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Effect of Dry Spells on Growth and Yield of Wheat Under Irrigated Condition

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A B S T R A C T

The experiment was conducted in *Rabi* 2020 at the Instructional cum Research Farm, Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur, Chhattisgarh to study the effect of dry spells on growth and yield of wheat under irrigated condition. The experiment was laid on Randomized Complete Block Design (RBD) with replicated 4 times and involved 5 treatments i.e., T_1 (25 days dry spell at 45 days after sowing), T_2 (20 days dry spell after flower initiation), T_3 (20 days dry spell after 50% flowering), T_4 (Irrigation at 30% moisture in soil) and T_5 (Control) were applied. Dry spells significantly decreased the plant height, panicle length, number of panicles plant^{-1}, test weight, grain yield and harvest index. Maximum reduction of all these parameters were recorded in treatment T_5 (Control). However, there was no significant effect of dry spells on the number of seeds panicle^{-1}. It was concluded that treatment T_4 with irrigation at 30% moisture in soil performed better and gave higher yield.

Introduction

Wheat (*Triticum aestivum* L.) is one of the important cereal crop which is grown worldwide. It is one of the essential staple of around 2.5 billion of the world population (Ramadas *et al.*, 2019). It is positioned second most significant staple food crop in India after rice. During 2019-20 wheat was cultivated in 31.45 million hectares area in India with a production of 107.59 million tonnes and productivity of 3421 kg ha^{-1} (Anonymous, 2020). In Chhattisgarh wheat was cultivated in 103.62 thousand hectares to produce an output of 142.27 metric tonnes and productivity of 1373 kg/ha during 2018-19 (Singh *et al.*, 2019).

Drought, heavy rainfall and extreme temperature are some of the abiotic stresses greatly affecting the growth, development and productivity of wheat crop. Lack of water is viewed as one of the most significant natural factors hindering plant growth and reducing productivity more than any other

environmental factor (Boutraa *et al.,* 2010). Dry spell intervenes with the development, water relations, nutrients, partitioning of assimilates, photosynthesis and eventually cause a remarkable decrease in the yield of crop (Farooq *et al.,* 2009). Improper management of water not only declines the productivity but also increase the insect and disease incidence by creating an environment favourable for their growth (Singh *et al.,* 2011). Severity of water stress and the stage of growth at which it occurs are the main factors determining the effect of water stress on the yield of crop (Rauf *et al.,* 2007). In the view of above consideration, the present experiment was conducted to study the effect of dry spells on growth and yield of wheat under irrigated condition.

Materials and Methods

The experiment was conducted at Instructional cum Research Farm, Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur in *Rabi* 2020.The soil of the experimental site was sandy loam in texture (*Inceptisol*) with neutral pH, low in organic carbon, N and P while medium in K. Variety GW-273 was sown on well prepared seed bed in Randomized Complete Block Design (RBD) with four replications on a gross plot size of 5 m x 4 m. The treatments comprised of five treatments which were T_1: 25 days dry spell at 45 days after sowing, T_2: 20 days dry spell after flower initiation, T_3: 20 days dry spell after 50% flowering, T_4: Irrigation at 30% moisture in soil and T_5: Control (No irrigation after 20 days). 80 kg ha^{-1} seeds were sown on 20th November, 2020 with crop geometry of 20 x 8 cm and the crop was harvested on 3rd March, 2021. The recommended dose of fertilizer @ 120:60:40 N: P: K kg ha^{-1} was applied to the crop. All the data collected on various parameters were subjected to statistical analysis by applying the procedure for Randomized Complete Block Design suggested by Gomez and Gomez (1984).

Results and Discussion

Plant height

Dry spells had significant effect on the plant height at all the growth stages of crop. Higher plant height was attained by irrigation at 30% moisture in soil (T_4) at all stages of growth which was comparable to 20 days dry spell after 50% flowering (T_3) and 20 days dry spell after flower initiation (T_2) respectively. The lowest plant height was observed in control (T_5) at all the growth stages of crop. The height of plants decreased because of lack of nutrients in treatments subjected to dry spells. Similar results were observed by Kilic and Yagbasanlar (2010).

Panicle length (cm)

Longest panicle length was observed in irrigation at 30% moisture in soil (T_4) followed by 20 days dry spell after 50% flowering (T_3), 20 days dry spell after flower initiation (T_2) and 25 days dry spell at 45 days after sowing (T_1). Shortest panicle length was observed in control (T_5). Similar outcomes were obtained Alderfasi (2001) and Shamsi (2010).

Number of panicles $plant^{-1}$

Maximum number of panicles $plant^{-1}$ was noticed in treatment T_4 which was similar to T_3 and T_2. This was because number of panicles $plant^{-1}$ is directly related to the number of irrigations. Least number of panicles $plant^{-1}$ was recorded in treatment T_5. This result is in accordance with Bilal *et al.,* (2015) and Rafiq *et al.,* (2005).

Number of seeds $panicle^{-1}$

Greater number of seeds $panicle^{-1}$ were observed treatment T_4 while treatment T_5 recorded minimum. The number of seeds per panicle might be reduced due to desiccation of the pollen grains leading to improper growth of pollen germination tube to ovary and ovule. The number of seeds per panicle are highly susceptible to moisture stress as reported by Moghaddam *et al.,* (2012) and Al-Tabbal (2011).

Test weight (g)

Lowest 1000 grain weight was observed in treatment T_5 (39.45 g) which might be due to unavailability of

water as well as deficiency of nutrients in the soil which resulted lower 1000 grain weight. On the contrary, treatment T_4 (46.80 g) recorded statistically highest 1000 grain weight which was found similar to treatment T_3 (43.27 g). This was due to continuous supply of water around the root zone which ultimately increased photosynthate translocation towards the grains. Sarwar *et al.*, (2010) and Nouri-Ganbalani *et al.*, (2009) reported the similar findings.

Table.1 Effect of dry spells on plant height, panicle length, number of panicle plant^{-1}, number of seeds panicle^{-1}, test weight, grain yield and harvest index in wheat

Treatments	Plant height (cm)	Panicle length (cm)	Number of panicles plant^{-1}	Number of seeds panicle^{-1}	Test weight (g)	Grain yield (q ha^{-1})	Harvest Index (%)
T_1: 25 days dry spell at 45 days after sowing	79.57	7.75	3.83	25.68	40.62	16.69	38.03
T_2: 20 days dry spell after flower initiation	83.57	7.80	4.35	27.96	42.46	18.25	38.66
T_3: 20 days dry spell after 50% flowering	85.92	7.81	4.57	25.14	43.27	19.51	41.57
T_4: Irrigation at 30% moisture in soil	89.42	8.10	4.60	29.70	46.80	25.75	45.10
T_5: Control (No irrigation after 20 days)	68.97	6.00	3.42	24.25	39.45	14.00	36.37
SEm±	**2.07**	**0.24**	**0.12**	**1.25**	**1.19**	**1.01**	**1.28**
CD (P = 0.05)	**6.46**	**0.76**	**0.37**	**NS**	**3.72**	**3.16**	**3.99**
CV %	**5.09**	**6.52**	**5.73**	**9.41**	**5.61**	**10.78**	**6.41**

Grain yield (q ha^{-1})

The highest grain yield (25.75 q ha^{-1}) was obtained with treatment T_4 (irrigation at 30% moisture in soil). Similar outcomes were reported by Ibrahim *et al.*, (2012) that availability of water at all the critical growth stages of crop which ultimately increases all the yield attributing characters and hence produces higher grain yield. While, minimum grain yield (14 q ha^{-1}) was obtained under treatment T_5 (control) respectively.

This reduction in grain yield might be due to unavailability of adequate moisture at the time of grain filling stage of the crop. Also, the translocation from leaves highly reduces during dry spell which in turn accelerates crop maturation and declines photosynthesis rate and ultimately decreases the grain yield. Khan and Naqvi (2011) reported similar findings in their research.

Harvest index (%)

Maximum value of harvest index (45.10%) was observed in treatment T_4 being statistically comparable to T_3 (41.57%). This was because when there was sufficient availability of moisture greater amount of grain yield and straw yield were obtained as more photosynthates were translocated from source to sink. Contrarily, minimum harvest index was recorded with treatment T_5 (36.37%). The results obtained are in accordance with Idnani and Kumar (2012) and Sarkar *et al.*, (2013).

The dry spells significantly affected different parameters. Treatment T_5 in which no irrigation was given after 20 days produced lowest plant height, number of panicles plant^{-1}, panicle length, number of seeds panicle^{-1}, test weight, grain yield and harvest index. Treatment T_4 with irrigation at 30% moisture in soil had higher yield and performance than others

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