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PERFORMANCE AND VARIABILITY OF SOME AGRONOMICAL TRAITS OF HULLESS WINTER BARLEY GENOTYPES UNDER NARDI FUNDULEA GROWING CONDITIONS

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Introduction

- Barley can control or reduce blood glucose levels and thereby reduce the risk of diabetes. According to the European Food Safety Authority (www.efsa.eu), three health claims associated with barley beta-glucans content were approved: normal blood LDL-cholesterol concentrations (at least 1g/meal), reduction of prandial glycemic response (dose >4 g per 30 g available carbohydrate) and lowering blood cholesterol (daily dose of 3 g/day).
- Barley is available in human food in the form of flakes, flour, and pearled barley and can be used in many recipes and for all three meals. Hulless barley is low in fat and cholesterol, and due to its soluble fibre content, it is a heart-healthy choice.
- The purpose of this analysis is to characterise hulless barley lines for use in functional foods, given their generally high beta-glucan content, which contributes to reducing the risk of heart disease, type 2 diabetes, and obesity.

Material and methods

- The variability of certain quantitative and qualitative parameters of a set of hulless winter barley lines compared to a hulled barley variety and an Ethiopian population renowned for its high protein and lysine content was studied over five consecutive years.
- Twenty winter two-row barley genotypes (19 hulless and 1 hulled) were obtained in the winter barley breeding program and tested under 5 different environmental conditions (2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018 growing seasons) in the same location (NARDI Fundulea).
- Four parameters of hulless and hulled barley were considered: yield, thousand kernel weight, protein content, and starch content.

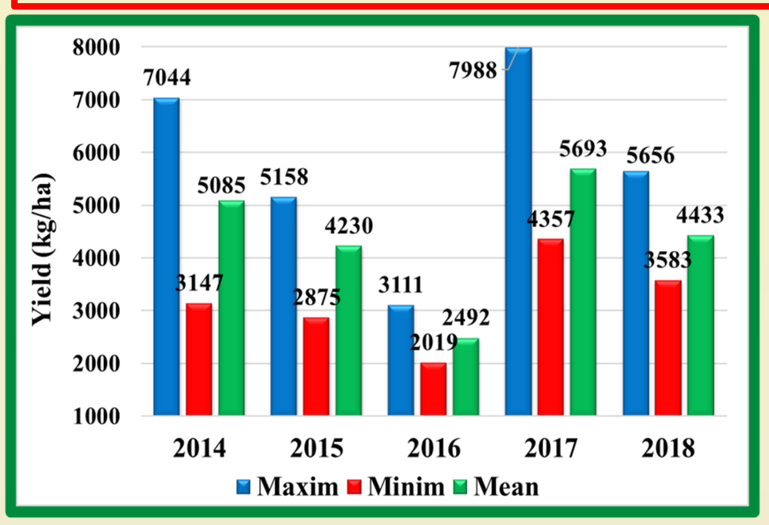

Figure 1. Maxim, minimum, and average values of yield, 2014-2018

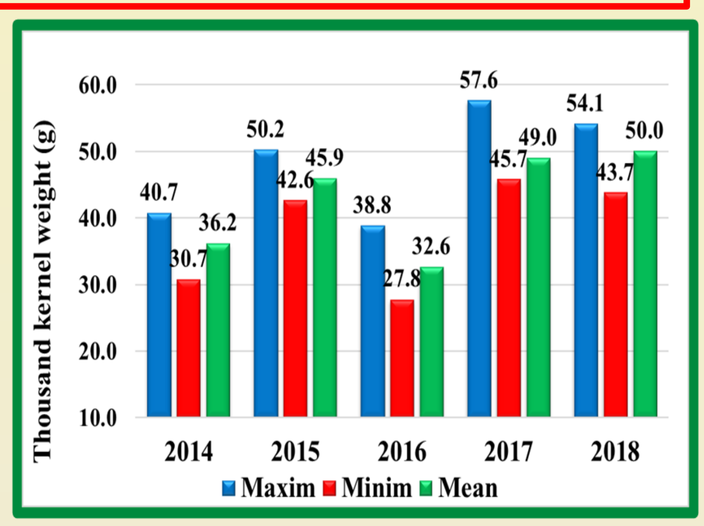

Figure 2. Maxim, minimum, and average values of TKW, 2014-2018

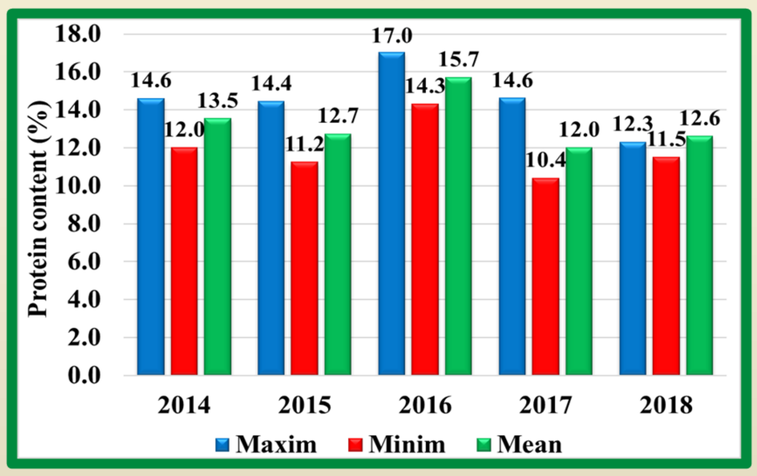

Figure 3. Maxim, minimum, and average values of protein content, 2014-2018

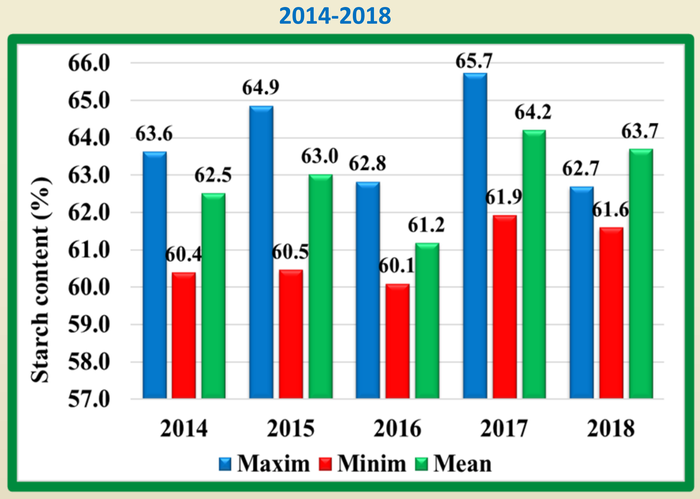

Figure 4. Maxim, minimum, and average values of starch content, 2014-2018

Results and discussions

- Analysis of variance revealed a significant influence (Table 1) of year, genotype, and year x genotype interaction on yield, TKW, protein and starch content (significant at $p<0.01$ level).

Table 1. Combined ANOVA for pooled data (yield, grain weight, protein, and starch content)

Source of variation	df	Yield		TKW		Protein content		Starch content	
		F	P-value	F	P-value	F	P-value	F	P-value
Year	4	168.852	0.000	951.319	0.000	653.154	0.000	189.072	0.000
Genotype	19	5.028	0.000	15.414	0.000	6.539	0.000	15.277	0.000
Y x G	76	2.095	0.000	3.030	0.000	4.010	0.000	4.780	0.000
Within	200								

- The reported values for the studied parameters (yield, TKW, protein and starch content) show that differences exist between two-row barley genotypes, and environmental factors influence these.
- Yield of winter two-row barley lines ranges from a minimum of 2019 kg/ha in 2016 to a maximum of 7988 kg/ha in 2017, and the TKW ranges from a minimum of 28g in 2016 to a maximum of 57g in 2017 (Figures 1 and 2).
- Depending on genotypes and climatic conditions, two-rowed barley protein content (Figure 3) of the analysed grain samples ranged from a minimum of 10.4% (2017) to a maximum of 17.0% (2016). The amount of starch content was also variable, registering values from a minimum of 60.1% in 2016 to a maximum of 65.7% in 2017 (Figure 4).
- In 2015 (Figure 5), the breeding barley line L 375-4 had one of the highest values of the protein content, compared with Hiproly and Andreea genotypes. The protein content was significantly negatively correlated with starch content. There was a high tendency for an increase in starch content over 65.0% and a decrease in protein content under 11.0%.
- It is important to note that barley endosperm is mainly composed of starch and includes many types of genotypes, such as waxy, normal, and high amylose varieties, similar to other cereals (Tang et al., 2002) and the high values in some years show a good translocation of assimilates to the grain.

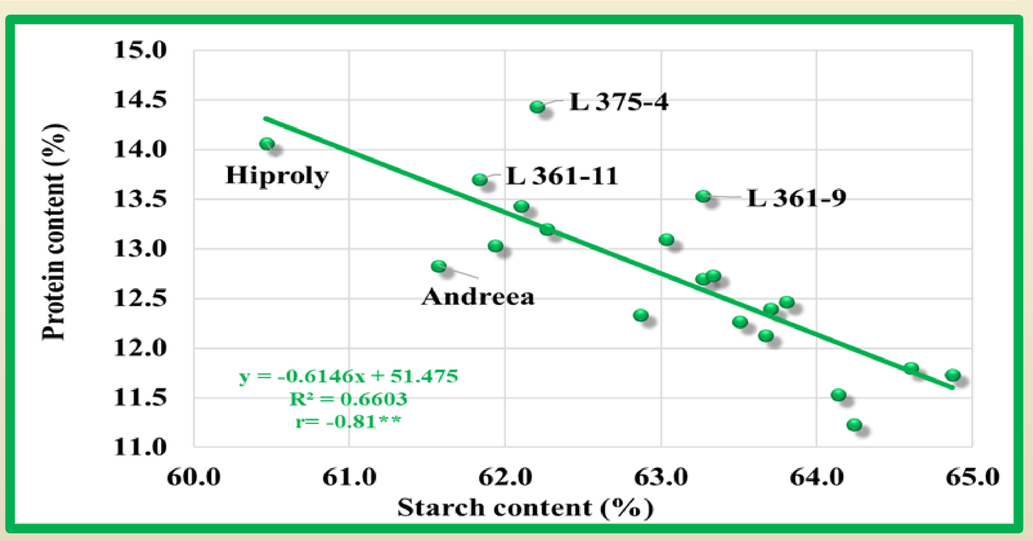

Figure 5. Relationship between protein and starch content in 2015

Conclusions

- Significant differences were observed in the protein and starch content across all analysed hulless barley lines, notably influenced by factors such as environment, genotype, and their interactions.
- During the 2014-2018 period, the breeding line L 375-4 had three consecutive years with a high protein content (14.1-17.0%) compared to the hulled two-rowed barley variety Andreea.
- The winter two-row hulless barley lines included in this study possess genotypic potential for developing improved barley breeding material specifically intended for food with high nutritional value (flakes, pasta, flat bread, muffins).

Refferences

1. Tang, H., Watanabe, K., Mitsunaga, T. (2002). Structure and functionality of large, medium and small granule starches in normal and waxy barley endosperms, Carbohydrate Polymers, vol. 49, Issue 2, p. 217-224.
2. www.EFSA.eu

Acknowledgments

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