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EARLY VEGETATIVE GROWTH OF BARLEY AND TRITICALE SOWN AT DIFFERENT SEED AND DAP FERTILIZER RATES UNDER RAINFED CONDITIONS

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ABSTRACT

This study was carried out during the growing season 2020-2021 at two locations (Sumail and Zakho) to study the influence of different seeding (2,500000, and 3000,000 and 3,500000 seeds.ha^{-1}) and DAP (0, 200, and 300 kg.ha^{-1}) rates on some early growth characters of barley (*Hordeum distichum* L.) and Triticale (X *Triticosecale wittmack*). The experimental was designed as factorial of three factors in a randomized complete block design (RCBD) with three replications. Some early and pre harvest (flag leaf area, plant height, number of total tillers and number on fertile tillers) were measured. The results displayed significant superiority of all studied characters for Zakho location compered to Sumail location. Also, Barley surpassed Triticale crop in flag leaf area, plant height, but inferior in number of total and fertile tillers. Higher numbers of tillers were recorded in Sumail location of experiment with lower seeding rate (314.17 tillers) compared to Triticale or other seeding rate or Fertilizer treatments. DAP fertilizer treatment enhanced most of the studied traits while their effect was not reached significant level. The results recommend that the crops or varieties with fewer tillers are favorable in water limited environments and more studies are recommended mainly for Triticale crop as the studies on this crop in our areas are very rare rather than its economic importance in feeding and food processing.

KEYWORDS: Barley, Triticale, DAP, Seeding rates, Growth

INTRODUCTION

Barley (*Hordeum spp*) is an herbaceous plant of grass family; it is one of the oldest cultivated grains for about 10000 years ago. Nowadays, it ranks the 4th after corn, rich, and wheat (Tigre *et al*., 2014). However, until now the yield of barley is very low in Iraq (1.28 t.ha^{-1}) in 2014 compared with the average yields of developed countries such as France (8.8 t/ha), Germany (8.7 t.ha^{-1}), Australia (7.9 t.ha^{-1}), Russia (6.9 t.ha^{-1}) and the United States (3.4 t.ha^{-1}). Perhaps, the main reason for the decline in the average yield in Iraq is poor management of the crop (Faraj and Jaddoa, 2015).

In most area of Kurdistan region, barley cultivated under rainfed conditions, which often leads to fluctuation in the productivity depending on precipitation rates and its distribution, and the lack of improved and certificated varieties and fertilizers, and therefore work must be done to find effective solutions to this problem. This is done by studying local varieties, determining their tolerance to drought, and finding new varieties that are tolerant to the early harvest conditions of the region. Knowing the seeding rates and levels of fertilizers, including nitrogen fertilizers, appropriate to the local environment is very important because of its close association with the production factors such as biological yield, and grain yield (Al-Rawashdeh *et al.*, 2013).

Optimum sowing rate and fertilizer plays a vital role in increasing yield and quality of plants. Seeding rates above the optimum level impose nutrients, light, moisture stresses and hence adversely affect crop yield while seeding below optimum rate usually have lower yield.

Triticale was intended as an alternative to wheat as a food crop. However, since the 1970s there has been increased interest in utilization of triticale as a conserved forage or pasture and recently in bioenergy production (Mergoum *et al.* (2019). The availability of both winter and spring types has influenced how triticale is used. Triticale is increasingly grown for livestock grazing, whole-plant silage, hay, and forage grain. The majority of triticale varieties have had prominent awns; however increasingly, varieties with reduced awns (Salmon *et al*. 1996), which make them more suitable for swath grazing and green forage (Baron *et al*. 2012), are being released.

Triticale (*Triticosecale Wittmack*), a cross between wheat and rye, is gaining in popularity as an alternative to wheat and barley world-wide. The crossing of wheat and rye aims to combine the high yield potential and grain quality of wheat with the favorable characteristics of rye such as increased pest and disease resistance, winter hardiness, drought tolerance and adaptability to marginal conditions (Karpenstein-Machan & Heyn, 1992, and Varughese, 1996). Triticale is, therefore, a crop which is particularly suited for marginal environments or where disease stress is high.

According to Bonachela *et al*. (1995) the determination of the optimum seed rate is one of the basic conditions for obtaining a high yield, because the reduction of the required limits may lead to the growth of large numbers of herbs that compete with barley in the early stages of growth through the lack of plants and to increase the number of seedlings, especially non-carriers, Is reflected negatively on the output of grain as a result of consumption of water and nutrients and failed to produce grains. Satari *et al.* (2001) found that the best seed rate gives a high harvest index was 100 kg.ha^{-1} when studying three barley seed rates (50, 100 and 150 kg.ha^{-1}).

Khalil *et al*. (2011) found that the interaction between a seeding rate and N fertilizer (150 kg.ha^{-1}, 160 kg N.ha^{-1}) respectively, gave the highest forage dry matter and biological yield of wheat. Meanwhile, grain yield was higher when 100 kg.ha^{-1} plus 120 kg N.ha^{-1} was used. Other researchers have reported that the interaction between seeding rate N fertilization rate (600 seed m^2 and 100 kg N.ha^{-1}), respectively, gave the highest barley production in grain-only and dual-purpose systems (Hajighasemi *et al*., 2016). Faiath *et al*. (2005) found that the seeding rate of 220 kg.ha^{-1} gave the highest plant height, number of tillers, number of spike, biological yield, and grain yield in both seasons and the mean of two seasons.

Nutrients and mainly Nitrogen is the most important and affects physiological events in plant development (Zhai et al 2022). If there is sufficient nitrogen in soil, plants grow healthy and turn a bold green color, but in high concentration of nitrogen the vegetation period will be longer and plants will ripe later. Also with high nitrogen doses, plants grow aggressive and become susceptible to diseases and environmental conditions such as lodging; as they grow very tall. On the other hand, low rates of nitrogen, plant development is weak, flower, fruit and seed formations are low and root development is weak (Wang et al 2021, Kacar, 1984 and Eyupoglu, 1986). Sun *et al* (2020) reported that the main purpose of nitrogen fertilization is to increase grain yield and quality (Zabunoglu & Karacal, 1992). Also, Jasim (1989). reported significant effects of nitrogen fertilizer levels on the yield of green fodder, dry matter, Protein and fiber for barley, oats and Triticale when it was studied on these crops, the study also showed that the treatment of 120 kg kg.ha^{-1} nitrogen gave the highest rates of the studied and mentioned traits of the three crops.

The objective of this study to involve the local two row varieties of barley that have become endemic and adapt to the drought conditions in the region and Triticale to evaluate their early growth performance under different seeding and NP fertilizers rates to achieve the highest production and motivate farmers to use chemical fertilizers, including nitrogenous fertilizers.

MATERIAL AND METHODS

This study was carried out during the winter growing season 2020-2021 at farm of two locations (College of Agricultural Engineering Sciences farm –University of Duhok; situated between longitudes 43.01°E, latituates 36.84°N , and altitude 583 meters, and the Agricultural Research station at Zakho ; situated between longitudes 42.41° E , latituates 37.8°N , and altitude 433 meters and about 70 Km North of Duhok), to study the impact of different Seeds and NP Rate on some early growth characters of barley (*Hordeum distichum* L.) and Triticale (X *Triticosecale Wittmack*).

The experimental was designed as factorial of three factors in a randomized complete block design (RCBD) 2×3×3 with three replications. the first factor two crops (barley and triticale), the second factor three seeding rates (2,500000, and 3000,000 and 3,500000 seeds.ha^{-1}) which estimated based on seed fixed number depending on agricultural value (purity and germination percentage, 1000 seeds weight, and expected field establishment which is 80% (Cereal seed guide, 2017), and third factor was three rates of Di-ammonium phosphate (DAP) fertilizer in a rates of 0, 200, and 300 kg.ha^{-1}.

Land preparation:

The land was irrigated during 25 of September and 5th of October to reduce weeds and to facilitate conventional ploughing system by sweep cultivator and smoothing with double action disc harrow before sowing. Soil samples was drawn immediately after plowing physical and chemical traits of soil was measured (Table, 1).

The land was divided according to the experiment layout to three blocks, each block consists of 18 experimental units, each of $4m^{-2}$, 5 m length and 0.8 m width as it consists four rows of 20 cm apart ($5m \times 0.8$ m = $4m^{-2}$). The distance between blocks and experimental units was 1m apart.

Table (1): -Some physical and chemical properties of experiment soil site.

Soil Property	Unit	Depth (0-30)cm	
		Sumail	Zakho
PH at 25 °C in(1:1) extract		7.74	7.43
EC at 25 °C	$ds.m^{-1}$	0.54	0.72
Available N	$mg.kg^{-1}$	102.31	
Available P	$mg\ kg^{-1}$	3.45	
K^{+}	Soluble cations ($mmole.L^{-1}$)	0.16	
CaCo3	$g.kg^{-1}$	247.76	231.3
O.M	$g.kg^{-1}$	16.98	14.8
F.C	%	32.48	
Sand	$g.kg^{-1}$	78.07	40.10
Silt	$g.kg^{-1}$	445.54	471.92
Clay	$g.kg^{-1}$	476.37	485.61
Soil Texture		Silty Clay	Silty Clay

Seed Sources:

Seeds of Triticale variety (Admiral) was supplied by Agriculture Research Development (ARD) company , Erbil; and two row barley variety (Diyarbakir) freshly harvest of June 2020, was obtained from Makhmour area, seeds were cleaned from all chaffs, impurities and inert maters, to achieve 100% purity, and sieved with 2mm aperture sieve to meet uniform size; the standard germination test was done according to ISTA rules (2013), as four replicates of 100 seeds each at 20ºC for seven days for barley and eight days for triticale in a germinator, thereafter at the end of the test normal germination percentage were recorded, and 1000 seeds weight was also recorded and used in seeding rate calculation taking in consideration that the expected field establishment 75% (Sharma, *et al*., 2017; McKenzie, 2017), using the following equation for seeding rates and the establishment was 80% (Cereal seed guide, 2017).

$$\text{Seed rate seeds.ha}^{-1} = \frac{\text{target plants per m2 x thousand seeds weight (g)x 100 (conversion factor)}}{\text{germination\% x establishment\%}}$$

The number of seeds were adjusted per experimental unit of 4 m^2. Sowing rates at targets of 250, 300, and 350 $seeds.m^{-2}$ which are equivalent to 2,500000, and 3000,000 and 3,500000 $seeds.ha^{-1}$ and the amount of DAP fertilizer was adjusted per plot of (4 m^2), hand broadcasted in to plots, two weeks after seed sown which accomplished last week of November at both locations.

Table (2):- Meteorological information of the experiment sites during the experiments growing season

Months	Sumail					Zakho				
	Max. Temp. (°C)	Min. Temp. (°C)	Average Temp.	Humidity (%)	Rainfall (mm)	Max. Temp. (°C)	Min. Temp. (°C)	Average Temp.	Humidity (%)	Rainfall (mm)
September	38.7	23.5	31.1	29	0.0	40.1	24.7	32.4	20	0.0
October	31.7	16.8	24.3	35	0.0	33.0	17.9	25.5	24	4.4
November	20.5	11.4	16	64	25.1	20.8	12.1	16.5	58	42.3
December	15.5	5.4	10.5	67	40.5	16.1	6.1	11	61	41.2
January	14.6	4.2	9.4	61	83.0	15.2	5.4	10.3	53	117.5
February	16.1	5.9	11	63	19.2	17.0	6.8	11.9	54	25.9
March	18.2	8.4	13.3	56	40.3	18.9	9.2	14.1	53	63.8
April	27.8	14.3	21.1	38	2.0	28.4	14.8	21.6	32	2.0
may	34.8	20.1	27.5	31	0.0	35.3	21.2	28.3	20	0.2
June	37.7	22.2	35	26	0.0	39.5	23.6	31.6	17	0.0
July	42.1	27.3	34.7	25	0.0	43.2	29.0	36.1	17	0.0
Total					**210.1**					**297.3**

Ministry of Agriculture and Water Resources, Directory of Meteorology, Duhok, Iraqi Kurdistan Region (2022).

Early Vegetative Growth Studied:

Ten plants were randomly selected from each experimental unit and the following growth characteristics were measured:

Flag leaf area (cm^2) was recorded at full physiological ripening stage following the equation used by (Yang *et al*., 2016), the mean for ten plants was taken:

Leaf area= leaf blade length cm × mid leaf blade width × factor 0.65

Plant height (cm): mean of ten main plant heights (cm), from soil surface up to the neck of the spike at full ripening stage before harvesting the mean for ten plants were calculated.

Total number of tillers per meter square: calculated after tillering stage completed, total number of tillers for ten plants was recorded and then the average for one plant was measured.

Number of Fertile tillers per meter square: Number of spikes per plant for ten plants was recorded at the full ripening stage before harvesting and then the average for one plant was taken.

Data were statistically analyzed using SAS, 2003.Program version, 9.1, and Duncan's Multiple Range Test was used for comparison of means at 0.05 level of significant

RESULTS AND DISCUSSIONS

Tables 3, 4 and 5, 6 show significant differences among barley and triticale crops on flag leaf area and plant height, while the effect of each of seeding rates and fertilizer treatments was not significant on these growth characters. On the other hand, the interactions of all studied factors were significant on each of flag leaf area and plant height characters. It is noted that Triticale crop surpassed barley in both flag leaf area and plant height characters and also, Zakho was superior in plant height compared to Sumail location but similar in flag leaf area (Figure 1 and 2). However, both flag leaf area and plant height were slightly increased by DAP fertilizer but their effect was not significant in both locations. The signification of any interaction and second order interactions for these two traits was due to the values of Triticale crop; as all interactions of this crop with each of DAP or seeding rates was significantly higher than those of barley crop. Superiority of Zakho location in these traits may due to the higher seasonal rainfall (Table 2). On the other hand, Plants are usually differing in height due to the genetic makeup as this trait is controlled by specific genes (Richards, 1992 and Robertson and Lowry, 2015). In addition to genetic concerns, plant growth and development is also influenced by growth circumstances surrounding the plant and mainly soil nutrition and fertilization (Deepa *et al*. 2019). Vern *et al.* (2015) reported that triticale crop is about 80% leafy material and this can be answering the enquiry of the superiority of this crop to barley in growth traits and mainly leaf area. Similarly, Tawaha *et al.* (2020) reported restrict growth performance of barley under rainfed conditions.

Table (3):- Effect of crop type, seeding rates and DAP fertilizer rates and their interaction of flag leaf area (cm^{-2}) in Sumail Location

Crop	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	10.43b	10.53b	11.53b	10.83c	10.70b
	300	11.96b	11.83b	9.86b	11.22c	
	350	10.46b	10.00b	10.03b	10.16c	
Triticale	250	19.63a	22.00a	23.66a	21.76a	20.75a
	300	17.90a	18.70a	18.43a	18.34b	
	350	22.83a	20.33a	20.86a	21.34a	
Crop x DAP	barley	10.95b	1.78b	10.47b	Mean of rate	
	triticale	20.12a	20.34a	20.98a		
Rate x DAP	250	15.03a	16.26a	17.60a	16.30a	
	300	14.93a	15.26a	14.15a	14.78a	
	350	16.65a	15.16a	15.45a	15.75a	
Mean of DAP		15.53a	15.56a	15.73a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

Table (4):- Effect of crop type, seeding rates and DAP fertilizer rates and their interaction of flag leaf area (cm^{-2}) in Zakho Location

Crop	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	8.76d	9.16d	9.06d	9.00c	9.06b
	300	8.53d	8.93d	9.40d	8.95c	
	350	8.20d	10.26d	9.23d	9.23c	
Triticale	250	26.86ab	26.96ab	29.03a	27.62a	26.74a
	300	27.26ab	28.76a	27.86ab	27.96a	
	350	29.36a	21.46c	23.13bc	24.65b	
Crop x DAP	barley	8.50b	9.45b	9.23b	Mean of rate	
	triticale	27.83a	25.73a	26.67a		
Rate x DAP	250	17.81a	18.06a	19.05a	18.31a	
	300	17.90a	18.85a	18.63a	18.46a	
	350	18.78a	15.86a	16.18a	16.94a	
Mean of DAP		17.59a	17.95a	18.16a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

Table (5): -Effect of crop type, seeding rates and DAP fertilizer rates and their interaction on plant height (cm) in Sumail Location

Crop	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	84.73b	88.80b	89.00b	87.51b	87.18 b
	300	86.83b	90.86b	87.23b	88.37b	
	350	85.00b	86.40b	85.83b	85.74b	
Triticale	250	103.03a	106.93a	110.86a	106.94a	106.68 a
	300	106.50a	103.90a	106.20a	105.53a	
	350	104.86a	108.83a	109.06a	107.58a	
Crop x DAP	barley	85.52b	88.68b	87.35b	Mean of rate	
	triticale	104.80a	106.55a	108.71a		
Rate x DAP	250	93.88a	97.86a	99.93a	97.22a	
	300	96.66a	97.38a	96.71a	96.92a	
	350	94.93a	97.61a	97.45a	96.66a	
Mean of DAP		95.16a	97.62a	98.03a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

Table (6):- Effect of crop type, seeding rates and DAP fertilizer rates and their interaction on plant height (cm) in Zakho Location

Crop	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	98.53b	97.00bc	95.36bc	96.96b	94.70b
	300	94.16bc	95.00bc	98.16b	95.77b	
	350	92.66bc	88.86c	92.53bc	91.35b	
Triticale	250	114.56a	111.10a	114.33a	113.23a	114.33a
	300	117.86a	112.43a	117.00a	115.76a	
	350	114.33a	115.20a	112.50a	114.01a	
Crop x DAP	barley	95.12b	93.62b	95.35b	Mean of rate	
	triticale	115.58a	112.91a	114.51a		
Rate x DAP	250	106.55a	104.05a	104.70a	105.10a	
	300	106.01a	103.71a	107.58a	105.77a	
	350	102.50a	102.03a	103.51a	102.68a	
Mean of DAP		105.35a	103.26a	104.93a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

Number of Tillers (spike.m^{-2})

However, number of tillers are a main yield component, in this study, their determination considered as a measure of growth for both Barley and Triticale due to their important contributions in silage making and animal feeding.

Significant results for both total number of tillers and fertile tillers were recorded for crop types, locations and their interaction. While the effect of seeding rate and DAP fertilization was not significant except for total number of tillers in Sumail location as the lower seeding rate significantly produced higher number of total tillers. Although, fertilizer rate recorded slightly higher number of total and fertile tillers, but these increasing was not significant. on the other hand, the total and number of fertile tillers (spikes per area unit) was generally lowest in Triticale than Barley crops (Table 7,8,9, and 10). As for locations, Zakho surpassed Sumail location for producing higher number of both total (421.67 and 268.89 vs 350.56 and 227. 78) and fertile number (535.04 and 242.67 vs 237.78 and 173.70) of tillers (Figures 1 and 2). The variation of results between crops and sites may belong to the nature of crops growth and environmental conditions (Table 1). Al-Falahi *et al*. (2021) demonstrate the variation in stability among wheat cultivars in yield under rainfed conditions and also Chaturvedi *et al.* (1981) reported that more than 40% of the total produced tillers fail to reach heading stage and also the number of tillers in wheat, triticale and barley decrease with the decreasing on available water. On the other hand, they also demonstrated that crops or varieties with fewer tillers are favorable in water limited environments. These results are agreed with those of Tawaha *et al.* (2020) who recorded limited number of tillers for barley (1-2 tillers.plant^{-1}) and other growth characters under rainfed conditions.

Table (7):- Effect of crop type, seeding rates and DAP fertilizer rates and their interaction on number of total tillers (m.$^{-2}$) in Sumail Location

Crop	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	358.33ab	380.00ab	406.67a	381.67a	350.56a
	300	313.33bc	373.33ab	320.00b	335.56b	
	350	305.00bcd	356.67ab	341.67ab	334,44b	
Triticale	250	300.00bcde	225.00ef	215.00f	246.67c	227.78b
	300	201.67f	203.33f	240.00cdef	215.00c	
	350	215.00f	216.67f	233.33def	221.67c	
Crop x DAP	barley	325.56a	370.00a	356.11a	Mean of rate	
	triticale	238.89b	215.00b	229.44b		
Rate x DAP	250	329.17a	302.50a	310.83a	314.17a	
	300	257.50a	288.33a	280.00a	275.28b	
	350	260.00a	286.67a	287.50a	278.06b	
Mean of DAP		282.22a	292.50a	292.78a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

Table (8):- Effect of crop type, seeding rates and DAP fertilizer rates and their interaction on number of total tillers ($m.^{-2}$) in Zakho Location

Crop	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	410.00ab	398.33abc	431.67a	413.33a	421.67a
	300	425.00a	435.00a	455.00a	438.33a	
	350	436.67a	398.33abc	405.00ab	413.33a	
Triticale	250	290.00d	261.67de	325.00bcd	292.92b	
	300	263.33de	180.00e	243.33de	228.89c	268.89b
	350	316.67cd	290.00d	250.00de	285.56b	
Crop x DAP	barley	423.89a	410.56a	430.56a	Mean of rate	
	triticale	290.00b	243.89b	272.78b		
Rate x DAP	250	350.00	330.00a	378.33a	352.78a	
	300	344.17a	307.50a	349.17a	333.61a	
	350	376.67a	344.17a	327.50a	349.44a	
Mean of DAP		356.94a	327.22a	351.67a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

Table (9): -Effect of crop type, seeding rates and DAP fertilizer rates and their interaction on number of fertile tillers $m.^{-2}$ in Sumail Location

Crop	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	243.33abc	240.00abc	290.00a	257.78a	
	300	241.67abc	256.67ab	201.67bcdef	233.33a	237.78a
	350	206.67bcdef	223.33abcd	236.67abc	222.22a	
Triticale	250	210.00bcde	178.33cdef	148.33ef	178.89b	
	300	135.00f	205.00bcdef	186.67bcdef	175.56b	173.70b
	350	148.33ef	153.33def	173.33cdef	166.67b	
Crop x DAP	barley	230.56a	240.00a	242.78a	Mean of rate	
	triticale	172.78b	178.89b	169.44b		
Rate x DAP	250	226.60a	209.17a	219.17a	218.33a	
	300	188.33a	230.83a	194.17a	204.44a	
	350	190.00a	188.33a	205.00a	194.44a	
Mean of DAP		201.67a	209.44a	206.11a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

Table (10):- Effect of crop type, seeding rates and DAP fertilizer rates and their interaction on number of fertile tillers $m.^{-2}$ in Zakho Location

\	Seeding rate	DAP fertilizer			Crop x rate	Mean of crop
		0.00	100	200		
Barley	250	343.33abcd	338.33abcd	363.33abc	348.33a	
	300	351.67abcd	380.00ab	381.67a	371.11a	353.04a
	350	378.33ab	348.33abcd	292.33abcde	339.67a	
Triticale	250	204.00ef	255.00cdef	311.67abcde	256.89b	
	300	251.67def	158.33f	216.67ef	208.89b	242.67b
	350	286.67abcd	270.00bcde	230.00ef	262.22b	
Crop x DAP	barley	357.78a	355.56a	345.78a	Mean of rate	
	triticale	247.44b	227.78b	252.78b		
Rate x DAP	250	273.67a	296.67a	337.50a	302.61a	
	300	301.67a	269.17a	299.17a	300.94a	
	350	332.50a	309.17a	261.17a	290.00a	
Mean of DAP		302.61a	291.67a	299.28a		

Means of the individual factors and their interactions that share the letters do not differ significantly according to the DMRT test, 1955, at the 5% level.

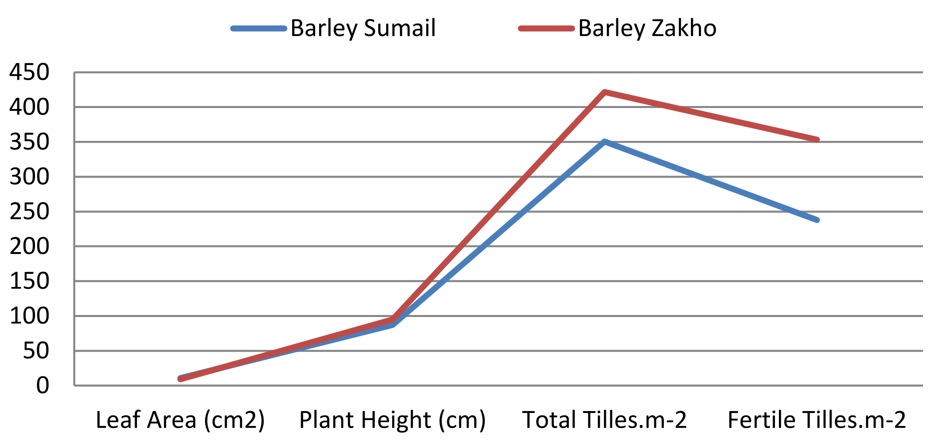

Fig. (1):- Comparison between both locations for Barley early growth traits

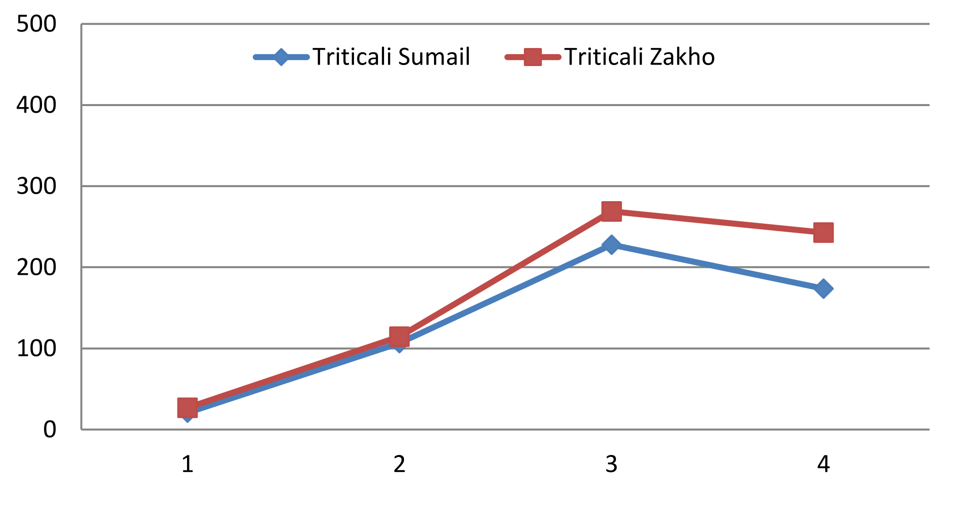

Fig. (2):- Comparison between both locations for Triticali early growth traits

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