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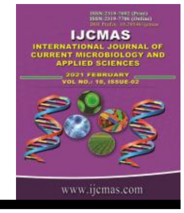


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# Performance of Wheat (*Triticum aestivum* L.) Cultivars under System of Wheat Intensification and Conventional Methods of Sowing

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A field experiment was conducted to determine the study of varieties as influenced by system of planting and spacing on wheat (*Triticum aestivum* L.) during the winter season (*Rabi*) of 2019. The experiment consists of 9 treatments with 3 replications laid out in a randomized block design. Three cultivars and Methods of sowing *i.e.* conventional, SWI at 15×15cm, SWI at 20×20cm at Crop Research Farm, Department of Agronomy, Faculty of Agriculture, SHUATS, Prayagraj (Allahabad). System of wheat intensification significantly influenced the growth parameters, yield attribute characters and yield. The result concluded that the treatment (20×20 cm + SHIATS W6) recorded highest plant height (89.9 cm). Maximum number of tillers (13.1), Maximum plant dry weight (29.17 g), Maximum number of effective tillers/hill (12.2) was recorded with treatment (20×20 cm + PBW343). However, higher grain yield (5.51 t/ha), straw yield (6.41 t/ha) and benefit cost ratio (2.67) recorded with (15×15 cm + SHIATS W6).

## Introduction

Wheat (*Triticum aestivum* L.) is one of the leading food crops of the world farming and occupies significant position among the cultivated cereals.

Wheat ranks first among the world food crops, in terms of cultivated area (223.813 m ha) or production (733.144 m t) and with productivity of (3280 kg/ha) (USDA 2016). In India, Uttar Pradesh state ranks first in both area (9.67 m ha) and production (27.52 m t), but the average productivity is much lower (2846 kg/ha) than Punjab (4307 kg/ha) and Haryana (4213 kg/ha), respectively (DAC, 2011). The wheat yields of western districts of U.P, are well comparable to adjoining Punjab and Haryana, but poor average yield of Eastern U.P, used to bring down the average productivity of the whole state. This clearly indicates that in spite of considerable improvement in genetic potential of the crop productivity of wheat is very poor in the country as well as in the states in light of realized yield level of 45-50 q/ha. SWI and some modified SWI intervention may give 54% more yield than the available best practices (Uphoff *et al.*, 2011).

Appropriate cultivars with proper row spacing is important for maximizing light interception, penetration, distribution in crop canopy and average light utilization efficiency of the leaves in the canopy, and thus affect yield of a crop.

Wider spacing between rows or pairs of rows, not only allow more light to reach the lower leaves at the time of grain formation but also allows easy inter-culture for weed control and inter-cropping (Ayaz *et al.,* 1999).

Hussain *et al.,* (2003) led to the conclusion that wheat grain yield was not reduced to a significant extent by increasing the row spacing and suggested that wider planting geometry technology can be adapted without any risk of reduction in yield, may facilitate inter-tillage devices for effective weed control and inter-cropping in wheat.

The grain yield is a function of interaction between genetic and environmental factors like soil type, sowing time and method, seed rate, fertilizers and time of irrigation. Among these factors proper genotype with appropriate row spacing plays a vital role in getting higher grain yield.

The prevalent system of wheat cultivation requires more chemical fertilizers and nearly100-125 kg of seed per hectare. SWI uses only 20-30kg improved seed per hectare. Row to row and plant to plant spacing of 15 - 20 cm use of manure and organic seed treatment ensure higher yield. Sufficient spacing between the plants and sowing of two seeds at one point facilitates desired moisture, aeration, nutrition and light to the crop roots.

This helps faster growth of plants. Only 2-3 times irrigation and weeding through cono-weeder saves time and expenses on labour. SWI is primarily based on these two principles of crop production first principle of root development and second principle of intensive care (Uphoff *et al.*, 2011).

SHIATS-W6 is Semi dwarf, matures in 115-120 days, high temperature tolerant (35-40$^0$C), tolerant to water logging (7-10days), resistant to- brown rust, leaf-sheath blight and smut, good for limited (2-3) irrigations.

Its grains are bold and amber in colour with 13%proteinandsugar0.57%. Its yield potential under timely sown conditions (45-50q/ha) and under late sown conditions (36- 40q/ha).

## Materials and Methods

The experiment was carried out during *Rabi* season of2019 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.58%), medium in available N (238 Kg/ha), high in available P (32.10 Kg/ha) and low in available K (189 Kg/ha).

The treatment consisted of 3 spacings *viz.* conventional (22 cm), SWI (15×15 cm) and SWI (20×20 cm) and 3 wheat cultivars PBW343, HD2967 and SHIATS W6. There are9treatments each replicated thrice.

The experiment was laid out in Randomized Block Design. It was sown on 6$^{th}$ December 2019.Recommended doses of nitrogen, phosphorus and potassium were applied.

## Results and Discussion

### Growth parameters

### Plant height (cm)

Wheat crop sown at SWI spacing 20×20cm along with variety SHIATS W6 resulted significant increase in plant height (89.9 cm) at 100DAS. Sowing with proper plant density allows for sufficient aeration, moisture, sunlight and nutrient availability, leading to proper root system development from the early stage of crop growth which significantly increases plant height (Abraham *et al.,* 2014).

### Number of tillers per hill

Wheat crop sown at SWI spacing 20×20 cm along with variety PBW-343 resulted significant increase in number of tillers (13.1) at 80DAS (Table 1).

Plant population (number of tillers) was influenced significantly by different planting and spacing.

Plant population increased under SWI techniques with increase in plant spacing from 10×10cm to 15×15 cm, however, the number of tillers per unit area reduced with increasing spacing beyond 15 cm x 15 cm. This was mainly due to the decrease in number of planting hills per unit area (Zheng *et al*., 2013).

### Dry weight (g/plant)

Wheat crop sown at SWI spacing 20×20 cm along with variety PBW-343 resulted significant increase in Dry weight (29.17g) at 100DAS. Total dry weight is attributed by its partitioning into stem, significantly higher dry matter accumulation at 80 DAS and 100 DAS respectively, was observed in 20×20 cm spacing compared to other spacing.

Similar findings have been reported by Puttaswamy and Krishnamurthy (1975). The significant increase of Dry weight was possibly due to emergence of number of new tillers/hill and more fertile spikes/plant (Alam2013).

### Yield attributes

### Number of grains per spike

Yield attributes and yield were significantly affected by System of wheat intensification, wheat crop sown at 20×20 cm along with wheat variety HD-2967 resulted significant increase in number of grains (51.5).Wider spacings facilitated better utilization of resources for plant under SWI techniques. Wider spacings reduced competition between plants for water, nutrient, light and space that lead better growth of plants, yield and yield attributes *i.e.* length of ear head and number of grains per ear head (Table 2).

This was in conformity with the finding of Hussain *et al.,* (2012). Photosynthesis rates of leaves supported more favorable yield attributes i.e. length of ear head, number of grains per ear head, grain filling rate and grain yield in individual hills than in closely-spaced plants. This was in conformity with the finding of (Thakur *et al.*2010).

### Number of effective tillers per hill

The data of Number of Effective tillers per hill was significantly influenced by system of wheat intensification at harvest. At harvest the data recorded (12.2) significantly higher in SWI spacing at 20×20 cm along with PBW-343. The effective tillers per unit area reduced with the increasing spacing which was due to the decrease in number of planting hills per unit area (Zheng *et al.,* 2013).

**Table.1** Effect of System of Wheat Intensification (SWI) and Conventional methods on growth parameters of wheat crop

| Treatment | Plant height (cm) | Number of tillers/hills (80 DAS) | Dry weight (g/plant) | Effective tillers/ hill |
|---|---|---|---|---|
| $T_1$-Conventional sowing (22 cm) + PBW343 | 82.2 | 7.4 | 24.95 | **6.9** |
| $T_2$-Conventional sowing (22 cm) + HD2967 | 81.5 | 7.5 | 25.09 | **7.0** |
| $T_3$-Conventional sowing (22 cm) + SHIATS W6 | 86.1 | 7.3 | 24.71 | **6.7** |
| $T_4$-SWI at 15 × 15 cm + PBW343 | 81.9 | 8.1 | 24.84 | **7.3** |
| $T_5$-SWI at 15 × 15 cm + HD2967 | 84.1 | 9.4 | 25.43 | **8.2** |
| $T_6$-SWI at 15 × 15 cm + SHIATS W6 | 85.1 | 9.2 | 26.91 | **8.4** |
| $T_7$-SWI at 20 × 20 cm + PBW343 | 87.5 | 13.1 | 29.17 | **12.2** |
| $T_8$-SWI at 20 × 20 cm + HD2967 | 85.5 | 9.1 | 28.21 | **8.0** |
| $T_9$-SWI at 20 × 20 cm + SHIATS W6 | 89.9 | 9.6 | 26.69 | **8.4** |
| **F- test** | S | S | S | S |
| **SEm (±)** | 0.79 | 0.19 | 0.42 | **0.24** |
| **CD (P = 0.05)** | **2.36** | **0.57** | **1.27** | **0.72** |

**Table.2** Effect of System of Wheat Intensification (SWI) and Conventional methods on yield attributes of wheat crop

| Treatment | No. of Grains/ Spike | Grain Yield (t/ha) | Straw Yield (t/ha) | B:C ratio |
|---|---|---|---|---|
| $T_1$-Conventional sowing (22 cm) + PBW343 | 43.8 | 3.72 | 5.94 | **1.53** |
| $T_2$-Conventional sowing (22 cm) + HD2967 | 46.0 | 3.84 | 6.03 | **1.60** |
| $T_3$-Conventional sowing (22 cm) + SHIATS W6 | 46.7 | 3.97 | 5.53 | **1.57** |
| $T_4$-SWI at 15 × 15 cm + PBW343 | 48.6 | 4.56 | 6.33 | **2.16** |
| $T_5$-SWI at 15 × 15 cm + HD2967 | 46.8 | 4.99 | 6.10 | **2.40** |
| $T_6$-SWI at 15 × 15 cm + SHIATS W6 | 49.9 | 5.51 | 6.41 | **2.67** |
| $T_7$-SWI at 20 × 20 cm + PBW343 | 50.7 | 3.03 | 4.86 | **1.10** |
| $T_8$-SWI at 20 × 20 cm + HD2967 | 51.5 | 3.19 | 4.42 | **1.17** |
| $T_9$-SWI at 20 × 20 cm + SHIATS W6 | 50.5 | 3.32 | 3.86 | **1.16** |
| **F- test** | S | S | S | |
| **SEm(±)** | 0.72 | 0.10 | 0.09 | |
| **CD (P = 0.05)** | **2.17** | **0.30** | **0.26** | |

## Grain Yield, straw yield and B:C Ratio

Highest grain yield (5.51t/ha), straw yield (6.41t/ha) and benefit cost ratio (2.67) was recorded in wheat crop sown at SWI spacing 15×15 cm along with SHIATS W6 over conventional sowing. Spacing has a high impact on grain yield *i.e.* grain yield of wheat significantly increases from 10×10 cm spacing to 15×15 cm spacing and decreased in 20×20 cm and thereafter, this was mainly due to the fact that wider spacing could not compensate the drastic decrease in plant population and productive tillers resulting in severe decreases in number of ear heads per unit area. This was in conformity with the finding of Jayawardena and Abeysekera (2011). Straw yield decreased when plant spacing increased more than 15cm x 15cm. This was mainly due to the decrease in number of plant population and decrease in tillers number per meter square. This was in conformity with the finding of (Zheng *et al.*2013).

In conclusion, it is inferred from the present investigation that sowing of wheat crop in system of crop intensification method with proper spacing is recommended for receiving higher growth and yield of wheat than in conventional method of sowing, among the varieties SHIATS W6 performed well both in terms of growth and yield than HD-2967 and PBW-343.

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