The Future of Agriculture

FSA

Article

Effect of Some Cutting Practices on Productivity of Triticale Under New Valley Conditions

Hosam A. Shoman* and Alaa M. Bughdady

Plant Production Dept., Desert Research Center, El-Matariya, Cairo, Egypt.

***Corresponding author:** h.shoman@gmail.com

Abstract: Two field experiments were carried out at the Experimental Research Station, Desert Research Center, EL-Kharga Oasis, New Valley Governorate, during the two winter growing seasons of 2020/ 2021 and 2021/ 2022. The aim of the present study was to investigate the potentiality evaluation of grain and forage yields of triticale using some cutting practices under New Valley conditions. Based on the results obtained, if the purpose of planting triticale is to obtain green fodder, the study recommends performing the mowing process 80 days after planting and at a height of 15 cm from the surface of the ground, while if the purpose is to produce grains, the study recommends performing the mowing process at 50 days old from planting and at a height of 15 cm from the ground under New Valley conditions.

Key words: Triticale, cutting height, cutting age, Green fodder, grains and yield.

Future Science Association

Available online free at www.futurejournals.org

Print ISSN: 2687-8151

Online ISSN: 2687-8216

DOI: 10.37229/fsa.fja.2024.09.19

Received: 29 July 2024
Accepted: 28 August 2024
Published: 19 September 2024

Publisher's Note: FA stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

The lack of availability of green fodder in the early winter season due to the most of areas being used for cultivating wheat and bean crops in the New Valley is considered one of the most important problems facing agricultural production. Livestock is a major component of the agricultural production system and is inextricably tied to forage production (**FAO, 2022**). In this regard, triticale is one of the new cereal crops in the plant kingdom. It is the first specific hybrid between wheat and ryegrass. The aim of its production was to combine the productive and technological qualities of wheat and the rye qualities in terms of tolerance and resistance to environmental conditions that are not suitable for wheat growth. **Royo (2019)** reported that triticale is characterized by its ability to withstand high temperatures and many diseases and the ability to grow in all types of soils and poorly drained lands. It is also characterized by a high percentage of protein and lysine, but the percentage of flour extraction

from it is low, and the technological characteristics determining the quality of bread are lower than those of bread wheat. **Bilgili *et al.* (2009)** indicated that triticale is characterized by strong vegetative growth in terms of plant height, leaf surface area, increased number of lateral branches, resistance to lodging, and has the ability to restore growth after cutting. Therefore, it can be used as a multi-cutting as green fodder crop for animal feed. The percentage of crude protein is 9-12 %, crude fiber is 27-30 %, and ash is 9- 12 %, fat 2-3 %, and soluble carbohydrates 46-48 %. It can be used as a dual-purpose crop, where one or two cuttings can be obtained as a green fodder crop and left to produce grains after the second cutting to provide multiple sources of green fodder throughout the year to provide the balanced nutritional needs of livestock. It can also be mixed with Egyptian clover to increase the proportion of carbohydrates in the diet, which increases the energy content. Thus, the diet is more balanced than when feeding on clover alone, which is reflected in the accumulation of meat or increased milk production in farm animals.

In the New Valley due to the presence of enormous animal wealth, entering of a dual-purpose winter fodder crop, such as triticale, is a great importance because the possibility of growing it as a green fodder yield in the winter period, which can be facing a shortage of green fodder, or obtaining two cutting of green fodder then leaving it until maturity to obtain grains and thus forage needs can be met for a long period of the year.

The date of the triticale cutting represents great importance in determining the yield, whether the purpose is to obtain green fodder only or obtain green fodder and grains together, because it is associated to many crop components such as area and density of the leaves, plant height، fresh and dry weights **(Yuanwei *et al.*, 2023)**. **Pipat *et al.* (2014)** found that cutting the triticale crop after 70 days of planting gave the highest green fodder yield compared to the other dates. In the same direction, **Rojas *et al.* (2022)** found that cutting of triticale crop after 75 days of planting gave the highest amount of green fodder yield. While **Yuanwei *et al.* (2023)** found that the highest grain yield for the triticale crop was obtained when cutting was at 50 days of planting.

The cutting height of the triticale crop is considered one of the most important factors that affect the amount of green fodder yield or the obtained grain yield, because this factor is specifically related to controlling the growth and development of the basal shoots, which grow and give lateral branches. In this respect, **Elena *et al.* (2021)** indicated that 270 kg ha^{-1} are lost per 1 cm increase in cutting height more than 15 cm. These results are consistent with both **(Kahle *et al.*, 2001, Dumoulin *et al.*, 2016** and **Fernando 2017)**. The aim of this research was to determine the effect of time and height cutting of triticale on the productivity under New Valley conditions.

2. Materials and Methods

Site description

Two field experiments were carried out at the Experimental Research Station, Desert Research Center (D.R.C.), EL-Kharga Oasis, New Valley Governorate, during the two winter growing seasons of 2020/ 2021 and 2021/ 2022 This was to investigate the potentiality evaluation of grain and forage yields of triticale using some cutting practices under New Valley conditions. The physical and chemical soil characteristics of the studied site were determined according to **Klute (1986)**, as recorded in table (1). The chemical analysis of irrigation water was carried out using the standard method of **Page *et al.* (1982)** and presented in table (2).

Table (1). Physical and chemical properties of the experimental soil

Season	Particles (%)			Texture	EC (ppm)	pH	P(ppm)	Available aions (meq/l)							
	Sand	Silt	Clay					N	K	Ca	Mg	$CO_3^{=}$	HCO_3^-	Cl^-	SO_4^{--}
2021	77.3	15.4	7.3	sand	951	8.2	0.54	0.67	1.35	1.10	0.89	4.32	7.15	104.6	0.82
2022	78.5	14.9	6.6		936	8.1	0.65	0.84	1.44	1.23	0.78	4.13	6.87	95.9	0.71

Table (2). Analysis of irrigation water

Season	pH	E.C. ds/m	S.A.R	Soluble cations (meq/l)				Soluble anions (meq/l)			
				Ca^{++}	Mg^{++}	Na^+	K^+	$CO_3^{=}$	HCO_3^-	$SO4^{=}$	Cl^-
2021	7.84	1.17	6.86	13.68	2.74	14.82	0.41	-	5.43	4.37	9.47
2022	7.79	1.12	6.14	15.32	2.93	14.51	0.45	-	5.69	4.76	10.24

Experimental treatments

The experiment included 9 treatments which were the combinations between three cutting dates for triticale and three cutting heights:

1. Cutting dates: CD

In this study, three dates of cutting for triticale can be explained after planting as follows:

1.1. 50 days.

1.2. 65 days.

1.3. 80 days.

Whereas, after the cutting process (whereas after 50, 65, or 80 days), the plants are left until it produces grains.

2. Cutting heights: CH

Three heights of triticale cutting will be studied, starting from the soil surface, shown as follows:

2.1. 5 cm.

2.2. 10 cm.

2.3. 15 cm.

Whereas, the cutting process was carried out after 30 days for each a height of 5, 10 and 15 cm above the soil surface to study the best cutting height. then all vegetative measurements were estimated at 50 % of spikes emergence, while grain yield at harvest.

Agricultural practices

While preparing the land for planting, 10 ton $fed.^{-1}$ of compost and 200 kg $fed.^{-1}$ calcium mono-phosphate (15.5 % P_2O_5) were added. Nitrogen fertilizer was added in the form of ammonium nitrate 33.5. % in an amount of 75 kg N $fed.^{-1}$ in doses through drip irrigation. The triticale variety used is Bahtim 2. Triticale grains were sowing at (55 kg $fed.^{-1}$) and had sown on the 15th of November in the two growing seasons. The preceding summer crop was peanut in both seasons. All recommended common agricultural practices were adopted through the two experimental seasons till harvest.

Measurements

A. Green fodder

Through a sample taken at each cutting, which is: 1- Plant height (cm). 2- Green fodder yield (kg/ fed.$^{-1}$). 3- Dry fodder yield (kg fed.$^{-1}$). 4- Protein g kg^{-1}. 5- Carbohydrate g kg^{-1}. 6- Fiber g kg^{-1}. 7- Water use efficiency WUE (kg m^{-3}). Whereas: WUE was calculated from equation (1) as followed, WUE = Green fodder yield kg fed.$^{-1}$ /actual consumptive use m^3 fed^{-1}. The crude protein content g kg^{-1} was estimated by estimating the percentage of nitrogen in 1 kg of green fodder for each treatment and multiplying it by 5.7 as described in **(AOAC, 2005)**. Total available carbohydrates were extracted according to **(Smith *et al.* 1964)**. Crude fiber % was determined according to the **(A.O.A.C. 1995)**.

B. Grain yield

The amount of grain yield in triticale was estimated after cutting (50 ,65 and 80 days). Grain yield (kg fed.$^{-1}$), determined by threshing the harvested area (plot, 10.5 m^2) for each treatment and weighting the grains.

Experimental design

The experiment was laid out in a split plot design with three field replications. The main plots were assigned to the three tested cutting dates, and the sub plots allotted with the three cutting heights. Each subplot was 10.5 m^2. All the obtained data for each treatment were subjected to analysis of variance according to the method described by **(Gomez and Gomez 1985)**. The least significant difference (LSD) at 5 % level of significance was used.

3. Results and Discussion

1. Effect of cutting dates: CD

The results recorded in Table 3 indicate that the effect of cutting dates was significant on all the traits studied in both seasons. When cutting the triticale plants after 80 days of planting, the highest values were obtained for most of the studied traits, as the plant height reached to 129 and 133 cm, the green fodder yield reached to 2816 and 2830 kg fed.$^{-1}$, the dry fodder yield reached to 2154 and 2173 kg fed^{-1}, the protein content of the plant reached to 176 and 181 g kg^{-1}, water use efficiency reached to 0.499 and 0.504 kg m^{-3}. On the other hand, the plant's carbohydrate content gave its highest value 255 and 258 g kg^{-1} when cutting was done at 65 days after planting, while the plant's fiber content had the lowest values of 209 and 213 g kg^{-1} when cutting was done at 50 days after planting. Regarding grain yield, the highest value was 1489 and 1499 kg fed.$^{-1}$ when cutting at 50 days after planting in the first and second seasons, respectively. Based on the results obtained, the study recommends that if the purpose of planting triticale is to obtain green fodder, then cutting must be carried out at 80 days of planting. However, if the purpose is to obtain grains, then cutting must be carried out 50 days after planting, to get the best results. These results are in agreement with those obtained by (**Pipat *et al.*, 2014, Rojas *et al.*, 2022, & Yuanwei *et al.*, 2023**).

2. Effect of cutting heights: CH

The results recorded in Table 4 show that all the studied traits were significantly affected by the cutting height treatment, with the exception of the plant's carbohydrate content, which did not reach the degree of significance in both seasons. The results showed that the best cutting height was 15 cm above the ground, with the exception of the plant's protein content, which gave the highest values (176

and 182 g kg^{-1}) when cutting was at a height of 10 cm in both seasons. Carrying out cutting at a height of 15 cm above the ground gave the highest value for: plant height 139 and 141 cm, green fodder yield 2906 and 2922 kg fed^{-1}, dry fodder yield 1987 and 1995 kg $fed.^{-1}$, plant fiber content 251 and 259 g kg^{-1}, water use efficiency 0.523 and 0.534 kg m^{-3} and grain yield 1993 and 2008 kg $fed.^{-1}$ in both seasons, respectively. These finding are agreement with those obtained by (**Kahle *et al.*, 2001, Habib *et al.*, 2015, Dumoulin *et al.*, 2016, Fernando 2017, Elena *et al.*, 2021 & Jorge *et al.*, 2021**).

3. Effect of the interaction

Regarding the effect of the interaction between the two study factors recorded in (Table 5 a and b) and indicated that the effect was significant in both seasons. The highest values of plant height, green fodder yield, dry fodder yield, plant content of protein and water use efficiency were obtained when cutting of triticale at age of 80 days from planting and perform the cutting process at a height of 15 cm above the ground. While the highest carbohydrate content was when cuttings were made at the age of 65 days and at a cutting height of 5 cm from the soil surface in both seasons. The fiber content of the plant had another trend, as it was given the lowest value when cutting was performed at the age of 50 days and a height of 15 cm in both seasons. As for grain yield, the highest value was when cutting at the age of 50 days and at a cutting height of 15 cm from the ground surface in both seasons.

Table (3). Effect of the cutting dates (CD) on productivity and some chemical composition of triticale during 2020/ 2021and 2021/ 2022 growing seasons at the New Valley

	Green fodder							**Grain**
Char. / **CD.**	**Plant height** cm	**Green fodder yield** kg $fed.^{-1}$	**Dry fodder yield** kg $fed.^{-1}$	**Protein** g kg^{-1}	**Total Carboh.** g kg^{-1}	**Fiber** g kg^{-1}	**WUE** kg m^{-3}	**Grain yield** kg $fed.^{-1}$
2020/ 2021								
After 50 days	53	1503	1127	91	158	209	0.275	1489
After 65 days	96	2141	1688	139	255	251	0.413	1182
After 80 days	129	2816	2154	176	204	269	0.499	6
LSD at 5%	**7**	**86**	**112**	**8.4**	**13**	**11**	**0.019**	**36**
2021/ 2022								
After 50 days	56	1528	1140	95	161	213	0.294	1499
After 65 days	98	2165	1712	142	258	259	0.426	1188
After 80 days	133	2830	2173	181	209	277	0.504	702
LSD at 5%	**6**	**95**	**104**	**9**	**17**	**14**	**0.016**	**38**

Table (4). Effect of the cutting heights (CH) on productivity and some chemical composition of triticale during 2020/ 2021and 2021/ 2022 growing seasons at the New Valley

	Green fodder							Grain
Char. / CH.	Plant height cm	Green fodder yield kg fed.$^{-1}$	Dry fodder yield kg fed.$^{-1}$	Protein g kg^{-1}	Total Carboh. g kg^{-1}	Fiber g kg^{-1}	WUE kg m^{-3}	Grain yield kg fed.$^{-1}$
2020/ 2021								
5 cm	107	1732	1624	114	269	286	0.387	1696
10 cm	121	2761	1936	176	251	264	0.476	1932
15 cm	139	2906	1987	159	222	251	0.523	1993
ySD at 5%	**6**	**74**	**32**	**13**	**NS**	**9**	**0.039**	**52**
2021/ 2022								
5 cm	111	1747	1642	118	273	292	0.390	1704
10 cm	129	2779	1944	182	259	271	0.483	1942
15 cm	141	2922	1995	163	227	259	0.534	2008
LSD at 5%	**8**	**86**	**35**	**10**	**NS**	**8**	**0.046**	**57**

CH.: Cutting heights at 5, 10 and 15 cm above ground, Total carboh. : Total carbohydrates g kg^{-1} and WUE: Water use efficiency.

Table (5 a). Effect of the interaction between cutting of dates and heights on productivity and some chemical composition of triticale during 2020- 2021 growing season at the New Valley

		Green fodder							Grain
Char. / Factors		Plant height cm	Green fodder yield kg fed.$^{-1}$	Dry fodder yield kg fed.$^{-1}$	Protein g kg^{-1}	Total Carboh. g kg^{-1}	Fiber g kg^{-1}	WUE kg m^{-3}	Grain yield kg fed.$^{-1}$
CD	**CH**	**2020/ 2021**							
After 50 days	**5 cm**	80	1618	1376	103	214	248	0.331	1592
	10 cm	87	2132	1532	134	205	237	0.376	1711
	15 cm	96	2205	1557	125	190	230	0.393	1741
After 65 days	**5 cm**	102	1937	1656	127	262	269	0.400	1439
	10 cm	109	2451	1812	158	253	258	0.445	1557
	15 cm	114	2524	1838	149	239	251	0.468	1588
After 80 days	**5 cm**	119	2274	1889	145	237	278	0.447	1193
	10 cm	125	2789	2045	168	228	267	0.490	1310
	15 cm	134	2861	2071	176	213	260	0.514	1341
LSD at 5%		**5**	**69**	**23**	**4**	**2**	**6**	**0.005**	**28**

CD.: Cutting dates, CH: Cutting heights at 5, 10 and 15 cm above ground, Total carboh. : Total carbohydrates % and WUE: Water use efficiency.

Table (5 b). Effect of the interaction between cutting of dates and heights on productivity and some chemical composition of triticale during2020/ 2022 growing season at the New Valley

		Green fodder							Grain
Char. / Factors		**Plant height** cm	**Green fodder yield** kg fed.$^{-1}$	**Dry fodder yield** kg fed.$^{-1}$	**Protein** g kg^{-1}	**Total Carboh.** g kg^{-1}	**Fiber** g kg^{-1}	**WUE** kg m^{-3}	**Grain yield** kg fed.$^{-1}$
CD	**CH**	**2021/ 2022**							
After 50 days	**5 cm**	84	1638	1391	107	217	253	0.342	1602
	10 cm	93	2154	1542	139	210	242	0.389	1721
	15 cm	99	2225	1568	129	194	236	0.414	1754
After 65 days	**5 cm**	105	1956	1677	130	266	276	0.408	1446
	10 cm	115	2472	1828	162	259	265	0.455	1565
	15 cm	120	2544	1854	153	243	259	0.480	1598
After 80 days	**5 cm**	124	2289	1908	150	241	285	0.445	1203
	10 cm	131	2805	2059	171	234	274	0.491	1322
	15 cm	137	2876	2084	182	218	268	0.517	1355
LSD at 5%		**4**	**63**	**20**	**3**	**2**	**4**	**0.008**	**32**

CD.: Cutting dates, CH: Cutting heights at 5, 10 and 15 cm above ground, Total carboh. : Total carbohydrates % and WUE: Water use effeiciency.

References

A.O.A.C., (1995). Official methods of analysis of the association of official agriculture chemists. 27th ed. Washington.

Bilgili, U., Cifci, E.A., Hanoglu, H., Yagdi, K. & Acikgoz E. (2009). Yield and quality of triticale forage. J. Food Agric. Environ., 15: 421-432.

Dumoulin, L.C., Bazot, M., Jeuffroy, M.H., Lorin, M. & Loyce C. (2016). Experimental research on biomass cutting process of triticale. Agric. Biol. Eng., 17, 241-248.

Elena, M., Andreas, K., John, C. & Iris L. (2021). Influence of cutting height on biomass yield and quality of some forage crops. GCB Bioenergy. 36:364–380.

FAO, (2021). Evaluation of plant production. Food and Agriculture Organization of the United Nation. 3: 104pp.

Fernando, A. (2017). Effect of cutting dates and cutting height on on yield and chemical composition of napier grass under irrigation. Pakistan Journal of Nutrition. 11 (5): 2145 – 2151.

Gomez, K. A. & Gomez, A. A. (198٥). Statistical procedures in agricultural research. New York, Chichester, Wiley 1984, 2nd edition, paperback. pp 680.

Habib, A., Ahmad, A. A. & Hamid, R. (2015). Effects of cutting height on the harvest times and forage yield of new sorghum cultivars in sistan region. Biological Forum – An International Journal 7(2): 581-584.

Jorge, A., Granados, N, David, G. Reta, S., Omar, I. Santana, B., Arturo, E., Fernando, D. & Juan I. (2021). Effect of the cutting height of sorghum at harvest on forage yield and nutritional value of silage. Rev Mex Cienc Pecu.,12(3):958-968.

Kahle, P., Beuch, S., Boelcke, B., Leinweber, P. & Schulten, H. (2001). Studies of three different cutting heights on triticale. European Journal of Agronomy, 63, 416– 425.

Klute, A. (1986). Water retention: Methods of soil analysis, part 1. Physical and mineralogical methods. Amer. Soc. Agron. Madison. 9: 635-662.

Page, A., Milled, R. & Keeney, D. (1982). Methods of soil analysis, Chemical and microbiological properties. Amer. Soc. Agron., Madison, Wisconsin, USA., 1018-1026.

Pipat, L., Wassana, L. & Wisitiporn, S. (2014). Effect of cutting interval and cutting height on yield and chemical composition of King Napier grass (*Pennisetum purpureum*). Journal of the Science of Food and Agriculture, 101(7): 187–193.

Rojas, G.C., Catrileo, S.A., Manríquez, B.M. & Calabi, F.F. (2022). An evaluation of the cutting stage on triticale (×*Triticosecale* Wittmack) for silage. Agric. Técnica 2004, 64, 34–40.

Royo, C. (2019). Yield and quality of winter and spring triticales for forage and grain. Grass Forage Sci., 51: 449-455.

Smith, D., Poulsen M. & Raguse, C. (1964). Extraction of total available carbohydrates from grass and legume tissues, Plant physiol., 39: 960.

Yuanwei, C., Huabin, Z., Weiqin, W. & Qiyuan, T. (2023). Cutting time & height improve carbon and energy use efficiency and forage yield of some forage crops. Ecol. Appl. 17 (3) 692–701.

تأثير بعض ممارسات الحش على إنتاجية التريتيكال تحت ظروف الوادى الجديد

حسام الدين أحمد ثابت شومان* و علاء محمد محمد بغدادي

قسم الإنتاج النباتى – مركز بحوث الصحراء - المطرية – القاهرة

E-mail: h.shoman@gmail.com

تم تنفيذ تجربتين حقليتين بالمحطة البحثية التابعة لمركز بحوث الصحراء – واحة الخارجة بمحافظة الوادي الجديد خلال موسمي النمو الشتوي ٢٠٢٠/٢٠٢١ و ٢٠٢١/٢٠٢٢ . كان الهدف من هذه الدراسة هو تقييم إنتاجية التريتيكال من الحبوب والعلف الأخضر باستخدام بعض ممارسات الحش تحت ظروف الوادي الجديد. وبناءًا على النتائج المتحصل عليها، فإنه إذا كان الغرض من زراعة التريتيكال هو الحصول على علف أخضر، توصي الدراسة بإجراء عملية الحش بعد ٨٠ يوماً من الزراعة وعلى ارتفاع ١٥ سم من سطح الأرض، أما إذا كان بهدف إنتاج الحبوب، توصي الدراسة بإجراء عملية الحش عند عمر ٥٠ يوماً من الزراعة وعلى إرتفاع ١٥ سم من سطح الأرض تحت ظروف الوادي الجديد.