Impact of temperature rise on growing season of wheat crop at selected stations in India

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INTRODUCTION

- Growing degree days (GDD) are used to estimate the growth and development of crop growing season.

- Heat controls the development of many crops. The measure of accumulated heat, and of available energy for crops, is known as physiological time. This is expressed in a unit called Growing Degree Days.

- The basic assumption in this concept is that development will only occur if the air temperature exceeds some minimum developmental threshold or base temperature.

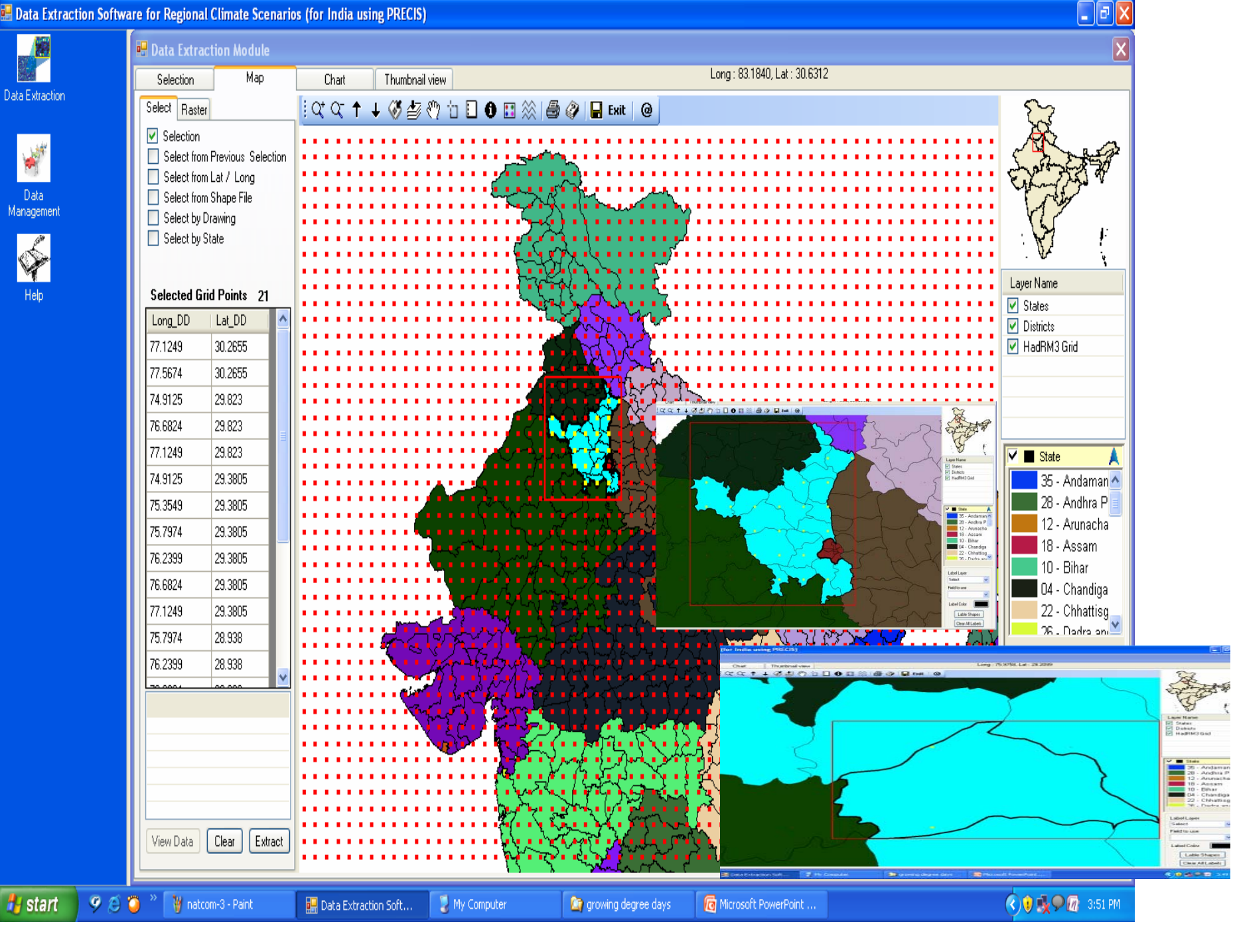
- Growing degree-days or heat unit requirement has often been used for characterizing thermal responses in crops (Shanker *et al*., 1996).

- In India this concept has been applied to various crops like wheat, barley and mustard (Sastry and Chakravarty, 1982, Hundal et al., 1997, Kar and Chakravarty 2000), and was found to be useful as an input in crop growth studies.

Data collection and methodology

- ✓ The PRECIS (RCM) data was used for this study
- ✓ Period 1961-1990 and 2071-2100
- ✓ Computed accumulated heat units for different stages of the wheat crop

$$GDD = \frac{(\text{Daily } \mathbf{Maximum} \text{ Temp.} + \text{Daily } \mathbf{Minimum} \text{ Temp.})}{2} - \mathbf{Base} \text{ Temp.}$$


Data Extraction Software for Regional Climate Scenarios (for India using PRECIS)
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Long_DD
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Date of sowing – 30th October

Heat Units

Year	GERMINATION	CRI	TILLERING	JOINTING	FLAG LEAF	EAR EMERGENCE	ANTHESIS	MILKING STAGE	HARD DOUGH	PHY. MATURITY
1961-1990	76.0	297.8	347.8	630.0	804.2	897.4	969.6	1075.9	1548.2	1744.4
2003-2005	74.2	294	343.8	625.7	797.1	891.2	960.7	1065.4	1537.9	1743.7
2071-2100	76.1	297.8	344.5	624.8	797.0	892.9	959.1	1064.0	1535.5	1743.4

No. of days requirement

Year	GERMINATION	CRI	TILLERING	JOINTING	FLAG LEAF	EAR EMERGENCE	ANTHESIS	MILKING STAGE	HARD DOUGH	PHY. Maturity
1961-1990	6.6	33.9	43.6	93.0	110.8	118.2	123.4	129.7	152.9	161.1
2003-2005	4.5	19.4	23.3	50.4	75.4	88.4	97.7	107.3	142.5	154.5
2071-2100	3.2	16.7	20.0	42.0	57.2	66.5	72.6	82.0	114.4	124.6

Date of sowing – 10th November

Heat Units

Year	GERMI NATION	CRI	TILLERIN G	JOINTING	FLAG LEAF	EAR EMERGENCE	ANTHESIS	MILKING STAGE	HARD DOUGH	PHY. MATURITY
1961-1990	68.5	296.2	334.9	578.4	741.2	851.1	939.5	1042.1	1472.3	1647.0
2003-2005	68.6	296.7	332.8	577.3	739.1	847.7	932.7	1039.2	1468.7	1635.3
2071-2100	72.7	299.5	338.4	574.8	739.9	848.0	936.2	1043.4	1466.5	1651.2

No. of days requirement

Year	GERMI NATION	CRI	TILLERING	JOINTING	FLAG LEAF	EAR EMERGENCE	ANTHESIS	MILKING STAGE	HARD DOUGH	PHY. Maturity
1961-1990	7.1	47.9	55.6	92.6	106.1	114.0	119.2	125.0	145.3	152.3
2003-2005	4.8	22.4	26.0	55.5	81.1	91.7	99.9	107.9	138.7	148.5
2071-2100	4.5	20.8	23.8	44.6	60.5	70.2	77.8	86.1	111.1	119.4

Date of sowing – 20th November

Heat Units

Year	GERMI NATION	CRI	TILLERIN G	JOINTING	FLAG LEAF	EAR EMERGENCE	ANTHESIS	MILKING STAGE	HARD DOUGH	PHY. MATURITY
1961-1990	77.8	270.9	346.6	497.7	573.2	708.3	859.2	1086.3	1316.8	1569.8
2003-2005	71.8	268.1	342.6	493.2	567.1	701.7	851.0	1075.2	1468.7	1559.0
2071-2100	71.5	265.3	345.4	494.0	567.4	704.4	852.1	1070.8	1326.9	1565.4

No. of days requirement

Year	GERMI NATION	CRI	TILLERING	JOINTING	FLAG LEAF	EAR EMERGENCE	ANTHESIS	MILKING STAGE	HARD DOUGH	PHY. Maturity
1961-1990	12.2	51.8	64.4	82.7	89.9	100.7	109.9	121.9	132.4	142.8
2003-2005	6.6	24.3	31.9	55.1	67.7	83.8	97.8	113.4	130.4	140.5
2071-2100	5.3	21.0	28.0	42.4	49.6	62.0	74.3	88.7	102.2	113.0

Conclusions

- Mean temperature rise is noticed during 2071-2100 period when compared to base year (1961 – 1990)
- This temperature rise, reduced the number of days required to attain a particular stage during 2071-2100 period than during 1961 – 1990 period
- The duration for the maturity is faster when the date of sowing is late and vice-versa
- The crop attains physiological maturity in 125 days, 119 days and 113 days for the sowing dates 30th October, 10th November and 20th November respectively during 2071-2100 period
- The crop duration has reduced by 36 days, 33 days and 30 days for the sowing dates 30th October, 10th November and 20th November respectively during 2071-2100 period


Thank you very much for your kind attention