STUDY OF THE MAIN CHEMICAL INDICES OF SOME MAIZE HYBRIDS CULTIVATED IN THE ARADULUI PLAIN (ARAD COUNTY, ROMANIA) UNDER THE IMPACT OF PLANT DENSITY

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Abstract: *Worldwide, maize ranks 3rd from the point of view of the areas cultivated with maize – after wheat and rice – and 1st from the point of view of the production. Due to the large areas cultuivated with maize and particularly due to the maize prodcutions, mankind largely depends on maize to feed. Due to the chemical composition of its component parts, maize is both a absic food for humans and a basic feed for animals as well as a valuable raw matetr for industry. The importance of corn as the crop is clear from this plant that uses it has. Thus, maize grain used to feed both people and animals to obtain oil. In human nutrition, by grinding dried beans are obtained: corn flour, corn flakes, baby food, milk etc artificially. The wet milling (grain with embryo), we obtain, in addition to the products listed and rich in fructose syrup (for diabetics), beer, coffee substitutes, etc. coated glazed pastes. The different treatments after wet milling are obtained: starch, glucose, dextrose, whiskey, drug. In forage nutritive value of maize is 1.17 to 1.30 units for 1 kg grain nutrition. The cobs are obtained: furfural, fodder for ruminants, soaps, vitamins are used as fuel. The world production of oil 2% is obtained from corn. Green plant is used as feed for dairy cattle feed. Expansion in culture is due to nutrition and special features. The main goal of this paper is to determine optimal planting density in six maize hybrids aiming at obtaining optimal production quality indices: "Research on the influence of sowing density on production and its quality from 6 corn hybrids, climatic conditions of Plain Arad" scholarship program funded by the European Social din Pilot Program Fund to support research doctoral scholars, under contract POSDRU/6/1.5/2 USAMVB Timisoara, under the distinguished University. Professor Dr. Valeriu Tabară.*

Key words: *corn hybrids, Plant density, Protein, fat content, starch*

INTRODUCTION

Modern maize (*Zea mays* L.) hybrids have the ability to tolerate narrow row spacing that helps enhancing yields per unit area.

Variation in developmental plasticity and tolerance of present-day hybrids to reduced row spacing has been evaluated by using 6 maize hybrids for 3 years under field conditions.

The objectives of this study was to determine whether hybrids belonging to different groups respond differently relative maturity in terms of agronomic performance, plant density decreases when the planting of 40.000 to 50.000, 70.000 plants.

MATERIAL AND METHODS

The goal of the present study is to disseminate experimental results of a doctoral cycle expanded over a period of 3 years. Experimental data are orienattive and were obtained in the 2nd experimental year (2010).

Pioneer maize hybrids were tested in the Aradului Plain at Şemlac (Arad County) within a bifactorial experiment. The factors we studied were maize planst density with three graduations – b_1 – 40,000 plants/ha, b_2 –55,000 plants/ha, b_3 – 70,000 plants/ha – and maize hybrid with six graduations – Pr37M34, Pr37N01, Pr36R10, Pr35F38, Florencia, and Pr35T06.

Harvesting experimental maize hybrid crops was done upon maturity.

To obtain maximum quality maize production, we monitored the fluctuations of the maize production depending on plant density and on the maize hybrid.

We carried out chemical tests of the biological material in the Laboratory for Seed and Vegetal Material Quality Testing, using last generation equipment – the OmegAnalyzer G equipment – used to precisely and quickly analyse cereal kernels from the point of view of their content in protein, starch, and fat. The Laboratory is within the Department of Ahricutlural Technolgoies of the Faculty of Agriculture of the Banat University of Agricultural Science and Veterinary Medicine in Timişoara (Romania).

RESULTS AND DISCUSSION

Protein content of maize kernels is influenced by both genetic factors and environmental conditions of maize plants growth. Climate, soil, and nutrition result in much higher differences from the point of view of porotein content of maize kernels than geentic factors (BÎLTEANU, 2003).

High soil and air moisture result in maize kernels rich in starch and poorer in protein, and *vice versa*. When maize is sowed at higher density, soil water is consumed sooner and then production results fit better low moisture levels, which leads to a decrease of the percentage of starch, to an increaseof the protein content, and to a slight increase of the fat content (VELICAN, 1957).

We need to note the following for the studied maize hybrids in the soil and climate conditions of the Aradului Plain (Arad County, Romania) in 2009: mean protein content (%) depending on the factor "maize hybrid" is higher in the maize hybrid Pr37M34 (9.6%): this maize hybrid is a simple, semi-early maize hybrid and it yields very high productions in areas with medium and good conditions. It is a drougth-tolerant maize hybrid, it is a "stay green" maize hybrid, and it has a good resistance to breaking and fall.

The next hybrid, Pr36R10, has a high content of protein – 9.5%. The maize hybrid Pr36R10 is a simple, semi-late maize hybrid, with a high yielding potential, with a wide range of agronomic features and disease-resistant.

The third maize hybrid with mean protein content (9.3%) is the maize hybrid Pr35T06. It is a simple, late maize hybrid with a high ratio prpoduction:moisture and a balanced-architecture plant (Figure 1).

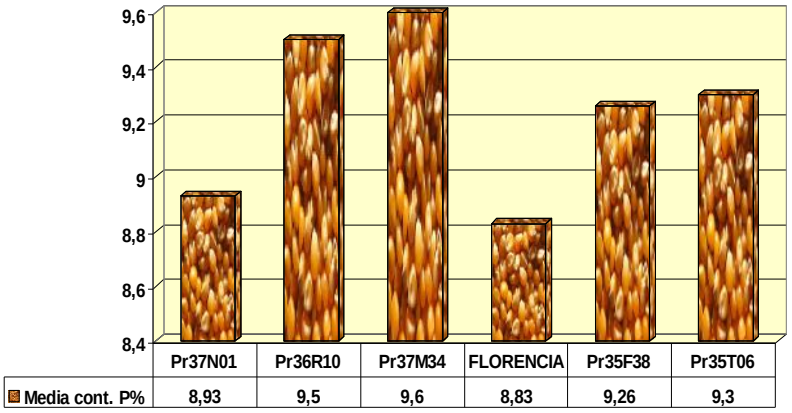


Figure 1. Variation of the mean protein content (%) depending on the maize hybrid (Aradului Plain, Şemlac, Arad County, 2010)

Mean protein content (%) compared to maize plant density cultivated in the soil and climate conditions of the Aradului Plain (Arad County) in 2010 is as follows: for a plant density of 40,000 plants/ha, we obtained a maximum protein content of 9.63%, for a plant density of 55,000 plants/ha we obtained a mean protein content of 9.36% and 8.75% for a plant density of 70,000 plants/ha (Figure 2).

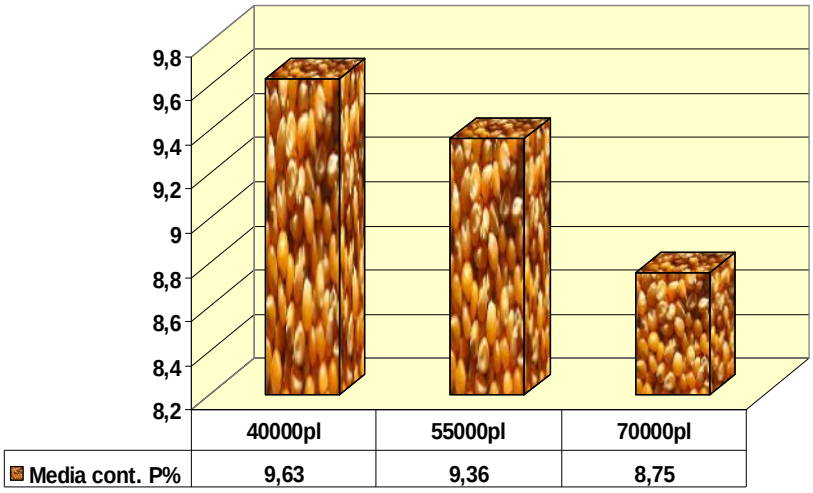
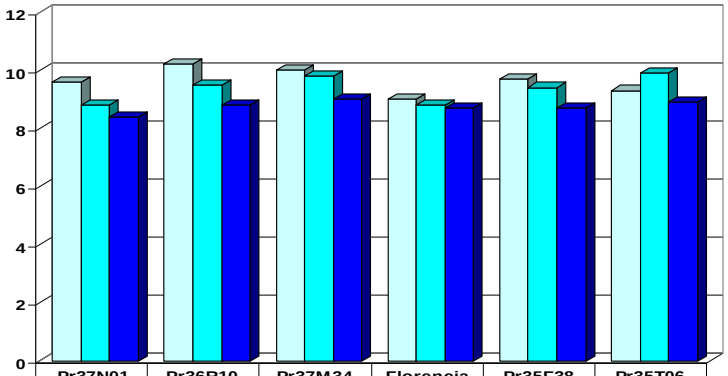


Figure 2. Variation of the mean protein content (%) depending on plant density (Aradului Plain, Şemlac, Arad County, 2010)

Maize quality depending on the maize hybrid and on plant density for the parameter "protein" is shown in Figure 3: the highest mean protein content was in the maize hybrid Pr36R10, i.e. 10.2% for a plant density of 40,000 plants/ha; the maize hybrid Pr37M34 has, for a plant density of 55,000 plants/ha, a protein content of 10%, and the maize hybrid Pr35T06 yielded a protein content of 9.9% for a plant density of 55,000 plants/ha.



	Pr37N01	Pr36R10	Pr37M34	Florencia	Pr35F38	Pr35T06
P%40000	9,6	10,2	10	9	9,7	9,3
P%55000	8,8	9,5	9,8	8,8	9,4	9,9
P%70000	8,4	8,8	9	8,7	8,7	8,9

Figure 3. Assessing maize quality depending on maize hybrid and on plant density from the point of view of the quality parameter "protein"

In the maize hybrids under study in the soil and climate conditions of the the Aradului Plain (Arad County) in 2010, mean starch content depending on the factor maize hybrid is higher in the maize hybrid Florencia – 72.5%. Florencia is a simple, semi-late maize hybrid with an excellent yielding potential and a remarkable drought-resistance (Figure 3).

The maize hybrid Pr35T06 ranked 2nd from the point of view of starch content – 72.2%. The following maize hybrid with high mean starch content (71.9%) is the maize hybrid Pr35F38: it has a quick growth rate during the first vegetation phases and a good resistance to breaking and fall.

Mean starch content (%) depending on plant density in maize cultivated in the soil and climate conditions of the Aradului Plain (Şemlac, Arad County) in 2010 is as follows: for a plant density of 55,000 plants/ha, we obtained a starch content of 73.25%, for a plant density of 70,000 plants/ha we obtained a mean starch content of 72.7% and 71.7% for a plant density of 70,000 plants/ha (Figure 4).

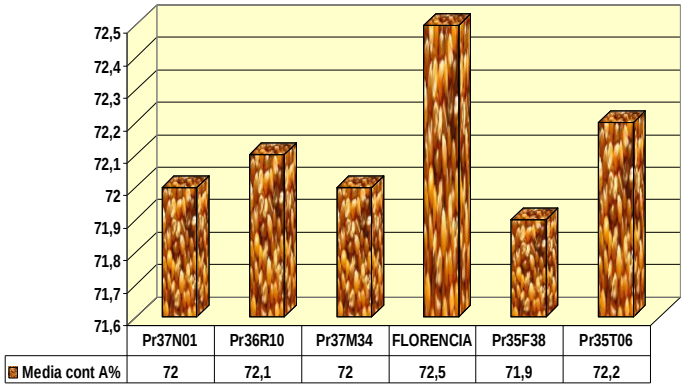


Figure 4. Variation of the mean starch content (%) depending on maize hybrid (Aradului Plain, Şemlac, Arad County, 2010)

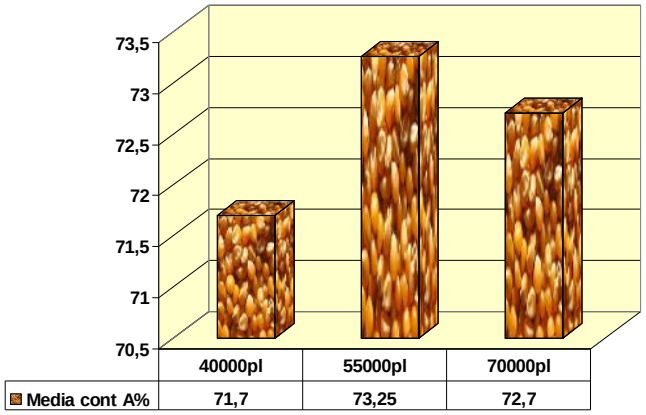
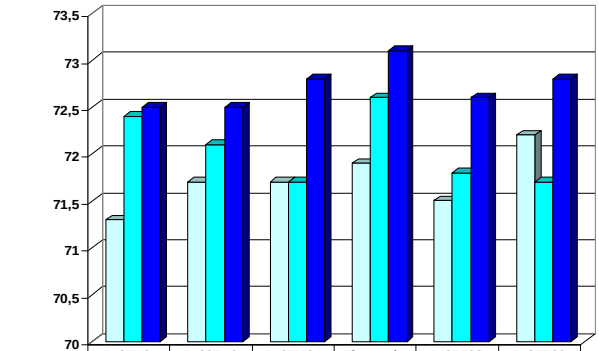


Figure 5. Variation of the mean starch content (%) depending on plant density (Aradului Plain, Şemlac, Arad County, 2010)

Maize quality depending on the maize hybrid from the point of view of quality parameter "starch" is as shown in Figure 5: the highest starch content is in the maize hybrid Florencia – 73.1% – for a plant density of 70,000 plants/ha; the maize hybrids Pr37M34 and Pr35T06 have, for a plant density of 7,000 plants/ha, a starch content of 72.8% and the maize hybrid Florencia yielded a starch content of 72.6% for a plant density of 55,000 plants/ha (Figure 5).



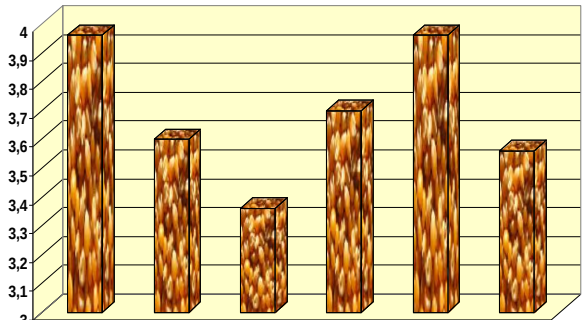
	Pr37N01	Pr36R10	Pr37M34	Florencia	Pr35F38	Pr35T06
A% 40000	71,3	71,7	71,7	71,9	71,5	72,2
A% 55000	72,4	72,1	71,7	72,6	71,8	71,7
A% 70000	72,5	72,5	72,8	73,1	72,6	72,8

Figure 5. Assessing maize quality depending on maize hybrid and on plant density from the point of view of the quality parameter "starch"

High soil and air moisture result in kernels poorer in fat and *vice versa*. Increasing row distance reults in a decrease of the protein content and of fat content (IONIȚĂ & SLUȘANSCHI, cited by SĂVULESCU & VELICAN, 1957).

For the maize hybrids unde rstudy in the soil and climate conditions of the Aradului Plain (Arad County) in 2010, the mean fat content (%) depending on the factor maize hybrid is higher in the maize hybrids Pr37N01 and Pr35F38, i.e. 3.96%. The maize hybrid Pr37N01 is a simple, semi-early maize hybrid that is drought-resistant (Figure 6).

To note the maize hybrid Florencia, with a mean fat content of 3.70% and the maize hybrid Pr36R10 with a mean fat content of 3.6%.



	Pr37N01	Pr36R10	Pr37M34	FLORENCIA	Pr35F38	Pr35T06
Media cont.Ul%	3,96	3,6	3,36	3,7	3,96	3,56

Figure 6. Variation of the mean fat content (%) depending on maize hybrid (Aradului Plain, Şemlac, Arad County, 2010)

Mean fat content (%) depending on plant density in the soil and climate conditions of the Aradului Plain (Şemlac, Arad County) in 2010 is as follows: for a plant density of 40,000 plants/ha, we obtained a maximum fat content of 3.75%; for a plant density of 55,000 plants/ha, we obtained a mean fat content of 3.70% and 3.63% for a plant density of 70,000 plants/ha (Figure 7).

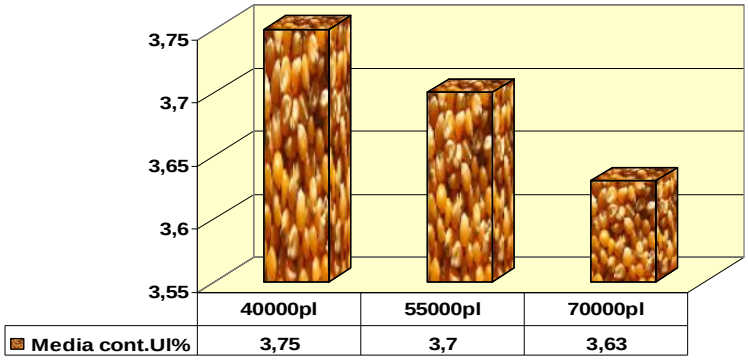
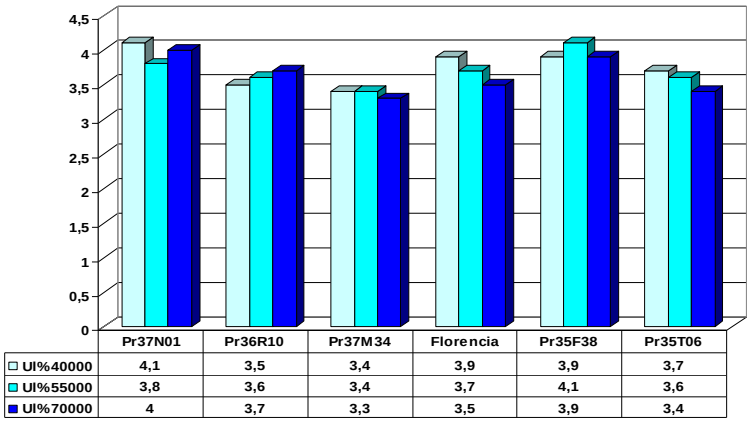


Figure 7. Variation of the mean fat content (%) depending on plant density (Aradului Plain, Şemlac, Arad County, 2010)

Maize quality depending on the maize hybrid and on plant density from the point of view of the parameter "fat content" is as shown in Figure 8: the highest fat content is in the maize hybrids Pr37N0, i.e. 4.1% for a plant density of 40,000 plants/ha and Pr35F38, i.e. 4.1% for a plant density of 55,000 plants/ha.

The maize hybrids Florencia and Pr35F38 have a fat content of 3.90% for a plant density of 40,000 plants/ha. For a plant density of 55,000 plants/ha, the maize hybrid Pr37N0 yielded a fat content of 3.8%.



	Pr37N01	Pr36R10	Pr37M34	Florencia	Pr35F38	Pr35T06
Ul%40000	4,1	3,5	3,4	3,9	3,9	3,7
Ul%55000	3,8	3,6	3,4	3,7	4,1	3,6
Ul%70000	4	3,7	3,3	3,5	3,9	3,4

Figure 8. Assessing maize quality depending on maize hybrid and on plant density from the point of view of the quality parameter "fat content"

CONCLUSION

In maize cultivation technology, plant density is one of the most dynamic factors.

Optimal plant density for maximum maize kernel production per unit of area differ

from one maize hybrid to another due to the significant interaction between hybrid and different plant densities.

The value of the chemical composition of the maize kernel si given by the combined actions of several factors: soil, climate, cultivation technology, local nutrition conditions, position of the maize ear on the maize plant, fertilisers, conditioning and preservation (FARNHAM, 2001; WIDDICOMBE & THELEN, 2002; TOKATLIDIS et al., 2005).

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