The young crop is intercultivated using D4 Caterpillar with cutters or pan breakers. This operation vertically cuts the soil to 12" — 15" depth. Field irrigation channels 1' wide by 9" deep, are then laid 35 ft. apart in criss-cross direction along and across the row. Irrigation water is let into the field channels by stages and filled to brim. After 6 to 12 hours, the water from these channels seeps out through the vertical cuts made between the two rows of cane and by capillarity, rise to surface and brings the soil to near field capacity. By this method of irrigation the open structure of soil and the soil pore space remain least disturbed atleast for two consecutive irrigations. The quantity of water utilised per irrigation is roughly ¾ to 1 acre inch.

This irrigation technique combined with surface trash mulch to soil is very helpful to overcome drought. The little available water could be spread over 3 to 5 times the area as compared to normal furrow irrigation. In saline soils, there is greater tendency for salts to concentrate near the surface. This is mitigated by trash mulching. These salts could be easily flushed out with the first irrigation when canals reopen by June or as soon as normal supply of water becomes available. Operational techniques to substitute manual labour for tractor power are under investigation.

REFERENCE

Renfro, G. M. 1958 Applying water under surface of the ground. *The Australian Irrigator* 3 : 11.

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Meteorological Factors Influencing Soil Temperature at Coimbatore

by

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Introduction : With a view to study the fluctuations of soil temperature, particularly under rain-fed conditions, soil thermographs were installed at the Central Agricultural Meteorological Observatory, in field No. 61, Central Farm, Coimbatore in 1951 and data on the soil temperature at depths of 3", 6" and 12" are being collected since then. The soil in the observatory is of a red-brown sandy loam type, with calcareous substrata, even at 18" depth and moderately

alkaline. The purpose of the present preliminary study is to see how far the meteorological elements like rainfall, maximum temperature, mean air temperature, duration of bright sunshine and relative humidity affect the soil temperatures at different depths. The tentative inferences drawn are presented in this paper.

Materials and Methods: The weekly charts of the soil thermographs for a period of ten years from 1951 to 1960 were criticially examined and the data on soil temperature at intervals of two hours were compiled. For this study the data representing the noon readings have been made use of.

The daily data on maximum temperature, mean air temperature, average relative humidity, rainfall and duration of bright sunshine were also compiled and used.

Methods: The daily data were compiled on standard week basis. Dividing the year into four main periods, namely, Dry Weather Period (January and February), Hot Weather Period (March to May), South West Monsoon Period (June to September) and North East Monsoon Period (October to December), the fifty-two standard weeks were also correspondingly apportioned as 1 to 9, 10 to 22, 23 to 39 and 40 to 52 for these four periods. In regard to rainfall and number of rainy days, a day with ten cents of rain and above was considered as a rainy day.

Results: (i) The data presented in Table I represent the nature of inter-depth correlations in the different periods of the year and also in the year as a whole. Of the three depths of 3″, 6″ and 12″ considered, positive significant correlations exist between the soil temperatures at 3″ and 6″ depths and 3″ and 12″ depths. But, between 6″ and 12″ depths there is no inter-depth correlation in all the seasons and also in the year as a whole. This indicates that the soil temperatures at 6″ and 12″ depths are affected positively by the temperature prevailing at 3″ depth in all seasons throughout the year. The temperature at 12″ depth is not influenced significantly by that prevailing at 6″ depth, as the temperature at 12″ depth is fairly steady throughout the year and the fluctuations at 6″ depth are lesser than at 3″ depth. Further, the correlations between soil temperature at 3″ and 12″ depths are more highly significant, at $P = 0{\cdot}01$ and $0{\cdot}001$ levels, than those prevailing between 3″ and 6″ depths.

(ii) Tabular statement II contains the details of the inter-seasonal correlations of noon soil temperatures at the depths of 3", 6" and 12". The inter-seasonal correlations are highly significant with the solitary exception of the Dry Weather Period and North East monsoon period combination, at the depths of 3" and 6". Even in this combination the correlation is significant at P = 0·1 at 12" depth. The inference is that the seasonal fluctuations in the noon soil temperatures at the depths of 3", 6" and 12" are fairly rhythmic in nature, the high or low noon soil temperature at 3" depth in the different seasons indicating a similar nature of noon soil temperature at the deeper depths of 6" and 12".

(iii) A critical study of the data presented in Table III will reveal the following inferences :—

(a) *Maximum Temperature :* The annual mean maximum temperature influences considerably at the level of P = 0·05 the noon soil temperature at 12" depth. The mean maximum temperature in the South West Monsoon Period mildly influences the soil temperature at 3" depth at the level of P = 0·1. The soil temperature at 6" depth seems to be unaffected by the fluctuations in the maximum temperature in the different seasons in the year.

(b) *Mean Air Temperature :* The mean air temperature in the different seasons of the year and year as a whole, has practically no effect on the noon soil temperature at 3" and 6" depths. Only in the South West Monsoon Period it slightly influences the soil temperature at 12" depth at the level of P = 0·1.

(c) *Average Relative Humidity :* The noon soil temperature at 6" depth appears to be unaffected by the changes in the average relative humidity. The noon soil temperature at 3" depth is mildly infiuenced negatively by the average relative humidity, at P = 0·1, in the North East Monsoon Period. The morning relative humidity has negative correlations with the noon soil temperature at 12" depth, practically throughout the year, with exception of the Dry-Weather Period of January any February, but only at P = 0·1, the level of influence being P = 0·05 in the North East Monsoon Period.

(d) *Total Rainfall :* The noon soil temperatures at 3" and 12" depths seem to be affected by the total rainfall, only during the South West Monsoon Period, at P = 0·05 and 0·01 levels respectively. During the other seasons the effect of rainfall on soil temperature at noon is not perceptible. At 6" depth the noon soil temperature appears to be unaffected by the nature of rainfall in the different seasons in the year and also year as a whole.

(e) *Total number of rainy days:* More than the total rainfall, its distribution throughout the year, with the exception of the Dry Weather Period of January and February, fairly influences negatively, the noon soil temperature at 3" and 12" depths, particularly the latter. The noon soil temperature at 6" depth does not seem to be influenced by the nature of distribution of rains.

(f) *Duration of bright sunshine:* The noon soil temperatures at 3" and 12" depths are not affected by the duration of bright sunshine in the different seasons. Only at 6" depth it affects the noon soil temperature in the South West Monsoon Period and year as a whole, respectively at the levels of $P = 0{\cdot}05$ and $P = 0{\cdot}01$.

Summary and Conclusion: (i) The soil temperature at noon is practically steady at 12" depth, while the fluctuation at 6" depth is only very little, throughout the year.

(ii) There seems to be some rhythm in the seasonal fluctuations of noon soil temperatures at the depths of 6" and 12".

(iii) Out of the various meteorological factors considered, only the number of rainy days affect the noon soil temperatures at 3" and 12" depths in all the seasons, except the Dry Weather Period of January and February, while the total rainfall affects them only during the South West Monsoon Period. The maximum temperature, mean air temperature and relative humidity influence the noon soil temperatures at 3" and 12" depths in varying degrees. The temperature at 6" depth seems to be influenced only by the duration of bright sunshine during the year as a whole and during the South West Monsoon Period. It seems to be unaffected by other meteorological factors.

(iv) The noon soil temperature at 12" depth seems to be more influenced by the meteorological conditions than that at 3" depth. This finding is of great agricultural importance in understanding the Crop Weather relationship.

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TABLE I.

Inter-depth Correlations in different Periods.

S. No.	Details of the period	Between 3" and 6"			Between 3" and 12"			Between 6" and 12"			Remarks
		A	B	C	A	B	C	A	B	C	
1.	Dry Weather Period (January & February) ...	+ 0·69	0·26	Y2	+ 0·88	0·17	Y4	+ 0·48	0·31	N	A = Correlation coefficient B = Standard Error (S. E.)
2.	Hot Weather Period (March to May) ...	+ 0·69	0·25	Y2	+ 0·82	0·20	Y3	+ 0·44	0·32	N	C = Nature of significance Y = Significant
3.	South West Monsoon Period (June to September) ...	+ 0·63	0·28	Y2	+ 0·87	0·18	Y4	+ 0·33	0·33	N	N = Not significant
4.	North East Monsoon Period (October to December) ...	+ 0·60	0·28	Y1	+ 0·88	0·17	Y4	+ 0·26	0·34	N	1 — P = 0·1 2 — P = 0·05 3 — P = 0·01
5.	Annual ...	+ 0·64	0·27	Y2	+ 0·83	0·20	Y3	+ 0·23	0·34	N	4 — P = 0·001

N. B: Figures are given correct to two decimal places.

TABLE II.

Inter-seasonal Correlations of Noon Soil Temperatures in Different Depths.

S. No.	Correlations between	3″ depth			6″ depth			12″ depth			Remarks
		A	B	C	A	B	C	A	B	C	
1.	Dry Weather Period and Hot Weather Period ...	+ 0·82	0·20	Y4	+ 0·88	0·17	Y5	+ 0·87	0·17	Y5	A = Correlation coefficient (r)
2.	Dry Weather Period and South West Monsoon Period ...	+ 0·74	0·24	Y3	+ 0·65	0·27	Y2	+ 0·65	0·27	Y2	B = Standard Error (S. E.)
3.	Dry Weather Period and North East Monsoon Period ...	+ 0·48	0·31	N	+ 0·55	0·30	N	+ 0·59	0·29	Y1	C = Nature of significance
4.	Dry Weather Period and Annual ...	+ 0·84	0·19	Y4	+ 0·80	0·21	Y4	+ 0·83	0·20	Y4	N = Not significant
5.	Hot Weather Period and South West Monsoon Period ...	+ 0·77	0·22	Y4	+ 0·86	0·18	Y4	+ 0·79	0·22	Y4	Y — Significant 1 — P = 0·1 2 — P = 0·05 3 — P = 0·02 4 — P = 0·01 5 — P = 0·001
6.	Hot Weather Period and North East Monsoon Period ...	+ 0·72	0·25	Y4	+ 0·78	0·22	Y4	+ 0·70	0·25	Y2	
7.	Hot Weather Period and Annual ...	+ 0·89	0·16	Y5	+ 0·95	0·11	Y5	+ 0·92	0·14	Y5	
8.	South West Monsoon Period and North East Monsoon Period ...	+ 0·91	0·15	Y5	+ 0·97	0·08	Y5	+ 0·96	0·10	Y5	
9.	South West Monsoon Period and Annual ...	+ 0·96	0·10	Y5	+ 0·97	0·09	Y5	+ 0·92	0·14	Y5	
10.	North East Monsoon Period and Annual ...	+ 0·65	0·27	Y2	+ 0·93	0·13	Y5	+ 0·86	0·18	Y4	

TABLE III.

Meteorological factors influencing soil temperature at depths

S. No.	Meteorological Factor	Details of the period	3″ depth A	3″ depth B	3″ depth C	6″ depth A	6″ depth B	6″ depth C	12″ depth A	12″ depth B	12″ depth C
1.	Maximum temperature	D	−0.38	0.33	N	−0.29	0.34	N	−0.48	0.31	N
		E	+0.36	0.33	N	−0.19	0.35	N	+0.53	0.30	N
		F	+0.56	0.29	Y1	−0.31	0.34	N	+0.44	0.32	N
		G	+0.22	0.34	N	−0.34	0.33	N	+0.52	0.30	N
		H	+0.31	0.34	N	−0.45	0.31	N	+0.66	0.26	Y2
2.	Mean Air temperature	D	−0.02	0.35	N	−0.11	0.35	N	−0.16	0.35	N
		E	+0.39	0.33	N	−0.29	0.34	N	−0.49	0.31	N
		F	+0.37	0.33	N	−0.20	0.35	N	+0.57	0.29	Y1
		G	−0.42	0.32	N	−0.42	0.32	N	−0.24	0.34	N
		H	+0.10	0.35	N	−0.49	0.31	N	+0.29	0.34	N
3.	Average Relative Humidity	D	+0.21	0.35	N	+0.50	0.31	N	+0.25	0.34	N
		E	−0.32	0.34	N	+0.05	0.35	N	−0.58	0.29	Y1
		F	−0.26	0.34	N	+0.17	0.35	N	−0.56	0.29	Y1
		G	−0.57	0.29	Y1	+0.06	0.35	N	−0.70	0.25	Y2
		H	−0.12	0.35	N	+0.43	0.32	N	−0.58	0.29	Y1
4.	Total Rainfall	D	−0.15	0.35	N	+0.20	0.35	N	+0.03	0.35	N
		E	−0.24	0.34	N	−0.29	0.34	N	−0.45	0.32	N
		F	−0.63	0.27	Y2	−0.54	0.30	N	−0.61	0.28	Y1
		G	−0.03	0.35	N	+0.49	0.31	N	−0.12	0.35	N
		H	−0.08	0.35	N	+0.17	0.35	N	−0.42	0.32	N
5.	Total number of Rainy days	D	−0.12	0.35	N	+0.01	0.35	N	+0.23	0.34	N
		E	−0.58	0.29	Y1	−0.41	0.32	N	−0.61	0.28	Y1
		F	−0.62	0.28	Y1	−0.48	0.31	N	−0.68	0.26	Y2
		G	−0.59	0.29	Y1	+0.10	0.35	N	−0.70	0.25	Y2
		H	−0.66	0.27	Y2	−0.35	0.33	N	−0.83	0.20	Y3
6.	Daily duration of bright sun-shine	D	−0.26	0.34	N	−0.08	0.35	N	−0.05	0.35	N
		E	+0.17	0.35	N	−0.16	0.35	N	−0.06	0.35	N
		F	+0.05	0.35	N	−0.66	0.26	Y2	+0.14	0.35	N
		G	+£	0.35	N	−0.54	0.30	N	+0.20	0.35	N
		H	−0.46	0.31	N	−0.90	0.15	Y3	−0.12	0.35	N

Remarks

A = Correlation coefficient (r)

B = Standard Error (S. E.)
C = Nature of significance
N = Not significant
Y = Significant
D = Dry Weather Period (January and February)
E = Hot Weather Period (March to May)
F = South West Monsoon Period (June to September)
G = North East Monsoon Period (October to December)
H = Annual
1 — P=0.1
2 — P=0.05
3 — P=0.01

£ = Actual value is +0.0033