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Response of nitrogen scheduling and weed management on growth and yield attributes of wheat (*Triticum aestivum* L.)

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ABSTRACT

A field experiment was conducted to study response of nitrogen scheduling and weed management on growth and yield attributes of wheat (*Triticum aestivum* L.) at the Experimental Farm, Mata Gujri College, Shri Fatehgarh Sahib during *Rabi* season of year 2018-2020. The experiment laid out in Split Plot Design (SPD) with three replications. The nitrogen scheduling includes N_1 -½ Basal + ¼ at 4WAS + ¼ at 8 WAS, N_2 -⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS, N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS while weed management treatment were W_2 -clodinafop @ 60 g/ha, W_3 -sulfosulfuron @ 25 g/ha, W_4-carfentrazone @ 20g/ha along with weed free and weedy check. The results revealed that the maximum growth and yield attributes were recorded of N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS which was at par N_2 -⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS and found significantly superior over N_1-½ Basal + ¼ at 4WAS + ¼ at 8 WAS.N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS + W_3 -sulfosulfuron @ 25 g/ha recorded significantly maximum which was significantly superior over all the treatments.

Introduction

Wheat (*Triticum aestivum* L.) is one of the major cereal crop and most important staple food in the world. It provides more protein than any other cereals crop. Wheat has a relatively high content of niacin and thiamine. It has higher food value over rice is that it contains 12% protein, 1.72% fat, 69.60% carbohydrates and 27.20% minerals matter (BARI, 1997). The insufficient fertilizer application, weed management and crop management are limiting factor for both growth and yield attributes. Consequently, to get more crop production, nitrogen application is indispensable and unavoidable (Massignam *et al.,* 2009). Nitrogen is vital constituent of protein, enzymes, coenzymes, nucleic acid and chlorophyll. Chlorophyll is primary observer of sunlight for photosynthesis (Leghari, 2016). The nitrogen availability has been reduced due to leaching, volatilization, surface runoff and denitrification (Gehl *et al.,* 2005). Fertilizer would not be taken by the plants if it is applied at wrong time or in the wrong place. Therefore, there is need to improve N use efficiency through maximizing N uptake at critical growth stages. So, the split application of nitrogen makes the nitrogen availability to the crop and increase the nitrogen use efficiency resulted growth and yield attributes also increase (Kumar *et al*., 2022). Nitrogen Scheduling not only increase the crop growth but also decrease the weed density and biomass (Kim *et al.,* 2006). Split application nutrients mostly taken by the crop than weeds. Application of sulfosulfuron + metsulfuron (POE) @ 30+2g a.i./ha were found most effective control of the all types of weeds than the rest of the

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treatments and improving growth and yield of wheat (Singh *et al.,*2020). Punia *et al*., 2018, reported that the higher crop yield and weed control were observed with application of carfentrazone 20 g/ha compared to carfentrazone 10 g/ha. A suitable combination of herbicides with nitrogen scheduling is to make out the effect on growth and yield of wheat (Singh *et al.,* 2015). Information of herbicide and split application of nitrogen in wheat is necessary to maximize yield and improve nitrogen use efficiency. Moreover, different N rates and application timings suggested that the application of 140 kg N ha^{-1} with triple splits timings, i.e., 25% at the sowing, 50% at the tillering, and 25% at the booting stage of the crop, resulted in the maximum yield and N recovery for different commercial wheat varieties (Khan *et al*., 2022).

Material and Methods

A field experiment was conducted at the Experimental Farm, Mata Gujri College, Fatehgarh Sahib during *Rabi* season of year 2018-2020. The experiment laid out in split plot design with three replications. The nitrogen scheduling was subjected to main plot, viz. N_1- ½ Basal + ¼ at 4WAS + ¼ at 8 WAS, N_2- ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS, N_3- ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS while, weed management was kept in sub plots, viz. W_0- weedy check, W_1-weed free, W_2- clodinafop @ 60 g/ha, W_3-sulfosulfuron @ 25 g/ha and W_4- carfentrazone @ 20 g/ha. The total treatment combinations were fifteen. The town lies between at 76^0-22'E and 76^0-46'E longitude and 30^0-36'N and 30^0-39'N latitude. The soil of experimental field was Gangetic alluvial having clay loam texture with pH 7.1. It was moderately fertile, with available nitrogen (392 kg N/ha), available phosphorus (18.31 kg P_2O_5/ha), available potassium (168.5 kg K_2O/ha), organic carbon (0.69 %) and electrical conductivity (0.57 dS/m). A uniform dose of 120 kg N/ha, 60 kg P_2O_5/ha, 40 kg K_2O/ha was applied to all treatments. Nitrogen was applied as per treatments and full dose of P and K was applied as basal at the time of sowing. Source of N, P and K were urea, single super phosphate and muriate of potash, respectively. The sowing of wheat variety "PBW 725" was sown in the experimental field on 10^{th} November 2018 as well as 11^{th} November 2019. The wheat crop was sown manually using seed rate 100 kg/ha at row to row distance of 22.5 cm. The first and second irrigation was applied after 21 days of sowing at CRI stage and at milking stage, respectively. Some shower of rains also occurs in the month of January, February, March and April. Regular biometric observations were recorded at periodic intervals of 30, 60, 90 DAS and at harvest stage viz., plant height was recorded from the ground level to the base of last fully opened leaf, the groundmass of plant to a length of running meter harvested from the border row then sun dried and oven dried at 60 ± 2 ^{0}C till a constant weight was obtained. After weighing the material, the dry matter of plant was recorded and leaf area index was measured by using assimilatory surface area occupied by the plants with the help of leaf area meter. Yield parameters were observed just before the harvesting of crop. The grain yield and straw yield of each plot was recorded and converted in hectare. The data obtained on various parameters were tabulated and subjected to analysis of variance techniques as described by Cochran and Cox, (1957).

Results and Discussion

The growth parameters of plant were significantly influenced by nitrogen scheduling and weed management practices. Among nitrogen scheduling, the maximum plant height (Table-1), number of tillers (Table-2), leaf area (Table-3) and dry matter accumulation (Table-4) was recorded with application of N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS which was at par N_2-⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS and found significantly superior over N_1 -½ Basal + ¼ at 4WAS + ¼ at 8 WAS at all growth stages of crop except 30, 60 DAS. This could be split application of nitrogen helps in more availability of nitrogen which might have encouraged high protein synthesis means more chlorophyll content leading to higher photosynthesis which increased growth parameters. Nitrogen split improved wheat growth and its competitive ability against weeds. Initially weed germination was increased by N use at sowing date. The minimum values were recorded under N_1-½ Basal + ¼ at 4WAS + ¼ at 8 WAS due to low nitrogen availability at the later stages because of nitrogen losses through leaching, denitrification and volatilization etc which was applied as basal application. Kaur & Kumar (2018) reported similar finding and they reported the maximum growth attributes were recorded with the application of ZT +. N@125 kg (4 splits) applied at ¼, ¼, ¼ and ¼ at basal, 4, 6 and 8 WAS gave the best result in the terms of growth character which was statistically at par to the application of ZT + N@125 kg (4 splits) applied at ¼, ¼, ¼ and ¼ at basal, 4, 6 and 8 WAS and it was significantly superior over rest of treatments. However at 30 and 60 DAS, the maximum plant height (Table-1), number of tillers (Table-2), leaf area (Table-3) and dry matter accumulation (Table-4) was recorded with the nitrogen scheduling as N_1 -½ Basal + ¼ at 4WAS + ¼ at 8 WAS which was at par with N_2 -⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS. It due to higher doses of nitrogen were applied as basal which contributes more nitrogen available to crop.

Table 1: Effect of nitrogen scheduling and weed management on plant height (cm) at different growth stages of wheat crop

Treatments	30 DAS		60 DAS		90 DAS		At Harvest	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
MAIN PLOT (Nitrogen Scheduling)								
N_1= nitrogen scheduling as ½ Basal + ¼ at 4WAS + ¼ at 8 WAS	17.28	18.10	36.61	36.14	77.31	77.89	78.79	78.58
N_2= nitrogen scheduling as ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS	15.70	16.44	33.37	33.02	83.99	85.41	84.25	84.03
N_3= nitrogen scheduling as ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS	15.17	15.96	35.36	35.46	91.97	91.42	93.05	92.82
SEm±	0.41	0.43	0.59	0.59	2.06	1.70	2.10	2.18
CD 5 %	1.63	1.67	2.31	2.31	8.08	6.67	8.24	8.55
SUB PLOT (Weed Management)								
W_0= Weedy check	13.86	14.42	27.60	29.04	68.90	69.66	67.04	70.37
W_1= Weed free	18.44	19.26	39.45	40.06	92.77	95.80	93.19	96.98
W_2= Clodinafop@60g/ha	14.64	17.00	33.98	32.94	81.18	82.99	83.98	82.17
W_3= Sulfosulfuron@25g/ha	15.87	17.96	38.36	36.65	92.00	88.59	92.00	88.66
W_4= Carfentrazone@20g/ha	17.45	15.51	36.18	35.68	87.26	87.48	90.61	87.55
SEm±	0.43	0.59	0.96	0.87	2.40	1.84	2.31	2.00
C`D 5 %	1.26	1.71	2.80	2.55	7.00	5.38	6.76	5.83
N×W	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Effect of nitrogen scheduling and weed management on number of tillers (in running meter) at 30, 60, 90 DAS and at harvest stage

Treatments	30 DAS		60 DAS		90 DAS		At Harvest	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
MAIN PLOT (Nitrogen Scheduling)								
N_1= nitrogen scheduling as ½ Basal + ¼ at 4WAS + ¼ at 8 WAS	72.60	83.63	99.60	100.80	113.20	115.80	104.60	110.20
N_2= nitrogen scheduling as ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS	66.20	74.52	82.80	84.40	127.20	134.80	114.80	129.40
N_3= nitrogen scheduling as ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS	59.40	68.87	87.40	89.60	141.20	149.40	132.00	143.60
SEm±	2.27	2.59	3.27	3.06	4.65	4.44	4.90	4.63
CD 5 %	8.90	10.18	12.84	12.03	18.26	17.43	19.26	18.18
SUB PLOT (Weed Management)								
W_0= Weedy check	55.00	63.43	54.33	56.00	66.00	73.33	54.67	68.67
W_1= Weed free	75.00	86.96	118.33	113.67	180.33	195.00	174.00	186.00
W_2= Clodinafop@60g/ha	61.00	70.72	74.00	80.33	107.00	113.33	94.33	109.33
W_3= Sulfosulfuron@25g/ha	70.67	79.87	104.33	107.33	149.67	149.00	136.33	143.33
W_4= Carfentrazone@20g/ha	68.67	77.39	98.67	100.67	133.00	136.00	126.33	131.33
SEm±	3.75	4.69	5.12	4.42	6.35	6.78	5.85	6.58
CD 5 %	10.94	13.70	14.95	12.90	18.55	19.79	17.07	19.19
N×W	NS	NS	NS	NS	NS	NS	NS	NS

***SEm± - Standard error mean *CD- Critical difference *N×W- Interaction between nitrogen scheduling and weed management *NS- Non significant**

Table 3: Effect of nitrogen scheduling and weed management on leaf area index at 30, 60 and 90 DAS

Treatments	30 DAS		60 DAS		90 DAS	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
MAIN PLOT (Nitrogen Scheduling)						
N_1= nitrogen scheduling as ½ Basal + ¼ at 4WAS + ¼ at 8 WAS	0.69	0.71	4.14	4.83	3.53	3.76
N_2= nitrogen scheduling as ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS	0.64	0.66	2.35	3.45	4.36	4.68
N_3= nitrogen scheduling as ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS	0.58	0.63	3.16	4.41	5.34	5.73
SEm±	0.02	0.02	0.29	0.14	0.29	0.34
CD 5 %	0.08	0.06	1.13	0.55	1.12	1.34
SUB PLOT (Weed Management)						
W_0= Weedy check	0.29	0.32	1.66	1.57	2.81	3.16
W_1= Weed free	0.87	0.88	4.63	5.79	5.83	6.64
W_2= Clodinafop@60g/ha	0.57	0.76	2.77	3.39	3.97	3.85
W_3= Sulfosulfuron@25g/ha	0.71	0.81	3.67	5.41	4.87	5.52
W_4= Carfentrazone@20g/ha	0.76	0.55	3.36	4.98	4.56	4.44
SEm±	0.02	0.03	0.25	0.25	0.25	0.47
CD 5 %	0.06	0.08	0.74	0.73	0.74	1.36
N×W	NS	NS	NS	NS	NS	NS

Table 4: Effect of nitrogen scheduling and weed management on dry matter accumulation (g/running meter) at 30, 60, 90 DAS and at harvest stage

Treatments	30 DAS		60 DAS		90 DAS		At Harvest	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
MAIN PLOT (Nitrogen Scheduling)								
N_1= nitrogen scheduling as ½ Basal + ¼ at 4WAS + ¼ at 8 WAS	2.97	3.08	33.38	36.25	289.60	293.47	724.00	739.63
N_2= nitrogen scheduling as ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS	2.74	2.83	25.38	29.93	309.33	321.80	773.33	786.40
N_3= nitrogen scheduling as ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS	2.09	2.14	31.77	34.40	330.13	336.90	825.33	836.32
SEm±	0.06	0.11	0.58	1.11	5.73	5.73	14.32	13.50
CD 5 %	0.23	0.43	2.29	4.36	22.49	22.51	56.22	53.00
SUB PLOT (Weed Management)								
W_0= Weedy check	1.23	1.24	19.42	25.80	238.22	260.01	595.56	623.56
W_1= Weed free	3.11	3.22	37.79	39.46	352.00	353.99	880.00	890.40
W_2= Clodinafop@60g/ha	2.80	2.91	27.63	30.05	297.33	305.49	743.33	749.07
$4W_3$= Sulfosulfuron@25g/ha	2.91	3.04	34.59	37.09	338.67	339.87	846.67	854.67
W_4= Carfentrazone@20g/ha	2.95	3.02	31.45	35.24	322.22	327.60	805.56	819.56
SEm±	0.14	0.12	1.97	2.04	6.65	6.82	16.61	18.22
CD 5 %	0.42	0.35	5.75	5.95	19.40	19.92	48.49	53.18
N×W	NS	NS	NS	NS	NS	NS	NS	NS

***SEm± - Standard error mean *CD- Critical difference *N×W- Interaction between nitrogen scheduling and weed management *NS- Non significant**

The result were confirmed by Akhter *et al.* (2017) and they reported that application of nitrogen in three splits with reduced basal dose in the ratio of 25 : 50 : 25 improved growth and yield as compared to recommended practice. Among the weed management practices, the maximum plant height, number of tiller, dry matter accumulation and leaf area index were recorded with the application of W_3- sulfosulfuron @ 25g/ha which was at par with theW_4- carfentrazone @ 20g/ha at 60, 90 DAS and at harvest stage due to less crop-weed competition for nutrients, light, space and soil moisture resulted nutrients were available constantly to crop ultimately photosynthetic rate was increased which increase the supply of carbohydrates ultimately increased growth attributes of crop. These both herbicides significantly lowering the population of weed density at initial stage. However, the minimum growth parameters were recorded in weedy check due to more weed flora which competes with the crop. Similar results were also validated by Singh *et* *al.,* 2019, reported that the application of pendimethalin + metribuzin (1.0 + 0.175 kg/ha) as pre-emergence being at par with weed free and pendimethalin (1.0 kg/ha) followed by sulfosulfuron (0.025 kg/ha) significantly reduced the density of weeds as compared to other treatments. The interactions between nitrogen scheduling and weed management were found non-significant effect on growth attributes of crop during the experimentation.The data showed that the yield parameters of crop were significantly influenced by nitrogen scheduling. Amongst the nitrogen scheduling, the maximum number of grains/spike, number of effective tillers, spike length, test weight (Table-5) were recorded with the nitrogen scheduling as N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS which was at par with the nitrogen scheduling as N_2 -⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS. It might be due to the resultant of that splitting of nitrogen at the different stages of crop period which improves nutrient use efficiency and also increased growth attributes. Due to higher performance of growth attributing character which increase yield attributing characters of crop. Further Similar results were also validated by Dubey *et al.* (2018) they reported that the higher growth attributes were recorded under nitrogen scheduling (T_2 - 1/3 at sowing and 2/3 after first irrigation) which was significantly superior over rest of the treatments. The minimum value of yield attributing characters was recorded with the nitrogen scheduling asN_1-½ Basal + ¼ at 4WAS + ¼ at 8 WAS because sufficient amount of N was not available due to maximum losses of nitrogen resulted reduced translocation of photosynthates which was responsible for poor yield attributing characters. Similar results were recorded by Litke *et al.*(2018) and they reported that application of nitrogen fertilizer rate (altogether eight rates: N0 or control, N60, N90, N120 (90+30), N150(90+60), N180 (90+60+30), N210 (90+70+50), and N240 (120+ 60+60). All spilt of nitrogen treatments have significant effect on improve nitrogen use efficiency as well as higher crop growth of wheat crop and least performance in no split application of nitrogen fertilizer. The maximum number of grains/spike, number of effective tillers, spike length, spike weight were recorded with the application of W_3- sulfosulfuron @ 25g/ha which was at par with theW_4- carfentrazone @ 20g/ha but under test weight highest value was recorded with the application of W_3- sulfosulfuron @ 25g/ha which was at par with theW_4- carfentrazone @ 20g/ha and W_2- clodinafop @ 60 g/ha (Table-5). It might be due to better weed management practice resulted less crop-weed competition for nutrients and provides the better environmental condition to the root zone of crop resulted maximum inputs used by the crop for their growth. Therefore, growth attributes were increased; ultimately yield attributes were also increased. The minimum value was recorded in weedy check treatment because weed density was high and more competition between weed and crop for nutrients resulted poor performance of growth attributes. Similar results were found by Singh *et al*., 2020, they reported that the application of sulfosulfuron + metsulfuron (POE) @ 30+2g a.i./ha were found most effective control of the all types of weeds followed by hand weeding control of weeds than the rest of the treatments and improving growth, yield attributes of wheat followed by hand weeding than the rest of the treatments (Singh *et al.,*2020). The interactions between nitrogen scheduling and weed management were found non- significant effect on growth attributes of crop during the experimentation.The highest grain yield (q/ha), straw yield (q/ha), biological yield (q/ha) and harvest index (%)(Table-6) was recorded with the nitrogen scheduling N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS which was at par with the nitrogen scheduling as N_2 -⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS. The reason for higher values of grain yield can be discussed in light of fact that there was positive correlation between grain yield and yield components like numbers of effective tillers and grains/spike which were increased in nutrients availability.Yield attributes was increased with the increasing nitrogen splitting as well as increased nutrient use efficiency and also less chance of nitrogen losses due to leaching, immobilization and denitrification as well as weed population were less ultimately competition was less. Split application of nitrogen maintained continuous supply of nutrients resulted better translocation of photosynthates from source to sink which was responsible for good growth and yield

Table 5: Effect of nitrogen scheduling and weed management on yield attributes of crop

Treatments	Spike Length (cm)		Spike Weight (g)		Grain/Spike		Effective tillers (m^2)		Test Weight (g)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2018-19	2018-19	2019-20	2018-19	2019-20
MAIN PLOT (Nitrogen Scheduling)										
N_1= nitrogen scheduling as ½ Basal + ¼ at 4WAS + ¼ at 8 WAS	11.26	11.73	3.22	3.57	62.02	63.72	95.80	107.00	38.31	38.78
N_2= nitrogen scheduling as ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS	12.06	12.54	3.38	3.79	67.43	67.94	107.80	127.80	38.35	38.82
N_3= nitrogen scheduling as ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS	12.70	13.35	3.39	3.93	69.81	70.18	123.20	142.00	39.97	39.99
SEm±	0.25	0.24	0.11	0.28	1.42	1.17	5.12	3.62	0.70	0.60
CD 5 %	0.96	0.95	0.44	1.11	5.59	4.60	20.11	14.22	2.74	2.36
SUB PLOT (Weed Management)										
W_0= Weedy check	9.39	9.36	2.56	2.97	47.94	48.87	50.33	66.00	37.32	37.78
W_1= Weed free	14.27	15.01	3.79	4.27	78.12	78.30	165.00	184.67	40.53	40.69
W_2= Clodinafop@60g/ha	10.91	11.18	2.96	3.36	60.80	64.21	84.00	104.33	37.99	38.01
W_3= Sulfosulfuron@25g/ha	13.25	14.06	3.74	4.19	74.66	73.82	127.00	142.00	39.44	39.92
W_4= Carfentrazone@20g/ha	12.19	13.09	3.60	4.03	70.58	71.21	118.33	131.00	39.10	39.57
SEm±	0.42	0.56	0.24	0.30	1.68	2.02	6.13	5.93	0.67	0.67
CD 5 %	1.21	1.63	0.69	0.87	4.91	5.91	17.88	17.30	1.96	1.97
N×W	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 6. Effect of nitrogen scheduling and weed management on yield (q/ha) and harvest index (%)

Treatments	Grain Yield (q/ha)		Straw Yield (q/ha)		Biological Yield (q/ha)		Harvest Index (%)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
MAIN PLOT (Nitrogen Scheduling)								
N1= nitrogen scheduling as ½ Basal + ¼ at 4WAS + ¼ at 8 WAS	37.74	39.23	57.58	61.30	95.31	100.53	39.36	38.83
N2= nitrogen scheduling as ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS	42.62	43.20	64.29	67.09	106.90	110.29	39.58	39.08
N3= nitrogen scheduling as ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS	46.06	47.23	68.97	69.34	115.03	116.57	39.67	40.33
SEm±	1.10	1.20	1.77	1.21	2.57	2.14	0.62	0.53
CD 5 %	4.31	4.73	6.94	4.76	10.09	8.41	2.44	2.08
SUB PLOT (Weed Management)								
W0= Weedy check	26.76	27.62	53.20	47.59	79.96	75.20	33.56	36.75
W1= Weed free	52.85	53.50	71.65	79.43	124.50	132.93	42.59	40.32
W2= Clodinafop@60g/ha	40.03	40.26	59.95	58.84	99.98	99.09	40.13	40.58
W3= Sulfosulfuron@25g/ha	46.04	47.82	67.54	72.21	113.58	120.02	40.65	39.78
W4= Carfentrazone@20g/ha	45.01	46.91	65.72	71.49	110.73	118.40	40.75	39.63
SEm±	0.82	1.71	2.40	1.89	2.47	2.76	1.15	0.63
CD 5 %	2.40	3.41	7.01	5.51	7.22	8.05	3.35	1.84
N×W	NS	NS	NS	NS	NS	NS	NS	NS

***SEm± - Standard error mean *CD- Critical difference *N×W- Interaction between nitrogen scheduling and weed management *NS- Non significant**

attributes. On the other hand, the lesser yield was recorded with the nitrogen scheduling asN_1 -½ Basal + ¼ at 4WAS + ¼ at 8 WAS due to insufficient supply of nutrients and more nutrients losses occurred due to higher weed population inthis treatment. Further reported that the application of 140 kg N ha^{-1} with triple splits timings, i.e., 25% at the sowing, 50% at the tillering, and 25% at the booting stage of the crop, resulted in the maximum yield and N recovery for different commercial wheat varieties (Khan *et al.*, 2022). Earlier finding also reported by Belete *et al.*, 2018 and they state that the split application of nitrogen (¼ at sowing, ½ at tillering and ¼ at booting) produced the highest crop yield and also nitrogen use efficiency traits. The maximum value of grain yield, straw yield and biological yield were recorded with the application of W_3- sulfosulfuron @ 25g/ha which was at par with the W_4-carfentrazone @ 20g/ha (Table-6). The reason for higher values of crop yield can be discussed in light of fact that the yield attributes increased due to very less competition for nutrients and improved dry matter accumulation in crop as well as high weed control efficiency resulted grain yield, straw yield and biological yield increased. The minimum value of crop yield was recorded in weedy check treatment due to high weed population as well as higher competition for nutrients, space and light as well as soil moisture. Similar results were recorded by the results revealed that application of ready mix of sulfosulfuron + metsulfuron (32 g/ha) and mesosulfuron + iodosulfuron (14.4 g/ha) gave higher yield attributes and yield of crop (Meena *et al*., 2019). Further, Punia *et al*., 2018, reported that application of different herbicides significantly reduced the dry weight of weeds compared to weedy check at different growth stages of crop. The higher crop yield and weed control were observed with application of carfentrazone 20 g/ha compared to carfentrazone 10 g/ha. The interactions between nitrogen scheduling and weed management were found non- significant effect on growth attributes of crop during the experimentation.

Conclusion

The present study helps to minimize the overuse nitrogen in wheat crop in central zone of Punjab and also help in find out the suitable herbicide in wheat crop. Based on results obtained in the present investigation it was concluded that application of N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS + W_3 -sulfosulfuron @ 25 g/ha performed better concerning growth and yield attributes of the wheat. Along with treatment consisted N_3 -¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS + W_4 -carfentrazone @ 20 g/ha which also showed good results in growth and yield attributes.

Conflict of interest

The authors declare that they have no conflict of interest.

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