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CONSIDERATIONS REGARDING THE HEMP HARVESTING

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Abstract: Hemp is one of the oldest plants cultivated in Romania (over 2000 years). In the past, there was a tradition in hemp cultivation, and nowadays there are existing European and national programmes that aim at increasing the surfaces cultivated with hemp. The hemp has over 25,000 utilizations, starting from food, paints and fuel up to clothes and building materials [2]. According to European laws, in Romania might be cultivated only the hemp varieties with a tetrahydrocannabinol content smaller than or equal to 0.2%. The hemp varieties chosen for direct payments are Denise, Diana, Lovrin 110, Silvana and Zenit.[3]. This article tackles several combines and equipment designed to mechanized harvesting of hemp cultivated on larger surfaces due to its food and energy potential.

Keywords: hemp, hemp harvesting, varieties, plant, energetic potential

INTRODUCTION

The hemp has a non-branched stem, long lanceolate leaves with serrated edges and dense semi-compact inflorescences. Plant leaves are hairy, male flowers forming poliniferous panicles, and female leaves are green and the fruit is a greenish-grey achene, (Bruce D.M. et al, 2001).

It is made of three parts, all useful: seeds can be used to prepare different food, oil and medicinal products; fibres are used in industry (to clothes up to cars) – they form the stem middle layer and are covered by a thin protecting stratum; the wooden core remained after extracting the fibres is the part used (lime included) for buildings (although we found information showing that it is possible to use the whole stalk –meaning that fibres and ligneous core should not separate).

We number several varieties of hemp (10, 11,12):

- # Denise – is a mixed monoecious variety, for fibres and seeds, homologated in 1999, obtained by hybridization, cross breeding and repeated selections, aiming to obtain high yield of stems and seeds ; it represents a variety with mixed cultivation features, being more resistant to spring low temperatures, allowing an early sowing. It blossoms by 4-5 days earlier than Secuieni 1, in the first stage the female flowers bloom ; the interval of blossoming lasts 20-25 days. The stem crop has a growing period of 120-130 days and 140-150 days for seeds. The average stem harvest can range between 8.2-10.5 t/ha depending on the agrofond applied and thermal and rainfall regime. The seed harvest reaches 1200 kg/ha, and fibre content is of 29-30%, determining a production of 2900-3200 kg/ha technical fibres.
- # Zenit – is obtained by hybridization and monoecious selection of Secuieni and a local population De Arieș. It is a monoecious variety with the smallest content of THC for homologation. Plant size is very reduced and the growing period is of 110-120 days. It is a specific variety designed to seed, -1100-1500 kg/ha, but also to fiber production (28% content of technical fibres and a production of 7.8-8.5 t/ha stems), can be obtained.

- # Diana is a variety obtained by selection and repeated crossbreeding between Hungarian dioecious varieties of high yield of stems and fibres, but tardy and with coarse fibre and monoecious selections from laboratory genetic sources.
- # Dacia –Secuieni, is a variety of monoecious hemp, homologated in 2011 for stems and fibres. It was achieved by selection of line AR-1 component of Diana variety brought at maximum yield after genetic and biological degradation through uncontrolled multiplication within the process of obtaining seeds and dioecious line K-7.
- # Secuieni – Jubileu – is a monoecious variety, homologated for production of seeds and oil, 33.8% content, as well as for its quality. It is a very precocious variety, the seed maturation happening in early august, by 15 – 20 days earlier than Zenit variety. Production of stems and fibres is close to Zenit variety, being an ultra-precocious derivation of its component families. [5]. Sowing density: at hemp for fibres- 70 kg/ha distance between rows 12.5 cm; at hemp for seeds- 15-25 kg/ha distance between rows 70 cm[12]

Hemp seeds contain: 36% oil, 28% proteins, 14-27% non-nitrate elements, 17.8-26.3% cellulose and 2.5-6.8% ashes. Due to this composition, hemp seeds can be used for extracting oil used directly for food and for obtaining margarine. Non-refined oil is designed to obtain varnishes, paints, linoleum, soap and waxed cloths. Seed is widely used directly, as such, or in concentrated fodder, bird food (especially for feeding exotic birds: parrots, canaries, peacocks, etc.).



Figure 1 - Hemp crop



Figure 2. Hemp inflorescence, [12]

The cakes remained after extracting the oil are used as such or in concentrated fodder for feeding birds, calves, horses, fish, etc. – 600 g of cakes equal as nutritive value 1000 g grains of cereals. Cakes should be carefully used for feeding cows with calf, as they provoke abortions. Hemp wood represent about 55% out of stalk weight and contains over 50% cellulose. The flake dust resulted when extracting the fibres or whole plant is used for obtaining: paper, agglomerated plates – phono-insulating panels, for furniture industry, artificial silk, puff for phonic insulation between the building plates. The seed crop chaff is a very valuable fertilizer: 10 t of chaff equal 40 t of litter. Leaves and inflorescences are used in medicine. [6]

Hemp harvesting can be performed in two stages both for fibres and seeds. For fibre hemp, the plants should be cut and left in the field, and in second stage after drying, their leaves are shaken and tied as sheafs of 20-25cm diameter and transported to melting houses. For seed hemp, the plants should be cut and left in the field to dry 7-8 days. Threshing the inflorescences is made by cereal harvesting combine. Seeds threshed are immediately cleaned, conditioned and dried.[8] In Figure 4 is shown the harvesting combine for seed hemp.



Figure 3. Hemp manual harvesting, [12]

MATERIALS AND METHODS

In olden times, hemp harvesting was made manually (fig 3), but, as surfaces cultivated with hemp increased, the harvesting methods modernized, thus appearing the harvesting machines of hemp both for seeds (Grabowska L.) and stalks. In Figure4 is presented a hemp field mowing with side rear mower. The hemp is mown and left in furrow for being tied as sheafs. In this case, hemp stem has different utilizations in industry.

Mechanized harvesting can be performed with Multi Combine HC 3400 (Figure 5), which is a self-propelled combine designed to hemp harvesting, launched in 2015, in Slovenia, at World Congress of Hemp. MultiCombine HC 3400 is endowed with a header similar to that of cereal harvesting combine. This header comprises: cutting apparatus with knife blades, rasp bar, header, conveying belt of

material cut towards the right end of header, where it discharges the material to another elevator that takes over the material and transports it to the combine body.



Figure 4 - Rear side mower [2]

The Multi Combine HC3400 body is tipping for enabling the harvested material discharge, respectively the hemp extremities where seeds are located, (Kaniewski R.). During the field movement, the combine tows the header on the transporting cart and folds the conveying belt of right part, belt that takes over the header material for easily displacing and surpassing the clearance issues.



Figure 5 - Multi Combine HC3400 for hemp harvesting [8]

In Figure 6a), we have: Tractor CLAAS XERION 4000, working in field, for harvesting the hemp crop. This tractor is endowed with a cabin that can rotate front-rear and with an equipment made of two harvesting headers. In front, there is one Jaguar type header for cutting the stems of hemp and in upper part, there is a rotor type equipment that cuts the hemp top (where seeds are placed). On right side, the tractor has a conveyor that takes over the material harvested by header rotor type that harvests only the hemp extremities and transport them to trailer [9].

In Figure6b, tractor Claas Xerion 4000 discharges the harvested material into the red trailer, towed by John Deer tractor, that transports the material. Body of tractor Xerion 4000 equipped for hemp harvesting, is tipping and is endowed with two hydraulic lifting cylinders, inclination of body under an angle of 30 degrees, conveyor chains on the body bottom, that are driven when the material is unloaded to the other trailer that ensures the transport to the farm.



Figure 6 - Claas Xerion 4000 [8]

RESULTS

In Figure 7a, we present the equipment for hemp harvesting that is endowed with a wide belt on longitudinal bars of rasp bar, where elastic teeth are placed, (popularly called hedgehogs). This belt is mounted for protecting the plant to be piqued by elastic fingers or to clogg. The belt may be made of wood, plastic, textolite, light sheet iron, rubber, and helps to introduce the plant into the cutting apparatus in right position. After cutting the material, it is transported to the header right end, where it is taken over by the conveyor mounted at the header end and is discharged on the conveying belt of elevator mounted on the truck that goes in parallel with tractor that harvests the hemp.

In Figure 7b is presented the frontal image of both tractor and truck going in parallel during the harvesting. The truck is endowed with an elevator of conveying belt type, that takes over the material harvested from the header. This conveying belt is mounted on left side of truck, situated between tractor and truck in the picture shown. At the end of the conveying belt, there is one person that controls the discharge of material into raphia square bags of about 900x900x900mm size.



Figure 7. Hemp harvesting equipment [7]

Hemp seeds harvesting with John Deer 660i caterpillar combine is shown in fig 8 a, b) that is endowed with two headers extension

and chopper of CSU type mounted in rear left side. Harvesting is performed by upper header, namely the cereal header with rasp bar and cutting apparatus with blades that cut the hemp extremities (where seeds are) and then the threshing flow is performed, obtaining the seeds in combine tank.

The lower header is of Jaguar type and chops the ligneous fibre, transforming it in chaff and incorporating it into soil when ploughing.



Figure 8 - Caterpillar John Deer 660i during hemp harvesting [7]



Figure 9 - Combine Claas of Jaguar type [4]



Figure 10 - Shortening the hemp with windrower [11]

In Figure 9, we can see the combine Claas Jaguar 650 type, endowed with 2 extended equipment, one original, the lower equipment that chops the ligneous fibre, leaving in furrow the fibre separated from hemp, and the second upper one of header type that cuts the extremities and remove them into furrow through the

right part of upper header, leaving in another furrow the extremities with seeds harvested, (Kobayashi Y., 2003). The harvested material, namely the seed extremities are left in furrow for several days for drying, approximately 7-8 days, after which they are threshed by the combine.

Shortening the hemp with windrower Figure 10, is performed in order to obtain short size harvest and enable the harvesting with combine with straw header. By this method, a short height hemp is obtained and harvesting is facilitated, because there is no need of two harvesting equipment (one that cuts the plant extremities and other that cuts the ligneous fibre) as in case of high hemp of about 2 meters height.

CONCLUSIONS

Hemp is a plant that can be successfully cultivated in our country because of its good adaptation features. The crop has a wide range of utilizations in industry of construction, textile, cars, pharmaceuticals and it has found that it also has a high energetic and food potential. Recently, the surfaces cultivated with hemp have increased, as well as the varieties number that give a better yield and are more resistant to draught, illness and pests. Hemp harvesting both for fibres and seeds has modernized very much, the agricultural machinery manufacturers being permanently concerned of creating high-performance harvesting machines. While certain manufacturers adapted the hemp harvesting equipment to tractors, others built self-propelled combines for hemp harvesting. Optimization of technology of cultivation of energy and food potential plants is an ongoing development activity, the hemp crop bringing by efficient capitalization, great profits to farmers.

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