Effect of weather parameter on growth and development of wheat under different growing environment

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Abstract
The present investigation entitled “Effect of weather parameter on growth and development of wheat under different growing environment” was carried out during Rabi seasons of 2016-17 at Research and Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur to examine to validate the results of crop weather relationship of different wheat varieties grown under different growing environments in factorial Randomized Block Design. Some of the important points that emerged from the study are summarized in the present chapter. Among the growth parameters plant height recorded significantly higher in early date of sowing i.e. 1st December as compared to other growing environments (sowing on 11th and 12th December). The interaction of date of sowing with different variety of wheat crop were founds significantly influenced on plant height of crops at 40 DAS and 100 DAS stages. Significantly maximum number of leaves per plant was found with 1st December of sowing. The interaction effect of different date of sowing and varieties were found significant at 60 DAS. Number of tillers per plants were found significantly influenced due to different date of sowing and different variety at 40 DAS. At 20 and 80 DAS plant accumulated significantly higher value of dry matter in crop sown on 1st December 2016.

Keywords: Growth and development, mustard crop, growing environments and weather

Introduction
Wheat is the world’s number one cereal crop after rice, grown under diverse agro-climatic conditions, contributing nearly one-third of total food grains production. This grown is not only in the temperate zone but also in tropical and sub tropical zone tropical and sub-tropical zones. Three main species commonly grown in the world including India are the common wheat (Triticum aestivum), Marconi or durum wheat (Triticum durum) and emmer wheat (Triticum dicoccum) maximum area are covered by Triticum aestivum out of 3 species. In India, more than 80% of the total wheat area is under this species where as 12% and 1% area under Marconi and emmer wheat. (Draganka et al, 2004) [2]. In Chhattisgarh, wheat is sown in an area of 0.171 million hectares out of which 0.063 million hectare area is irrigated and 0.108 million hectare area is unirrigated, with the total production of 181000 metric tons and productivity 1140 kg ha−1 (Anonymous, 2010) [3]. In Chhattisgarh, wheat is grown mostly under irrigated conditions in a rice based cropping system. The sowing of wheat is often delayed due to delay in harvesting of medium and late duration rice varieties. Late sown wheat crop faces high temperature during grain filling and ripening phases which is one of the major causes of stunted growth and low productivity of wheat in this area. Time of sowing is one of the most important factors which govern the crop phenological development and total biomass production along with the efficient conversion of biomass into economic yield. Delayed sowing of the wheat crop is exposed to sub-optimal temperatures at the establishment and supra-optimal temperatures at reproductive phases resulting into reduction of not only crop duration but also the yield (Sardana et al., 1999) [4].

Material and Methods
The present study entitled “Effect of weather parameter on growth and development of wheat under different growing environment” was conducted during the Rabi season of 2016-17.
The experimental details, prevailing weather conditions, materials used and techniques adopted during the course of the investigation are briefly presented in this chapter. The field experiment was carried out at the Research and Instructional farm of Indira Gandhi Krishi Vishwavidyalaya; Raipur situated in Eastern Central part of Chhattisgarh at latitudes of 21°.16’ N, longitude 81°.36’ E and altitude 289.5 m above mean sea level. The general climatic condition of Raipur is classified as sub-humid with mean annual rainfall of about 1188 mm out of which 85 percent rainfall is received during monsoon (June to September). During Rabi, (December to February) only 33.8 rainfall is received and hence wheat is mostly grown under irrigated conditions. The soil of the experimental field was sandy loam with moderately coarse texture of Inceptisol group locally known as “Matasi.”

Observations recorded
1. **Plant population**: To record the observation on plant population 3 sample plots 01 m² area each was randomly selected in each treatment. The number of plants in each quadrate was counted carefully at 20 days after sowing and average were worked out.
2. **Plant height (cm)**: Five randomly selected plants from each plot were taken at 20 days intervals starting from 20 days after sowing (DAS) till maturity. The plant height was measured from base of the plant to tip of the longest leaf. The mean height was worked out by dividing the summation by five.
3. **Number of leaves**: To record the observation for number of leaves 5 sample randomly selected in each treatment. The number of leaves per plants was counted carefully at 20 DAS at an interval of 20 days. The mean number as haves per plant was worked out by dividing five in total value.

Results and Discussion

**Growth parameters**

1. **Plant population**
The data summarizing the plant population per unit area under different dates of sowing and varieties are shown in Table 1. It can be noted from the table that both factor including their interaction effect were found non-significant. In general highest plant population was observed in crop sown on first December (1st December) (182) followed by D3 (21st December) (174) and lowest plant population was found under D2 (11th December) sown crop. The highest plant population was recorded by variety Ratan (178.96) followed by GW-366 (171) and lowest plant population was recorded under GW-273 (163). The plant population in all treatment was uniform might be due to seed was placed in proper depth by dibbling method and favourable temperature favars to uniform germination.

|        | V1 - Ratan | D1-1st December | D2-11th December | D3-21st December | Mean |
|--------|------------|-----------------|------------------|-----------------|------|
| V2     | - GW-273   | 196             | 126              | 166             | 163  |
| V3     | - GW-366   | 172             | 159              | 182             | 171  |
| Mean   | 182        | 156             |                  | 174             |      |

*S.Em ±* CD (*p* = 0.05)

|        | D | V | D X V |
|--------|---|---|-------|
|        | 12.32 | 12.32 | 21.33 |

* Significant at 5% level; ** significant at 1% level

2. **Plant height**
The data on plant height influence by various treatments are presented in Table 2. Plant height was differed significantly due to different growing environments at all growth stages. At 20 DAS, significantly highest plant height was recorded with D1 (1st December) (21.4 cm) followed by D1 (1st December) (20.7 cm.) and lowest plant height was recorded in D2; 11th December growing (17.0 cm). At 40 DAS, significantly highest plant height was recorded with D2 (11th December) growing environments (37.1cm) followed by D1 (21st December) growing environments (35.7 cm) where as lowest plant height was recorded with D1 (1st December) growing environments (33.8 cm). At 60 DAS significantly highest plant height (68.0 cm) was noticed in D1 (1st December) growing environments than D1 (21st December) growing environments (66.0 cm). Plant height seems to be a combination of genetic trait as affected by environmental conditions. At 80 DAS and 100 DAS the significantly highest plant height was recorded with D1 (1st December) growing environments (86.6 cm) followed by D2 (11th December) growing environments (80.4 cm.) and the lowest plant height was recorded with D3 (21st December) growing environments (73.3 cm). The response of variety under different growing environment was non-significant. However in general the maximum plant height recorded by GW-366 at all stages of observation except at early stage in 20 days where in GW-273 responded well over other variety trended. The interaction between varieties and dates of sowing showed the significant difference at 5% level of significance at 40 DAS and 80 DAS. Interaction effect was found non-significant at all the stage of observation except the required recorded at 40 and 100 DAS.

![Image Content]
Number of leaves
The number of leaves/plant of different wheat varieties as influenced by different sowing dates are presented in Table 3. The number of leaves/plant was found significantly highest in crop sown on D1 (1st December) followed by D2 (11th December) sown crop at 20 DAS. At 40 DAS it was rapidly increased and significantly highest Number of leaves recorded from D3 (11th December) growing environments followed by D1(1st December) and D2 (21st December) growing environments. Among different growing environment and significantly highest number of leaves per plant was observed under D1 (1st December) growing environment at 60 DAS.

Table 3: Number of leaves/plant of wheat varieties as influenced by different dates of sowing

| Treatments | 20 DAS | 40 DAS | 60 DAS | 80 DAS | 100 DAS |
|------------|--------|--------|--------|--------|---------|
| Dates of sowing |        |        |        |        |         |
| D1 - 01 December | 20.76  | 33.82  | 68.06  | 86.62  | 87.63   |
| D2 - 11 December | 17.05  | 37.11  | 66.09  | 80.46  | 81.12   |
| D3 - 21 December | 21.45  | 35.58  | 67.72  | 73.38  | 75.79   |
| S. Em± | 0.54  | 0.63  | 1.07  | 0.94  | 0.80    |
| CD (p = 0.05) | 1.62** | 1.88** | (NS) | 2.81** | 2.41**  |

* Significant at 5% level; ** significant at 1% level

3. Number of tillers
The numbers of tillers were recorded under various treatments and subjected to statistical analysis indicates that there were significant a variety was observed for growing environment where varieties of interaction were found non significant. It quite clear from the table 4. that sowing of wheat on D1 (1st December) recorded significantly higher no. of tillers plant over other date of sowing similarly trend was recoreded during all the stage of observations.. The average no. of tillers per plant was 4 to 7 under various treatment. This might be due to favourable weather parameters during its growth period. Similar trend recorded under all the stages. Patel et al. (2009) reported that the duration of the reproductive period in all the four varieties was related with mean maximum, minimum and average temperature during the reproductive period, i.e., 50 per cent flowering to maturity.

Table 4: Number of tillers per plant of wheat varieties as influenced by different date of sowing

| Treatments | 40 DAS | 60 DAS | 80 DAS | 100 DAS |
|------------|--------|--------|--------|---------|
| Dates of sowing |        |        |        |         |
| D1 - 01 December | 5      | 7      | 7      | 7       |
| D2 - 11 December | 4      | 6      | 6      | 6       |
| D3 - 21 December | 4      | 6      | 6      | 6       |
| S. Em± | 0.22  | 0.31  | 0.30  | 0.31    |
Varieties  

| CD (p = 0.05) | 0.67 | 0.94 | 0.92 | 0.95 |
|---------------|------|------|------|------|
| (V₁) Ratan    | 5    | 6    | 6    | 6    |
| (V₂) GW-273   | 4    | 6    | 6    | 6    |
| (V₃) GW-366   | 4    | 6    | 6    | 6    |
| S.Em+         | 0.22 | 0.31 | 0.30 | 0.31 |
| CD (p = 0.05) | 0.67 | (NS) | (NS) | (NS) |

Interaction D X V  

| CD (p = 0.05) | 0.38 | 0.54 | 0.52 | 0.54 |
|---------------|------|------|------|------|
| (NS)          | (NS) | (NS) | (NS) | (NS) |

Significant at 5% level; ** significant at 1% level

5. Dry matter production  
The accumulated dry matter were recorded at an interval of 20 days from sowing to maturity under various treatments are shown in Table 5. The highest value of dry matter obtained at 20 DAS (17.63 g/m²) under D₁ (1st December) sowing, 40 DAS, (129.31 g/m²) at D₃ (21st December) sowing, 60 DAS (598.22 g/m²) at D₂ (11th December), 80 DAS (1785.97 g/m²) at D₁ (1st December) sowing and 100 DAS was (2384.23 g/m²) under D₂ (11th December) sowing. The effect of varieties interaction of both the factor non-significant.

| Treatments | 20 DAS | 40 DAS | 60 DAS | 80 DAS | 100 DAS |
|------------|--------|--------|--------|--------|---------|
| D₁ 01 December |        |        |        |        |         |
| D₁ 11 December |        |        |        |        |         |
| D₁ 21 December |        |        |        |        |         |
| S.Em±       | 1.02   | 6.53   | 43.13  | 86.31  | 101.55  |
| CD (p = 0.05)| 3.05 * | (NS)   | (NS)   | (NS)   | (NS)    |

Varieties  

| CD (p = 0.05) | 0.67 | (NS) | (NS) | (NS) | (NS) |
|---------------|------|------|------|------|------|
| (V₁) Ratan    | 14.66| 121.75| 619.29| 1669.84| 2327.67|
| (V₂) GW-273   | 14.69| 118.70| 598.22| 1569.76| 2384.43|
| (V₃) GW-366   | 16.95| 129.31| 542.50| 1659.51| 2300.86|
| S.Em±         | 1.02 | 6.53 | 43.13 | 86.31 | 101.55 |
| CD (p = 0.05) | (NS) | (NS) | (NS) | (NS) | (NS) |

Interaction D X V  

| S.Em±        | 110.65| 11.32 | 74.70 | 149.50 | 175.89 |
| CD (p = 0.05) | (NS)  | (NS)  | (NS)  | (NS)  | (NS)  |

Significant at 5% level; ** significant at 1% level

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