ABSTRACT

Keywords: potato, varieties, organic fertilizers, quality.

Potato is a plant of big economic importance, because of its multiple utilities: food for people, food for animals and for industrial manufacturing. The most important use is of course that of food for people, the potato being one of the basic foods in many countries of the world, from a long time ago.

This thesis of doctorate has 10 chapters, with 252 pages, 114 tables and 51 figures. This thesis has two distinct parts: the first part, which is a synthesis of the bibliographic data about the theme of the doctorate theses. This part has 82 pages and 16 tables.

In the second part of the theses it is presented: the natural setting, the climatic conditions from the experimenting years, the material and the studying method, and the results of my own analysis about the subject in the thesis of doctorate. This part has 170 pages, 98 tables and 51 figures.

The first experiment was made in a small farm of the Grupul Scolar Agricol "V. Adamachi" Iasi, and the second in the farm of Societatea Agricola ASTRA Trifesti, jud. Iasi. These places are on an old platform called Platforma Moldoveneasca.

The first experiment was made during 3 agricultural years (2006-2009), the climate conditions being very different. The year 2007 was a very dry year and without many precipitation, which induced a thermo-hydric stress in all the phases of the vegetation of the potato, with negative followings for the production. Compared to the year 2007, the years 2008 and 2009 were more favorable to the culture of potato, the medium values of temperatures and precipitations were closer to the multiannual medium.

The type of land on which the experiment was made was cambium mezocalcaric black earth with a mould of 3,3%, pH -6,7, N total -0,169, and the C/N rapport -9,71 being favorable to the culture of potato.

The purpose of the examination was to improve the technology of cultivating the potato in ecologic conditions in the depression of Jijia-Bahlui and the using of data for a more durable ecologic agriculture.

The objectives of the studies were: the quantification of the effect of different types of organic fertilizers (cattle manure, poultry manure, swine manure and sheep manure), related to the chemical fertilizers and to no fertilizers; the determination of the productivity and of the quality of some varietys of potato where there is no irrigation and where there is irrigation; the assessment of the influence of the density of potato plants on the production and of its quality, the effect of the interaction between the fertilizers and varietys of potato and plantation density on the production of tubers and its quality and the role of ecologic conditions of the three different climatic years on the influence of the production of tubers and on the content of starch in these.

For the realization of the objectives in the farm Grupul Scolar Agricol "V. Adamachi" was organized a polifactorial experience, like 6A x 3B x 2C three times.

The factors of the study were:

Factor A – fertilizing, with 6 steps: no fertilizer ($N_0P_0K_0$), $N_{120}P_{120}K_{120}$, swine manure 20t/ha, poultry manure (5t/ha), cattle manure (25t/ha), sheep manure (15t/ha). The dosage of fertilizers was calculated according to its content of NPK, that it would be doses close to $N_{120}P_{120}K_{120}$.

Factor B – variety, with 3 steps, CLEOPATRA variety, FABULA variety, and BARNA variety. The varietys come from Holland and are cultivated in Societatea Agricola ASTRA Trifesti.

Factor C – the density, with 2 steps: 40000 tubers/ha, 70000 tubers/ha.

The length of an experimenting plot was of 6 m, and the width of 2,1 m, and the harvested surface of 12.6 m². The surface of the entire experiment was 1360,8m².

In the second experiment, the studies were made in two agricultural years, 2007-2008, 2008-2009 and we followed up the influence of the cultivator on the production and on the content in starch in potato.

The experiment was made in different plots, three times, having the harvesting surface of 12,6 m². The types were: in 2008: Fabula, Rodeo, Adora, Carrera, Derby, Cicero, Red Scarlet, Silvana, Caesar, Quincy, Vivaldi, and in 2009: Carrera, Rodeo, Red Scarlet, Innovator, Camberra, Silvana, Mozart, Courage, Adora, fibula, Sagitta, Asterix, Sifra.

During the period of vegetation were made phonologic observations about the date of the sunrise, assessment of the sunset, the resistance at the viruses and manna, the date of the withering of the bushes and the maturity degree of the bushes at the harvest.

At the harvest there were made assessments about the location of the tubers in the nest, it was determined the number of the tubers in the nest, the number and the weight of the tubers

with the diameter smaller than 35 mm, with the diameter between 35 an 55 mm and with the diameter larger than 55 mm and the percentage of those on the samples of 10 kg of tubers. It was determined the total weight of the tubers on a plot and on a hectare for the statistic evaluation through the analysis of the variance. In the laboratory it was determined the content of starch in the varietys of potato, the content of dry substance in the tubers, it was determined the rhythm of dehydrating and it was extracted the photosynthetic pigments.

The technology used in the experimental field was specific to the culture of the potato.

The three years of experimenting were climatically different, with important influences on the production of tubers, especially in the first experiment were there were not used irrigations. After the analysis of the production of medium tubers on the three years of experiments, it could be distinguished the fertilizing with $N_{120}P_{120}K_{120}$, cattle manure (25t/ha) and poultry manure (5t/ha).

After the applying of organic and chemical fertilizers on the culture of potato it can be observed that the highest medium productions of the tubers, 19,9 t tubers/ha, were obtained at the fertilizing with $N_{120}P_{120}K_{120}$, and with cattle manure (25t/ha), followed by the poultry manure (5t/ha), where it was obtained a production of 19 t/ha. The fact that the productions were equal both at the fertilizing with $N_{120}P_{120}K_{120}$, and cattle manure (25t/ha) proves the fact that the chemical fertilizers can be successfully replaced by the organic fertilizers in an ecological agriculture. Less production, but close, 17,4 t of tubers/ha and 17,3 t tubers/ha were obtained at the fertilizing with the sheep manure (15t/ha) and swine manure (20t/ha). The lowest medium production was obtained at the unfertilized version, which is the witness version of the experiment.

It is remarkable the fact that in the conditions of a dry year as 2007, the organic fertilizers reacted differently on the production of tubers. As a result, in 2007, the highest production of tubers, 13,1 t tubers/ha and 12,4 tubers/ha were obtained at the fertilized plots with sheep manure (15t/ha) and swine manure (20t/ha). At the fertilization with chemical fertilizers, cattle manure, poultry manure were obtained lower and similar productions. This fact demonstrates that in a dry year the fertilizers $N_{120}P_{120}K_{120}$, cattle manure (25t/ha) and poultry manure (5t/ha), without irrigation can’t assure the plants the necessary nutritive elements.

In 2008 on the first places were cattle manure (25t/ha) and poultry manure (5t/ha) where were obtained 22,7 t tubers/ha and 22,6 t tubers/ha. In 2009 the fertilizers $N_{120}P_{120}K_{120}$ and cattle manure (25t/ha) distinguished themselves obtaining productions of 25,4 t tubers/ha and 25,2 tubers/ha. The highest medium content of starch was registered at the unfertilized parcel, 16,2% starch, and the lowest medium content of starch was registered at the tubers obtained trough

fertilization with $N_{120}P_{120}K_{120}$, 15,6% starch. At the fertilizing with organic fertilizers were obtained values similar to the content of starch from the tubers: 15,8% starch at the fertilized plots with cattle manure and sheep manure and 15,7% starch at the fertilized plots with poultry manure and swine manure. The highest content of dry substance was obtained at the unfertilized plot 17,2% d.s., and the lowest content of dry substance was registered at the fertilized plot with sheep manure (15t/ha), 15,6% d.s. The most productive variety, on the average on three years was the Cleopatra variety where it was obtained a medium production of 20,3 t tubers/ha. On this variety, in 2009 was registered the highest production of tubers in all three years of experimenting, the production of 27,5 t tubers/ha, this fact placed it on the top of the productivity varietys, although in 2007 and 2008 the leader at the productivity was the Barna variety. The lowest production was registered at the Fabula variety, 15,6 t/ha, this variety being very sensitive at the climate conditions and at the attack of different pathogen agents and pests. Also, on this variety, if there is no irrigation, it can't produce its biologic potential and can't land itself to a biologic culture without irrigation. At Trifesti, on irrigation conditions was registered a production of 46,2 tubers/ha. The variety with the highest medium content of starch is Cleopatra variety, 16,5% starch, followed by the Barna variety with 16,2 % content of starch. The lowest content of starch was registered at Fabula variety, 15,1% starch. At the conditions of Trifesti, it registered a content of starch of 13,4%, finding that the irrigations produce a decrease of the content of starch in tubers. The variety with the highest content of dry substance is Cleopatra variety, 18,5% d.s. At the Barna variety the content of dry substance is 16,9%, and at Fabula variety is 14,2% d.s. In the conditions of Trifesti, Fabula variety registered a content of dry substance of 14,6%.

The density of plantation witch registered the highest medium production of tubers, 19,3% t tubers/ha is 70000 tubers/ha. At the density of 40000 tubers/ha was obtained a medium production of 16,7 t/ha. At the density of 70000 tubers/ha was obtained the highest medium content of starch, 15,9%, but also the highest content of dry substance: 16,9% d.s.

The varietys of potato reacted differently according to which fertilizer was used, and the medium productions were very different. The highest medium production, 23,5 t tubers/ha was obtained at Cleopatra variety, with the fertilizer $N_{120}P_{120}K_{120}$, and the lowest medium production, 13,2 t tubers/ha, with Fabula variety without fertilizers. After analyzing each variety it can be noticed that the highest medium productions were registered to the versions fertilized with $N_{120}P_{120}K_{120}$, cattle manure (25t/ha) and poultry manure (5t/ha), and the lowest medium productions at those fertilized with swine manure (20t/ha), sheep manure (15t/ha) and at the unfertilized version. At the Cleopatra variety the highest medium productions were registered

with the fertilizers $N_{120}P_{120}K_{120}$ – 23,5 t tubers/ha, cattle manure (25t/ha) – 22.8 t tubers/ha and poultry manure (5t/ha) – 20,4 t tubers/ha. In 2009 the interaction between Cleopatra and $N_{120}P_{120}K_{120}$, obtained the highest production of tubers in the three years of experiments, 30,9 t tubers/ha. At the Barna variety, the highest medium production was registered at the fertilization with poultry manure (5t/ha) – 21.2 t tubers/ha, followed by the fertilization with $N_{120}P_{120}K_{120}$ – 19,4 t tubers/ha and cattle manure (25 t/ha) – 18,7 t tubers/ha. At the Fabula variety, at the fertilization with cattle manure (25t/ha) was obtained the highest medium production, 18,2 t tubers/ha, followed by the fertilization with $N_{120}P_{120}K_{120}$ and poultry manure (5t/ha), were it was obtained productions of 17,0 t tubers/ha and 15,3 t tubers/ha. Fertilizations with pig and sheep manure were situated on the fourth and fifth place on the production of tubers, and with the unfertilized version all the varietys had the lowest productions.

At the Cleopatra variety, the highest content of starch, 16,8% was registered at the version fertilized with swine manure (20t/ha), and at the Barna variety the highest content of starch was registered at the unfertilized version, 17,1%, followed by the version fertilized with sheep manure (15t/ha), 16,5%. At the Fabula variety, the highest content of starch was obtained at the version fertilized with cattle manure, 15,5% starch, followed by the unfertilized version, 15,1% starch. At the Barna and Cleopatra varietys, at the fertilization with sheep manure, swine manure and at the unfertilized version the content of starch rises, and the versions fertilized with $N_{120}P_{120}K_{120}$, cattle manure (25t/ha) and poultry manure (5t/ha) the content of starch decreases. The highest content of dry substance, 19,8% d.s., was obtained at the Cleopatra variety which was fertilized with $N_{120}P_{120}K_{120}$, the Fabula variety, fertilized with sheep manure (15t/ha) registered the lowest content of dry substance, 13,2%, d.s.

Planting density also influenced the productivity of varieties. Generally, at all varieties, highest productions were registered at the density of 70000 tubers/ha. Comparing the varieties at this density, Cleopatra variety recorded the highest production of 21.7 tonnes tubers/ha followed by variety Barna, 19.5 tonnes tubers/ha.

The average for the three years, the largest starch content was recorded at the interactions: Barna variety x density 40000 tubers/ha -16.2% starch, Cleopatra variety x density 70000 tubers/ha- 16.6% starch. Planting density influenced tuber dry matter content, so, at the interaction Cleopatra x density 70000 tubers/ha produced the highest dry matter content, 19.1%. Fabula variety at both of planting densities were the lowest recorded production of tubers (16.9 t tubers/ha to density70000 tubers/ha and 14.4 tonnes tubers/ha to 40000 tubers/ha), has the lowest starch content (14.9% starch) and dry matter (14.7% d.s. to density 70000 tubers/ha and 13.6% d.s. to density 40000 tubers/ha).

At the interaction of the three factors variety x fertilizer x density were obtained different productions, which explains the fact that the production is conditioned by the combined effect of the three factors and not separated. Effectively, cattle manure (25t/ha) and poultry manure (5t/ha) can have similar productions with chemical fertilizers, and at some varietys they can exceed them. At the development and quality of production directly participate the climatic conditions of the years of experimenting. In 2007 the highest productions were obtained at the fertilizing with cattle manure, ovine dirt and swine manure, and in the years 2008 and 2009 (normal climate years), the highest productions were obtained at the fertilizations with $N_{120}P_{120}K_{120}$, cattle manure and poultry manure. Thereby it demonstrates that in the years with rainfall close to the multiannual average, solubility of the nutritive substances from the cattle manure, poultry manure and from the chemical fertilizers are more intense. The pig and ovine dirt in a dry year keep more easily the water in the soil assuring the soil a more low temperature, and thereby it can be explained the fact that in 2007, at these fertilizations were obtained the highest productions of tubers.

At the Cleopatra variety, at the density of 70000 tubers/ha, the highest productions were obtained at the fertilizations with $N_{120}P_{120}K_{120}$– 26,4 t tubers/ha, cattle manure (25t/ha) – 245 t tubers/ha and poultry manure (5t/ha) – 21,5 t tubers/ha, and the lowest productions were obtained at the interactions between; $N_0P_0K_0$ and density of 70000 tubers/ha – 16,8 t tubers/ha and between $N_0P_0K_0$ and density of 40000 tubers/ha – 14,7 t tubers/ha.

At the Barna variety, the highest productions (24,0 t/ha t tubers/ha) were obtained at the interactions between poultry manure (5t/ha) and density of 70000 tubers/ha, between cattle manure (25t/ha) and 70000 tubers/ha and between $N_{120}P_{120}K_{120}$ and density of 70000 tubers/ha. The Fabula variety at the density of 70000 tubers/ha obtained the highest production at the fertilization with cattle manure (25t/ha) – 19,8 t tubers/ha, followed by the fertilization with $N_{120}P_{120}K_{120}$ – 17,9 t tubers/ha.

At the interaction between density of 70000 tubers/ha with $N_0P_0K_0$ at all varietys registered the highest productions. At the density of 40000 tubers/ha, with the fertilization with swine manure (20t/ha), sheep manure (15t/ha) and unfertilized varietys were obtained the lowest productions in the three varietys. After the interaction between the three factors, the highest content of starch from the tubers, 17,6% was registered at the interaction between Barna variety with $N_0P_0K_0$ with density of 40000 tubers/ha, and the lowest content of starch, 13,9% was registered at the interaction between Fabula variety with swine manure and density of 40000 tubers/ha.

Cleopatra is the highest in starch content. The highest content of starch in the tubers, 16,9% starch was registered at the interactions: $N_{120}P_{120}K_{120}$ and density of 70000 tubers/ha, $N_0P_0K_0$ and density of 70000 tubers/ha and between swine manure (20t/ha) and density of 40000 tubers/ha. The lowest content of starch was registered at the fertilized with poultry manure (5t/ha) version and density of 70000 tubers/ha, 15,8% starch. At the Barna Variety, at the interaction between $N_0P_0K_0$ and density of 70000 tubers/ha was registered the highest content of starch, 17,6%, and at the density of 40000 tubers/ha, the highest content of starch was registered at the fertilization with poultry manure (5t/ha). The lowest values of the starch content, 15,6% and 15,3% were registered at the interactions between cattle manure (25t/ha) and density of 70000 tubers/ha and between $N_0P_0K_0$ and density of 40000 tubers/ha. The Fabula variety has the lowest starch content. At the density of 70000 tubers/ha, the highest content of starch, 15,6% was registered at the fertilization with cattle manure (25t/ha), followed by the $N_0P_0K_0$ – 15,4 % starch. Because of the content of starch which is between 17,6% - 15,6% at the Barna variety, 16,9%-15,8% at the Cleopatra variety, 15,6%-13,9% at the Fabula variety, it situates itself in the class of table varietys. At the interaction between Cleopatra and $N_{120}P_{120}K_{120}$ and 70000 tubers/ha was registered 20,3% content of dry substance, thus being the highest content, and at the interaction between Fabula and sheep manure and 40000 tubers/ha were registered 12,8% content of dry substance.

At the six varietys studied at Trifesti in 2008 and 2009 the productions varied between 23- 30 t tubers/ha (Silvana variety) and 49,95 t tubers/ha (Carrera variety). The highest content of starch was registered at the Rodeo variety, 19,3% and the lowest content of starch was registered at the Fabula variety, 13,4% starch being the only variety in which the content of starch didn’t vary in the tubers.

On average over the three years of experimentation highest gross profit rate was obtained from the interaction of poultry manure (5 t / ha) x 40 000 x variety Cleopatra tubers / ha and 430.4%.

The most efficient potato in irrigation conditions, averaged over two years was Carrera, with a profit rate of 329,8% and the highest yield per hectare, 49.95 tonnes.