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RESEARCH ON THE EVALUATION OF QUALITY CHARACTERISTICS IN SOME SORGHUM GENOTYPES UNDER THE CONDITIONS SANDY SOILS FROM SOUTHERN OLTENIA

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ABSTRACT

The present paper aims at the behavior of some sorghum genotypes in terms of adaptability to the climatic conditions specific to the sandy soils areas in southern Oltenia, manifested during the testing of the production capacity and its quality.

The quality of grains at sorghum specie is strongly influenced by the genotype, the technology of culture and climatic conditions during the experimentation period.

The best results were obtained from the hybrids: Es Mousson (75.6 kg / hl hectolitric mass, 31.5 g mass of one thousand grains, 7.4% moisture, 20.5% protein, 10.8% fats), Elan (74.8 kg / hl hectolitric mass, 28.8 g weight of one thousand grains (WTG), 5.2% moisture, 19.2% protein, 8.9% fats) and Es Alize (72.4 kg / hl hectolitric mass, 23.9 mass of one thousand grains, 7.8% moisture, 18.3% protein, 8.4% fats). The highest yields were obtained from hybrids Es Shamal (9646kg / ha) and Es Foehn (9421kg / ha).

INTRODUCTION

Sorghum is a high-grain cereal, ranked fourth in the world after grains production, and fifth on the cultivated surface (wheat, rice, corn and barley). It has a great development due to its use in human nutrition, especially in the semi-arid areas of the world, where the pedoclimatic conditions offer limited conditions for agriculture [16].

Of the total world production of sorghum, the consumption has the following weight: 53.3% serve in human food, 39.4% is used in animal feed and 2% in the light food industry [14].

The climatic evolution towards heating and aridization in 2001-2050 in the Balkans area, where Romania is located, obliges the sorghum to be reconsidered as: food cereal (the grains are used in the formula the composite flour for gluten and agltutenic baking, juice, extracts from strains used in the manufacture of syrup, vinegar and other food), fodder plant (green meal, hay, silo, fodder pellets) and technical plant (sugar sorghum and broomstick) intended for the production of raw materials for the energy industry (fuels, liquids, solids, gasses, electricity, heat), chemical industry (paper and textile pulp, plastic), building materials industry and handicraft (household and industrial brushes, braids) [2].

Sorghum forms a major source of protein and calories in large population diets. Like other vegetable proteins, its protein is of poor quality. Inadequate consumption of food protein is an important factor responsible for the widespread prevalence of protein malnutrition observed in vulnerable populations such as growing children and nursing mothers. A problem of public health importance for a high incidence of pelegra is seen among sorghum consumers [8]. Thus, the nutritional

quality of sorghum is an important aspect of the sorghum improvement program [18].

Sorghum is a cereal rich in nutrients, dietary fiber and bioactive components, but considered to be of low value for humans and often used as animal feed.

Determinations of the qualities of sorghum grains have been the subject of many research that has highlighted the influence of variety, technological factors and climatic factors on protein, fat, water, cellulose,tannins,etc.[1, 2, 4, 5, 7, 9 ,10 ,14, 16, 17].

In Romania, the research aimed to determine the production potential of grain sorghum hybrids (Sorghum bicolor (L.) Moench var. Eusorghum) in terms of the use of restrictive pedo-climatic conditions [3, 6, 11, 13], and the results obtained varied under the influence of the experimental factors (fertilization, rotation, water regime, sowing distance, density).

MATERIAL AND METHOD

Research has been conducted in Research and Development Station for Plant Culture on Sandy Soils Dăbuleni.

The biological material studied consisted in 10 varieties of sorghum: Es Alize, Albanus, Arsky, Calatur, Es Mousson, Es Shamal, Es Foehn, Armorik, Alimentar 1, Elan. Were performed the following observations and determinations:

* determined protein (%) - Perten method;
* determined moisture (%) - Perten method;
* determined faths(%) - Perten method;
* determined hectolitric mass (HM) (kh/hl)- Swantec device method;
* determined the weight of one thousand grains (WTG), (g) - weighing balance KERN digital electronic type method;
* production (kg / ha).

RESULTS AND DISCUSSIONS

The sorghum crop, in the form of grains used in food, or in the food industry, as well as the silo, or paste used in animal feed, can be characterized qualitatively after several parameters. Sorghum is a cereal rich in nutrients, dietary fiber and bioactive components, but considered to be of low value for humans and often used only as animal feed.

Sorghum grains are made up mostly of non-added extractive substances, proteinaceous substances, and water. Fatty substances are found in smaller quantities. The grains of sorghum also contain mineral substances, vitamins, enzymes and others. Their nutritional value is close to that of corn. In this experience we studied the influence of the hybrid on qualitative qualities of sorghum grains. The results obtained are shown in Table 1.

Moisture grains is an important indicator of quality appreciation. Optimum grains moisture at harvest is 14%. At hybrids studied, grains humidity was between 5.2% for the Elan hybrid and 10.2% for the Armorik hybrid, with an average hybrid of 8.05%.

The amount of protein in the beans showed different values depending on the hybrid studied, as well as the climate conditions in the area of culture. In the sorghum grains, an average protein content of 13.8% for the Shamal hybrid and 20.5% for the Es Mousson hybrid was determined, with an average hybrid of 17.22%. Greater than the hybrids higher hybrids were found in the hybrids: Elan (19.2%), Es Alize (18.3%), Albanus (17.6%) and Armonik (17.5%).

Similar results were obtained by Khalil J. K., et al., 1984,[9] in sorghum hybrids under conditions in Saudi Arabia

(15.3-15.9%), and the researches of M. Mabelebele et al., 2015,[10] showed much lower protein content (8.1-9.5%) but similar to those of Rooney and Serna-Saldivar 2000,[17] which reported a crude protein content in sorghum grains ranging from 6.0 to 10.0%.

Table 1

The influence of variety on the nutritional quality of grains sorghum

No. var.	Hybrid	Moinsture (%)	Protein		Production on grains (kg/ha)	Fats (%)	HM (kg/hl)	WTG (g)
			(%)	(Kg/ha)				
1	ES ALIZE	7,8	18,3	1350,2	7378,3	8,4	72,4	23,9
2	ALBANUS	8,3	17,6	1192,6	6776,3	7,9	73,8	32,1
3	ARSKY	9,0	17,3	878,3	5077,3	7,3	76,4	34,8
4	CALATUR	8,5	16,4	1073,6	6546,3	7,0	75,8	33,5
5	ES MOUSSON	7,4	20,5	1097,5	5353,6	10,8	75,6	31,5
6	SHAMAL	7,9	13,8	1331,2	9646,3	6,5	72,8	27,2
7	ES FOEHN	8,3	15,1	1422,6	9421,3	6,1	74,3	28,3
8	ARMORIK	10,2	17,5	1331,6	7609,3	6,8	80,6	30,8
9	ALIMENTAR 1	7,9	16,5	1086,1	6582,3	6,3	74,9	32,3
10	ELAN	5,2	19,2	1306,3	6803,6	8,9	70,4	28,8
The average of hybrids		***8,1***	***17,2***	***1225,9***	***7119,5***	***7,6***	***74,7***	***30,3***

The amount of protein calculated from the production in kg / ha was influenced by the hybrid studied and the production of the grains obtained. The amount of protein expressed in kg / ha was between 878.3kg / ha for Arsky hybrid and 1422.6kg / ha for the Es Foehn hybrid. These results are similar to those obtained by I Antohe, 2007,[7] on the soils from Fundulea (the amount of crude protein in grain sorghum hybrids created and tested on zonal soils at INCDA Fundulea, between 1982-1986 ranged between 959 kg / ha in hybrid F31 and 976kg / ha in hybrid F21), but higher compared to those obtained by Pochiscanu Simona, 2015[16] (the amount of protein ranged between 178kg / ha in Alize hybrid and 802kg / ha in the Armida hybrid) under the conditions pedoclimatic center of Moldova.

Between the grain production and the amount of protein expressed as a percentage and in kg / ha were established polynomial correlations given by the second degree equations with significant correlation factors (Figure 2). The amount of protein expressed as a percentage decreases with the increase in production and the one expressed in kg / ha increases with the increase in production.

Fat content ranged between 6.1% for the Es Foehn hybrid and 10.8% for Es Mousson, with an average hybrid of 7.6% (Table 1). Similar values were obtained by I. Antohe, 2007, [2] under the conditions of Fundulea (the amount of fat was between 3.2% for hybrid F32 and 6.5% for hybrid F26l hl).

The results obtained by M. Mabelebele et al., 2015 showed that the sorghum grains fat content ranged from 2.7% to 3.7%. These fat contents were slightly lower than the hybrids evaluated by Gassem and Osman, 2003,[7] which showed values ranging from 3.58% to 4.47%, although they were similar to those reported by Basahy, 1995, [4] and Abdel- Rahman, 2000,[1]. These results highlight the determinant influence of the hybrid studied, the pedoclimatic conditions in the area of culture, but also the applied technology.

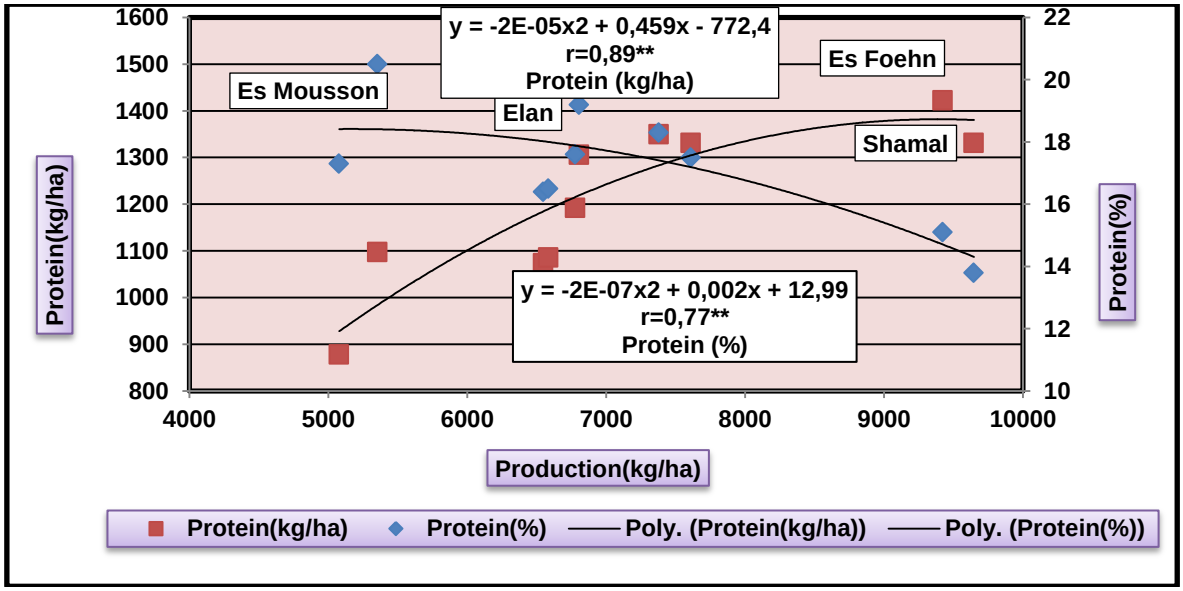

Figure 1 **- The correlation between grains production and the amount of protein expressed in % and kg / ha**

The hectolitreal mass ranged from 70.4kg / hl to the Elan hybrid and 80.6kg / hl to the Armorik hybrid with an average hybrid of 74.7kg / hl. A polynomial correlation given by a second degree equation with a significant correlation factor (r = 0.90 **) was established between the hectolitric mass of sorghum grains and grain humidity. The hectolitreal mass of the grains increases with increasing humidity (Figure 2).

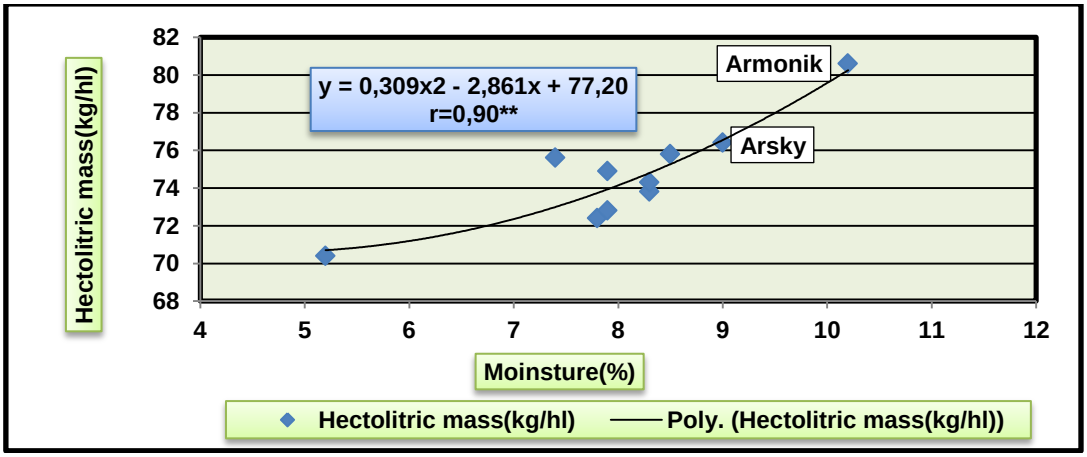

Figure 2 **- The correlation between grain s moinsture (%) and mass hectolitric(kg/ha)**

As for the weight of one thousand grains (WTG), the values ranged from 23.9g to the Es Alize hybrid and 34.8g to the Arsky hybrid, with an average hybrid of 30.3g.

Drăghici I., 2007, [7] in the conditions of sandy soils in southern Oltenia, resulted in a series of sorghum hybrids obtained at ICDCC Fundulea WTG values ranging from 20.1-24.8g, thus lower compared to the results obtained at hybrids studied under the same conditions, and Volf M., 2009,[19] under the conditions of Fundulea determined a WTG in sorghum grains, between 20-38g, so similar values. The obtained results reveal the influence of the studied hybrid and the climatic

conditions in the area of culture on the qualities of sorghum grains.

The grains yield was 5077.3kg / ha for the Arsky hybrid and 9646.3kg / ha for Shamal hybrid, with an average hybrid of 7119.46kg / ha. Compared to the mean value statistical gains were obtained from the Shamal and Es Foehn hybrids.

Similar results were also obtained on the sandy soils in southern Oltenia by Drăghici I, 2007, [7] at a series of hybrids obtained at ICDCC Fundulea (5283-7866kg / ha). Also, Oprea Cristina Andreea, 2018, [15] under conditions in the southeastern part of Romania, obtained production ranging from 5000 to 11880kg / ha.

Table 2

Production of grains obtained in 2018 for grain sorghum hybrids

No var.	Hybrids	Production of grains			The meaning
		(Kg/ha)	Relative (%)	The difference from the witness (Kg/ha)	
1	Es Alize	7378,3	103,64	258,84	-
2	Albanus	6776,3	95,18	-343,16	-
3	Arsky	5077,3	71,32	-2042,16	000
4	Calatur	6546,3	91,95	-573,16	
5	Es Mousson	5353,6	75,20	-1765,86	00
6	Shamal	9646,3	135,49	2526,84	***
7	Es Foehn	9421,3	132,33	2301,84	***
8	Armorik	7609,3	106,88	489,84	-
9	Alimentar 1	6582,3	92,46	-537,16	-
10	Elan	6803,6	95,56	-315,86	-
Media hibrizilor		**7119,46**	**100**	**Wt.**	**Wt.**

DL 5%=998kg/ha DL 1%=1369kg/ha DL 0,1%=1863kg/ha

CONCLUSION

The quality of grains at sorghum specie is strongly influenced by the genotype, the technology of culture and climatic conditions during the experimentation period.

The best results were obtained from the genotypes: Es Mousson (75.6 Kg/hl hectolitric mass, 31.5 g mass of one thousand grains, 7.4% moisture, 20.5% protein, 10.8% fats), Elan (70.4 kg/hl hectolitric mass, 28.8 g mass of one thousand grains, 5.2% moisture, 19.2% protein, 8.9% fats) and Es Alize (72.4 kg / hl hectolitric mass, 23.9 mass of one thousand grains, 7.8% moisture, 18.3% protein, 8.4 % fats). The highest yields were obtained from hybrids Shamal (9646.3kg / ha) and Es Foehn (9421kg / ha).

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