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Original Research Article

Nitrogen Level with Herbicidal Combination on Weed Flora in Wheat Crop

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A B S T R A C T

An experiment was conducted at Agronomy research farm A.N.D.U.A.&T Kumarganj, Ayodhya during year 2017-18 on silty loam soil, having pH 8.6, EC 0.36 dSm-1, organic carbon 0.31%, available N, P and K 178.0, 14.5 and 231.5 kg ha^{-1} respectively. Experiment consisted of nine treatment combinations with three levels of nitrogen *viz.* 80, 120 and 160 kg N ha^{-1} and three herbicide treatments *viz.* pendimethalin *fb* 2, 4-D (1 + 0.5 kg a.i. ha^{-1}), clodinafop + metsulfuron(0.06 + 0.004 kg a.i. ha^{-1}) and sulfosulfuron (0.025 kg a.i. ha^{-1}). Results reveal that all the herbicides applied as post-emergence, except pendimethalin. Weed density and dry weight of weeds and nitrogen uptake by weeds increased consistently with increasing rate of nitrogen up to 160 kg N ha^{-1}. Post emergence application of clodinafop + metsulfuron (0.06 + 0.004 kg ha^{-1}) reduced the weed density and dry weight of weeds. Application of 160kg N ha^{-1}with clodinafop + metsulfuron (0.06 + 0.004 kg ha^{-1}) proved better to minimize the weed infestation and enhance the yield of wheat.

Introduction

Wheat is the fastest growing food grain in India and all set to overtake rice (113 million metric tonnes). The demand of wheat by 2020 has been projected to be between 105 to 109 million tonnes in the country. The increase in production has to be managed from integrated use of resources, as the land area under wheat is not expected to expand further. Weed alone causes average 30-33% reduction in wheat yield. Weeds are considered as one of the major constraints in wheat cultivation. In eastern U.P. wheat field was mainly infested with *Phalaris minor*, *Avenafatua*, *Chenopodium album*, *Cyperus rotundus*, *Convolvulus arvensis*, *Anagallis arvensis*, *Mililotus alba*, *Medicago denticulata* and *Cynodon dactylon* which compete for light, moisture, nutrients with crop(Singh *et al.*, 2013). The winter months are very cold whereas summers are hot and dry. Western hot winds start from the month of April and continue till the onset of monsoon. Weekly minimum and maximum temperatures during the crop season ranged from 5.50 to 17.20^{0}C and 18.34 to 37.60^{0}C and total rainfall received was 24.62 mm during the entire crop season.

Materials and Methods

The experiment was conducted during *Rabi* season of the year 2017-18 at Agronomy Research Farm of Achariya Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya, (U.P.). The farm is situated in the main campus of university. The experimental site falls under sub-tropical region in Indo-Gangatic plains and lies between 26^0.47`N latitude and $82^0$.12` E longitude at an altitude of about 113 meters from mean sea level. Experiment field was slightly alkaline in reaction (8.6pH), low in organic carbon(0.31 %) and low in available nitrogen (178 kg ha^{-1}), medium in phosphorus (14.5 kg ha^{-1}) and potassium (231.5kg ha^{-1}).Wheat variety 'PBW-373' was sown December 10th, 2017 in rows at 20 cm apart at 4-5 cm deep by seed drill.

The experimental was conductedin factorial RBD and replicated three times. Recommended dose of fertilizer and irrigation were applied uniformly but nitrogen level different 80, 120, 160 kg nitrogen.

The treatment comprised with pendimethalin, sulfosulfuron, clodinaop+metsulfuron and 2,4-D, Pre-emergence application of pendimethalin @ (1 kg ha^{-1})at (2^{nd}DAS)and post emergence application of 2,4-D (0.5 kg ha^{-1}),VESTA 0.4 -clodinafop + metsulfuron (@0.06+0.004 kg ha^{-1}), sulfosulfuron (0.025 kg ha^{-1}) at 30 DAS was done with the help of manually operated knapsack sprayer fitted with flat fan nozzle using 500 litres of water per hectare. Observations for weed flora population and dry matter accumulation were recorded at 30 DAS within the help of quadrate (0.5 x 0.5 m) at three places in a plot and then converted into per $m^{2.}$ The data was statistically analysed.

Results and Discussion

Effect on weed density

Various levels of nitrogen recorded significant effect on total weed density at various stages of crop growth. Maximum density of weeds recorded with160 kg N ha^{-1} (N_3) and minimum under 80 Kg N ha^{-1} (N_1) (Table 1 and 2). This might be due to utilization of soil applied nitrogen in grater quantity by weeds. Upasani *et al.,* (2013) also reported that increasing dose of nitrogen up to120 kg ha^{-1} significantly increased the density and biomass of weeds as compared to lower rates of nitrogen 80 kg ha^{-1}. It is evident from Tables 1 and 2 that the various herbicides showed significant effect on weed species. The maximum weed density was noticed under W_1 (pendimethalin *fb* 2, 4-D @ 1+0.5 kg ha^{-1}) and minimum in W_2 (clodinafop + metsulfuron @ 0.06+0.004 kg ha^{-1}) which was proved most effective in arresting the population of weeds.

Dry matter accumulation of weeds(g m^{-2})

The dry matter accumulation of total weed species increased with advancement of crop age and record highest at 90 days stage, thereafter, declined at harvest stage of the crop (Table3). The rate of dry matter accumulation was showed down trend. Different levels of nitrogen used under experiment affected weed dry matter accumulation significantly at various stages of the crop growth. Maximum weed dryweight was found under treatment N_3 (160 Kg N ha^{-1}) which was recorded significant then lower dose of nitrogen N_2 (120 Kg N ha^{-1}) and N_1 (80 Kg N ha^{-1}) at60, 90 DAS and at harvest stage (Table 3). This might be due to utilization of soil applied nitrogen in grater quantity by weeds resulting in more growth and high drymatter accumulation.

Table.1 Weed species (number m^{-2}) at 30 DAS as affected by nitrogen levels and herbicides in wheat

Treatment	*Phalaris minor*	*Mililotus alba*	*Chenopodium album*	*Rumex spp.*	*Coronopus*	*Anagallis arvensis*	*Convolvulas arvensis*	*Other*	Total
A. Nitrogen levels (kg ha^{-1})									
N_1-80 kg N ha^{-1}	4.10 (16.33)	3.20 (9.80)	4.82 (22.87)	3.19 (8.49)	3.28 (10.29)	3.07 (8.98)	1.46 (1.63)	3.02 (8.66)	9.34 (87.06)
N_2-120 kg N ha^{-1}	4.41 (19.00)	3.44 (11.40)	5.19 (26.60)	3.22 (9.88)	3.52 (11.97)	3.30 (10.45)	1.55 (1.90)	3.25 (10.07)	10.07 (101.27)
N_3-160 kg N ha^{-1}	4.62 (21.00)	3.61 (12.60)	5.45 (29.40)	3.37 (10.92)	3.70 (13.23)	3.46 (11.55)	1.61 (2.10)	3.40 (11.13)	10.58 (111.93)
SEm±	0.08	0.06	0.11	0.06	0.06	0.06	0.02	0.06	0.20
CD at 5 %	0.22	0.20	0.33	0.19	0.20	0.19	0.82	0.81	0.61
B. Herbicides (kg ha^{-1})									
W_1-Pendimethalin *fb* 2,4-D (@ 1+0.5 kg ha^{-1})	4.13 (16.67)	3.24 (10.00)	4.87 (23.33)	3.02 (8.67)	3.31 (10.50)	3.10 (9.17)	1.47 (1.67)	3.05 (8.83)	9.44 (88.83)
W_2-Clodinafop + metsulfuron (@0.06+0.004 kg ha^{-1})	4.37 (18.67)	3.41 (11.20)	5.15 (26.13)	3.19 (9.71)	3.49 (11.76)	3.27 (10.27)	1.54 (1.87)	3.22 (9.89)	9.97 (99.49)
W_3-Sulfosulfuron (@ 0.025 kg ha^{-1})	4.62 (21.00)	3.61 (12.60)	5.45 (29.40)	3.37 (10.92)	3.70 (13.23)	3.46 (11.55)	1.61 (2.10)	3.40 (11.13)	10.57 (111.93)
SEm±	0.08	0.06	0.11	0.06	0.06	0.06	0.02	0.06	0.20
CD at 5 %	0.22	0.20	0.33	0.19	0.20	0.19	0.82	0.81	0.61

*****Data subjected to square root $(\sqrt{x+0.5})$ transformation and original data presented in parenthesis

Table.2 Weed species (number m^{-2}) at 60 DAS as affected by nitrogen levels and herbicides in wheat

Treatment	*Phalaris minor*	*Mililotus alba*	*Chenopodium album*	*Rumex spp.*	*Coronopus*	*Anagallis arvensis*	*Convolvulas arvensis*	*Other*	Total
A. Nitrogen levels (kg ha^{-1})									
N_1-80 kg N ha^{-1}	1.93 (3.33)	1.56 (2.00)	2.24 (4.67)	1.48 (1.73)	1.59 (2.10)	1.51 (1.83)	0.91 (0.33)	1.49 (1.77)	4.20 (17.77)
N_2-120 kg N ha^{-1}	2.59 (6.33)	2.06 (3.80)	3.03 (8.87)	1.93 (3.29)	2.10 (3.99)	1.98 (3.48)	1.06 (0.63)	1.95 (3.36)	5.79 (33.76)
N_3-160 kg N ha^{-1}	3.26 (10.33)	2.57 (6.20)	3.48 (14.47)	2.41 (5.37)	2.63 (6.51)	2.47 (5.68)	1.23 (1.03)	2.43 (5.48)	7.39 (55.08)
SEm±	0.05	0.004	0.06	0.03	0.004	0.03	0.01	0.03	0.11
CD at 5 %	0.16	0.11	0.18	0.10	0.12	0.10	0.03	0.11	0.35
B. Herbicides (kg ha^{-1})									
W_1-Pendimethalin *fb* 2,4-D (@ 1+0.5 kg ha^{-1})	2.82 (7.76)	2.23 (4.60)	3.31 (10.73)	2.09 (3.99)	2.28 (4.83)	2.15 (4.22)	1.12 (0.77)	2.11 (4.06)	6.34 (40.86)
W_2-Clodinafop + metsulfuron (@0.06+0.004 kg ha^{-1})	2.15 (4.33)	1.72 (2.60)	2.50 (6.07)	1.63 (2.25)	1.76 (2.73)	1.66 (2.38)	0.96 (0.43)	1.64 (2.30)	4.71 (23.10)
W_3-Sulfosulfuron (@ 0.025 kg ha^{-1})	2.82 (8.00)	2.23 (4.80)	3.30 (11.20)	2.09 (4.16)	2.28 (5.04)	2.15 (4.40)	1.13 (0.80)	2.11 (4.24)	6.32 (42.64)
SEm±	0.05	0.004	0.06	0.03	0.004	0.03	0.01	0.03	0.11
CD at 5 %	0.16	0.11	0.18	0.10	0.12	0.10	0.03	0.11	0.35

*****Data subjected to square root $(\sqrt{x+0.5})$ transformation and original data presented in parenthesis

Table.3 Weed dry weight ($g^{-}m^{2}$) at successive stages of wheat crop

Treatment	30 DAS	60 DAS	90 DAS	At harvest
A. Nitrogen levels (kg ha^{-1})				
N_1-80 kg N ha^{-1}	4.33 (18.28)	4.79 (23.27)	5.01 (25.54)	4.76 (22,99)
N_2-120 kg N ha^{-1}	4.66 (21.27)	6.62 (44.22)	6.92 (48.50)	6.57 (43,65)
N_3-160 kg N ha^{-1}	4.89 (23.51)	8.45 (72.15)	8.85 (79.21)	8.40 (71.29)
SEm±	0.09	0.10	0.14	0.15
CD at 5 %	0.27	0.38	0.43	0.45
B. Herbicides (kg ha^{-1})				
W_1-Pendimethalin *fb* 2,4-D (@ 1+0.5 kg ha^{-1})	4.37 (18.66)	7.25 (53.53)	7.59 (58.74)	7.20 (52.87)
W_2-Clodinafop + metsulfuron (@0.06+0.004 kg ha^{-1})	4.61 (20.89)	5.38 (30.26)	5.63 (33.19)	5.35 (29.87)
W_3-Sulfosulfuron (@ 0.025 kg ha^{-1})	4.88 (23.51)	7.22 (55.86)	7.56 (61.32)	7.18 (55.19)
SEm±	0.09	0.10	0.14	0.15
CD at 5 %	0.27	0.38	0.43	0.45

Table.4 Nitrogen uptake by weeds (kg ha^{-1})

Treatments	Nitrogen uptake by weeds (kg ha^{-1})
A. Nitrogen levels (kg ha^{-1})	
N_1-80 kg N ha^{-1}	3.450
N_2-120 kg N ha^{-1}	6.505
N_3-160 kg N ha^{-1}	10.717
SEm±	0.195
CD at 5 %	0.586
B. Herbicides (kg ha^{-1})	
W_1-Pendimethalin *fb* 2,4-D (@ 1+0.5 kg ha^{-1})	8.300
W_2-Clodinafop + metsulfuron (@0.06+0.004 kg ha^{-1})	4.467
W_3-Sulfosulfuron (@ 0.025 kg ha^{-1})	7.950
Sem±	0.195
CD at 5 %	0.586

The weed dry weight increased with increasing nitrogen doses had also been reported by Patel *et al.*, (2012), Upasani *et al.*, (2013), Alemu *et al.*, (2016).Weed dry matter accumulation was also influenced at various crop growth stages under the different herbicides during the experimental year. In W_1 (pendimethalin *fb* 2, 4-D @ 1+0.5 kg ha^{-1}) treatment, dry matter production was highest. Whereas, the

minimum dry matter accumulation of weeds was recorded with W_2 (clodinafop + metsulfuron @ 0.06+0.004 kg $ha^{-1)}$ treatment found most effective for weed control in wheat. Among the herbicides, minimum weed dry matter accumulation was found under the treatment W_2 (clodinafop + metsulfuron @ 0.06+0.004 kg ha^{-1}) reduced the weed dry weight more effectively as compared to W_1 (pendimethalin *fb* 2, 4-D@ 1+0.5 kg ha^{-1}) and (W_3) sulfosulfuron. Sulfosulfuron reduced the weeds but less effective as compared to clodinafop + metsulfuron. It might be owing to effective control of *Phalaris minor, Cynodon dactylon*, narrow as well as broad leaf weeds. Reduced weed density under the effect of above treatments might have resulted less dry weight of weeds. These findings are also supported by Yadav *et al.,* (2009) and Meena and Singh (2011).

Nitrogen uptake by weeds

Nitrogen uptake by weeds increased with increasing dose of nitrogen. It may be due to the fact that the weed population and weed dry matter production was higher with increasing dose of nitrogen and consequently more nitrogen was taken up by weeds (Table 4). Similar results were also reported by Upasani *et al.,* (2013). The significantly lowest nitrogen uptake by weed was under W_2 (clodinafop + metsulfuron @ 0.06+0.004 kg ha^{-1}) as compare to W_1 (pendimethalin *fb* 2, 4-D @ 1+0.5 kg ha^{-1}) and W_3 (sulfosulfuron @ 0.025 kg ha^{-1}). Consequent reduction in nitrogen depletion with the control of weeds through herbicides has also been reported by Kumar *et al.,* (2012), Singh *et al.,* (2015).

Summary and conclusions are as follows:

Increased dose of nitrogen from 80 to 120 and 120 to 160 kg N ha^{-1} resulted significantly increased weeds density at each stage of crop growth. However, increasing dose of nitrogen significantly increased the dry weight of weeds. Among the herbicides, post-emergence application of clodinafop + metsulfuron @ (0.06 + 0.004 kg ha^{-1}) recorded the lowest density and dry weight of grassy and broad leaved weeds followed by sulfosulfuron @ (0.025 kg ha^{-1}).Nitrogen uptake by weeds was recorded maximum with @ 160 kg ha^{-1}, which is significant then the lower doses @ 80 and 120 kg N ha^{-1}. Lowest uptake of nitrogen by weeds was noticed under W_3 (clodinafop + metsulfuron @ 0.06 + 0.004 kg ha^{-1}) treated plots.

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