*Journal of Agrometeorology 6 (2) : 274 - 277 (Dec 2004)*

*Short communication*

# Growth of rice varieties in terms of degree days under South Telangana agroclimatic conditions

D. RAJI REDDY, G. SREENIVAS, T. RATNA SUDHAKAR and S.B.S. NARASIMHA RAO

Agricultural Research Institute, Rajendranagar, Hyderabad - 30.

Prediction of phenophases helps in farm operations like fertilizer application, irrigation management and harvesting etc. In recent years predicting crop development under field conditions has gained importance (Angus *et al.*, 1980). The duration of each growth phase determines the accumulation and partitioning of dry matter in different organs (Dalton, 1967) as well as crop response to environmental and external factors. Reaumr was the first to suggest in 1735 that the duration of particular stages of growth was directly related to temperature, and this duration for particular species, could be predicted using the sum of daily air temperatures (Wang, 1960). Growth of rice varieties under Southern Telangana agro-climatic conditions was assessed here in terms of degree days.

Field experiment was conducted at Agricultural Research Institute, Rajendranagar, Hyderabad during *kharif* and *rabi* seasons of 1998 and 1999 to assess the temperature requirement in terms of degree days to attain various growth phases in rice. The experiment was laid out in randomized block design with factorial concept and replicated thrice. Treatments consisted of three dates of plantings with two varieties having different durations (*kharif* - Samba Mahsuri and Tellahamsa and *Rabi*- Tellahamsa and IR - 64) (Table 1).

A uniform package of practices were adopted by leaving only weather as variable. The meteorological data recorded at a class B observatory were employed for summation of air temperatures. Growing degree days (GDD) were computed as follows.

$$GDD = \Sigma \frac{Tmax + Tmin}{2} - Tb$$

where, Tmax = maximum temperature(°C) Tmin = minimum temperature (°C) Tb = base temperature. Base temperature 10°C was taken for calculation of GDD (Thomas, 1957).

Accumulated growing degree days and calander days required to attain various phenophases in rice during experimental period are presented in Table 2. Perusal of data revealed that irrespective of the duration of cultivar, flowering and maturity dates can be predicted in terms of growing degree days as indicated by the least coefficient of variation. Tellahamsa showed

Table 1: Dates of planting of different varieties

| Tellahamsa - *kharif* | Tellahamsa - *rabi* | Samba Mahsuri - *kharif* | IR-64 - *rabi* |
|---|---|---|---|
| $D_1$ - 15.07.98 | $D_1$ - 16.12.98 | $D_1$ - 15.07.98 | $D_1$ - 16.12.98 |
| $D_2$ - 01.08.98 | $D_2$ - 04.01.99 | $D_2$ - 01.08.98 | $D_2$ - 04.01.99 |
| $D_3$ - 22.08.98 | $D_3$ - 23.01.99 | $D_3$ - 22.08.98 | $D_3$ - 23.01.99 |
| $D_4$ - 15.07.99 | $D_4$ - 20.12.99 | $D_4$ - 15.07.99 | $D_4$ - 20.12.99 |
| $D_5$ - 01.08.99 | $D_5$ - 09.01.2000 | $D_5$ - 01.08.99 | $D_5$ - 09.01.2000 |
| $D_6$ - 13.08.99 | $D_6$ - 03.02.2000 | $D_6$ - 13.08.99 | $D_6$ - 03.02.2000 |

wide variation in accumulation of days do attain flowering and maturity from sowing in *kharif* and *rabi* seasons. It attained flowering and maturity by accumulating 1460±110 and 1910±97 growing degree days during *kharif* and 1566 ±83 and 2157±98 in *rabi*, though wide variation is observed in duration ranging from 82 to 99 days for flowering and 113 to 131 days for maturity from sowing during *kharif*, with 106 to 133 days for flowering and 136 to 160 days for maturity from sowing during *rabi* season.

Number of days required for completion of vegetative phase for Tellahamsa varied when crop was planted in different seasons. Late planting in *kharif* and early planting in *rabi* resulted into extended vegetative phase. However the degree days required to attain this phase did not vary much as the confidence interval was 83 and 118 degree days, respectively. The accumulated degree days for vegetative phase were 1074±118 and 1128±83 during *kharif* and *rabi* seasons, respectively, though duration widely varied from 62 to 77 days and 84 to 103 days, respectively.

Samba Mahsuri a long duration variety has accumulated 1898±132 and 2280±186 growing degree days for completion of flowering and physiological maturity, respectively, while duration varied from 115 to124 days for flowering and 144 to 151 days for maturity. Duration for completion of vegetative phase did not vary much and ranged from 87 to 94 days and accumulatede. 1470±167 growing degree days in this phase. The cultivar, IR-64 growing during *rabi* season has shown a decrease in the period of vegetative growth from 108 to 86 days with delayed plantings. Accumulated degree days for vegetative phase were 1163±95 degree days. With delayed planting number of days required for completion of flowering and maturity decreased from 133 to 107 days and 160 to 136 days, respectively and accumulated 1579±90 and 2156±97 growing degree days. Though total duration widely varied within variety, they came to maurity by accumulating certain amount of growing degree days, regardless of the date of

**Table 2** : Accmulated growing degree days (GDD) and calender days (D) required to attain various phenophases in rice

| Palnti | S to PI | | PI to F | | F to M | | PI to M | | S to F | | S to M | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | GDD | D | GDD | D | GDD | D | GDD | D | GDD | D | GDD |
| Tellahamsa - *kharif* | | | | | | | | | | | | |
| D1 | 68 | 1204 | 24 | 392 | 27 | 435 | 51 | 827 | 92 | 1596 | 119 | 2030 |
| D2 | 70 | 1202 | 19 | 309 | 24 | 368 | 43 | 677 | 89 | 1512 | 113 | 1879 |
| D3 | 77 | 969 | 22 | 352 | 32 | 454 | 54 | 807 | 99 | 1322 | 131 | 1776 |
| D4 | 62 | 1049 | 25 | 422 | 28 | 492 | 55 | 914 | 88 | 1471 | 117 | 1963 |
| D5 | 65 | 988 | 25 | 413 | 30 | 494 | 56 | 907 | 82 | 1401 | 121 | 1895 |
| D6 | 63 | 1034 | 24 | 429 | 29 | 459 | 55 | 888 | 88 | 1463 | 118 | 1922 |
| Mean | | 1074 | | 386 | | 450 | | 836 | | 1460 | | 1910 |
| SD | | 103.8 | | 46.9 | | 46.3 | | 89.4 | | 93.6 | | 85.4 |
| CV% | | 9.6 | | 12.1 | | 10.3 | | 10.6 | | 6.4 | | 4.5 |
| CI | | 1074±118 | | 386±53 | | 450±52 | | 836±101 | | 1460±110 | | 1910±97 |
| Tellahamsa - *rabi* | | | | | | | | | | | | |
| D1 | 103 | 1144 | 30 | 487 | 27 | 542 | 57 | 1026 | 133 | 1628 | 160 | 2170 |
| D2 | 96 | 1052 | 25 | 437 | 27 | 538 | 52 | 975 | 121 | 1489 | 148 | 2027 |
| D3 | 93 | 1097 | 24 | 450 | 27 | 602 | 51 | 1052 | 117 | 1547 | 144 | 2149 |
| D4 | 103 | 1220 | 24 | 393 | 30 | 593 | 54 | 986 | 127 | 1614 | 157 | 2206 |
| D5 | 85 | 1054 | 25 | 422 | 31 | 632 | 56 | 1054 | 110 | 1476 | 141 | 2108 |
| D6 | 84 | 1205 | 22 | 441 | 30 | 635 | 52 | 1076 | 106 | 1647 | 136 | 2282 |
| Mean | | 1128 | | 438 | | 590 | | 1028 | | 1566 | | 2157 |
| SD | | 73.3 | | 31.1 | | 42.3 | | 40.3 | | 73.6 | | 86.7 |
| CV% | | 6.5 | | 7.1 | | 7.2 | | 3.9 | | 4.7 | | 4.0 |
| CI | | 1128±83 | | 438±35 | | 590±48 | | 1028±45 | | 1566±83 | | 2157±98 |
| Samba Mahsuri - *kharif* | | | | | | | | | | | | |
| D1 | 93 | 1613 | 26 | 401 | 29 | 424 | 54 | 825 | 118 | 2014 | 147 | 2438 |
| D2 | 89 | 1512 | 26 | 398 | 30 | 424 | 56 | 822 | 115 | 1909 | 145 | 2334 |
| D3 | 90 | 1194 | 34 | 488 | 27 | 306 | 61 | 794 | 124 | 1682 | 151 | 1988 |
| D4 | 94 | 1570 | 23 | 411 | 26 | 417 | 51 | 829 | 118 | 1981 | 145 | 2398 |
| D5 | 87 | 1453 | 28 | 472 | 29 | 391 | 59 | 863 | 116 | 1926 | 151 | 1988 |
| D6 | 89 | 1408 | 25 | 400 | 28 | 326 | 55 | 726 | 115 | 1881 | 144 | 2206 |
| Mean | | 1470 | | 428 | | 381 | | 809 | | 1898 | | 2280 |
| SD | | 147.5 | | 40.6 | | 52.4 | | 37.5 | | 116.7 | | 163.6 |
| CV% | | 10.0 | | 9.5 | | 13.7 | | 4.6 | | 6.5 | | 7.2 |
| CI | | 1470±167 | | 428±46 | | 381±59 | | 809±42 | | 1898±132 | | 2280±186 |
| IR - 64 - *rabi* | | | | | | | | | | | | |
| D1 | 104 | 1158 | 29 | 471 | 27 | 542 | 56 | 1013 | 133 | 1629 | 160 | 2170 |
| D2 | 96 | 1052 | 25 | 437 | 27 | 538 | 52 | 975 | 121 | 1489 | 148 | 2027 |
| D3 | 95 | 1133 | 22 | 414 | 27 | 602 | 49 | 1016 | 117 | 1547 | 144 | 2149 |
| D4 | 107 | 1281 | 22 | 370 | 28 | 556 | 50 | 926 | 129 | 1650 | 157 | 2207 |
| D5 | 89 | 1118 | 22 | 378 | 30 | 613 | 52 | 992 | 111 | 1496 | 141 | 2109 |
| D6 | 86 | 1241 | 21 | 425 | 29 | 612 | 50 | 1037 | 107 | 1667 | 136 | 2279 |
| Mean | | 1163 | | 415 | | 577 | | 993 | | 1579 | | 2158 |
| SD | | 83.9 | | 37.7 | | 35.6 | | 39.2 | | 79.1 | | 85.8 |
| CV% | | 7.2 | | 9.1 | | 6.2 | | 3.9 | | 5.0 | | 3.9 |
| CI | | 1163±95 | | 415±42 | | 577±40 | | 993±44 | | 1579±90 | | 2156±97 |

S = sowing; PI = Paniele initiation, F = 50% flowering M = Maturity,
SD = standard deviation, CI = confidence interval

planting. Similar results were recorded by Yogeswara Rao (1981). It can be concluded that the important phenophases of rice can be assessed by using growing degree days.

## REFERENCES

Angus, J.F., Cunningham, R.B., Moncus, M.W. and Mackenzil, D.H. 1980. Phasic development in field crops I. Thermal response in the seeding phase. *Field Crops Res.*, 3 : 365-378.

Dalton L.G. 1967. A positive response of yield on maturity of Sorghum. *Crop Sci.*, 7:721-726.

Thomas, J.E. 1957. Rice in Spain. *World Crops*, 9:247-250.

Wang, J.Y. 1960. A critic of the heat unit approach to plant response studies. *Ecology*, 41 : 785-790.

Yogeswara Rao, A. 1981. Studies on the effect of sunshine and temperature on yield and yield compontnts of certain popular lowland rice varieties of Coastal Andhra Pradesh, Ph.D. thesis, Andhra University, Waltair.