

¹. Ana ZAICA, ¹. Radu CIUPERCĂ, ¹. Ancuța NEDELCU, ¹. Alexandru ZAICA, ¹. Lucreția POPA,
¹. Vasilica ȘTEFAN, ¹. Ana-Maria MARIN, ¹. Ioan-Ciprian MIRON, ². Lorena Diana POPA

CURRENT HEMP CULTIVATION TECHNOLOGIES

¹. I.N.M.A. Bucharest, ROMANIA

². S.C.D.A. Secuieni, ROMANIA

Abstract: Hemp is cultivated for its high content in natural, durable, resistant fibres and for its oil-rich seeds. Hemp for seeds is cultivated to fulfil the requests in the technical, cosmetic, food, fodder fields. Hemp has the highest industrialization capacity of all technical plants. Because for a long period of time, the cultivation of hemp in Europe as well as in Romania was in decline, being continuously practiced only in certain European states, it is desired to emphasize how hemp can make an essential contribution to the development of innovative solutions regarding the relaunch of the industrial hemp sector. The paper presents some research results obtained during the realization and experimentation of some technical equipment intended for the mechanization of the works within the hemp cultivation technologies in different systems. The technology of establishing, managing and valorising the hemp culture for fibre or seed can have perspectives starting with the conventional system, the ecological or successive one and at the level of experimental lots.

Keywords: technology, hemp, fiber, seed, sowing, soil

1. INTRODUCTION

Increasing cultivated areas in Romania and encouraging farmers to cultivate hemp represents a chance to return to tradition in our country's agriculture in conditions of economic efficiency. This culture can become a business with prospects for the future of Romanian farmers, given that the Romanian state encourages the development of this sector through substantial subsidies intended to encourage the return of hemp in the crop rotation structure of small households or larger farms, because this plant it was the most cultivated in the territory of our country.

The hemp industry went through a continuous process of degradation and almost ceased to exist in Romania. Before 1989 it included smelters, specific machinery and factories alongside tens of thousands of hectares cultivated annually with hemp, now this chain of production and processing no longer exists.

Hemp is cultivated primarily because it has a high natural fiber content, for its oil-rich seeds, and the fibers are longer than other textile plant fibers and are very durable and resistant. Hemp fiber was in great demand in construction as an insulator, it was used in the textile industry, for tent sheets, ropes, raw material for popular costumes, bags, and strings, because it was very resistant, (Troțuș, E. et. al., 2020)

The smelters, where hemp fibers could be obtained, represented that part of the textile industry that used the woody part of the stem, but it no longer exists and that is why the farmers who still cultivate in the current period do it only for the use of the seed, which is a loss because the rest the plant is not used.

Hemp fibers are used to make a wide range of textile products, being resistant to rotting even if it sits in water, the short fibers obtained from hemp are used to make mattresses. As is known, hemp has the highest industrialization capacity among all technical plants (cotton, flax, hemp and others) (Budoii Gh. et al, 2001).

Following cultivation with hemp, the land becomes suitable for the establishment of cereal crops in the following year, because hemp kills weeds. Also, the amount of chemical fertilizer required for a good production is much lower than for other crops (Suhorevschi M., Tabara V. 2009).

Hemp is used to extract the fibers by melting and crushing the stems and by extracting the oil from the seeds, which is used in various industries (Popa, L-D, et al. 2021).

2. MATERIAL AND METHOD

The cultivation technology of hemp, fig.1, mainly follows a series of steps known as for other crops, but with a specificity of climate conditions, soil, temperature, the place in rotation field which gives a fast pace of growth (ex. the fiber variety) quickly covers the ground with smothering and weed-killing effect.

Hemp is one of the plants that is self-supporting, being able to grow by itself. Recently, it is recommended to include hemp in the rotation and to cultivate it on the same land only after 3-5 years, to prevent the attack of diseases (white rot, leaf spot, etc.), pests (hemp moth, hemp flea, corn borer, etc.), weeds and specific weeds (Miron, Gh., 2021).

Hemp is a plant that requires a rich fertilization of the soil, which it highlights better than other crops, through the appearance of the plants (height, color), having high requirements for fertilizers (Samuil, C, 2007).

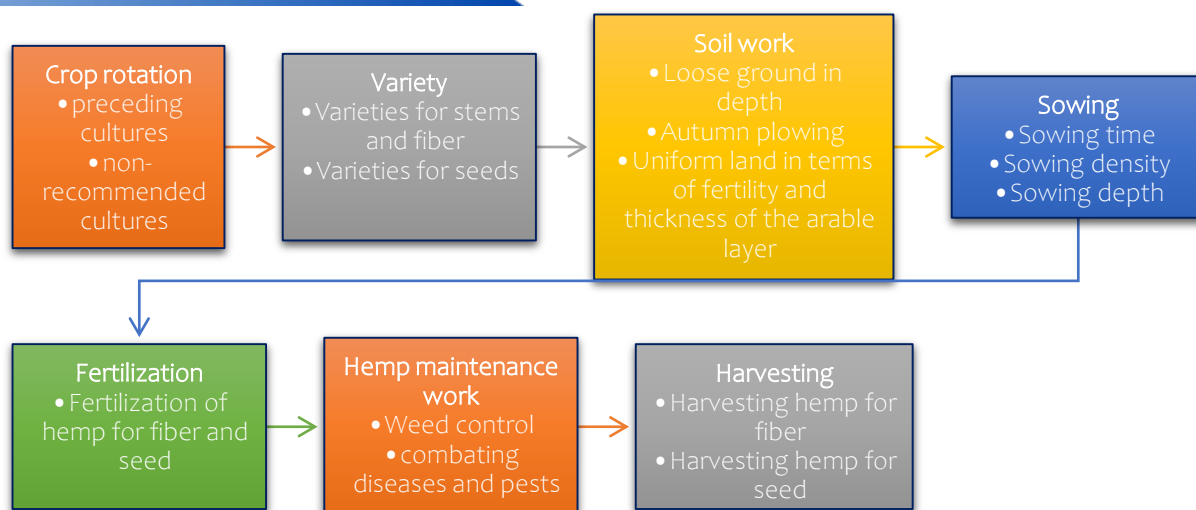


Figure 1 - Hemp cultivation technology

Hemp requires a soil of a qualitatively supported composition and structure, it demands medium, loose soils, with good moisture, rich in humus, high fertility (uniformity) and neutral to slightly alkaline reaction. Sowing is done when the temperature in the soil, at a depth of 6-7 cm, reaches 8-9°C. When sown too early the plants suffer from low temperatures, they grow slowly and do not reach the normal height, there is also substantial flea damage. By delaying sowing, the moth attack is favored, the vegetation period is shortened, the plants bloom prematurely. Therefore, failure to observe the sowing season always results in lower yields of stalks and fiber and inferior technological properties in seed production as well.

The method of preparing the seedbed, the speed of the equipment, the uniform distribution of the seeds, etc. also contribute to achieving uniformity of sowing in the experimental field (Oancea I., 1998). Important is the strict observance of some technological elements (Olan M., 2021) specific to each species (sowing season, sowing depth, density, etc.) according to the related cultivation technology.

As part of the care work in conditions of medium, well-structured soils and ideal soil preparation (lack of weeds), hemp can do well without any other care work carried out on the soil. But the existence of some situations that require crop maintenance measures: if sowing is done in loose land or in dry springs, a rolling must be carried out immediately after sowing or the appearance of the crust in the period from sowing to sunrise requires intervention with the harrow or star rollers. After emergence, perennial weeds with vegetative propagation are removed by weeding / specific herbicides (Marin E., et al., 2009).

Harvesting, hemp for tow, is harvested at the end of flowering of the male plants, when it is found that no more pollen is shed. Premature harvesting leads to obtaining relatively lower productions of fiber with technological properties that become inferior (Vătămanu, V., 2015). The delay in harvesting becomes very harmful, the large losses are determined by the degradation of the stems, and the fiber loses its fineness, becomes rough and brittle.

In some areas, hemp is harvested by hand, the stalks are cut at a height of 4-6 cm, with a sickle or with special brooms, then they are left on the ground in bundles of 15-20 cm thickness laid out in scissors for drying. When the upper part has turned yellow, the sheaves turn to the other side and dry for another 2-3 days, drying takes up to 4-8 days in its entirety (Vătămanu, V., 2015).

Mechanized harvesting is done with special machines. The cut stalks remain on the ground in a thin layer, generally placed perpendicular to the direction of the machine. After drying, proceed as in the case of manual harvesting: defoliation and bundling.

In Romania there are concerns for the production of machines and special equipment for harvesting hemp and which perform the operations of gathering, defoliating and mechanically tying the stems into bundles.

3. RESULTS

In order to expand the organic farming system in Romania, national legislative regulations have been established regarding the production, processing and utilization of organic agri-food products, in accordance with international norms in this regard.

Field plant cultivation technologies/techniques are developed in harmony with these regulations, economically efficient and non-polluting, with the prevention of environmental damage and the maintenance of the fundamental resources of agriculture. It is recommended to place crops in rotation on

plots (experimental plots) transformed for organic agriculture, after the best preceding crops, some that also improve soil fertility (such as legumes and green manures), the use of only fertilizers allowed in organic agriculture and the exclusion of all pesticides that pollute production and the environment.

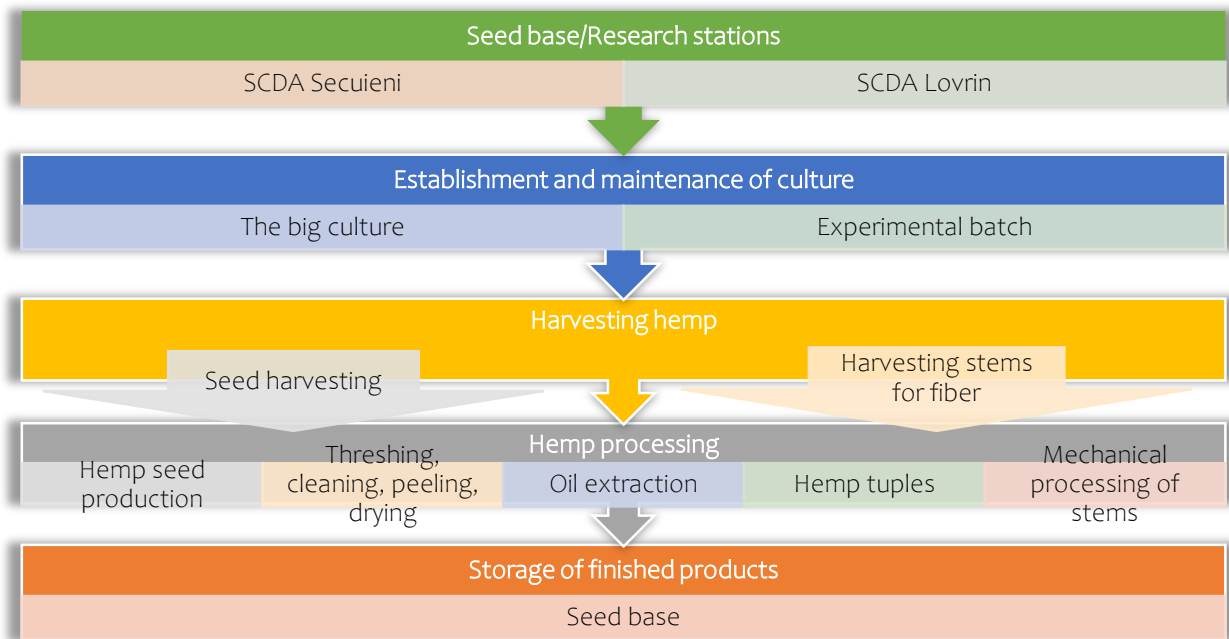


Figure 2 - The technological scheme for hemp cultivation

Hemp cultivation technologies, fig. 2, can successfully adapt to modern farming systems. Organic agriculture emerged as an alternative to the intensive (conventional) practice of agriculture based on the maximization of productions through the use of inputs, production stimulators, with the aim of continuously increasing agricultural production.

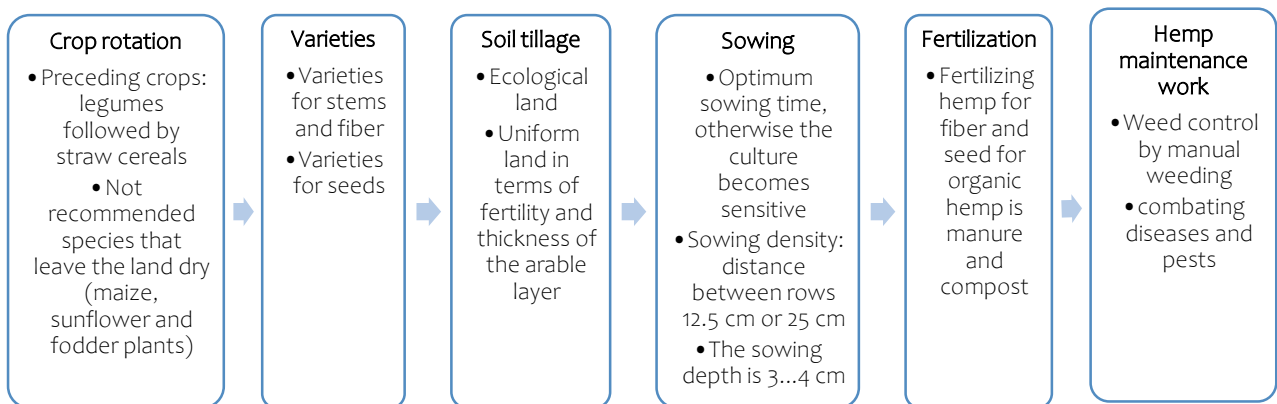


Figure 3 - The technology of growing hemp in an ecological system

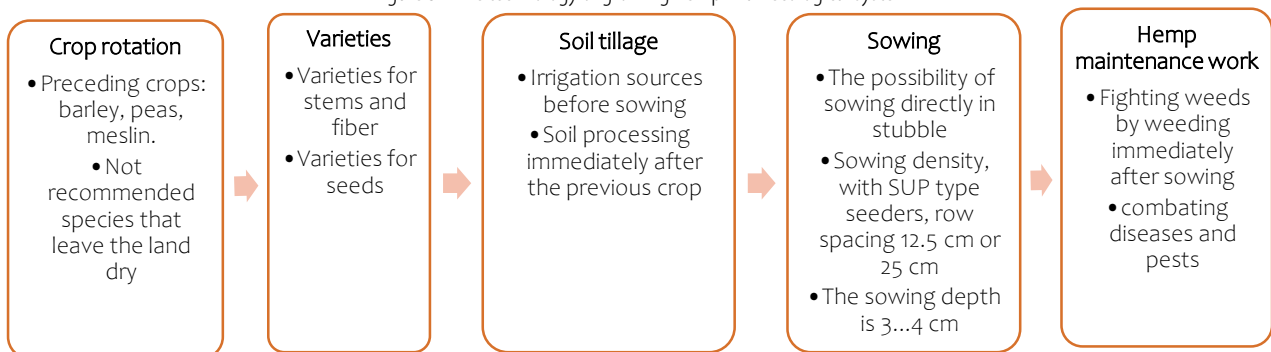


Figure 4 - The technology of cultivating hemp in a successive system

Ecological agriculture, fig.3, promotes the cultivation of the land by those means that ensure a balance between agroecosystems and nature. It is based on the use of those means and methods provided by society, by scientific and technical research that ensure the achievement of large, constant and high-quality productions, under the conditions of environmental protection.

The material resulting from the harvest from the technology of cultivation in a successive system (fig. 4) is conditioned, after the seed is stored in small layers and the humidity is lowered to approx. 9%, humidity at which the seed can be harvested and stored in optimal conditions (Popa, L-D, et al. 2021).

In recent years INMA Bucharest has developed new experimental models of equipment intended for various works in the technological flow of systems in agriculture, for hemp harvesting and processing technologies.



Figure 5 - Equipment for sowing technical plants, SPT



Figure 6 - Harvesting equipment in the green of hemp stalks, ERCV



Figure 7 - Equipment for harvesting hemp stalks, ERC

Figure 5 shows the equipment for sowing technical plants in aggregate with a motor cultivator. The equipment for sowing technical plants carries out sowing in 2 rows at an adjustable distance between rows, between 50...90 cm. In order to prepare the equipment to carry out the sowing operation on previously prepared land, it is necessary to make specific adjustments regarding the distribution system, the sowing depth, the distance between the rows and the rate of seed embedded in the soil.

An experimental model of trailed equipment for the sequential green harvesting of hemp stems (fig. 6), addressed to the harvesting work to obtain tow. The harvested plants remain cut in the furrow in a mixture of the inflorescence with the stems.

The SRC equipment, fig.7, harvests the hemp stalks and ties them into bundles, plus unloading the bundles onto the ground on the side of the work system. The equipment is semi-used and works in aggregate with agricultural tractors.

4. CONCLUSIONS

Hemp is grown for fiber and seeds. If a fiber crop is established it is sown under the conditions of a fiber crop: sown often, as with grass cereals, wheat or barley, to produce thin stalks which will provide long, strong fibers. If a seed crop is desired, sow in the conditions of a seed crop, where the SPC type machines are used with which the other creeping crops are also sown, with the interval of 70 cm between the rows. There is also the mixed variant when the density is higher and then you can get both fiber and seed, the main product in this case is the seed and the fiber is the secondary product, the two goals are in antithesis, being one at the expense of the other.

To achieve large productions, at the level of current requirements, hemp must be included in organic/successional farming systems through its ability to participate in crop rotation after: alfalfa, clover, perennial grasses, peas, beans, soybeans or rapeseed. Good results were also obtained after grass cereals, sorghum, as well as after the early harvested potato and beet crops.

Hemp cultivation technologies for both fiber and seed can be successfully adapted to modern, ecological farming systems that have emerged as an alternative to conventional agriculture, which is based on maximizing the productivity of crops through the use of production stimulators, with the aim of continuously increasing agricultural production.

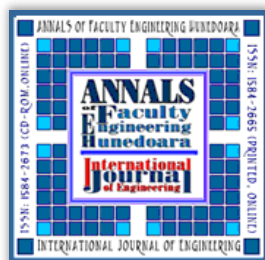
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