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# PERFORMANCE OF WHEAT AS AFFECTED BY DATES OF SOWING AND METHODS OF STAND ESTABLISHMENT IN PATNA REGION

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Shift in atmospheric temperature, particularly in case of minimum temperature, from 1979 onwards was recorded at Patna. Consequently a field trial was conducted for three years at the Agricultural Research Institute. Patna to re-evaluate the optimum time for wheat sowing and method of stand establishment in the region. Wheat sowing around first week of December was found to be the best. Sowing of the crop earlier (mid November) or later (mid December) than first week of December have well marked adverse effects on various characters. Sowing of wheat in line 20 cm apart, significantly out yielded broadcast, on an average by 2 to 3 q/ha.

Growth and yield of wheat largely depends on the temperature condition when irrigation and nutrient supply are adequate. The studies on the environmental responses to wheat carried out under controlled conditions in Ottaws Phytotron reveled that for the best vegetative growth in wheat a temperature of 20–25°C was very conducive (Hawksbridge 1964). At Patna this optimum mean maximum temperature regime reaches only by end of November. Again, mean minimum temperature between 5-7°C not only induces tillering (Sandhu and Gill, 1972) but low night temperature greatly helps in maintaining high net assimilation rate. At Patna presently mean weekly minimum temperature comes down to 10°C or less only by the end of December as against first week of December in the past. There appears to be considerable change in the temperature in recent years and naturally calls forth for re-evaluation of earlier recommendations of sowing time of wheat by mid November in the plain of Bihar (Nizamuddin and Prasad, 1962).

## MATERIALS AND METHODS

A field trial under irrigated condition was conducted for three years (1981-82 to 1983-84) at Agricultural Research institute, Patna (25°-30'N Latitude, 85°-15' E Longitude at an altitude to 58.80m). The soil of the experimental plot was heavy in texture and neutral in reaction.

The experiment was laid out in split plot design with 4 replication having three seeding dates *viz* mid November, first December and mid December in main plot and three levels of Nitrogen (75, 100 and 125 kg N/ha) and two methods of stand establishment (broadcast and sowing in line 20 cm apart) in the sub-plots. The sub-plot size was 5 m x 3 m Nitrogen as Urea was applied in two splits, half at sowing and the rest at

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first irrigation at C.R.I. stage. A common basal dose of 60 kg/ha of $P_2O_5$ as Single Super Phosphate and 40 kg/ha of $K_2O$ as Muriate of Potash was applied in all the plots

During 1983-84 season tillers were counted from permanent quadrats of 625 sq. cm. (25 cm x 25 cm) fixed in each treatment plots, Tiller counting was started 15 DAS (days after sowing) at 15 days interval. For the study of yield component 10 ear heads were randomly selected from each plot

The crop sown on mid-November first December and mid-December were harvested, respectively on 25 March, 31 March and 7 April during 1981-82, on 31 March, 10 April and 15 April during 1982-83 and on 21 March, 25 March and 1 April during 1983-84 crop season.

*Temperature regime* :

For finding shift in temperature regime during wheat growing season at patna weekly average of minimum and maximum temperature, in groups of 5 years, starting from 1936-40 till 1981-84, were calculated. Studies of these average indicate that shift in temperature particularly in case of minimum temperature, is quite pronounced from 1976-80 onwards (for brevity details of the data is not given here). In the past mean minimum temperature were less than 10°C by 1st week of December but now minimum temperature reaches less than 10°C only by 3rd week of December. As a matter of fact since 1976, mean weekly minimum temperature seldom dropped down below 9°C during the crop growing season. Earlier weekly mean minimum temperature were fluctuating between 7° and 8°C during mid-December to third week of January. During reproductive phase mean weekly minimum temperature used to be below 10°C till mid-February but now it remains so till end of January As regards mean weekly maximum temperature thereis not much variation except that mean weekly maximum temperature apporaches 25°C by end of November instead of mid November as in the past During the month of February mean weekly maximum temperature remains below 30°C (between 24° to 30°C). During the month of March it generally remains above 30°C whereas during April weekly mean maximum temperature fluctuates between 34° to 38°C.

## RESULTS AND DISCUSSION

*Tillering*

In the first 15 DAS period, total tiller production was significantly higher under mid-November (273/m²) than under mid-December (226/m²) sown crop. low tillering in mid-December sown crop might be due to slow rate of crop germination (Table-1) But by 30 DAS, tiller production was significantly more under mid-December (728/m²) than other dates of sown crop (531-553/m²). Maximum number of tillers are produced by 35 DAS (Singh *et al* 1972) This tillering phase, in case of mid-December sown crop, coincided with the period of the crop season (mid-January) when mean minimum temperature was less than 10°C which is very conductive for tillering (Friend, 1965). By 45 DAS, total tiller production in mid-November sown crop, in which peak tillering phase (35 DAS) coincided with period when minimum temperature remained above 10°C, fell behind other dates of sown crop. By 90 DAS, first December sown crop produced maximum productive

tillers (634/m²). In mid-December sown crop later formed young tillers might have died due to rise in atmospharic temperature above 30°C by the beginning of March causing high respiration and conseqently low available photsoynthetes (Fried, 1965). Tiller survival was maximum in first December sown crop (89.6%).

Table 1. Effect of dates of sowing on tillering in whea

| Date of sowing | Number of Tillers/m² | | | | | | |
|---|---|---|---|---|---|---|---|
| | Days after sowing | | | | | | Tillers |
| | 15 | 30 | 45 | 60 | 75 | 90 | Survived(%) |
| Mid November | 273 (1 Dec.) | 553 (15 Dec.) | 670 (15 Jan.) | 648 (15 Jan ) | 555 (1 Feb.) | 528 (15 Feb ) | 78.8 |
| First December | 266 (15 Dec ) | 531 (1 Jan.) | 707 (15 Jan.) | 677 (1 Feb.) | 645 (15 Feb.) | 634 (1 Mar.) | 89 6 |
| Mid December | 226 (1 Jan.) | 728 (15 Jan ) | 716 (1 Feb ) | 633 (15 Feb.) | 619 ( 1 Mar.) | 569 (15 Mar.) | 78.1 |
| S.Em (+) | 4 3 | 37.3 | 40.4 | 35.6 | 36.9 | 31.2 | — |
| C. D. 5% | 14.8 | 129.1 | NS | NS | NS | NS | — |

Note : Dates of actual tiller conuts are within Parenthesis

Table 2. Effect of dates of sowing, levels of nitrogen and stand establishment on leaf area duration and grain yield of wheat.

| Treatments | Leaf Area Duration (WKs) | Grain yield (q/ha) | | | |
|---|---|---|---|---|---|
| | 1983-84 | 1981-82 | 1982-83 | 1983-84 | Mean |
| Dates of sowing : | | | | | |
| Mid-November | 15.6 | 33.61 | 31.24 | 32.33 | 32 39 |
| First December | 23.2 | 42.10 | 35 68 | 40 93 | 39.57 |
| Mid December | 13.2 | 24 56 | 30.36 | 28.64 | 27.86 |
| S. EM (+) | 0.10 | 1.01 | 0.53 | 0.37 | 1.83 |
| C .D. 5% | 0.25 | 3.49 | 1.82 | 1.30 | 6.19 |
| Level of nitrogen (kg/ha) | | | | | |
| 75 | 14.8 | 32.78 | 28.67 | 31.73 | 31.06 |
| 100 | 17.3 | 33.27 | 32 50 | 33.46 | 33.08 |
| 125 | 19 9 | 34 22 | 36.11 | 36.10 | 35 68 |
| S Em (+) | 1.67 | 0.73 | 0.40 | 0.93 | 0.88 |
| C. D. 5% | 3.35 | NS | 1.15 | 2.694 | NS |
| Method of stand establishment | | | | | |
| Broadcast | 16.7 | 31.71 | 30.78 | 32.98 | 31.82 |
| Line sowing (20 cm apart) | 18.0 | 35.14 | 34 07 | 34.96 | 34.72 |
| S. Em. (+) | 1.36 | 0.60 | 0.33 | 0.76 | 0.34 |
| C. D. 5% | NS | 1.70 | 0.94 | NS | 0.94 |

NS = Statistically not Significant

*Leaf Area Duration* :

Leaf Area Duration (D) after flowering (Table-2) was significantly highest in the crop sown on first December (23 2 wk) and lowest in mid-December sown crop (13.2 wk). Levels of nitrogen also helped in increasing the D, highest being in plots receiving 125 kg N/ha (13.9. wk). Though line sown crop (18.0 wk) maintained a little higher D over the crop established by breadcast (16.7 wk) the diffenence was not significant.

*Number of grains/spike*:

Except during 1982-83 crop season, first December sown crop had significantly largest number of grain/spike (32 to 36) than crops sown on other dates (Table-3). Number of grains/spike also increased with increase in levels of nitrogen. Line sown crop produced a little more grain/spike than broadcast sown crop.

Table 3. Effect of dates of sowing, levels of nitrogen and method of stand establishment on yield components of wheat.

| Treatments | No. of grains/spike | | | | wt. of grain/spike (gm) | | | | Test wt. of grains (gm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1981-82 | 82-83 | 83-84 | Mean | 1981-82 | 82-83 | 83-84 | Mean | 1981-82 | 82-83 | 83-84 | Mean |
| Date of sowing : | | | | | | | | | | | | |
| Mid November | 27 | 38 | 26 | 30 | 1.09 | 1 96 | 1.08 | 1.38 | 39.33 | 43.32 | 43.95 | 43.87 |
| First December | 32 | 36 | 32 | 33 | 1 42 | 1 69 | 1.51 | 1.54 | 43.62 | 46.66 | 46 01 | 45.43 |
| Mid December | 30 | 34 | 26 | 30 | 0.97 | 1 57 | 1.04 | 1.19 | 32.56 | 46.21 | 38.13 | 38.77 |
| S.Em(±) | 1.07 | 0.87 | 0.41 | — | 0 05 | 0.06 | 0.089 | — | 0 78 | 1.30 | 2.44 | — |
| C.D.5% | 3.0 | 3.0 | 1.41 | — | 0.19 | 0.22 | 0.308 | — | 2.72 | NS | NS | — |
| Levels of Nitrogen (kg/ha) | | | | | | | | | | | | |
| 75 | 28 | 35 | 27 | 30 | 1 09 | 1.70 | 1.19 | 1.33 | 38.44 | 50 01 | 43.56 | 44.00 |
| 100 | 30 | 35 | 29 | 31 | 1.16 | 1.73 | 1 25 | 1.38 | 38.49 | 47.18 | 41.32 | 42.33 |
| 125 | 31 | 38 | 29 | 33 | 1.22 | 1.79 | 1.19 | 1.40 | 38,58 | 44.06 | 43.20 | 41.95 |
| S.Em(±) | 0.97 | 0 82 | 0.73 | — | 0.04 | 0.04 | 0.042 | — | 0.81 | 0 58 | 1 87 | — |
| C. D. 5% | NS | 2.0 | NS | — | NS | NS | NS | — | NS | 1.63 | NS | — |
| Method of Stand establishment | | | | | | | | | | | | |
| Broadcast | 29 | 34 | 28 | 30 | 1.10 | 1.60 | 1.15 | 1.28 | 37.41 | 47.33 | 41.51 | 42 08 |
| Line sowing (20 cm apart) | 30 | 38 | 29 | 32 | 1.21 | 1.88 | 1.27 | 1.45 | 39.60 | 46.81 | 43.89 | 42.43 |
| S.Em(±) | 9.79 | 0.67 | 0.59 | — | 0.03 | 0.03 | 0,03 | — | 0.66 | 0.48 | 1.53 | — |
| C.D.5% | NS | 2.0 | NS | — | 0.09 | 0.10 | NS | — | 1.84 | NS | NS | — |

NS. Statistically not significant

*Weight of grain/spike* :

Weight of grain/spike was significantly affected by different dates of sowing (Table-3). It was significantly highest when crop was sown on first December during 1981-82 (1.42 gm) 1983-84 (1.51 gm) and when data was

pooled together (1.54 gm). During 1982-83 weight of grain/spike of mid November sown crop (1.96 gm) was significantly heavier than others (1.69 gm in first December to 1.57 gm in mid December sown crop). During 1982-83 crop season the winter was prolonged with desicating westerly, winds beig observed in middle of April Mid December sown crop producad lighter grains during all the 3 years of experimentation, In case of mid November sown crop, weight of grain/ spike was not much affected as the grain maturation period coincided with milder temperature of February. But in case of mid December sown crop grain weight was reduced as the maturation period coincided with high temperature of March-April (above 30°c). Several workers (Friends, 1965 b) also reported reduction in weight of grain due to rise in temperature during grain ripening period as this leads to sharp increase in respiration and reduced rate of photosynthesis.

Weight of grain/spike increased with the increase in levels of nitrogen, both during individual years data when two years data were pooled. However, the treatment differences were non-significant.

Line sown crop maintained significantly heavier grains/spike than broadcast, both during individual years or when data were pooled together.

*Test weight of grains :*

Test weight of grain under different treatments, behaved more or less in the same fashion as that in the case of weight of grain/spike (Table-3)

Higher levels of nitrogen showed a tendency of lowering the grain weight effect being significant only during 1982-83 (Table-3).

Methods of stand establishment showed conflicting effect on 1000 grain weight, However, line sown crop appeared to have some beneficial effect on increasing the 1000 grain weight.

*Grain Yield*

First December sown crop (39.57 q/ha) significantly out yielded crops sown on other dates of sowing (Table2) Lowest grain yield recorded was is mid-December (27.86 q/ha) sown crop Similar was trend of treament variation during the individual years also, except that during 1982-83 crops season yield difference between mid-November (31.24 q/ha) and mid-December (30.36 q/ha) sown crop was non-significant and relatively lower grain yield under first December sown crop (35.68 q/ha) than other years. This crop season also witnessed unusual continuous day and night air frost during first fortnight of January 1983 and prolonged winter with desicating westerly wind only by the middle of April Higher grain yield under first December sown crop was mainly due to its better maintenence of high leaf of area duration more effective tillers per unit area, more number and heavier grains/spike. Due to sharp decrease in weight of grains/spike and test weight, grain yield was lowest under mid-December sown crop (27 86 q/ha). Leaf area duration of mid-December (13.2 wks) sown crop was also significantly lowest,

Grain yield increased with increase in levels of nitrogen. from 31.06 q/ha

at 75 Kg N/ha to 35.68 q/ha at 125 Kg N/ha (Table-2) Many workers also got positive effect of nitrogen application.

Line sown crop yielded about 3 q/ha more grain than broadcast differences being significant, This was the trend during individual years also (except during 1983-84) which is in confirmity with the results of other workers Singh and Sharma (1981,)

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