RESEARCH REGARDING THE INFLUENCE OF SOWING DENSITY ON SILAGE PRODUCTION AT *Sorghum bicolor* L., UNDER CENTER OF MOLDAVIA PEDOCLIMATIC CONDITIONS

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Abstract

The present configuration in Romania agricultural structures and the lack of functional infrastructure, including drought phenomenon appearance that has created major problems in recent years in restructuring and managing the feed obtaining systems, requires the adoption and definition of a field that agricultural research must approach to identify and testing new nutritional solutions using the animal rations of basic components, which will be provided by fodder crops less dependent on the amount of water during the growing season. Silage sorghum (*Sorghum bicolor* L.) respond to the current needs of Romanian livestock being a fodder with excellent quality and an increased resistance to drought. Improving technology is imperative in this species because from it depends largely the crop yield. Thus, between 2013 - 2014, at the Agricultural Research – Development Station, has been studied the influence of sowing density on the silage production at some hybrids showing adaptability to the Center of Moldavia pedoclimatic conditions. The results obtained in the conducted experiments revealed that silage sorghum prefer higher sowing densities (greater than 200000 bg/ha) and the maximum level of production was recorded in the variants sown with 250000 bg/ha. Sowing sorghum over this sowing density increases the risk of lowering plant resistance to lodging before harvest.

Key words: density, nutrition, production, sorghum, silage

The silage sorghum presents high importance for Romania, given that by its expanding on alkaline soils less favorable for corn, it might increase the agricultural production. Also, because it supports high temperatures during the germination – vegetation period, sorghum could be a solution for the arid areas of Romania (Volf M., 2009).

It is used as green fodder, concentrated and pickled and as a raw material for spirits and beer industry. From sweet sorghum strain is extracted a syrup which contains 55-60 % sugar, used in pastry and alcohol industry. The sorghum hay is superior in quality compared with the corn hay, because it contains large amounts of calcium salts, phosphorus and carotene, and as silage, has the same value as silage corn, but is ensile very easy thanks to the high content in carbohydrates (Dragomir N., 2009).

The percentage of sorghum integration into animal feed is variable, between 25% and 100%. The silage corn is used in a greater proportion in fodder, and the silage sorghum is used as a supplement. The sorghum digestibility is excellent (60-65%), which generates favorable performance in animal husbandry. Moreover, the high level of soluble sugars (4-10%) allows mass silage fermentation, resulting a perfect taste for animals.

Given the current configuration of the agricultural structures in Romania and the lack of functional infrastructure, including drought phenomenon that has created major problems in the last years in restructuring and managing the obtaining of feed systems, implicit in keeping herd species, it should be adopted and defined a field which the the agricultural research need to approach for identification and testing of some new nutritional solutions, by using in animal rations of some basic components, which will be provided by fodder crops less dependent on the amount of water during growing season (Voicu I. and al., 2013). The silage sorghum respond to the current needs of Romanian zootechnics, being a fodder with excellent quality and high resistance to drought.

In this paper, we want to present the results obtained in the climatic conditions from the Agricultural Research – Development Station

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Secuieni, during 2013 – 2014, regarding the influence of the sowing density on silage production at *Sorghum bicolor* L..

MATERIAL AND METHOD

The researches were conducted during 2013 – 2014, at the Agricultural Research – Development Station Secuieni. In the unit experimental field was placed a bifactorial experience of 4 x 4 type, after the subdivided parcels method, in three repetitions. The placement was made on a typical cambic chernozem soil type, medium texture, slightly acidic ($pH_{H2}o$ – 5.98), characterized as: well stocked in phosphorus (77.6 ppm P_{AL}), Ca (13.6 meq/100 g soil Ca) and Mg (1.8 meq/100 g soil Mg), medium stocked in active humus (1.88 %) and nitrogen (16.2 ppm N-NO_3) and poorly stocked in potassium (124.6 ppm K_2O).

The factors studied in the experience were AxB type, where: the A factor was represented by hybrids, with four graduations, namely: a_1 - Fundulea 135 ST, a_2 - BMR Gold, a_3 – Zerberus and a_4 – Biomass 150, and the B factor was represented by the sowing density, with four graduations, namely: b_1 - 150.000 germinate seeds/ha, b_2 – 200.000 germinate seeds/ha, b_3 - 250.000 germinate seeds/ha and b_4 – 350.000 germinate seeds/ha.

The experiments seeding was done in the same day (3.05.2013 and 30.04.2014), at a temperature of 12ºC in soil, and the sowing density was secured according to the experience plan. The sowing depth was of 3-4 cm, and the fertilization was made with 40 kg a.s./ha nitrogen and 40 kg/ha P_2O_5. The previous plant was the soybean.

To describe the linear association degree between the obtained production and experienced densities it has been calculated the Pearson correlation coefficient (r), which takes values between +1 and -1, the positive values showing a positive correlation and the negative ones showing a negative correlations.

In the experiment were complied all the technological links, and the obtained data were statistically processed and interpreted according to the variance analysis method.

RESULTS AND DISCUSSIONS

The experimental results obtained at sorghum, in the analyzed period, indicates a significant difference of the dry matter production, depending on the cultivated genotype, sowing density and climatic conditions.

The climatic conditions of 2013 agricultural year were very favorable to sorghum for silage crop, which is reflected in the very high silage productions obtained. The maximum level of silage productions was recorded in this year at the variants sown with 250.000 g.s./ha, and the highest production was recorded at the variant sown with the Biomass 150 hybrid, at a density of 250.000 g.s./ha (29.85 to/ha). Compared with the control variant, Fundulea 135 ST x 150.000 g.s./ha, except the variant sown with Fundulea 135 ST hybrid, at a density of 200.000 g.s./ha, at which was achieved a production increase significantly distinct, all the tested variants have achieved very significant production increases (*table 1*).

The 2014 agricultural year was more uneven than the previous agricultural year, both in terms of heat and rainfall. This was reflected in the silage productions obtained in this year, which were lower by approx. 20 % (*table 2*).

Table 1

The influence of hybrids x sowing densities interaction on the dry matter production at *Sorghum bicolor* L., 2013

Sowing density (B)	Hyibrid (A)	Production(to/ha)	% compared to control	Difference (to/ha)	Significance
150.000	Fundulea 135 ST	20.98	100	Mt.	-
	BMR Gold	26.26	125	5.28	***
	Zerberus	23.31	111	2.33	***
	Biomass 150	24.70	118	3.72	***
200.000	Fundulea 135 ST	22.86	109	1.88	**
	BMR Gold	27.58	131	6.60	***
	Zerberus	25.71	123	4.73	***
	Biomass 150	26.33	126	5.35	***
250.000	Fundulea 135 ST	28.51	136	7.53	***
	BMR Gold	28.91	138	7.93	***
	Zerberus	26.33	125	5.35	***
	Biomass 150	29.85	142	8.87	***
350.000	Fundulea 135 ST	24.45	117	3.47	***
	BMR Gold	27.93	133	6.95	***
	Zerberus	26.16	125	5.18	***
	Biomass 150	27.71	132	6.73	***
LD A x B (to/ha)			5% = 1% = 0.1 % =	= 1.30 = 1.74 = 2.30	

Table 2

The influence of hybrids x sowing densities interaction on the dry matter production at *Sorghum bicolor* L., 2014

Sowing density (B)	Hyibrid (A)	Production(to/ha)	% compared to control	Difference (to/ha)	Significance
150.000	Fundulea 135 ST	16.22	100	Mt.	-
	BMR Gold	19.14	118	2.92	***
	Zerberus	20.25	125	4.03	***
	Biomass 150	18.37	113	2.15	*
200.000	Fundulea 135 ST	18.41	114	2.19	*
	BMR Gold	22.64	140	6.42	***
	Zerberus	22.95	141	6.73	***
	Biomass 150	21.76	134	5.54	***
250.000	Fundulea 135 ST	20.61	127	4.39	***
	BMR Gold	23.84	147	7.62	***
	Zerberus	24.15	149	7.93	***
	Biomass 150	23.08	142	6.86	***
350.000	Fundulea 135 ST	19.51	120	3.29	***
	BMR Gold	23.14	143	6.92	***
	Zerberus	23.56	145	7.34	***
	Biomass 150	22.62	139	6.40	***
LD A x B (to/ha)			5% = 1% = 0.1 % =	= 1.86 = 2.21 = 2.85	

With higher production than all the tested variants, it was noted the variant sown with Zerberus hybrid at a density of 250.000 g.s./ha. Compared to the control variant (Fundulea 135 ST x 150.000 g.s./ha), the variants sown with Fundulea 135 ST and Biomass 150 hybrids, at densities of 150.000 g.s./ha, showed significant differences in production, the remaining tested variants have achieved very significant production increases.

The climatic conditions of 2013 have greatly contributed to achieving silage productions with sowing density, in this year the correlation between the number of germinable seeds ensured at sowing and the obtained silage productions was direct, and the correlation coefficient (r) was statistically ensured and interpreted as significant. As regards the next year, the climatic conditions being unfavourably, the silage production formation was strongly influenced by the provided seeding densities. Thus, in this agricultural year, the correlation between the obtained silage production and sowing density was direct and very close and the correlation coefficient was statistically ensured and interpreted as very significant (*figure 1*)

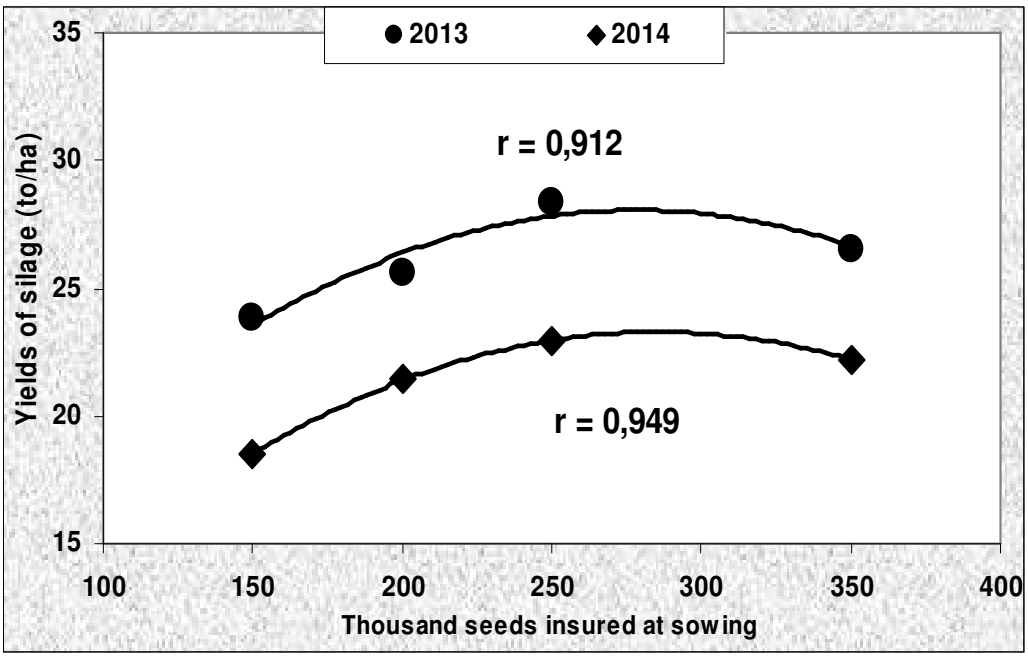

Figure 1. **The correlation between sowing density ensured at seeding and the silage production obtained at *Sorghum bicolor* L.**

CONCLUSIONS

The results obtained during the conducted researches revealed the following conclusions:

- the productions obtained in 2013 agricultural year were favored by the climatic conditions during the sorghum growing season and were higher by 20 t/ha, within the limits of 20.98 to/ha and 29.85 to/ha;
- in the second year of research, the productions achieved were lower compared to the first year and ranged between 16.22 t/ha and 24.15 to/ha;
- the maximum level of productions was recorded in the variants sown with 250000 g.s./ha;
- in 2013 favorable conditions, with higher productions than all the varieties it was noted the variant sown with Biomass 150 at a density of 250000 g.s./ha, and in unfavorable climatic conditions (2014) it was noted the variant sown with Zerberus hybrid at a density of 250000 g.s./ha;
- the correlations between the silage production and sowing density were direct, the correlation coefficients were statistically ensured and interpreted as significant (2013) and very significant (2014);
- the results presented in this paper are extended on 2013 – 2014 period, but the research will continue in this purpose.

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