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CONSIDERATIONS ON MECHANICALLY ACTIVE EQUIPMENT FOR OPENING INTERRUPTED FURROW USED IN TECHNOLOGY OF HOEING PLANT CULTURES, FRUIT AND VINE PLANTATIONS

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Abstract: Lately, there is a decrease in arable land surface while the population grows, therefore the need to increase agricultural production per unit of surface is a must to meet food needs. Water resources are reduced and therefore it is important to promote techniques and technologies that efficiently utilize water from various sources with low energy consumption. In sapling crops, directing water along the plant line or uniform storage is achieved with continuous or interrupted (compartmentalized) furrows. The paper aims to analyse the construction and operation of several types of equipment for opening compartmentalized furrows and how they work.
Keywords: efficient capitalization of water, technical equipment, interrupted furrow

INTRODUCTION

For soil supply with additional water to those naturally received by precipitation, quantities established according to the pedoclimatic conditions and plant requirements, it is necessary to establish additional works in the respective technologies.

Due to the fact that the arable area is decreasing as the population grows, the increase in agricultural production per unit of surface remains the main solution to meet the growing demands and better quality of food.

The achievement of large agricultural output is influenced by several factors (mechanization, fertilization, weed control, pests, biological soil potential, seed quality), each with its importance, but lack of soil water over periods overlapping the critical phases in plant development, diminishes the harvest even compromises it as a result of the drought.

In Romania, the area with economic irrigable potential is estimated at 3 million hectares, of out of which 1.5 million ha with high economic efficiency. In this context, irrigation will become the most important water consumer in agriculture and one of the main consumers nationwide, demanding on average 35-45% of the country's exploitable water resources. Water resources in Romania are low with a value of about 1660m3 / inhabitant and in other countries in Europe they are 2.5 times bigger and, therefore, it is important to promote techniques and technologies that efficiently capitalize water from various sources with low energy consumption, soil water and its circulation. About 41% of our country's arable land is affected at some times of the year by excessive humidity on about half of the arable area and in the same year longer or shorter droughts are recorded and watering with variable rules is required; soil erosion phenomena are manifested on 35% of the total agricultural area. Water resources in Romania are modest compared to other countries in Europe (11th place for local resources and 21st place for the ones formed on its territory) [1]

Due to the fact that for the watering of the plants an important amount of fresh water is used and their needs are higher in dry periods, other sources of water (groundwater, drainage, wastewater, precipitation water etc.) are needed which by their chemical composition qualitatively corresponds to plant requirements.

The effects of the watering process are felt both economically and socially and in environment protection. Watering ensures the normal development of agricultural crops which leads to stable revenues, by increasing the photosynthesis process to enriching the atmosphere in oxygen and reducing the carbon dioxide content, allowing the development of microbial activity in the soil and increasing the humus content by producing a quantity of increased by vegetal debris, avoiding the deterioration of the ecological balance by improving the drought-affected microclimate. Gravitation is the oldest form of irrigation. The surface leakage consists in the fact that water is distributed on the ground by free flowing on the furrows or strips, while the drain and the infiltration of water into the soil, take place. In general, the lands for watering are modelled by shaping them to ensure a continuous slope imposed by the general characteristics of the leakage, the watering method or the requirements of the agricultural exploitation.

The modelling of irrigable agricultural land is of particular importance because this work ensures a uniform distribution of water in the soil, whether it is conducted through furrows or strips on the surface of the land, or it is sprayed. Opening the interrupted furrows is necessary in the following situations:

- on landscaped lands for sprinkling with fixed or mobile installations and with uneven or sloping streams causing water leakage and pouring into microdepreses;
- on lands with kneaded microrelief with small slopes, not arranged for irrigation and in which rainwater flows rapidly downstream, being not used by the plant and producing the phenomenon of erosion [2].

MATERIAL AND METHOD

Watering is both an important technological sequence in the crop culture agro technology, as well as the most important technical means of eliminating the water of the soil, constituting the infrastructure of sustainable development. Technologies to combat the effects of climate change have evolved to reduce the water consumption of plants (dripping, micro-spraying). of the superior capitalization of water by reducing losses and associating with other works (fertilization, herbicides, etc.) and using other sources of water waste from animals or rural, urban and industrial environment).

To meet water requirements, it is necessary to adopt new technologies that reduce water consumption by associating with other works, storing water from other sources, distributing water near plant roots, increasing watering efficiency etc. The rational use of water in agriculture implies prioritization of water use in critical situations (droughts. etc.), the adoption of measures to impose the application of reference models, the application of innovative solutions for reducing water losses, the quality control of water for the reduction of environment pollution. A superior valorisation of the water from the rainfall and also of the water obtained by the sprinkler irrigation method is obtained by modelling the soil surface.

In the case of continuous or interrupted furrows, it is intended to obtain as many sections of the furrow as necessary to carry and accumulate as much water as possible. Interrupted brasses are executed to reduce the erosion phenomenon resulting from rainfall, slope or creep. Depending on the sowing scheme, interrupted watering grooves can be performed on sowing crops between plant rows, alternately or on each interval.

Furrows used in agriculture are of great importance for agricultural production and are a major component of the agricultural ecosystem [3] [4] [5] and [7].

It is estimated an increase in agricultural production per hectare by 20% in agricultural crops with broken furrows. This is explained by the infiltration of a larger amount of water at the plant roots and by the reduction of the soil erosion phenomenon [1]. Water management along the plant line or uniform storage is achieved with continuous or interrupted furrows (compartments).

For the constructive and functional analysis of mechanically operated equipment for open furrows used in owing crops technology and viticol and fruit plantations, it is necessary to study the constructive characteristics of these equipments, the functioning of the working parts and the working process carried out by them so that at the end to be able to recommend the best constructive solution that can be considered.

RESULTS

The open furrow work is known as soil processing by ridgeplowing (soil modelling) and was initially made with the help of some trailed animals.

This operation is done with a machine that works in aggregate with a tractor, the machine on which is mounted equipment for continuous furrows or specialized equipment for making interrupted furrows.

The machine equipped for the execution of the continuous furrows is made up of ridgeplows which make the tringhiular section of the furrow and the modifiers that make the parabolic section and the finishing of the furrow; the machine equipped for the execution of the interrupted furrows is composed of the same ridgeplows, the rotors with blades and a mechanism for controlling the rotors for interruption of the furrows and the execution of some digestions (plugs); both equipment is mounted on a frame with supporting wheels. The number of workstations is selected based on the sowing pattern, the section spacing and the row between the processed rows (on each interval or at two intervals). The most commonly used seed sowing scheme is 6 or 8 rows and the maximum number of machined intervals is 5 and 7 respectively, which must coincide with the number of workstations.

In the case of continuous or interrupted furrows, it is important to obtain an enlarged section of the furrow (Figure 1) to transport and accumulate a larger volume of water respectively.

Figure 1 - Continuous compartmented furows after rain [2]

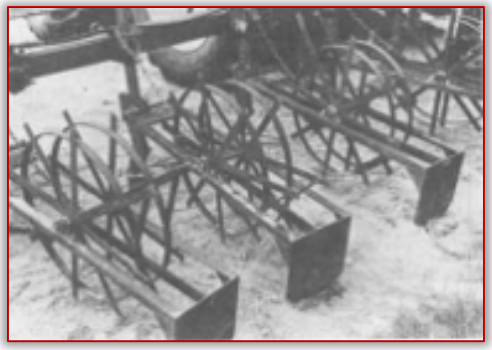

Figure 2 - Equipment for continuous open furrows [2]

Aspects during working with a broken open furrow are shown in Figure 3-6.

Figure 3 - Open furrow machine compartmented into each row interval [6]

Figure 4 - The open-beam machine is divided into three ranges

Figure 5 - Open furrow machine divided over a single interval [8]

Figure 6 - Open furrow machine compartimented over a single interval [9]

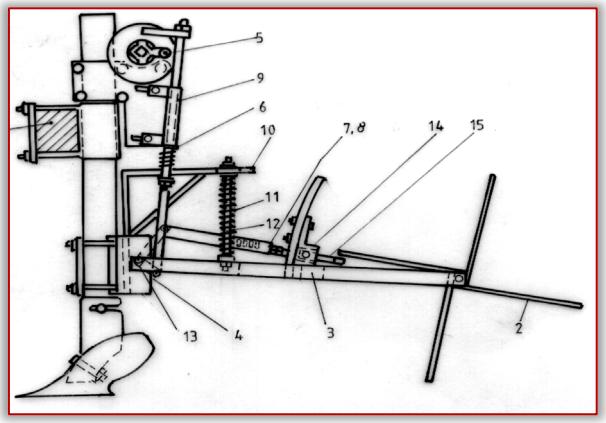

Figure 7 - Work unit with splitting furrow equipment [10]:
1. Equipment frame for opening watering furrows; 2. Pallets rotor; 3. Support arm; 4. Lever system; 5. Roller cam; 6. Resort traction; 7. Adjusting pipe; 8. Adjustment nut; 9. Guide; 10. Surface support; 11.Rod; 12. Compression resort; 13. Joint; 14. Lock bolt guide; 15. Bolt lock

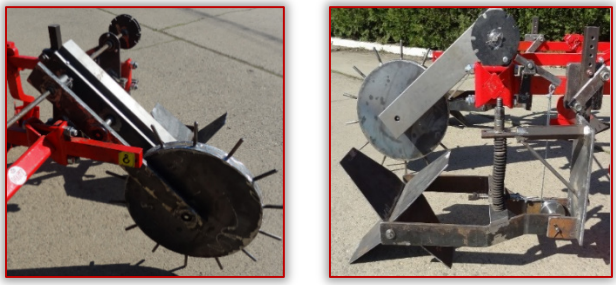

Figure 8 - Driving mechanism [6]

The adriving mechanism aims to unlock the pallet rotor to form the ground plug on the furrow. It consists of the following main parts:

- camshaft support;
- camshaft;
- lever / cable and locking bolt.

The control mechanism of the rotor blades in order to interrupt the furrows on variable lengths correlated with the slope of the ground is driven by the rotating wheel (Figure 8). The rotation motion is transmitted by means of a chain transmission (Figure 9) to a cam shaft positioned next to each work section.

During the rotation movement, the camshaft will operate the lever / cable mechanism from each section in the direction of unlocking the blade by means of the locking bolt and by rotating the blade, the furrow plug will be made at predetermined distances. The rotors will have three or four pallets of trapezoidal shape being pressed on the bottom of the furrow by two spring-mounted bends or spring-loaded spring bends. The time when the rotation of one of the pallets will be blocked by a bolt it will scrape the bottom and the side walls of the furrow by mobilizing a quantity of soil in front of it.

When the eccentric cam is operating the lever mechanism, the bolt retracts. releases the rotor with the blades, which rotates one step leaving a ground plug with a base width between 20 and 40 cm and the height equal to the depth of the furrow . While the blade rotor rotates with a 90 ° bolt released by the camming action, it returns to the previous position blocking the next rotor blade and then repeating the cycle. The device provides for the modelling of the watering compartments on the intervals between the plant ranges in two ways: alternatively a range with a furrow and a furrow interval or consecutive interval, depending on the sowing pattern, the soil type and the root zone [6].

Figure 9 - Chain transmission for driving the rotor control mechanism [6]

Since lately. temperatures have been growing at increasing intervals, watering of trees and vines is becoming a necessity. In FIGURE 10 is presented the equipment for modelling the soil in furrows divided into vineyard plantations, simultaneously in two furrows per interval PCMV2.2 + EMBC2-0. at a distance of 20-40 cm in order to accumulate water from precipitation in the soil on the surface to which the droplets fall, avoiding water leakage outside the cultivated perimeter or accumulation in depression areas on land with a slope of up to 5% on mild, medium or heavy texture, showing a depth of at least 250 mm at a near humidity by the minimum ceiling. The equipment consists of the following main components: 2 plows (left. right), a device for making split compartments provided with a control mechanism and optionally with two knife arrows if the simultaneous carrying of the pigs is desired. The plows are mounted on the plow frame in the lateral sides corresponding to the plowing in the bellows with the furrow overhanging inside the row, having the support of the deformed bodies towards the inside of the frame.

The device for making compartmented furorows consists of the following main parts: the control mechanism, the rotor support. the blade rotor and the presser mechanism of the rocker blades. The adjustment of the swath compartmenting mechanism will allow the creation of soil plugs along the furrow at different distances (1.5. 3 or 6 m).

The driving mechanism consists of spur gear, transmission and drive mechanism. The spur gear is provided with steel spurs on the belt to increase the grip on the ground, avoiding skidding. For the transport position, the spur gear will be locked in a vertical position. The transmission is of the chain type and has the role of transmitting the movement from the spur gear to the camshaft. The driving mechanism is designed to block the blade rotor to form the ground plug on the furrow.

Figure 10 - Equipment for soil modelling in furrows compartmented on fruit and vineyard plantations. simultaneously in two furrows per interval. PCMV2.2 + EMBC2-0 [6]

CONCLUSIONS

In order to provide the soil with additional water to those naturally received by precipitation, it is necessary to develop technologies adapted to the new pedoclimatic conditions.

Technologies to combat the effects of climate change have evolved to reduce the plants water consumption (dripping, micro-spraying), high water utilization by reducing losses and associating with other works (fertilization, herbicides. etc.) and using other sources of water waste from animals or rural, urban and industrial).

A superior capitalization of water from precipitation, as well as of water obtained by sprinkler irrigation method is obtained by shaping the soil surface in the form of continuous or interrupted furrows. It is estimated an increase in agricultural production per hectare by 20% in agricultural crops with lands so shaped.

Note: This paper is based on the paper presented at ISB-INMA TEH' 2017 International Symposium (Agricultural and Mechanical Engineering), organized by University "POLITEHNICA" of Bucharest – Faculty of Biotechnical Systems Engineering, National Institute of Research-Development for Machines and Installations Designed to Agriculture and Food Industry – INMA Bucharest, Scientific Research and Technological Development in Plant Protection Institute (ICDPP), National Institute for Research and Development for Industrial Ecology – INCD ECOIND, Research and Development Institute for Processing and Marketing of the Horticultural Products "HORTING" and Hydraulics, Pneumatics Research Institute INOE 2000 IHP, University of Agronomic Sciences and Veterinary Medicine of Bucharest (UASVMB) – Faculty of Horticulture and Romanian Society of Horticulture (SRH), in Bucharest, ROMANIA, between 26 – 28 October, 2017.

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