ABSTRACT

The mechanization of potato production technology is an essential element, a natural necessity in increasing the production of potatoes as it is the main way to achieve of one of the basic requirements, namely, performing of all mechanical works in time and with good quality.

Chapter I of the thesis " *Technologies for potato growing* " deals with very important information regarding the cultivation of the plants. This chapter has two parts: 1.1 “Potato growth technologies” and 1.2 “ Mechanized works for potato growth”. The problems concerning the culture location and rotation are presented in chapter 1.2. When establishing the location of the culture the first fact taken into account is that the plant has high demands towards the air regime into the soil. Complete mechanization of potato growth requires that it should be located on flat land, with slopes less than 60 (10.5%). Details are provided regarding the best preceding plants for potato, pointing out the fact that this plant is an excellent run for other crops.

This chapter also deals with potato fertilization, its requirements towards nitrogen, phosphorus, potassium, magnesium, calcium. Manure is used potato culture, since it determines the achievement of high and economical increases of the production, having also an important contribution to maintaining and improving soil physical and chemical properties. Some issues relating to the use of green manure and extra root fertilization are also presented.

Soil tillage for potato crop is presented in detail, both for the fall and for the spring period. The following works may be done in autumn: stubble-turn, chemical control of weeds, perennial weed control using agro technical methods, deep autumn plowing, deep soil loosening, processing of autumn plowing, and autumn preparation of ridges. The works that may be performed in the spring, before setting up the culture are: plow land leveling and seedbed preparation.

An important phase of the technology is the planting of potatoes. The tubers’ preparation for planting is presented (sorting of planting material, potatoes grading, possibly cutting the tubers that are greater than the fraction of seed or sprouting the tubers), and then the actual

planting of potatoes. The problems concern the planting period, planting density, the distance between rows, the quantity of planted potatoes, planting depth, size and quality of the ridge.

Further, the technological works concerning the maintenance of the potato culture are presented: maintenance of the potato crop between planting and emergence, potato ridging and hoeing, methods for weeds, pests and disease control, irrigation of potato.

Potato harvesting is an important work to be performed in this culture. Regarding the harvesting, in this chapter several issues are presented: the purpose and importance of this work, evaluation of production, potatoes harvesting, processing and production capitalization. Regarding the harvesting process the following problems are presented: harvesting timing, destruction of vegetable remains, crop irrigation in order to wet the soil, plot preparation for harvest, potato harvesting methods (manual harvesting, semi mechanized harvesting, mechanical harvesting), organization of production transport and reception.

The issue referring to the ”*Mechanized works for potato growth* **“** is closely related to the previous issue. Regarding the mechanization technologies in potato growth, all the works that should be carried out are presented, in chronological order, emphasizing the mechanical means and the active parts that are used for each phase.

Each phase may be done with one or more machines, which results in several mechanization technologies for potato growth.

Deep autumn plowing can be done with several types of plows: general purpose moldboard plow, reversible moldboard plow, moldboard plow + fore plough body, chisel plow. Seedbed preparation may be performed with different tools, depending on conditions: combined cultivator for total cultivation, combinator, combined rotary harrow, harrow with oscillating teeth, light disc harrow, rotary cutter with horizontal rotor, on unplowed terrain.

Potato planting may be also performed with different types of machines: potato planting machines using a vertical disc with gripping flaps as a distribution apparatus, potato planting machines using a rubber belt with cups as a distribution apparatus, potato planting machines using a conveyor chain with cups as a distribution apparatus.

Regarding the work of hoeing + ridging, it can be performed with one of the following machines: hoeing cultivator equipped with arrow knives + ridging bodies or special cutter + ridging modeler.

Harvesting potatoes, depending on working conditions, can be made by one of the following equipments: potatoes harvester with rotating forks, potatoes harvester with sieving web, potatoes harvesting and loading machine, potatoes harvesting combines.

In **Chapter II** "*Worldwide and Romanian potatoes planting and harvesting machines*" different types of potatoes planting and harvesting machines are presented.

Years ago, Romania has imported from the former USSR the SK-2potatoes planting machine, equipped with a vertical disc and cups distribution. The 6 SAD-75 and 4 SAD-75 potatoes planting machines, manufactured by Agrostroj Prostejov, were also imported in our country; they were equipped with a vertical disc with gripping flaps type distribution apparatus. Currently, in our country, potatoes planting machines equipped with the above mentioned distribution equipments are no longer used.

Most of the potatoes planting machines now being built are equipped with a conveyer type distribution apparatus (chain or rubber band), with two rows of cups. The potatoes planting machine produced by Reeke (Scotland, UK) uses a toothed belt with cups distribution apparatus.

The potatoes planting machine Cramer Marathon Jumbo, produced by Cramer in Germany, the distribution apparatus uses a chain with cups, having three strands: a vertical ascending strand, a horizontal strand and a descending inclined strand. More specifically there is an elongated main cup, holding the tuber when it is located on the ascending strand. Towards the chain there is a smaller, hemispherical cup, holding the when it is transported when the horizontal strand of the chain.

Many other planting machines are equipped with a conveyer type distribution apparatus, with two rows of cups: the machine produced by Kverneland (Norway), the GLE, GLO, GLK, GLB, GLV machines produced by Hassia (Germany), the machine produced by Gruse (Germany), the MPC-2 Solana and Mondialmachines produced by Mecanica Codlea S.A. Brasov (Romania), the 2MPC machine produced by S.C. Mechanica Ceahlău S.A. Piatra Neamt (Romania), etc.

The potatoes planting machine model 500, produced by Mc Connell (USA), is provided with a distribution apparatus with tubers gripping devices. Each gripping device consists of a fixed part and a mobile part, each tuber being gripped between them. The potatoes planting machines manufactured by Structural (Netherlands) and JEANTIL (France) tubers distribution is done in very original ways, radically different from the known ones.

Potatoes harvesting machines made worldwide or in our country, differ notably through the constructive solutions applied to remove the clods. The potatoes harvesting combines designed for light and medium soils use sieving webs and, possibly, conveyors for the manual separation of stones and clods.

For clay-loam soils and loam-clay soils, in addition to sieving webs and conveyors for manual separation of clods and stones, combines are equipped with one, two or three devices for mechanical separation of clods and stones. Regarding the construction of these devices, there is a large variety of constructive solutions.

The SBM potatoes harvesting machine, produced by Hassia (Germany), the mechanical

separation of clods and stones is made with an inclined conveyor, equipped with a rubber belt with fingers. The GBS machine, produced by the same firm, separates very well clods and stones with the help of a reciprocating belt; the material is transported towards some baffles, which separate the clods and the stones.

The 1500B potatoes harvesting machine, produced by Reekie (Scotland, England), achieves the mechanical separation of clods and stones using a system of four small profiled rubber drums, with adjustable distance between them.

In the case of the Grimme potatoes harvesting machine (England), clods and stones are separated with the help of three star-type rollers (with 6 or 12 arms). The Crusader-type Cavalier machine (Grimme) the mechanical separation of clods and stones is made with the help of two inclined conveyor belts, fitted with thin rubber fingers. The Jumbo GB-type machine (Grimme) achieves the mechanical separation of clods and stones by the means of belts and a pair of counter rotating rollers.

The mechanical separation of clods and stones in the case of the Superfaun 1800 potatoes harvesting machine, produced by the Norwegian company Kverneland, is achieved using a hedgehog type conveyor, whose horizontal inclination angle can be adjusted. The belt is made of rubber and has thin, high and thick fingers. Above the band there is an oscillating deflector which removes potatoes from the belt, leaving the stones and clods in place.

Chapter III of the thesis "*Theoretical research concerning the working processes of potatoes planting and potatoes harvesting machines*" encompasses a theoretical research regarding the working processes of these machines, using mathematics and physics, and also including mathematical formulas. The most important ensembles and active parts of the planting and harvesting machines are investigated: the conveyor with cups type distribution apparatus, the sieving webs used for stones and clods separation and the haulm separators of the potatoes harvesting combines.

In the case of the tubers distribution apparatus the planting process is investigated, starting with their takeover from the supply area and finishing with their distribution into the trench opened by the share. A theoretical study of the working processes of the distribution apparatus is developed for all the five areas concerning to the planting process: the takeover of the tuber by the cup in the supply area, the ascending strand of the conveyor, the turning area of the conveyor, the descending strand of the conveyor, the tuber discharge area.

In the case of the sieving webs the relative movement of the material layer and of the conveyer is studied, as well as the ratio of the machine speed to the sieving web speed, in order to establish the values that lead to a more pronounced separation of the earth. The advance

motion by leaps of the material layer is also examined, motion which is due to the free elliptical rollers.

The working process of the haulm separator is also examined, as well as the construction parameters and operating conditions of the overflow drum and the separator; these should not cause tuber losses and should not damage the tubers. The construction parameters and operating mode of the separator leading to a more complete removal of debris are also established.

Chapter IV of the thesis "*Experimental research on potatoes planting and potatoes harvesting machines*" presents the experimental results obtained during the testing of two types of machines. For both the potatoes planting machines and the potatoes harvesting machines the research material and method are firstly presented, followed by the evaluation of the quality and operating indices of the machines.

In the case of the **potatoes planting machines**, three types of machines were tested: the six rows planting machine SAD-75, using a vertical disk with flaps type of distribution apparatus; the Cramer Marathon Jumbo, 4 rows planting machine, equipped with a chain conveyer with cups type of distribution apparatus; 2MPC two rows planting machine, with rubber belt and two rows of cups type of distribution apparatus.

The agro technical requirements imposed for potatoes planting are presented, as well as the quality indicators which were evaluated during the tests. The exploitation indicators are also presented, with the corresponding relationships, as well as the testing conditions and measured quality indices. The influence factors to be used in the tests were also marked and also the number of graduations for each factor. Given the influence factors and the number of graduations it was established that 12 experiments should be performed.

In the experiment studying the influence of working speed over the quality indicators regarding the distance between tubers along the row, it was established that all these indices are suitable for a working speed of 2.58 ... 5.57 km/h.

When the influence of shape of tubers over the quality indices (regarding the distance between tubers along the row) was studied, it was found that those indices are appropriate for all types of tested tubers (round, oval and round-oval tubers), the best results being obtained with round tubers.

In the experiment dealing with the effect of tuber size over the quality indices (regarding the distance between tubers along the row), it was established that these indices are suitable for both potatoes having 30…45 mm and for those having 45 ... 55 mm. The best results were obtained for 45 ... 55 mm tubers.

When the effect of planting machine type over the quality indicators (regarding the distance between tubers along the row) was studied, it was concluded that these indices are

appropriate for all the three types of potatoes planting machines. The best results were obtained by the Cramer Marathon Jumbo machine, followed by the 2MPC machine, at a short distance. The 6 SAD-75 machine was ranked third place, at a slightly greater distance form the other two machines.

In the experiment in which the effect of the working speed over the coefficient of variation of the distance between tubers was studied, it was concluded that this index is suitable for speeds between 2.58 and 5.94 km / h.

In the experiment in which the effect of the shape (round, round-oval, oval) over the coefficient of variation of the distance between tubers was investigated, it was found that the coefficient is appropriate for all forms of tuber used in the tests.

In the experience studying the effect of tuber size over the coefficient of variation of the distance between tubers per row, the results indicate that that quality is suitable for the both size fractions used in the tests (30 ... 45 mm and 45… 55 mm). The best results were obtained for the 45 ... 55 mm tubers.

When the effect of the machine type over the coefficient of variation of the distance between tubers was taken into account, it was found that this index is appropriate for all three types of potatoes planting machines. The best results were obtained by the Cramer Marathon Jumbo machine; the 2MPC machine is at a very short distance behind the first, while the 6 SAD-75 was ranked bellow the first two types.

In the experiment which investigated the influence of the moving speed over the coefficient of variation of the planting depth, it was determined that this factor is adequate for speeds between 2.58 and 5.94 km/h.

When the effect of the type of planting machine over the coefficient of variation of the planting depth was taken into account, it was concluded that this coefficient has appropriate values for all three types of potatoes planting machines taken into account. The best results were obtained by the Cramer Marathon Jumbo machine. The 2MPC machine followed, at a very short distance, while the 6 SAD - 75 machine was placed beyond the other two.

In the experiment regarding the effect of the moving speed over the tubers' degree of injury it was found that the quality index has adequate values for speeds of 2.58 ... 5.94 km/h.

In the experiment studying the effect of the type of potatoes planting machine over the degree of injury to tubers it was decided that this quality index is adequate for all three types of machines. The best results were obtained by the 2MPC machine. The Cramer Marathon Jumbo machine followed, at a very small difference, while the 6 SAD-75 machine was placed far behind the first two ones.

When considering the exploitation indices, it appears that the best results were obtained by the Cramer Marathon Jumbo potatoes planting machine. The 2MPC machine was ranked last, but only at a small distance compared to the others.

When considering the **potatoes harvesting machines**, the tested types are presented: the E-684 potatoes harvesting and loading machine and the CRC-2 and Dewulf TD 1700 potatoes harvesting
combines.

Then the agro technical requirements referring to potatoes harvesting were presented, as well as the quality indices taken into account, including the mathematical relations and accepted values. The testing conditions and the evaluated indices were also presented. Also, the influence factors were established and also the number of graduations for each factor; it was established that researches regarding the quality indices impose a number of six experiments.

In the experiment regarding the effect of the moving speed over the quality indicators it was found that they are appropriate at a speed of 2.24 ... 3.43 km / h.

In another experience, which aimed to establish the influence of the shares' penetration depth over the quality indices, it was established that these indices are acceptable for the 12 cm and 14 cm share penetration depth.

When the influence of soil clay content over the quality indices was investigated, it was found that these indices are acceptable for soils with up to 30% clay.

In the experiment that studied the influence of soil penetration resistance over quality indicators it has been established that those indices are appropriate when the soil resistance to penetration is comprised between 9 daN/cm^2 and 16 daN/cm^2.

In the experiment referring to the effect of soil humidity over the work of quality indices of potatoes harvesting machines, it was concluded that these indices are acceptable for soils with a humidity comprised between 16% and 11%.

In the experiment dealing with the influence of the type of potatoes harvesting machine over the quality indices, it was established that these indices are appropriate for all the three types of machines that were tested. It was found that best results were achieved by the Dewulf RDT 1700 potatoes harvesting machine. The CRC-2 was ranked second, while the E-684 potatoes harvesting and loading machine was ranked the third.

In terms of exploitation indices the best results were obtained by the Dewulf RDT 1700 potatoes harvesting machine, followed by the CRC-2 combine; the third place was occupied by the E-684 machine.

In the **fifth chapter** the conclusions reached are presented, in relation with the research results. These refer to all the experiments and regard all the investigated quality and exploitation indices. The conclusions are summarized below.

It is estimated that the optimal working speed should be comprised between 5.6 and 5.8 km/h for potatoes planting and of 3.4 km/h for the potatoes harvesting.

When planting potatoes the best results are obtained by the Cramer Marathon Jumbo machine. The second place, at small distance, is taken by the 2MPC machine, and the third place I occupied by the SAD-75 machine, at a great difference from the first two.

When harvesting potatoes the best results are obtained by the Dewulf RDT 1700 combine. The second place is occupied by the CRC-2 combine, while the third place is taken by the E-684 potatoes harvesting and loading machine.