

SHORT COMMUNICATION

EFFECT OF GROWTH ENVIRONMENTS ON PHYSIOLOGICAL PARAMETERS OF RICE HYBRIDS DURING DRY SEASON

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A field experiment was conducted to find out the effect of two planting dates on nine rice hybrids during dry season of 2001. 15th February planted crop had longer (7.8 days) growth duration but it was superior in terms of LAI, CGR and light interception with the advancement of crop growth than 28th February planting. Average cultivar GDD from sowing to four leaf, flowering and maturity were 188, 1613 and 2174, respectively. Among rice hybrids, KRH 2 appeared as most promising due to having medium duration (140.5 days), moderate canopy architecture ($k = 0.50 - 0.58$) and maximum LAI (4.02) as well as CGR (22.87 g/ m²/day) at midphase of growth.

Key words : Growth, hybrid rice, phenology, planting date

Heterotic effect in hybrid rice can effectively be exploited by growing under favourable weather conditions. Among the climatic parameters, temperature greatly influences the duration, pattern of growth (Sharma and Singh 1999) and affects dry matter production mainly through the development of leaf area in young and middle growth stages (Murata 1976). Keeping this in view, some promising Indian rice hybrids were grown under different growth environments to know the best favourable one for northern part of West Bengal.

A field experiment was conducted during dry season (January – May) of 2001 at Instructional Farm (26° 19' N, 89° 23' E and 43m above mean sea level) of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India. Treatments replicated thrice, were arranged in split-plot design with two dates of planting (15th and 28th February, with the seedlings sown on 12th and 25th January, respectively) in main plots and nine hybrid cultivars (KRH 2, Sahyadri, PA 6201, PHB 71, CORH 2, DRRH 1, APHR 2, PSD 1 and CNHR 3) in sub-plots. 34 days old seedlings @ single/hill were

transplanted at a spacing of 15 x 15cm. Other agronomic practices were adopted as per standard recommendations.

For each phenophase, growing degree days (GDD) were calculated following Nuttonson (1955) by taking a base temperature of 8°C, while heliothermal units [Σ (GDD x Bright sunshine hour)] following Singh *et al.* (1990). Leaf area index and crop growth rate (Watson 1958), light transmission ratio (Yoshida *et al.* 1972) and light extinction co-efficient (k) for Beer's law (Saeki 1963) were determined at different growth stages.

Delay in sowing from 12th to 25th January reduced the time taken for maturity by 7.8 days (Table 1). Lower summed GDD and heliothermal units (HTU) were recorded in late sown crop during the periods between sowing and fourth leaf emergence as well as between flowering and maturity; but in 12th January sown crop during fourth leaf emergence to flowering. Thus, rice hybrids sown at two different dates accumulated similar total GDD (2172 v. 2176) and HTU (16935 v. 17030) for the entire life circle.

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EFFECT OF GROWTH ENVIRONMENTS ON RICE HYBRIDS

Table 1. Effect of sowing dates on duration and growth environment in hybrid rice cultivars.

| Treatment | Number of days | | | | Growing degree days | | | | Heliothermal units | | | |
|--|----------------|-------|------|-------|---------------------|------|-----|------|--------------------|-------|------|-------|
| | S-4L | 4L-F | F-M | S-M | S-4L | 4L-F | F-M | S-M | S-4L | 4L-F | F-M | S-M |
| Planting date (Sowing date) | | | | | | | | | | | | |
| 15 February (12 January) | 24.4 | 94.7 | 30.7 | 149.8 | 198 | 1411 | 567 | 2176 | 1310 | 11598 | 4122 | 17030 |
| 28 February (25 January) | 20.4 | 91.6 | 30.0 | 142.0 | 177 | 1439 | 556 | 2172 | 1159 | 11892 | 3884 | 16935 |
| Cultivar | | | | | | | | | | | | |
| KRH 2 | 23.0 | 88.0 | 29.5 | 140.5 | 193 | 1332 | 544 | 2069 | 1275 | 10953 | 4062 | 16290 |
| Sahyadri | 23.0 | 100.0 | 29.0 | 152.0 | 193 | 1559 | 539 | 2291 | 1275 | 12834 | 3646 | 17755 |
| PA 6201 | 22.0 | 89.0 | 31.0 | 142.0 | 184 | 1341 | 574 | 2099 | 1202 | 11026 | 4309 | 16537 |
| PHB 71 | 22.0 | 91.5 | 30.0 | 143.5 | 184 | 1390 | 554 | 2128 | 1202 | 11449 | 3942 | 16593 |
| CORH 2 | 23.0 | 96.0 | 29.0 | 148.0 | 193 | 1482 | 538 | 2213 | 1275 | 12240 | 3715 | 17230 |
| DRRH 1 | 22.0 | 98.0 | 31.5 | 151.5 | 184 | 1512 | 588 | 2284 | 1202 | 12479 | 4055 | 17736 |
| APHR 2 | 22.0 | 95.0 | 31.0 | 148.0 | 184 | 1454 | 577 | 2215 | 1202 | 11957 | 4111 | 17270 |
| PSD 1 | 23.0 | 96.5 | 30.0 | 149.5 | 193 | 1494 | 557 | 2244 | 1275 | 12327 | 3866 | 17468 |
| CNHR 3 | 22.0 | 84.0 | 32.0 | 138.0 | 184 | 1262 | 585 | 2031 | 1202 | 10443 | 4324 | 15969 |

S-4L = Sowing to fourth leaf emergence, 4L-F= Fourth leaf emergence to flowering , F-M = Flowering to maturity, S-M= Sowing to maturity.

Average number of days from sowing to four leaf, flowering and maturity of rice hybrids were 22.4, 115.6 and 145.9, respectively; while mean cultivar GDD for those stages were 188, 1613 and 2174. CNHR 3 was the earliest (138.0 days) maturing hybrid followed by KRH 2 (140.5 days) and PA 6201 (142.0 days). Perusal of data reveals that variations observed among cultivars during the period from fourth leaf emergence to flowering primarily determined the differences in number of days towards maturity, summed GDD and HTU.

Progressive increase in LAI was observed up to a little before heading (77 DAT) in both the planting dates (Table 2), which is consistent with the findings of Thakur and Patel (1999). Mean cultivar CGR was 6.60 at 21-34 DAT, 8.98 at 35-48 DAT, 11.24 at 49-62 DAT and 17.21g/m²/day at 63-76 DAT. This suggests that CGR increased gradually up to a period of 63-76 DAT, which is in agreement with Chandrasekhar *et al.* (2001). At maximum LAI and CGR stage, KRH 2 recorded the highest values of LAI (4.02) and CGR (22.87g/ m²/day).

Values of light extinction co-efficient (k) for rice hybrids are similar or greater to the values for inbred cultivars in the literature (Kiniry *et al.* 2001). The k value was highest for PA 6201 at both the stages (0.62 and 0.52) due to more horizontal leaves and lowest for PHB 71 (0.53) at 21 DAT and PSD 1 (0.45) at 49 DAT.

Higher temperature regime from sowing to 48 DAT (data not shown) in 28th February planted crop had positive effect on foliage growth. Thus, the crop planted on 15th February intercepted 8.0 and 6.3% significantly greater light at 21 and 49 DAT with having lower LAI values than later planting. With the age (particularly after 49 DAT), 15th February planted crop had higher rate of growth (LAI and CGR) due to production of more photosynthates under greater mean air temperature (26.4 v. 25.3°C) and bright sunshine hours/day (8.61 v. 7.86) at 49-62 DAT than 28th February planting .

Thus, it can be concluded that 15th February planted crop had greater leaf area and was more efficient to

Table 2. Effect of planting dates on growth of hybrid rice cultivars.

| Treatment | Leaf area index | | | Light transmission ratio | | Light extinction co-efficient (k) | | Crop growth rate (g/m ² /day) | | | |
|------------------------------------|-----------------|--------|--------|--------------------------|--------|-----------------------------------|--------|--|-----------|-----------|-----------|
| | 21 DAT | 49 DAT | 77 DAT | 21 DAT | 49 DAT | 21 DAT | 49 DAT | 21-34 DAT | 35-48 DAT | 49-62 DAT | 63-76 DAT |
| Planting date (Sowing date) | | | | | | | | | | | |
| 15 February (12 January) | 0.65 | 2.30 | 3.51 | 69.3 | 31.3 | 0.56 | 0.51 | 6.26 | 8.79 | 12.27 | 18.73 |
| 28 February (25 January) | 0.76 | 2.72 | 3.23 | 64.2 | 29.5 | 0.59 | 0.45 | 7.11 | 9.16 | 10.20 | 15.68 |
| C.D. at 5% | 0.01 | 0.05 | 0.08 | 0.23 | 0.09 | 0.01 | 0.01 | 0.03 | 0.08 | 0.08 | 0.05 |
| Cultivar | | | | | | | | | | | |
| KRH 2 | 0.75 | 2.46 | 4.02 | 65.0 | 30.6 | 0.58 | 0.50 | 6.57 | 7.69 | 12.29 | 22.87 |
| Sahyadri | 0.74 | 2.74 | 3.16 | 66.9 | 28.9 | 0.55 | 0.47 | 7.01 | 9.60 | 9.15 | 13.69 |
| PA 6201 | 0.70 | 2.30 | 3.35 | 65.4 | 31.3 | 0.62 | 0.52 | 7.79 | 5.67 | 14.19 | 14.73 |
| PHB 71 | 0.66 | 2.62 | 3.29 | 70.6 | 30.0 | 0.53 | 0.46 | 5.87 | 12.64 | 12.09 | 16.50 |
| CORH 2 | 0.68 | 2.28 | 3.53 | 67.2 | 31.4 | 0.59 | 0.51 | 6.57 | 7.19 | 12.36 | 17.69 |
| DRRH 1 | 0.70 | 2.45 | 2.95 | 65.3 | 31.7 | 0.61 | 0.47 | 6.72 | 7.64 | 8.65 | 18.16 |
| APHR 2 | 0.70 | 2.40 | 3.51 | 66.3 | 31.4 | 0.59 | 0.49 | 6.20 | 7.46 | 11.99 | 19.94 |
| PSD 1 | 0.73 | 2.88 | 3.11 | 67.3 | 27.4 | 0.55 | 0.45 | 7.80 | 12.12 | 6.58 | 14.94 |
| CNHR 3 | 0.69 | 2.46 | 3.46 | 66.6 | 30.8 | 0.59 | 0.49 | 5.65 | 10.81 | 13.86 | 16.33 |
| C.D. at 5% | 0.02 | 0.11 | 0.11 | 2.21 | 1.53 | 0.05 | 0.03 | 0.33 | 0.56 | 1.35 | 1.88 |

DAT = Days after transplanting

intercept light as well as to produce biomass than later planted one. KRH 2 appeared as promising among nine rice hybrids due to having desirable growth characters.

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