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HEMP CULTIVATION IN ROMANIA. PRESENT AND FUTURE

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Abstract: Hemp is not a crop prohibited or restricted by law, only that such a plantation must be authorized and monitored by the Ministry of Health, the Ministry of Internal Affairs and the Ministry of Agriculture and Rural Development. Beyond the impediment to authorization and monitoring, hemp cultivation brings more than profitable gains to those who invest in it. It is grown for its relatively high natural fiber content and for its seeds rich in drying oil. Hemp fibers are longer than flax, very durable and quite resistant. They are used to make a wide range of rot-resistant textiles, even in water. Short fibers (tows) are used in the manufacture of mattresses as well as as an insulating material. Lately, the market demand for green hemp inflorescence has increased. The paper will present the partial results obtained in a research project in which a piece of equipment for harvesting green hemp stems was grounded and made in order to process these stems to obtain fibers. However, there are factors in the agro-industrial chain that limit the large-scale marketing of these crops and their products. From an agronomic point of view, some of the problems are associated with technological gaps in harvesting technologies, which prevent the full exploitation of some crops. For example, the production of high-quality textile fibers depends primarily on the quality of the raw material, which in turn is linked, inter alia, to the efficiency of the harvesting system adopted. In most cases, these systems have been developed locally, based on available solutions related to specific local agricultural practice. The purpose of this paper is to present a review of existing mechanical harvesting systems for hemp fiber crops with special reference to hemp. In addition, the paper will provide a description of the innovations that have been adopted in recent years to improve harvesting processes to increase the value of these crops and their products, made by INMA Bucharest.

Keywords: green hemp stalks, industrial plant, technology, processing

INTRODUCTION

Agriculture is the branch of the economy that provides in addition to daily food and a part of the raw material related to other areas of the economy, raw material resulting from the cultivation of some technical plants: flax, hemp, cotton, etc. At the moment, the demand for hemp on the European market is growing, and the value of the subsidies offered by the European Community helps farmers to make a profit.

Industrial hemp (Cannabis sativa) is considered to be one of the most profitable crops. According to specialists, the profit that can be obtained per hectare when cultivating this crop can reach 7-10 thousand euros, but the restrictions imposed by the authorities do not allow farmers to cultivate it.

Hemp is a multifunctional crop that, worldwide in the last decade, has been the subject of many research projects and industrial enterprises (*Amaducci S., et al, 2017)*. Hemp cultivation can reduce deforestation. One hectare of hemp is the equivalent of four hectares of forest, when we talk about the pulp used to produce paper. The wood produced per hectare of hemp is equivalent to the amount of wood that is made by the annual growth of one hectare of mature fir forest. The vegetation period of hemp is about 100 days, which does not compare with the time required to plant and obtain cellulose from the trees of a forest. Starting in 2020, it is expected that most textile companies in the world will switch to the production of hemp fiber.

Hemp strains from local populations and wild hemp contain 10-12% fiber, and improved varieties, 26-32% (*Nedelcu A. et al, 2020*).

Before 1989 in Romania over 50,000 hectares were cultivated with hemp, but in the 2000s hemp disappeared from Romanian agriculture, only after 2012 the cultivation of hemp began to enter the attention of Romanian farmers *(Cotuna O.. et al, 2020)*. Romania was the third largest producer of hemp fiber worldwide, the production being mainly concentrated in the counties of Timiş, Arad, Bihor, Satu Mare, favorable to hemp cultivation. In recent years, trends have been reported to revive hemp into other production niches, such as the production of oil from hemp seeds and the extraction of hemp fibers by mechanical peeling of the stems. Industrial hemp is a plant used to obtain textile fibers for food purposes which, in order to be planted, must by law have an overall THC content between 0.2% and 0.6%. The substance content with psychoactive effects tetrahydrocannabinol (THC) in Cannabis Sativa (industrial hemp) is only 0.2%, ie one hundred times less than in narcotic hemp (Cannabis Indica) (*Carmen Brăcăcescu et al, 2019*). It is time for hemp cultivation to return to the range of agricultural crops in Romania, say researchers from the Lovrin Agricultural Research and Development Station (*Cotuna O.. et al, 2020*).

At Lovrin, the hemp culture never disappeared and the improvement works continued after 1989. At SCDA Lovrin, valuable varieties of hemp have been obtained over time. We mention here the dioecious hemp varieties for fiber and seed: Lovrin 110, Silvana, Armanca and Teodora. Also at the SCDA Secuieni resort, valuable varieties of hemp were obtained. Of particular interest worldwide is the cultivation of hemp for the extraction of cannabidiol (CBD) for the pharmaceutical industry. In this sense, breeders have produced hemp varieties that produce compounds that can have pharmaceutical value. One such product is cannabidiol.

About cannabidiol, studies show that it has antiemetic, neuroprotective, antiepileptic, antipsychotic, anti-inflammatory properties, etc. (*Grotenheim and Müller - Vahl, 2016*). Romanian varieties are not drugs. They have a TCH (tetrahydrocannabinol) content below 0.2%, a level imposed by the EU.

The project developed by INMA *(PN 19 10 01 03, INMA)* aims to achieve technologies and equipment for green harvesting and processing of hemp stalks, to meet the requirements of current growers and processors of hemp cultivation.

MATERIALS AND METHODS

The primary processing of hemp aims at extracting the textile fibers contained in the stems of these plants, by removing with the help of physical, chemical, biochemical and mechanical means the non-filable components (epidermis, parenchyma and lumen) contained in the stems. After processing, two categories of fibers are obtained, which are called *molten fibers* and *unmelted fibers* (*Cuzic-Zvonaru C. et al, 2002*).

Figure 1 shows the complete technological scheme of the hemp processing process in the case of molten fibers. It should be noted that at the moment there are only two smelters in the country.

The molten fibers are obtained, as a rule, by going through two stages:

- in the first stage the aim is to destroy, or at least weaken the connection between the fibrous bundles and the neighboring tissues or the tissues in which the fibers are embedded. This step is called generic melting and is performed by biochemical, chemical or physical means;
- the second stage, performed with mechanical means, aims to eliminate the non-filable parts, respectively the remains of the epidermis and parenchyma, as well as the entire wooden part.

The unmelted fibers, obtained by the so-called "green" processing of hemp, go through a single stage, aiming only at the elimination of the main wood mass of the plants by mechanical processing. The dehulling of the green stems results in a semi-finished product, which is subsequently dried and can be subjected to a ennobling process, biological, chemical or physical, and the fibrous material obtained can be spun directly in this state, even being called green processed fiber. In general, a number of technological phases are included for the primary processing of hemp, some of which are excluded, depending on the variant of obtaining the melted or unmelted fibers.

A complete process of primary processing involves the following technological phases:

- preparation of stems for melting;
- melting the stems;
- drying the molten stems;
- mechanical processing of molten stems by crushing and melting;
- processing and sorting of melita tow by drying, shaking and ennobling;
- sorting flax and hemp;
- pressing and packing the rope or tow.

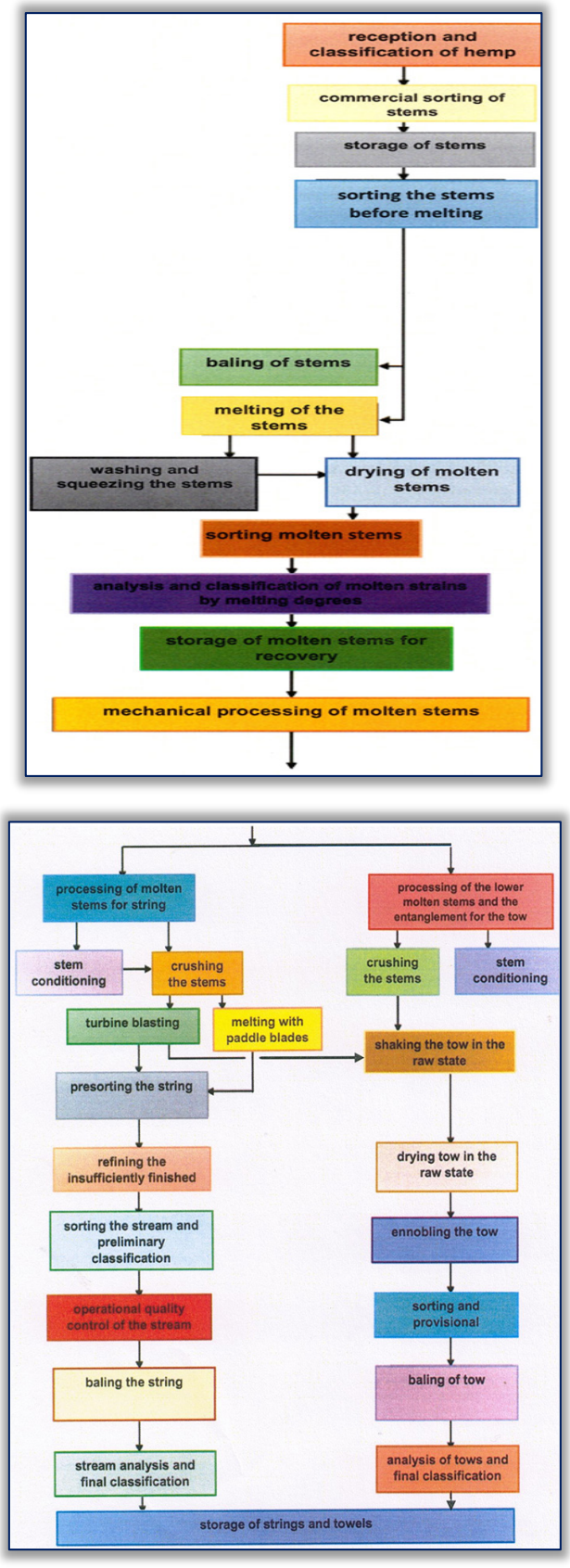

Figure 1. Complete technological scheme of the hemp processing process in the case of molten fibers

If melting is excluded, the resulting fiber being unitary, from the seven phases are excluded those concerning melting and, respectively, the grouping of technical fibers into strings and tow.

Because in Romania the processing of hemp by melting is almost non-existent and to meet the requirements of the beneficiaries, who grow or process hemp, INMA has developed a technology, figure 2 (*Păun A. et al, 2020*) and a technical equipment for harvesting and processing strains of green hemp figure 3 a and b (*Olan M., et al, 2020*).

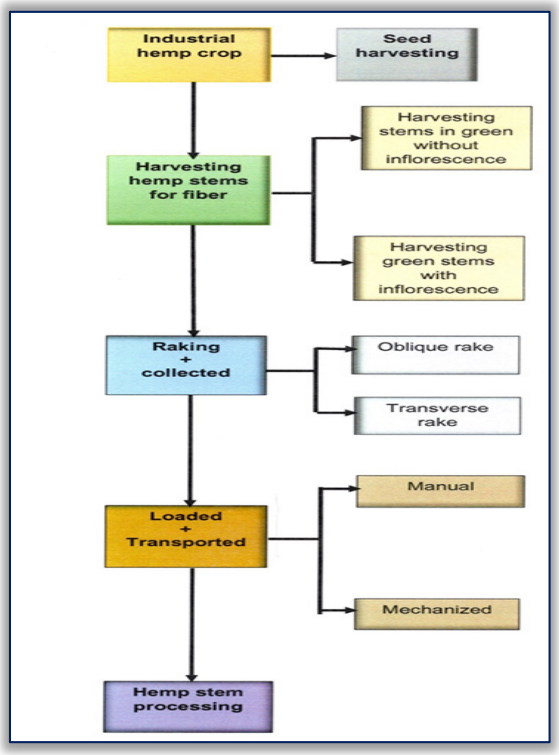

Figure 2. Technology for harvesting green hemp

Figure 3. Technical equipment to process green hemp stalks

The experimental model of Green Hemp Stem Harvesting Equipment ERCV, figure 3 a is intended for the sequential harvesting of hemp stalks, in order to process them to obtain the string.

In the case of using this equipment, the cut plants remain mixed in the furrow, the inflorescence with the stems. Strain losses to be less than 5%; broken stems of up to 6%. It should be noted that this equipment is intended for small and medium farms that grow hemp.

The green harvesting equipment of hemp stems, figure 4 a and b consists of the following components:

Figure 4. a Green harvesting equipment for ERCV hemp stems (Păun A. et al, 2019)
1-ERCV assembled mobile platform - 1.0; 2-Knife 1 ERCV - 2.0; 3- Knife 2 ERCV - 3.0; 4-ERCV hydraulic installation - 4.0

Because the height of the inflorescence of the hemp varieties varies, Knife 2 ERCV - 3.0 has the possibility to adjust the cutting height in a wide range of values with the help of a vertical cylinder. The second hydraulic cylinder works at the stroke ends in the working or transport position of the equipment.

In transport, this knife can be folded 90 degrees backwards on a support (figure 4), with the help of the hydraulic installation. This knife is a double-edged knife like the first knife.

Each knife is driven by a hydraulic motor through a distributor, driven by the hydraulic installation of the equipment.

RESULTS

Before entering the hemp crop, the tractor is started and the two cutting devices are operated by means of the hydraulic installation - ERCV - 4.0, figure 5 (*Bogdanof C-ti.G. Et.al. 2019*).

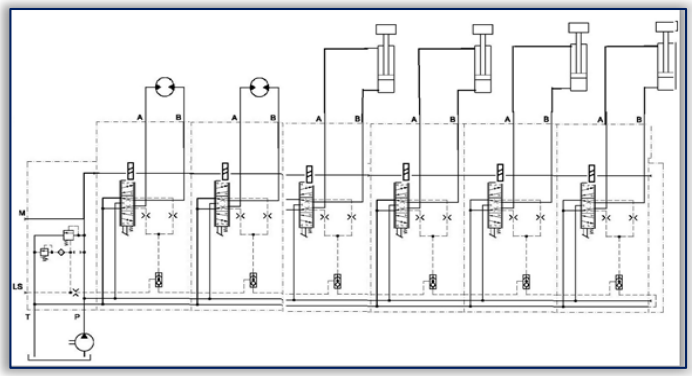

Figure 5. Hydraulic scheme

The equipment for harvesting and processing the hemp stalks in green was subjected to house tests using as raw

material hemp from the culture at INMA. The house tests consisted in checking the following aspects of the standard - SR EN ISO 12100: 2011 - Safety of machines. General design principles. Risk assessment and risk reduction applicable to products. Also, during the house tests, the integrity of the equipment and the general technical condition of the transmission, the guards, the active organs were checked.

The experimental ERCV model provides the following general characteristics:

- car type: Trailed
- energy source: tractor >65 CP
- type of the cutting device: double knife
- number of cutting knives: 2
- rear cutting device: 100 mm
- front cutting device: 1500-2500mm

As the 2021 hemp crop (from INMA) did not meet the requirements imposed by the harvesting equipment (uneven height, low density, etc.) the tests under operating conditions are to be carried out in 2022.

CONCLUSIONS

It is a technical equipment for small and medium-sized hemp farms. From the house tests it was found the following:

- the average cutting height from the ground did not exceed 100 mm;
- due to the variable height of the culture not all the inflorescences were cut, a compact furrow did not result
- strain losses were greater than 5%;

It is a technical equipment for small and medium-sized hemp farms.

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