CONTRIBUTIONS TO THE STUDY ON THE INFLUENCE OF THE SOWING DATE IN THE GRAIN MILLET PRODUCTION (PANICUM MILIACEUM L.) CULTIVATED IN AN ECOLOGICAL SYSTEM IN THE DOBROGEA PLATEAU

Liliana PANAITESCU*, Simona Mariana PRICOP*, M. LUNGU*, Simona NIȚĂ**

**) Faculty of Natural and Agricultural Sciences - Ovidius University from Constanta*
***) Banat University of Agricultural Sciences and Veterinary Medicine Timisoara, Calea Aradului, no 119, Timisoara, Timis County, Romania,*
e-mail: nitasimona70@yahoo.com

Abstract .*The millet (Panicum milliaceum L.) is one of the first crop cereals (cultivated 3000 years ago), being cultivated in India, Egypt, the south and south-east Europe (Gh. V. Roman, 2011). Until the corn was taken into culture, the millet was used on a large-scale in people's nutrition in our country, being used after its processing in porridge, which is used for the manufacture of a beverage called "braga". In the last period, considering the instability of the crops due to the climate change, the problem of replacing the compromised winter crops with other crops, capable to capitalize better the Romania's climate and soil, is more pronounced. Having a short vegetation period, the grains germinate at a temperature of 8-10^{o} C, being also a drought - resistant plant, without having major disfunctions in the physiological functions, the millet could become in the future an alternative for the farmers in the south and south-east of the country to replace the winter crops affected by the frost. In this paperwork the authors observed the behavior of a millet crop (Panicum milliaceum L.) in experimental conditions, cultivated in two sowing dates, using the same cultivation technology in both variants. Therefore, the first experimental variant was sown on April 6, 2016 and the second variant on April 29, 2016. Considering the experimental results obtained on the two variants taken into study, we can make recommendations to the farmers in the area, that in the case of winter crops compromised by frost, if they want to establish millet crops, then their sowing should be carried out in the first decade of April (experimental variant 1)*

Keywords: *millet, compromised crops, sowing date*

INTRODUCTION

The millet (*Panicum milliaceum*) belongs to the family *Gramineae*, tribe *Panicaceae* (2 n=36), being an annual herbaceous plant, with a very high tillering capacity. In the last years, in Romania are cultivated quite a few millet varieties. The millet varieties approved for cultivation in the years 2014 and 2015, according to the Official Catalogue are Marius and Maldrom 1, and in 2016 in the Official Catalogue is present a single variety, respective the variety Marius. The millet has an increased resistance to diseases and pests and a very high coefficient of multiplication, which allows a very large grain production and fodder mass. In the present the millet can be used for obtaining body care products, shampoos, hair dye, face creams, food supplements, baby foods, cakes, biscuits, spices, different beverages.

MATERIAL AND METHOD

The implementation area for the study of the millet crop is the Experimental field of Phytotechny laboratory, located in Constanta County, the County residence with the same name, having the coordinates 44°11' N latitude and 28°39' eastern longitude. Constanta County is located in the South-East part of Romania, in Dobrogea region, having as neighbors Bulgaria in the south, The Black Sea in the East, Tulcea County in the North and the Counties Calarasi and Ialomita in the west.

Fig 1 – The experimental trial in the Phytotechny field of F.N.SA.S. from O.U.C.

The soil is a typical Chernozem from the Cernisol class, having a soil profile composed of the horizons: Ap, Am, A/C, Cca_1, Cca_2 and R. The horizon Ap is present until 25 cm depth, having a clay - loam texture and granular structure. It is uncompacted, with root debris and an intense vermic activity. The horizon Am is included in the depth interval of 23-43 cm with a clay - loam texture and polyhedral-angular structure. It is compacted, having rare plant debris in its composition. The horizon A/C is included in the depth interval of 43-58 cm, having a loamy texture and polyhedral-angular structure. The horizon Cca_1 is situated at the depth of 58-83 cm, with loamy texture and polyhedral-angular structure. The horizon Cca_2 is found at 83-110 cm depth, having a loamy texture and a polyhedral-angular structure. It presents limestone formations in the form of calcium carbonate concretions. The horizon R is found after the depth of 110 cm, being represented by the limestone hard rock.

The climate is maritime, characterized by the summers with high temperatures attenuated by the sea breeze and mild winters with very strong and humid winds that blow from the sea direction. The maximum monthly temperatures above 30°C are recorded in July, August and September. The wind Crivăț is the dominant wind that blows in Dobrogea from North-East, being a cold and dry wind that brings low temperatures very quickly. It evaporates very fast the water reserve stored into the soil during the winter and blows the snow that is in small quantities. In the terms of sunshine duration, Dobrogea holds the highest values from the country, with 2300 hours of sunshine per year.

Dobrogea is a region with a very high climatic risk, having one of the most diversified risk palettes. The area under discussion is one of transformation of the polar origin air into tropical nature air, therefore presents this diversity of risks. Permanently, in this area, polar air masses appear and bring with them massive cooling, hoarfrosts, frost, blizzards. Also in the summer, there are invasions of warm air masses that bring massive heating, droughts, aridity. When these two air masses meet, appear very dangerous phenomena such as heavy snows, violent blizzards. These climatic risks, that lead to instable meteorological phenomena give to Dobrogea a character of agricultural instability which makes the farmers to analyze very well the structure of cultures that will manage to overcome all phenological-vegetative phases. The plant taken into discussion in the paperwork is a long day plant, termophilic and very resistant to drought.

The description of biological material and the work method. In order to know better the behavior of the millet crop *(Panicum milliaceum*) in the experimental field of the Faculty of Natural and Agricultural Sciences from Ovidius University, we initiate an experiment in which it was observed the study of the biology and ecology of the millet plant under the environment conditions from Dobrogea. It was followed the cultivation technology, the difference between the millet behavior to different sowing dates, the weeds frequent in this culture and the yield analysis.

We chose the variety Marius that we sown at two distinct dates: April 6, 2016 and April 29, 2016, on two different plots.

RESULTS AND DISCUSSIONS

In the choice of the study theme it was taken into account the importance of the millet cultivation worldwide, European and in Romania. Therefore, worldwide, the surface cultivated with millet oscillated from 29 mil. ha in the year 2015, to over 38 mil. ha in the year 2011 (Tab. 1), the average production being under 1000 kg/ha. Although, analyzing the productions from the countries in European Union, these can overcome 2000 kg/ha (Tab. 2). In Romania, the millet does not enjoy the farmers interest, so that in the period 2013-2015, according to the official data, it was not cultivated at all (Tab. 3). In the year 2016 it was cultivated on 401 ha, the productions being at the level of countries from EU, respectively 1920.9 kg/ha (tab. 3).

Table 1

Surfaces cultivated with millet worlwide in the period 2010-2016

Year	Cultivated surface (ha)	Yield (kg/ha)
2016	31 705 489	894.4
2015	29 496 556	970.4
2014	32 248 549	882.0
2013	32 916 261	846.1
2012	31 722 594	852.7
2011	38 819 227	796.4
2010	35 851 148	910.8

***)www.faostat.org

Table 2

Surfaces cultivated with millet in the European Union in the period 2010-2016

Year	Cultivated surface (ha)	Yield (kg/ha)
2016	50233	2167.9
2015	53193	1904.9
2014	61790	1860.4
2013	57276	1840.3
2012	54981	1953.6
2011	44017	1982.0
2010	46469	2083.7

***)www.faostat.org

Table 3

Surfaces cultivated with millet in Romania in the period 2010-2016

Year	Cultivated surface (ha)	Yield (kg/ha)
2016	401	1920.9
2015	0	0
2014	0	0
2013	0	0
2012	5319	1347.8
2011	3236	1944.7
2010	3946	1489.6

***)www.faostat.org

The behavior of the millet crop cultivated on April 6, 2016 (table 4). The land was plowed at 25 cm depth and preliminary harrowed, having a very good degree of loosening and crumbling. The sowing was effectuated at the distance between the rows of 25 cm, the sowing depth was 2 cm due to the small size of the millet seed and low emergence capacity, characteristics specific to this plant. The air temperature was 8°C, the soil being moist. After sowing it was applied a starter irrigation to favor the seed germination. The crust formed at the soil surface in the period sowing-emergence was destroyed. The problem of the crust formation is one often found in Dobrogea area, especially on the irrigated lands. The mass emergence took place on April 24. During the vegetation period it was effectuated an analysis of the weed species in the millet crop. The following dominant weed species were observed: *Rumex patientia*, *Sorghum halepense*, *Amaranthus retroflexus*, *Convulvulus arvensis*. *Chenopodium sp*. The weed control was effectuated by manually hoeing.

There were effectuated the following determinations: the mass of whole plants, the mass of the grains from a plant, the number of grains on a plant. To accomplish these determinations, we harvested 10 samples from the field, and the determinations were effectuated in the Phytotechny laboratory.

Table 4

Results obtained in the millet variety Marius, sown at the date of April 6, 2016

Sample no.	Mass of the plant (g)	Mass of the grains/plant (g)	Number of grains/plant
1	16.7	7.12	423
2	18.2	7.35	402
3	16	7.1	394
4	16.9	7.15	460
5	15	7.59	430
6	17.9	6.1	560
7	17.5	8.12	510
8	17.1	9.3	350
9	16.1	6.13	480
10	15.7	6.14	491
Average	16.71	7.21	450

At the variety Marius, sown on April 6, 2016 in the experimental field of F.N.S.A.S, the mass of the whole plants had minimum values of 15 g and maximum of 18.2 g, with an average of 16.71 g. The mass of the grains on a plant varied between 6.1 g and 9.3 g, with an average of 7.21 g/plant. The number of grains on a plant at the millet cultivated in the experimental field of Phytotechny laboratory of OUC varied from 350 grains/plant to 560 grains/plant, the average being 450 grains/plant.

The behavior of the millet crop cultivated on April 29, 2016 (table 5). The land was plowed the same as the previous variant, the sowing being effectuated at the distance of 25 cm between the rows, the sowing depth being 2.5 cm. The air temperature was 24°C. After sowing it was applied an irrigation to favor the seed germination. No crust has been formed. The mass emergence took place after de date of June 6. Also, on this plot was effectuated an analysis of the weed species in the crop, being identified the following dominant species: *Amaranthus retroflexus*. *Convulvulus arvensis*. *Chenopodium sp*.. *Sorghum halepense*. *Setaria glauca*. *Sinapis arvensis*. The weed control was effectuated by manually hoeing. The height of the plants on the date of June 28, 2016 was of 56 cm on average.

The preliminary plant was the common bean, variety Domus, for the both variants taken into study. No diseases or pest attacks were observed in any of the variants.

At variety Marius, sown on the date of April 29, 2016 in the experimental field of FNSAS, the mass of the whole plants had minimum values of 12.5 g and maximum of 15.2 g, with an average of 13.91 g. The mass of the grains on a plant varied between 2.9 g and 6.1 g, the average being of 5.09 g/plant.

Fig. 2 – Practical aspects regarding the establihsment of the millet crop *(Panicum miliaceum L.)*

Fig. 3. – Crust formed in the period sowing-emergence in the variant seeded on April 6, 2016

The number of the grains on a plant at the millet crop cultivated in the experimental field of Phytotechny laboratory of OUC varied from 297 grains/plant to 497 grains/plant, with the average of 390 grains/plant.

Table 5

Results obtained in the millet variety Marius sown at the date of April 29, 2016

Sample no.	Mass of the plant (g)	Mass of the grains/plant (g)	Number of grains/plant
1	13.5	5.8	401
2	13.7	5.4	440
3	14.1	3.1	460
4	15.2	6.1	371
5	14.1	7.1	299
6	13.5	5.2	391
7	16	6.1	497
8	13.4	4.1	371
9	12.5	5.1	373
10	13.1	2.9	297
Average	13.91	5.09	390

CONCLUSIONS

Analysing the data obtained in a millet crop (*Panicum milliaceum L.*). from variety Marius, cultivated in experimental condition at two different sowing dates, respectively on April 6, 2016 and April 29, 2016, using the same cultivation technology in both variants, on a typicl chernozem from Cernisol class, resulted the following conclusions:

- Dobrogea is a region with a very high climatic risk, having one of the most diversified risk palettes
- In the cultivation conditions of the year 2016, the millet variety Marius had an increased resistance to diseases and pests, in the culture during the vegeation period no diseases or pest attacks were observed
- The floristic composition of the weed spectrum was the following: *Rumex patientia*. *Sorghum halepense*. *Amaranthus retroflexus*. *Convulvulus arvensis*. *Chenopodium sp*. at the variant sown on April 6, 2016 and *Amaranthus retroflexus*. *Convulvulus arvensis*. *Chenopodium sp*.. *Sorghum halepense*. *Setaria glauca*. *Sinapis arvensis* at the variant sown on April 29, 2016
- At the variety Marius, sown on April 6, 2016 in the experimental field of F.N.S.A.S, the mass of the whole plants had minimum values of 15 g and maximum of 18.2 g, with an average of 16.71 g. The mass of the grains on a plant varied between 6.1 g and 9.3 g, with an average of 7.21 g/plant. The number of grains on a plant at the millet cultivated in the experimental field of Phytotechny laboratory of OUC varied from 350 grains/plant to 560 grains/plant, the average being 450 grains/plant.
- At variety Marius, sown on the date of April 29, 2016 in the experimental field of FNSAS, the mass of the whole plants had minimum values of 12.5 g and

maximum of 15.2 g, with an average of 13.91 g. The mass of the grains on a plant varied between 2.9 g and 6.1 g, the average being of 5.09 g/plant. The number of the grains on a plant at the millet crop cultivated in the experimental field of Phytotechny laboratory of OUC varied from 297 grains/plant to 497 grains/plant, with the average of 390 grains/plant.

Taken into consideration the experimental results obtained in the two variants taken into study, we cam make recommendations to the farmers in the area, that in the case of winter crops compromised by the frost, if they want to establish millet crops, then their sowing should be effectuated in the first decade of April (experimental variant 1)

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