

Effect of Tillage, Fertilizer, and Herbicide Application on Height and Dry Biomass Development in Wheat Crop (*Triticum aestivum* L.)

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Received: 20 Feb 2021 | Revised accepted: 14 Apr 2021 | Published online: 15 Apr 2021

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ABSTRACT

The experiment was conducted at Research farm of Bhrahmanand P.G. College Rath, Hamirpur (U.P.) during rabi season of 2017-18 and 2018-19 to study the impact of tillage, nutrients and herbicides on wheat. The results of experiment indicated that maximum weed density and weed dry matter was recorded in conventional tillage as compared to zero tillage, while plant height and dry matter accumulation of wheat was also recorded maximum in conventional tillage as compared to zero tillage. Among herbicides, application sulfosulfuron 25g/ha + metsulfuron 4g/ha reduced the density and dry matter of weeds at all stages compared to other treatments of herbicides, while maximum plant height and dry matter accumulation of wheat was improved by sulfosulfuron 25g/ha + metsulfuron 4g/ha. The application of nutrients did not influence the density of weeds before spray. While application of 30kg sulphur + 5kg zinc significantly increased weed density and dry matter at all crop growth stages and it was also improved plant height and dry matter accumulation of wheat as compared to other nutrient treatments.

Key words: *Triticum aestivum* L., Tillage, Nutrient, Weed, Morphological

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops and is a staple food for about one third of the world's population. It occupies second position both in terms of area and production in the world. Since wheat is fertility exhaustive, the declining yield trend under long term fertilizer experiments have indicated that the productivity of the crop suffers due to emerging deficiencies of plant nutrients. Intensive input use continues over mining of nutrients from soil and imbalanced use of fertilizers lead to deterioration of soil health and stagnation in productivity of wheat. Sulphur is one of the essential plant nutrients for growth and development of plants. Zinc plays significant role in enzymatic and physiological activities of plant body. The role of sulphur and zinc in balanced fertilization and accruing better crop yield is being increasingly recognized. Increasing cropping intensity, use of HYV, use of high analysis fertilizers have been some of the most important reasons for wide spread deficiencies of sulphur and zinc. Apart from primary nutrients, sulphur and zinc deficiencies are wide spread in Indian soils. Weeds have been recognized as a serious menace in crop production. Therefore, Chemical weed control is most suitable to overcome this problem. To manage the dynamics of wheat flora, there is need to evaluate a range of herbicides at tank mix to have broad spectrum weed control [1]. Therefore, with

the availability of metsulfuron + sulfosulfuron and metsulfuron and clodinafop in mixer, it is logical to test for broad spectrum to weed control. Tillage accelerates the mineralization of organic matter and destroys the habitat of the soil life. On the contrary, when soil tillage is reduced or eliminated, soil life returns and the mineralization of soil organic matter slows down, resulting in better soil structure. Under zero tillage the mineralization of soil organic matter can be reduced to levels inferior to the input, converting the soil into a carbon sink [2]. Zero tillage also results in water saving and improved water-use efficiency. Since the soil is not exposed through tillage, the unproductive evaporation of water is reduced while water infiltration is facilitated [3]. The minimum tillage has positive effects on chemical, physical and biological soil properties compared to conventional soil preparation. Keeping the above facts in view, an experiment was conducted.

MATERIALS AND METHODS

The experiment was conducted at Research farm of Bhrahmanand PG College Rath, Hamirpur (U.P.) during rabi season of 2017-18 and 2018-19. The experiment was laid out in split plot design with 24 treatments combination and was replicated thrice. These treatments are made from two tillage operations (viz., conventional tillage and zero tillage), three weed control practices (viz., weedy check, clodinafop proparzil 60g/ha + metsulfuron 4g/ha and sulfosulfuron 25g/ha + metsulfuron 4g/ha) and four nutrients (viz., Recommended NPK (120kg N, 60kg P₂O₅ and 40 kg K₂O ha), Recommended NPK + 30 kg S ha, Recommended NPK + 5kg Zn ha and Recommended NPK + 30 kg S +5kg Zn ha) were

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applied. The observations were recorded on weed density before herbicide spray at 50, 75 DAS and at harvest/m² and weed dry matter before herbicide spray at 50, 75 DAS and at harvest/m².

RESULTS AND DISCUSSION

Effect of tillage on weed density, weed dry matter and crop growth

The results indicated that zero tillage was reduced the weed density and weed dry matter at all the growth stages of wheat and the minimum number of weeds (18.76, 8.70, 9.56 and 9.54 m⁻²) before herbicide spray at 50, 75 DAS and at harvest and weed dry matter (173.90, 98.61, 151.59 and 149.51 g) before herbicide spray at 50, 75 DAS and at harvest

was recorded in zero tillage. The zero tillage minimized the number of weeds and weed dry matter in all of growth stages of wheat. At it is helps to weed control as compared to conventional tillage. In zero tillage there is no ploughing practices so weeds were not easily germinated and grown up in zero tillage plots as compared to conventional tillage plots [4].

The maximum plant height (69.02 cm) at harvest and dry matter accumulation (15.88, 72.78, 77.43 and 93.23) before herbicide spray at 50, 75 DAS and at harvest was recorded in treatment conventional tillage, whereas the minimum plant height (64.14 cm) at harvest and dry matter accumulation (13.96, 48.98, 61.25 and 81.03) before herbicide spray at 50, 75 DAS and at harvest was found in treatment zero tillage [5].

Table 1 Impact of tillage operations, nutrients and weed control on weed density and weed dry matter before herbicide spray, at 50 DAS, at 75 DAS and at harvest of wheat

Treatment	Weed density (m ²) before herbicide spray	Weed density (m ²) at 50 DAS	Weed density (m ²) at 75 DAS	Weed density (m ²) at harvest	Weed dry matter before herbicide spray	Weed dry matter at 50 DAS	Weed dry matter at 75 DAS	Weed dry matter at harvest
	Pooled Mean	Pooled Mean	Pooled Mean	Pooled Mean	Pooled Mean	Pooled Mean	Pooled Mean	Pooled Mean
Tillage Operations								
Conventional tillage	19.67	9.11	10.32	10.44	175.44	111.69	153.56	151.04
Zero tillage	18.76	8.70	9.56	9.54	173.90	98.61	151.59	149.51
SEm(d)	0.043	0.044	0.083	0.058	0.037	0.182	0.102	0.066
CD (AT 5%)	0.120	0.123	0.231	0.162	0.103	0.506	0.283	0.184
Weed control								
Weedy check	19.51	18.03	19.19	19.17	175.25	202.23	241.35	239.33
Clodinophop proparzil 60g/ha + metsulfuron 4g/ha	19.19	4.36	5.54	5.78	174.55	61.42	108.94	105.98
Sulfosulfuron 25g/ha + Metsulfuron 4g/ha	18.95	4.32	5.08	5.02	174.21	51.80	107.45	105.51
SEm(d)	0.090	0.101	0.137	0.108	0.076	0.240	0.341	0.165
CD (AT 5%)	0.180	0.202	0.272	0.215	0.152	0.477	0.679	0.327
Nutrients								
RDF + (120kg N, 60kg P ₂ O ₅ and 40 kg K ₂ O ha)	19.06	8.76	9.72	9.76	174.42	102.92	151.54	149.12
RDF + 30 kg S ha	19.25	8.91	9.86	9.92	174.68	104.70	152.35	150.55
RDF + 5kg Zn ha	19.15	8.92	9.86	10.08	174.61	103.96	153.43	150.55
RDF + 30 kg S + 5kg Zn ha	19.40	9.03	10.31	10.21	174.96	109.01	152.99	150.88
SEm(d)	0.104	0.117	0.158	0.125	0.088	0.277	0.394	0.190
CD (AT 5%)	0.207	0.233	0.314	0.248	0.176	0.551	0.784	0.378

Effect of herbicides on weed density, weed dry matter and crop growth

The results (Table 1) indicated that all the herbicides caused marked reduction in density and dry matter of weeds at all stages. Post-emergence application of sulfosulfuron 25g/ha + metsulfuron 4g/ha reduced the density and dry matter of weeds at all stages compared to other treatments. Application of sulfosulfuron 25g/ha + metsulfuron 4g/ha was found effective in suppressing the growth of weeds over weedy check and clodinophop proparzil 60g/ha + metsulfuron 4g/ha.

The minimum weed density (18.95, 4.32, 5.08 and 5.02 m⁻²) before herbicide spray at 50, 75 DAS and at harvest was recorded in sulfosulfuron 25g/ha + metsulfuron 4g/ha, while the maximum in weedy check. The various tank mix application of herbicides reduced total weed density and dry matter compared to weedy check and clodinophop proparzil 60g/ha + metsulfuron 4g/ha. This was due to broad spectrum control of weeds viz. grassy and broadleaf weeds. Efficacy of herbicide mixtures by way of reduced density and dry matter of the various weed species. Applying two or more herbicides

simultaneously, either using pre-package mixtures or by mixing different herbicide products before the application, is very common approach in intensive agriculture [6-7].

The maximum plant height (68.20 cm) at harvest and dry matter accumulation (15.52, 68.38, 74.11 and 90.74) was recorded in treatment Sulfosulfuron 25g/ha + Metsulfuron 4g/ha and the minimum plant height (64.56 cm) at harvest and dry matter accumulation (14.16, 53.18, 63.73 and 82.62) was recorded in weedy check plot, there is no herbicide use in

weedy check plot. The results reflect that various weed control treatments provided significant improvement in growth attributes of wheat crop. Higher plant height and greater dry matter accumulation by crop plants under weed control treatments is an indirect effect on account of least competition for plant growth inputs viz. light, space, water and nutrients etc. Under reduced density and dry matter of weeds, plants get sufficient space for optimum expansion of leaves and branches as early as possible [8-9].

Table 2 Impact of tillage operations, nutrients and weed control on plant height at harvest and dry matter accumulation before herbicide spray, at 50 DAS, at 75 DAS and at harvest of wheat

Treatment	Plant height at harvest	Dry matter accumulation before herbicide spray	Dry matter accumulation at 50 DAS	Dry matter accumulation at 75 DAS	Dry matter accumulation at harvest
	Pooled Mean	Pooled Mean	Pooled Mean	Pooled Mean	Pooled Mean
Tillage operations					
Conventional tillage	69.02	15.88	72.78	77.43	93.23
Zero tillage	64.14	13.96	48.98	61.25	81.03
SEm(d)	0.137	0.092	0.319	0.447	0.617
CD (AT 5%)	0.381	0.255	0.886	1.241	1.714
Weed control					
Weedy check	64.56	14.16	53.18	63.73	82.62
Clodinophop proparzil 60g/ha + metsulfuron 4g/ha	66.99	15.09	61.07	70.18	88.03
Sulfosulfuron 25g/ha + Metsulfuron 4g/ha	68.20	15.52	68.38	74.11	90.74
SEm(d)	0.473	0.112	0.742	0.895	1.006
CD (AT 5%)	0.941	0.222	1.476	1.778	2.001
Nutrients					
RDF + (120kg N, 60kg P ₂ O ₅ and 40 kg K ₂ O ha)	65.23	14.47	56.00	65.47	84.12
RDF + 30 kg S ha	66.98	15.08	62.33	70.75	88.10
RDF + 5kg Zn ha	66.43	14.87	61.11	68.80	86.44
RDF + 30 kg S +5kg Zn ha	67.70	15.25	64.07	72.34	89.85
SEm(d)	0.547	0.129	0.857	1.033	1.162
CD (AT 5%)	1.087	0.256	1.704	2.054	2.310

Effect of nutrients on weed density, weed dry matter and crop growth

Different fertility levels did not influence the density of weeds before spray. The application of 30kg sulphur + 5kg zinc significantly increased weed density and dry matter at all crop growth stages. The minimum weed density (19.06, 18.76, 9.72 and 9.76 m⁻²) before herbicide spray at 50, 75 DAS and at harvest was recorded in RDF (120kg N, 60kg P₂O₅ and 40 kg K₂O/ha), while the maximum (19.40, 9.03, 10.31 and 10.21) before herbicide spray at 50, 75 DAS and at harvest was found in RDF + 30kg sulphur + 5kg zinc. When sulphur and zinc fertilizers are applied in soil, especially in the form of basal dose, a part of sulphur and zinc also becomes available to weeds. Therefore, in an ecosystem where weeds are present along with crop plants, additional sulphur and zinc is uptake by weeds in tune with advancing sulphur and zinc levels which might have facilitated the present results [10].

The maximum plant height (67.70 cm) at harvest and dry matter accumulation (15.25, 64.07, 72.34 and 89.85) was recorded in treatment recommended NPK + 30 kg S +5kg Zn

ha. The minimum plant height (65.23 cm) at harvest and dry matter accumulation (14.47, 56.00, 65.47 and 84.12) was found in treatment recommended NPK (120kg N, 60kg P₂O₅ and 40 kg K₂O ha). In general, the overall improvement in growth of wheat crop with the addition of higher sulphur and zinc could be ascribed to its pivotal role in several physiological and biochemical processes which are of vital importance for development of the plants. It is well established that nutrients are involved in the synthesis of chlorophyll [11-12].

CONCLUSION

It can be concluded from the results that zero tillage minimized the number of weed and weed dry matter at all of growth stages of wheat as compared to conventional tillage, while conventional tillage improved the plant height and dry matter accumulation at all growth stages. Post-emergence application of sulfosulfuron 25g/ha + metsulfuron 4g/ha reduced the density and dry matter of weeds at all stages

compared to other treatments, while it was maximized plant height and dry matter accumulation at all growth stages. The application of recommended dose of fertilizers (RDF) + 30kg

S + 5kg Zn significantly increased weed density, weed dry matter, plant height and dry matter accumulation at all crop growth stages.

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