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RESPONSE OF DUAL PURPOSE WHEAT VARIETIES TO VARYING SEED RATE AND FERTILIZER LEVELS

MEENA SEWHAG*, D. S. AHLAWAT, NARESH SANGWAN, NEERAJ PAWAR AND MEENAKSHI SANGWAN*

CCS HAU Regional Research Station, Rohtak-124 001 (Haryana), India
*Krishi Vigyan Kendra, Rohtak-124 001 (Haryana), India
**(e-mail: meenasewhag@gmail.com)*
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SUMMARY

Understanding about the combinations of agronomic options can be used to improve the fodder and grain yield of dual purpose wheat varieties is limited. An experiment involving three management strategies was conducted during *Rabi* season of 2020-2021 at Research farm of CCSHAU Regional Research Station, Rohtak, to evaluate changes in fodder and grain yield of dual purpose wheat varieties. The soil of the experimental field was sandy loam in texture, neutral in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in split plot design with two varieties *viz*. V_1: VL289 and V_2: C306 and six seed rate x cut treatment at 55 DAS *viz*. S_1: 100 kg/ha. without cut, S_2:100 kg/ha with cut, S_3:112.5 kg/ha without cut, S_4:112.5 kg/ha with cut, S_5:125 kg/ha without cut and S_6: 125 kg/ha with cut in main plot and three fertility levels viz. F_1: 100% RDF (60 kg N/ha+30 kg P_2O_5/ha), F_2: 20% higher than RDF and F_3: 50% higher than RDF in subplot replicated thrice. Results revealed that among both the dual purpose wheat varieties, VL 829 recorded taller plants with 33.51 % higher grain yield than C 306. Among various seed rate × cut treatments, highest green fodder yield was recorded in seed rate of 125 kg/ha with cut while highest grain yield was recorded in 125 kg/ha without cut treatment which was at par with 100 kg/ha and 112.5 kg/ha without cut treatments. Fodder yield increased significantly with increase in fertilizer dose from 100 % RDF to 150 % RDF. Application of 150 % RDF being at par with 120 % RDF recorded significantly higher grain yield with better yield attributes of wheat. The B: C ratio calculated was higher in wheat variety C 306 and application of 150% RDF. Among various seed rate × cut at 55 DAS, highest B: C was recorded with 125 kg/ha without cut treatment.

Keywords: Dual purpose wheat, fodder yield, grain yield and BC ratio

Wheat is grown all over the world and it covers more of the earth's surface than any other cereal crop. Wheat is the predominant *Rabi* crop of N-W plain zone and central zone of India. In India, it is the second largest cereal crop after rice both in the terms of production and productivity and plays an important role in the national food basket.

In India agriculture and animal husbandry are complimentary to each other and livestock rearing is an integral part of rural economy and food security is directly linked with fodder availability. It is not possible to further increase the area under fodder crops in *rabi* season as wheat is the principal cereal crop. As per ministry of agriculture and farmers welfare, India is deficit in dry fodder by about 26 per cent and green fodder by about 35.6 per cent. Wheat, if used as dual purpose crops (grains as food for human beings and green fodder as feed for livestock); fodder shortage during the lean seasons can be reduced to great extent as reported by Singhal *et al*. (2006). They also revealed that dual-purpose wheat is a viable option for different situations. According to Carver *et al*. (2001), more than 50% of the winter wheat acreage in the Southern Great Plains of the United States is used for the dual purpose for grazing cattle and harvesting grain. Wheat can be a good option for getting more forage dry matter (DM) per hectare and better fodder quality as compared to other small grain crops. Winter wheat can provide high quality forage at a time of the year when fodder is not available due to freezing temperature. Harvesting green fodder at 70 DAS or before stem elongation stage did not prolong physiological maturity more than three days with no significant reduction in yield indicating that wheat can

be used as dual purpose for valuable additional fodder costing no or least reduction in grain yield to fill the fodder gap in winter (Munsif *et al*., 2015). Roberts (2009) reported that for full exploitation of the higher yield potential of traditional, high yielding varieties as well as dual purpose varieties, higher nitrogen application is a must. Traditional nitrogen applications, in most cases, result in over and under application of nitrogen in various parts of the field due to infield spatial variability (Frasier *et al.,* 1999; Khosla *et al*., 1999).

High-yielding wheat varieties exhaust soil nutrients, limiting crop production and restrict upward growth of productivity. The farmer's perception of nutrient management is the use of major nutrients like N, P and K. Under Indian conditions, the nutrient recommendations are based upon crop response data which is averaged over large geographic areas and fail to consider the spatial variability in soil nutrient supplying capacity (Majumdar *et al.,* 2013), which has led to low nutrient use efficiencies and lowered profits (Pampolino *et al*.,2012). Appropriately increasing the seeding rate is considered the basis for achieving greater grain yield (Hiltbrunner *et al.,* 2007) and N accumulation (Arduini *et al*., 2006; Dai *et al.,* 2014) in winter wheat. So it is essential to test dual purpose wheat varieties with different seed rate and cutting management to exploit their full production potential. Various genotypes may behave differently under different seed rate and cutting management due to their plant architecture particularly under different fertility levels. Few studies focusing on the effects of combinations of agronomic options (such as seeding rate, sowing date, and nutrient management) on grain yield have been reported for wheat. Thus, there is urgent need to find optimum seed rate and fertilizer levels for dual purpose wheat to obtain better grain yield as well as to get quality fodder for animals during scarce period. Keeping these points in view, it was considered to carry out a field experiments on "Effect of seed rate and fertilizer levels on dual purpose wheat varieties".

MATERIALS AND METHODS

A Field experiment was conducted at Samargopalpur Research farm of CCSHAU Regional Research Station, Rohtak. The aim of this experiment was to find best dual purpose wheat varieties and its optimum seed rate and fertilizer levels to get potential yield. The soil of the experimental field was sandy loam in texture, neutral in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in split plot design with two wheat varieties viz. V_1: VL289 and V_2: C306 and six seed rate x cut at 55 DAS *viz*. S_1: 100 kg/ha. without cut, S_2: 100 kg/ha with cut, S_3: 112.5 kg/ha without cut, S_4:112.5 kg/ha with cut, S_5:125 kg/ha without cut and S_6: 125 kg/ha with cut in main plot and three fertility levels *viz*. F_1: 100% RDF (60 kg N/ha+30 kg P_2O_5/ ha), F_2: 20% higher than RDF and F_3: 50% higher than RDF in subplot with three replications. The climate of Rohtak (28°40' N latitude and 76° 13' E longitude) is classified as subtropical monsoon, mild and dry winter, hot summer and sub-humid which is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrates into the district. The hot weather season starts from mid March to last week of the June followed by the South West monsoon which lasts up to September. The transition period from September to November forms the post monsoon season. The normal annual rainfall in Rohtak district is about 592 mm spread over 23 days. The South West monsoon sets in the last week of June and withdraws towards the end of September and contributes about 84% of the annual rainfall. July and August are the wettest months. About 16% of the annual rainfall occurs during the non monsoon months in the wake of thunder storms and western disturbances. The experimental field was prepared by two ploughings and one planking, followed by pre-sowing irrigation. Dual purpose wheat variety VL 829 and C 306 were sown on 6th November 2020 with different seed rates i.e. 100, 112.5 and 125 kg/ha and harvested on 11 April 2021. Wheat was sown with row-to-row spacing of 20 cm. Harvesting and threshing of wheat was done manually to minimize yield losses. As per the treatment full dose of phosphorus and half dose of nitrogen were applied as basal dose at the time of sowing and remaining half dose of nitrogen was top dressed after cut while in no cut situation as per package of practice. The other agronomic practices from sowing to till the crop harvesting like irrigation, insect-pests control and weed control measures were done as per recommended package of practices of Chaudhary Charan Singh Haryana Agricultural University, Hisar. Data on five randomly selected tagged plants from each plot in each replication were recorded on different quantitative characters viz. Plant height (cm), no. of spikelet/ spike and no. of grains/ spike.

For recording test weight of wheat, grain samples were taken from the produce of each treatment and 1000 grains were counted and were dried in oven at 60°C for 48 hours. After drying, they were weighed and mean weight of 1000 grains was noted as test weight.

RESULT AND DISCUSSION

Performance of wheat varieties

Results reveal that wheat variety VL 829 recorded taller plants with significantly higher number of grains per spike and test weight (Table 1). Number of spikelet per spike and harvest index was not significantly influenced due to varying wheat variety. Among both the dual purpose wheat varieties, VL 829 recorded 33.51 % higher grain yield than C 306 which might be due to better yield attributes of VL 829 because to its genetic makeup (Table 2). Green fodder yield and biological yield of wheat was also recorded significantly higher in VL 829.Thus, VL 829 is the most suitable variety of wheat for dual purpose and can be cut after 55 DAS for green fodder, thereby ensuring fodder and food security. Jarial (2014) also reported that the improved variety VL 829 provided significant quantity of additional green fodder (about 3.20 mt/ha) in the lean season without any significant reduction in the grain and straw yields after harvesting crop for fodder at 79 days after sowing (DAS). Singhal *et al.* (2008) also reported that yield of wheat grain from the varieties VL 829, VL 616 and PBW 343 without harvesting them for fodder and application of 120 kg N/ha was 32.90, 32.15 and 49.58 q/ha, respectively. The B: C was calculated over variable cost (Table 2). Unlike grain yield higher B: C ratio was calculated in wheat variety C 306 as compared to VL 829 which might be due to higher market price of grain and fodder of C 306.

Effect of seed rate x cut at 55 DAS

Plant height of wheat varieties in un-cut treatments was significantly higher over cut treatments at all the three seed rates (Table 1). Seed rate of 125 kg/ha without cut treatment resulted in significantly taller plant with higher number of grains per spike (18.91) than other treatments. Varying seed rate and cutting management had significant influence on harvest index of dual purpose wheat varieties (Table 2). Test weight recorded was highest in 100 kg /ha seed rate with cut treatment while it was lowest in 125 kg/ha without cut treatment. The treatment 125 kg/ha seed rate with cut treatment resulted in significantly higher number of spikelets per spike than other seed rate x cutting management treatments.

Green fodder yield increased significantly with increase in seed rate of wheat. The grain yield was significantly higher in without cut treatment at all seed rates over cut treatments. Grain yield obtained with 100 kg/ha seed rate without cut treatment was at par with seed rate of 125 kg/ha with cut treatment. The

TABLE 1
Effect of seed rate x cut and fertilizer levels on growth and yield attributes of dual purpose wheat varieties

Treatments	Plant height (cm)	Test weight (g)	No. of grain/ spike	No. of spikelet/ spike
Varieties				
VL 829	125	41.96	18.27	37.12
C 306	105	39.45	17.91	37.34
C.D. at 5 %	8.3	0.93	0.23	N.S.
Seed rate x cut at 55 DAS				
100 kg/ha without cut	120	41.25	18.09	36.64
100 kg/ha with cut	99	41.28	17.84	36.83
112.5 kg/ha without cut	125	41.15	18.56	36.76
112.5 kg/ha with cut	106	41.09	17.13	37.47
125 kg/ha without cut	129	39.53	18.91	37.54
125 kg/ha with cut	111	40.07	18.01	38.14
C.D. at 5 %	4.8	1.71	0.21	0.47
Fertilizer level				
100% RDF	109	40.05	17.92	36.08
120 % RDF	116	41.27	18.09	37.65
150% RDF	120	41.63	18.26	37.96
C.D. at 5 %	4.9	1.16	0.18	0.38

TABLE 2
Effect of seed rate x cut and fertilizer levels on yields and economics of dual purpose wheat varieties

Treatments	Green fodder yield (q/ha)	Grain yield (q/ha)	Biological yield index	Harvest (q/ha)	B : C
Varieties					
VL 829	46.21	38.96	115.6	33.59	1.97
C 306	42.03	29.18	87.1	33.54	2.09
C.D. at 5 %	3.87	7.51	10.78	NS	-
Seed rate x cut at 55 DAS					
100 kg/ha without cut	--	35.33	107.0	33.02	2.01
100 kg/ha with cut	40.94	29.19	82.9	35.17	1.56
112.5 kg/ha without cut	--	36.37	110.8	32.77	2.06
112.5 kg/ha with cut	44.75	32.54	94.9	34.25	1.51
125 kg/ha without cut	--	37.04	110.1	33.67	2.19
125 kg/ha with cut	47.13	33.95	101.7	33.28	1.57
C.D. at 5 %	1.43	2.93	9.11	1.22	-
Fertilizer level					
100% RDF	41.27	31.91	93.7	33.95	1.56
120 % RDF	44.45	34.37	102.0	33.70	1.66
150% RDF	46.63	35.93	108.2	33.27	1.72
C.D. at 5 %	1.27	2.65	6.24	NS	-

grain yield increased significantly with increased in seed rate without having significant differences within cut and without cut treatments. Seed rate of 112.5 kg/ha without cut treatment being at par with 100 kg/ ha without cut and 112.5 kg/ha without cut treatment recorded significantly higher biological yield over all the three cut treatment. Among various seed rate x cut treatment highest B: C was found in 125 kg/ha seed rate without cut while lowest B: C was found in 112.5 kg/ha seed rate with cut treatment. Dai *et al.* (2013) also reported that proper management of the seeding rate can lead to higher grain yield of wheat. Tomar *et al.* (2001) assessed the potential of wheat production for green fodder cum grain in three varieties viz. UP 2003, UP 2338 and WH 542 and observed that harvesting green fodder at 60 or 70 DAS yielded good amount of green fodder, but grain yield was significantly lower as compared to uncut control.

Effect of fertilizer levels

Significantly higher yield (43.50 q/ha) and better growth and yield attributes was recorded with the application of 120 % RDF was applied over recommended dose (40.83 q/ha). Whereas, yield reduced significantly when 150% RDF was applied than 120% RDF dose this might be due to lodging. Green fodder yield also increased with increase in fertilizer dose from 100 % RDF to 150 % RDF. This might be due to more nutrient availability resulting in taller plants and enhanced crop growth. This tendency can be attributed to higher dose of nitrogen, which greatly helps the plant to expose its potential to grow vigorously. The results corroborate with the findings that nitrogen application significantly affected yield and yield components of wheat (Dean and Munford 2004). Wheat yield and yield components increased with nitrogen application up to 150 kg N/ha compared with control (Waraich *et al*., 2007 and Ahmad *et al.,* 2007). The results corroborates with the findings of Fluegel and Johnson (2001) who reported that higher nitrogen has a positive effect on dry matter production of wheat crop.

Highest B:C was recorded with application 150 % RDF which was followed by application of 120 % RDF which might be ascribed to the higher green fodder yield and grain yield recorded due to application of 50 % extra fertilizer than recommended. Varying fertilizer levels fail to influence harvest index of wheat varieties.

CONCLUSION

Wheat variety VL 829 outperformed C 306 and recorded significantly higher green fodder yield and grain yield than C 306. The B: C calculated was however higher in C 306 due to higher market price of its grain. Thus, VL 829 is more suitable variety for dual purpose in terms of fodder and grain yield but C 306 is economically better than VL 829. Increasing seed rate of dual purpose wheat varieties from 100 to 125 kg/ha resulted in significantly higher green fodder

yield. Highest grain yield was recorded in 125 kg/ha without cut treatment which was at par with 100 kg/ ha without cut and 112.5 kg/ha without cut treatments. Green fodder yield of dual purpose wheat varieties increased significantly with increase in fertilizer dose from 100 % RDF to 150 % RDF. Application of 150 % RDF being at par with 120 % RDF recorded significantly higher grain yield of dual purpose wheat varieties.

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