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Research Article

Comparative Study between Yield and Quality Performance of Triticale (X Triticosecale Wittmack) Varieties in Wet and Dry Conditions of Ankara-Polatlı, Türkiye

Hakkı AKDENİZ[1]*, Ali KOÇ[2], Mohammad Sohidul ISLAM[3] and Ayman EL SABAG[4]

[1]*Iğdır University, Department of Agronomy, Faculty of Agriculture, Turkey*

[2]*General Directorate of Agricultural Enterprises Chief Expert, Ankara, Turkey*

[3]*Department of Agronomy, Hajee Mohamad Danesh Science and Technology University, Dinajpur, Bangladesh*

[4]*Siirt University, Department of Agronomy, Faculty of Agriculture- Siirt-Türkiye*

***Corresponding Author:** Hakkı AKDENİZ, Iğdır University, Department of Agronomy, Faculty of Agriculture, Turkey.

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Abstract

The experiments were conducted in dry and Wet conditions with nine triticale varieties (Bienvenu, Kereon, Alper, Tribeca, Oxygen, Umran Hanım, Alembic, Tatlıcı and Biscoto) during 2014 growing season. The main objective of the study was to compare varietal performance of quality parameters in Ankara environmet of Polatlı. All the quality parameters of nine triticale varieties were influenced significantly ($p < 0.05$) by the both in in dry and irrigated conditions except for hectoliter in dry conditions. Among the quality parameters, plant height ranged from 94.0 to 111.3 and 110.7 to 134.5 cm in dry and irrigated conditions respectively. Hectoliter weight ranged from 72.00 to 74.01, and 75.5-80.0 to 77.13 kg/L, and 1000 grain weight from 33.40 to 39.43, and 41.09 to 45.17 g, crude protein ratio from 10.37 to 11.68 and 7.50 to 9.98 % in dry and irrigated conditions, respectively. Grain yield was found to be between 461.1 to 606.3 and 782.3 to 881.0 kg/da in dry and irrigated conditions, respectively According to the correlation analysis, there was a positive and highly significant correlation between grain yield and plant height ($r = 0.742^{**}$), hectoliter weight ($r = 0.763^{**}$), and 1000-kernel weight ($r = 0.785^{**}$). There was a negative and highly significant correlation between grain yield and crude protein ($r = 0.759^{**}$), and a positive and very important relationship between 1000-grain weight and hectoliter weight ($r = 0.865^{**}$). According to the results of the experiment, the Alembic variety appears more promising under irrigated conditions, while the Bienvenu variety seems more hopeful under dry conditions.

Keywords: Growth; Yield; Quality; Dry and *İrrigated conditions*; Triticale

Introduction

Triticale, scientifically referred to as x Triticosecale Wittmack, is a fascinating hybrid cereal crop born from the intentional crossing of wheat (*Triticum* spp.) and rye (*Secale cereale*). This innovative hybrid has the potential to significantly boost grain production for human consumption in the years to come [37]. Triticale is a versatile and valuable crop, especially in light of recent global climate changes that have led to increased extreme temperatures all over the World, making agricultural production challenging and emphasizing the importance of species resistant to extreme conditions [7]. This makes triticale a suitable crop for many different parts of the world, offering farmers the opportunity to grow a reliable and profitable crop. Additionally, triticale has excellenet disease resistance qualities, making it a hardy, durable and sustainable crop. Triticale grain contains substances that nutritional rich, providing a variety of healt benefits and a good source of dietary fiber, protein and essential minerals such as iron, magnesium, and zinc. Its nutritional profile contributes to a healty diet and can help prevent various health issues, including heart disease and diabets [21]. Furthermore, it is gaining popularity as a cover crop to imrove soil health, reduce nutrient leaching, and improve the crop for better adaption, although its grain quality lags behind that of other small grains [5].

Gluten and protein contents were positivly and significantly affected by salinity stress. Salinity casued a decrease of SDS-sedimentation volume and an increase of gliadin/glutenin ratio, both diminishing baking quality [43]. Apart from specific varieties, other factors such as soil type, management practices, and irrigated conditions also play a significant role in determining the yield of triticale. Heredity and genetic advance for grain yield/plant were high the stress environmnet, refleting the effectiveness of direct selection. The 1000 seed-weight, grain/spike and plant heigth were the crucial traits for phenotypic selection in both the environment [32]. The yield formation were strongly dependent on weather conditions (R = 0.554), the most important climatic factors was photosynthetically active radiation during the active vegetation period [47].

Heritability has been observed to be moderate to high for traits like grain yield, days to heading, day to maturiy, 1000-grain weight, biological yield, spikelets/spike, leaf are index, spesicific leaf area weight and stomatal number, weheras genetik advance was moderate to high for grain yileld and 1000-grain weight, biological yield and leaf area index [19]. Some triticale varieties have shown good performance in both irrigated and dry conditions, and have higher yield potention for forage production compared to grain production. Therefore, breding triticale for yield and lodgin resistance under irrigated conditions is achievable, and can be pursued with confidence in breeding porgrams [30]. Althoug the grain quaity of triticale is unsatisfactory compared to other small grain crops such as wheat, it still possessese a good level of resistance to multiple disease and pest, and many useful genes have been successfully transferred to wheat from triticale [29].

Triticale is a grain used in animal feed due to its high efficiency and nutritional quality, and resistans to strees factors. There is a high level of proteins in triticale grain (2-3% more than wheat, and 4% more than rye), with a very beneficial amino acid composition, making it a valuable component of domestic animals nutrition. Triticale is becoming increasingly attractive and is occupying larger portions of arable land [12].

Nitrogen doses have been increased, resulting in generally increased yield and yield components [14]. There are numerous studies on triticale, the highest grain yield (520.3 kg da^{-1}) was obtained from Karma-2000 variety, with a seed rate of 550 seed m^{-2} and the fourth dose of nitrogen (10.8 kg N da^{-1}) application. It was concluded that Karma-2000 variety can be successfully grown in the ecological condition Van city during winter [35].

Improved triticale cultivars have shown higher performance than wheat regarding plant height, grain and biomass yield, and making triticale a viable alternative crop, particularly in nutrient-deficient environments with both biotic and abiotic stress factors [5]. However, there is still a lack of similar researh on triticale cultivars' adaptive response and recommendation for different environmental conditionas. Triticale is mainly agriculated as a forage cereal crop in the Central Anatolia, Turkey. The values ranged in genotypes between 537.5 and 678.5 kg da^{-1} for grain yield, 29.89 and 45.21 g in 1000-seed weiht, 73.13 and 79.50 kg hL^{-1} test weigth, 14.00 and 16.19 % in protein content [22]. [36]conluded that yields of the genotypes ranged from 630.7 to 737.8 kg/da, with a grain yield positively correlated with 1000-kernel weight and hardness, and negatively correlated with protein ratio. Protein ratio was positively correlated with days to heading and plant height and negatively correlated with 1000-kernel weight.

The climatic values of temperature, rainfall, and humidity play a crucial role in determining the environmental conditons and ecosystem dynamics of any given location or research area. In recent years, there has been an increasing interest in studying the performance of triticale in both dry and irrigation conditions due to the change climate and water scartiy in many regions. The characteristics of soil can vary significantly depending on whether it is obtained from a dry or irrigated area. In dry areas, the soil tends to be more compact and dry, with lower moisture content due to the lack of regular rainfall, which limits the water available to the soil. As a result, the soil in dry areas is often more difficult to farm and may require additional irrigation or fertilization to support plant growth. There is a large variation in the ranking of cultivars between locations in the regions, i.e., the ranking of cultivars in the locations belong to the same region may differ [11]. The purpose of this study was to evaluate some triticale cultivars and lines in the irrigated and dry climatic conditions of Polatlı-Ankara territory.

Material and Method

The investigation was conducted using a total of nine genotypes, including six French triticale varieties (Bienvenu, Kereon, Tribeca, Oxygen, Alembic, Biscoto) and three native triticale varieties (Umran Hanım, Alper and Tatlıcı) in both dry and irrigated conditions of Polatlı-Ankara. The experiments followed a randomized block design with four replications, and plot size was 7.2 m^{-2} (1.2 m × 6 m), consisting of six rows spaced 20 cm apart. Sowing took place on 10 October 2014, with a planting density of 500 seeds m^{-2} [37], using an experimental drill. The triticale varieties under dry conditions were harvested on 10 July, 2015, and on July 17, 2015 under irrigated conditions.

Soil analysis indicated that some properties of the soils under both irrigated and dry conditons were similar. The electrical conductivity (EC; dSm^{-1}), total salt content (%) and pH were found to be very similar in both conditins (Table 1). In the experimental area, the lime content was notably high at 14.54%, with higher water saturation (60 %) and K_2O content (kg da^{-1}) observed in dry conditions compared to irrigated conditios. However, despite the low organic matter content in the irrigated area (1.83%), it was still higher than in the dry conditions.

The data presented in Table 2 shows the sum of the rainfal during the growing seasons 2014-2015 were higher by 46.4 mm and much of the rainfal in October ane November seasons compared to long-term averages. However, the mean of temperature during the growing seasons were almost the same. The avarage annual rainfal of dry conditions in the region of Polatlı ranges from 451.9 mm, much higher than long-term averages of 302.2 mm. Rainfall is distributed almost evenly, with fluctiations depending on the months of year, as observed in the Polaltı-Ankara experiment (Table 1).

In both plots under irrigated conditions, 6 kg da^{-1} of P_2O_5 and 2.34 kg da^{-1} ofs pure nitrogen (N) were applied during sowing, 7 kg da^{-1} N for top-dressing at the tillering stage, and 5.66 kg da^{-1} of pure N at the heading stage in the second top-dressing, making a total amount of 6 kg da^{-1} P_2O_5 and 15 kg da^{-1} of N.

In dry conditions, 6 kg da^{-1} of P_2O_5 and 2.34 kg da^{-1} of pure N were used during sowing. For top-dressing, 5.66 kg of pure N was applied at the tillering stage. Consequently, a total of 6 kg P_2O_5 and 8 kg da^{-1} of N were applied in dry conditions. According to soil analysis results, no additional potassium (K) was required.

Soil conditions	Saturation with water (%)	Soil Class	EC (dS^{-1})	Total Salt (%)	pH	Lime (%)	Organic Carbon (%)	Organic matter (%)	P_2O_5 (kg da^{-1})	K_2O (kg da^{-1})
Irrigated	55	Clay loam	0.75	0.03	7.54	3.64	1.06	1.83	4.33	50.69
Dry	60	Clay loam	0.89	0.04	7.47	14.54	0.91	1.59	3.35	63.09

Table 1: Some soil characters of obtained from the dry and irrigates area.

Months	Average temperature (°C)		Precipitation (mm)		Relativley Humidity (%)	
	2014-2015	5 Yearly	2014-2015	20 Yearly	2014-2015	5 Yearly
November	18.6	18.7	46.4	12.2	58.9	52.3
December	10.45	11.9	54.9	30.2	71.7	65.8
January	7.85	7.85	19	26.3	63.4	69.6
February	4.85	4.3	38.1	36.5	87.3	80.3
March	-1.4	-0.69	13.2	32.2	88.1	87.3
April	2.9	3.96	55	27.1	77.1	76.8
May	7.05	5.93	72.7	36.1	74.2	72.32
June	9.8	11.11	23.8	43.3	59.5	62.6
July	17.15	12.28	51.4	34.2		50.9
August	0	15.58	77.4	23.7		45.4
September	7.725	9.09	451.9	301.8	58.02	66.3
October	18.6	18.7	451.9	302.2		
November	10.45	11.9		323.1		
Total/Mean	7.85	7.85	46.4	12.2	58.9	52.38

Table 2: Some climatic values of the locations or researh area in 2014-15 (Polatlı-Ankara).

Results and Discussıon

Plant height (cm)

In the study conducted with nine triticale genoypes, significant statistical differenses were found among the plant height, hectoliter weight (kg/L, except for dry coditions), 1000-grain weight (g), crude protein (%) and grain yield (kg da^{-1}) in both dry and irrigated conditions of Polatlı-Ankara (Tablo 3,4). Means comparison analysis showed that the highest plant height of was associated with the Tatlıcı genotype, whereas the lowest mean of this phonological trait was related to the Oxygen genotype of triticale under the dry conditions (Table 3). On the other hand, in irrigated conditions, the highest plant highests were obtained from Umran Hanım, Alper and Tatlıcı varieties, while Alembic and Bienvenu varties showed the lowest plant highests under the irragated conditions (Table 4). The means of the plant height of riticale species were statistically significant in both dry and irrigated conditions (101.8 cm and 123.4 cm, respectively) (Table 3-5). However, plant heights of triticale varieties ranged between 94.0 and 111.3 cm in dry conditions, and between 110.7 and 134.5 cm in irrigated conditions, with mean plant heights of varieties being 18% higher in irrigated conditions than in dry conditions.

These results are compatible with the findings of several researchers. For instance, [45] found in their study of 20 triticale genotypes in Samsun ecological conditions that plant heights ranged from 94.7 to 117.4 cm. Similarly, [20] reported plant heights ranging from 112 to 120.8 cm. [6], and [25] also found variations in plant height values between in wet and dry conditions with ranges of 92.2-116.5 cm and 89.6-98.7, respectively. [44] observed plant height variations among triticale genotypes, ranging from 127.1 to 114.9 cm. [13] reported plant heights between 99.6 and 119.8. However, some findings such as [34], were lower. Similarly [23] concluded that the plant heights of varieties under dry and irrigated conditions ranged from 101.5 to 131.5 and 113.5 to 125.6 cm, respectively. These studies suggest that triticale species and varieties may exhibit different phenological characteristics in different ecological conditions.

Hectoliter weight (kg/L)

Hectoliter weight, also known as hectoliter mass, is a measure of the weight of a substance per hectoliter (100 liters). It is commonly used in agriculture and trade to measure the weight of grains and other bulk commoditie. The results of Duncan's means comparison multiple range test analysis at 5 % probability level showed that the highest hectoliter weight was related to the Kereon genotype, while the lowest of this characteristic was achieved from Tribeca genotype of triticale under irrigated conditions (Table 1). Based on means comparison analysis, there was no significant difference between investigated genotypes of triticale releated to hectoliter weigth under the dry conditions of Polatlı. However, the hectoliter weigth (77.55 kg L) on means comparison under the irrigated conditions was greater than the other experiment area (73.08 kg L) (Table 4). Similar results have been reported by [13-15]. In contrat, [3], and [45] reported different data, with hectoliter weights ranging from 65.95 to 73.32 kg and 57.8 to 76.3 kg, respectively. [23] cited that hectoliter weights of 70.8-74.6 kg/L and 72.40-77.13 kg/L, which are compatible with the resultes of this trial.

1000 grain weight (g)

The results presented in Table 4 showed that the highest 1000-seed weight was associated with the Tatlıcı genotype (39.43g), while the lowest was achieved from Umran Hanım genotype of triticale (35.68g) under the dry conditions of Polatlı-Ankara. On the other hand, the highest 1000-seed weight were obtained from both Tatlıcı and Kereon under the irrigated conditions of Polatlı. However, the Tatlıcı triticale genotype revealed the highest 1000-seed weight in both dry and irrigated conditions of the investiagated area. In terms of 1000 seed weigth, locations were found statistically significant ($p < 0.01$). The means of 1000- seed weight (41.69g) of triticale genotype related to irrigated conditions were higher than those in dry conditions, with 35.64 g (Table 3, 4 and 5). The findings 1000-seed weigth in this study were higher than those of previous studies by [10,13,15,20,27] and [45]. Nonetheless, the results of this study are highly consistent with the findings of [23], who conducted an experiment in the irrigated and rainfed conditions of Şanlıurfa.

Crude protein ratio (%)

The protein content in triticale can vary based on factors such as the specific variety, growing conditions, and agricultural practices. On average, triticale grain typically contains around 12-15% protein. It's worth noting that protein rate is more important than duration in determining the quality characteristics of grains, as higher grain weights and protein percentages correspond to higher rates of dry matter (DM) and N accumulation [17]. However, these values can vary, and some varieties may have higher or lower pro-

tein content. From the stand point of the protein ratio of varieties, the protein ratio of tritticale varieties under dry coditions ranged from 11.68 to 10.37%, while under irrigated conditions of Polatlı, they ranged from 9.98 to 7.50%. On average, the protein ratio was higher in dry conditions with 10.96%, than in irrigated conditions (Table 3-5). In terms of this feature, the variation of variety average was greater in dry conditions than in irrigated conditions. This change may be due to the possible irrigation conditions being homogeneous enough or may be due to the reaction of the varieties in irrigated conditions.

The results of previous researchers such as [2] with protein ratios of 10.3-12.7%, [4] with protein ratios of 10.63-11.43%, [11] with grain protein content of 14.38-18.06%, and [13] and [23] with protein ratios of 10.6-12.1%, were found to be quite similar to the findings of this study. On the other hand, [44] found lower protein contents of triticale genotypes (12.0-9.8%) compared to their values. In contrast, [22]cited that differences between locations were found significant for all investigated traits except protein content.

Grain Yield (kg da^{-1})

The investigated genotypes of triticale expressed significant differences for the average values of grain yields in different growing conditions, indicating the diversity among the examined genotypes. For instance, while the grain yield of Bienvenu was 606.3 kg da^{-1} in the dry locatin of Polatlı, this variety under the irrigations of the same location yielded 859.7 kg da^{-1}.

Conversely, Biscoto yielded lower in both dry and irrigated locations, although the yields of the locations were found to be quite different on average for each variety. In other words, the average yield of varieties was 509.7 kg da^{-1} in dry conditions and 825.4 kg da^{-1} in irrigated conditions of Polatlı-Ankara (Table 3, 4 and 5). According to the grain yied parameters, Bienvenu was the highest-yielding and most stable variety in both dry and irrigation conditions. On the other hand, similarly, Biscoto was the variety with the lowest yield in both dry and irrigated conditions, and maintained its stability (Table 3 and 4).

In the experiment, the average grain yields ranged from 461.1 to 606.3 kg da^{-1} in dry conditions, which are generally in agreement with previous studies. For example, [20] reported grain yields 412.06-518.47 kg da^{-1}; [10]reported grain yields of 361.5-645 kg da^{-1}, which are higher than values of other studies by [15] with 328.13-440.13 kg/da, [45]with 225.5-415.3 kg da^{-1}, [4] with 378.18-478.30 kg da^{-1}, [1] with 190.54-338.53 kg da^{-1}, [44]with 367.1-277.9 kg da^{-1}, [33]with 230.4-366.1 kg da^{-1}, and [13] with 189.2-314.2 kg da^{-1}. These grains yields of trial, ranging from 782.3 to 881.0 kg da^{-1} in irrigated conditions, were partially similar to the results reported by [16,46]. Since grain yield in marginal environments reflects the genotypic response to the total environment, progress has to be associated with advances for all biotic and abiotic factors involved [39]. A sustainable management system for triticale includes modern cultivars, a seeding date that can accumulate 1750 GDDs before frost, and a sowing density of at least 375 seeds m^{-2} [8]. Both total biomass and HI were strongly correlated with kernels m^{-2}. Thus, having more kernels m^{-2} is essential to obtain high grain yields in triticale, regardless of earliness, highlighting the importance of the pre-anthesis period, even in conditions of increasing drought stress during spring [40].

Variety	Plant height (cm)	Hectoliter weight (kg/L)	1000 grain weight (g)	Crude protein (%)	Grain Yield (kg/da)
Bienvenu	97.5 d	72.00	34.37 cd	10.80 b	606.3 a
Kereon	105.0 bc	73.50	37.42 b	10.97 ab	548.2 ab
Alper	107.5 b	72.25	39.45 b	11.60 a	518.3 ab
Tribeca	99.5 5 d	73.01	35.08 cd	10.58 b	514.7 ab
Oxygen	94.0 e	72.25	34.48 cd	10.55 b	501.8 ab
Umran Hanım	103.8 c	74.01	35.68 c	11.55 a	489.6 ab
Alembic	99.3 d	72.50	33.40 d	10.52 b	475.4 b
Tatlıcı	111.3 a	73.50	39.43 a	11.68 a	471.4 b
Biscoto	98.0 d	72.75	33.43 d	10.37 b	461.1 b
R-Square	0.90	0.37	0.82	0.63	0.50
Coeff. of Var.	2.01	1.69	3.10	4.20	14.52
Means	101.8	73.08	35.64	10.96	509.7

Table 3: Yield and some characteristics of triticale varieties in dry conditions.

*The same letter are not important in their group. ($p < 0.05$).

Variety	Plant height (cm)	Hectoliter weight (kg/L)	1000 grain weight (g)	Crude protein (%)	Grain Yield (kg/da)
Alembic	123.3 b	76.0 de	41.65 c	7.50 e	881.0 a
Bienvenu	110.7 d	79.1 ab	42.76 b	9.48 ab	859.7 ab
Kereon	127.0 b	80.0 a	44.30 a	9.98 a	847.4 abc
Umran Hanım	131.0 a	77.0 cd	41.18 c	8.08 de	835.7 abc
Tribeca	119.3 c	75.0 e	39.53 d	8.35 d	826.3 abc
Oxygen	112.7 d	78.0 ab	40.10 d	8.77 abc	819.7 abc
Tatlıcı	134.5 a	79.0 ab	45.17 a	8.57 cd	788.7 bc
Alper	134.0 a	76.0 de	39.50 d	9.93 a	788.0 bc
Biscoto	117.7 c	78.0 ab	41.09 c	9.27 abc	782.3 c
R-Square	0.93	0.83	0.92	0.78	0.68
Coeff. of Var.	2.21	1.08	1.57	5.83	5.43
Means	123.4	77.55	41.69	8.88	825.4

Table 4: Yield and some characteristics of triticale varieties under irrigated conditions.

*The same letter are not important in their group. ($p < 0.05$).

Sources of Variation	Plant height (cm)	Hectoliter weight (kg/L)	1000 grain weight (g)	Crude protein (%)	Grain Yield(kg/da)
Location (Irri. / Dry)	0.001	0.001	0.001	0.9679	0.001
Varieties	0.001	0.001	0.001	0.5209	0.3905
Location * Varieties	0.001	0.001	0.001	0.4486	0.8977
Least Sq Mean (LS Means Student's)					
Dry conditions	101.8 b	73.08 b	35.64 b	10.96 a	509.7 b
İrrigated conditions	123.4 a	77.55 a	41.69 a	8.88 b	825.4 a

Table 5: Significance degrees of varieties according to average of Polatlı dry and irrigated conditions.

Under irrigated conditions, the grain yield has been higher by an average of 61.6%, plant height by 18%, hectoliter weight by 5.8%, and 1000-seed weight by 16.9% compared to dry conditions. Moreover, crude protein content has been found 19% higher in dry farming (Table 5).

Correlation coefficients

Correlation coefficients of the results of the traits examined in the varieties are summarized in Table 6. Correlation coefficient among nine triticale genotypes revealed highly significant positive correlation of grain yield with plant height (0.742**), hectolitre weigth (0.763**) and 1000-grain weight (0.785**) under both the environments, indicating the importance of these traits for high grain yield.

On the other contrary, a negative and significant correlation was found between grain yield and crude protein rate (-.759**) in Table 6. However, 1000-grain weight (g) exhibited positive correlations with the plant heigth and hectoliter weigth. The correlation between different agronomic and yield characteristics of nine different genotype of triticale, and reported positive and significant correlation of grain yield with plant height, hectoliter weight and 1000 grain weight and 1000-seed weight [42]. The correlation among the traits (grain yield and its components) and the results of yield component analysis were significantly related in the study, suggesting similar genotypic sources [24]. The highest significant correlation with grain yield was related to plant height, spike/shoot ratio, straw yield, biological yield, and harvest index [42].

Plant traits	Plant height (cm)	Hectoliter weight (kg/L)	1000 grain weight (g)	Crude protein (%)	Grain yield(kg/da)
Plant height (cm)	1				
Hectoliter weight (kg/L)	.714**	1			
1000 grain weight (g)	.827**	.865**	1		
Crude protein (%)	-.583	-.088	-.049	1	
Grain yield (kg / da)	.742**	.763**	.785**	-.759**	1

Table 6: Correlation coefficients of the results of the traits examined in the varieties.

*: p <0.05, **: significant at p <0.01 level.

On the contary, a negative and significant correlation was found between grain grain yield and the 1000-grain weight [41]. The results of this experiment were in agrement with [15,19,24]. The results of this experiment show significant similarity with a previously conducted study by [23], who concluded that there was a positive and very significant correlation between grain yield and plant height (r = 0.361 **), hectoliter weight (r = 0.711 **) and 1000-kernel weight (r = 0.577 **), as well as a negative and highly correlation (r=-0.431 **) between grain yield and crude protein, and a positive and very significant relationship between 1000-grain weight and hectoliter weight. In additionally, the varietal selection for grain yield in triticale was found to be insufficient if based solely on morphological traits [18], as grain yield was more associated with the number of grains m^{-2} than with grain weight [31]. For more reliable results, studies should be conducted in multiple locations over several years and with more genotypes [26]. Under irrigated conditions, biological yield per plant had the highest positive direct effect on grain yield followed by harvest index, spikes per plant, 1000-grain weight, days to maturity and plant height. The plant height, number of spikelets per spike, number of grains per spike, and hectoliter weight characteristics should be considered as selection criteria in breeding studies [9].

Conclusion

Based on the results and discusstion of the present study, it can be concluded that Alembic appears to be the highest yielding variety under irrigated conditions with a yield of 881 kg da^{-1}, while under dry conditions, Bienvenu has shown promise by surpassing others with a yield of 606.3 kg kg da^{-1}. However, it's important to note that these conclusions are based on one-year data, and it would be more rational to determine the stability of the outcomes over several years. This would provide a more reliable indication of which variety is more consistent in its results and better suited for various environmental conditions.

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