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EVALUATING SEED RATE, CUTTING AND NITROGEN LEVEL STUDY OF YIELD AND YIELD COMPONENTS OF *TRITICALE*

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ABSTRACT

This field experiment was conducted at New Development Farm, The University of Agriculture Peshawar to evaluate the seed rate, cutting and nitrogen level study of yield and yield components of *triticale*. Randomized complete block (RCB) design with split plot arrangement having four replications of each treatment was used. A control treatment was also included for comparison. The size of the sub plot was 1.5 m × 3 m. The row-row distance was 30 cm with five rows. Phosphorous was also applied at the rate of 90 kg ha^{-1} at the time of sowing. Irrigation was done as per required by the crop. All of the phosphorus and sulphur were applied at sowing time. Finding of the experiment illustrated that maximum emergence m^{-2} (118), fresh fodder yield (136 g m^{-2}), days to heading (117 days), plant height (98.6 cm) and delayed maturity (151 days) with seed rate of 140 kg ha^{-1}, while higher number of productive tillers (233 m^{-2}), grains spike^{-1} (44) was recorded at seed rate of 100 kg ha^{-1}. Higher unproductive tillers (17 m^{-2}) was obtained at the seed rate 120 and 140 kg ha^{-1}. Application of N at the highest level in (150 kg ha^{-1}) delayed day to heading (117 days), days maturity (150 days), produced taller plants (210 m^{-2}), higher fresh and dry weight (129 and 75 g m^{-2}), more number of grains spike^{-1} (42) as compared with other levels of N. Higher productive tillers (222 m^{-2}), CGR (14 g m^{-2} day^{-1}) were recorded at 120 kg N ha^{-1}. It can be concluded from the study that increase in seed rate at140 kg ha^{-1} and increase in nitrogen levels enhances the emergence m^{-2}, fodder yield, days to heading, plant height, and delayed maturity.

Keywords: Cutting, Nitrogen, Peshawar, Productive, RCBD, Seed rate, *Triticale*

INTRODUCTION

Triticale (*Triticosecale* W) belongs to the family gramineae, which is the result from intergeneric crossings of two crops, wheat and rye. It provides many economic and environmental benefits and produces grain in a high amount, which is being used into the industries (Kang *et al*., 2016). The purpose of this cultivar of crop was basically to get higher yield and huge amount of quality grains of wheat and rye. In addition, they have the characteristic to tolerate to different biotic and abiotic and other environmental conditions (Jorgensen *et al*., 2017). The characteristics includes the fast growth of the yield. Pragmatic approach in productivity in the lowlands, while the quality of the crop is preferred globally. The latest developed cultivars of the *triticale* crop which are sowed in winter, produces greater crop yield, however they are quickly adapted to various soils to grow and other environments (Estrada-Campuzano *et al*., 2012). The scientists are nowadays focusing greater on *triticale* crop as it presents various purposes like, higher amount of grain, greater amount in fodder, and best quality. These grains are used to feed the livestock, like animals and poultry etc. The analysis of the *triticale* seed proved that it preserves 19%-71% grain protein, which is greater than wheat, rice, rye, maize and oat seeds together and is proved to be an essential element in making up the human tissues (Viviana *et al*., 2016). The other crops produce low gluten, presents less resistance to the environment and shows up high rates of activity towards the alpha-amylase and results to get prepared for pre-harvest germination primarily, which generally produce low *triticale* yield and of lower quality which is unsuitable for many conditions for use at industry level.

Iqbal *et al*., (2016) revealed that higher number of grains spike^{-1} (72) and grain yield (4231 kg ha^{-1}) were produced by irrigation applied two times (seedling + tillering) while thousand grain weight (54 g) were recorded by irrigation applied three times (seedling + tillering + booting), in which the synthetic chemicals were not used and the data is simply been taken on irrigation intervals, but no other standard chemical was not used. Dumbrava *et al*., (2016) conducted an experiment on two *triticale* varieties (Tulus and Gorun 1) under few technological conditions. The irrigation was supplied as required by the crop. The experiment was conducted two varieties, where there is maximum probability that the data could not be called as valid, and may not be used further for research experiments, as there is a greater chance of missing the random data collection into the experiment. The data based on more than two varieties might be concluded valid and true.

Nitrogen is found in more amount in *triticale* which is a vital nutrient for stimulation. It influences on the formation of the important components of yield which are the final yield processing nutrients. The effect of nitrogen fertilizers in grain yield, components of yield and on the quality of grains depends highly on weather conditions, fertilization strategy, and other environmental hazards. (Hristofor, 2016).

The optimum seed rate selection for cereals may vary widely due to the variation in environment, area, the seed quality, seed genetics, other conditions of environment, planting dates and planting methods which varies like, drilling or broadcast. The higher and most vital factor to evaluate the ability of a cultivar about its resources, yield production and other components are the seed rate. The farmers often use the method to use the seed rate for better quality of yield and production. Various scientists and researchers showed their interest in evaluating the relationship for seed rate with that of the better yield crops in a quantitative mode to make optimal stocks at market level and maximize yields in various situations. The focus and attention from the farmers, agricultural scientists and researchers has increased in recent few years towards the density on *triticale* crop in capacity to its productive yield and its greater quality (Borneo, 2016). The researchers and agronomists do not have any uniform and valid recommendations for the seed rate of *triticale* cultivar per unit area like, Bartolozzo (2015) reported that the yield may be increased by providing 75 kg ha^{-1} seed rate while seeding at 100 kg ha^{-1} in field conditions may be used to boost up the grain yield of *triticale*.

The 17.1 million tons are produced in 37 countries according to FAO (FAO, 2014). The data and facts and figures on triticale cultivar is rather limited over the area and production in Pakistan region, as in general, the cultivation and experiments on *triticale* cultivar by the researchers is practiced in quite limited cities in this specific region. The objective of the current experiment is designed by keeping in view the importance of the seed rate, nitrogen level and fodder quality and quantity of the *triticale* cultivar under the field conditions.

MATERIALS AND METHODS

Experimental design/Layout/Treatment application: An experiment entitled "Evaluating seed rate, cutting and nitrogen level study of yield and yield components of *triticale*" was conducted, in order to study the effects of cutting (cutting or no cutting), seed rate (80, 100, 120 and 140 kg ha^{-1}) and nitrogen level (0, 90, 120 and 150 kg ha^{-1}) on *triticale*. The experiment was conducted at the Newly Development Farm, The University of Agriculture Peshawar (340-00° N, 710-300° E, 510 MASL). Our experiment was based on the design RCBD, following the split plot arrangements and four replications for every treatment, including the control. The specified combinations of cutting with seed rate were applied to the main plots with the allotted nitrogen level to the subplots (0, 90, 120 and 150 kg ha^{-1}). The size of the sub plot was 1.5 m × 3 m. The row-row distance was 30 cm with five rows. Phosphorous was also applied for the better yield at the rate of 90 kg ha^{-1} when the plants were sowed into the field. The seed rates of the crop sowing were 80, 100, 120 and 140 kg ha^{-1}. Irrigation was done as per required by the crop. pH of the soil was 7.6 - 7.7. Nitrogen was applied at its recommended rate of 120 kg ha^{-1} in the form of urea. All the agronomic practices were kept standard and uniform for all the tested treatments. The factors with their levels are given below:

Main plot: Factor A (Cutting) and No cut. Factor B (Seed rates at 80 kg ha^{-1}, 100 kg ha^{-1}, 120 kg ha^{-1}, and 140 kg ha^{-1}). Factor C (Nitrogen levels 0 kg ha^{-1}, 90 kg ha^{-1}, 120 kg ha^{-1}, and 150 kg ha^{-1}).

Data were recorded on the following parameters: Days to emergence, emergence m^{-2}, fodder yield, days to heading, number of productive tiller (m^{-2}), number of un-productive tillers, plant height (cm), lodging %age, days to maturity, and grains spike^{-1}.

Days to emergence: The time (days) of the emergence were noted initiating from the date of planting to the time, on which 80% emergence was finished in every subplot.

Emergence: The number of plants were counted by the emergence m^{-2} was noted in a meter-long row in 3 different rows from various locations randomly, after completing the maximum germination.

$$\text{Emergence m}^{-2} = \frac{\text{Number of seedling counted}}{\text{Row} - \text{row distance x row length x number of rows}} \text{x1m}^2$$

Fodder yield: After completing 40 days of the sowing a cut was created. The weight of the fresh material was been taken as a cut, it was later on dried and weighted for the send time (dry fodder yield) and was converted into kg ha-1.

Days to heading: When 80% heading were completed in each subplot, then a day to heading was noted. The days to heading was counted on the basis when 80% headings were recorded into the whole experiment field. It was counted from the date of planting.

Productive tillers: The number of productive tillers m-2 were taken into consideration in a single meter row which should not have different conditions than the other rows, into a single plot but at 3 various places which were later transferred into productive tillers (m-2).

Unproductive tillers: The number of unproductive tillers (m-2) were recorded in a 1 meter and straight row at each sub-plot but 3 different places which were then transformed into unproductive tillers (m-2) and the data were taken.

Plant height: Plant height (cm) was measured in a random selection of various 10 plants which were measured from ground-top after some time when they became physiologically matured.

Lodging score: Lodging score will be determined as described by Oplinger et al., (1985) using the following formula:

Lodging Score (LS) = S × I × 0.2

S=Surface area Loged (1=None) (9=Totally Loged)

I=Intensity of Lodging (1=None) (S=Totally Flate)

Lodging range=0.2-9.0

Physiological maturity days: The data for physiological maturity days were taken by calculating all the days from planting date till 80% of physiological maturity of the plants into the research field. The physiolo-gical maturity is measured by the total loss of green color from the leaves of the plant but not left for strong yellow color or brown.

Grains spike-1: Grains spike-1 was recorded by coun-ting the grains of triticale from 10 randomly selected plants in each plot and averaged.

Statistical analysis: ANOVA test was completed for the statistical analysis of the taken data of various parameters under the RCB design, following the split plot arrangements. Means were compared through LSD test at the level of $P \leq 0.05$ upon significant F-test (Jan et al., 2009).

RESULTS

Days to emergence: Days to emergence data of *triticale* as affected by cutting, seed rate and nitrogen level are given in table 1. The data for mean values showed that cutting, seed rate and nitrogen level did not significantly affect the data for days to emergence of *triticale* cultivar. All the interactions of the table 1 had no significant differrence. Maximum days to emergence (21) were revealed at the seed rate of 120 kg ha^{-1}, while the least days to emergence (10 and 10) were recorded at the seed rate of 80 kg ha^{-1} and 100 kg ha^{-1}, respectively.

Emergence m^{-2}: The data (table 2) revealed that the mean values of seed rate had significantly affected emergence m^{-2} of *triticale* while cutting, nitrogen level and all other interactions remained non-significant. Maximum emergence^{-2} was revealed at plot sown at 140 kg ha^{-1} (124), while minimum emergence^{-2} was recorded with the plot sown at 80 kg ha-1 (73).

Fresh fodder yield (g m^{-1}): Fresh fodder yield (g m^{-1}) is dependent on various level of seed rate and nitrogen level, which is all presented in table 3. The data for fresh fodder yield recorded significant differences on different level of seed rate and nitrogen level on *triticale's* fresh fodder yield, while the interaction effect was found non-significant. Mean values of the data revealed that increasing seed rates increased the fresh fodder yield (136 g m^{-2}) at the seed rate of 140 kg ha^{-1} whereas lower fodder yield (114g m^{-2}) was recorded with seed rate of 80 kg ha^{-1}. Regarding nitrogen level, more fodder yield (129g m^{-2}) was recorded, adding 150 kg N ha^{-1}, which was statistically at par with fodder yield (127g m^{-2}) obtained with the addition of 120 kg N ha^{-1} and lower fodder yield (120 g m^{-2}) was obtained from control plots.

Days to heading: Mean value (table 4) indicated that cutting, seed rate and nitrogen level had significantly affected days to heading of *triticale*. All interactions were found non-significant. Significant headings delayed with no cutting. Cut plots took more days to heading (117 days) while early heading (115 days) was recommended for no cut plots. Heading was delayed and increased with increasing seed rate as more days to heading (117 days) were recorded from plots sown at 140 kg seeds ha^{-1} while plots sown with the 80kg ha^{-1} seed rate had appeared heading in less days than the other plots (115 days). Delay to heading with increasing nitrogen levels was observed. Among nitrogen levels, 150 kg N ha^{-1} revealed highest data for days to heading (117 days) whereas the control plots recorded minimum data for days to heading (116 days) and was at per with other levels of N.

Productive tillers (m^{-2}): The productive tillers (m^{-2}) data of *triticale* were taken which showed significant difference by cutting, seed rate and nitrogen are presented in table 5. Mean values of the data revealed that cutting, seed rate and nitrogen level had significantly affected the number of productive tillers (m^{-2}) of *triticale* cultivar. All interactions were found non-significant. Results revealed that number of productive tillers (m^{-2}) degraded through cutting. *Triticale* cultivar recorded least data (203) from cut plots, whereas highest number of productive tillers (221) were recorded in no cut plots into the experiment. The plots which were provided 100 kg seeds ha^{-1} presented maximum data (233), whereas the plots provided 120 kg ha^{-1} seed rate recorded least data (204) and showed that it was statistically at par from the plots with 140 and 80 kg ha^{-1} seed rate. The plots which were provided 120 kg N ha^{-1} recorded the maximum data (222), while the control plots presented minimum data (202), which is presented in table 5.

Table 1: Days to emergence of *triticale* as affected by seed rate, nitrogen level and cuttings.

Nitrogen Level (kg ha^{-1})	Seed rate (kg ha^{-1})				Mean
	80	100	120	140	
0	10	10	15	13	12
90	12	14	19	17	15
120	15	19	21	17	18
150	11	13	19	20	15
Mean	12 d	14 c	18 a	16 b	

LSD for seed rates = 2.7, N = 5.6 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

:**Table 2: Emergence (m^{-2}) of *triticale* as affected by seed rate, nitrogen level and cuttings.**

Nitrogen Level (kg ha^{-1})	Seed rate (kg ha^{-1})				Mean
	80	100	120	140	
0	73	82	103	114	93
90	77	87	109	116	97
120	80	83	112	121	99
150	83	92	113	124	103
Mean	78 d	86 c	109 b	118 a	

LSD for seed rates = 6.0, N = 11.8 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Table 3. Fresh fodder yield (g m^{-2}) of *triticale* as affected by seed rate, nitrogen level and cuttings.

Nitrogen level (kg ha^{-1})	Seed rate (kg ha^{-1})				Mean
	80	100	120	140	
0	107	117	126	132	120
90	114	119	129	134	124
120	117	123	131	136	127
150	118	125	133	141	129
	114 d	121 c	130 b	136 a	

LSD for seed rates = 3.5, N = 7.4 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Table 4. Days to heading of *triticale* as affected by seed rate, nitrogen level and cuttings.

Cuttings	Nitrogen levels (kg ha^{-1})	Seed rates (kg ha^{-1})				C × N
		80	100	120	140	
No cut	0	115	114	115	116	115
	90	114	115	115	116	115
	120	114	115	116	117	116
	150	115	116	116	117	116
Cut	0	115	116	117	117	116
	90	116	117	117	118	117
	120	116	117	117	118	117
	150	116	118	118	118	118
	Mean	115 b	116 ab	116 ab	117 a	

LSD for seed rates = 15.8, N = 22.9 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Table 5: Productive tillers (m^{-2}) of *triticale* as affected by seed rate, nitrogen level and cuttings.

Cuttings	Nitrogen Levels (kg ha^{-1})	Seed rates (kg ha^{-1}) 80	100	120	140	C × N
No cut	0	207	237	182	201	207
	90	221	266	197	218	226
	120	232	274	236	209	238
	150	224	244	194	194	214
Cut	0	182	212	190	204	197
	90	179	207	210	210	201
	120	193	209	219	207	207
	150	208	213	201	201	206
	Mean	206 b	233 a	204 b	205 b	

LSD for seed rates = 19.3, N = 26.4 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Unproductive tillers (m^{-2}): The data for unproductive tillers m^{-2} of *triticale* cultivar as affected by cutting, seed rate and nitrogen levels is presented in table 6. The data table indicates that cutting, and seed rate had significant differences, which affected the number of unproductive tillers m^{-2}, whereas the effect of N level was recorded to have no significant difference. All interactions were found to be non-significant. Number of unproductive tillers m^{-2} increased with cutting. Cut plots produced higher number of unproductive tillers m^{-2} (17) while no cut plots resulted in lower number of unproductive tillers m^{-2} (15).

Plots sown at 120 kg seeds ha^{-1} produced more number of unproductive tillers m^{-2} (17), which was statistically at par compared to the plots which were provided 140 kg ha^{-1}seed rate. In addition, the plots provided 100 kg ha^{-1} seed rate revealed minimum data (14).

Plant height (cm): Table 7 showed cutting, seed rate and nitrogen level had significantly affected plant height (cm) of *triticale*. The interaction between SR × N was found significant while all other interactions were found non-significant. Mean value of the data revealed that plant height of *triticale* increased with no cutting. No cut plots attained maximum plant height (97.8 cm) while cut plots had minimum plant height (94.0 cm). Plant height increased with increasing seed rate. Plots sown at 140 kg seeds ha^{-1} produced taller plants (100.3 cm) while plots provided 100 kg ha^{-1} seed rate recorded smaller plants (93.0 cm), and revealed statistically at par with plots treated with 80 kg ha^{-1} and 120 kg ha^{-1} seed rate. The height of the *triticale* cultivar plant increased with nitrogen application. Among nitrogen level, 150 kg N ha^{-1} resulted in maximum plant height (96.8 cm) while control plots produced minimum plant height (93.6 cm) which was statistically at par with plots fertilized with 120 and 90 kg N ha^{-1}. The interaction between SR × N showed that *triticale* sown at either seed rate did not gain maximum height with increase in N level above 90 kg ha^{-1} although the absolute values were higher in seed rate.

Table 6: Unproductive tillers (m^{-2}) of *triticale* as affected by seed rate, nitrogen level and cuttings.

Cuttings	Nitrogen Levels (kg ha^{-1})	Seed rates (kg ha^{-1}) 80	100	120	140	C × N
No cut	0	11	12	19	16	15
	90	12	12	16	14	13
	120	14	12	14	16	14
	150	15	15	17	18	16
Cut	0	16	15	19	19	17
	90	19	17	17	16	17
	120	16	15	16	16	16
	150	16	16	16	19	17
	Mean	15 b	14 c	17 a	17 a	

LSD for seed rates = 17.8, N = 26.9 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Table 7: Plant height (cm) of *triticale* as affected by seed rate, nitrogen level and cuttings.

Cuttings	Nitrogen levels (kg ha^{-1})	Seed rates (kg ha^{-1}) 80	100	120	140	C × N
No cut	0	94.5	96.0	94.8	98.3	95.9
	90	99.5	97.0	100.0	103.0	99.9
	120	95.3	89.8	99.5	109.0	98.4
	150	95.5	99.0	96.3	97.5	97.1
Cut	0	91.5	91.0	90.8	92.3	91.4
	90	96.5	92.5	92.5	97.0	94.6
	120	93.8	85.5	93.0	102.5	93.7
	150	92.5	93.5	97.0	102.8	96.4
	Mean	94.9 b	93.0 b	95.5 b	100.3 a	

LSD for seed rates = 21.1, N = 26.5 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Lodging score: No data was collected on lodging as there was no lodging therefor during the experiment in each plot.

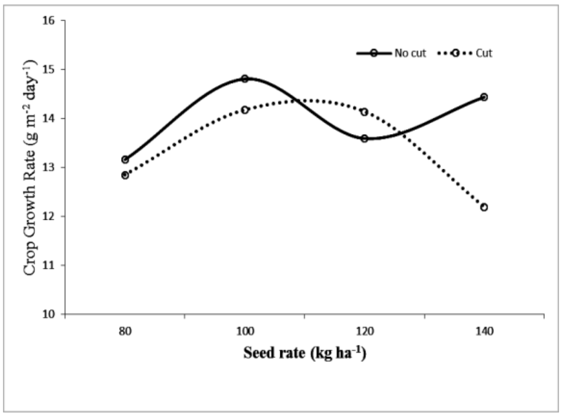

Figure 1. Crop growth rate of *triticale* as affected by C × SR interaction.

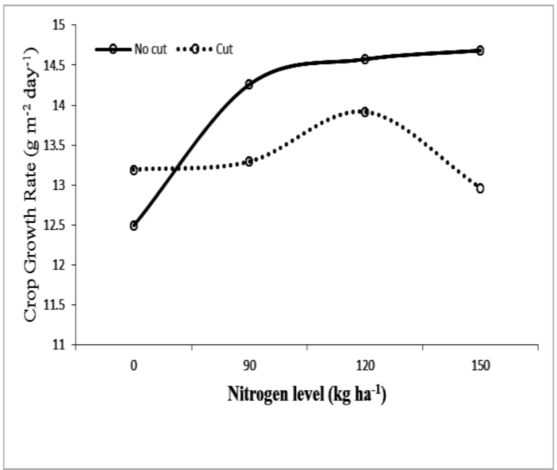

Figure 2. Crop growth rate as affected by C × N interaction.

Days to maturity: The table 8 revealed the data for days to maturity of *triticale* cultivar as affected by cutting, seed rate and nitrogen. The mean values inside the table recorded that cutting, seed rate and nitrogen level had significantly affected the data. Data showed that maturity was signify-cantly delayed with no cutting. Cut plots took more days to maturity (150 days) while no cut plots took less days to maturity (148 days). Delay in maturity with increasing seed rate was obser-ved. More days to maturity (150 days) were recor-ded from plots sown at 140 kg seeds ha^{-1} took while fewer days to maturity (147 days) were obtained from plots having seed rate 80 kg ha^{-1}. Maturity delayed with increasing nitrogen levels. Among nitrogen levels, 150 kg N ha^{-1} significan-tly delayed maturity (150 days) while control plots enhanced maturity (148 days).

Grains spike^{-1}: Table 9 revealed that cuttings, seed rates and nitrogen levels had significantly affected grains spike^{-1} of *triticale*. All interactions were found non-significant. Grains spike^{-1} decre-ased with cutting. Cut plots recorded minimum grains spike^{-1} (41) while no cut plots had maxi-mum grains spike^{-1} (43). The 100kg ha^{-1} seed rate plots revealed maximum data (44), whereas the plots provided the 80kg ha^{-1} seed rate revealed lower data (40). Among nitrogen levels, 120 kg N ha^{-1} resulted in maximum grains spike^{-1} (45) while control plots produced grains spike^{-1} (40) which was statistically at par with plots fertilized with 90 kg N ha^{-1}.

Table 8: Days to maturity of *triticale* as affected by seed rate, nitrogen level and cuttings.

Cuttings	Nitrogen Levels (kg ha^{-1})	Seed rates (kg ha^{-1})				C × N
		80	100	120	140	
No cut	0	148	147	147	150	148
	90	147	148	148	149	148
	120	147	148	148	150	149
	150	147	149	149	150	149
Cut	0	147	149	149	150	149
	90	148	150	150	151	150
	120	148	150	150	151	150
	150	149	151	151	152	151
	Mean	147 c	149 b	149 b	150 a	

LSD for seed rates = 29.4, N = 32.0 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Table 9: Grains spike^{-1} of *triticale* as affected by seed rate, nitrogen level and cuttings.

Cuttings	Nitrogen levels (kg ha^{-1})	Seed rates (kg ha^{-1})				C × N
		80	100	120	140	
No cut	0	39	48	40	38	41
	90	39	42	40	47	42
	120	41	47	47	47	46
	150	45	45	40	43	43
Cut	0	37	42	38	36	38
	90	34	41	38	45	40
	120	44	46	47	41	45
	150	43	42	38	41	41
	Mean	40 bc	44 a	41 b	42 b	

LSD for seed rates = 22.3, N = 29.6 and SR × N = Ns
Mean values in each set followed by various alphabets considerably varies at 5% level of probability.

Economic Analysis: The economic analysis of the data are presented in table 10. The economic analysis of the data showed that in not cut plots, higher net income (97,144/- PKR) was revealed and value cost ratio (2.8) at the seed rate 100 kg ha^{-1}, followed by 120 kg N ha^{-1}. In addition, lower net income (60475/- PKR) and value cost ratio (1.9) was recorded at 120 kg ha^{-1} seed rate along with control plots including nitrogen. Similarly, in cut plots maximum net income (72,201/- PKR) and value cost ratio (2.0) was obtained at 120 kg ha^{-1} seed rate plots as well as 120 kg N ha^{-1} were used. While minimum net income (61,149/- PKR) and value cost ratio (1.6) was obtained from those plots where 120 kg ha^{-1} seed rate along with 150 kg N ha^{-1} were used. No cut plots revealed higher net income (97,144/- PKR) and value cost ratio (2.8) as compared to cut plots.

Table 10: Economic Analysis

Cuttings	N- levels kg ha^{-1}	Seed rate kg ha^{-1}	Fodder yield kg ha^{-1}	Straw yield kg ha^{-1}	Fodder income (Rs)	Grain income (Rs)	Straw income (Rs)	Total Expenditure	Gross income (Rs)	Net income (Rs)	VCR
No	0	80	0	3722	0	86415	14888	29250	101303	72053	2.5
No	0	100	0	3962	0	97125	15848	30250	112973	82723	2.7
No	0	120	0	3865	0	76265	15460	31250	91725	60475	1.9
No	0	140	0	4105	0	83965	16420	32250	100385	68135	2.1
No	90	80	0	3366	0	91385	13464	31600	104849	73249	2.3
No	90	100	0	5212	0	106120	20848	32600	126968	94368	2.7
No	90	120	0	4691	0	82355	18764	33600	101119	67519	2.0
No	90	140	0	4853	0	89145	19412	34600	108557	73957	2.1
No	120	80	0	3909	0	94360	15636	33550	109996	76446	2.3
No	120	100	0	5116	0	111230	20464	34550	131694	97144	2.8
No	120	120	0	4529	0	95375	18116	35550	113491	77941	2.2
No	120	140	0	4850	0	86380	19400	36550	105780	69230	1.9
No	150	80	0	4498	0	92225	17992	35532	110217	74684	2.1
No	150	100	0	4998	0	98735	19992	36532	118727	82194	2.2
No	150	120	0	5068	0	80850	20272	37532	101122	63589	1.7
No	150	140	0	5307		80080	21228	38532	101308	62775	1.6
Cut	0	80	107	3955	1391	76755	15820	29250	93966	64716	2.2
Cut	0	100	117	3770	1521	85365	15080	30250	101966	71716	2.4
Cut	0	120	126	4631	1638	78120	18524	31250	98282	67032	2.1
Cut	0	140	132	3342	1716	83895	13368	32250	98979	66729	2.1
Cut	90	80	114	4108	1482	75460	16432	31600	93374	61774	2.0
Cut	90	100	119	4097	1547	83650	16388	32600	101585	68985	2.1
Cut	90	120	129	4465	1677	85610	17860	33600	105147	71547	2.1
Cut	90	140	134	3634	1742	84840	14536	34600	101118	66518	1.9
Cut	120	80	117	4134	1521	79240	16536	33550	97297	63747	1.9
Cut	120	100	123	4167	1599	86345	16668	34550	104612	70062	2.0
Cut	120	120	131	4147	1703	89460	16588	35550	107751	72201	2.2
Cut	120	140	136	4208	1768	85925	16832	36550	104525	67975	1.9
Cut	150	80	118	3177	1534	85750	12708	35532	99992	64459	1.8
Cut	150	100	125	4122	1625	87920	16488	36532	106033	69500	1.9
Cut	150	120	133	3562	1729	82705	14248	37532	98682	61149	1.5
Cut	150	140	141	4162	1833	82845	16648	38532	101326	62793	1.6

Price of seed kg^{-1} = Rs. 48, Price of fodder kg^{-1} = Rs. 13, Price of seed kg^{-1} = Rs. 48, Price of fodder kg^{-1} = Rs. 13

DISCUSSION

Data pertaining emergence m^{-2} showed that seed rates had a significant effect on emergence m^{-2} of *triticale* while cutting, nitrogen levels and all interactions remained non-significant. Emergence m^{-2} increased with enhancing seed rates to 140kg ha^{-1} while nitrogen levels and cutting remained non-significant. The results are similar with the experiment of Mohammed and Hamed (2013), who reported that enhanced seeding density resulted in an increase of emerged plants. There was an increase in emergence m^{-2} with increased seed rate.

Data regarding days to emergence showed that cuttings, seed rates and nitrogen levels had no significance over days to emergence of *triticale*. This might be since the seed consumes food from endosperm for germination and nutrients from exogenous sources, which have no effect on germination (Scarlett *et al*., 2017).

Fresh fodder yield was increased with increase in seed rate. The probable reason for this increase was the increase of seed rate of planting density, while more number of plants were harvested which lead to increase the fodder yield. The results show similarity with the results of Pejin *et al*. (2014) who worked on increased biomass yield using higher seed rate. The total yield in fodder and that of nitrogen level was due to the higher nutrient availability, which increased plant growth and accumulated more dry matter. Gutierrez *et al*., (2015) has reported the same findings, who concluded that by increasing the nitrogen level, the total yield of the crop maximizes.

Data regarding days to heading shows that cuttings, seed rate and nitrogen level had signifycantly affected days to heading of *triticale*. Heading was delayed with increasing seed rate and application of nitrogen also delayed the headings, which was due to the increase vegetative growth promotion in case of higher nitrogen level. Moreover, heading was delayed in no cut plots, which might be due to the fact that the growth duration of cut plots were made shorter as compared with no cut plots.

The productive tillers (m^{-2}) data presents that cuttings, seed rate and nitrogen level have signifycant difference towards the number of productive tillers (m^{-2}) of the *triticale* cultivar. The data reveals and increase at 100 kg ha^{-1} seed rate and recorded a decrease by increasing the seed rate beyond 100kg ha^{-1}. These results are similar to the experiment of Aguirre *et al*. (2013) which concluded that the number of tillers decreased with increasing planting density. The use of N boosts up the number of productive tillers than the control plot plants. Bartolozzo *et al*., (2015) concluded a significant difference in the data for productive tillers followed by the higher application of N. The increase in number of productive tillers m^{-2} could be produced with the application of nitrogen level on *triticale*. These results are in line with Bielski (2015), who reported that there will be a total increase in tillers by increasing nitrogen level. Plots with no cut produced more productive tillers, which was due to the more assimilate synthesis with no cut treatment, which leads to the dry matter production and ultimately produce more productive tillers.

Data regarding unproductive tillers m^{-2} showed that cuttings, seed rate and nitrogen level had a significant effect on the data taken of the *triticale* cultivar. The data boosts up by increasing the seed rate, which was due to more competition for assimilates and resources, which leads to lower crop growth. Increasing nitrogen application decreases the number of unproductive tillers by vigorous growth by providing the nitrogen levels which leads to more productive tillers. The no cut plots produce less number of unproductive tillers, which was due to the longer growing period and thus increasing the productive growth as well.

Data pertaining plant height showed that cuttings, seed rate and nitrogen level had significant effects on plant height of *triticale*. Plant height increases with increasing seed rates and nitrogen level in cut plots. Our results are keeping pace with the experiment of Stoyanov (2015) who reported that in cut plots there would be greater number of taller plants while in non-cutting treatments, shorter plants would be greater in number. Their experiment also showed that the increase in plant height after increasing the planting density. It was due to the high planting density, and plants competing for light which resulted in greater plant height. Scarlett *et al.*, 2017 reported that increase in nitrogen level significantly enhances the plant height over the control. The results are in accordance with Gutierrez *et al*. (2015) who observed taller plants due to nitrogen fertilization. This trend was due to higher nitrogen availability which leads the plot to grow vigorously.

Data pertaining days to maturity showed that cutting, seed rate and nitrogen level had signifycantly affected days to maturity of *triticale*. Maturity was delayed with increasing seed rates. The delay in maturity due to increased seed rate was due to excessive vegetative growth, which leads to delayed maturity. Application of nitrogen delayed maturity of *triticale*, which was due to better utilization and supply of nutrients till the end at growing season and the ability of nitrogen to enhance the vegetative growth delayed the maturity. The cut plots took more days to maturity which are due to the longer growth duration. Our results are similar to Khalil (2011), who reported that cutting stem at elongation period delays phonological characteristics. Priya *et al*., (2015) reported that delayed maturation and increasing the nitrogen level increases the duration of vegetative growth.

Data regarding grains spike^{-1} showed that cutting, seed rate and N level makes significance difference towards the grains spike^{-1} of the *triticale* cultivar. The data reveals increase by increasing the seed rate as inter and intra plant competition is lower at lower seed rates, which resulted in higher yield in grains. The application of nitrogen increased the number of grains spike^{-1}, which was due to increase in growth and assimilates synthesis with higher N and thus increasing the number of grains. The cut plots produced lower grains in comparison with no cut plots, probably due to more dry matter production in the no cut plots which resulted in higher number of grains production. Our results are confirmed by Baixauli *et al*., (2015), who reported that when the apical meristem is cut, the appearance of secondary tillers and smaller spikes results in less grain. Our results are similar to Deuter *et al*., (2017), who found that all planting densities significantly influences number of grains spike^{-1}, but in contrast to Iqbal *et al*. (2010), who observed that increased planting density produces significantly more number of grains spike^{-1}. Their experiment also revealed that increase in nitrogen level produces maximum number of grains spike^{-1}. Priya *et al.* (2015) found that the plots fertilized with nitrogen had more grains spike^{-1}. Amjed *et al*. (2011) reported that increasing nitrogen level produces greatest number of grains spike^{-1} as compared to no nitrogen application.

The economic analysis of the data showed that in not cut plots, higher net income (97,144/- PKR) and value cost ratio (2.8) was recorded at the seed rate 100 kg ha^{-1}, followed by 120 kg N ha^{-1}. In addition, lower net income (60,475/- PKR) and value cost ratio (1.9) revealed at the seed rate 120 kg ha^{-1}, followed by the control plots of N applications. Similarly, in cut plots maximum net income (72,201/- PKR) and value cost ratio (2.0) was obtained at the seed rate 120 kg ha^{-1}, followed by the application of 120 kg N ha^{-1}. Whereas the lowest net income (61,149/- PKR) and value cost ratio (1.6) was obtained from those plots at the seed rate 120 kg ha^{-1}, followed by 150 kg N ha^{-1}. The no cut plot treatments gave higher net income (97,144/- PKR) and value cost ratio (2.8) as compared to cut plot treatments.

CONCLUSION

It is concluded from the experiment that by providing the seed rate in greater amount, the yield of all the parameters like, days to emergence, emergence m^{-2}, fresh fodder yield (g m^{-1}), days to heading, the data for productive tillers m^{-2}, the data for unproductive tillers m^{-2}, heights of plants cm, lodging score, while data for days to maturity, and the data for grains spike^{-1} increased. Likewise, by increasing the nitrogen level into the field, all the parameters revealed maximum yield. Cutting is also one of the best tool to increase the total production and to maximize the yield. The cut plot plants recorded higher yield into our experiment as compared to the non-cut plot plants. It is recommended that to use the nitrogen levels and seed rate both in a greater amount at the field to achieve higher productive yield.

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