

RESEARCH OF THE MAIN PROCESSING WORKS FOR ESTABLISHING A JERUSALEM ARTICHOKE CROP ON DIFFICULT AND CONTAMINATED SOILS

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ABSTRACT

Jerusalem artichoke, is a technical plant that have some special features which make it suitable to be cultivated on degraded and difficult soils. However, processing difficult lands can cause major problems for farmers, in terms of using the right technology and reducing investment costs. The paper aim to address to the main challenges faced in preparing the soil for a Jerusalem artichoke culture, in order to maximize the productivity and efficiency.

INTRODUCTION

From many perspectives, the Jerusalem artichoke crop can be considered a plant that deserves to be taken into account for cultivation. This crop can bring a high economic profit, due to the very high production that can be obtained by harvesting the tubers per unit area and their high marketing price. The plant can be fully fruited, because the aerial biomass of the plant can also become a source of income, being used both as animal feed and as an energy plant.

Another advantage of cultivating these plants is the resistance of the tubers to extreme soil temperature conditions, during the winter. The establishment and maintenance of this crop does not require high costs compared to other crops in the category vegetable species. The soil on which this plant is grown does not require special qualities, the plant can be grown on degraded and difficult soils, on which other plants do not give economic efficiency. In Romanian climatic conditions, the plant can be exploited as

a perennial plant, but very good results are obtained when the Jerusalem artichoke culture is established and harvested annually.

MATERIAL AND METHOD

The Jerusalem artichoke culture is very similar to that of the potato, much better known in our country, but, unlike the potato, the Jerusalem artichoke has a much deeper rooting capacity, reaching up to 80 cm depending on the variety grown and the type soil. They have no special demands on the soil. Good results are not obtained on heavy soils, with excess moisture, preferring meadow soils, sandy-clayey, loose, rich in humus and calcium, with a pH between 6-7.5. It also has special demands on light, preferring sun-exposed soils.

From the point of view of establishing the crop, Jerusalem artichoke is a plant that supports various technological options, it can be successfully cultivated even in an ecological system. The cultivation technology is very similar to that of the potato, stating that the establishment of

the crop can be done successfully in the autumn. From the research conducted at S.C.D.L. Buzau came to the conclusion that there are no significant differences in production between Jerusalem artichoke crops established in autumn compared to those established in spring. The preparation of the soil, of the germination bed for the establishment of a Jerusalem artichoke crop is done according to several soil parameters, such as: the degree of weeding of the soil, its texture, soil moisture ([http://evyrafid.ro/2017/08/28 / lucrările - solului-lucrarile-de-baza/](http://evyrafid.ro/2017/08/28/lucrarile-solului-lucrarile-de-baza/)).

The Jerusalem artichoke crop, (figure 1) being in many ways similar to that of the potato, can be grown on soils with different degrees of water maintenance, in this category falling both clayey soils and the category of sandy soils. The best soils are well-structured ones that allow the roots to aerate for the smooth development of the tubers and with a proper drainage of water.



Fig. 1 Jerusalem artichoke culture

Where possible, extreme soil pH values will be balanced, in order to provide proper development conditions. ([https://www.yara.ro/nutritia-plantelor/cartof /agronomic -principles/](https://www.yara.ro/nutritia-plantelor/cartof/agronomic-principles/))

For the establishment of Jerusalem artichoke crops, the land is prepared by using a disc harrow to destroy weeds and plant debris. Then a classic plowing is done if the soil requires such work or a loosening of the soil is done with the help of the scarifying equipment if the soils on which the crop is to be established are compact or heavy. Loosening the soil by scarification

considerably reduces soil compaction which leads to higher yields.

After the plowing or scarifying work, the land is levelled. The preparation of the land for planting is done by mobilizing the soil to a depth of 14-18 cm, with the help of the combine or cultivator. In this phase, various complex organo-mineral fertilizers can be administered. ([https://www.botanistii.ro/blog/topinambur -cum-sa-plantezi-si-sa-ingrijesti-aceasta-leguma/](https://www.botanistii.ro/blog/topinambur-cum-sa-plantezi-si-sa-ingrijesti-aceasta-leguma/))

RESULTS AND DISCUSSIONS

Surface tillage operations repeatedly lead to aggressive degradation of the soil, its structure. This affects the development of the root system of crops, water absorption and nutrients. The scarifier is a machine that can significantly improve the physical properties of the soil, especially the porosity of the soil. Scarifiers are used for deep loosening of the soil. This work aims to improve its aeration, facilitate the infiltration of water more easily in depth and achieve optimal conditions for the development of plant roots (https://ro.wikipedia.org/wiki/Aerarea_solului)

The working process performed by the loosening member consists of cutting the soil in a horizontal plane, detaching it from the ground mass and lifting it on the inclined plane of the coulter. At the same time, the vertical support acts on the ground; the raised ground mass is split and moved sideways by pressing, forming a ditch after passing the machine.

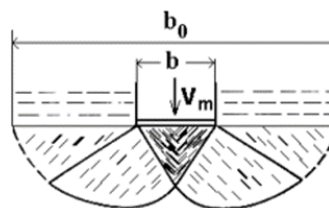


Fig. 2. Deformation zone created by the scarifier coulter, (CIULU GH., 2002)

During the lifting of the dislocated soil, a deformation zone is created in front

of the working member. The hypothetical sliding lines, which delimit this area, are presented in figure 2. In front of the coulter a compact triangle is created, which moves the dislocated soil to the side. In the deformation zone the soil is loose, (figure 3). The study of the effects of the distance between the working organs of the subsoiler on the tillage characteristics can determine the optimal distance between the working organs. This study is not easy to perform due to the existence of many factors that influence this process such as: soil variation, machine dynamics, complexity of soil dynamics. (Chengguang Hang 2018)

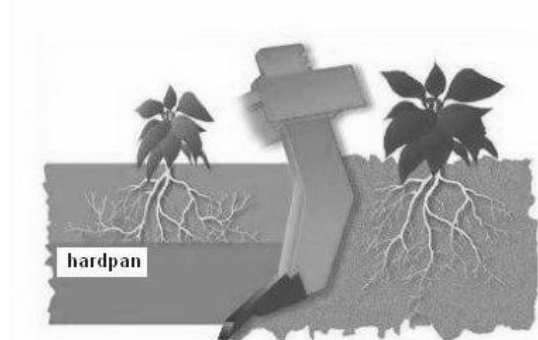


Fig. 3. The effect of deep loosening on the soil (Ciulu Gh.2002)

Loose members have different construction shapes. A more intense loosening is obtained by mounting on the support an additional organ, usually an arrow, which works at a shallower depth than the main loosening member. (Vlad R. 2013)

RESULTS AND DISCUSSIONS

For soil preparation, in order to establish a Jerusalem artichoke crop, combine harvesters are used. This type of equipment is equipped with different types of active organs: type arrows with equal wings; claw or chisel type; fangled harrows, helical harrows, disc harrows; milling cutters; levelling blades, etc., so they can perform various works such as: simultaneously removing weeds, shredding lumps, levelling the ground, loosening the surface and deeply compacting the soil. The combined

aggregates consist of machines and equipment suitable for the preparation of the germination bed, the application of chemical fertilizers, herbicides and insecticides, sowing or planting

By carrying out several works in a single pass, the number of passes of the aggregates on the plots is reduced, reducing the degree of compaction of the soil by the wheels of tractors and work machines at repeated passes on the ground, reducing energy consumption, respectively fuel consumption for the execution of these works. Also, by using combined machines, germination bed preparation works, sowing or planting works can be performed in the optimal periods, corresponding to the agrotechnical requirements.

The combined machines are intended for the simultaneous execution of several works. By destination they are classified into three groups:

- Combined machines for the preparation of the germination bed (combiners);
- Combined machines for the preparation of the germination bed, simultaneously with the application of herbicides, insecticides and chemical fertilizers;
- Combined machines for the preparation of the germination bed, simultaneously with the application of herbicides, insecticides, chemical fertilizers and with the execution of sowing or planting work. The most common are the combined machines for the preparation of the germination bed - the combine harvesters, which at a single pass ensure the preparation of the land for sowing or planting



Fig. 4 Cultivator HORSCH Tiger MT (<http://www.agriculturaromaneasca.ro/produse/cultivatoarele-horsch-tiger-as-tiger-dt-tiger-lt-tiger-mt-tiger-xl-1003-t10.html>)

In figure 4 we have presented a cultivator with a common configuration, in modern agriculture, in order to prepare the soil for planting or sowing. When preparing the germination bed, the aim is for the soil surface to be well levelled without ditches, the ridges to have a uniform appearance. The optimal time for the execution of the germination bed preparation works is chosen according to the soil moisture, and this humidity is optimal when the soil does not stick to the working organs, the effect of cutting and settling the soil being diminished. Failure to comply with the time and optimal period of execution of land preparation works leads to a decrease in the quality of the work. Delaying the preparation of the germination bed, causes the soil to dry out, which determines the reduction of production by 10 - 25%, but working the soil too wet does not produce the necessary loosening and will lead to soil degradation. In order to achieve the necessary planting depth, we must choose the right machine depending on the condition of the works previously performed (plant debris, weather conditions, peculiarities of the planting material, etc.), but also their regulation and speed of movement. In ploughing activities, when weeds have already been installed, they must be completely cut and detached from the ground, (<http://agroromania.manager.ro/articole/stiri/pregatirea-patului-germinativ-in-agricultura-ecologica-9991.html>)

There is no standard answer when choosing a tillage system. Most farmers who opt for reduced crossing systems use a number of different systems depending on farm conditions. However, there are a number of situations in which a particular piece of equipment is preferred to have the desired processing effect. Discs work best:

- for surface cultivation
- when plant debris needs to be foliated
- when lumps should not be too large, especially on heavy and dry soils

- when there are too many stones on the surface - the discs press the stones into the ground

- when the power requirement is important
- when a high cultivation speed is required

Teeth work best:

- when straw needs to be spread or mixed
- when deep loosening is required
- in humid conditions
- when there is a risk of creating hard layers
- when the hard layers must be crushed and the soil must be raised
- to eliminate traces and irregularities

A good germination bed ensures quality sowing, uniform germination and emergence of plants, achieving optimal density and, finally, high, good quality crops.

CONCLUSIONS

In the last period, the interest of the farmers regarding the optimization of the soil processing phases, in order to achieve a quality germination bed that lead to obtaining high yields, has increased considerably. Numerous articles and studies have been made to present solutions regarding the reduction of fuel consumption, uses of working organs with geometric shapes, that allow a minimum energy consumption. It is also found through actual studies that the working speed of the unit, soil conditions (soil moisture, soil texture, type of stubble) can influence the degree of optimization of the work performed.

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