th fortnight of lockdown and beginning of unlock down, lowest and highest values noted were 19.6°C and 24.8°C whereas as compared to normal data the lowest and highest values observed were 22.43°C and 24.56°C depicting significant impact of-4.13% from normal mean value. The standard deviation calculated was 1.55 in lockdown and 0.58 in normal data. In cumulative analysis of 81 days data, lowest and highest values observed were 10.6°C and 24.8°C in lockdown and 12.89°C and 24.56°C in case of normal data. The change in night temperature was still -4.44% from normal mean value. The standard deviation calculated was 3.61 in lockdown and 3.38 in normal data.

The decreasing pattern observed in day and night temperature might be due to the fluctuation in CO_2 pattern as record of high temperatures prior lockdown can be correlated to shifting with more extreme climate events and CO_2 climbing in our atmosphere due to burning of fossil fuels for energy and other activities of humans and amid lockdown reduction of the anthropogenic activities could have reduced the gases content in atmosphere [8]. Deviation of -8.07% in day and -4.44% in night temperature from normal mean values can be attributed towards lack of greenhouse gas emissions which is due to the changes in the economic output, lack of energy consumption, decreasing emission from land usage, livestock, septic processes and reduced usage of fertilizers as lockdown effect. Decreased industrialization, use of fertilizers, reduced burning of fossil fuels and other human and natural activities might have resulted in reduction of below normal average atmospheric temperature; thus reducing threat to our environment [9,10]. Also, research identifies methane and carbon dioxide as the main greenhouse gases [11]. Therefore, the reduction of both the gases concentration in the atmosphere tackled the negative outcomes of high temperature.

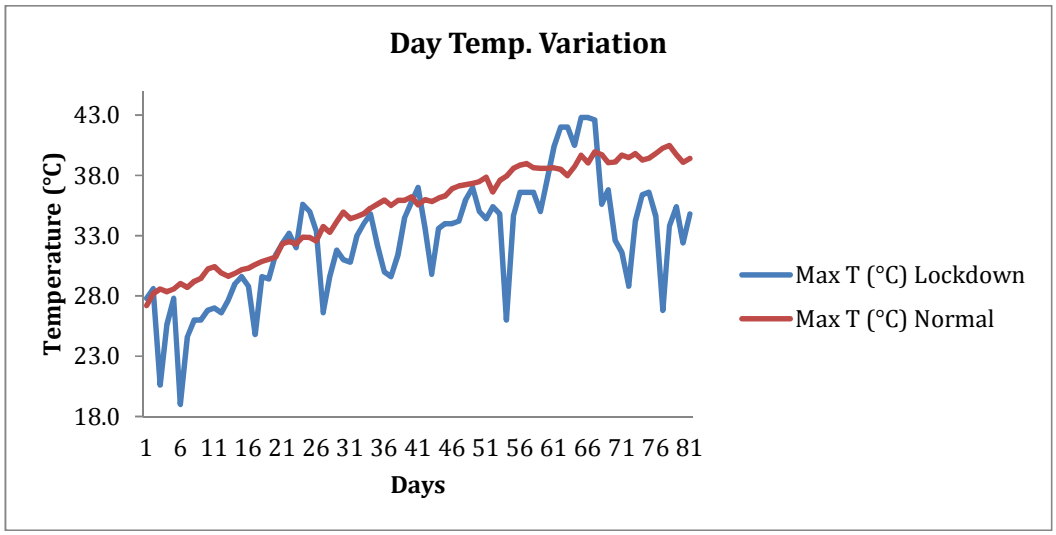

Fig. 1. Effect of lockdown on day temperature (°C) variation with normal

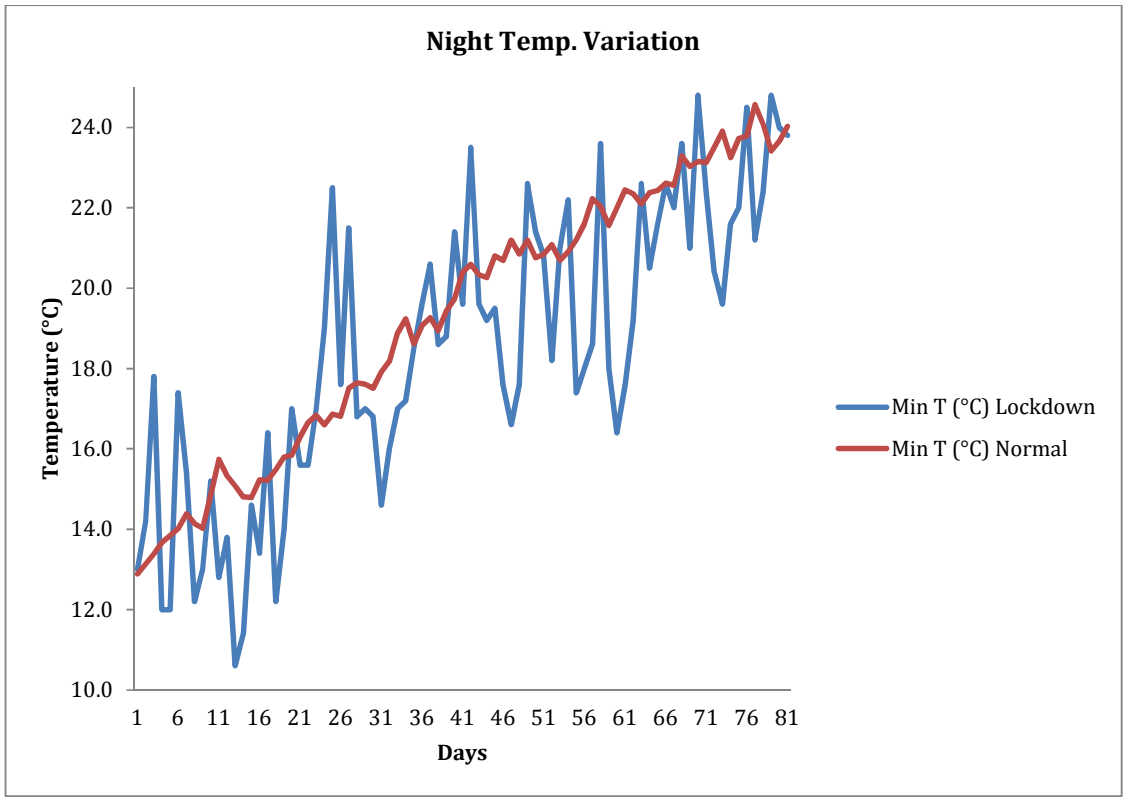

Fig. 2. Effect of lockdown on night temperature (°C) variation with normal

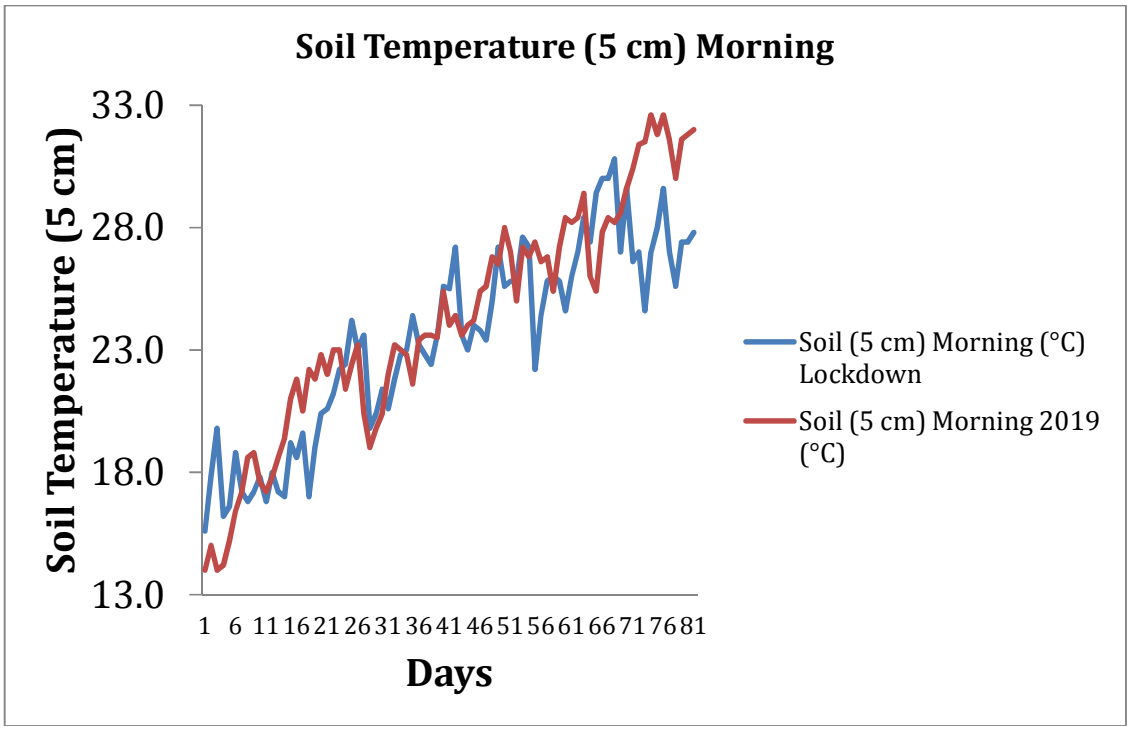

Fig. 3. Effect of lockdown on soil temperature at 5 cm in morning with normal

Table 1. Descriptive coefficients of day temperature (°C) during lockdown and normal data

Day	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
temp.(°C)	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	19.00	27.19	24.80	30.60	29.60	34.83	26.00	36.64	26.80	39.04	19.00	27.19
Highest	29.60	30.44	35.60	34.95	37.00	37.22	42.00	38.99	42.80	40.47	42.80	40.47
Mean	26.34	29.24	31.23	32.77	33.41	36.02	36.53	38.17	35.21	39.58	32.58	35.21
S.E	0.72	0.23	0.70	0.34	0.56	0.16	0.96	0.17	1.08	0.10	0.54	0.43
S.D	2.90	0.92	2.82	1.37	2.23	0.65	3.83	0.66	4.47	0.42	4.86	3.87
C.V (%)	0.11	0.03	0.09	0.04	0.07	0.02	0.10	0.02	0.13	0.01	0.15	0.11
Kurtosis	2.26	-0.20	0.73	-1.00	-0.58	0.09	3.06	0.14	0.15	-0.17	0.22	-1.13
Skewness	-1.57	-0.57	-0.73	-0.06	-0.47	0.41	-1.02	-0.91	0.27	0.48	-0.15	-0.47

Table 2. Descriptive coefficients of night temperature (°C) during lockdown and normal data

Night	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
temp.(°C)	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	10.60	12.89	12.20	15.22	16.60	18.61	16.40	20.70	19.60	22.43	10.60	12.89
Highest	17.80	15.74	22.50	18.18	23.50	21.19	23.60	22.44	24.80	24.56	24.80	24.56
Mean	13.68	14.33	16.85	16.80	19.06	19.89	19.88	21.58	22.49	23.42	18.44	19.26
S.E	0.51	0.21	0.64	0.22	0.44	0.21	0.56	0.16	0.38	0.14	0.40	0.38
S.D	2.03	0.83	2.55	0.90	1.78	0.83	2.23	0.64	1.55	0.58	3.61	3.38
C.V (%)	0.15	0.06	0.15	0.05	0.09	0.04	0.11	0.03	0.07	0.02	0.20	0.18
Kurtosis	0.05	-0.90	1.16	-0.95	1.32	-1.54	-1.33	-1.68	-0.83	-0.34	-0.77	-1.23
Skewness	0.70	-0.10	0.70	-0.24	0.93	-0.03	0.14	-0.03	-0.01	0.00	-0.21	-0.28

Table 3. Descriptive coefficients of soil temperature (5 cm depth), morning (°C) during lockdown and 2019

Soil temp.	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
5 cm (°C)	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019
Lowest	15.60	14.00	17.00	19.00	22.40	21.60	22.20	25.00	24.60	25.40	15.60	14.00
Highest	19.80	21.80	24.20	23.20	27.20	26.80	28.40	29.40	30.80	32.60	30.80	32.60
Mean	17.54	17.30	21.08	21.69	23.96	24.06	26.05	27.14	27.93	30.31	23.37	24.18
S.E	0.28	0.60	0.45	0.33	0.32	0.31	0.37	0.29	0.42	0.49	0.44	0.54
S.D	1.13	2.40	1.82	1.31	1.29	1.26	1.49	1.16	1.71	2.03	3.99	4.82
C.V (%)	0.06	0.14	0.09	0.06	0.05	0.05	0.06	0.04	0.06	0.07	0.17	0.20
Kurtosis	-0.24	-0.68	0.46	-0.65	1.19	0.64	1.83	-0.09	-0.65	0.36	-0.96	-0.58
Skewness	0.42	0.19	-0.31	-0.65	1.21	0.40	-0.96	0.01	-0.02	-0.97	-0.24	-0.20

Table 4. Descriptive coefficients of soil temperature (10 cm depth), morning (°C) during lockdown and 2019

Soil temp.	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
10 cm (°C)	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019
Lowest	16.80	15.00	18.20	20.00	23.20	22.20	23.00	26.00	25.20	26.40	16.80	15.00
Highest	20.40	22.50	25.00	24.40	28.20	27.40	29.40	30.60	32.00	33.80	32.00	33.80
Mean	18.33	18.43	21.99	22.60	24.93	25.07	26.95	28.16	28.78	31.28	24.25	25.18
S.E	0.27	0.60	0.44	0.32	0.33	0.32	0.37	0.29	0.44	0.48	0.45	0.53
S.D	1.09	2.41	1.75	1.29	1.34	1.30	1.48	1.15	1.80	1.97	4.02	4.78
C.V (%)	0.06	0.13	0.08	0.06	0.05	0.05	0.05	0.04	0.06	0.06	0.17	0.19
Kurtosis	-0.62	-1.11	0.25	-0.52	1.02	0.36	2.48	0.36	-0.35	0.83	-0.95	-0.60
Skewness	0.58	-0.01	-0.20	-0.59	1.08	-0.12	-1.04	0.05	0.02	-1.07	-0.24	-0.20

Table 5. Descriptive coefficients of soil temperature (20 cm depth), morning (°C) during lockdown and 2019

Soil temp.	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
20 cm (°C)	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019	Lockdown	2019
Lowest	18.00	17.00	19.60	21.20	24.20	19.20	24.80	27.60	27.00	28.20	18.60	18.00
Highest	21.80	23.80	25.40	25.60	29.00	29.00	30.60	32.20	33.40	34.80	44.60	47.00
Mean	19.31	19.95	23.00	24.08	26.06	26.41	28.30	29.91	29.99	33.12	33.71	36.15
S.E	0.29	0.56	0.41	0.31	0.32	0.57	0.32	0.31	0.42	0.45	0.65	0.77
S.D	1.18	2.26	1.65	1.24	1.26	2.26	1.30	1.25	1.74	1.87	5.84	6.94
C.V (%)	0.06	0.11	0.07	0.05	0.05	0.09	0.05	0.04	0.06	0.06	0.17	0.19
Kurtosis	-0.25	-1.19	-0.31	0.50	0.48	6.97	2.91	0.15	-0.55	1.56	-0.45	-0.52
Skewness	0.83	0.06	-0.33	-1.01	0.72	-2.17	-1.10	-0.25	0.24	-1.43	-0.32	-0.34

Table 6. Descriptive coefficients of soil temperature (5 cm depth), evening (°C) during lockdown and 2019

Soil temp.	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
5 cm (°C)	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	18.60	18.00	23.80	21.50	27.80	31.60	26.80	30.00	27.00	28.20	18.60	18.00
Highest	30.40	33.50	34.40	35.60	39.00	42.00	42.60	44.00	33.40	34.80	44.60	47.00
Mean	26.20	27.66	31.26	31.63	35.45	37.32	38.51	38.69	29.99	33.12	33.64	36.23
S.E	0.84	1.07	0.80	0.96	0.84	0.69	0.96	1.10	0.42	0.45	0.65	0.77
S.D	3.37	4.30	3.19	3.84	3.35	2.76	3.84	4.40	1.74	1.87	5.84	6.94
C.V (%)	0.13	0.16	0.10	0.12	0.09	0.07	0.10	0.11	0.06	0.06	0.17	0.19
Kurtosis	0.68	0.30	2.21	2.02	1.15	0.08	5.33	-0.73	-0.55	1.56	-0.45	-0.52
Skewness	-0.94	-0.88	-1.66	-1.42	-1.30	-0.29	-1.94	-0.77	0.24	-1.43	-0.32	-0.34

Table 7. Descriptive coefficients of soil temperature (10 cm depth), evening (°C) during lockdown and 2019

Soil temp.	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
10 cm (°C)	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	19.40	17.00	22.40	21.80	26.60	28.60	27.20	30.00	28.00	37.00	19.40	17.00
Highest	27.00	29.40	30.80	31.40	35.00	38.20	38.40	39.20	40.60	42.80	40.60	42.80
Mean	24.06	24.54	28.33	28.51	32.01	33.53	34.84	35.43	34.20	40.83	30.73	32.67
S.E	0.55	0.89	0.56	0.64	0.62	0.73	0.70	0.77	0.88	0.38	0.54	0.70
S.D	2.19	3.55	2.25	2.57	2.47	2.94	2.78	3.07	3.62	1.58	4.83	6.32
C.V (%)	0.09	0.14	0.08	0.09	0.08	0.09	0.08	0.09	0.11	0.04	0.16	0.19
Kurtosis	0.06	-0.22	2.10	1.75	0.21	-0.95	2.70	-0.93	-0.95	0.77	-0.64	-0.71
Skewness	-0.69	-0.72	-1.43	-1.31	-0.94	0.00	-1.29	-0.67	0.12	-1.12	-0.22	-0.23

Table 8. Descriptive coefficients of soil temperature (20 cm depth), evening (°C) during lockdown and 2019

Soil temp.	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
20 cm (°C)	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	19.60	16.80	22.20	22.60	25.80	26.40	27.80	29.60	29.00	32.00	19.60	16.80
Highest	24.00	25.60	27.60	27.40	31.50	33.00	34.00	34.60	36.40	39.40	36.40	39.40
Mean	21.56	21.48	25.56	25.70	28.88	29.40	31.55	32.07	32.02	36.56	27.97	29.13
S.E	0.30	0.67	0.40	0.34	0.43	0.53	0.45	0.40	0.58	0.43	0.48	0.62
S.D	1.21	2.69	1.62	1.34	1.73	2.13	1.80	1.62	2.38	1.77	4.32	5.59
C.V (%)	0.06	0.13	0.06	0.05	0.06	0.07	0.06	0.05	0.07	0.05	0.15	0.19
Kurtosis	-0.19	-0.88	-0.17	0.57	-0.83	-0.80	0.61	-1.47	-0.96	2.05	-0.91	-0.74
Skewness	0.10	-0.23	-0.78	-1.05	-0.36	0.39	-0.78	0.10	0.42	-1.09	-0.25	-0.13

Table 9. Descriptive coefficients of relative humidity – morning (%) during lockdown and normal data

R.H (%)	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	64.00	74.91	59.00	64.27	54.36	36.00	36.00	53.68	37.00	50.27	36.00	50.27
Highest	94.00	84.05	85.00	76.50	64.95	81.00	76.00	59.00	94.00	60.32	94.00	84.05
Mean	80.25	78.57	72.25	69.80	59.64	48.75	59.06	55.36	63.24	54.73	68.23	63.51
S.E	2.41	0.57	1.94	0.80	0.84	3.25	2.69	0.43	3.92	0.78	1.45	1.07
S.D	9.63	2.29	7.75	3.18	3.35	13.01	10.77	1.72	16.18	3.20	13.07	9.67
C.V (%)	0.12	0.03	0.11	0.05	0.06	0.27	0.18	0.03	0.26	0.06	0.19	0.15
Kurtosis	-1.04	0.91	-0.99	-0.11	-0.86	1.64	-0.16	0.47	-0.65	-1.05	-0.27	-1.14
Skewness	-0.09	0.65	-0.28	0.32	0.15	1.49	-0.14	1.29	0.27	0.42	-0.15	0.53

Table 10. Descriptive coefficients of relative humidity - evening (%) during lockdown and normal data

R.H (%)	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	34.00	38.05	27.00	31.23	26.82	12.00	11.00	25.95	16.00	25.91	11.00	25.91
Highest	94.00	46.18	87.00	41.32	33.23	44.00	64.00	32.05	95.00	33.36	95.00	46.18
Mean	52.38	42.23	44.00	34.74	29.23	20.31	28.25	27.69	43.76	28.53	41.00	32.43
S.E	4.21	0.59	3.89	0.73	0.49	1.98	3.20	0.43	5.02	0.57	1.92	0.66
S.D	16.83	2.35	15.55	2.92	1.96	7.91	12.79	1.72	20.69	2.37	17.32	5.92
C.V (%)	0.32	0.06	0.35	0.08	0.07	0.39	0.45	0.06	0.47	0.08	0.42	0.18
Kurtosis	1.29	-0.49	3.00	0.25	-0.85	4.80	3.24	1.63	1.06	-0.21	1.42	-0.54
Skewness	1.24	-0.03	1.68	1.10	0.49	1.77	1.45	1.48	0.92	0.87	1.07	0.85

Table 11. Descriptive coefficients of evaporation (mm) during lockdown and normal data

Evaporation	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
(mm)	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	0.60	2.82	3.80	3.50	5.20	5.04	3.20	6.57	3.20	7.96	0.60	2.82
Highest	6.60	3.62	6.80	5.13	7.60	8.97	9.00	7.98	9.60	8.48	9.60	8.97
Mean	4.71	3.22	5.98	4.28	6.28	6.37	7.15	7.27	7.74	8.19	6.39	5.90
S.E	0.39	0.06	0.21	0.13	0.18	0.22	0.31	0.11	0.40	0.04	0.18	0.22
S.D	1.56	0.24	0.84	0.53	0.71	0.89	1.24	0.43	1.66	0.15	1.62	1.94
C.V (%)	0.33	0.07	0.14	0.12	0.11	0.14	0.17	0.06	0.21	0.02	0.25	0.33
Kurtosis	3.04	-1.06	1.69	-1.06	-0.90	4.37	7.32	-1.17	2.13	-0.87	1.72	-1.49
Skewness	-1.69	-0.14	-1.29	0.17	0.15	1.46	-2.07	-0.17	-1.46	0.16	-0.71	-0.19

Table 12. Descriptive coefficients of rainfall (mm) during lockdown and normal data

Rainfall	1st fortnight		2nd fortnight		3rd fortnight		4th fortnight		5th fortnight		Cumulative	
(mm)	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal	Lockdown	Normal
Lowest	0.00	0.35	0.00	0.17	0.00	0.19	0.00	0.07	0.00	0.00	0.00	0.00
Highest	47.40	7.38	15.00	2.88	11.00	2.51	5.80	1.90	21.80	2.29	47.40	7.38
Mean	4.14	2.25	0.94	1.28	0.94	0.91	0.50	0.83	2.28	0.89	1.77	1.23
S.E	2.96	0.55	0.94	0.20	0.72	0.15	0.38	0.15	1.32	0.16	0.69	0.14
S.D	11.86	2.19	3.75	0.81	2.86	0.60	1.52	0.62	5.45	0.65	6.22	1.24
C.V (%)	2.87	0.98	4.00	0.64	3.05	0.65	3.03	0.74	2.39	0.73	3.52	1.01
Kurtosis	13.97	0.78	16.00	-0.72	11.64	2.16	11.34	-1.25	11.39	-0.48	37.76	10.13
Skewness	3.67	1.35	4.00	0.37	3.36	1.29	3.32	0.42	3.25	0.61	5.68	2.81

Table 13. Correlation of coefficients among weather parameters in 1st fortnight of lockdown

Correlation	Day T.	Night T.	Rainfall	RH I (M)	RH II (E)	Evaporation	Soil Temp. 5 cm (M)	Soil temp. 10 cm (M)	Soil temp. 20 cm (M)	Soil temp. 5 cm (E)	Soil temp. 10 cm (E)
Night T.	-0.70**										
Rainfall	-0.18	0.21									
RH I (M)	-0.68**	0.27	0.35								
RH II (E)	-0.92**	0.73**	0.18	0.58*							
Evaporation	0.34	-0.11	-0.77**	-0.5	-0.3						
Soil Temp. 5 cm (M)	-0.37	0.72**	-0.08	-0.06	0.38	0.4					
Soil Temp. 10 cm (M)	-0.27	0.61*	-0.17	-0.06	0.24	0.50*	0.97**				
Soil Temp. 20 cm (M)	-0.07	0.45	-0.27	-0.12	0.04	0.58*	0.87**	0.95**			
Soil Temp. 5 cm (E)	0.94**	-0.61*	-0.09	-0.67**	-0.94**	0.36	-0.26	-0.14	0.04		
Soil Temp. 10 cm (E)	0.91**	-0.56*	-0.14	-0.72**	-0.93**	0.42	-0.17	-0.05	0.13	0.99**	
Soil Temp. 20 cm (E)	0.68**	-0.30	-0.23	-0.69**	-0.72**	0.57*	0.08	0.17	0.27	0.78**	0.84**

***Correlation is significant at 1% level of significance; *Correlation is significant at 5% level of significance*

Table 14. Correlation of coefficients among weather parameters in 2nd fortnight of lockdown

Correlation	Day T.	Night T.	Rainfall	RH I (M)	RH II (E)	Evaporation	Soil Temp. 5 cm (M)	Soil temp. 10 cm (M)	Soil temp. 20 cm (M)	Soil temp. 5 cm (E)	Soil temp. 10 cm (E)
Night T.	0.21										
Rainfall	-0.15	-0.01									
RH I (M)	-0.14	-0.17	0.13								
RH II (E)	-0.74**	0.20	0.02	0.22							
Evaporation	0.34	0.37	-0.69**	0.09	0.01						
Soil Temp. 5 cm (M)	0.44	0.86**	-0.19	-0.28	0.02	0.58*					
Soil Temp. 10 cm (M)	0.45	0.86**	-0.21	-0.27	0.01	0.57*	0.99**				
Soil Temp. 20 cm (M)	0.48	0.81**	-0.19	-0.29	0.01	0.55*	0.99**	0.99**			
Soil Temp. 5 cm (E)	0.88**	-0.19	-0.11	-0.24	-0.89**	0.13	0.12	0.14	0.19		
Soil Temp. 10 cm (E)	0.93**	0.00	-0.13	-0.24	-0.75**	0.25	0.34	0.36	0.42	0.95**	
Soil Temp. 20 cm (E)	0.83**	0.45	-0.16	-0.34	-0.47	0.43	0.77**	0.78**	0.82**	0.69**	0.84**

***Correlation is significant at 1% level of significance;*Correlation is significant at 5% level of significance*

Table 15. Correlation of coefficients among weather parameters in 3rd fortnight of lockdown

Correlation	Day T.	Night T.	Rainfall	RH I (M)	RH II (E)	Evaporation	Soil temp. 5 cm (M)	Soil temp. 10 cm (M)	Soil temp. 20 cm (M)	Soil temp. 5 cm (E)	Soil temp. 10 cm (E)
Night T.	0.21										
Rainfall	-0.15	-0.01									
RH I (M)	-0.14	-0.17	0.13								
RH II (E)	-0.74**	0.20	0.02	0.22							
Evaporation	0.34	0.37	-0.69**	0.09	0.01						
Soil Temp. 5 cm (M)	0.44	0.86**	-0.19	-0.28	0.02	0.58*					
Soil Temp. 10 cm (M)	0.45	0.86**	-0.21	-0.27	0.01	0.57*	0.99**				
Soil Temp. 20 cm (M)	0.48	0.81**	-0.19	-0.29	0.01	0.55*	0.99**	0.99**			
Soil Temp. 5 cm (E)	0.88**	-0.19	-0.11	-0.24	-0.89**	0.13	0.12	0.14	0.19		
Soil Temp. 10 cm (E)	0.93**	0.00	-0.13	-0.24	-0.75**	0.25	0.34	0.36	0.42	0.95**	
Soil Temp. 20 cm (E)	0.83**	0.45	-0.16	-0.34	-0.47	0.43	0.77**	0.78**	0.82**	0.69**	0.84**

***Correlation is significant at 1% level of significance; *Correlation is significant at 5% level of significance*

Table 16. Correlation of coefficients among weather parameters in 4th fortnight of lockdown

Correlation	Day T.	Night T.	Rainfall	RH I (M)	RH II (E)	Evaporation	Soil temp. 5 cm (M)	Soil temp. 10 cm (M)	Soil temp. 20 cm (M)	Soil temp. 5 cm (E)	Soil temp. 10 cm (E)
Night T.	-0.15										
Rainfall	-0.17	-0.22									
RH I (M)	-0.49	-0.27	0.43								
RH II (E)	-0.84**	0.32	0.07	0.65**							
Evaporation	0.47	0.32	-0.79**	-0.49	-0.25						
Soil Temp. 5 cm (M)	0.19	0.64**	-0.69**	-0.29	0.16	0.80**					
Soil Temp. 10 cm (M)	0.22	0.63**	-0.70**	-0.35	0.11	0.84**	0.99**				
Soil Temp. 20 cm (M)	0.30	0.55*	-0.70**	-0.49	-0.04	0.88**	0.93**	0.96**			
Soil Temp. 5 cm (E)	0.94**	-0.14	-0.24	-0.45	-0.82**	0.42	0.16	0.17	0.21		
Soil Temp. 10 cm (E)	0.94**	-0.08	-0.31	-0.54*	-0.84**	0.53*	0.23	0.25	0.31	0.98**	
Soil Temp. 20 cm (E)	0.84**	0.12	-0.55*	-0.54*	-0.65**	0.75**	0.54*	0.56*	0.59*	0.88**	0.92**

***Correlation is significant at 1% level of significance; *Correlation is significant at 5% level of significance*

Table 17. Correlation of coefficients among weather parameters in 5th fortnight of lockdown

Correlation	Day T.	Night T.	Rainfall	RH I (M)	RH II (E)	Evaporation	Soil temp. 5 cm (M)	Soil temp. 10 cm (M)	Soil temp. 20 cm (M)	Soil temp. 5 cm (E)	Soil temp. 10 cm (E)
Night T.	0.03										
Rainfall	-0.52*	-0.40									
RH I (M)	-0.82**	-0.11	0.62**								
RH II (E)	-0.87**	0.16	0.61**	0.71**							
Evaporation	0.28	0.38	-0.13	-0.50*	-0.13						
Soil Temp. 5 cm (M)	0.51*	0.50*	-0.40	-0.73**	-0.22	0.69**					
Soil Temp. 10 cm (M)	0.45	0.47	-0.32	-0.69**	-0.17	0.71**	0.99**				
Soil Temp. 20 cm (M)	0.39	0.34	-0.19	-0.65**	-0.11	0.70**	0.95**	0.98**			
Soil Temp. 5 cm (E)	0.88**	-0.03	-0.52*	-0.73**	-0.90**	0.30	0.37	0.32	0.26		
Soil Temp. 10 cm (E)	0.88**	0.00	-0.49*	-0.79**	-0.85**	0.36	0.46	0.42	0.37	0.98**	
Soil Temp. 20 cm (E)	0.81**	0.16	-0.46	-0.86**	-0.69**	0.55*	0.73**	0.71**	0.67**	0.86**	0.92**

***Correlation is significant at 1% level of significance;*Correlation is significant at 5% level of significance*

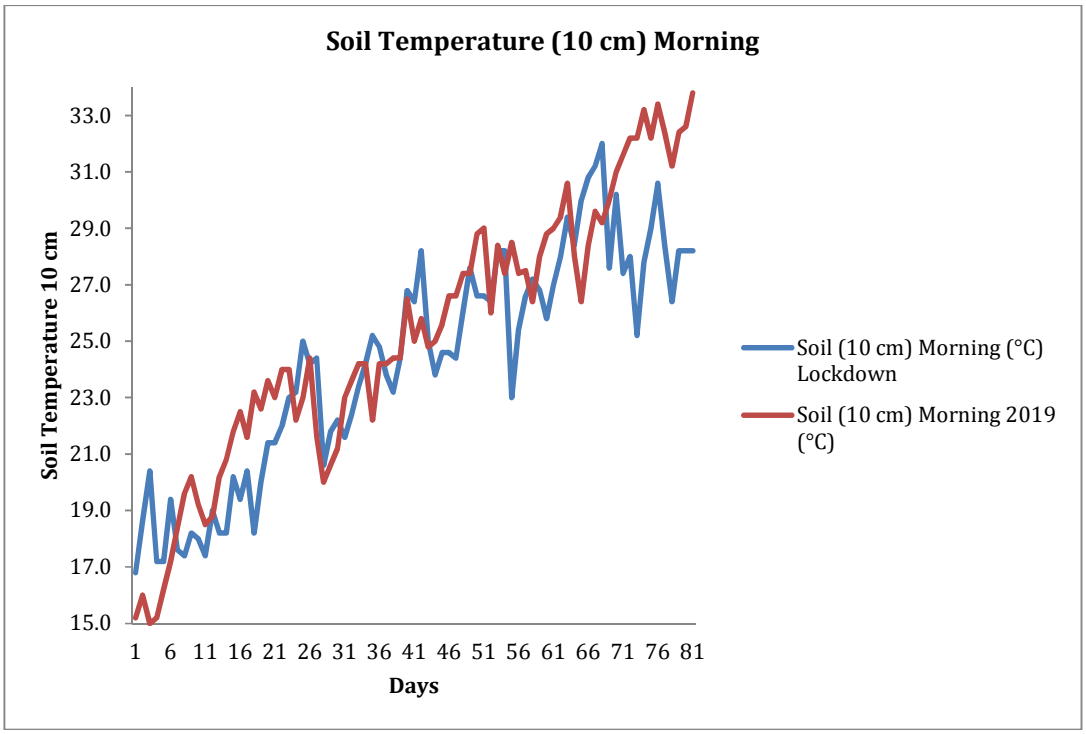

Fig. 4. Effect of lockdown on soil temperature at 10 cm in morning with normal

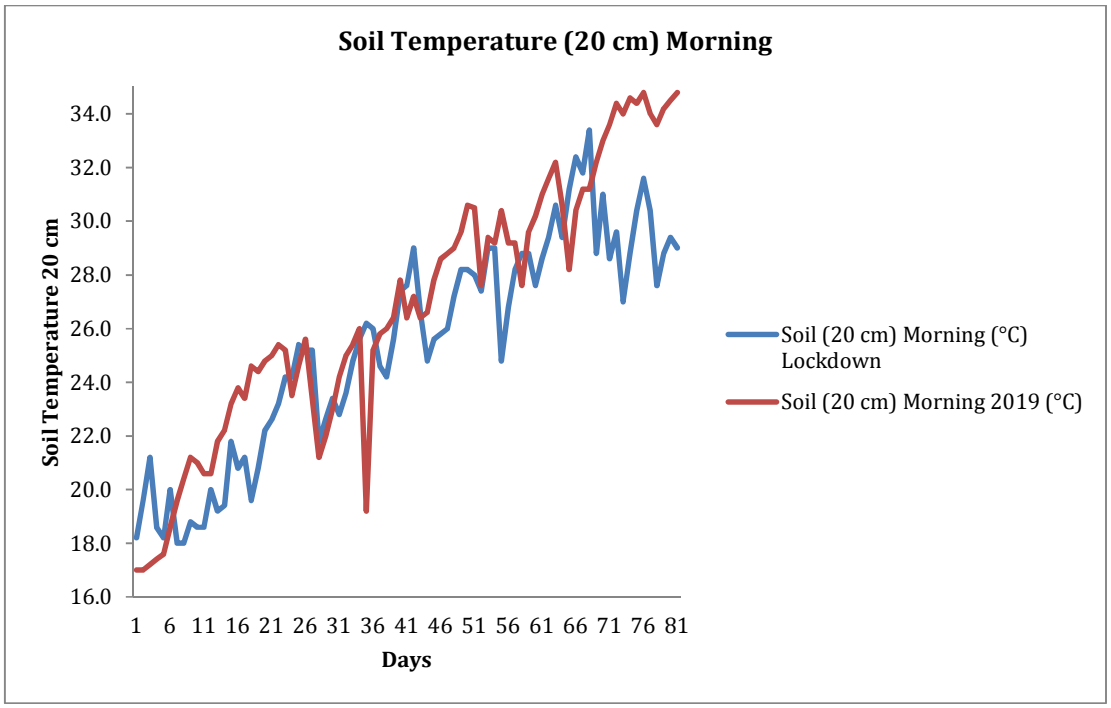

Fig. 5. Effect of lockdown on soil temperature at 20 cm in morning with normal

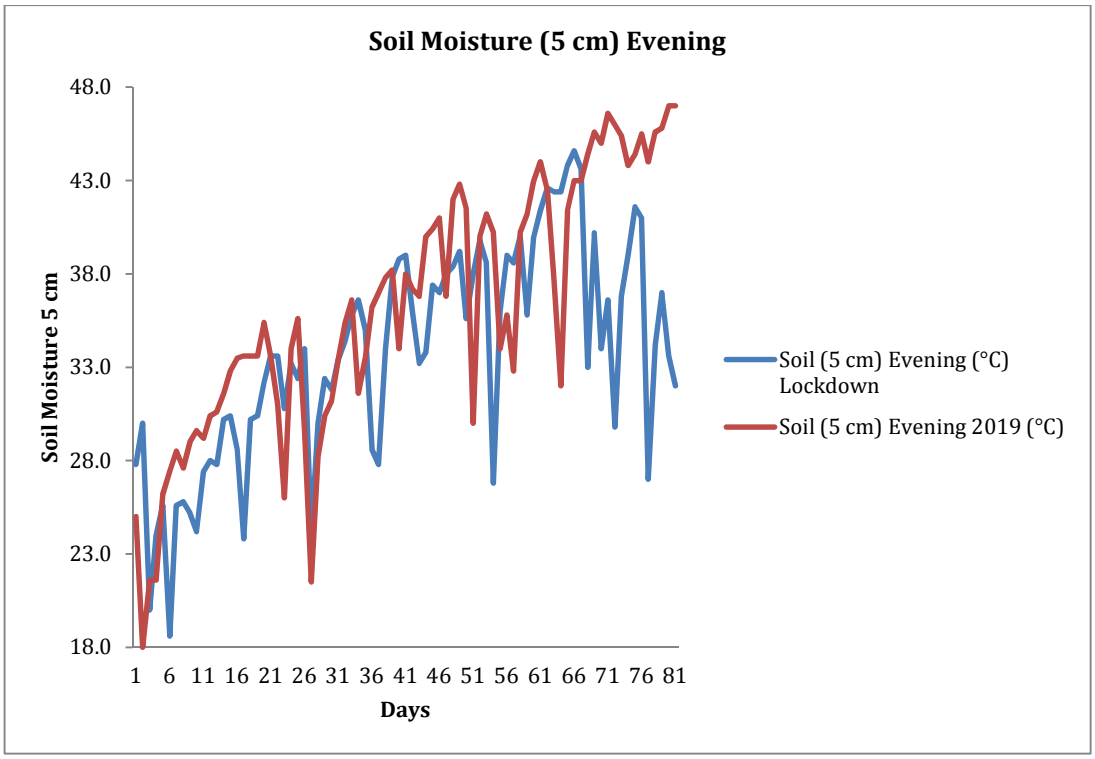

Fig. 6. Effect of lockdown on soil temperature at 5 cm in evening with normal

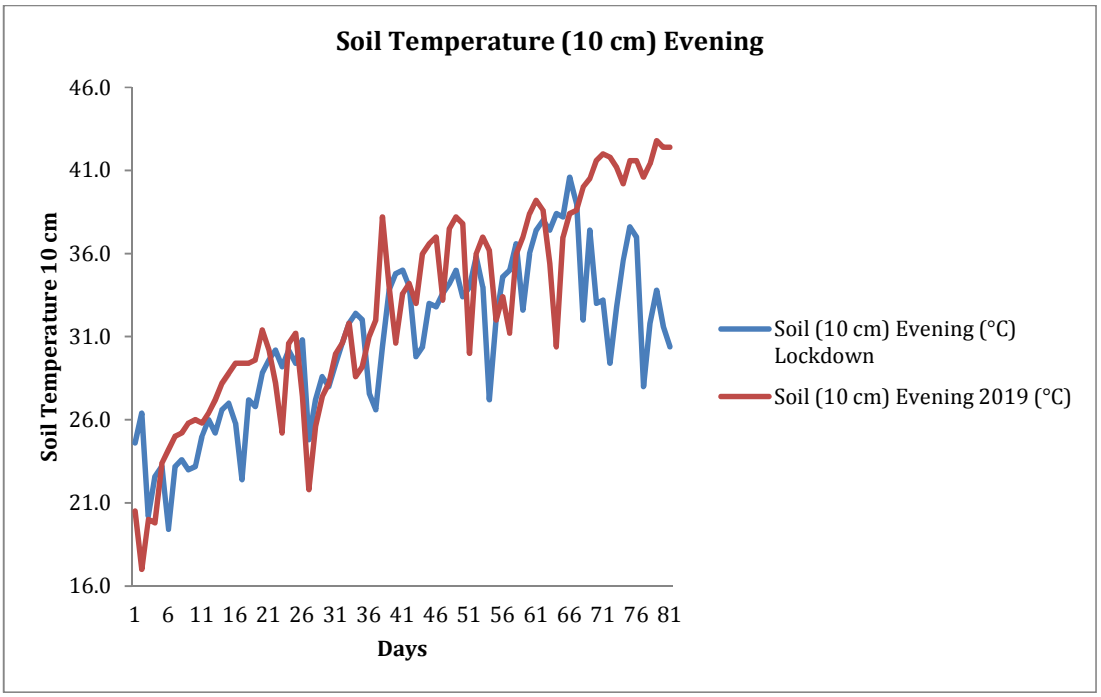

Fig. 7. Effect of lockdown on soil temperature at 10 cm in evening with normal

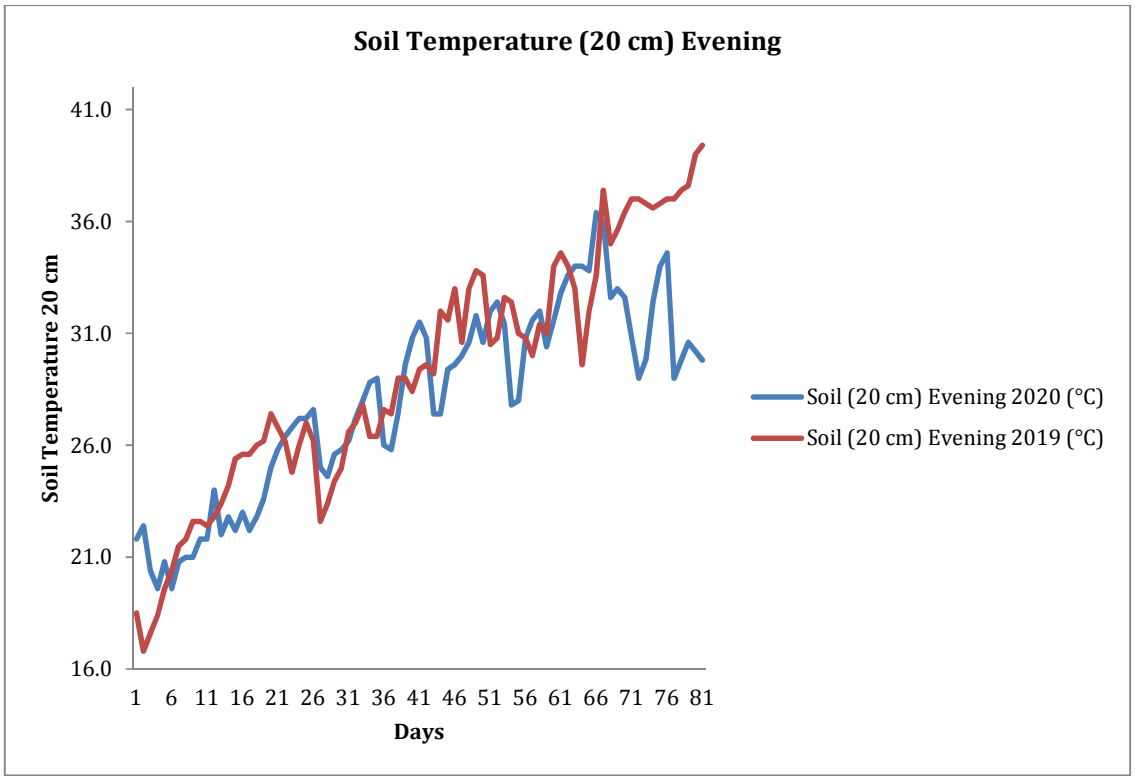

Fig. 8. Effect of lockdown on soil temperature at 20 cm in evening with normal

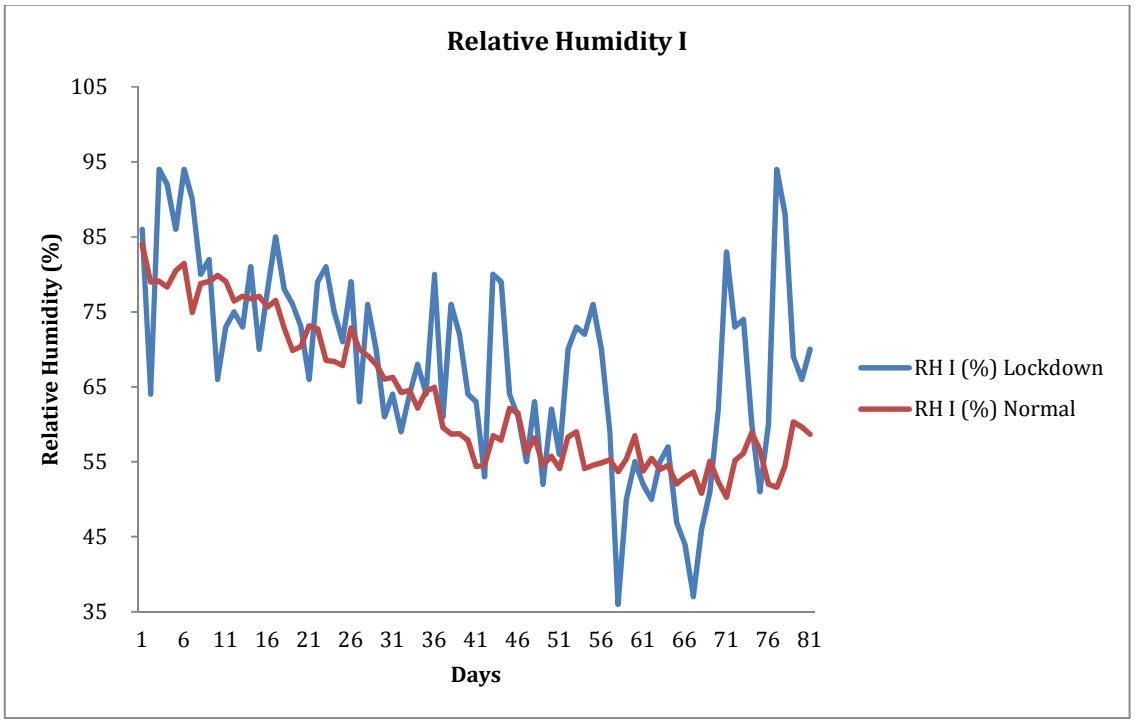

Fig. 9. Effect of lockdown on relative humidity, morning (%) with normal

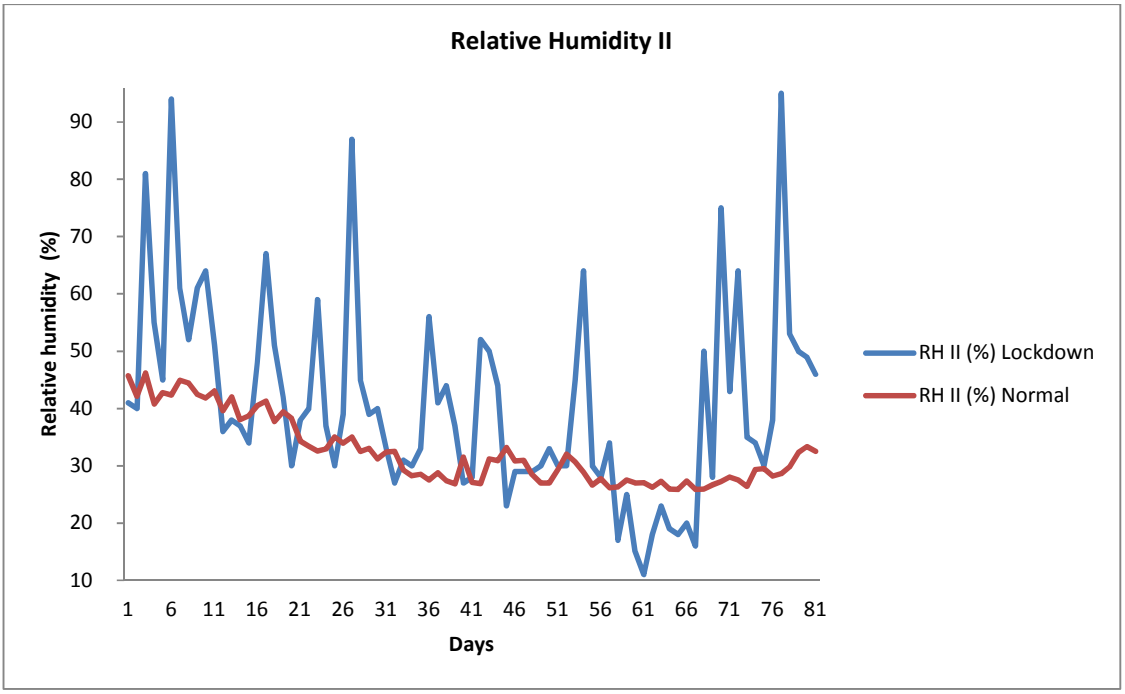

Fig. 10. Effect of lockdown on relative humidity evening (%) with normal

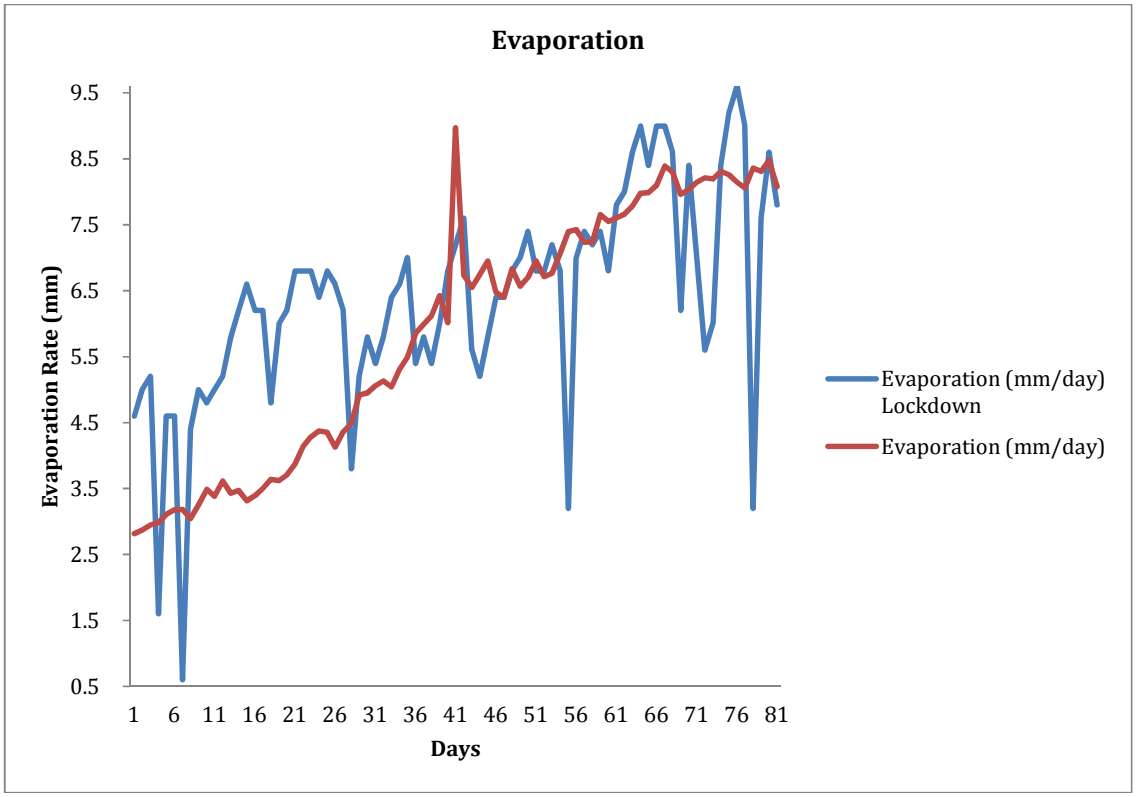

Fig. 11. Effect of lockdown on evaporation (mm) with normal

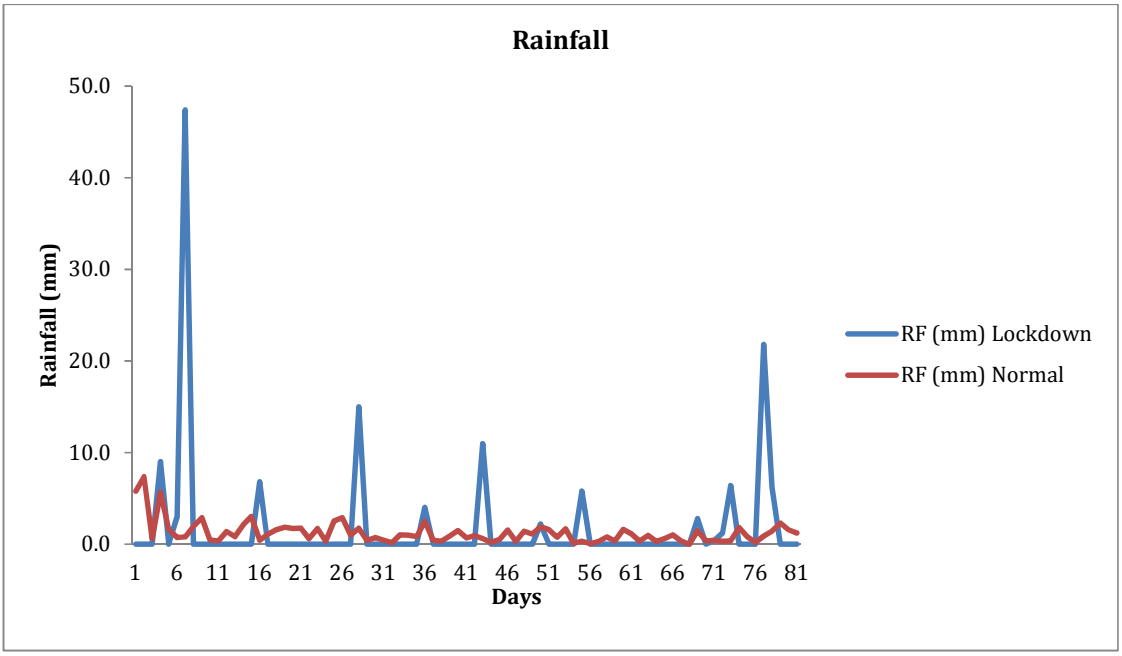

Fig. 12. Effect of lockdown on rainfall (mm) variation with normal

3.1.2 Effect on soil temperature at 5, 10, 15 cm depth (Morning and Evening), comparison with Year 2019 data of same timeline i.e from 22nd March to 10th June

Soil temperature at 5 cm depth in morning was seen distinct from normal data (Table 3). Comparatively a significant pattern was observed in lowering the soil temperature values as time moved from complete lockdown to unlock down 1.0 (Fig. 3). In 1st fortnight observation, lowest and highest values were 15.6°C and 19.8°C and in 2019 the lowest and highest values observed were 14.0°C and 21.8°C. So, soil temperature at 5 cm depth was 1.13% more than year 2019 in 1st fortnight analysis. The standard deviation calculated was 1.13 in lockdown and 2.40 in 2019. The 2nd fortnight observation of lockdown period depicted lowest and highest values of 17°C and 24.2°C and in 2019, the lowest and highest values observed were 14.0°C and 21.8°C thereby expressing -2.89% change from mean value of 2019. The standard deviation calculated was 1.82 in lockdown and 1.31 in 2019 data. Again, in 3rd fortnight observation of lockdown, lowest and highest values were 22.4°C and 27.2°C whereas in 2019 data the lowest and highest values observed were 21.6°C and 26.8°C significantly depicting -0.40% variation from 2019 mean value. The standard deviation calculated was 1.29 in lockdown and 1.26 in 2019. Following data collection in 4th fortnight of lockdown, lowest value was 22.2°C and highest value was 28.4°C whereas in 2019 the lowest and highest values observed were 25°C and 29.40°C illustrating -4.18% significant change from year 2019 mean value. The standard deviation calculated was 1.49 in lockdown and 1.16 in 2019. From 5th fortnight in lockdown and beginning on process of unlock down, lowest and highest values observed were 24.6°C and 30.8°C whereas compared to 2019 the lowest and highest values observed were 25.4°C and 32.6°C depicting significant impact of -8.52% as compared to 2019. The standard deviation calculated was 1.71 in lockdown and 2.03 in 2019. In cumulative analysis of 81 days data; lowest and highest values observed were 15.6°C and 30.8°C in lockdown and 14°C and 32.6°C in 2019. The change in soil temperature at 5 cm depth was still -3.46% from mean value of 2019. The standard deviation calculated was 3.99 in lockdown and 4.82 in 2019.

Soil temperature at 10 cm depth in morning was seen distinct from normal data (Table 4). Comparatively a significant pattern of lowering of the soil temperature was observed as time moved from complete lockdown to unlock down 1.0 (Fig. 4). In 1st fortnight observation of lockdown, lowest and highest values were 16.8°C and 20.4°C and in 2019, the lowest and highest values observed were 15°C and 22.5°C.

So, soil temperature depicted -0.54% variation than mean value of 2019 in 1st fortnight analysis. The standard deviation calculated was 1.09 in lockdown and 2.41 in 2019. The 2nd fortnight observation in lockdown period depicted lowest and highest value of 18.2°C and 25°C and in 2019, the lowest and highest values observed were 20.0°C and 24.4°C thereby expressing -2.77% change from 2019 mean value. The standard deviation calculated was 1.75 in lockdown and 1.29 in 2019 data. Again, in 3rd fortnight observation of lockdown, lowest and highest values noted were 23.2°C and 28.2°C whereas in 2019 data the lowest and highest values observed were 22.2°C and 27.4°C significantly depicting -0.56% variation from 2019 mean value. The standard deviation calculated was 1.34 in lockdown and 1.30 in 2019 data. Following data collection in 4th fortnight of lockdown, lowest value was 23.0°C and highest value was 29.4°C whereas in 2019 the lowest and highest values observed were 26°C and 30.6°C illustrating -4.48% significant change from year 2019 mean value. The standard deviation calculated was 1.48 in lockdown and 1.15 in normal data. From 5th fortnight day in lockdown and beginning on process of unlock down, lowest and highest values were 25.2°C and 32.0°C whereas as compared to 2019 the lowest and highest values observed was 26.4°C and 33.8 °C depicting significant impact of -8.68% from 2019 mean value. The standard deviation calculated was 1.80 in lockdown and 1.97 in normal data. In cumulative analysis of 81 days data; lowest and highest values observed were 16.8°C and 32.0°C in lockdown and 15°C and 33.8°C in 2019. The change in soil temperature at 10 cm depth in morning was -3.84% from 2019 mean value. The standard deviation calculated was 4.02 in lockdown and 4.78 in normal data.

Soil temperature at 20 cm depth in morning was seen distinct from normal data (Table 5). Comparatively a significant pattern was observed in lowering of the soil temperature from complete lockdown to unlock down 1.0 (Fig. 5). During 1st fortnight observation of lockdown, lowest and highest values observed were 18°C and 21.8°C and in 2019, the lowest and highest values observed were 17.0°C and 23.8°C. So, soil temperature depicted -3.31% variation from 2019 during 1st fortnight analysis. The standard deviation calculated was 1.18 in lockdown and 2.26 in 2019 data. The 2nd fortnight observation of lockdown period depicted lowest and highest values of 19.6°C and 25.4°C and in case of 2019 data, lowest and highest values observed were 21.2°C and 25.6°C thereby expressing -4.69% change from 2019 data in mean value. The standard deviation calculated was 1.65 in lockdown and 1.24 in 2019 data. Again, in 3rd fortnight observation of lockdown, lowest and highest values noted were 24.2°C and 29°C whereas in 2019 the lowest and highest values observed were 19.2°C and 29°C significantly depicting -1.34% variation from 2019. The standard deviation calculated was 1.26 in lockdown and 2.26 in 2019 data. Following data collection in 4th fortnight of lockdown, lowest value observed was 24.8°C and highest value was 30.6°C whereas in 2019 the lowest and highest values observed were 27.6°C and 32.2°C illustrating -5.68% significant change from year 2019 mean value. The standard deviation calculated was 1.30 in lockdown and 1.25 in 2019 data. From 5th fortnight day of lockdown and beginning of process of unlock down, lowest and highest values were 27°C and 33.4°C whereas as compared to 2019 the lowest and highest value observed was 28.2°C and 34.8°C depicting significant impact of -10.43% from 2019 mean value. The standard deviation calculated was 1.74 in lockdown and 1.87 in 2019. In cumulative analysis of 81 days data; lowest and highest values observed were 18°C and 33.4°C in lockdown and 17°C and 34.8°C in 2019. The change in soil temperature at 20 cm depth in morning was -7.23% from 2019 mean value. The standard deviation calculated was 4.10 in lockdown and 4.95 in 2019.

Soil temperature at 5 cm depth in evening was seen distinct from normal data (Table 6). Comparatively a significant pattern was observed in lowering of the soil temperature values as time moved from complete lockdown to unlock down 1.0 (Fig. 6). During 1st fortnight observation in lockdown, lowest and highest values noted were 18.6°C and 30.4°C and in 2019 the lowest and highest values observed were 18.0°C and 33.5°C. So, soil temperature depicted -5.57% variation than 2019 in 1st fortnight analysis. The standard deviation calculated was 3.37 in lockdown and 4.30 in 2019 data. The 2nd fortnight observation of lockdown period depicted lowest and highest value of 23.8°C and 34.4°C and in 2019, the lowest and highest values observed were 21.5°C and 35.6°C thereby expressing -1.18% change from 2019 mean value. The standard deviation calculated was 3.19 in lockdown and 3.84 in 2019. Again, in 3rd fortnight observation of lockdown, lowest and highest values were 27.8°C and 39.0°C whereas in 2019

data the lowest and highest values observed were 31.6°C and 42.0°C significantly depicting -5.27% variation from 2019 mean temperature value. The standard deviation calculated was 3.35 in lockdown and 2.76 in 2019. Following data collection in 4th fortnight of lockdown, lowest value was 26.8°C and highest value was 42.6°C whereas in 2019 the lowest and highest values observed were 30.0°C and 44.0°C illustrating -0.46% significant change from year 2019 mean value. The standard deviation calculated was 3.84 in lockdown and 4.40 in 2019. From 5th fortnight of lockdown and beginning of process of unlock down, lowest and highest values were 27.0°C and 33.4°C whereas compared to 2019 the lowest and highest value observed was 28.2°C and 34.8°C depicting significant impact of -10.43% from 2019 mean value. The standard deviation calculated was 1.74 in lockdown and 1.87 in 2019. In cumulative analysis of 81 days data; lowest and highest values observed were 18.6°C and 44.6°C in lockdown and 18.0°C and 44.7°C in 2019. The change in soil temperature at 5 cm depth in evening was -7.69% from 2019 mean value. The standard deviation calculated was 5.84 in lockdown and 6.94 in 2019.

Soil temperature at 10 cm depth in evening was seen distinct from normal data (Table 7). Comparatively a significant pattern was observed in lowering of the soil temperature values as time moved from complete lockdown to unlock down 1.0 (Fig. 7). During 1st fortnight observation of lockdown, lowest and highest values noted were 19.4°C and 27.0°C and 2019 the lowest and highest values observed were 17.0°C and 29.4°C. So, soil temperature illustrated -1.99% change over mean value of 2019 in 1st fortnight analysis. The standard deviation calculated was 2.19 in lockdown and 3.55 in 2019. The 2nd fortnight observation of lockdown period depicted lowest and highest value of 22.4°C and 30.8°C and in 2019, the lowest and highest values observed were 21.8°C and 31.4°C thereby expressing -0.63% change from 2019 mean value. The standard deviation calculated was 2.25 in lockdown and 2.57 in 2019. Again, in 3rd fortnight observation of lockdown, lowest and highest values were 26.6°C and 35.0 °C whereas in 2019 data the lowest and highest values observed were 28.6°C and 38.2°C significantly depicting -4.74% variation from 2019 mean temperature value. The standard deviation calculated was 2.47 in lockdown and 2.94 in 2019. Following data collection in 4th fortnight of lockdown, lowest value was 27.2°C and highest value was 38.4°C whereas in 2019 the lowest and highest values observed were 30°C and 39.2°C illustrating -1.69% significant change from year 2019 mean value. The standard deviation calculated was 2.78 in lockdown and 3.07 in 2019. From 5th fortnight of lockdown and beginning of process of unlock down, lowest and highest values were 28°C and 40.6°C whereas as compared to 2019 the lowest and highest value observed was 37°C and 42.8°C depicting significant impact of -19.38% from 2019 mean value. The standard deviation calculated was 3.62 in lockdown and 1.58 in 2019. In cumulative analysis of 81 days data; lowest and highest values observed were 19.4°C and 40.6°C in lockdown and 17°C and 42.8°C in 2019. The change in soil temperature at 10 cm depth in evening was still -6.31% from 2019 mean value. The standard deviation calculated was 6.94 in lockdown and 4.83 in 2019.

Soil temperature at 20 cm depth in evening was seen distinct from normal data (Table 8). Comparatively a significant pattern was observed in lowering of the soil temperature values as time moved from complete lockdown to unlock down 1.0 (Fig. 8). During 1st fortnight observation in lockdown, lowest and highest values observed were 19.6°C and 24.0°C and in 2019 data the lowest and highest value observed were 16.8°C and 25.6°C. So, soil temperature was 0.37% more than 2019 in 1st fortnight analysis. The standard deviation calculated was 1.21 in lockdown and 2.69 in 2019. The 2nd fortnight observation in lockdown period depicted lowest and highest value of 22.2°C and 27.6°C and in 2019, the lowest and highest values observed were 22.6°C and 27.4°C thereby expressing -0.54% change from 2019 mean value. The standard deviation calculated was 1.62 in lockdown and 1.34 in 2019. Again, in 3rd fortnight observation in lockdown, lowest and highest values were 25.8°C and 31.5°C whereas in 2019, the lowest and highest value observed were 26.4°C and 33°C significantly depicting -0.54% variation from 2019 mean temperature value. The standard deviation calculated was 1.73 in lockdown and 2.13 in 2019 data. Following data collection during 4th fortnight of lockdown, lowest value was 27.8°C and highest value was 34.0°C whereas in 2019 the lowest and highest values observed were 29.6°C and 34.6°C illustrating -1.64% significant change from year 2019 mean value. The standard deviation calculated was 1.80 in lockdown and 1.62 in 2019. From 5th fortnight day of lockdown and beginning of process of unlock down, lowest and highest value were 29°C and 36.4°C

whereas as compared to 2019 the lowest and highest value observed was 32.0°C and 39.4°C depicting significant impact of -14.17% from 2019 mean value. The standard deviation calculated was 2.38 in lockdown and 1.77 in 2019. In cumulative analysis of 81 days data; lowest and highest values observed were 19.6°C and 36.4°C in lockdown and 16.8°C and 39.4°C in 2019. The change in soil temperature at 20 cm depth in evening was still -4.14% from 2019 mean value. The standard deviation calculated was 4.32 in lockdown and 5.59 in 2019.

Soil temperature is a major parameter affecting crop germination and growth and is directly correlated with the air temperature. In study it has been analyzed that lockdown has consistently dropped the air temperature values thereby significantly reducing the soil temperature values at varying depths [12] and highly significant impact has been noticed at the end of lockdown Also soil temperature in deeper layers is less variable [13] and therefore a significant trend has been observed in soil temperature at 20 cm depth.

3.2 Variation in Moisture

3.2.1 Effect on relative humidity (%) morning and evening

Relative Humidity (RH) values were seen distinct from normal data (Table 9). Comparatively a significant pattern was observed in RH values as time moved from complete lockdown to unlock down 1.0 (Fig. 9). During 1st fortnight observation in lockdown, lowest and highest values were 64% and 94% and in case of normal data the lowest and highest values observed were 74.91% and 84.05%. So, the significant impact of lockdown was observed in 1st fortnight as humidity was 2.09% more than normal mean value. The standard deviation calculated was 9.63 in lockdown and 2.29 in normal. The 2nd fortnight observation in lockdown period depicted lowest and highest value of 59% and 85% and in normal, the lowest and highest values observed were 64.27% and 76.50% thereby expressing 3.39% more RH than normal mean value. The standard deviation calculated was 7.75 in lockdown and 3.18 in normal. Again, in 3rd fortnight observation in lockdown, lowest and highest values observed were 54.36% and 64.95% whereas in normal data the lowest and highest values observed were 36% and 76% depicting 18.25% significant change from normal mean RH value. The standard deviation calculated was 3.35 in lockdown and 13.01 in normal. Following data collection in 4th fortnight of lockdown, lowest value was 36% and highest value was 76% whereas in normal data the lowest and highest values observed were 53.68% and 59% illustrating 6.26% more RH from normal mean value. The standard deviation calculated was 10.77 in lockdown and 1.72 in normal data. From 5th fortnight of lockdown and beginning of process of unlock down, lowest and highest values were 37% and 94% whereas as compared to normal data the lowest and highest values observed were 50.27% and 60.32% depicting significant impact of 13.45% from normal mean value. The standard deviation calculated was 16.18 in lockdown and 3.20 in normal data. In cumulative analysis of 81 days data, lowest and highest values observed were 36% and 94% in lockdown and 50.27% and 84.05% in case of normal data. The change in RH pattern was 6.94% from normal mean value. The standard deviation calculated was 16.18 in lockdown and 3.20 in normal data.

RH Evening values were seen distinct from normal data (Table 10). Comparatively a significant pattern was observed in RH values as it moved from complete lockdown to unlock down 1.0 (Fig. 10). During 1st fortnight observation of lockdown, lowest and highest values were 34% and 94% and in case of normal data the lowest and highest values observed were 38.05% and 46.18%. So, the significant impact of lockdown was observed in 1st fortnight as humidity was 19.37% more than normal mean value. The standard deviation calculated was 16.83 in lockdown and 2.35 in normal. The 2nd fortnight observation in lockdown period depicted lowest and highest value of 27% and 87% and in case of normal data, the lowest and highest values observed were 31.23% and 41.32% thereby expressing 21.04% more RH in evening than normal mean value. The standard deviation calculated was 15.55 in lockdown and 2.92 in normal. Again, in 3rd fortnight observation in lockdown, lowest and highest values noted were 26.82% and 33.23% whereas in normal data the lowest and highest value observed were 12% and 44% depicting 30.51% significant change from normal mean RH evening value. The standard deviation calculated was 1.96 in lockdown and 7.91 in normal. Following data collection in 4th fortnight day in lockdown, lowest value was 11% and highest value was 64% whereas in normal the lowest and highest value observed were 25.95% and 32.05% illustrating 1.98% more RH from normal mean value. The

standard deviation calculated was 12.79 in lockdown and 1.72 in normal data. From 5th fortnight of lockdown and beginning of process of unlock down, lowest and highest value were 16% and 95% whereas as compared to normal data the minimum and maximum values observed were 25.91% and 33.36% depicting significant impact of 34.80% from normal mean value. The standard deviation calculated was 20.69 in lockdown and 2.37 in normal. In cumulative analysis of 81 days data, lowest and highest values observed were 11% and 95% in lockdown and 25.91% and 46.18% in case of normal data. The change in RH evening pattern was 20.90% from normal mean value. The standard deviation calculated was 5.92 in lockdown and 13.88 in normal data.

As its proven already, RH value increases with increase in temperature, however in the lockdown study it is noticed that RH values in lockdown were near normal mean value in beginning of lockdown and tends to increase in later stages of lockdown with decrease in temperature and might be correlated to the fact that due to saturation of water vapor content in air, the air became cold and temperature dropped and air didn't require much water as warm air, thereby increasing relative humidity [14]. Also, the increase in relative humidity in turn results in the increase in the transport of tropospheric water vapor thereby increasing precipitation lowering temperature values too [10].

3.2.2 Evaporation rate

Evaporation rate was seen distinct from normal data (Table 11). Comparatively a significant pattern was observed in evaporation rate values as time moved from complete lockdown to unlock down 1.0 (Fig. 11). During 1st fortnight observation of lockdown, lowest and highest values were 0.6 mm and 6.6 mm and in case of normal data the lowest and highest value observed were 2.82 mm and 3.62 mm. So, the significant impact of lockdown was observed in 1-16 days as rainfall was 31.63% more than normal mean value. The standard deviation calculated was 1.56 in lockdown and 0.24 in normal data. The 2nd fortnight observation of lockdown period depicted lowest and highest value of 3.8 mm and 6.8 mm and in normal data, the lowest and highest values observed were 3.5 mm and 5.13 mm thereby expressing 28.42% more evaporation than normal mean value. The standard deviation calculated was 0.84 in lockdown and 0.53 in normal. Again, in 3rd fortnight observation in lockdown, lowest and highest values were 5.2 mm and 7.6 mm whereas in normal the lowest and highest values observed were 5.04 mm and 8.97 mm depicting -1.43% evaporation from normal mean value. The standard deviation calculated was 0.71 in lockdown and 0.89 in normal. Following data collection in 4th fortnight of lockdown, lowest value was 3.20 mm and highest value was 9.00 mm whereas in normal the lowest and highest value observed were 6.57 mm and 7.98 illustrating -1.67% evaporation from normal mean value. The standard deviation calculated was 1.24 in lockdown and 0.43 in normal. From 5th fortnight of lockdown and beginning of process of unlock down, lowest and highest values were 3.2 mm and 9.6 mm whereas compared to normal data the lowest and highest values observed was 7.96 mm and 8.48 mm depicting significant impact of -5.81% from normal mean value. The standard deviation calculated was 1.66 in lockdown and 0.15 in normal. In cumulative analysis of 81 days data, lowest and highest values observed were 0.6 mm and 9.6 mm in lockdown and 2.82 mm and 8.97 mm in case of normal. The change in evaporation pattern was 7.66% from normal mean value. The standard deviation calculated was 1.62 in lockdown and 1.94 in normal data.

Illustrating a significant change in overall evaporation rate in lockdown i.e. 7.66% more than normal mean value may be referred to negative correlation among rainfall and humidity. Since the saturation with water vapor in air which increases with increased surface temperature, it is expected that the rate of evaporation from the Earth's surface also increases [10], however with further extension in lockdown the decrease in temperature has led to the decrease in the evaporation rate.

3.2.3 Rainfall

Rainfall values were seen distinct from normal data (Table 12). Comparatively a significant pattern was observed in Rainfall values as timeline moved from complete lockdown to unlock down 1.0 (Fig. 12). During 1st fortnight observation of lockdown, lowest and highest values were 0.0 mm and 47.4 mm and in case of normal data the lowest and highest values observed were 0.35 mm and 7.38 mm. So, the significant impact of lockdown was observed in 1st fortnight as rainfall was 45.56% more than normal in mean value. The standard deviation

calculated was 11.86 in lockdown and 2.19 in normal. The 2nd fortnight observation in lockdown period depicted lowest and highest value of 0.0 mm and 15 mm and in case of normal data, the lowest and highest values observed were 0.17 mm and 18.18 mm thereby expressing -36.17% less than normal data mean value. The standard deviation calculated was 3.75 in lockdown and 0.81 in normal. Again, in 3rd fortnight observation in lockdown, lowest and highest values were 0.0 mm and 11 mm whereas in normal data the lowest and highest values observed were 0.19 mm and 2.51 mm depicting 3.00% change from normal mean rainfall value. The standard deviation calculated was 2.86 in lockdown and 0.6 in normal. Following data collection in 4th fortnight in lockdown, lowest value noted was 0.0 mm and highest value was 5.80 mm whereas in normal data the lowest and highest values observed were 0.07 mm and 1.90 illustrating 60.52% more rainfall from normal mean value. The standard deviation calculated was 1.52 in lockdown and 0.62 in normal data. From 5th fortnight in lockdown and beginning of process of unlock down, lowest and highest values were 0.0 mm and 21.8 mm whereas as compared to normal data the lowest and highest values observed was 0.0 mm and 2.29 mm depicting significant impact of 60.96% from normal mean value. The standard deviation calculated was 5.45 in lockdown and 0.65 in normal data. In cumulative analysis of 81 days data, lowest and highest values observed were 0.0 mm and 47.4 mm in lockdown and 0.0 mm and 7.38 mm in case of normal. The change in rainfall pattern was 30.50% from normal mean value. The standard deviation calculated was 6.22 in lockdown and 1.24 in normal.

In the entire lockdown process, it was observed that nature was trying its best to be near normal and that's why the observance of significant pattern in rainfall can be attributed to slight increase in the rate of evaporation in a sustainable manner resulting in corresponding increase in the rate of precipitation, increasing the strength of the global water cycle effect [10]. However, uneven change in overall rainfall rate in lockdown was 30.50 % greater than normal mean value can be attributed towards settling of values of temperature towards normal due to reduced anthropogenic activities amid lockdown. Also the significant change in lockdown can be correlated with a study in which scientists ran a series of model simulations using a range of CO_2 concentrations and temperature as a result of which the effect on extreme climate events was studied by changing CO_2 concentrations which highlighted a significant deviation in precipitation events in certain regions around the world [15]. So, reduction in emissions due to lockdown can be the main reason why there is precipitation change, affecting the distribution of the water availability in mid hill region of Jammu district.

Along with descriptive statistics, Pearson's correlation coefficient was analyzed in order to find any impact of one weather parameter over another in fortnightly interval (Tables 13, 14, 15, 16 and 17).

4. CONCLUSION

In this changing world, where industrialization and urbanization is gaining importance, the rising emissions trend and climate change is on peak. In such grim situation, lockdown has emerged as a significant solution of control and management to tackle negative impact of anthropogenic activities. In almost all parameters, significant change due to lockdown were observed; however it's not possible to implement complete lockdown but following the phased, selective or stepwise lockdown techniques can lead to greater reduction in emissions trend. As we are observing the varying pattern in crop yields and weather in routine due to anthropogenic increase in percentage of GHG gases in air causing climate change; lockdown in phases amid COVID-19 pandemic has resulted in micro-climate change reflecting significant improvisation of day and night temperature, soil temperature at varying depths, relative humidity, rainfall and evaporation rate in mid hill regions of Jammu thereby indicating lockdown as an effective and promising technique to mitigate the pace of climate change.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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