RESEARCH ON SOME TECHNOLOGICAL MEASURES FOR INCREASING THE YIELDS ON GRAIN SORGHUM CULTIVATED ON SANDY SOILS FROM TÂMBUREŞTI

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ABSTRACT

Grain sorghum is a common species in the world also an old culture show since the fifth century BC (Antohe, I., 1991). It is grown on large areas in areas where climatic conditions are unfavorable for corn, with poor soils and nutrients in water supplies, degraded and climatic conditions with high temperatures. This ability to adapt to almost extreme weather conditions makes the species *Sorghum bicolor* as an alternative to exploit the productive potential of sandy soils in south-western Romania (Draghici I. et al. 1997).

In this paper are presented results obtained from sorghum grain production under the testing of various rotation crops - monoculture, crop rotation of 2 years (cowpea - grain sorghum) and three years (cowpea - rye - grain sorghum) under the influence of various doses of mineral fertilizers with NPK applied in non irrigated conditions.

The results obtained during the testing period showed that the conditions of sandy soils from Tâmbureşti as the best run for grain sorghum was cowpea which conduct to obtain a higher production on sorghum at the variant fertilized with $N_{150}P_{80}K_{80}$.

INTRODUCTION

Sorghum is a genus of numerous species of grasses, one of which is raised for grain and many of which are used as fodder plants either cultivated or as part of pasture. The plants are cultivated in warmer climates worldwide.

Species are native to tropical and subtropical regions of all continents in addition to the South West Pacific and Australasia (wikipedia.org).

MATERIAL AND METHOD

The research was carried out in Experimental and Didactical Research Station from Tamburesti during the period of 2009 - 2011years;

Soil type – sandy soil, with very low natural fertility, poor in organic matter with a high permeability for water and other liquids;

The experience was done using the subdivided parcel method taking in account two factors: *A factor – crop rotation (monoculture, 2 years rotation cowpea – grain sorghum and 3 years rotation cowpea – rye – grain sorghum) and B factor - doses fertilizers with three levels:* $N_0P_0K_0$, $N_{80}P_{80}K_{80}$ *and* $N_{150}P_{80}K_{80}$.

Distance between rows – 70 cm and sowing density – 100 000 plants/ha

As controls we use unfertilized variant and monoculture.

Data collected from experimental field were processed using the variance analysis.

RESULTS AND DISCUSSIONS

Related to the production (table no 1) it can be observed large differences between level of yields obtained in experimented years and also between experimented variants.

From climatic point of view, the three years prove to have different favorability for crops made on sandy soil: the most valuable was 2010 with a rainfall regime which conduct to register highest values of yields from all years.

In average 2009 – 2011, the productions obtained varied as follow:

- *In monoculture system* – yields recorded varied between 9.6 q/ha at unfertilized variant and 16.4 q/ha registered at the highest level of fertilizers of $N_{160}P_{80}K_{80}$. Related to the standard we can observe distinct significant increases in production even in case of moderate applied of fertilizers, fact which prove the necessity of nutrients to be applied on this kind of poor soil with lack of organic matter. The increases were 4.2 q/ha at $N_{80}P_{80}K_{80}$ and 6.8 on $N_{160}P_{80}K_{80}$ variant.
- *In 2 years rotation system (cowpea – grain sorghum)* – the effect of cowpea crop were obvious in all three experimented years. The yields varied in this rotation between 12.1 q/ha at the unfertilized variant and 22.7 q/ha registered at variant with high level of fertilizers. In this case just rotation with cowpea as a previous plant ensure significant increases in production even at level of unfertilized variant in comparison with previous system, the plus production observed being of 2.5 q/ha. The favorable effect of cowpea was registered in other two variants with mineral fertilizers, but the level of increases was higher that the monoculture system of 7.4 q/ha for moderate level of nitrogen and 13,2 q/ha in case of N_{150}. Both variants registered very significant increases in production related to the standard.

Table 1

The yields obtained on grain sorghum cultivated under the influence of different systems of crop rotation and levels of fertilization during the 2009 – 2011 years

Crop rotation	Level of fertilization	Yield q/ha				Diff.	Sign.
		2009	2010	2011	Average		
Monoculture	$N_0P_0K_0$	9.3	10.8	8.6	9.6	Mt	Mt
	$N_{80}P_{80}K_{80}$	13.7	15.3	12.4	13.8	4.2	**
	$N_{160}P_{80}K_{80}$	16.8	18.5	13.9	16.4	6.8	**
Cowpea – grain sorghum	$N_0P_0K_0$	12.0	13.6	10.7	12.1	2.5	*
	$N_{80}P_{80}K_{80}$	16.5	19.2	15.1	16.9	7.4	***
	$N_{160}P_{80}K_{80}$	22.1	25.7	20.4	22.7	13.2	***
Cowpea – rye – grain sorghum	$N_0P_0K_0$	11.2	12.5	10.2	11.3	1.7	-
	$N_{80}P_{80}K_{80}$	16.4	13.9	14.8	15.0	5.5	**
	$N_{160}P_{80}K_{80}$	19.1	20.4	18.3	19.3	9.7	***
DL 5% =		1.8	3.1	3.4	2.4	q/ha	
DL 1% =		2.6	4.5	4.9	5.1	q/ha	
DL0.1%=		4.3	5.9	6.7	6.9	q/ha	

- *In three years rotation system (cowpea – rye – grain sorghum)* – level of productions registered was higher that the monoculture system, but smaller than the two years rotation. This fact can be explained by the positive influence of the cowpea crop as previous plant, thru the capacity of cowpea to fix atmospheric nitrogen based of bacteria of Rhizobium class. Distinct increases in production were observed at $N_{80}P_{80}K_{80}$ variant with a plus production of 5.5 q/ha, and very significant increases in production were registered at $N_{80}P_{80}K_{80}$ variant with a plus production of 9.7 q/ha.

In addition with the production measurements were made quality analysis to the recorded yields in grain sorghum seeds, in accordance with the following factors: level of nitrogen (protein content), level of phosphorus, level of potassium and level of calcium.

All this determinations were made in laboratory of biochemistry on representative grain sample from recorded yields.

The protein content (figure 1) – varied between 8.34% at unfertilized variant in monoculture system and 13.2% observed at variant with $N_{150}P_{80}K_{80}$ from 2 years rotation system. As it can be observe highest values were registered at variants with high level of nitrogen of N_{150} and N_{80} which confirm the direct link between nitrogen content of soil and level of protein from grain sorghum seeds.

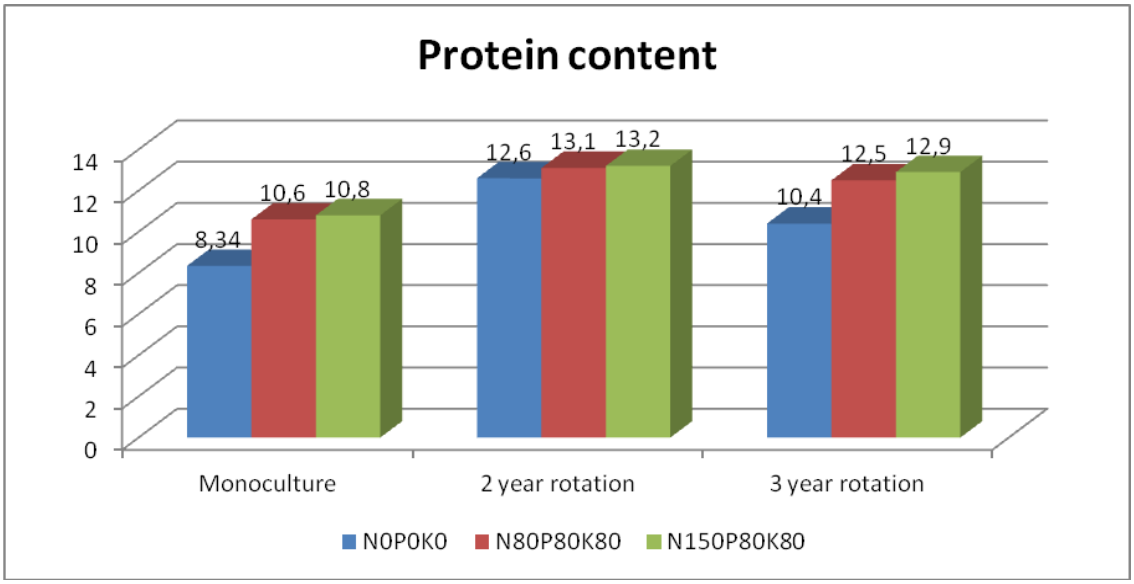

Figure 1 – protein content (%) at grain sorghum cultivated in sandy soil conditions during the 2009 – 2011 period

The phosphorus content (figure 2) – has values between 0.31% at unfertilized variant from 3 years rotation system and 0.4% registered in 2 years rotation system at highest level of applied fertilizers. Variations between registered values were very smaller which shows us that the level of phosphorus in grain sorghum seed was influenced in small ratio than the nitrogen.

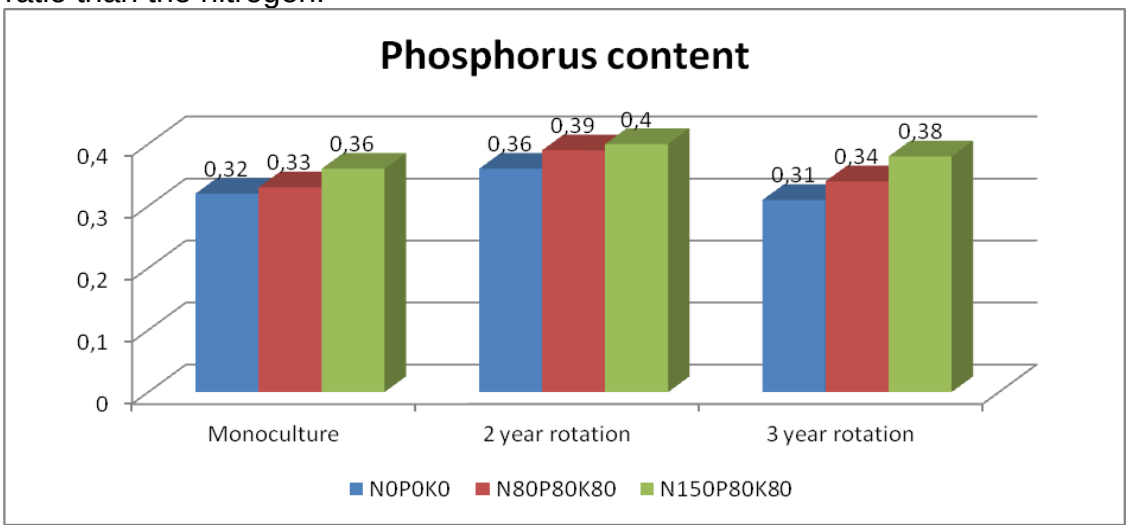

Figure 2 – phosphorus content (%) at grain sorghum cultivated in sandy soil conditions during the 2009 – 2011 period

The potassium content (figure 3) – potassium content of sorghum grains determined was not changed under the influence of mineral fertilization. The values range between 0.26% and 0.38% and particularly type of rotation produced not obvious changes from this point of view.

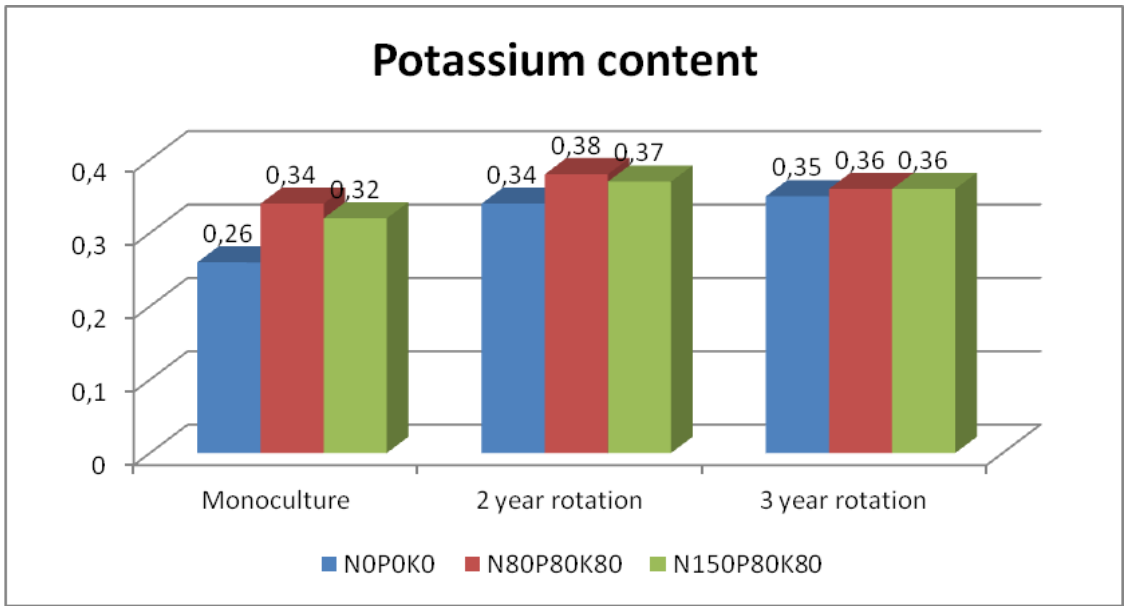

Figure 3 – potassium content (%) at grain sorghum cultivated in sandy soil conditions during the 2009 – 2011 period

The calcium content (figure 4) – The mineral fertilization applied to grain sorghum in different crop rotation system led to slide increases in calcium content in grain sorghum seeds in all rotation chosen, values ranging between 0.024% at witness and 0.039% at $N_{150}P_{80}K_{80}$ variant in 2 years system with cowpea as previous plant.

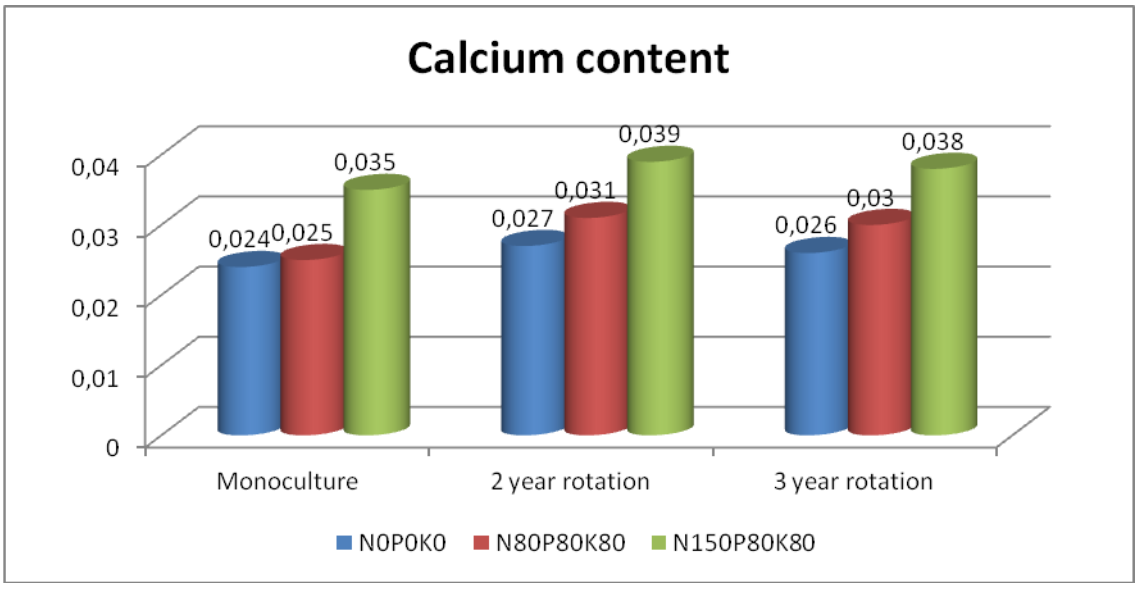

Figure 4 – calcium content (%) at grain sorghum cultivated in sandy soil conditions during the 2009 – 2011 period

CONCLUSIONS

From the presented data we can say that:

- both studied factors (crop rotation and mineral fertilization) prove to have a high influence to the levels of recorded yields, with high amplitude between studied variants;
- the most valuable rotation system for grain sorghum cultivated on sandy soils prove to be 2 years rotation system with cowpea as previous plant;
- highest production were obtained at level of $N_{150}P_{80}K_{80}$ variant which shows us the necessity of fertilization with high level of NPK on this type of soil;
- the protein content was directly influenced by the nitrogen doses applied to the crop, the highest content being observed at $N_{150}P_{80}K_{80}$ variant on the 2 years rotation system;
- phosphorus and potassium content has a small range between determined values, with a small influence from the studied factors;
- calcium content registered few increases of values highlighted by the highest level of mineral fertilizers.

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