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Effect of dry spells on growth parameters and chlorophyll content of wheat (*Triticum aestivum* L.)

Abhishika Sonal John, Ashwini Kumar Thakur and Narendra Kumar

Abstract
A field experiment about the effect of dry spells on the growth parameters and chlorophyll content of wheat was conducted during *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 parameters and chlorophyll content of wheat. The experiment was laid on Randomized Complete Block Design (RBD), replicated 4 times with 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). Dry spells significantly reduced the plant height, number of tillers per plant, number of leaves as well as the dry matter. Similarly, the content of chlorophyll A and B were significantly reduced during and after imposition of dry spells. Maximum reduction of all the growth parameters as well as chlorophyll content were recorded in treatment T_5 (Control). Hence it was concluded that treatment T_4 with irrigation at 30% moisture in soil performed better than all other treatments.

Keywords: Wheat, dry spells, growth parameters, chlorophyll, irrigation

1. Introduction
Wheat (*Triticum aestivum* L.) is a chief grain crop cultivated all over the world. It is one of the essential staple foods of around 2.5 billion of the world population. It is ranked as the second most important food crop in India after rice (Ramdas *et al*., 2019). This crop is mainly responsible for the green revolution and attenuating the problem of food insecurity in India.
Water is one of the most important factors for the proper growth and development as well as the yield of all crops (Kanwal *et al*., 2020) [4]. One of the major obstacles to the production of wheat is irrigation which puts a huge limit on the per-unit production of wheat (Nowsherwan *et al*., 2018) [10]. Water deficit is considered as one of the most critical natural factors hindering plant growth and reducing productivity more than any other environmental factor (Shao *et al*., 2009) [14]. Dry spell intervenes with the development, water relations, nutrients, partitioning of assimilates, photosynthesis and eventually cause a remarkable decrease in the yield of the crop (Lisar *et al*., 2012) [7]. Improper management of water not only declines productivity but also increases insect and disease incidence by creating an environment favorable for their growth (Singh *et al*., 2011) [16]. Bukhat (2005) [2] reported that lack of water at any stage of crop growth results in decreased biomass, tillering ability, number of grains per ear, and size of grains. Whereas, Nowsherwan (2018) [10] found that water stress distinctly affects different phases of crop growth as certain stages can adapt up very well with water stress while some other are discovered to be more defenseless. The 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 the crop (Rauf *et al.*, 2007) [12]. In view of above issues, the present study was conducted to study the effect of dry spells on growth parameters and chlorophyll content of wheat.

2. Materials and Methods
2.1 Experimental site, soil, and climate
The field experiment was carried out during *Rabi* 2020 at Instructional cum Research Farm of S. G. College of Agriculture and Research Station, Jagdalpur, Chhattisgarh, India. The soil of the study site had a sandy loam texture with neutral pH (6.91), EC (0.026 dS m^{-1}), and less content of OC (0.47%), Also, the soil was deficient in available N (141.8 kg ha^{-1}) and P (9.56 kg ha^{-1}) while high in K (270 kg ha^{-1}). Average annual rainfall of 1665.4 mm was received during 2020-21.

2.2 Experimental design

The experiment was laid out in Randomized Block Design (RBD) with four replications on a gross plot size of 5 m x 4 m. The treatments comprised of 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). Variety GW-273 was sown on 20th November 2020 with a geometry of 20 x 8 cm and the crop was harvested on 3 March 2021. The crop was fertilized with the recommended application dose of 120-60-40 kg ha^{-1} of N-P-K. The data relating to growth parameters and chlorophyll content were collected from five randomly selected plants from each plot.

2.3 Growth parameters

2.3.1 Plant height (cm)

Plant height was measured from the ground surface to the apex of the plant with the help of a meter scale and the average was calculated.

2.3.2 Number of tillers per plant

The number of tillers of five randomly selected plants was counted at an interval of 15 days and the mean was worked out.

2.3.3 Number of leaves per plant

The number of leaves of five randomly selected plants was counted at an interval of 15 days by the visual counting method and its mean was calculated.

2.3.4 Dry matter (g plant^{-1})

Three plants harvested randomly from the outside of the net plot were washed properly to remove any extraneous material and dried in an oven at 60^{0}C until a constant weight was achieved. Subsequently, the dry weight of all the plant samples from each plot was recorded as the total dry weight of the plant.

2.4 Chlorophyll content

The chlorophyll content was estimated by the method suggested by Arnon (1949) and Wellburn and Lichtenthaler (1984) by using the formula:

Chl a (mg g^{-1}) = [12.7 (A663)-2.69 (A645)] x V/1000 x W

Chl b (mg g^{-1}) = [22.9 (A645)-4.68 (A663)] x V/1000 x W

2.5 Statistical analysis

All the data collected on various parameters were subjected to statistical analysis by applying the Randomized Complete Block Design procedure suggested by Gomez and Gomez (1984).

3. Results and Discussion

3.1 Plant height

Plant height is a hereditary feature which is likewise constrained by several ecological components. The data concerning plant height is presented in Table 1. Dry spells had a significant effect on the plant height at all the growth stages of the crop. Higher plant height was attained by irrigation at 30% moisture in the soil (T_4) at all stages of growth but it 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 the crop. The height of plants decreased due to a lack of nutrients in treatments subjected to dry spells. Similar results were observed by Khayatnezdah *et al*. (2010) [19].

3.2 Number of tillers per plant

The data relating to the number of tillers plant^{-1} as influenced by dry spells are presented in Table 1. Among all the treatments, irrigation at 30% moisture in soil (T_4) produced significantly higher number of tillers per plant throughout the crop growth period which was found significantly on par with 20 days dry spell after 50% flowering (T_3). The minimum number of tillers per plant was produced in control (T_5) during all the growth stages. The increment in the number of tillers might be due to adequate accessibility of water throughout the crop growth period especially at tillering stage along with greater nutrient uptake and increased photosynthetic activity. The number of tillers is directly related to the number of irrigations applied. These results are in accordance with the findings of McDonald (1984) [8] and Sharif (1999) [15].

3.3 Number of leaves per plant

The number of leaves per plant as affected by different treatments has been presented in Table 1. A significantly higher number of leaves were observed in irrigation at 30% moisture in soil (T_4) than the remaining treatments which was found on par with 20 days dry spell after 50% flowering (T_3). This might be due to the fact that healthy plants produced higher number of green leaves. On the other hand, the minimum number of leaves was counted in control (T_5). Similar findings are reported by Kriedemann and Barrs (1981) [6].

3.4 Dry matter (g plant^{-1})

The data regarding the accumulation of dry matter have been presented in Fig. 1. The highest dry matter accumulation was recorded under treatment T_4 (Irrigation at 30% moisture in soil) throughout the growth period which was found statistically at par with T_3 (20 days dry spell after 50% flowering) and T_2 (20 days dry spell after flower initiation). This was because of the sufficient availability of moisture required by the crops. Minimum dry matter accumulation was noted under T_5 (Control) throughout the growth period. This might be due to a reduction in the number of leaves, leaf area index and lack of adequate water at the important growth stages which led to a reduction in photosynthetic activity and ultimately reduced the accumulation of dry matter. These findings are concomitant with the outcomes of Wajid *et al*. (2011) [17] and Naserian *et al*. (2007) [9].

Table 1: Effect of dry spells on plant height, number of tillers per plant and number of leaves per plant

Treatments	Plant height	Number of tillers per plant	Number of leaves per plant
T_1: 25 days dry spell at 45 days after sowing	79.57	7.75	3.83
T_2: 20 days dry spell after flower initiation	83.57	7.80	4.35
T_3: 20 days dry spell after 50% flowering	85.92	7.81	4.57
T_4: Irrigation at 30% moisture in soil	89.42	8.10	4.60
T_5: Control (No irrigation after 20 days)	68.97	6.00	3.42
S.Em±	2.07	0.24	0.12
CD (P = 0.05)	6.46	0.76	0.37
CV %	5.09	6.52	5.73

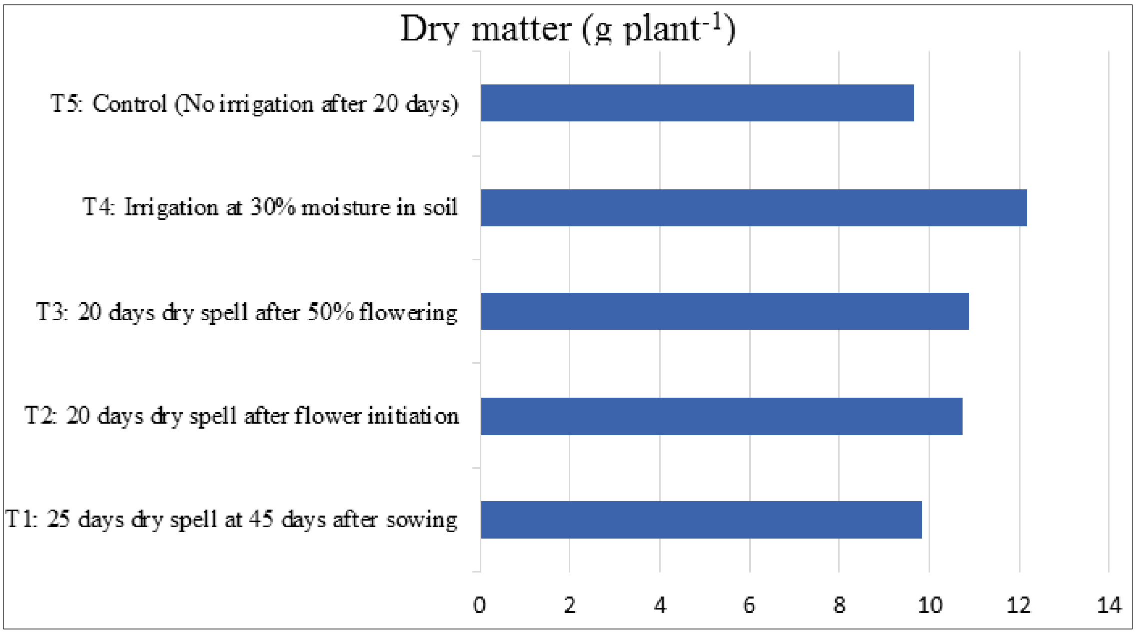

Fig 1: Effect of dry spells on the dry matter

3.5 Chlorophyll content

Chlorophyll is one of the significant chloroplast segments for photosynthesis and chlorophyll content is a measure of the activity of photosynthesis and its strength for the conjugation of biosynthesis of assimilates**.** Data in Table 2 reveals the effect of dry spells on the chlorophyll content of the crop. The data clearly shows that there was a significant effect of the different treatments on chlorophyll content. The values of chlorophyll *A* and *B* were more during the dry spell and reduced significantly after the dry spell. The least chlorophyll *A* and *B* value were computed in control (T_5) both during dry spell and after dry spell. The reason behind this is extreme dry spells repress the photosynthesis in plants by altering the content of chlorophyll and destroying the photosynthetic apparatus which ultimately decreases the total chlorophyll content in plants. Also, chlorophyll in plants starts deteriorating when they are exposed to dry spells. Significantly higher chlorophyll *A* content was computed in irrigation at 30% moisture (T_4) which was superior over remaining treatments however it was on par with 20 days dry spell after 50% flowering (T_3) during and after imposition of dry spell. A comparable pattern was noticed in chlorophyll *B* as well. This might be due to the availability of adequate moisture at all basic development stages served in solubilizing the available nutrients present in soil which thereby increased several metabolic processes and consequently increased the chlorophyll content in leaves. Also, a greater reduction in chlorophyll *B* was noted under all the treatments than chlorophyll *A* both during and after the dry spell. These results are in accordance with the findings of Sairam *et al.* (1998) [13] and Wajid *et al.* (2011) [17].

Table 2: Effect of dry spells on chlorophyll content during and after dry spell in wheat

	Treatments	Chlorophyll A		Chlorophyll B	
		During dry spell	After dry spell	During dry spell	After dry spell
T1	25 days dry spell at 45 days after sowing	2.65	0.83	0.32	0.18
T2	20 days dry spell after flower initiation	2.77	0.65	0.35	0.21
T3	20 days dry spell after 50% flowering	2.95	0.88	0.38	0.23
T4	Irrigation at 30% moisture in soil	3.35	0.97	0.40	0.25
T5	Control (No irrigation after 20 days)	1.88	0.64	0.28	0.16
S.Em±		0.17	0.03	0.01	0.01
CD (P = 0.05)		0.53	0.10	0.03	0.02
CV %		12.47	7.87	5.53	6.27

4. Conclusions
Results showed that dry spells caused a significant reduction in the growth parameters like plant height, number of tillers per plant, number of leaves per plant, dry matter as well as chlorophyll content of the crop. Hence, it's quite evident that dry spells seriously hinder the growth of wheat and also bring a drastic reduction in the chlorophyll content of the crop.

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6. References
1. Arnon DI. Copper enzymes in isolated chloroplasts. Polyphenoloxidase in Beta vulgaris. Plant Physiology. 1949;24(1):1.
2. Bukhat NM. Studies in yield and yield associated traits of wheat (*Triticum aestivum* L.) genotypes under drought conditions. M.Sc. Thesis, Sindh Agriculture University, Tandojam, Pakistan. 2005.
3. Gomez KA, Gomez AA. Statistical procedures for Agricultural Research. International Rice Research Institute, John Wiley and Sons, New York, 1984, 139-240.
4. Kanwal T, Maryam H, Ahmad R, Ahmad S, Ali A, Hussain B, *et al*. Effect of irrigation regimes on growth and yield of wheat (*Triticum aestivum* L.); economic analysis. International Research Journal of Advanced Science. 2020;1(2):53-59.
5. Khayatnezhad M, Zaefizadeh M, Gholamain R. Study of drought tolerance of durum wheat genotypes under water stress conditions. Plant Ecophysiology. 2010;2:187-192.
6. Kriedemann PE, Barrs HD. Water deficits and plant growth. Academic Press, New York, 1981, 325-416.
7. Lisar SYS, Motafakkerazad R, Rahman IMM. Water stress in plants: causes, effects and responses. Water Stress. 2012, 1-14.
8. McDonald GK, Sutton BG, Ellison FW. The effect of sowing date, irrigation and cultivar on the growth and yield of wheat in the Namoi River Valley, New South Wales. Irrigation Science. 1984;5(2):123-135.
9. Naserian B, Asadi AA, Rahimi M, Aradkani MR. Evaluation of wheat cultivar and mutants for morphological and yield trait and comparing of yield components under irrigated and rainfed conditions. Asian Journal of Plant Sciences. 2007;6(2):214-224.
10. Nowsherwan I, Shabbir G, Mallik SI, Ilyas M, Iqbal MS, Musa M. Effect of drought stress on different physiological traits in bread wheat. SAARC Journal of Agriculture. 2018;16(1):1-6.
11. Ramadas S, Kumar TM, Singh GP. Wheat production in India: trends and prospects. Recent Advances in Grain Crops Research, 2019, 1-16.
12. Rauf M, Munir M, Ul- Hassan M, Ahmed M, Afzai M. Performance of wheat genotypes under osmotic stress at germination and early seedling growth stage. African Journal of Biotechnology. 2007;8:971-975.
13. Sairam RK, Shukla DS, Saxena DC. Stress induced injury and antioxidant enzymes in relation to drought tolerance in wheat genotypes. Biologia Plantarum. 1998;40:357-364.
14. Shao HB, Chu LY, Jaleel CA, Manivannan O, Panneerselvan R, Shao MA. Understanding water deficit induced changes in the basic metabolism of higher plants- biotechnologically and sustainably improving agriculture and the eco environment in arid regions of globe. Critical Reviews in Biotechnology. 2009;29:131-151.
15. Sharif M. Effect of irrigation at different growth stages on growth and yield performance of wheat cultivars. M.Sc. Agri. Thesis, Univ. Agri, Faisalabad, 1999.
16. Singh A, Singh D, Kang JS and Agrawal N. Management practices to mitigate the impact of high temperature in wheat: a review. IIOAB J. 2011;2(7):11-22.
17. Wajid AJ, Baloch MJ, Kumbhar MB, Khan NU, Kerio MI. Effect of water stress on physiological and yield parameters at anthesis stage in elite spring wheat cultivars. Sarhad Journal of Agriculture. 2011;27(1):59-65.
18. Wellburn AR, Lichtenthaler H. Formulae and program to determine total carotenoids and chlorophylls A and B of leaf extracts in different solvents. Advances in Photosynthesis Research, 1984, 9-12.
19. Similar results were observed by Inamullah *et al.* (1999), Kilic and Yagbasanlar (2010) and Khayatnezdah *et al*. 2010).