ABSTRACT

Key words: fertilization, hybrids, sowing density, sorghum

The sorghum (*Sorghum bicolor* L. Moench) is a cereal with high importance, fourth place in the world after obtained production and fifth place after the cultivated area (after wheat, rice, corn and barley). It has a great development because it's use in the alimentation especially in the semi-arid areas of the world where the climatic conditions gives limited conditions for agriculture. Such situations predominantly in Africa, Asia and Latin America, which are frequently drought-prone.

It is a very important species, especially in dry areas, where it can be a good alternative to the corn culture. This is because the sorghum species can tolerate the high temperatures of summer and realized high yields even under conditions of water stress. It can increased by less than 100 mm/ growth cycle and the critical period to drought is short, 20 days less than corn (27 days sorghum and 46 days from corn), and the pollen can resist at the high temperatures, 45-50 °C, while the pollen of maize resistant to 35-40 °C.

A further advantage of sorghum crop is the poor attack of pests and diseases. To combat fusariosis is sufficient the cultivation of hybrids that show tolerance to this disease and for combating the worms of *Agriotes* sp., the apply a specific treatment. For areas where is reported the attacks of *Diabrotica* sp. at corn, sorghum introduction in the rotation is a good way to control this pest.

Also, sorghum has a low requirements regarding the needs nutrient because it has a well-developed root system, which allows it to extract all the nutrients it needs on the soil.

With improvements, sorghum may become "global cereal of the future" because of it resource efficiency and his ability to access the market, as an energy resource.

Unfortunately, in our country, this culture does not occupy the place that it deserves although we have a large areas with high incidence of dry years or areas with sandy soils eroded

etc., where at the culture of corn (because these two cultures divide the same area) the yields obtained are small or very small.

Sorghum is not demanding of the previous plant, succeeding even in monoculture. Is not recommended their cultivation in a repeated culture because it leads to an impoverishment of the soil accentuated in major nutrients. Reduced requirements compared to the previous plant is explained by its ability to take water and soil nutrients. After sorghum, succeed in best crops the cultures which have moderate requirements for water and nutrients (legumes, castor, sunflower, corn, etc.).

Sorghum belongs to the family *Poaceae (Gramineae)*, cultivated species is Sorghum vulgare sin. Sorghum bicolor L. Moench.

PhD thesis entitled "Research on the application of some modern technological sequences at sorghum (*Sorghum bicolor* L.) in the climatic conditions of Central Moldavia" contains 9 chapters embedded in 226 pages, 80 tables and 60 figures. It has two distinct parts, where the first summarizes the data on the "National and international current stage of knowledge at sorghum culture" and contains three chapters. This chapters presented informations from the literature regarding the subject of thesis which were subsequently used in Part II – for comaparing and interpreting the obtained results.

In Part II - entitled "The presentation and interpretation of the experimental results. Conclusions and recommendations " are six chapters. Here we presented the natural environment in which we performed the researches, research material and method and own research results.

The location of the experiences was at Agricultural Research and Development Secuieni Neamț, located in the SE Neamt County, between the geographical coordinates of $26^0$5' east longitude, $46^0$5' north latitude. In terms agrosistematical territory belongs to Moldavian Central Plateau.

Annual average temperature for the 1962-2013 period is 8,7^{O}C, and the media of 2008-2013 is 9,2^{O}C, exceeding whith 0,5 ^{O}C the multiannual media.

The average amount of rainfall for the period 1962 - 2013 is 548.0 mm, total neuniformly distributed during to the growing season of plants. The largest amounts recorded of rainfall in May, June, September and July in some years rainfall values greater than 67-75 mm per month.

The main purpose of the thesis is represented by: developing and promoting the technological means at sorghum in order to increase the quantity and quality of agricultural production.

In the researches conducted we have the following objectives: the study of sorghum hybrids for grain and for silage and establish the genotypes with the greatest adaptability to conditions climatic zone of Central Moldova; determining the effect of different doses of nitrogen fertilization and the phosphate on the production and quality of grain; establishing the influence of sowing density on yield and grain quality; establishing ecological factors influence from years of experimentation on the production of sorghum and verification of some herbicides in different doses on the crop sorghum and their introduction in technology.

In order to elucidate the proposed aspects for the period 2013 - 2014 in the Agricultural Research and Development Station Secuieni - Neamt, were placed three polifactorial experiments, one by type 4 x 3 x 4, where we watched the hybrids of sorghum for grains : Fundulea 32, Alize and Armida and the influence of fertilization and sowing density on yield and quality. Another experience was placed in order to study the hybrids of sorghum silage: Fundulea 135 ST, BMR Gold, Zerberus and Biomass 150 and the influence of sowing density on dry matter production. A third experiment was aimed at weed control in sorghum crop. We have conducted a number of 16 tests with herbicides, both in the recommended dose, and low dose by 25%.

The results obtained indicated the fact that the preferred sorghum minimum germination temperatures is higher than 10 °C. At the temperatures of 14 °C is achieved a 81.2% percentage of grains germinated in 9 days and at the temperatures of 18ºC, sorghum germinate in 6 days, with a very small percentage of seeds which do not germinate.

The fertilization with nitrogen and phosphorus have a positive influence on the number of shoots/ha, but the sowing density causes a decrease at their numbers in lan.

The results revealed the fact that the hybrid Armida has the highest adaptability to the area. It realized a high average production of 7041 kg/ha.

Nitrogen and phosphorus fertilization had a positive influence on the production of grains sorghum, and the highest production was recorded at fertilized variants $N_{120}P_{120}$ dose. The

average for the period, at variants fertilized with this dose achieved an average production of 8656 kg / ha.

The results averaged over the two years of experimentation emphasizes that the highest yields (7217 kg/ha, 7844 kg/ha) was obtained at variations at density of sowing by 250.000 g.b./ ha and 3000.00 g.b. / ha, which shows that sorghum responds very well to high densities.

The average production in the period analyzed were directly influenced by the interaction of experienced technological factors. They varied within very wide limits, from 2328 kg/ha (150.000 g.b./ha x Alize x N_0P_0) and up to 10480 kg/ha (Armida x 300.000 g.b./ha x $N_{120}P_{120}$). The largest production increase per 1 kg fertilizer active substance (94.14 kg grains / 1 kg fertilizer a.s.) was obtained at the interaction between $N_{40}P_{40}$ x Armida x 300.000 g.b./ha.

The interaction between the hybrid Armida x 300.000 g.b./ha x $N_{120}P_{120}$ achieved the highest yields, which leads us to recommend its introduction in cultivation technology of sorghum for grain.

Regarding the influence of hybrid at sorghum for silage, the results revealed the fact that the hybrids BMR Gold and Biomass 150, has the highest adaptability to the climatic conditions of the area. The average production of these hybrids ranged from 24.14 t/ha (Biomass 150) and 24.21 t/ha (BMR Gold).

Sowing density had a positive influence on dry matter production and the highest level of production was achieved in variants sown with 250.000 g.b./ha (26.14 t/ha). Increasing sowing density than this density, increase the percentage of fallen plants and causes a reduction at production of silage.

Obtained results regarding the interaction of studied factors revealed the fact that the the maximum production is recorded at the interaction between Biomass 150 x 50.000 g.b./ha (26.47 t/ha), and the minimum level at the interaction between Fundulea 135 ST x 150 000 g.b./ha (18.60 t/ha).

For combating the weeds from sorghum culture, from the 16 herbicide tested, we have identified a number of two herbicides who can be applied preemergence (Wing P, Trek) and in postemergence an number of eight herbicides (Dicopur, Buctril, Ceredin Super, Bromotril, Banvel, Callam, Casper şi Basagran Forte).

Of these, the greatest effectiveness in controlling weeds and increasing grain production was the herbicide Trek, but good results were obtained at Wing P – 4,0 l/ha, Trek - 2,5 l/ha, Trek - 3,5 l/ha, Dicopur - 1 l/ha, Casper - 0,4 l/ha and Basagran Forte - 2,0 l/ha.

Also, the results obtained in analyzed period revealed that between fertilization with nitrogen and phosphorus have a positive influence of the physical indicators of seed (TKW, HM) but sowing density negatively influenced the values of TKW, but positively the HM values.

The average values of thousand grains weight ranged from the limit of 22.7 g (Alize x 300.000 g.b./ha x N_0P_0) and up to 32.5 g (Armida x 150.000 g.b./ha x $N_{120}P_{120}$) and the mass hectoliter between 63.3 kg/hl (Fundulea 32 x 150.000 g.b./ha x N_0P_0) and 72.5 kg/hl (Armida x 300.000 g.b./ha x $N_{120}P_{120}$).

Technological factors studied had influences positivly and negativly the chemical composition of grain sorghum. Thus, the production of soluble fiber in the detergent acid (ADF) varied from 134 kg/ha (Alize x N_0P_0 x 150.000 g.b./ha) and up to 833 kg/ha (Armida x $N_{120}P_{120}$ x 300.000 g.b./ha), and the soluble fiber in a neutral detergent (NDF) ranged from 48 kg ha (Armida x N_0P_0 x 150.000 g.b./ha) and up to 266 kg/ha (Armida x $N_{80}P_{80}$ x 250.000 g.b./ha).

The production of saturated fats was between 92 kg/ha (Fundulea 32 x N_0P_0 x 150.000 g.b./ha) and 395 kg/ha (Armida x $N_{80}P_{80}$ x 300.000 g.b./ha), and the productions of unsaturated fats, between 82 kg/ha (Alize x N_0P_0 x 150.000 g.b./ha) and 337 kg/ha (Armida x $N_{120}P_{120}$ x 300.000 g.b./ha).

The production of proteins was favored by increasing doses of fertilizers with nitrogen and phosphorus, its values ranged between 178 kg/ha (Alize x N_0P_0 x 300.000 g.b./ha) and up to 802 kg/ha (Armida x $N_{120}P_{120}$ x 250.000 g.b./ha).

The highest production of starch was realized from the interaction of Armida x $N_{120}P_{120}$ x 300.000 g.b./ha (5595 kg/ha), and the lowest at the interaction between Alize x N_0P_0 x 150.000 g.b./ha (1334 kg/ha).

Production of sugar had a very large fluctuations, its values ranging between 49 kg/ha (Fundulea 32 x N_0P_0 x 150.000 g.b./ha) to 240 kg/ha (Armida x $N_{80}P_{80}$ x 250.000 g.b./ha).

The lowest cost of the average production was realized from the interaction between hybrid Armida x $N_{80}P_{80}$ x 300.000 g.b./ha (0,330 lei/kg), while the most costly solution was of the interaction between Alize x N_0P_0 x 150.000 b.g./ha (0,913 lei/kg).

The net profit positive obtained in the analyzed period varied in a very wide limits, from 63 lei/ha (Fundulea 32 x $N_{40}P_{40}$ x 150.000 g.b./ha) and up to 2524 lei/ha (Armida x $N_{80}P_{80}$ x 300.000 b.g./ha). At five of the variants tested, the net profit were negative and ranged from - 34 lei/ha (Alize x $N_{80}P_{80}$ x 200.000 g.b./ha) and up to - 764 lei/ha (Alize x N_0P_0 x 150.000 g.b./ha).

The results obtained in the two agricultural years emphasize that the variant sown with the Armida hybrid, at 300.000 g.b./ha and fertilized with $N_{80}P_{80}$, who obtained the highest net profit. This makes us recommend the introduction of this alternative in the technology for cultivation of sorghum.