ABSTRACT

The doctoral thesis entitled „**Researches concerning the system of machines for soil tillage in vineyards and orchards**" was elaborated at Doctoral School of University of Agricultural Scienes and Veterinary Medicine from Iaşi on a period of three years of study.

Mechanization technologies for soil works are designed for different technologic opperations for working processes in vineyards and orchards. The place and importance of mechanization technologies for soil works results from the following advantages: increasing of working productivity, realization of some superior qualitative indexes, processing of working in due time, obtaining of increased and constant yields on cropped square unit; decreasing of price cost on product unit. For these reasons the proposed theme is justified and have a aplicative character.

First chapter of PhD thesis „*Mechanization technologies of soil works in vineyards and orchards*" present the main maintenance works of soil used in vineyards and plantations.

This chapter have two sub-chapters: „**General mechanization technologies of soil works in vineyards and orchards**" and „**Maintenance systems of soil in vineyards and orchards**".

Mechanization technologies of soil works applied in vineyards and orchards include operations which are made on soil with different machines and equipments and are done to break up, loose and level the soil and for a weed combat in the two categories of plantations.

Making in optimal conditions of soil works observing the demands imposed by agro-technique offers good conditions for plants' growing and development, finally obtaining a high quality yield.

Must be know some particularities of land, soil tillage, the presence of uncalled weeds, some features of the cultivated species to be able to decide on working methods, required equipments and working indexes for making in the best conditions of interventions on soil.

The most important soil work is tillage, which is realized, usually, on 15-20 cm deep, in autumn or spring, being compulsory in cultivated field system. Shallow soil works during

vegetation period of vine and trees implies the stimulation o the top soil layer at depth of 8-10 cm.

Soil represent the physical base and main reserve of nutritive substances and water for vine and trees, having an influence together with climate factors and the level of used agro-technique, yield quantity and quality.

The main methods for soil maintenance in vineyards and orchards are:

- soil maintenance system as black cultivated field;
- soil maintenance system through weed and pest control;
- soil maintenance system by using green fertilizers;
- soil maintenance system through grassing;
- soil maintenance system through mulch.

Choosing the most suitable maintenance soil system in vineyards and orchards is a major problem and on it depend preservation or increasing of soil fertility, improving or worsening of physical, chemical and biologic proprietes of them.

In the **second chapter** of the paper „Systems of machines used at world level and in Romania for soil works mechanization in vineyards and orchards" are presented the main types of machines and equipments used for soil works mechanization in the two categories of plantations.

The main soil works which are made mechanized in vineyards from Romania are: periodical deep loosening of soil, autumn tillage, additional spring loosening and different agro-technical works for soil cultivation during vegetation period.

Function of working conditions (lands' microrelief, climatic conditions, pedologic conditions, crop technology) could choose between profound interventions on soil (up to 45 cm), interventions at average depth (15-25 cm) or shallow interventions (5-10) by using plughs, disk harrows, cultivators, combinators and hoes.

Machine system used for soil works mechanization in Romanians' vineyards have a large categories of equipments.

The main soil works which are mechanized processed in Romanian vineyards are: periodic loosening (once at 2-3 years) of soil, autumn tillage, spring tillage, aditional spring loosening, soil cultivation on vegetation period. Those works are made by sub-soils, ploughs, disk harrows, cultivators, combinators and hoes.

In vineyards from Romania soil works are realised on the intervals between rows with units like, SPV-45 monted sub-soil for vineyards, PCV-1,8 (2.25) vineyard plough, DPV-1,2

(1,5) disk harrow for vineyard, GEV-1,8 (2,2) harrow with elastic teeth, GSV-1,8 (2,2) vineyard harrow, FV-1-1,5 vineyard hoe. Soil processing on rows could be done with the following units: mobile sector with mechanic movement mounted on PCV, hoe type equipment mounted on PCV.

Soil maintenance woorks on the intervals between tree rows, in Romania, are realised with the following units: PDL-5-25 orchard plough, GDD-1,8 disk harrow, CPLR-2,5-3,5 mounted cultivator with adjustable working width, FDL-1,3 orchard hoe. Soil processing on tree rows could be realised with the units: side sector with pick-up unit mounted on CPLR-2,5-3,5 cultivator, SUD-4 universal disk sector, FA-0,76 side hoe with pick-up unit.

At world level were designed and orchards very efficient units for soil maintenance in vineyards and orchards, many of those being combined or complex units: machine for soil deep loosening, combinator for total cultivation with device for soil processing on row, combinator with reversible knives and bar roller, complex unit for soil which could be equipped with different organs (extirpation knives, paraplow furrows, spherical disks batteries), complex unit with extirpation arrow knives and processing sectors on rows, vertical rotary hoe.

Units designed for soil maintenance in vineyards and orchards, both realized in world and also in Romania, are suitable and could realize the necessary works with respecting the imposed agro-technical demands.

In the **third chapter** oh PhD thesis entitled „Aim and goals of PhD thesis" are mentioned the following objectives:

- establishment of some modern technologies for soil maintenance in vineyards and orchards from the ecologic area of Moldova Plateau;
- establishment of technologies for soil works mechanization able to assure optimal growing and developing conditions for plants;
- determination of qualitative, energetic and exploitation indexes for the main equipments used for soil workers mechanization in vineyards and orchards;
- impact of technologies for soil works mechanization on soils' physical-mechanical properties;
- optimization of machines system to decrease soil degradation;
- optimization of machines system to improve biologic potential of studied vineyards and orchards;
- optimization of machines system to decrease the number of soil works and fuel consumption.

Natural conditions in which trials were carried out are presented in **fourth chapter** „*Material and research method*".

Also this chapter include the machine system used in our experiments, respectively of the agricultural units formed by Aster 45 tractor with the following equipments:

- PCV 1,8 vineyards plough (control);
- DL 1300 vertical rotary hoe;
- VF 7 vibro-cultivator;
- TRC 150 mincing machine for vegetal mass (alternative).

To determinate the desired indexes were used a number of apparatus and instruments, being presented the main functional and constructive characteristics of them.

Trials were carried out on Didactic Station of University of Agricultural Scienes and Veterinary Medicine „Ion Ionescu de la Brad" from Iași, Vasile Adamachi Farm, during 2009-2011, on a cambic chernozem with a clay-loam texture and a moderate to good fertility.

We studied the influence of different units used for soil works mechanization on soil resistance at penetration, soil bulk density, yield, qualitative working indexes, energetic and exploitation indexes.

The experimental results obtained by the units used for soil works mechanization in vineyards and orchards are presented in the **fifth chapter** „*Research regarding determination of qualitative, energetic and exploitation indexes of the units used for soil works mechanization*".

During the three years of study, 2009-2011, were investigated qualitative indexes (mean working deep, mean working width, soil breaking up degree, soil loosening degree, weed control degree, injury degree of plants, global chooping degree), energetic indexes (working speed, tractors' drive wheel slip, hourly fuel consumption) and exploitation indexes (coefficient for shift time usage, coefficient for safety exploitation, working capacity per hour during the shift, working capacity per 8 hours shift, fuel consumption per hectare).

Sixth chapter „*Impact of mechanization technologies for soil works on some physical-mechanic characteristics of soil*" deals with the results regarding the main physical-mechanical features of soil from vineyards and orchards after usage of those five agricultural units.

To analyse the physical-mechanical soil features were gathered soil samples to determine the instant soil moisture content, soil bulk density and we measured directly in the field soil resistance at penetration.

Soil bulk density varied from one years to another function of the used unit for soil work, intensity of soil processing by the operating organ, the obtained values for this indicator

were between the limits imposed by agro-technical demands.

The effectuated trials show the fact that soil resistance at penetration had, in generally, suitable values, without viewing an increase of this indicator due to the usage of certain units.

In **seventh chapter** „*Influence of soil works mechanization on yields*" are presented grape and apple yields obtained in those two plantations on the whole analysed period.

From the three studied years, year 2009 was the most favorable for vineyard with the highest grape yields.

In vineyards, grape yields obtained under the five experimental variants, it has been established in the following that the order, starting from the best: DL 1300 vertical rotary hoe, VF 7 vibro-cultivator, vineyard plough PCV-1.8, and CV 5 cultivator and TRC mincing machine for vegetal mass.

For apple plantation, after analyzing the results on apple production obtained under the five experimental variants, it was established that the order equipment from the best is: DL 1300 vertical rotary hoe, VF 7 vibro-cultivator, vineyard plough PCV-1.8, and CV 5 cultivator and TRC mincing machine. It is noted that the order is the same as laid down in grape production.

Differences in excess of minus blank version of the TRC mincing machine can be attributed to competition for water and plant nutrients used for grassing land.

Chapter eight „*Optimization of machines system for soil works mechanization in vineyards and orchards*" is a synthesis, presenting a statistic interpretation of the obtained results regarding the main indexes for vineyards and orchards, to be able to choose the optimal variant for soil maintenance.

Statistic correlation of the results was made through variation analyse method and followed the next stages: establishment of liberty degrees (GL), concretion of limit differences (DL) for transgression probabilities of 5%, 1% and 0.1% concretion of differences faces to control and establishment of significance.

Nineth chapter „*Conclusions and recommendations*". Based on the analysis of the results obtained for all indices determined (qualitative working indices, energy indices, exploitation indices, soil bulk density, soil resistance to penetration, grape and apple yields obtained) it has been established that the order of the four processors for soil, starting from the best, is VF 7 vibro-cultivator, DL 1300 vertical rotary hoe, vineyard plough PCV-1.8, and CV 5 cultivator.

Of the four soil processing equipment to be used in production we recommend the use of the first two: VF 7 vibro-cultivator and DL 1300 vertical rotary hoe. In order to protect soil structure we recommend that speed rotor blades should be not to high and the speed of the cutter

not to small.

We recommend that the CV 5 cultivator not to be used, because it gives the worst results. First of all the qualitative indices are well below the minimum limits required by agro-technical requirements.

Regarding the TRC mincing machine, we recommend that it should be used in viticulture and fruit plantations, since its energy indexes, operational and those related to soil compaction are appropriate, and the degree of chopping the strings and branches meet the agro-technical requirements.