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Effect of nutrient management and weed control practices on growth, yield attributes, yield, nutrient uptake and economics of wheat crop (*Triticum aestivum* L.)

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Abstract

An experiment was conducted at Agronomy Research Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (Uttar Pradesh) during *Rabi* season (2019-20) to find out the effect of nutrient management and weed control practices on growth and yield of wheat crop and nutrient uptake by crop and economic feasibility of different treatments in wheat crop. All the growth parameters and yield contributing characters and yield *viz.* plant height, number of tillers, dry matter accumulation, LAI, as well as grain and straw yield were significantly higher with the application of 75% RDF + 10 t ha⁻¹ FYM and Sulfosulfuron+ Metsulfuron@ 30+2 g a.i. ha⁻¹ was comparable with two hand weeding and significantly higher than the other treatments. With respect to economics, 75% RDF + 10 t ha⁻¹ FYM with the spraying of Sulfosulfuron+ Metsulfuron@ 30+2 g a.i. ha⁻¹, recorded maximum net return (Rs. 108865.08) and B:C ratio (2.92). It can be concluded that application of 75% RDF + 10 t ha⁻¹ FYM with the spraying of Sulfosulfuron+ Metsulfuron@ 30+2 g a.i. ha⁻¹ proved better for achieve higher yield and remuneration of wheat crop.

Keywords: Nutrient management, yield attributes, yield, *Triticum aestivum*

Introduction

Wheat (*Triticum aestivum* L.) is staple food of the world and belongs to Poaceae family. It is commonly grown in temperate and tropical climatic regions in winter season. The Three cultivated species of wheat are *T. aestivum*, *T. durum* and *T. dicoccum* that are called as Common bread wheat, Marconi wheat and Emmer wheat, respectively. In world, Wheat ranks first amongst the cereals crop having the area (217.02 mha) and production (764.50 mmt) with productivity of wheat 3.52 mt ha⁻¹ (FAS/USDA 2019-20) [8]. In India, total production of wheat crop was 99.87 mmt from a covered area of 29.65 mha with productivity of 3.37 mt ha⁻¹ during the past 2018-19 *Rabi* season (Anonymous, 2019-20) [2].

As far as India is concerned, about 91% of the total wheat production is contributed by six northern states *viz.*, Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan and Bihar. Among them U.P. ranks first in respect of area (9.54m.ha.) and production (32.74mt), however, the productivity (3432 kg ha⁻¹) is comparatively low as compared to Punjab (5123 kg ha⁻¹) and Haryana (5195 kg ha⁻¹) states (Anonymous, 2018-19) [3].

The major challenge i.e. adoption of cereal- cereal (rice-wheat) cropping system which resulted in declining nutrition status of soil and use of insufficient amount of chemical fertilizers is increasing day by day. The balance nutrition plays an important role in raising the production potential of wheat. Application of fertilizer alone has a detrimental effect on soil health and crop productivity therefore, integration of various sources of nitrogenous (organic and inorganic) fertilizer are more suitable because this reduces the application of chemical fertilizer and cost of cultivation, besides being an environment friendly approach also indicated the beneficial effect of FYM in combination with chemical fertilizer to wheat (Ram and Mir, 2006; Gupta *et al.*, 2006) [15, 13].

The *Phalaris minor* is one amongst the terribly serious issue in wheat in rice-wheat cropping system and causes 65% crop losses. (Chhokar *et al.*, 2008). In order to eradication of weeds cultural, mechanical and chemical methods are commonly used. Inaccessibility of labour in peak season and adverse weather condition don't allow timely control of weeds.

Therefore, weed control by mechanical means and hand or manual weeding alone isn't achievable. So, the chemical weed control is a crucial substitute. However, the repeated application of single herbicides makes the weeds resistant. In the present investigation, some of the new herbicides molecules (combination) having its very high potency at lower doses to kill grassy along with broad leaved weeds have been developed as ready mixed.

Material and Methods

The experiment was carried out during *Rabi* season 2019-20 at Agronomy Research farm, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). Geographically the experimental site falls under sub-tropical climate of Indo-gangatic plains (IGP) having alluvial calcareous soil and the soil of experimental field was "silty loam" in texture, low in organic carbon and available nitrogen while medium in phosphorous and rich in potassium. The treatment comprised of 3 nutrient levels 100% RDF, 75% RDF + 10 t ha⁻¹ FYM and 50% RDF + 15 t ha⁻¹ FYM and 5 weed control practices Metribuzin + Metsulfuron (@ 150 + 4 g a.i. ha⁻¹, Sulfosulfuron+ Metsulfuron (@ 30+2 g a.i. ha⁻¹, Clodinofof @ 60 g a.i. ha⁻¹, Two hand weeding (after first and second irrigation) and Weedy Check was laid out in Factorial Randomized Block Design with three replications. The wheat variety NW- 5054 was sown at 20 cm rows distance at the rate of 100 kg ha⁻¹ seed rate with the help of seed drill on 7th December 2019. Herbicides are used at 30 DAS as post emergence.

Results and Discussion

Effect of fertility levels

Yield attributes i.e. length of spike (cm), number of grains spike⁻¹, grain weight spike⁻¹ and test weight (g) were found non-significant due to different nutrient levels. However, maximum values of above characters were recorded with the application of 75% RDF + 10 t ha⁻¹ FYM.

Application of 75% RDF + 10 t ha⁻¹ FYM produced significantly higher number of effective tillers (m) over rest of nutrient levels. Grain, straw and biological yield was affected significantly due to different nutrient levels. Maximum grain yield (49.59 q ha⁻¹), straw yield (74.38 q ha⁻¹) and biological yield (123.97 q ha⁻¹) recorded with 75% RDF +10 t ha⁻¹ FYM treatment. Harvest index did not affected significantly by different nutrient levels. N, P and K content (%) of grain and straw had non-significant effect under different nutrient levels for wheat crop. Maximum N, P and K uptake and total N, P & K uptake was recorded with the application of 75% RDF + 10 t ha⁻¹ FYM, which has significant effect on over rest of the treatments.

Effect of weed management practices

Yield attributes characters i.e. effective tillers (m⁻²), length of spike (cm), number of grains spike⁻¹, grain weight spike⁻¹ and test weight (g) were found significant due to different weed control practices. The maximum values of above characters was recorded with the two hand weeding which was being at par with the spraying of Sulfosulfuron + Metsulfuron @ 30+2 g a.i. ha⁻¹ and Metribuzin+ Metsulfuron @ 150 + 4 g a.i. ha⁻¹. Maximum Grain, straw and biological yield was recorded with the two hand weeding which was being at par with Sulfosulfuron+ Metsulfuron @ 30+2 g a.i. ha⁻¹. The harvest index did not affected significantly by weed control practices. N, P and K content (%) of grain and straw had non-significant effect under different weed control practices for wheat crop. Maximum N, P and K uptake and total N, P & K uptake was recorded with two hand weeding which was being at par with Sulfosulfuron+ Metsulfuron @ 30 + 2 g ha⁻¹.

Economics

Application of 75% RDF + 10 t ha⁻¹ FYM with the spraying of Sulfosulfuron+ Metsulfuron @ 30+2 g a.i. ha⁻¹ gave the highest net income (Rs. 108865.08) and benefit cost ratio (2.92).

Table 1: Effect of nutrient management and weed control practices on yield attributes and yield weed on wheat crop (*Triticum aestivum* L.).

Treatments	Yield attributes					Yield Studies			
	Effective tillers (m ⁻²)	Length of spike (cm)	No. of grains spike ⁻¹	Grain weight spike ⁻¹	Test weight (g)	Grain yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	Biological yield (q ha ⁻¹)	Harvest Index (%)
100% RDF	253.36	9.81	42.94	1.76	40.88	45.48	68.62	114.16	39.78
75% RDF + 10 t ha ⁻¹ FYM	281.54	10.00	43.34	1.79	41.28	49.59	74.38	123.97	39.95
50% RDF + 15 t ha ⁻¹ FYM	233.68	9.62	42.78	1.74	40.68	40.80	61.59	102.39	39.79
SEm=	3.392	0.184	0.787	0.035	0.609	0.619	1.303	2.257	0.822
CD at 5%	9.828	NS	NS	NS	NS	1.794	3.776	6.541	NS
Weed control									
Metribuzin + Netsulfuron (@150 + 4 g a.i. ha ⁻¹)	257.13	9.70	42.47	1.72	40.47	43.98	66.07	109.02	40.33
Sulfosulfuron + Metsulfuron (@ 30 + 2 g a.i. ⁻¹ ,	268.80	10.20	44.27	1.87	42.17	50.18	73.79	123.98	40.48
Clodinofof @ 60 g a.i. ha ⁻¹	247.23	9.65	41.30	1.71	39.80	42.50	65.04	108.57	39.14
Two hand weeding (after first and second irrigation)	273.27	10.30	44.43	1.87	42.17	51.20	75.43	126.63	40.43
Weedy Check	234.53	9.20	41.00	1.64	39.57	38.58	60.74	99.32	38.84
SEm=	4.379	0.238	1.017	0.045	0.786	0.799	1.683	2.914	1.061
CD at 5%	12.689	0.690	2.946	0.130	2.277	2.316	4.875	8.444	NS

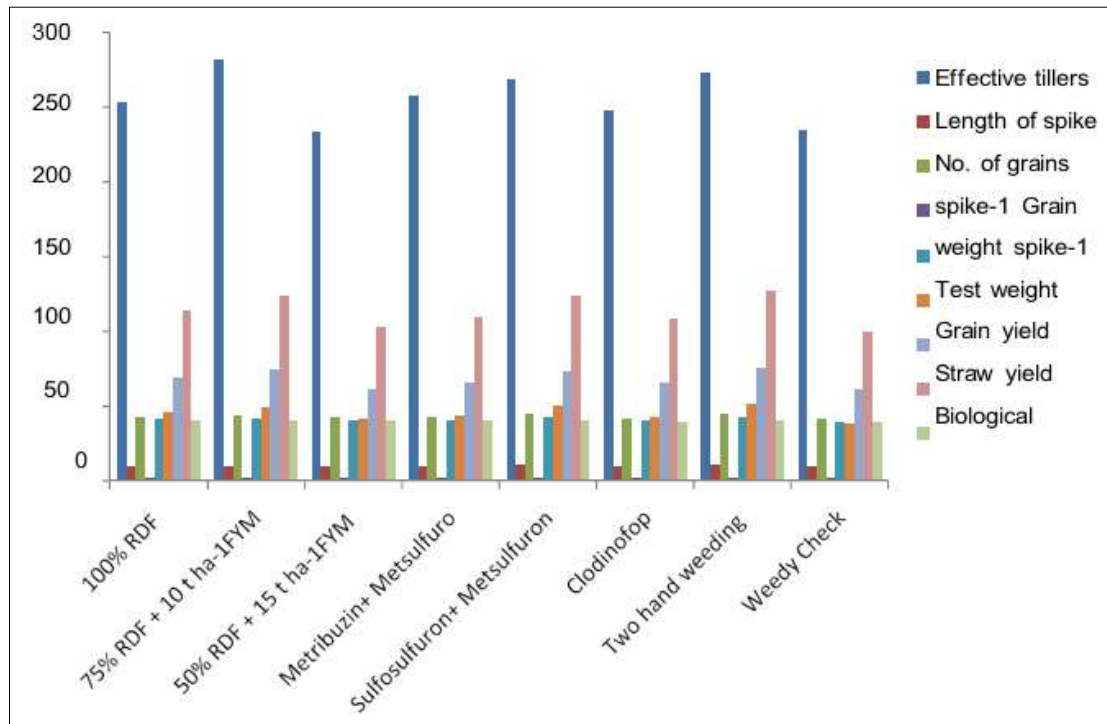


Fig 1: Effect of nutrient management and weed control practices on yield attributes and yield weed on wheat crop

Table 2: Effect of nutrient management and weed control practices on NPK content (%) in wheat and NPK uptake by wheat (g m^{-2}) in wheat crop (*Triticum aestivum* L.)

Treatments	NPK content (%) in wheat						NPK uptake by wheat crop		
	N content (%)		P content (%)		K content (%)		Total N uptake (kg ha^{-1})	Total P uptake (kg ha^{-1})	Total K uptake (kg ha^{-1})
Nutrient management	Grain	Straw	Grain	Straw	Grain	Straw			
100% RDF									
75% RDF + 10 t ha ⁻¹ FYM	1.76	0.55	0.353	117.98	23.40	103.9	117.98	23.40	103.92
	1.77	0.55	0.354	127.35	25.29	126.2	127.35	25.29	126.20
50% RDF + 15 t ha ⁻¹ FYM	1.75	0.54	0.350	106.20	21.07	105.4	106.20	21.07	105.41
SEm±	0.017	0.005	0.003	2.027	0.348	1.645	2.027	0.348	1.645
CD at 5%	NS	NS	NS	5.874	1.009	4.767	5.874	1.009	4.767
Weed control									
Metribuzin+ Metsulfuron(@ 150 +4 g a.i. ha ⁻¹)	1.76	0.55	0.351	0.107	0.386	1.44	110.75	21.97	111.56
Sulfosulfuron+ Metsulfuron(@ 30+2 g a.i. ha ⁻¹)	1.77	0.55	0.355	0.107	0.390	1.45	129.56	25.71	126.79
Clodinofof @ 60 g a.i. ha ⁻¹	1.75	0.54	0.351	0.106	0.386	1.44	112.39	22.31	101.12
Two hand weeding (after first and second irrigation)	1.79	0.56	0.359	0.109	0.395	1.47	133.75	26.55	131.29
Weedy Check	1.73	0.54	0.347	0.105	0.381	1.42	99.43	19.73	88.45
SEm±	0.021	0.007	0.004	0.001	0.005	0.020	2.617	0.450	2.124
CD at 5%	NS	NS	NS	NS	NS	NS	7.583	1.303	6.154

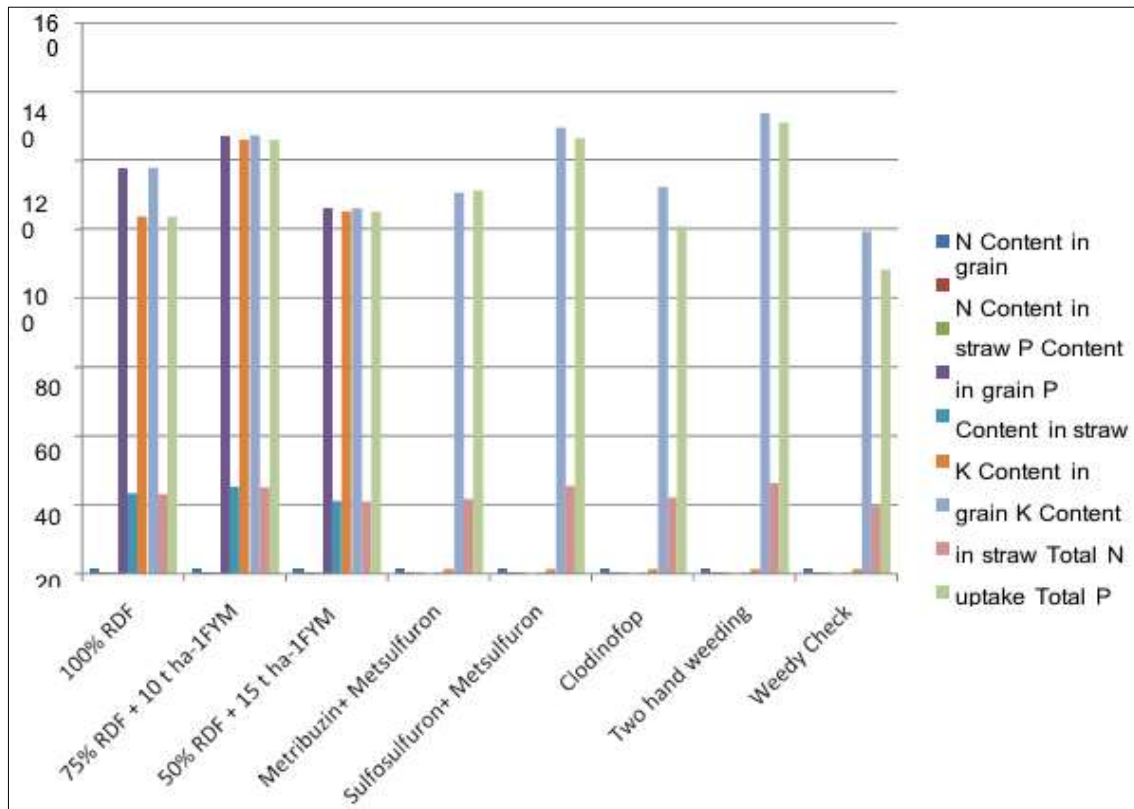


Fig 2: Effect of nutrient management and weed control practices on NPK content (%) in wheat and NPK uptake by wheat (g m^{-2}) in wheat crop

Table 3: Effect of various nutrient levels and weed control practices on Economics

Treatment	Common cost (Rs ha ⁻¹)	Treatment cost (Rs ha ⁻¹)	Total cost of cultivation (Rs ha ⁻¹)	Gross return (Rs ha ⁻¹)	Net return (Rs ha ⁻¹)	B:C
T1= F1W1	27956.00	6607.08	34563.08	118585	84021.92	2.43
T2 = F1W2	27956.00	6317.48	34273.48	134040	99766.52	2.91
T3 = F1W3	27956.00	68.39.24	34795.24	115047.5	80252.26	2.30
T4 = F1W4	27956.00	12799.24	40.755.24	136780	96024.76	2.35
T5 =F1W5	27956.00	5839.24	33795.24	104982.5	71187.26	2.10
T6 = F2W1	27956.00	9647.27	37603.27	128598.75	90995.48	2.41
T7 = F2W2	27956.00	9357.67	37.313.67	146178.75	108865.08	2.92
T8 = F2W3	27956.00	9879.47	37835.47	124662.5	86827.03	2.29
T9 = F2W4	27956.00	15839.43	43795.43	149302.5	105507.07	2.41
T10 = F2W5	27956.00	8879.43	36835.43	114511.25	77675.82	2.10
T11 = F3W1	27956.00	10437.46	38.393.46	105930	67536.54	1.76
T12 = F3W2	27956.00	10147.86	38393.46	120280	81886.14	2.13
T13 = F3W3	27956.00	10669.62	38625.62	103282.5	64656.88	1.67
T14 = F4W4	27956.00	16629.62	44585.62	122747.5	78161.88	1.75
T15 = F5W5	27956.00	9669.62	37625.62	94435	56809.38	1.32

Conclusion

From the above overall studies, it can be concluded that application of 75% RDF + 10 t ha⁻¹ FYM with the spraying of Sulfosulfuron+ Metsulfuron @ 30+2 g a.i. ha⁻¹ found better to growth, yield attributes, yields, nutrients uptake, gross return, net return and B:C ratio.

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