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COMPARATIVE STUDY OF SOFT WHEAT GENOTYPES UNDER MEDITERRANEAN CLIMATE CONDITIONS IN ALBANIA

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The aim of the study was to define the main morphological, biometric and production elements of 25 common wheat genotypes (*Triticum aestivum* L.) of Albanian origin. In the study the following data were registered: entire vegetation period (germination – ripening), vegetative growth period (germination – flowering), reproduction period (flowering – ripening), number of tiller per plant, plant height, length of the main spike, number of spikelet in the main spike, number of grains in the main spike, average number of grains in the spikelet, weight of grains in the main spike, weight of 1,000 grains and grain yield (dt/ha) calculated at 14% moisture. The experimental data showed that the genotypes under study have significant differences with respect to the characteristics and traits under study. The results obtained were also analyzed for correlation coefficient among traits, where several interesting relationships related to grain yield and production components were found.

Keywords: genotype, descriptors, production elements, grain yield

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Cilj istraživanja bio je definirati glavne morfološke, biometrijske i proizvodne elemente 25 genotipova obične pšenice (*Triticum aestivum* L.) albanskog podrijetla. U istraživanju su bilježeni sljedeći podaci: cijelo vegetacijsko razdoblje (nicanje - dozrijevanje), vegetativno razdoblje rasta (nicanje - cvatnja), reprodukcijsko razdoblje (cvatnja - dozrijevanje), broj busena po biljci, visina biljke, duljina glavnog klasa, broj klasića u glavnom klasu, broj zrna u glavnom klasu, prosječan broj zrna u klasiću, masa zrna u glavnom klasu, masa 1000 zrna i prinos zrna (dt/ha) izračunato kod 14% vlage. Eksperimentalni podaci su pokazali da se ispitivani genotipovi značajno razlikuju u ispitivanim karakteristikama i svojstvima. Dobiveni rezultati analizirani su i na korelacijski koeficijent među svojstvima, pri čemu je utvrđeno nekoliko zanimljivih relacija vezanih uz prinos zrna i komponente proizvodnje.

Keywords: genotype, descriptors, production elements, grain yield

INTRODUCTION

Common wheat (*Triticum aestivum* L.) is an agricultural crop basic to human civilization. It is one of the most important food crops in the world and the main source of food for about 35% of the world's population (Ma *et al.*, 2022). Wheat alone provides one fifth of global food calories and protein, significantly more than corn (Shiferaw

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et al., 2013). For more than 7 centuries, wheat has been cultivated and harvested in many countries of the world. It is one of the major agricultural crops cultivated worldwide and its production greatly affects global food security (Grote *et al.*, 2021). This is also reflected by the total area of over 200 million hectares occupied by wheat (FAO accessed 15 June 2024 (http://www.fao.org/faostat/en/#data,).

According to Smith (1998), as cited by Shiferaw *et al.* (2013), between 8 and 10 thousand years ago, in the earliest permanent agricultural settlements of the Fertile Crescent, farmers created common wheat from the wild forms of emmer and einkorn. However, these wheat forms were very different from the ones that are used nowadays – the plant height would outgrow modern cultivars typically reaching 160 cm and had a great genetic diversity. These 'landraces' were created by generations of natural selection by farmers saving different seeds year after year. Over time, among the features commonly associated with the domestication process there was also an increase in local adaptation (Hancock, 2003) with the best genotypes for those environments being more widespread.

However, the trend of higher yields, as well as the industrialization of agriculture, has caused a genetic erosion estimated to over 70% in Albania and Southern Italy (Dwivedi, 2016). Most of those traditional landraces have disappeared from our fields and all that remains is a handful of seeds that make up the seed series in gene banks worldwide, known as accessions (Mir *et al.*, 2020).

Although global wheat production is currently over 700 million tons (Erenstein *et al.*, 2022), demand for wheat production is projected to increase by 60% by 2050. In 2022–2023, global wheat production reached almost 785 million tons, securing its place as one of the most consumed cereals in the world, second only to rice (Statista, 2024). Its ability to adapt in different soil and climate conditions (Ortiz *et al.*, 2008, de Sousa *et al.*, 2021) contributes significantly to its widespread consumption. Globally, wheat is responsible for 41% of total cereal calorie consumption, 35% in developing countries and 74% in developed countries (Shiferaw *et al.*, 2013). Currently, wheat ranks second only to rice in terms of volume of consumption in the human diet (Erenstein *et al.*, 2022), with 68% of wheat produced being used for human food, and approximately 19% for animal feed, and the rest for other purposes, including biofuels and industrial use (Kashta *et al.*, 2010).

Despite fluctuations in the last decades wheat demand has experienced an overall increasing trend (Shewry, 2009; D'Odorico *et al.*, 2014). Its importance in global food consumption is undeniable, with an average annual per capita wheat consumption of 65.6 kg, accounting for 37% of the average annual per capita cereal consumption (excluding beverages) of 175 kg globally. Wheat consumption surpasses 50 kg per capita annually in 102 countries, particularly in regions such as Northern Africa, West/Central Asia, and Europe, where wheat dietary traditions hold strong (Shaikh, 2023). Increasing global demand for wheat is based also due to its ability to be made into unique food products and the increasing consumption of these products with industrialization and westernization (Shewry & Hey, 2015).

To meet the growing demand for wheat, the responsible groups of human society are tasked with seeking and realizing increased wheat production. This requires knowing the factors on which wheat production depends and finding the most suitable solution for today and for the future.

There are many factors responsible for wheat production, such as increasing the area planted with wheat, choosing the best cultivars, improving cultivation technology through increased investment in inputs. The area sown with wheat shows fluctuations depending on market prices and local agricultural policies with an overall increasing trend. However, there is a limit to the expansion of the area sown with wheat, and under some scenarios of climate change predictions and socioeconomic development it could be even reduced (Guo *et al.*, 2024). Despite these fluctuations in the area devoted to wheat, the total amount of wheat produced is constantly increasing (FAO accessed 15 June 2024 (http://www.fao.org/faostat/en/#data). This is attributed to increasing trends in yield potential as a result of better crop management and improved genetic material, which gradually increased the yields obtained by farmers on a global basis (Dadrasi *et al.*, 2023; Sendhil *et al.*, 2023).

The environment in which agricultural crops, including wheat, are cultivated have a tremendous impact on the growth, development and productive capacity of the crop. Wheat crops need optimal conditions during their growth and development in order to achieve high yield. Studies have proven that wheat yield is strongly influenced by temperatures and light intensity during growth, flowering and, ultimately, grain production (Asseng *et al.*, 2004; 2011; Ottman *et al.*, 2012). However, among cultivars differences have been found in resistance to adverse weather conditions (Stone & Nicolas, 1995; Seefeldt *et al.*, 2002; Verma *et al.*, 2024). So, the wheat variety is among the main factors of production growth, both for its productive capacity, for its resistance to abiotic and biotic stresses, and for its response to cultivation technology. According to Araus *et al.* (2008) the need to accelerate breeding for increased yield potential and better adaptation to drought and other abiotic stresses is an issue of increasing urgency. Different cultivars respond differently to the chemical fertilizers used and, therefore, differ in their yield potential (Pahlavan-Rad *et al.*, 2011). Similarly, cultivars differ significantly in terms of fertile tillers per plant and, therefore, per m^{-2}, spike length, number of grains per spike, grain yield, etc. Likewise, according to Williams *et al.* (2008) Ilieva (2011), Kirchev & Delibaltova (2016) the creation of the appropriate structure of cultivars, depending on the specific agro-ecological conditions of the region, can significantly increase the yield and quality of wheat. This requires good understanding of the characteristics of different cultivars, in order to be able to make the right choice among them (Araus *et al.*, 2008). According to Kendal (2019), the first issue for researchers is to identify cultivars that are stable and not affected by the genotype-environment interaction (GE). For this purpose, the GE interaction and the additive main effect and multiplicative interaction have been developed to characterize the behavior of varieties under different environmental conditions.

Starting from the beginning of the 1960s, the global production of wheat has increased sharply mainly due to the adoption of semidwarf high-yielding and input-responsive wheat varieties (Tadesse *et al.*, 2016). About 50% of all wheat worldwide is now planted in semi-dwarf cultivars originating from the plant breeding system of CIMMYT and national research institutions (Shiferaw *et al.*, 2013). According to Elezi *et al.* (2014), landraces (farmers' cultivars) of wheat in Albania were planted in significant numbers (around 60) until the 1950s. In the 60s-80s of the last century, a significant number of wheat lines and cultivars were created in the former Agricultural Research Institute of Lushnja and in the Plant Breeding Department of the Agricultural University of Tirana. The wheat cultivars created in the country were almost entirely cultivated in the whole surface of Albania for more than 20 years (Elezi *et al.*, 2014). The landraces that are no longer used for cultivation were stored in the genetic bank. and constitute very valuable genetic material for wheat breeders. The first step in using this valuable genetic material is to evaluate it for different characteristics. This was also performed in the present study, in which we compared and evaluated 25 genotypes from the genetic material of the genetic bank for their productive characteristics.

Objectives and Purpose of the Study

The aim of the study was to identify the genotypes with the best indicators of the production elements through the recording of data on quantitative traits, that is, the data on production and yield components. Through this study it becomes possible to group the genotypes under study according to the status of each evaluation descriptor. A better understanding of the quantitative traits of each of the genotypes will simplify the work of the wheat breeders, who will use them in the selection of genotypes for each trait for the purposes of soft wheat genetic improvement programs, and will also create opportunities for farmers to choose the most suitable plant materials for the concrete conditions of cultivation.

MATERIALS AND METHODS

For this study, during the year 2022–2023, 25 soft wheat genotypes were studied, which represent farmers' cultivars (landraces) and soft wheat cultivars and lines created by the former Agricultural Research Institute of Lushnja and the Plant Breeding Department of the Agricultural University of Tirana.

The experiment was conducted in the Didactic Experimental Economy of the Agricultural University of Tirana (latitude 0410 23' N; longitude 0190 47' E; altitude 4.5 m). Each variant (genotype) in each replicate was sown in five rows; and the size of each variant in each replication was 6 m^2 with dimensions of 5 × 1.2 m. In the field trial, conventional tillage was applied. Phosphorus (75 kg P2O5 ha^{-1}) and potassium (75 kg K2O ha^{-1}) were applied before plowing, whereas nitrogen (150 kg N ha^{-1}) was applied 50% before planting and 50% at the beginning of stem elongation. When the plant had reached the technical ripening stage, 10 random plants for each repetition, or 30 plants for each treatment were taken, from which data were obtained on plant height, the number of spikelets in the main spike, the number of grains in the main spike, the weight of 1,000 grains, the weight of the grains of the main spike, and the average number of grains per spikelet in the main spike was calculated, in addition to the grain yield data; days from germination to flowering, days from germination to ripening were also recorded, the period in days from flowering to ripening was calculated . Quantitative trait data were subjected to analysis of variance, through the ANOVA program. Correlation coefficients among different traits were calculated and their evaluation was done according to these classes: r = ±0.3 weak correlation; r = ±0.3 to ±0.5 medium correlation relation; r = ±0.5 to ±0.7 links good correlation and r = ±0.7 to ±0.9 links strong correlation. The obtained data were statistically analyzed through ANOVA.

RESULTS AND DISCUSSION

For the purpose of the study, the data on the morphological features as well as those of the development phases of the plants were recorded, in addition to the data on the quantitative features.

According to the variance analysis, the soft wheat genotypes in the study showed significant variation for all the examined traits (Tab. 1). The fact that the analysis of variance found the data of all the examined traits to have significant differences at the P ≤ 0.01 level means that we are dealing with different genotypes; on the other hand, this proves that these traits are controlled by genetic factors. Of interest also is the finding that, for almost all traits, except grain yield, the differences between replications are confirmed. This gives us the right to conclude that these traits can be improved through the selection of plant forms with higher indicators in different agro-ecological conditions, thus also in different cultivation environments.

Although the plant life cycle is influenced by environmental conditions, it is characteristic of the cultivar, i.e. it is controlled by genetic factors. Information about the length of the life cycle of the genotypes help breeders to create strategies and contribute to the prediction of yield risks, such as drought, frost or heat, and thereby improve crop management (Hyles *et al.*, 2020).

From the data of the study, we notice that the extreme values of the plant life cycle are 211 and 219 days, which means that the genotypes are distributed with 8 days of difference between them. Only one genotype (AGB0259) has the shortest life cycle, while 3 genotypes (AGB0147, AGB0252 and AGB2815) were found to have the longest life cycle. However, the other genotypes also differ by 1 day (Tab. 2). Under these conditions, we cannot make any conclusions about influence of the plant period on the yield of the genotypes. Regarding the period of vegetative growth of plants (germination–flowering), we note that extreme values are represented by 152 days (AGB0005) and 189 days (AGB0252), with a difference between genotypes of 37 days. It is already known that the longer the stem-elongation phase, the higher the grain number through the larger biomass accumulation during this critical phase and consequently increasing assimilate supply to the juvenile spike determining the proportion of floret primordia as competent florets at anthesis (Slafer *et al.*, 2014). For the present genotypes, we can claim that genotype AGB0252 should have somewhat higher indicators of the production components (Tab. 3). The period of reproduction (flowering-ripening), is claimed to affect the production of the plant and its optimal length, for higher production is between 45 and 60 days. According to our data, the extreme values of this period are 30 days (AGB0252) and 63 days (AGB0005) with a difference of 33 days (Tab. 2).

Tab. 1. Statistical analysis (ANOVA) data (average of 2022–2023).

No.	Trait	Treatment (T) / Repetition (R)	df	Mean square	Observed "F"
1	Plant height	T	24	1479.50	1467.843646**
		R	2	5.70	5.666986**
2	Spike length	T	24	13.30	414.332815**
		R	2	3.20	98.55,544**
3	Spikelets per spike	T	24	30.12	188.250000**
		R	2	96.16	601000000**
4	Grain per spike	T	24	381.70	143.765223**
		R	2	171.61	64.637790**
5	Grain per spikelet	T	24	0.26	120.138831**
		R	2	0.13	63.008613**

No.	Trait	Treatment (T) / Repetition (R)	df	Mean square	Observed “F”
6	g/main spike	T	24	1.02	71.837304**
		R	2	0.27	18.939618**
7	g/1.000 grains	T	24	76.00	373.577465**
		R	2	29.50	144.866689**
8	Grain yield	T	24	468.30	168.892500**
		R	2	4.80	1,7

Even for the number of tillers per plant, significant variations were observed among the 25 genotypes. Thus, for example, the extreme values of this trait were 1.1 tillers (AGB2825 and AGB0051) and 3.0 tillers per plant (AGB0147). However, for this trait, genotypes with two and more tillers per plant prevail.

Tab. 2. Data on tillers per plant, developmental phases and main spike length (average of 2022–2023)

Genotype	Germination - ripening (days)	Germination – flowering (days)	Flowering – ripening (days)	Tillers per plant	Plant height (cm)	Spike length (cm)
AGB0004	218	177	41	2.7	133	15.0
AGB0005	215	152	63	1.9	91	11.0
AGB0009	215	155	60	2.3	88	10.5
AGB0024	217	156	61	1.3	89	8.0
AGB0034	215	157	58	2.0	89	8.8
AGB0061	217	184	33	2.3	112	10.4
AGB0071	217	155	62	2.9	115	10.7
AGB0075	217	176	41	2.6	104	11.3
AGB0078	218	179	39	2.5	103	13.3
AGB0125	217	156	61	2.2	120	11.1
AGB0127	217	175	42	1.5	105	7.4
AGB0132	217	159	58	2.0	103	9.2
AGB0147	219	183	36	3.0	166	9.2
AGB0148	214	179	35	2.1	95	9.8
AGB0156	214	156	58	2.1	102	12.5
AGB0252	219	189	30	2.5	169	17.0
AGB0254	213	158	55	2.0	122	11.5
AGB0259	211	158	53	1.9	117	11.1
AGB2813	218	179	39	2.3	93	8.7
AGB2814	218	162	56	1.7	99	10.0
AGB2815	219	180	39	1.5	122	10.7
AGB2816	218	161	57	2.0	94	10.6
AGB2825	217	176	41	1.1	79	10.2
AGB0048	216	180	36	1.2	105	10.7
AGB0051	217	177	40	1.1	88	8.5

According to the plant height data, although the extreme values were 79 cm (AGB2825) and 169 cm (AGB0252), 6 genotypes (24 %) were distinguished by their greater plant height, 120 to 169 cm. The genotypes in the study showed large differences in main spike length, which is be closely related with yield, which is also due to a longer period of staying green (Okuyama *et al.*, 2025). In our experiment the shortest spike (7.4 cm) was found in AGB0127, while the longest spike (17.0 cm) was in AGB0252 (Tab. 2, Fig. 1), which means that the shortest spike was 2.3 times smaller than the longest one.

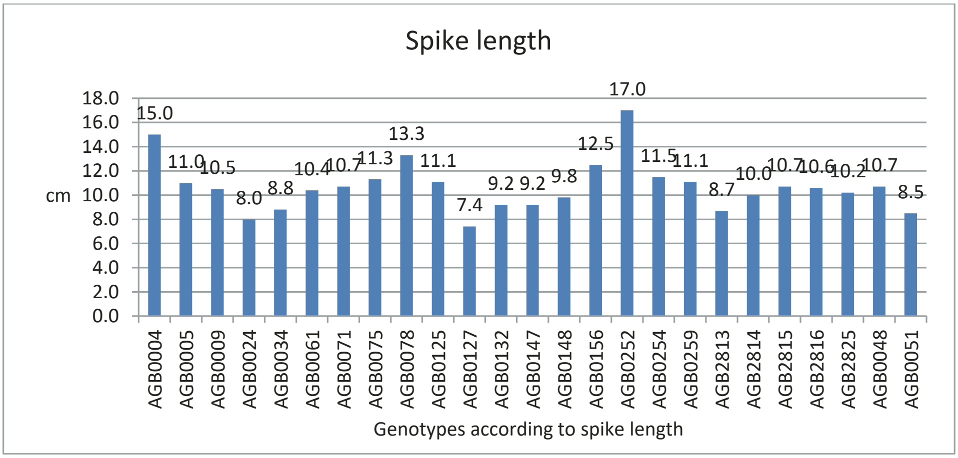

Fig. 1.: Frequency of genotypes according to spike length

In the general judgment of the values of the features of table 2, we note that AGB0252 stands out for higher values of three traits, germination-flowering period, plant height and spike length, followed by AGB0147 with two higher values, vegetative period and number of tillers per plant

Also, significant differences were found among the genotypes under study in production components and grain yield. For the number of spikelets in the main spike, the extreme values 11.0 (AGB0024) and 26.0 spikelets (AGB0004), while 13 genotypes had between 20 and 25 spikelets (Tab. 3, Fig. 2). This means that there is a clear variability of the genetic material under study in relation to the number of spikelets in the main spike.

For the number of grains in the main spike, which, being controlled by genetic factors, is characteristic of a given cultivar the maximum value was almost three times higher than the minimum one. Thus, while genotype AGB0024 had the lowest number of grains (31), genotype AGB0034 had the highest (91). However, 12 genotypes (48 %) had a high number of grains per spike, between 60 and 73 (Tab. 3, Fig. 3)

Also of interest is the number of grains in the spikelet, which expresses its fertility. According to the data on this feature, the minimum value was 2.69 grains per spikelet (AGB0004) and the maximum one, 4.33 grains per spikelet (AGB0034) (Tab. 3). However, values for this trait were generally high, almost up to 3.0 grains per spikelet in all the genotypes.

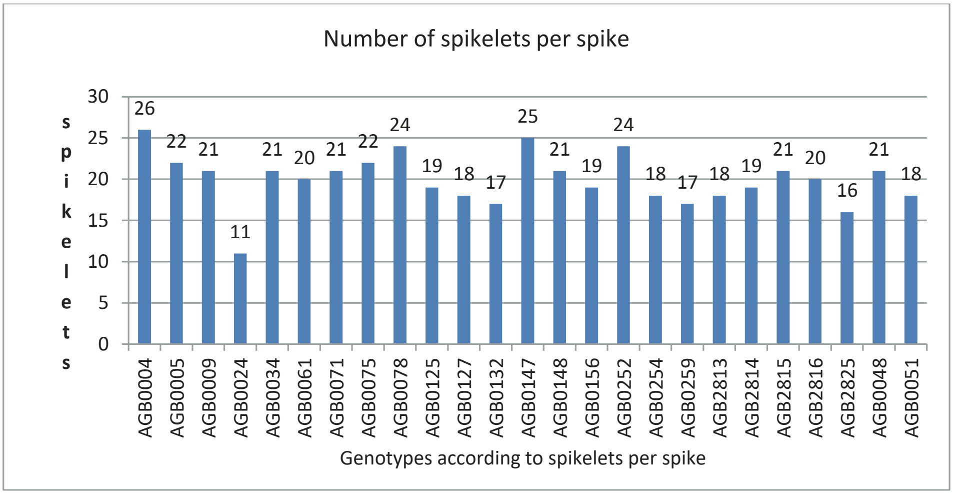

Fig. 2.: Frequency of genotypes according to spikelets per spike

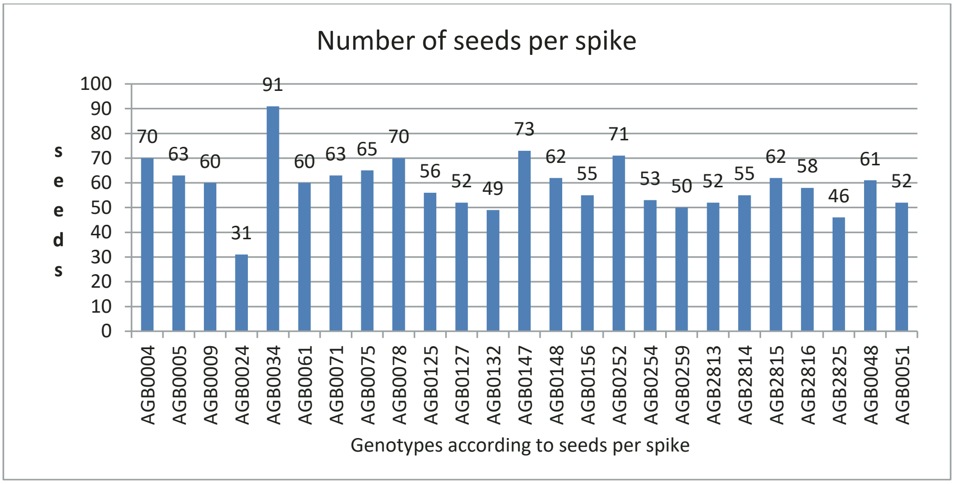

Fig. 3.: Frequency of genotypes according to seeds per spike

Of course, the weight of the main spike is an important component that contributes to the production per plant and, consequently, to the grain yield. However, due to the comparison effect of the plant material in the study, also due to the fact that the field trial was cultivated and treated equally, the recorded values of the weight of the grains of the main spike are significant. Among the 25 plant materials under study, the extreme values of the grain weight of the main spike ranged from 1.24 g/main spike (AGB0024) to 4.27 g/main spike (AGB0252), there thus being a significant variation for this indicator (Tab. 3, Fig. 4).

The weight of 1,000 grains is an extremely important value for both wheat breeders and farmers. It is a specific trait of the cultivar (Campbell *et al.*, 1999) that is also influenced by agroecological conditions and cultivation technology (Siddique *et al.*, 1989; Lizana & Calderini, 2013; Woźniak & Stępniowska, 2017). The large variationss in the values of this indicator indicate the genetic variability between the genotypes under study. For this trait, the values of the 25 genotypes vary from 38.0 g (AGB0034) to 60.1 g (AGB0252), while most of them record values above 40.0 g (Tab. 3, Fig. 5).

Tab. 3. Data on spikelet per spike, grains per spike, grains per spikelet, weight of 1,000 grains and grain yield (average of 2022–2023)

Genotype	Spikelet / spike	Grains / spike	Grains / spikelet	Spike weight (g)	1000 grains weight (g)	Grain yield (kv/ha)
AGB0004	26.0	70	2.69	3.15	45.0	63.0
AGB0005	22.0	63	2.86	2.71	43.0	54.5
AGB0009	21.0	60	2.86	3.00	50.0	60.0
AGB0024	11.0	31	2.82	1.24	40.0	24.6
AGB0034	21.0	91	4.33	3.46	38.0	69.2
AGB0061	20.0	60	3.00	2.40	40.0	48.0
AGB0071	21.0	63	3.00	2.94	46.7	58.9
AGB0075	22.0	65	2.95	3.25	50.0	65.0
AGB0078	24.0	70	2.92	3.15	45.0	62.7
AGB0125	19.0	56	2.95	2.86	51.0	57.0
AGB0127	18.0	52	2.89	2.50	48.0	49.9
AGB0132	17.0	49	2.88	2.21	45.0	44.0
AGB0147	25.0	73	2.92	3.83	52.5	76.2
AGB0148	21.0	62	2.95	2.91	47.0	58.8
AGB0156	19.0	55	2.89	2.49	45.3	49.6
AGB0252	24.0	71	2.96	4.27	60.1	85.1
AGB0254	18.0	53	2.94	2.18	41.2	42.9
AGB0259	17.0	50	2.94	2.00	40.0	39.7
AGB2813	18.0	52	2.89	2.33	44.9	45.9
AGB2814	19.0	55	2.89	2.20	40.0	44.0
AGB2815	21.0	62	2.95	2.77	44.7	55.5
AGB2816	20.0	58	2.90	2.32	40.0	46.1
AGB2825	16.0	46	2.88	2.30	50.1	46.2
AGB0048	21.0	61	2.90	2.93	48.0	58.6
AGB0051	18.0	52	2.89	2.49	47.8	49.7
D01*	0.88	3.60	0.10	0.26	1.00	3.60
D05**	0.66	2.70	0.08	0.20	0.70	2.70

In an overall view of all the grain yield indicators, a great variation among the 25 genotypes under study can be noticed. Previous studies have reported that these indicators are closely related with the genetics characteristics of the genotype (Kumar *et al*. 2006; Feng *et al*., 2018) which confirm once more the variability of the genotypes in our experiment. The variations in the grain indicators of the different genotypes had as result also a large variation in the grain yield. The lowest grain yield was in

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* D01 is the smallest difference for the probability of 99%

** D05 is the smallest difference for the probability of 95%

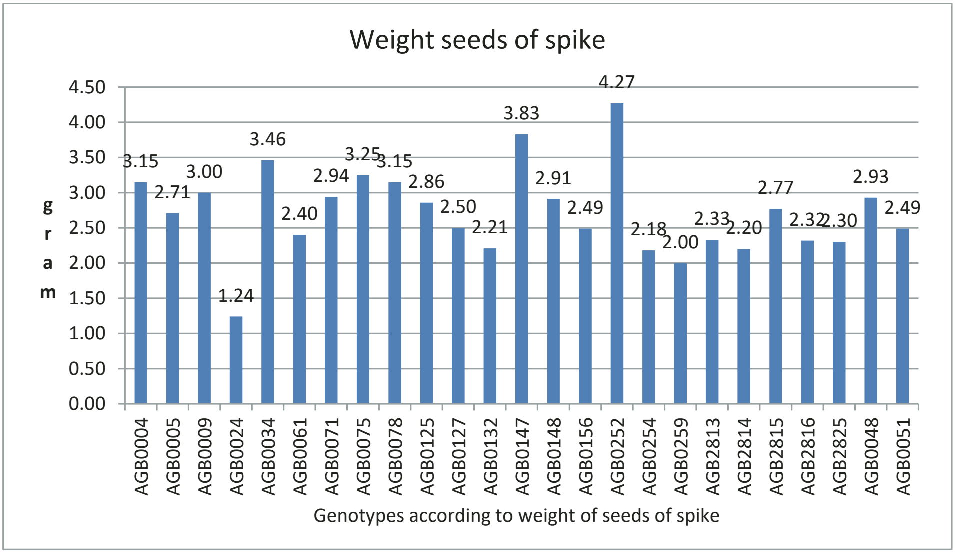

Fig 4.: Frequency of genotypes according to seeds per spike

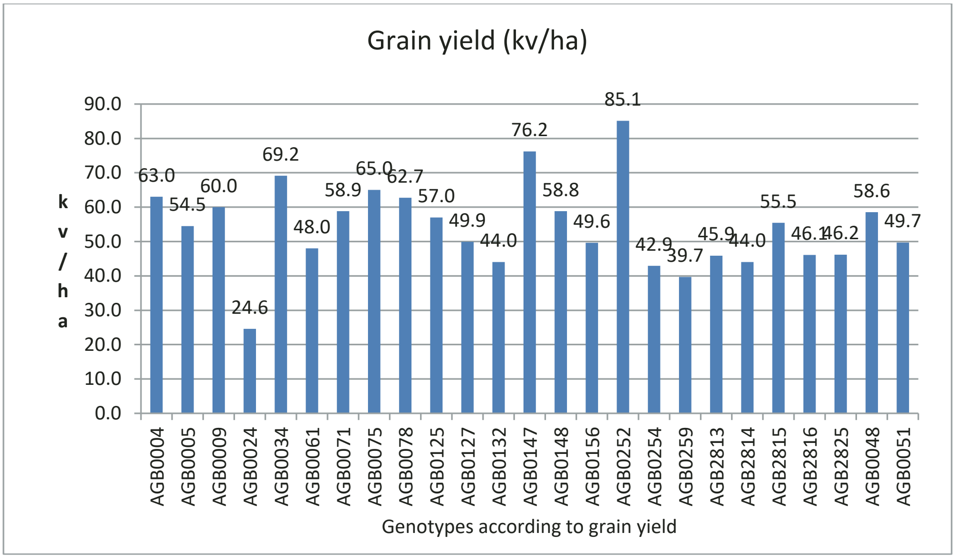

Fig. 5.: Frequency of genotypes according to grain yield

AGB0024 with only 24.6 dt ha^{-1}, while the highest yield was in AGB0252 with 85.1 dt ha^{-1}, a difference of about 3.5 times. However, AGB0024 registered a yield that was 15.1 dt ha^{-1} lower than the second lowest yield (AGB0259). Another genotype that recorded high grain yield and should be taken into account was AGB0147 with 76.2 dt ha^{-1}.

To understand the relationship among different traits, we examined the correlations. From the study data, 20 correlations were found, of which 15 were significant at the $P \leq 0.01$ and 5 at the $P \leq 0.05$ level.

According to the data of this study, significant positive correlations were found for the germination-flowering period with the number of spikelets per spike, (r_{0602}=0.41*), with the weight of 1000 grains, (r_{0902}=0.47*) and with yield (r_{1002}=0.44*). As mentioned above this correlation is confirmed by other authors (Slafer *et al*., 2014) who stress that the longer the stem-elongation phase, the higher the grain number. On the other hand a negative correlation was observed between the period from flowering to maturity and the yield, although these correlations are very weask. We should stress that during the period flowering to grain maturity the climatic conditions in in the western part of Albania, where our experiment was conducted, are not favorable for wheat growth. Predominant in this part of the country during this period is a typical Mediterranean climate with high temperatures and very low precipitation (Zhllima *et al*., 2022).

The number of tillers per plant is an important component of wheat yield. Its influence on yield depends on cultivation practices, especially plant density (Tilley *et al*., 2019). In our case, where plants were cultivated in a low density, the number of tillers is positively correlated with the spike characteristics and the grain yield, but no significative relation was found with 1000 grain weight.

Of more interest are the correlations of the yield with other indicators. In our experiment, yield showed 7 positive correlations: with the number of spikelets per spike the number of grains per spike, tillers per plant, plant height (r_{1005}=0.59**), spike length and the weight of 1000 grains with the germination-flowering period.

CONCLUSIONS

From the results obtained in the present experiment we can conclude that

- The genotypes under evaluation had large genetic variability.
- The best performance, under the present environmental conditions (lowland area of Albania), was shown by genotypes AGB0252 and AGB0147. They had the highest yield of all the 25 genotypes in the experiment. At the same time both genotypes were among those with a longer germination to flowering period and sa shorter flowering tomaturity period, which as mentioned above is very important for wheat cultivation in the areas with Mediterranean climate.
- Both genotypes also showed among the highest 1000 grain weight values, whichis not only an important quantitative parameter, but also a qualitative one (Bergkamp et al., 2018).

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Tab. 4. Correlation coefficient data between soft wheat traits

		Germination - ripening	Germination – flowering	Flower–ripen	Tillers / plant	Plant height	Spike length	Spikelet / spike	Grains / spike	Grains / spikelet	1000 grains weight
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Germ. –flower	0,52**									
2	Flower–ripen	-0,38	-0,99								
3	Tillers / plant	0,16	0,07	-0,04							
4	Plant height	0,29	0,40	-0,38	0,55**						
5	Spike length	0,09	0,22	-0,22	0,44*	0,54**					
6	Spikelet / spike	0,29	0,41*	-0,39	0,66**	0,54**	0,59**				
7	Grains / spike	0,14	0,23	-0,23	0,54**	0,36	0,36	0,84**			
8	Grains / spikelet	-0,18	-0,18	0,16	0,02	-0,14	-0,19	0,07	0,60**		
9	1000 grains weight	0,36	0,47*	-0,44	0,24	0,49*	0,38	0,37	0,15	-0,29	
10	Grain yield	0,31	0,44*	-0,42	0,57**	0,59**	0,51**	0,86**	0,85**	0,28	0,65**

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