

Effect of Environmental Conditions on Quantitative Traits of Spring Barley

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Abstract. Spring barley (*Hordeum vulgare* L.) is an important cereal crop in temperate regions, whose productivity is strongly influenced by environmental conditions. The objective of this study was to evaluate the agronomic performance and yield stability of spring barley genotypes under contrasting agroecological conditions in Romania. A comparative field experiment was conducted during the 2024 growing season at three locations: Turda, Fundulea, and Secuieni, using 21 spring barley cultivars. The experiment assessed key yield-related traits, including plant height, grain weight per ear, number of grains per ear, thousand kernel weight (TKW), and grain yield. The results showed that the morpho-productive performance of the genotypes varied significantly among the three locations, reflecting the influence of agroclimatic conditions on the analyzed traits. Turda showed higher TKW values and more stable grain yields, while Fundulea recorded lower performance, likely due to increased abiotic stress. In Secuieni, high variability among traits suggested a complex interaction between genotypes and local pedoclimatic factors. These findings highlight the importance of multilocation testing for identifying stable spring barley cultivars and provide valuable information for breeding programs and region-specific cultivation strategies.

Key words: genotypes, stability, yield, environmental factors

INTRODUCTION

Barley is currently the fourth most cultivated cereal crop worldwide in terms of cultivated area, following wheat, maize, and rice. This is due to its agronomic importance (animal feed, brewing industry, human consumption) and adaptability to diverse agro-climatic conditions, as it exhibits moderate drought tolerance (Mishra and Shivakumar, 2000; Valenzuela and Smith, 2002) and higher heat tolerance compared to wheat, rye, and oats (Muntean, 1993). Barley can be cultivated at altitudes up to 2700 m in the Caucasus, 4400 m in Tibet, and over 4250 m in Bolivia (Helena Gomez-Macpherson, 2001).

The fundamental objective of crop improvement programs is generally the development of varieties and hybrids with high and stable yield potential, as well as other favorable agronomic traits (Constanța Popescu, 1985). Yield potential is a highly complex trait determined by a multitude of physiological and morphological components. Among the morphological traits contributing to yield formation are: thousand kernel weight (TKW), number of grains/spike, and grain weight/spike. These traits play a significant role in determining final yield and are strongly influenced by environmental factors (Voltas et al., 2013; Alqudah et al., 2021).

Climate change, including rising temperatures, water deficits, and uneven precipitation, represents a major constraint to yield stability in spring cereals, including spring barley (Ceccarelli and Grando, 2010; Carter et al., 2019). Multi-location testing is essential for identifying barley varieties with high yield potential and stable performance under variable environmental conditions. Evaluating genotypes across contrasting agroecological zones allows not only the quantification of environmental effects but also the selection of varieties with high general adaptability (Yan and Kang, 2003). Such approaches are particularly relevant under current climatic conditions, which increasingly vary from one cultivation area to another. In this context, we propose testing spring barley cultivars in an agroecological zone that is not very favorable for this crop (Fundulea).

In Romania, even in regions favorable for spring barley cultivation (cool and humid areas), periods of water deficit and high temperatures occur frequently. Therefore, testing spring barley genotypes in climatically diverse areas is of particular importance and becomes a strategic objective for making the most informed decisions regarding the selection of candidate varieties to be tested within the ISTIS Romania ecological network.

Therefore, the aim of this study was to evaluate the morpho-productive performance of spring barley genotypes across contrasting agroecological zones in Romania, with a focus on identifying genotypes with high yield potential and stable performance under variable environmental conditions. Specifically, this research sought to: compare key agronomic traits including plant height, number of grains/ear, grain weight/ear, thousand kernel weight (TKW), and grain yield among genotypes; quantify the effects of pedoclimatic variation on these traits; and identify genotypes with broad adaptability suitable for use in breeding programs and cultivation under conditions of water and heat stress.

MATERIALS AND METHODS

The experiment was established according to the randomized block design (RBD) with five replications, and the harvestable area of each plot was 10 m². A total of 21 spring barley variants, including varieties and lines developed at ARDS Turda, were tested. Sowing dates were adjusted according to the specific climatic conditions of each location: 22 March in Turda, 10 March in Fundulea, and 7 March in Secuieni. Considering that soil preparation in all three locations was conducted under very good conditions, resulting in a high-quality seedbed, a common sowing density of 550 germinable seeds/m² was used. This decision was also supported by the fact that sowing occurred within the optimal sowing window for spring barley, as early as possible in the spring.

The soil type in all three locations is a cambic phaeozem, with differing pH values: 7.0 in Turda, 6.14 in Secuieni, and 6.5 in Fundulea. Regarding the physico-chemical properties, all three soils have a loam-clay texture, with total nitrogen content of 0.205 % (Turda), 0.180 % (Fundulea), and 0.134 % (Secuieni); P₂O₅: 30 ppm (Turda), 28 ppm (Fundulea), and 74 ppm (Secuieni); and K: 283 ppm (Turda), 98 ppm (Fundulea), and 221 ppm (Secuieni).

Fertilization varied by location: in Secuieni and Fundulea, a complex fertilizer containing N (18 %): P (46 %) was applied at a rate of 120 kg active substance/ha. In Turda, ammonium nitrate (NH₄NO₃ – 33 % N) was applied at a rate of 50 kg a.s./ha. Additionally, in Fundulea, urea (100 kg/ha) was applied in spring. Fertilizer application timing was as follows: in Turda, it was applied once after crop emergence; in Fundulea, complex fertilizers were applied in autumn before seedbed preparation, and in spring, urea was applied after sowing but before crop emergence; in Secuieni, fertilization was applied once, two days before sowing.

For weed control in all three locations, Sekator Progres herbicide (0.12 l/ha) and Evure contact insecticide (0.2 l/ha) were applied at BBCH 20–31. No disease control treatments were applied.

Quantitative traits analyzed in the experiment included: plant height (measured at full maturity, BBCH 92, from soil surface to the tip of the awns), grain weight/spike, thousand kernel weight (TKW), number of grains/spike, and average grain yield/ha. For each genotype, 20 measurements were taken, with spikes randomly sampled from the plot, avoiding the margins.

Collected data were statistically processed using variability parameters (arithmetic mean, standard error, median, mode, standard deviation, minimum and maximum values, and coefficient of variation %) for each trait. This processing allowed, in addition to evaluating variability, a preliminary quantification of trait stability. Statistical analysis was performed using Microsoft Excel.

RESULTS AND DISCUSSIONS

During 2024, in the three experimental locations (Turda, Fundulea, and Secuieni), throughout the maturation period (January–July), positive deviations in the thermal regime were recorded, ranging from 0.4 °C to 8.4 °C. In Fundulea, a single negative deviation of –0.6 °C was recorded in May. The precipitation regime also exhibited variable distribution throughout both the vegetative and generative stages, coinciding with periods of water stress during critical growth phases for spring barley. In Turda, although June was dry, rainfall in May promoted sustained vegetative growth, whereas in Secuieni, precipitation was unevenly distributed, with a major deficit in July, negatively affecting the final grain-filling stage.

These meteorological conditions resulted in variations in the analyzed morpho-productive parameters, including plant height, number of grains/spike, grain weight/spike, thousand kernel weight (TKW), and final grain yield. The following sections present these results, highlighting how temperature and water availability influenced the performance of barley genotypes at each location (Table 1).

The results indicate significant variations in morpho-productive traits depending on the pedoclimatic conditions of each location. In this context, agronomic performance depends not only on genetic potential but also on the ability of genotypes to efficiently remobilize assimilated resources under water stress, a key mechanism for maintaining high thousand kernel weight (TKW) (Yang & Zhang, 2006; Passioura, 2007).

The observed variability in trait expression among genotypes across the three experimental locations reflects differential responses of genotypes to the prevailing agro-climatic conditions, as evidenced by differences in mean values and variability parameters such as coefficient of variation. This suggests that environmental factors such as temperature and water availability influenced the expression of morpho-productive traits, as indicated by the observed variations in trait performance across locations.

Table 1. Evolution of Monthly Temperatures and Precipitation Amounts in the Three Locations

Temperature (°C)									
Locations Month	Mean Temp. (°C)	Turda 65- year Avg.	Deviation	Mean Temp. (°C)	Fundulea 60- year Avg.	Deviation	Mean Temp. (°C)	Secuieni 60- year Avg.	Deviation
January	0.2	-3.3	3.5	1.0	-2.4	3.4	-1.8	-3.7	1.9
February	7.0	-0.6	7.6	7.6	-0.4	8.0	5.8	-1.9	7.7
March	8.8	4.4	4.4	8.5	4.9	3.6	6.4	2.8	3.6
April	13.3	10.0	3.3	15.0	11.3	3.7	13.2	9.6	3.6
May	15.8	15.0	0.8	16.4	17.0	-0.6	15.8	15.4	0.4
June	21.7	18.0	3.7	26.1	20.8	5.3	21.9	18.9	3.0
July	24.0	19.8	4.2	27.7	22.7	5	24.5	20.4	4.1

Precipitation (mm)									
Locations Month	Monthly Total (mm)	Turda 65- year Avg.	Deviation	Monthly Total (mm)	Fundulea 65- year Avg.	Deviation	Monthly Total (mm)	Secuieni 65- year Avg.	Deviation
January	4.8	21.7	-16.9	17.6	35.1	-17.5	16.4	19.6	-3.2
February	9.2	19.2	-10.0	1.4	32.0	-30.6	9.4	19.2	-9.8
March	37.7	24.3	13.4	38.6	37.4	1.2	40.6	26.3	14.3
April	38.8	45.6	-6.8	62.4	45.1	17.3	33.4	44.9	-11.5
May	60.7	69.4	-8.7	34.2	62.5	-28.3	36.0	64.3	-28.3
June	36.2	84.6	-48.4	15.6	74.9	-59.3	84.4	84.7	-0.03
July	49.0	78.0	-29.0	45.4	71.1	-25.7	19	80.6	-61.6

Source of primary data: Turda, Fundulea, and Secuieni Meteorological Stations.

Plant Height

Plant height varied among locations and genotypes, reflecting the influence of environmental conditions on vegetative vigor.

At Fundulea, where spring temperature and precipitation conditions were favorable (62.5 mm in April), the highest plant heights were recorded, with mean values exceeding 100 cm and low variability (CV = 5.75 %) (Table 2).

Table 2. Variation in Plant Height of Spring Barley under the Soil and Climatic Conditions of Turda, Fundulea, and Secuieni.

Plant Height (cm)			
Genotype	Turda	Fundulea	Secuieni
Daciana	90.2	100.3	61.3
Turdeana	96.5	99.3	63.6
Romanița	96.2	97.0	69.2
Ioana	83.0	97.7	68.8
To 2198-13	93.2	93.7	76.8
To 2096-10	86.0	86.0	74.1
To 2122-17	81.5	91.3	78.1
To 2187-18	79.7	101.3	66.8
To 2238-18	85.5	84.7	75.1
To 2108-18	92.3	86.7	76.0
To 2222-18	85.7	95.3	79.1
To 2335-15	74.3	100.7	65.5
To 2183-17	88.7	95.3	79.3
To 2017-93	96.7	87.3	78.7
To 2014-99	90.8	97.7	75.7
To 2051-10	82.0	92.7	72.9
To 2123-01	89.5	93.7	81.3
To 2027-10	86.3	94.0	72.8
To 2170-01	93.8	90.0	77.0
To 2169-12	88.0	96.7	68.5
Dumbrăvița	89.7	100.0	72.4
Mean±Standard Error	88 ± 1.25	94 ± 1.18	73 ± 1.23
Median	89	94	74
Mode	86	100	79
Standard Deviation	5.8	5.39	5.63
Minimum	74	83	61
Maximum	97	101	81
Coefficient of Variation (%)	6.51	5.75	7.72

Among the genotypes, Daciana, Turdeana, and Dumbrăvița stood out for uniform and vigorous growth. These results are consistent with literature reports on the role of spring rainfall in stimulating vegetative growth (Lobell et al., 2011; Cammarano et al., 2019). Additionally, Farooq et al. (2009) emphasize the negative effect of water stress during the stem elongation phase on plant height.

In Turda, the mean plant height was 88 cm, with slightly higher variability (CV = 6.51 %). Genotypes Romanița, To 2198-13, and To 2170-01 exceeded the location mean, demonstrating good adaptability to moderate climatic conditions and uneven precipitation distribution (Table 2). In Secuieni, the mean plant height was the lowest (73 cm), with higher variability (CV = 7.72 %) due to pronounced water stress. Genotypes To 2123-01, To 2222-18, and To 2183-17 maintained heights close to the location mean, indicating better tolerance to adverse conditions, in agreement with observations by Hatfield & Prueger (2015).

Overall, Daciana, Turdeana, Dumbrăvița, and To 2123-01 exhibited consistent performance and are recommended for use in breeding programs and cultivation in areas with moderate water stress.

Number of Grains/ear

The comparative analysis of the number of grains/ear revealed significant differences between genotypes and locations, reflecting the complex interaction between genetics and agro-climatic conditions. The overall mean was higher in Fundulea and Secuieni (29 grains/ear) compared to Turda (27 grains/ear), suggesting that genotype fertility was favored by the microclimatic conditions of these locations. Variability of this trait was low across all locations (CV = 4.28–6.73 %), indicating a relatively uniform response of the genotypes, which may be attributed to the limited number of genotypes tested and the homogenization resulting from breeding (Table 3).

The genotypes showing the highest stability across locations were Daciana, Turdeana, Romanița, Ioana, To 2198-13, and To 2096-10, maintaining consistent values for the number of grains/ear, indicating good adaptability to diverse conditions. In contrast, Dumbrăvița, To 2169-12, and To 2238-18 exhibited greater fluctuations, suggesting lower adaptability.

These observations align with the literature, which indicates that water stress can amplify genotype response variation and genotype × environment interactions (Ahmadi et al., 2018). Additionally, Araus et al. (2002) and Barnabás et al. (2008) emphasize the sensitivity of genotypes to water and heat stress during the flowering stage, directly affecting grain fertility.

Table 3. Variability of the number of grains/ear in spring barley under the pedoclimatic conditions of Turda, Fundulea, and Secuieni

Genotype	Number of grains/ear		
	Turda	Fundulea	Secuieni
Daciana	25	27	26
Turdeana	31	28	30
Romanița	29	27	29
Ioana	29	28	26
To 2198-13	29	27	27
To 2096-10	27	27	29
To 2122-17	26	27	29
To 2187-18	28	28	29
To 2238-18	25	31	30
To 2108-18	26	29	29
To 2222-18	26	30	28
To 2335-15	28	29	29
To 2183-17	27	30	29
To 2017-93	26	29	28
To 2014-99	30	32	30
To 2051-10	26	29	30
To 2123-01	26	30	29
To 2027-10	27	30	30
To 2170-01	27	30	29
To 2169-12	25	30	30
Dumbrăvița	24	30	30
Mean ± Standard Error	27 ± 0.40	29 ± 0.32	29 ± 0.27
Median	27	29	29
Mode	26	30	29
Standard Deviation	1.82	1.47	1.24
Minimum	24.00	27.00	26.00
Maximum	31.00	32.00	30.00
Coefficient of Variation (%)	6.73	5.06	4.28

Genotypes Daciana, Turdeana, Romanița, Ioana, and To 2198-13 stand out for their stability and high performance in the number of grains/ear and are recommended for both breeding programs and cultivation in areas with moderate climatic variability.

Grain weight/ear

Grain weight/ear represents a valuable agronomic indicator that integrates flower fertility and grain-filling capacity, being highly sensitive to water and temperature conditions during the flowering-to-maturity period. Comparative analysis of data from the three experimental locations (Turda, Fundulea, and Secuieni) revealed significant differences in mean values, distributions, and individual genotype variability (Table 4).

In Turda, the mean grain weight/ear was the highest (1.33 g), with a symmetric distribution around the mean (median = 1.32 g; mode = 1.35 g) and low variability (CV = 6.52 %) (Table 4). These results indicate uniform grain filling and efficient utilization of accumulated resources, confirming Fischer's (1993) observations on the possibility of compensating for a lower number of grains through additional dry matter accumulation.

Under more stressful conditions in Fundulea and Secuieni, grain weight/ear was lower (0.99 g and 0.65 g, respectively) and more variable (CV = 20.23 % and 17.19 %), reflecting the negative effects of post-flowering drought and heat stress. This highlights differences among genotypes regarding adaptability and stability of this trait (Barnabás et al., 2008; Lopes et al., 2011).

Analysis of individual values identified genotypes with consistently high performance and grain weight, recommended for selection and breeding: Daciana (Turda 1.35 g, Fundulea 1.20 g, Secuieni 0.79 g), Romanița – top performance in Turda (1.49 g) and good values under more challenging conditions (Fundulea 1.20 g, Secuieni 0.75 g), Ioana – excellent stability under variable conditions, ranking first in Fundulea and third in Secuieni, confirming its adaptability.

Genotypes To 2122-17, To 2222-18, and To 2183-17 exhibited high values across all locations, indicating good grain-filling capacity and stress tolerance.

Table 4. Variability of grain weight /ear in spring barley under the pedoclimatic conditions of Turda, Fundulea, and Secuieni

Genotype	Grain weight /ear (g)		
	Turda	Fundulea	Secuieni
Daciana	1.35	1.2	0.79
Turdeana	1.47	0.6	0.48
Romanița	1.49	1.2	0.75
Ioana	1.29	1.32	0.76
To 2198-13	1.35	1	0.59
To 2096-10	1.42	0.8	0.72
To 2122-17	1.38	1.18	0.76
To 2187-18	1.25	0.9	0.57
To 2238-18	1.39	0.93	0.50
To 2108-18	1.46	1.02	0.74
To 2222-18	1.30	1.18	0.85
To 2335-15	1.21	1	0.61
To 2183-17	1.44	1.25	0.68
To 2017-93	1.24	1.05	0.63
To 2014-99	1.32	0.98	0.55
To 2051-10	1.26	1	0.52
To 2123-01	1.19	0.58	0.76
To 2027-10	1.31	0.78	0.69
To 2170-01	1.26	0.89	0.67
To 2169-12	1.30	0.8	0.51
Dumbrăvița	1.32	1	0.51
Mean ± Standard Error	1.33 ± 0.02	0.99 ± 0.04	0.65 ± 0.02
Median	1.32	0.98	0.67
Mode	1.35	0.9	0.76
Standard Deviation	0.09	0.2	0.11
Minimum	1.19	0.47	0.48
Maximum	1.49	1.47	0.85
Coefficient of Variation (%)	6.52	20.23	17.19

Conversely, genotypes such as Turdeana, To 2238-18, To 2169-12, and Dumbrăvița showed lower values or higher variability between locations, suggesting reduced adaptability to stress conditions.

The slightly skewed distribution in Fundulea (mode = 0.90 g; median = 0.98 g; mean = 0.99 g) indicates a higher frequency of lower values, while in Secuieni, extremely low minimum values (0.48 g) reflect

underdeveloped ears and flower abortion, revealing severe limitations in the grain-filling process under multiple stress factors. These observations are supported by Araus et al. (2002) and Zhang et al. (2025), who emphasize the impact of abiotic stress on grain weight and plant uniformity.

Grain weight/ear is highly responsive to environmental conditions, and genotypes Daciana, Romanița, Ioana, To 2122-17, To 2222-18, and To 2183-17 stand out for performance and stability across locations, being recommended for breeding and cultivation in areas affected by water and heat stress.

Thousand kernel weight (TKW)

Thousand kernel weight (TKW) is an important agronomic trait with relatively high heritability, whose phenotypic expression is primarily influenced by environmental conditions during the grain-filling period. Comparative analysis of TKW values obtained in the three locations highlights significant differences between genotypes, driven by the levels of water and heat stress experienced in each area.

In Turda, the mean TKW was 49.97 g, with a low coefficient of variation (CV = 6.49 %), indicating uniform expression of the trait. Among the genotypes analyzed, Daciana (55.18 g), Dumbrăvița (54.77 g), To 2122-17 (54.51 g), To 2238-18 (53.93 g), and Ioana (52.25 g) recorded the highest TKW values. The relatively high stability of kernel weight suggests a good capacity for assimilate remobilization to the grain, even under moderate water stress, consistent with the findings of Yang & Zhang (2006).

At Fundulea, the mean TKW was 42.0 g, with higher variability (CV = 15.19 %), reflecting the influence of pedoclimatic conditions on the grain-filling process. The highest TKW values at this location were observed for Daciana (51.28 g), To 2122-17 (50.73 g), To 2198-13 (50.35 g), and Romanița (50.30 g). The wide range of values (29.14–51.28 g) indicates differential ability among genotypes to maintain dry matter accumulation in the grain under water deficit after flowering, as reported by Saini & Westgate (2000).

In Secuieni, the mean TKW was 41.88 g, with a coefficient of variation of 12.86 %, indicating pronounced variability among genotypes. The highest TKW values were recorded for Daciana (55.20 g) and Ioana (55.10 g), followed by To 2198-13 (48.80 g). The performance of these genotypes suggests superior tolerance to water stress under the agroecological conditions of this location, where water deficit during grain filling was severe, in agreement with Passioura (2007).

Overall, genotypes Daciana and Ioana stood out for high and consistent TKW values across all three locations, making them valuable candidates for cultivation and as parental material in barley breeding programs.

Table 5. Variability of thousand kernel weight (TKW) in spring barley under pedoclimatic conditions in Turda, Fundulea, and Secuieni

Genotype	TKW (g)		
	Turda	Fundulea	Secuieni
Daciana	55.18	51.28	55.20
Turdeana	48.04	47.37	35.60
Romanița	52.01	50.30	39.70
Ioana	45.24	44.68	55.10
To 2198-13	52.25	50.35	48.80
To 2096-10	51.05	49.88	40.60
To 2122-17	54.51	50.73	42.20
To 2187-18	47.56	46.02	40.50
To 2238-18	53.93	32.85	36.20
To 2108-18	52.69	40.41	42.40
To 2222-18	48.39	38.69	43.80
To 2335-15	45.97	40.73	42.50
To 2183-17	47.53	37.70	39.60
To 2017-93	48.10	42.59	43.90
To 2014-99	50.01	29.14	36.00
To 2051-10	48.12	42.56	37.20
To 2123-01	45.21	38.94	41.20
To 2027-10	49.58	35.60	39.40
To 2170-01	46.49	36.86	42.40
To 2169-12	52.72	37.76	38.80
Dumbrăvița	54.77	37.45	38.20
Mean ± Standard Error	50 ± 0.71	42 ± 1.40	41.88 ± 1.18
Median	49.58	40.73	40.6
Mode	-	-	42.4
Standard Deviation	3.24	6.38	5.39
Minimum	45.21	29.14	35.6
Maximum	55.18	51.28	55.2
Coefficient of Variation (%)	6.49	15.19	12.86

Yield

The analysis of mean yield values and the coefficient of variation (CV%) for the 21 studied genotypes highlights considerable differences in their performance across the three locations. This suggests that the environment plays a decisive role in yield formation, or that the environmental contribution to yield is significant. Mean yields ranged from 3,440 kg/ha (To 2017-93) to 5,415 kg/ha (Ioana), while the coefficient of variation ranged from 13% (Turdeana) to 49% (To 2123-01). The relatively low CV of Turdeana indicates a high adaptability of this genotype to both biotic and abiotic variations.

Regarding the relationship between yield level and stability, an inverse trend is observed: highly productive genotypes tend to be less stable, whereas genotypes with moderate yields show lower variability. This relationship aligns with previous reports in the literature, which indicate that genotypes with high yield potential respond more sensitively to environmental fluctuations. A clear example is the genotype Ioana, which recorded the highest mean yield (5,415 kg/ha) but a CV of 28.3%, reflecting high productivity but lower stability.

Genotypes with mean yields above 4,300 kg/ha can be considered high-performing, though their stability varies significantly. Among these, Turdeana (4,310 kg/ha, CV = 12.5%), To 2198-13 (4,085 kg/ha, CV = 19.7%), and To 2222-18 (4,793 kg/ha, CV = 21.4%) stood out for their favorable balance between yield potential and stability, being considered well-balanced genotypes with good adaptability. These results indicate high ecological plasticity, making them suitable for cultivation in regions with moderate climatic variations.

At Turda and Fundulea, mean yields were around 5,000–6,000 kg/ha, whereas under unfavorable conditions at Secuieni, yields were reduced by approximately half. Similar behavior was observed in genotypes To 2238-18 (4,808 kg/ha, CV = 30.1%) and To 2187-18 (4,352 kg/ha, CV = 33.5%), which, despite high yields, exhibited pronounced variability across locations.

Overall, the results indicate that lines To 2198-13 and To 2222-18 optimally combine yield level and stability, making them valuable candidates for registration and wider cultivation in different regions of Romania. Furthermore, these genotypes could serve as valuable genetic material for breeding programs aimed at developing high-performing, stable, and environmentally adaptable spring barley cultivars.

Table 6. Analysis of yield and variability of 21 spring barley genotypes across three locations

Genotyp	Turda	Fundulea	Secuieni	Average	CV (%)
Daciana	4669	4494	2829	3997	25
Turdeana	4587	3641	4703	4310	13
Romanița	4954	4754	2811	4173	25
Ioana	6373	6226	3647	5415	28
To 2198-13	4919	4006	3329	4085	20
To 2096-10	6285	3712	2822	4273	40
To 2122-17	6029	4640	3473	4714	27
To 2187-18	5949	4101	3007	4352	34
To 2238-18	6349	4582	3493	4808	30
To 2108-18	5566	4235	3519	4440	24
To 2222-18	5566	5256	3556	4793	21
To 2335-15	5785	4028	3266	4360	28
To 2183-17	5425	5145	2584	4385	34
To 2017-93	4464	3426	2430	3440	30
To 2014-99	4550	3566	2525	3547	29
To 2051-10	4706	3514	2105	3442	38
To 2123-01	5048	1692	3606	3449	49
To 2027-10	5424	3608	2900	3977	29
To 2170-01	4777	3327	2669	3591	30
To 2169-12	5009	3635	2933	3859	27
Dumbrăvița	4776	3563	2583	3641	30
Average	5295	4055	3085	4145	29

*CV- Coefficient of Variation

CONCLUSIONS

The results obtained highlight significant variability in the agro-morphological and production traits of spring barley genotypes, primarily determined by the pedoclimatic conditions of the studied locations.

Plant height was significantly influenced by spring precipitation, with the highest values recorded at Fundulea. Genotypes Daciana, Turdeana, Dumbrăvița, and To 2123-01 demonstrated consistent performance and good adaptability under moderate water stress.

The number of grains/ear exhibited low variability, indicating relatively stable expression of this trait. Genotypes Daciana, Turdeana, Romanița, Ioana, and To 2198-13 stood out with high and consistent values and are recommended for breeding and cultivation.

Grain weight/ear was strongly influenced by environmental conditions during the flowering-maturity period. Genotypes Daciana, Romanița, Ioana, To 2122-17, To 2222-18, and To 2183-17 showed superior performance and stability across locations.

Thousand kernel weight (TKW) had the highest values in Turda, and Daciana and Ioana were distinguished by high and consistent TKW values across all three locations, confirming their potential for direct use and as parental material in breeding programs.

Grain yield was strongly influenced by pedoclimatic conditions, with the highest values obtained in Turda and Fundulea. Genotypes To 2198-13 and To 2222-18 combined high yield levels with good stability and are recommended for variety registration and wider cultivation.

Overall, genotypes Daciana, Ioana, To 2198-13, and To 2222-18 stood out for superior performance across multiple traits and can serve as valuable genetic material for spring barley breeding programs.

The study underscores the importance of multi-location testing and monitoring of stress-sensitive parameters in the breeding process, providing concrete data for the selection of genotypes with high yield potential and resilience to variable environmental conditions, thereby contributing to the stability of spring barley production in Romania.

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