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Effect of irrigation and weed management on growth and yield of wheat (*Triticum aestivum*)

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Abstract

The experiment was done at the Crop Research Farm at Dev Bhoomi Uttarakhand University Dehradun, Uttarakhand, India. The farm is above 410 meters above sea level and is situated at 30.3841ºN latitude and 77.9326º E longitude. Split plot design was used to test twelve different combination of irrigation and weed management, as well as different herbicide doses and hand weeding. The results showed that irrigation and weed management had a significant effect on plant height, no. of tillers, dry weight, leaf area index, crop growth rate, relative growth rate and yield attributes such as no. of effective tillers, no. of grains/ear, test weight, harvest index. I_3 (CRI + Tillering + booting + ear emergence + grain filling) and W_2 (2 handweeding at 25 and 45 DAS) are best for weed management, growth and yield. Both of the treatment I_2 (CRI + Tillering + Booting + Grain filling) and W_3 (Sulfosulfuron @ 25 g/hac) did about well, which shows that the right use of herbicide and irrigation can effectively control weeds and increase wheat yield.

Keywords: Wheat, irrigation, growth, weed management and yield

Introduction

Wheat, the most important grain for the world's population, is crucial for national food security. Globally, about 23.7 million hectares of wheat are cultivated each year, making it the most cultivated cereal. In 1960-1961, India produced 11.0 million tons of wheat; In 2011-2012, this amount jumped to 93.9 million tons. Wheat grain contains starch (60-68%), protein (6-21%), fat (1.5-2.0%), cellulose (2.0-2.5%), minerals (1.8%) and vitamins (Das, 2008) [4]. About one-third of the damage caused by pests is caused by weeds, which are thought to be the most damaging to agricultural productivity. One of the most important factors affecting agricultural productivity is weeds. Weeds make harvesting difficult and reduce yield. *Phalaris minor* is one of the very serious weeds in wheat production in this cropping system and sometime almost 100 percent crop losses have been reported (Singh and Singh 2002) [13]. Fertilizer, irrigation, and the use of short-growing, high-yielding varieties increased wheat production more than eightfold. If we want to restore soil productivity and improve crop health, we need nutrient management that uses both organic and inorganic nutrients. One of the biggest problems in growing wheat, a staple human crop, in arid and semi-arid regions of the world is water scarcity. Six to eight irrigations at a depth of four to seven centimeters are often required to meet the water requirements of semi-dwarf wheat varieties. The lack of irrigation water during critical stages of the wheat growing season forced scientists to work on the problem and find a solution to stabilize profitable wheat production with limited irrigation.

Materials and Methods

The experiment was carried out in Crop Research Farm at Dev Bhoomi Uttarakhand University Dehradun, Uttarakhand, India. The university research farm is located near Dehradun in the state of Uttarakhand. Its coordinates are around 30.3841ºN latitude and 77.9326º E longitude. The location of the site is 410 meters above mean sea level. Dehradun's subtropical climate makes it an ideal and yield of wheat. Comprises of twelve treatments T_1 CRI + Booting + grain filling + Control (No weeding), T_2 Crown root initiation + Booting + Grain filling + 2 handweeding at 25 and 45 DAS, T_3 Crown root initiation + Booting + Grain filling + Sulfosulfuron @ 25 g/ hac, T_4Crown root initiation + Booting + Grain filling + Metasulfuron @ 4 g/hac as pre-emergence, T_5 CRI + Tillering + Booting + Grain filling + Control (No weeding), T_6 CRI + Tillering + Booting + Grain filling + 2 handweeding at 25 and 45 DAS, T_7 CRI + Tillering + Booting + Grain filling + Sulfosulfuron @ 25 g/hac, T_8 CRI + Tillering + Booting + Grain filling + Metasulfuron @ 4 g/hac as pre-emergence, T_9 CRI + Tillering + booting + ear emergence + grain filling + Control(No weeding), T_{10} CRI + Tillering + booting + ear emergence + grain filling + 2 handweeding at 25 and 45

DAS, T_{11} CRI + Tillering + booting + ear emergence + grain filling + Sulfosulfuron @ 25 g/ hac, T_{12} CRI + Tillering + booting + ear emergence + grain filling + Metasulfuron @ 4 g/hac as pre-emergence

Results and Discussion

1. Growth and growth analytical parameters

The close examination of mean data revealed that irrigation practices and weed management were significantly affected and maximum growth attributes viz. Plant height, No. of tillers, Dry weight was recorded I_3 (CRI + Tillering + booting + ear emergence + grain filling) and W_3 (sulfofulfuron @ 25 g/ hac)

Among the different growth analytical characters viz. Crop growth rate, Relative growth rate, Leaf area index were significantly influenced by irrigation practices and weed management. Maximum growth analytical characters were recorded by I_3 (CRI + Tillering + booting + ear emergence + grain filling) and W_2 (2 handweeding at 25 and 45 DAS).
However, analysis of the data was also revealed that I_2 (CRI + Tilllering + booting + Grain filling) at par with I_3 (CRI + Tilllering + booting + ear emergence + Grain filling) However, analysis of the data revealed that W_3 (Sulfosulfuron @ 25 g/hac) was found to be at par with W_2 (2 handweeding 25 and 45 DAS).

Table 1: Effect of different irrigation and weed management on weed dynamic growth and yield of on Pre-harvest of wheat (*Triticum aestivum*)

Treatment	Plant height	Dry weight	No. of tillers	CGR	RGR	LAI
Irrigation level						
I_1 CRI + Booting + Grain filling	53.68	12.17	21.14	19.21	0.06	2.05
I_2CRI + Tillering + Booting + Grain filling	57.47	13.06	22.08	21.63	0.19	2.20
I_3CRI + Tillering + booting + ear emergence + grain filling	59.71	13.57	24.39	23.43	0.35	2.28
SEd (±)	1.15	0.26	0.23	1.17	0.16	0.04
CD (P= 0.05)	2.39	0.54	0.48	2.42	0.24	0.09
Weed management						
W_1 Control (No weeding)	54.83	12.55	18.07	18.68	0.04	2.10
W_2 2 handweeding	59.60	14.17	23.52	21.39	0.54	2.63
W_3 Sulfosulfuron @ 25 g/ hac	57.96	13.55	22.01	20.81	0.48	2.50
W_4 Metasulfuron @ 4 g/hac	55.42	12.46	20.22	19.81	0.40	2.45
SEd (±)	1.33	0.30	0.27	0.89	0.24	0.05
CD (P= 0.05)	2.75	0.63	0.55	0.95	0.29	0.11

2. Yield attributes and yield

The close examination of mean data revealed that irrigation practices and weed management were significantly affected and maximum yield attributes and yield viz. No. of effective tillers, No. of grains, test weight was recorded I_3 (CRI + Tillering + booting + ear emergence + grain filling) and W_2 (2 handweeding 25 and 45 DAS).
Among the different growth analytical characters viz. Crop growth rate, Relative growth rate, Leaf area index were significantly influenced by irrigation practices and weed management. Maximum growth analytical characters were recorded by I_3 (CRI + Tillering + booting + ear emergence + grain filling) and W_2 (2 handweeding 25 and 45 DAS).
However, analysis of the data was also revealed that I2 (CRI + Tilllering + booting + Grain filling) at par with I_3 (CRI + Tilllering + booting + ear emergence + Grain filling).However, analysis of the data revealed that W_3 (Sulfosulfuron @ 25 g/hac) was found to be at par with W_2 (2 handweeding 25 and 45 DAS).

Table 2: Effect of different irrigation and weed management on weed dynamic growth and yield of on Post-harvest of wheat (*Triticum aestivum*)

Treatment	No. of effective tillers	No. of grains/ear	Test weight	Grain yield	Straw yield	Harvest index
Irrigation level						
I_1 CRI + Booting + Grain filling	297.17	20.97	39.38	8.30	20.69	31.22
I_2CRI + Tillering + Booting + Grain filling	302.50	25.89	42.06	10.78	23.56	36.34
I_3CRI + Tillering + booting + ear emergence + grain filling	306.00	28.81	45.87	13.53	27.67	37.77
SEd (±)	1.55	0.38	0.31	0.09	0.43	0.10
CD (P= 0.05)	3.21	0.79	42.33	0.18	0.89	0.21
Weed management						
W_1 Control (No weeding)	295.30	20.96	36.33	6.39	22.15	31.31
W_2 2 handweeding	315.40	27.19	43.25	11.57	24.34	37.43
W_3 Sulfosulfuron @ 25 g/ hac	301.45	26.02	41.30	10.78	23.75	36.81
W_4 Metasulfuron @ 4 g/hac	398.40	25.93	40.57	9.40	23.52	35.41
SEd (±)	0.01	0.01	0.02	0.03	0.01	0.01
CD (P= 0.05)	0.02	0.02	0.03	0.06	0.02	0.02

Conclusion

The study performed at the Crop Research Farm of Dev Bhoomi Uttarakhand University in Dehradun, Uttarakhand, effectively demonstrated the significant impact of irrigation and weed management on wheat growth, weed dynamics and yield. It was found that 5 irrigation and application of sulfofulfuron 25 g/hac worked best when using in the Randomized Block Design (RBD). Plant height, dry weight, crop growth rate, leaf area index, relative growth rate, no. of effective tillers, no. of grains/ear, straw yield, grain yield, harvest index, biological yield were all better with these treatments. Additionally, the herbicide treatments with (metasulfuron 4 g/hac as pre emergence) was found to be comparable to sulfosulfuron. Overall, the results emphasize the importance of selecting suitable irrigation and weed management to improve wheat productivity and reduce weed interference.

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