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Influence of Different Levels of Fertilizer and Post-Emergence Herbicides on Weed Control Efficiency, Nutrient Depletion by Weeds and Production of Wheat [*Triticum aestivum* (L.)]

Sarita[1], Ishwar Singh[1] and M. L. Mehriya[2]

[1]College of Agriculture, Jodhpur, [1]Directorate of Extension Education, [2]Agricultural Research Station, Agriculture University, Jodhpur, Rajasthan (342 304), India
[3]College of Agriculture, Sumerpur, Pali, Rajasthan (306 902), India

Corresponding saritachoudhary739@gmail.com

0000-0002-1731-3949

ABSTRACT

The field studies were conducted at Instructional Farm, College of Agriculture, Jodhpur (Agriculture University, Jodhpur), Rajasthan, India on Wheat during *rabi* seasons (November to April) of both the 2018–2019 and 2019–2020. The experiment was consisted of three fertility levels viz., 75% of recommended dose of fertilizer (90-30 kg N-P_2O_5 ha^{-1}), 100% of RDF (120-40 kg N-$P_2O_5$$ha^{-1}$) and 125% of RDF (150-50 kg N-P_2O_5 ha^{-1})] and sub-plots: seven post-emergence herbicides (trisulfuron 15 g ha^{-1}, sulfosulfuron 75%+metsulfuron methyl 5% (ready-mix) 32 g ha^{-1}, clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1}, carfentrazon 20 g ha^{-1}, metsulfuron methyl 4 g ha^{-1}, weedy check and weed free) in split plot design and replicated thrice. Findings revealed, application of 100% recorded the higher growth attributes viz, plant height, dry matter accumulation (g^{-2}) and leaf area index at 50 DAS, yield parameters viz, effective tillers m^{-1} row length, and grain, straw and biological yield of wheat over 75% RDF, however it was at par with 125% RDF. Among the post-emergence herbicides, the herbicide clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1} significantly increased the growth and yield parameters and yield, while remaining at par with sulfosulfuron 75%+metsulfuron methyl 5% (ready-mix) 32 g ha^{-1} and proved superior in comparison to rest of the treatments. Maximum nutrients (NPK) depletion by weeds was recorded with the application of 125% RDF. Among herbicides, clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1} was also obtained significantly minimum nutrients depletion by weeds.

KEYWORDS: Fertility rate, herbicides, nutrient depletion, weed control efficiency, yield

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1. INTRODUCTION

Wheat [*Triticum aestivum* (L.)] is grown under diverse agro-climatic conditions. Wheat has been described as the 'King of cereals' because of the acreage it occupies, high productivity and it holds a prominent position in the international food grain trade (Tiwari et al., 2015). Wheat contains water soluble protein (Chaquilla-Quilca et al., 2018), good dietary fibre content (Rasane et al., 2013; Ciudad-Mulero et al., 2020) and minerals (Ciudad-Mulero et al., 2021). The total area under wheat in India is about 34.5 m ha with a production of 107.18 m t, respectively (Anonymous, 2021). To keep the rate with the increasing population, India requires increasing wheat production.

Fertilizers make up a vital part of improved wheat production. Proper quantity of fertilizer application is considered a key to the bumper crop production (Jain et al., 2018). Nitrogen is the universally deficient nutrients in soils of India (Mohan et al., 2015) particularly in the loamy sand soils of semi-arid regions of Rajasthan. One more reason for low productivity is minimum efficiency and availability of phosphorus in soil due to high fixation. Nitrogen and phosphorus use efficiency in India is less than 50% and 20%, respectively (Sarkar et al., 2021). Nitrogen and phosphorus are important nutrients for the growth and development of the crop (Massignam et al., 2009). These play a vital role in photosynthesis, energy storage, and transfer, stimulating root development, and vigorous start leading to better tillering in wheat and seed formation (Patel et al., 2012). A significant interaction between herbicide and nitrogen observed by Kim et al. (2006), where increased nitrogen found to enhance the performance of herbicide as well as N-scheduling not only influences the crop growth but also influences weed density and biomass also.

Production of wheat is directly affected by one of the most limiting biological constraints is the infestation of weeds, as they reduce productivity due to competition between wheat plant and weed (Siddiqui et al., 2010; Nazari et al., 2013) and allelopathy (Zhang et al., 2016). Weeds compete with crops for water, and nutrients; in absence of an effective weed control measures, weeds uptake considerable quantity of applied nutrients resulting in higher loss of yield (Shaktawat et al., 2019). The yield losses of wheat vary between 17-30% annually (Raoand Chauhan, 2015) depending upon the density of weed and weed flora. Therefore, the management of weeds is a basic requisite production system. The use of herbicides not only reduces weed density, but also increases nutrient uptake by wheat and reduces nutrient losses due to weeds (Nadeem et al., 2016). Chemical control is the most commonly used and reliable, quick, more effective, time and labor saving method for controlling weeds in wheat (Frihauf et al., 2010; Mandal et al., 2014; Mehmood et al., 2014; Das et al., 2017; Singh et al., 2017). Herbicide combinations not only enhance weed control efficacy (Singh et al., 2011) against complex weed flora, but manipulation of crop fertilization is also a promising cultural practice to reduce weed interference in crops so that increases the competitive ability of crops against weeds. Fertilizer may advantage weeds to a larger extent than crops, because nutrient absorption is faster in weeds than in crop (Nadeem et al., 2016); weeds in the first three weeks of growth take one-third of fertilizer applied to crops; for each kilogram of dry matter of wheat, 5.5 kg N and 1.2 kg P are required while *Chenopodium album* L. required 7.6 kg N and 1.6 kg P (Nadeem et al., 2016).

This study was carried out to investigate the effect of adequate fertilization along with herbicidal weed management for the stable production of wheat.

2. MATERIALS AND METHODS

2.1. Experimental site and climate details

The field investigation was performed in wheat during two consecutivesduring *rabi* seasons (November to April) of both the 2018–2019 and 2019–2020 at the Instructional Farm, College of Agriculture-Jodhpur, Rajasthan, India, situated in Arid Western Plains Zone. Geographically, it is located between 26° 15' N to 26° 45' North latitude and 73° 00' E to 73° 29' East longitude at an altitude of 231 meters above mean sea level. The average annual rainfall is about 367 mm and the bulk of it (85%–90%) is received from June to September (*Kharif* season) by the South-west monsoon. The mean daily maximum and minimum temperatures varied between 20 to 28.8°C and 10.1 to 20.0°C, respectively in 2018-2019 and the corresponding values in the year 2019-2020 were 15 to 25.9°C and 5.4 to 18.0°C during the crop growing seasons.

2.2. Soil type

Soil organic carbon, textural class, soil pH, and available NPK of the experimental field (0 cm–15 cm soil depth) were determined using standard procedure. The soil of the field was loamy sand in texture, slightly alkaline in reaction (pH 7.7–7.8), low in organic carbon (0.12%- 0.14%), low available nitrogen (174 kg ha^{-1} –175.1 kg ha^{-1}), medium available phosphorus (20.3 kg ha^{-1} –21.0 kg ha^{-1}), high in available potassium (324 kg ha^{-1}–325 kg ha^{-1}) before experimentation.

2.3. Design of experimental and treatment details

The experiment was laid out using split-plot design with three replications. The treatments comprising of three levels of fertilizer application in main plots viz., 75% of the recommended dose of fertilizer (RDF) (90-30 kg N-P_2O_5 ha^{-1}), 100% of RDF (120–40 kg N-P_2O_5 ha^{-1}) and 125%

of RDF (150–50 kg N-P_2O_5ha^{-1})] and seven different herbicidal treatments in subplots viz., trisulfuron 15 g ha^{-1}, sulfosulfuron 75%+metsulfuron methyl 5% (ready-mix) 32 g ha^{-1}, clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1}, carfentrazon 20 g ha^{-1}, metsulfuron methyl 4 g ha^{-1}, weedy check and weed-free). Fertilizer rates were applied using DAP and urea as a source of P_2O_5 and N. Half of N and a full dose of P were applied as basal dose at the time of sowing. The remaining quantity of N was applied as a top dressing in a standing crop through urea in two equal split doses at the time of first and second irrigation. Potassium was applied of 40 kg ha^{-1} uniformly by muriate of potash. All the tested herbicides were sprayed as the post-emergence application (PoE) at 35 days after seeding (DAS) using an ASPEE Knapsack sprayer fitted with a flat-fan nozzle in 600 liters of water per hectare. Weed-free plots were weeded regularly to keep them weed-free throughout the crop period. Wheat variety 'GW 11' was sown at a row spacing of 22.5 cm using 100 kg seeds ha^{-1} on 20th November 2018 and 18 November 2019 and harvested on 14th April 2019 and 12th April 2020 in respective crop seasons.

2.4. Weed control efficiency, growth, and yield parameters

Weed control efficiency (WCE) at 75 DAS was calculated using the standard procedure. The observation related to plant height was written down manually from five randomly selected adumbrative plants from each net plot of respective replication separately. Likewise, the grain, straw, and biological yield from the net plots of wheat harvested at physiological maturity were reported using standard. The number of tillers bearing productive spikes was counted in three randomly selected 1.0 m row lengths in each plot of trial, averaged and calculated as effective tillers m row length. The leaf area index (LAI) at 50 DAS was calculated by using the standard formula (Sestak et al., 1971).

2.5. Nutrient depletion and quality analysis

The weed samples were taken randomly by throwing a metallic quadrate size of 0.25 m^2 at two places in net plots (Das et al., 2017). Then, the collected weed samples were first sun-dried and then oven-dried at 70°C till constant dry weight and converted to total weed dry matter (kg ha^{-1}) at wheat harvest during both years. Nutrient concentrations (N, P and K) in these weed samples vis a vis NPK nutrient depletion (kg ha^{-1}) by weeds (at 50 DAS) were determined using standard procedures (Rana et al., 2014). Crude protein content in grain samples was determined by multiplying respective grain nitrogen concentration (%) by the factor 5.70 (Tkachuk, 1969). The protein yield was estimated by using the following formula:

Protein yield (kg ha^{-1}) =((Crude protein content (%)×Grain yield (kg ha^{-1}))/100

2.6. Statistical analysis

The experimental data recorded for growth, yield, and quality characters were subjected to statistical analysis under the 'Analysis of variance' technique. The significance of differences among treatment effects was tested by the 'F' test as described by Panse and Sukhatme (1985) for split-plot design experiments. The critical difference (CD) values at p=0.05 were used to determine the significant differences among treatment means. Assuming homogeneity in the experimental data of two years, pooled analysis was done (Gomez and Gomez, 1984).

3. RESULTS AND DISCUSSION

Weed flora of the experimental field consisted of *Chenopodium murale*, *Chenopodium album*, *Rumex dentatus*, *Asphodelus tenuifolius*, *Melilotus alba*, *Melilotus indica*, *Fumaria parviflora, Cynodon dactylon*, *Launaea asplenifolia* and *Cyperus rotundus* during all the two years of experimentation. However, broad-leaved weed were dominated over grassy and sedge weeds.

3.1. Weed dry weight and weed control efficiency

Application of different herbicides substantially influence weed dry weight and weed control efficiency (Table 1). Maximum weed dry weight (23.23 g m^{-2}) recorded under application of 125% fertility level. The progressive increase in RDF from 75–100 and 100–125% significantly increased weed dry weight by 0.17 and 0.27 g m^{-2}, respectively. Compared to weedy check, maximum reduction in weed dry weight was brought by applying various herbicides in wheat crop. Minimum weed dry weight was exhibited by clodinafop-propargyl 15%+metsulfuron-methyl 1% @ 64 g ha^{-1}. Application of this herbicide significantly reduced weed dry weight by 84.7 and 68.9% in over weedy check and triasulfuron @ 15 g ha^{-1}, respectively.

The highest weed control efficiency was recorded by clodinafop-propargyl+metsulfuronmethyl (ready-mix) 64 g ha^{-1} herbicide (85.80%) after a weed-free check. Weed control efficiency followed the decreasing order by weed-free check,clodinafop-propargyl+metsulfuron methyl (ready-mix) (85.03%), sulfosulfuron+metsulfuron methyl (ready-mix) (84.63%), metsulfuron methyl (81.39%), carfentrazon @ 20 g ha^{-1} (73.96%), trisulfuron @ 15 g ha^{-1} (50.64%), respectively, indicating that clodinafop-propargyl+metsulfuron methyl (ready-mix) and sulfosulfuron+metsulfuron methyl (ready-mix) are highly effective against the different weed flora in wheat crop. Similar results were made by Choudhary et al. (2021) and Sirazuddin et al. (2016). The excellent weed knockdown ability of clodinafop-propargyl+metsulfuron methyl (ready-mix) and sulfosulfuron+metsulfuron methyl (ready-mix) against complex weed flora could be assigned as the reason

Table 1: Influence of different fertility levels and herbicides on nutrient (NPK) depletion by weed

Treat-ments	Weed dry weight (g m^{-2})	Weed control efficiency (%)	Nitrogen concentration (%)	Nitrogen uptake (kg ha^{-1})	Phosphorus concentration (%)	Phosphorus uptake (kg ha^{-1})	Potassium concentration (%)	Potassium uptake (kg ha^{-1})
Fertility levels ($N:P_2O_5$) kg ha^{-1}								
F_1	3.81 (17.93)	-	1.310	2.10	0.104	0.151	1.131	1.86
F_2	3.98 (19.50)	-	1.327	2.33	0.117	0.190	1.134	2.04
F_3	4.25 (23.23)	-	1.340	2.72	0.123	0.235	1.136	2.36
SEm±	0.03	-	0.001	0.05	0.0003	0.005	0.003	0.05
CD (p=0.05)	0.11	-	0.003	0.16	0.001	0.015	NS	0.16
Herbicides								
W_1	5.60 (31.19)	50.64	1.500	3.61	0.119	0.290	1.322	3.18
W_2	3.18 (9.71)	84.63	1.608	1.15	0.152	0.109	1.330	0.95
W_3	3.13 (9.42)	85.03	1.604	1.13	0.154	0.109	1.327	0.94
W_4	4.07 (16.12)	73.96	1.531	2.04	0.127	0.169	1.323	1.76
W_5	3.48 (11.64)	81.39	1.578	1.50	0.143	0.135	1.321	1.26
W_6	7.97 (63.47)	0.00	1.457	7.26	0.107	0.531	1.312	6.53
W_7	0.71 (0.00)	100.00	0.000	0.00	0.000	0.000	0.000	0.00
SEm±	0.06	0.86	0.002	0.07	0.001	0.006	0.003	0.06
CD (p=0.05)	0.16	2.42	0.006	0.19	0.003	0.017	0.007	0.18

Figures of weed dry weight in parentheses are original value; Note: F_1: 75% RDF; F_2: 100% RDF; F_3: 125% RDF; W_1: Trisulfuron @ 15 g ha^{-1}, W_2: Sulfosulfuron 75%+metsulfuron methyl 5% @ 32 g ha^{-1}, W_3: Clodinafop-propargyl 15%+metsulfuron methyl 1% @ 64 g ha^{-1}; W_4: Carfentrazon @ 20 g ha^{-1}, W_5: Metsulfuron methyl @ 4 g ha^{-1}, W_6= Weedy check; W_7: Weed free

for superior weed control efficiency over other herbicidal treatments (Meena et al., 2019). The combined application of clodinafop-propargyl+metsulfuron methyl (ready-mix) and sulfosulfuron+metsulfuron methyl (ready-mix) inhibits cell division in shoots and roots by inhibiting the ALS enzyme and thereby blocks the biosynthesis of amino acid; thus, the weed plants suffer selectively (Choudharyet al., 2021, Meena et al., 2019, Chand and Puniya, 2017), hence providing excellent control all types weed by minimizing weed counts and biomass (Choudharyet al., 2021, Chand and Puniya, 2017, Barla et al., 2017).

3.2. Nutrients (NPK) concentration and depletion by weeds

Nutrients (NPK) concentration and depletion by weed biomass were significantly influenced up to 125% RDF (Table 1). Potassium concentration in weed biomass was not influenced significantly by any levels of fertility on a pooled basis. Minimum nutrients (NPK) concentration and depletion by weed were obtained under 75% RDF. Application of 125% RDF significantly improved the NP concentration by 2.29 and 0.97 and 18.26 and 5.12% over 75 and 100% RDF, respectively on pooled basis. On pooled basis, raising fertility levels from 75–100% RDF and 100–125% RDF were associated with hike by 10.95 and 16.73% in nitrogen depletion 25.82% and 23.68% in phosphors depletion and 9.67 and 15.68% potassium depletion by weeds. It might be the reason for greater NP concentration in weeds is maximum availability of nutrients in the soil by fertilization of 125% RDF. An increase in P concentration seems to be directly associated with the synergistic effect of N. The maximum biomass of weed accumulated under a higher fertility rate with a concomitant increase in its nutrient concentration appeared to be directly responsible for higher NPK depletion by the weeds (Nadeem et al., 2016). Average NPK concentrations in mixed weed biomass taken at the time of 50 DAS followed the decreasing trend of clodinafop-propargyl+metsulfuron methyl (ready-mix), sulfosulfuron+metsulfuron methyl (ready-mix), metsulfuron methyl, carfentrazon 20 g ha^{-1}, trisulfuron 15 g ha^{-1}, weedy check, respectively on the pooled basis (Table 1), while NPK depletion followed the reverse trend where weedy check exhibited the significantly highest NPK depletion. Sulfosulfuron+metsulfuron methyl (ready-mix) remained at par with clodinafop-propargyl+metsulfuron methyl (ready-mix) and metsulfuron methyl 4 g ha^{-1} exhibited the least NPK depletion (Table 1). It recognized higher weed nutrient concentrations due to the least inter- and intra weed species competition (Choudharyet al., 2021; Rajpootet al., 2016; Rajpoot et al., 2018). The lowest depletion of weed nutrient under clodinafop-propargyl+metsulfuron methyl (ready-mix) due to the lowest weed count of total weeds that computed the lowest total weed biomass per m^2 area over other herbicidal treatments (Choudharyet al., 2021).

3.3. Growth, yield and yield parameters

Fertilization at a different rate significantly influenced the growth parameters, yield attributes, and yield of wheat on the pooled basis (Table 2). Fertilization at 100% RDF recorded the maximum plant height at 75 DAS (77.81 cm), dry matter accumulation (g m^{-2}) at 75 DAS (229.74 kg ha^{-1}), Leaf area index at 50 DAS (3.06), and effective tillers m^{-1} row length (147) as well as seed (4083 kg ha), straw (5019 kg ha) and biological (9103 kg ha) yield (Table 2) proved significantly superior over 75% RDF on a pooled basis, however, it remained at par with 125% RDF. It

Table 2: Influence of different fertility levels and herbicides on growth and yield attributes of wheat

Treatments	Plant height at 75 DAS	Dry matter accumulation (g m^{-2}) 75 DAS	Leaf area index	Effective tillers m^{-1} row length	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Protein yield (kg ha^{-1})
	Pooled	Pooled	Pooled	Pooled				
Fertility levels ($N:P_2O_5$) kg ha^{-1}								
F_1	71.07	142.00	2.64	121	4083	5019	9103	415.4
F_2	77.81	229.74	3.06	147	4121	5108	9228	427.5
F_3	78.45	242.10	3.26	147	72.5	89.4	132.4	7.4
SEm±	1.369	3.925	0.06	2.5	236.5	291.5	431.7	24.3
CD (p=0.05)	4.464	12.801	0.20	8.1				
Herbicides								
W_1	69.89	180.44	2.88	118	4188	5193	9381	439.4
W_2	78.17	222.11	3.18	151	4374	5381	9755	458.4
W_3	79.39	225.89	3.15	156	3605	4536	8141	350.7
W_4	76.17	201.72	3.02	131	4024	4942	8966	406.9
W_5	77.94	211.50	3.13	144	2979	3791	6770	278.2
W_6	68.17	155.67	2.24	109	4454	5461	9915	479.0
W_7	80.72	234.94	3.31	161	85.3	94.8	165.4	8.9
SEm±	1.796	4.836	0.10	2.9	240.4	267.2	466.2	25.2
CD (p=0.05)	5.062	13.632	0.29	8.0				

F_1: 75% RDF; F_2: 100% RDF; F_3: 125% RDF; W_1: Trisulfuron @ 15 g ha^{-1}, W_2: Sulfosulfuron 75%+metsulfuron methyl 5% @ 32 g ha^{-1}, W_3: Clodinafop-propargyl 15%+metsulfuron methyl 1% @ 64 g ha^{-1}; W_4: Carfentrazon @ 20 g ha^{-1}, W_5: Metsulfuron methyl @ 4 g ha^{-1}, W_6= Weedy check; W_7: Weed free might be due to that nitrogen and phosphorus nutrition at optimum levels might have increased root length and root area resulting in better uptake of other nutrients (Hemerly, 2016) and this efficient absorption and utilization of other minerals produced more leaves, greater accumulation of photosynthates, as well as net assimilation rate (Rafiq et al., 2010), resulted in higher plant height, dry weight effective tillers ultimately resulting improvement in yield (White and Veneklaas, 2012). Too little application of nitrogen directly minimize crop yield while an excess amount of nitrogen also causes negative effects on plant and this concern gets well defined continuously in crop production (Magistad et al., 1945). Similar results recorded by Kumar et al. (2016). Growth and yield parameters viz., plant height, dry matter accumulation, leaf area index effective tillers m^{-1} row length and grain, straw, and biological yield of wheat were significantly influenced by the post-emergence application of herbicides on the pooled basis (Table 2). The maximum plant height (79.39 cm), dry matter accumulation (225.89 g m^{-2}), leaf area index at 50 DAS (3.15) and effective tillers m row length (156) were observed under clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1} herbicide, proved significantly superior over rest of the treatments being at par sulfosulfuron 75%+metsulfuron methyl 5% (ready-mix) 32 g ha^{-1}. Herbicide clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1} represented an increase in growth and yield parameters to the magnitude of 16.45% in plant height, 45.1% in dry matter accumulation, 41.96% in leaf area index and43.1% ineffective tillers m row length weedy check plot, respectively. Thus, overall improvement in these parameters seems to be duetoclodinafop-propargyl 15%+metsulfuron methyl 1% @ 64 g ha^{-1} and sulfosulfuron 75%+metsulfuron methyl 5% exhibited a relatively higher knockdown effect on mixed weed flora owing to the inhibition of ALS enzyme-debilitate amino acid biosynthesis selectively killing the weeds and minimizing crop-weed competition for space, light, and nutrients, which conjointly led to excellent growth and yield attributes in wheat, arising a higher wheat yield and protein yield over other herbicidal combinations (Walia et al., 2010; Dasset al., 2016 and Barlaet al., 2017). The results are in agreement with those of Choudhary et al. (2021), Deshmukh et al. (2020), Rana et al. (2017), and Sirazuddin et al. (2016).

The significantly higher grain, straw and biological yield (Table 2) were also noted under clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g $ha^{-1}$with the respective values of 4374 kg ha^{-1}, 5381 kg ha^{-1} and 9755 kg ha^{-1}, being at par with sulfosulfuron 75%+metsulfuron methyl 5% (ready-mix) 32 g ha^{-1} proved significantly superior over remaining treatments (on pooled basis). Significant increase in crop yield might be due to the elimination of all narrow and broad-leaved weeds owing to the inhibition of ALS enzyme-hindering amino acid biosynthesis in addition to better availability of natural resources *i.e.* space, moisture, nutrients, and light and minimizing crop-weed competition which in turn had superior yield attributes and consequently higher yield of wheat (Barla et al., 2017; Dass et al., 2016). These results conform to the findings of (Dass et al., 2016, Rajpoot et al., 2018).

3.4. Protein yield

The highest protein yield (Table 2) was recorded with 125% RDF (427.5 kg ha^{-1}) followed by 100% (415.4 kg ha^{-1}) and 75% (329.8 kg ha^{-1}). Similar results of higher protein yield with increased fertilizer rate were recorded by Chauhan et al. (2017) and Nadeem et al. (2016). Amongst herbicidal treatments, weed-free check obtained highest protein yield (458.4 kg ha^{-1}) followed by clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha-1 (439.4 kg ha^{-1}), sulfosulfuron 75%+metsulfuron methyl 5% (ready-mix) 32 g ha^{-1} (439.4 kg ha^{-1}) and metsulfuron methyl 4 g ha^{-1} (406.9 kg ha^{-1}). It might be due to higher protein content and grain yield was recorded under superior treatments. These results closely conformity by findings of Shivran et al. (2020).

4. CONCLUSION

Application of 100% RDF (120-40 kg N-P_2O_5 ha^{-1}) to wheat gave substantially higher grain yield (4083 kg ha^{-1}) and straw yield (5019 kg ha^{-1}). Moreover, herbicide 'clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1}' recorded significantly higher grain (4374 kg ha^{-1}) and straw (5381 kg ha^{-1}). Minimum nutrients (NPK) depletion by were also fetched by clodinafop-propargyl 15%+metsulfuron methyl 1% (ready-mix) 64 g ha^{-1}.

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