IJAFLS
e-ISSN: 2602-4381
International Journal of Agriculture, Forestry and Life Sciences
Original Article | Open access | Int J Agric For Life Sci (2023) 7(2): 40-42

A Study on the Differences of Yield and Yield Components Among Some Winter Cereal Species in Kahramanmaraş Condition

Mustafa Yıldırım [1] **Songül Çiftçi Sakin**[1] **Ömer Süha Uslu** [1*]

[1]Kahramanmaraş Sütçü İmam University, Faculty of Agriculture, Depatment of Field Crops, Kahramanmaraş, Türkiye
***Correspondence:** suhauslu@ksu.edu.tr

Citation
Yıldırım, M., Çiftçi Sakin, S., Uslu, Ö.S. (2023). A Study on the Differences of Yield and Yield Components Among Some Winter Cereal Species in Kahramanmaraş Condition. Int J Agric For Life Sci (2023) 7(2): 40-42.

Received :7 August 2023
Accepted :20 September 2023
Published Online :22 December 2023
Year: :2023
Volume :7
Issue :2 (December)
Pages :40-42

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY-NC) license https://creativecommons.org/licenses/by-nc/4.0/

International Journal of Agriculture, Forestry and Life Sciences; Edit Publishing, Eskişehir, Türkiye.
Copyright © 2023

Available online https://dergipark.org.tr/ijafls

Abstract
This study was carried out in Kahramanmaraş ecological conditions in the 2020-2021 growing season in order to determine the differences among yield and yield components in some cereal species (triticale, wheat, barley and oat). The fertile tiller number (number), hectolitre weight (kg), bunch/spike grain number (number), bunch/spike grain weight (g), thousand seed weight (g) and grain yield (kg da-1) characteristics of cereal species were taken into consideration. Except for the number of fertile tiller, significant differences were found among the winter cereals in other characters. Wheat (68.24 kg) and triticale (67.45 kg) gave the highest values in terms of hectolitre weight. The number and weight of bunch/spikes gave the highest triticale values (25.27 number and 1.16 g, respectively). Oats (28.35 g) and triticale (26.86 g) took the first place in terms of thousand kernel weight. Wheat (702.96 kg da-1) had the highest grain yield, followed by barley, triticale and oats. According to the results, it has been seen that there are differences among the cereal species considered in terms of yield and yield components in Kahramanmaraş conditions and the order of the species in terms of characters has changed.

Key words
Barley, Wheat, Yield, Yield components, Triticale, Oat.

Introduction
Cereals are among the most consumed foods in the world, which are still agriculturally produced in the world (Sarwar et al., 2013). The most important reason for this is that it constitutes an important source of basic foods for the global population. One of the reasons why it is an important source of basic foods is that it is rich in nutritional content. For example, in the grain of winter cereals (although it varies depending on the grown variety, cultivation technique and harvest period), carbohydrate is 79.50%, protein 13.60%, fat 2.30%, cellulose 2.50% and ash 2.10% (Geçit, 2016).

According to TUIK 2021 statistical data in Türkiye, while the cultivation area of wheat in winter cereals is 6.759.751 ha in Türkiye, 137.438 ha in Kahramanmaraş. Production is 17.936.270 tons in Türkiye, 553.924 tons in Kahramanmaraş and the yield is 24.3 t ha^{-1} in Türkiye, 8 t ha^{-1} in Kahramanmaraş. While the cultivation area of barley is 3.197.043 ha in Türkiye, 43.582 ha in Kahramanmaraş, while the production is 6.193.553 tons in Türkiye, 108.482 tons in Kahramanmaraş and while the yield is 19.8 t ha^{-1} in Türkiye, 2.5 t ha^{-1} in Kahramanmaraş. While the cultivation area in oats is 511.007 ha in Türkiye, 24.5 ha in Kahramanmaraş, while the production is 4.028.850 tons in Türkiye, in Kahramanmaraş it is 94 tons, while the yield is 12.2 t ha^{-1} in Türkiye, in Kahramanmaraş it is 9 t ha^{-1}. In triticale, while the cultivation area is 140.874 ha, it is 712 ha in Kahramanmaraş, while the production is 901.112 tons in Türkiye, in Kahramanmaraş it is 2.144 tons, the yield is 16.9 t ha^{-1}, while it is observed as 10 t ha^{-1} in Kahramanmaraş (TUIK, 2022). This research aimed to compare the yield and yield factors based on the demand for increase in production due to the use of winter cereals in human and animal nutrition in Turkey and in the world, as well as in value-added products in the industry recently. Comparison of winter cereals (wheat, triticale, oat and barley) in terms of yield and yield elements in Kahramanmaraş ecological conditions is discussed.

Material and Methods
The research was carried out in Kahramanmaraş ecological conditions in the 2020-2021 growing season in Kahramanmaraş Sütçü İmam University, Faculty of Agriculture, Field Crops Department Research and Application area. Coordinates of the experiment area are given in Figure 1. In the study, triticale, wheat, barley and oat species, which are among the winter cereal types, were selected as material. In the study, Ayşehanım variety in triticale, Balkoni variety in wheat, Ibaiona variety in barley and Kahraman variety in oats were used. The experiment was established in a randomized complete block design (RCBD) with 3 replications. Seed species were sown on 18.11.2020 with a row length of 6 m, 6 rows and 500 m^{-2} seeds with experiment drill. Calculated over a total of 16 kg da^{-1} pure nitrogen, half of the base fertilizer 20.20.0 compound fertilizer was applied. The remaining amount of nitrogen was used as top fertilizer with urea fertilizer. The Mediterranean climate is observed in Kahramanmaraş province where the study was conducted. The climate data of the months and long years in which the experiment was carried out are given in Table 1 (Anonymous, 2022a).

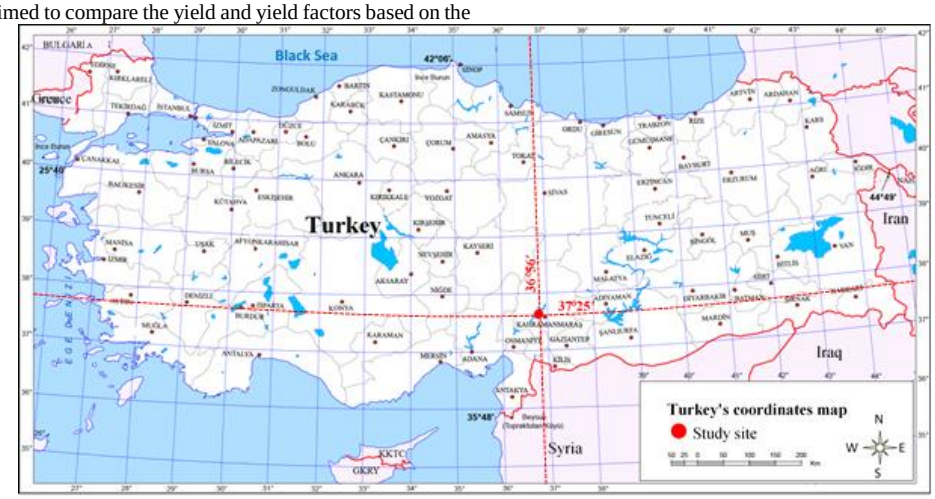

Figure 1. The coordinates of experimental area

Table 1. Climatic data of Kahramanmaraş province where the experiment was conducted

Months	Total Precipitation (mm)		Average Temperature (°C)	
	2020-2021	Long Years (1930-2021)	2020-2021	Long Years (1930-2021)
November	27.2	78.0	12.4	11.8
December	23.6	130.6	8.2	6.6
January	41.6	124.0	7.0	4.8
February	25.8	112.2	9.3	6.2
March	35.4	95.1	10.4	10.4
April	10.0	73.0	16.6	15.1
May	12.8	38.8	23.5	20.1
June	0.0	8.6	25.5	24.9
Total	176.40	660.30	--	--
Mean.	--	--	14.11	12.49

The soil analysis result of the field where the experiment was carried out is given in Table 2. According to Table 2, the soil of the study area; clay loam (52.8%), pH close to neutral 6.92, salt-free (0.11%), slightly calcareous (0.20%), organic matter at medium level (2.61%), potassium content sufficient (218.90 mg kg^{-1}), In terms of phosphorus content, it was found to be at a moderate level (15.14 mg kg^{-1}) (Anonymous, 2021b).

Table 2. Some physical and chemical properties of the soils of the trial area

Characteristics	Saturation (%)	Salt (%)	pH	Lime $CaCO_3$ (%)	Fhosphorus P_2O_5 (mg kg^{-1})	Potassium K_2O (mg kg^{-1})	Organic matter (%)
Results	52.8	0.11	6.92	0.20	15.14	218.90	2.61

In the experiment, among the yield factors, the number of fertile tiller (number), spike seed number (pieces), spike seed weight (g), thousand kernel weight (g) and hectolitre weight (kg), and grain yield (kg da^{-1}) properties were examined. It was harvested with a parcel harvester on June 7th, 2021, when the time of full maturity of the seeds.

Examined features in 10 plants in each plot; for the number of kernel in bunch and spike, by counting the kernels in the bunch; weighing the seeds in the bunch or spike on a sensitive scale with 0.001 g sensitivity for the weight of the bunch and the seed, for the number of fertile tiller, counting the number of bunch in a 1 meter row for the number of fertile tiller, and counting the seeds obtained from all plots four times for a thousand kernel weight, and it was measured in grams after taking the average and multiplying by 10, and for hectolitre weight by calculating in a 1/l hectolitre device. Seed yield was found by harvesting 6 rows of all plots with a plot harvester and converting the obtained seed yield to decare yield. Statistical analysis of the data was made in the SAS (2013) statistical package program.

Results and Discussion

In this study, in which different grain types (triticale, wheat, barley and wheat) were compared, the average values of their effects on the investigated properties are given in Table 3.

Table 3. Bunch length, number of fertile tillers, hectolitre weight, spike seed number, spike seed weight, thousand kernel weight and average values of seed yield.

Cereal Species	Fertil Tiller Number (number)	Hektolitre Weight (kg)		Spike Seed Number (number)		Spike Seed Weight (g)		Thousand Kernel Weight (g)		Seed Yield (kg da^{-1})	
Triticale	3.27	67.45	A	25.27	a	1.16	a	26.86	b	552.22	ab
Wheat	3.60	68.24	A	17.27	c	0.79	b	22.99	c	702.96	a
Barley	4.33	55.56	Ab	10.93	d	0.49	c	26.94	b	688.70	a
Oat	3.53	49.92	B	20.07	b	0.82	b	28.35	a	465.37	b
LSD (%5)	0.87^{ns}	14.40*		1.38**		0.29**		1.396**		218.55^{ns}	
CV (%)	11.90	11.96		3.76		18.05		2.66		18.16	

According to the results of the analysis of variance in the study, the statistical difference between the number of fertile siblings was found to be insignificant (Table 4). Atak and Çiftçi (2005) determined that the number of fertile tillers of triticale according to varieties was between 3.63 $plant^{-1}$ and 4.55 $plant^{-1}$ in the first year, between 3.30 $plant^{-1}$ and 3.7 $plant^{-1}$ in the second year, as a result of two years of research. They reported that the number of fertile tillers varies depending on climate change, stating that the reason for the difference in the number of fertile tillers according to years is due to the amount of precipitation over the years.

According to the variance analysis results of the study, the difference between the cereal species of hectoliter weight was found to be statistically significant ($P<0.05$) (Table 4). In previous studies, Mut et al. (2006), in their research to determine some characteristics of the triticale plant, the hectolitre weight of triticale was 67.30 kg and 71.80 kg in the first year of Amasya location, 63.30 kg and 73.30 kg in the second location of Amasya location, 65.80 kg and 73.00 kg in Samsun location, according to the average of three locations. they reported that it varies between 65.90 kg and 71.90 kg. Yanbeyi and Sezer (2006), in their research with triticale lines in Samsun ecological conditions, determined that the hectolitre weight of triticale was between 57.80 kg and 76.30 kg, according to the two-year average. Doğan and Kendal (2012), in their study conducted in Diyarbakır ecological conditions, reported that the hectolitre weight of bread wheat genotypes varied between 77.60 kg and 82.40 kg, according to the two-year average. Chaudhary et al. (2017) observed that the hectolitre weight of four different barley varieties varied between 56.60 kg and 62.70 kg. Jokinen et al. (2021), in their study to estimate the quality of oat flour, they determined the average hectolitre weight of oat seed to be 59.30 kg. Kahraman et al. (2021), in their study on 14 oat genotypes in Edirne and Kırklareli ecological conditions, they determined the hectolitre weight between 47.00 kg and 59.80 kg according to the average of both locations.

According to the results of the analysis of variance in the study, the difference between the cereal species ($P<0.01$) was found to be statistically significant in the number of seed per bunch and spike. It was observed that the number of seed per bunch and spike in cereal species varied between 10.93 and 25.27. The highest number of seed per spike was found in triticale with 25.27, and the least number of seed per spike was determined in barley with 10.93 (Table 4). In previous studies, Giunta and Motzo (2005) reported that triticale had a higher number of seed than wheat when they compared triticale (Antares variety) and wheat (Duilio and Creso varieties) species in Italian ecological conditions in terms of the number of seed per spike. In his study, Monouchehr (2006) reported that the number of seed per spike was the most important factor with a direct effect on seed yield in the correlation analysis in barley. Duğan (2010), in his study, compared the triticale plant with the winter cereals in terms of yield, reported that the number of seed per spike of triticale varied between 28.20 and 118.78 pieces among the varieties, and among the winter cereals, the oat variety had more seed per spike than the triticale varieties, and triticale stated that it was higher than bread wheat and barley in terms of the number of seed in the spike. Mendez-Espinoza et al. (2019), as a result of researching the agricultural characteristics between triticale and bread wheat in Mediterranean conditions in their studies, found that despite the lower spike number per square meter, triticale was 35% higher than the seed number per spike, which is in line with our findings. Mut et al. (2021), in their research on 255 oat genotypes in the Central and Western Black Sea Region, emphasized that the number of seed in a bunch of oat genotypes varied between 51.54 and 155.00, and that the number of seed in a bunch was an important feature in terms of seed yield. Aydoğan and Yağdı (2022), in their study in Bursa ecological conditions, reported that the number of seed per spike in 41 wheat varieties varied between 40.83 and 71.93.

According to the results of the analysis of variance in the study, the statistically significant difference ($P<0.01$) between the spike seed weight was found. The spike seed weight in cereal species varied between 0.49 g and 1.16 g. The highest spike seed weight was found in triticale with 1.16 g, and the lowest spike seed weight was found in barley with 0.49 g (Table 4). In previous studies, Giunta and Motzo (2005) reported that when triticale (Antares variety) and wheat (Duilio and Creso varieties) species, which are included in the Italian ecological conditions, were compared in terms of spike seed weight, triticale had a higher seed number than wheat and their findings were consistent with our findings. Duğan (2010), in his study, compared the triticale plant with winter cereals in terms of yield, reported that the spike seed weight of triticale varied between 1.32 g and 3.72 g among varieties, and found that triticale had a higher spike seed weight than bread wheat, barley and oats in

winter cereals. In addition, he reported that the spike seed weight was directly related to the photosynthesis capacity of the plants and changed depending on the genotype, climate and growing conditions. Mut et al. (2021), in their research on 255 oat genotypes in the Central and Western Black Sea Region, they determined that the seed weight of the oat genotypes varies between 1.44 g and 4.85 g, and also the bunch seed weight differs according to the genotypes. Aydoğan and Yağdı (2022), in their study in Bursa ecological conditions, stated that the spike seed weight in 41 wheat cultivars varied between 3.33 g and 1.61 g.

According to the results of the analysis of variance in the research, the difference between the cereal species ($P<0.01$) was found to be statistically significant in thousand kernel weight. The thousand kernel weight in cereal species varied between 28.353 g and 22.987 g. Among the winter cereal species, the highest thousand kernel weight was found in oats with 28.353 g, and the lowest thousand kernel weight was found in wheat with 22.987 g (Table 4). Duğan (2010), reported that it had a lower thousand kernel weight in his study, compared the triticale plant with the winter cereals in terms of yield, reported that the thousand kernel weight of triticale varied between 26.62 g and 44.91 g among the varieties, and that among the winter cereals, triticale had a higher thousand kernel weight than oat varieties, but it was higher than wheat and barley varieties. Kahraman et al. (2017), in their research to determine the agricultural characteristics of 16 different oat genotypes, stated that the thousand kernel weight varied between 18.70 g and 45.00 g. Mendez-Espinoza et al. (2019), as a result of researching the agricultural characteristics between triticale and bread wheat in Mediterranean conditions, they found that triticale was 16% higher in terms of thousand kernel weight. Kaziu et al. (2019) stated that the thousand kernel weight varies between 21.60 g and 30.30 g in their study with 10 oat genotypes. Kahraman et al. (2021), in their study on 14 oat genotypes in Edirne and Kırklareli ecological conditions, they recorded that the thousand kernel weight was between 21.10 g and 41.30 g according to the average of both locations. Aydoğan and Yağdı (2022), in their study in Bursa ecological conditions, reported that the thousand kernel weight in 41 wheat varieties varied between 32.67 g and 57.28 g.

According to the results of the analysis of variance in the study, the statistical difference in seed yield between cereal species was found to be insignificant (Table 4). In previous studies, Dugan (2010), in his study, compared triticale plant with winter cereals in terms of seed yield, reported that the seed yield of triticale varied between 255.00 kg da^{-1} and 646.08 kg da^{-1} among varieties, and 100 kg da^{-1} of bread wheat among winter cereals. He stated that it has a higher seed yield than barley at 200 kg da^{-1} and 400 kg da^{-1} than oat. Karahan and Sabancı (2010), in their research, observed that the average seed yield of 9 different barley varieties in Diyarbakır and Ceylanpınar ecological conditions was 540 kg da^{-1} in Diyarbakır, 36 kg da^{-1} in Ceylanpınar, and the overall average seed yield was 428 kg da^{-1}. Yıldırım and Çakmak (2013) observed that the average seed yield of the locations was between 2764 kg ha^{-1} and 5125 kg ha^{-1} in hundred wheat materials in Eskişehir and Mahmudiye locations. Kahraman et al. (2017), in their research to determine the agricultural characteristics of 16 different oat genotypes, reported that the seed weight data ranged from 372.10 kg da^{-1} to 734.80 kg da^{-1}. Mendez-Espinoza et al. (2019) determined the highest seed yield in the triticale type with 200 g m^{-2} as a result of their research on the agricultural characteristics between triticale and bread wheat in Mediterranean conditions. Karaman et al. (2020) stated that the seed yield of different bread wheat genotypes was between 354.51 kg da^{-1} and 810.77 kg da^{-1} in Diyarbakir ecological conditions. In the study of Yürürdurmaz et al. (2021), as a result of their research in Kahramanmaraş ecological conditions, reported that the average seed yield of 10 different barley genotypes was 572.90 kg da^{-1} in the first year, 461.00 kg da^{-1} in the second year and the average seed yield of the years was 517.00 kg da^{-1}. Aydoğan and Yağdı (2022), in their study in Bursa ecological conditions, observed that the seed yield of 41 wheat varieties varied between 294.00 kg da^{-1} and 656.23 kg da^{-1}.

Conclusion

According to the results of the research, it was observed that there were statistically significant differences among the winter cereals in other characters except the number of fertile tillers. In terms of hectolitre weight, oats had a very low value compared to other types. Triticale had the highest number of grains per spike and number of grains per spike. Oat and triticale took the first place in terms of thousand kernel weight. Wheat had the highest grain yield, followed by barley, triticale and oats. As a result, it has been observed that there are differences in yield and yield elements among the cereal species considered in Kahramanmaraş conditions, and the order of the species in terms of characters has changed. It is seen that conducting such studies using more varieties for each species in different locations and years will yield more accurate

Statement of Conflict of Interest

The authors declared that for this research article, they have no actual, potential or perceived conflict of interest.

Author's contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before results.

References

Anonymous (2022a). Kahramanmaraş Meteorology Provincial Directorate.

Anonymous (2022b). Soil analysis, KSU Faculty of Agriculture, Soil Laboratory.

Atak, M., Çiftçi, C.Y. (2005). The effects of different planting frequencies on yield and some yield elements in Triticale (*xTriticosecale* Wittmack). Journal of Agricultural Sciences, 11(1), 98-104.

Chaudhary, A., Sewhag, M., Hooda, V.S., Singh, B., Kumar, P. (2017). Effect of different dates of sowing on yield attributes, yield and quality of Barley (*Hordeum vulgare* L.) cultivars. Journal of Applied and Natural Science, 9 (1): 129-132.

Doğan, Y., Kendal, E. (2012). Determination of grain yield and some quality characteristics of bread wheat (*Triticum aestivum* L.) genotypes. Journal of GOU Faculty of Agriculture, 29(1), 113-121.

Duğan, S. (2010). Determination of adaptability of triticale to different soil conditions and comparison with other winter cereals in terms of yield and quality. Master Thesis. Field Crops Department. Namık Kemal University, Institute of Science and Technology. p. 159.

Geçit, H.H. (2016). Winter cereals (wheat, barley, oats, rye, triticale). Ankara University Press. Faculty of Agriculture.

Giunta, F., Motzo, R. (2005). Grain yield, dry matter, and nitrogen accumulation in the grains of durum wheat and spring triticale cultivars grown in a Mediterranean environment. Australian J. Of Agric. Research, (56), 25-32.

Jokinen, L., Pihlava, J.M., Puganen, A., Sontag-Strohm, T., Linderborg, K.M., Holopainen-Mantila, U., Hietaniemi, V., Norflund, E. (2021). Predicting the properties of ındustrially produced oat flours bythe characteristics of native oat grains or non-heat-treated groats. Foods, (10),3-21.

Kahraman, T., Avcı, R., Yıldırım, M. (2021). Determination of grain yield, yield components and quality characteristics of oat (*Avena sativa* L.) genotypes. KSU Journal of Agriculture and Nature, 24(5), 1003-1010.

Kahraman,T., Avcı, R., Kurt, C. (2017). Determination of grain yield, quality and agricultural characteristics of some oat (*Avena sativa* L.) genotypes. Journal of Field Crops Central Research Institute, 26 (Special Issue),

Karahan, T., Sabanci, C.O. (2010). Determination of yield and yield components of some barley (*Hordeum vulgare* L.) cultivars in South-eastern Anatolian ecological conditions. West Mediterranean Agricultural Research Institute Derim Journal, 27(1), 1-11.

Karaman, M., Seydoşoğlu, S., Çam, B. (2020). Investigation of bread wheat (*Triticum aestivum* L.) genotypes in terms of agricultural characteristics in augmented trial design in Diyarbakir province conditions. Eurasia Journal of Mathematics, Engineering, Natural & Medical Sciences, 7(9), 195-205.

Kaziu, I., Kashta, F., Selami, A. (2019). Estimation of grain yield, grain components and correlations between them in some oat cultivars. Albanian j. Agric. Sci.,18 (1), 13-19.

Mendez-Espinoza, A.M., Romero-Bravo, S., Estrada, F., Garriga, M., Lobos, G.A., Castillo, D., Matus, I., Aranjuelo, Í., del Pozo, A. (2019). Exploring agronomic and physiological traits associated with the differences in productivity between triticale and bread wheat in Mediterranean environments. Frontiers in Plant Science, (10), 404.

Monouchehr, A. (2006). Path analysis of barley (*Hordeum vulgare* L.). yield. Journal of Agricultural Science, 12(3), 227-232.

Mut, Z., Albayrak, S., Töngel, Ö. (2006). Determination of grain yield and some properties of Triticale (*xTriticosecale* Wittmack) lines. Journal of Agricultural Sciences, 12 (1), 56-64.

Mut, Z., Erbaş Köse, Ö., Akay, H., Sezer, İ. (2021). Evaluation of some characteristics of local oat genotypes collected from Central and Western Black Sea Region. Journal of Iğdır University Institute of Science and Technology, 11(2), 1582-1594.

Sarwar, M.H., Sarwar, M.F., Sarwar, M., Qadri, N.A., Moghal, S. (2013). The importance of cereals (Poaceae: Gramineae) nutrition in human health: A review. Journal of Cereals and Oilseeds, 4(3), 32-35.

TUIK, (2022). Turkish Statistical Institute, www.tuik.gov.tr, (Access Date: 01.09.2022).

Yanbeyi, S., Sezer, I. (2006). Research on yield and yield components of some triticale lines in Samsun conditions. OMU Agr. Fac. Journal, 21(1), 33-39.

Yıldırım, M. Cakmak, M. (2013). Effects of sister line mixtures on grain yield and some quality parameters in wheat. Journal of Food Agriculture and Environment, 11(3), 915-923.

Yururdurmaz, C., Kurt, A., Kara, R., Akkaya, A. (2021). Investigation of some physiological properties of barley during flowering and maturation period in Kahramanmaraş conditions. KSU Journal of Agriculture and Nature, 24 (6): 1304-1314.