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# Response of wheat (*Triticum aestivum*) to sowing time with varying levels of spacing

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### Abstract

A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, and Sardarkrushinagar during *Rabi* season of the year 2017-18 on "Response of wheat (*Triticum aestivum*) to sowing time with varying levels of spacing". Twelve treatments comprising of sowing time and spacings *viz.*, T<sub>1</sub> : 15<sup>th</sup> November + Broadcasting; T<sub>2</sub> : 15<sup>th</sup> November + 18 cm between two rows; T<sub>3</sub> : 15<sup>th</sup> November + 22 cm between two rows; T<sub>4</sub> : 25<sup>th</sup> November + Broadcasting; T<sub>5</sub> : 25<sup>th</sup> November + 18 cm between two rows; T<sub>6</sub> : 25<sup>th</sup> November + 22 cm between two rows; T<sub>7</sub> : 5<sup>th</sup> December + Broadcasting; T<sub>8</sub> : 5<sup>th</sup> December + 18 cm between two rows; T<sub>9</sub> : 5<sup>th</sup> December + 22 cm between two rows; T<sub>10</sub> : 15<sup>th</sup> December + Broadcasting T<sub>11</sub> : 15<sup>th</sup> December + 18 cm between two rows and T<sub>12</sub> : 15<sup>th</sup> December + 22 cm between two rows were tried in strip plot design with four replications. In all cases, The yield and yield attributes of wheat *i.e.* number of earhead per plant (9.5), number of grains per earhead (41.0), grain yield per plant (24 g), grain yield (4523 kg/ha) and straw yield (7203 kg/ha) significantly higher with wheat sown at 25<sup>th</sup> November over other treatments. In case of spacings number of earhead per plant (9.4), number of grains per earhead (41.0), grain yield per plant (23.5 g), grain yield (4632 kg/ha) and straw yield (7014 kg/ha) were significantly higher with respect to wheat sown with 18 cm between two rows over all other treatments. Interaction effect of sowing time and spacing *i.e.* 25<sup>th</sup> November + 18 cm between two rows gave significantly higher grain (5291 kg/ha) and straw yield (8649 kg/ha) the other interactions.

**Keywords:** Wheat, *Triticum aestivum*, sowing time, varying levels, spacing

### Introduction

Wheat (*Triticum aestivum*) is one of the most important cereal crops for the majority of world's population and India. It is second most important cereal crop next to rice contributing nearly 35 per cent to the national food and nutritional security. Wheat has been described as "King of cereal or staff of life." It finds a major place in meals of common population in major wheat growing states of India. The cultivation of wheat has also symbolic of green revolution. The proper time of sowing exploit a distinguished effect on growth and eventually on the yield of wheat crop. In general the optimum time for sowing wheat depends upon the genotypes and the temperature, for timely and late sown varieties of long and short duration are preferred, respectively. The high yielding dwarf wheat varieties are most sensitive to date of sowing and hence, optimum time of sowing contributes more towards yield and very early sowing in first week of October resulted in lower yield (Singh *et al.* 1974) [11]. While, delaying the sowing from 15<sup>th</sup> November to 15<sup>th</sup> December and up to 15<sup>th</sup> January resulted in average yield reduction of 18.1 and 52.1 per cent, respectively. (Randhawa and jolly, 1974) [10].

Crop geometry is another important agronomic factor influencing crop production. Crop geometry refers to the shape of the space available for individual plants. It influences crop yield through its influence on light interception, rooting pattern and moisture extraction pattern. Crop geometry is altered by changing inter and intra-row spacing (Planting pattern). Optimum spacing depends on morphological characteristics of the genotypes as well as sowing time. There is limited information is available in this aspect with respect to newly released high yielding variety of wheat *i.e.* GW 451.

### Materials and Methods

A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardar krushinagar during *rabi* season of the year 2017-18. The soil of experimental field was loamy sand in texture.

Physical properties of soil: Sand- 84%, Silt- 7.55%, Clay- 7.09%. Chemical Properties of soil: Soil PH- 7.53, EC- 0.17 ds/m, OC- 0.21%, Available N- 154.36 (kg/ha), Available P<sub>2</sub>O<sub>5</sub>- 36.60 kg/ha, Available K<sub>2</sub>O- 288.5 kg/ha.

In all 12 treatment combinations consisting of four levels of Sowing time [15<sup>th</sup> November (D<sub>1</sub>), 25<sup>th</sup> November (D<sub>2</sub>), 5<sup>th</sup> December (D<sub>3</sub>) and 15<sup>th</sup> December (D<sub>4</sub>)] and three levels of spacing [Broadcasting (S<sub>1</sub>), 18 cm between two rows (S<sub>2</sub>), 22 cm between two rows (S<sub>3</sub>)] were tested in Strip plot design with four replications. Crop was fertilized as per treatments. Two hand weeding and one interculturing were carried out during the early crop growth stages. Observations related to yield attributes and yield viz., number of earhead per plant, number of grains per earhead grain yield per plant, grain yield and straw yield. Other interactions.

## Results and Discussion

### Effect of sowing time

The results given in table 1 revealed that yield and yield attributes were significantly influenced by sowing time treatment 25<sup>th</sup> November gave significantly higher result in number of ear head per plant, number of grains per ear head grain yield per plant, grain yield and straw yield. This was due to the fact that timely sowing condition of wheat provided better adaptability of weather parameters like, lower gap between minimum and maximum temperature, relative humidity, lower evapotranspiration leading to better availability of soil moisture and nutrients, which in turn favoured to profuse growth in terms of more taller plant and late or very late sowing conditions restricted the growth in terms of shorter plants. The results are in agreement with those reported by Lathwal and Thakral (1999)<sup>[6]</sup>, Zende *et al.* (2005)<sup>[12]</sup>, Man (2010)<sup>[8]</sup> and Jat Lokesh Kumar *et al.* (2013)<sup>[5]</sup>. Further, the results revealed that sowing time treatment. 25<sup>th</sup> November recorded significantly higher number of earhead per plant (9.5), number of grains per earhead (41.0), grain yield per plant (24.0 g), grain yield(4523 kg/ha) and straw yield(7203 kg/ha). The results are in agreement with those reported by Jat *et al.* (2013)<sup>[4]</sup>, Md. Parwaizalam *et al.* (2013)<sup>[8]</sup> and, Aslani and Mehrvar (2012)<sup>[11]</sup>.

### Effect of spacings

The results given in table 1 revealed that yield and yield attributes were significantly influenced by sowing time treatment. 25<sup>th</sup> November gave significantly higher result in number of ear head per plant, number of grains per ear head, grain yield per plant, grain yield and straw yield. This was mainly due to the fact that closour spacing (18 cm × 18 cm) could not compensate the increase in plant population and productive tillers resulting in increase in number of ear head per unit area. The results are in agreement with those reported by Hussain *et al.* (2012)<sup>[3]</sup> and Bhunia *et al.* (2014)<sup>[2]</sup>. Further, the results revealed that spacings treatment 18 cm between two rows recorded significantly higher number of earhead per plant (9.4), number of grains per earhead (41.0), grain yield per plant (23.5 g), grain yield(4632 kg/ha) and straw yield(7014 kg/ha). The results are in agreement with those reported by Hussain *et al.* (2012)<sup>[3]</sup>, Bhunia *et al.* (2014)<sup>[2]</sup>, Ogunlele *et al.* (2000) and Kumar *et al.* (2013)<sup>[5]</sup>.

### Interaction effect

In the case of grain yield and straw yield (Table 1) D × S interaction effect was found to be significant. Interaction effect of sowing time (25<sup>th</sup> November) and spacing (18 cm between two rows) gave higher yield (5291 kg/ha) and straw yield (8649 kg/ha).

### Economics

#### Effect of sowing time

The data on economics of different levels of sowing time are presented in Table 2. Treatment 25<sup>th</sup> November sowing time was found superior by recording the higher values of net realization (₹66007/ha) and benefit: cost ratio (2.85).

#### Effect of spacings

The data on economics of different spacings are presented in Table 2 Treatment 18 cm between two rows was found superior by recording the highest values of net realization (67013 ₹/ha) and benefit: cost ratio (3.01) over other treatments.

**Table 1:** Effect of inorganic fertilizers and foliar spray on yield attributes, yield and quality characters of wheat

| Treatments                                 | Number of ear head per plant | Number of grains per ear head | Grain yield per plant (g/plant) | Grain yield (kg/ha) | Straw yield (kg/ha) |
|--|------------------------------|-------------------------------|---------------------------------|---------------------|---------------------|
| <b>Sowing time (D)</b>                     |                              |                               |                                 |                     |                     |
| D <sub>1</sub> : 15 <sup>th</sup> November | 8.6                          | 39.2                          | 21.1                            | 4336                | 6323                |
| D <sub>2</sub> : 25 <sup>th</sup> November | 9.5                          | 41.0                          | 24.0                            | 4523                | 7203                |
| D <sub>2</sub> : 5 <sup>th</sup> December  | 7.7                          | 34.8                          | 19.5                            | 3962                | 5859                |
| D <sub>2</sub> : 15 <sup>th</sup> December | 7.5                          | 33.2                          | 18.7                            | 3739                | 5609                |
| S.Em.±                                     | 0.4                          | 1.9                           | 0.7                             | 146.6               | 229.7               |
| C.D. at 5%                                 | 1.2                          | 6.0                           | 2.4                             | 469                 | 734                 |
| C. V. (%)                                  | 15.3                         | 13.1                          | 12.3                            | 12.2                | 12.7                |
| <b>Spacings (S)</b>                        |                              |                               |                                 |                     |                     |
| S <sub>1</sub> : Broadcasting              | 7.2                          | 38.0                          | 17.8                            | 3517                | 5351                |
| S <sub>2</sub> : 18 cm between two rows    | 9.4                          | 41.0                          | 23.5                            | 4632                | 7014                |
| S <sub>3</sub> : 22 cm between two rows    | 8.8                          | 40.5                          | 21.1                            | 4271                | 6381                |
| S.Em.±                                     | 0.2                          | 1.5                           | 0.6                             | 110.1               | 184.1               |
| C.D. at 5%                                 | 0.7                          | 5.1                           | 1.9                             | 381                 | 637                 |
| C. V. (%)                                  | 9.4                          | 11.7                          | 10.6                            | 10.6                | 11.7                |
| <b>Interaction (N × F)</b>                 |                              |                               |                                 |                     |                     |
| S.Em.±                                     | 0.5                          | 2.2                           | 0.7                             | 138.1               | 156.1               |
| C.D. at 5%                                 | NS                           | NS                            | NS                              | 410                 | 463                 |
| C.V. (%)                                   | 10.9                         | 8.6                           | 6.7                             | 6.6                 | 5.0                 |

**Table 1 (a):** Interaction effect of sowing time and spacings on grain yield (kg/ha) of wheat

| Treatments                                 | S <sub>1</sub> : Broadcasting | S <sub>2</sub> : 18 cm between two rows | S <sub>3</sub> : 22 cm between two rows |
|--|-------------------------------|---|---|
| D <sub>1</sub> : 15 <sup>th</sup> November | 3582                          | 4988                                    | 4348                                    |
| D <sub>2</sub> : 25 <sup>th</sup> November | 3672                          | 5291                                    | 4741                                    |
| D <sub>3</sub> : 5 <sup>th</sup> December  | 3536                          | 4228                                    | 4077                                    |
| D <sub>4</sub> : 15 <sup>th</sup> December | 3279                          | 4021                                    | 3918                                    |
| S.Em.±                                     | 138.1                         |   |   |
| C.D. at 5%                                 | 410                           |   |   |
| C. V. (%)                                  | 6.6                           |   |   |

**Table 1 (b):** Interaction effect of sowing time and spacings on straw yield (kg/ha) of wheat

| Treatments                                 | S <sub>1</sub> : Broadcasting | S <sub>2</sub> : 18 cm between two rows | S <sub>3</sub> : 22 cm between two rows |
|--|-------------------------------|---|---|
| D <sub>1</sub> : 15 <sup>th</sup> November | 5508                          | 7032                                    | 6429                                    |
| D <sub>2</sub> : 25 <sup>th</sup> November | 5604                          | 8649                                    | 7356                                    |
| D <sub>3</sub> : 5 <sup>th</sup> December  | 5373                          | 6293                                    | 5912                                    |
| D <sub>4</sub> : 15 <sup>th</sup> December | 4918                          | 6081                                    | 5828                                    |
| S.Em.±                                     | 156.1                         |   |   |
| C.D. at 5%                                 | 463                           |   |   |
| C. V. (%)                                  | 5.0                           |   |   |

**Table 2:** Economics of different treatment combinations of spacing and sowing date

| Sr. No. | Treatment Combinations        | Yield (kg/ha) |       | Cost of cultivation (₹/ha) | Gross realization (₹/ha) Total | Net realization (₹/ha) | Benefit : Cost Ratio (BCR) |
|---------|-------------------------------|---------------|-------|----------------------------|--------------------------------|------------------------|----------------------------|
|         |                               | Grain         | Straw |                            |                                |                        |                            |
| 1.      | D <sub>1</sub> S <sub>1</sub> | 3582          | 5508  | 35676                      | 80037                          | 44361                  | 2.24                       |
| 2.      | D <sub>1</sub> S <sub>2</sub> | 4988          | 7032  | 35676                      | 109858                         | 74182                  | 3.08                       |
| 3.      | D <sub>1</sub> S <sub>3</sub> | 4348          | 6429  | 35676                      | 96510                          | 60834                  | 2.71                       |
| 4.      | D <sub>2</sub> S <sub>1</sub> | 3672          | 5604  | 35676                      | 81942                          | 46266                  | 2.30                       |
| 5.      | D <sub>2</sub> S <sub>2</sub> | 5291          | 8649  | 35676                      | 119506                         | 83830                  | 3.35                       |
| 6.      | D <sub>2</sub> S <sub>3</sub> | 4741          | 7356  | 35676                      | 106098                         | 70422                  | 2.97                       |
| 7.      | D <sub>3</sub> S <sub>1</sub> | 3536          | 5373  | 36751                      | 78848                          | 42097                  | 2.15                       |
| 8.      | D <sub>3</sub> S <sub>2</sub> | 4228          | 6393  | 36751                      | 94200                          | 57449                  | 2.56                       |
| 9.      | D <sub>3</sub> S <sub>3</sub> | 4077          | 5912  | 36751                      | 90204                          | 53453                  | 2.45                       |
| 10.     | D <sub>4</sub> S <sub>1</sub> | 3279          | 4918  | 36751                      | 72956                          | 36205                  | 1.99                       |
| 11.     | D <sub>4</sub> S <sub>2</sub> | 4021          | 6081  | 36751                      | 89591                          | 52840                  | 2.44                       |
| 12.     | D <sub>4</sub> S <sub>3</sub> | 3918          | 5828  | 36751                      | 87053                          | 50302                  | 2.37                       |

**Note:** Cost of seed @ ₹18.33/kg.

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