

INDUSTRIAL HEMP CERTIFIED SEED PRODUCTION IN VOJVODINA REGION

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Alternative Crops and Cultivation Practices

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SUMMARY

Market demand for quality varietal seeds of industrial hemp has caused an increase in the production area of hemp certified seed crops in our country. Maintenance and multiplication of varietal seed is in the competence of a registered institution which is the owner or maintainer of the variety. Production, processing and marketing of industrial hemp certificated seed are regulated by the Seed Law. Many elements of agricultural practices are common in cultivation of hemp as certified seed crop and for the grain. There are also agricultural practices specific for certified industrial hemp seed crop production. Compared to the cultivation management of the hemp grain crop, main differences are in crop maintenance practices, sowing and harvesting.

KEYWORDS: certified seed, industrial hemp, seed production

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INTRODUCTION

Until the WW II, industrial hemp producers in Yugoslavia, seeds for their cultivation produced in the traditional way – on the edges of other crops plots. The industrialization of production and processing of industrial hemp was accompanied by increased demand for hemp seed of consistently high quality. Therefore, the producers imported certified seed from Italy,

France and Hungary. The Hemp and Flax Committee of the Yugoslav Textile Industry Association in Novi Sad in early 1950's dimensioned domestic demands for the certified hemp seed. The Committee proposed strategy to multiply certified imported seed of cv. Bologna and cv. Carmagnola, 5 kg of each, to 336 t of seeds per cultivar by the year 1959 (Pasković, 1966). The plan and all later failed, and the import of industrial hemp certified seed continued. The closure of the hemp stalk processing plants and fiber production facilities is accompanied by a decline in the interest of producers in the cultivation of mercantile hemp and thus in the procurement of varietal seeds.

In 21st century, revived interest in industrial hemp as a universal renewable raw material with great market potential (Koren & Sikora, 2020) imposes demand for certified hemp seed.

CERTIFIED SEED PRODUCTION OF INDUSTRIAL HEMP CULTIVARS

The crown of a cultivar breeding program is certified seed production that is consisted of cultivation, processing and trade of seeds of the registered variety (Milošević & Malešević, 2004). Thus, through a regulated system of activities, mass multiplication of the crop certified seeds is ensured, with maximum preservation of varietal purity and seed qualities. (Milošević et al., 1996).

Cultivation technology

Crop management, as a set of agricultural practices, improves crop productivity, mitigates the negative effects of climatic and edaphic factors and can contribute to greater yields with improved quality (Walia, 2021). Many

elements of agricultural practices are common in cultivation of hemp as certified seed crop and for the grain (Table 1).

There are also agricultural practices specific for certified industrial hemp seed crop production. Compared to the cultivation management of the hemp grain crop, main

Table 1. Agricultural practices common to both industrial hemp grain and seed production

Practice	Key points
Crop rotation	annual legumes/small grains → hemp → spring crops
Soil tillage	Primary soil tillage in late summer/early fall, 20-30 cm in depth (Pasković, 1966; Starčević 1966) Secondary tillage (Starčević, 1966): after winter furrow closing → seedbed preparation prior to sowing
Soil fertilization	The amount of primary nutrients required by the crop to yield 1 t/ha of grain and 6-8 t/ha of stems is 60 kg N, 32 kg P ₂ O ₅ and 72 kg K ₂ O (Starčević, 1966)
Seed sowing	Sowing time: last decade of March to first decade of April for the production conditions of Vojvodina Province (minimal soil temperature at sowing depth is 7-9 °C) (Pasković, 1966) Depth of seed sowing: 3-5 cm Seeding rate: 20 kg/ha ≈ 1 million seed; intra-row and inter-row spacing 3-5 and 50 cm, respectively; with small grain seeder
Crop maintenance	Disease and insect pest control: <i>Sclerotinia</i> stem rot (<i>Sclerotinia sclerotiorum</i>), gray mold blight (<i>Botrytis cinerea</i>) and hop flea beetle (<i>Psylliodes attenuata</i>) Topping (Figure 1): Induction of branching by trimming the top of hemp plants. At the top cut, hemp plants intensively develop a larger number of lateral branches (Figure 2) with numerous inflorescences leading to an increase in seed yield (Venturi, 1963)
Harvest	Hemp seed is harvested at biological maturity, at the end of September-beginning of October for the production conditions of Vojvodina. Harvesting should begin when 75% of the seeds on the plants have matured. Axial-flow combine harvesters are used for direct harvesting of hemp seeds

Table 2. Specific agricultural practices of industrial hemp certified seed production

Practice	Description
Seed sowing	Seeding rate*: 2 kg/ha; inter-row and intra-row spacing 50-70 and 25-30 cm, respectively; with grain air seeder
Crop maintenance	Male plants removal*: In the crop of dioecious hemp varieties in order to promote better branching and higher seed yield of female plants. In the crop of monoecious varieties of hemp in order to preserve the purity of the variety, three times in the vegetation at least Ethephon (a plant growth regulator) treatments: Pro - initiation of female flowers on male plants, resulting in an increase in the number of female flowers per unit area and an increase in grain yield (Orlov & Zhatov, 1976); Contra - smaller seeds (Di Candolle et al., 2000; 2003).
Harvest	Manually* (Figure 3)

*Pre-basic hemp seed production

differences are crop maintenance practices and sowing and harvesting ways of certified seed crops of certain classes (Table 2).

The field inspection of the hemp seed crops of commercial seed classes is under the authority of the Extension services while the control of the pre-basic seed crops under the authority of the maintainer of the variety.

Control of industrial hemp seed production is regulated by the Rule on seed production control, content and the way of keeping files on production of nursery plants of agricultural plants and the form of report on production of mycelium of edible and medicinal mushrooms (Official Gazette of RS No. 60/2006).



Figure 1. Topping of industrial hemp crop cv. Helena (a) and hemp plants after the trimming the top (b).
Photo by Sikora V., 2017



Figure 2. Branching at the top cut in industrial hemp plant cv. Helena.
Photo by Sikora V., 2015



Figure 3. Pre-basic hemp seed crop: manual harvest of hemp plants (a), hemp plants drying (b) and manual seed harvest (c). Photo by Sikora V., 2016

Processing and packaging of industrial hemp certified seed

In order for industrial hemp seeds to meet the quality standards defined by Seed Law (Official Gazette of RS No. 45/2005), it is necessary to eliminate excess moisture and inert matter, treat the seed if necessary and pack.

Seed drying. Seed moisture content is a basic factor that affects the certified seed quality. If hemp seeds are harvested manually, the seeds are air-dried outdoor on cut plants stacked on the field plot, and additionally dried only when the autumn is wet. Modern technologies of direct harvesting of hemp seeds by combines require mandatory drying in dryers to a residual humidity less than 10% (Berenji & Sikora. 2011).

Hemp seed processing. By processing natural seeds, separation of seeds by fractions and cleaning from inert matter is achieved. The seeds can be additionally cleaned on a gravity separator, in order to separate components of the same size but different specific masses. In this way, hemp seeds of low biological value are separated.

Five fractions of industrial hemp seed are distinguished (Pasković, 1966). The middle seed fraction is characterized by the highest germination energy and germination (Marquart, 1919). If smaller seed is used for sowing of mercantile hemp crop, the total fiber yield and the long fiber yield are reduced by 23.0% and 26.5%, respectively (Pasković, 1966). Too large seeds are characterized by reduced germination energy and therefore are not used for sowing instead as bird food or food industry raw material.

Certified hemp seed is usually not chemically treated, although it is possible to find the seed treated with Vitavax fungicide on the market.

Seed storage. Produced hemp certified seed must be stored in a timely and proper manner in as dry, cold and clean warehouses as possible (Babić & Babić, 2003). During the preparation of the warehouse, special attention is paid to the control of storage pests, especially rodents.

The processed and stored hemp certified seed lots are than packed, labelled and tested

for the quality in the authorized laboratory, after what the seed becomes the subject of commercial sale.

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SAŽETAK

PROIZVODNJA SEMENA INDUSTRIJSKE KONOPLJE U VOJVODINI

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Potražnja za kvalitetnim sortnim semenom industrijske konoplje, kako na domaćem tako i na inostranom tržištu, uzrokovala je povećanje površina pod semenskim usevima kod nas. Održavanje i umnožavanje sortnog semena je u nadležnosti institucije koja je upisan u Registar proizvođača i dorađivača semena konoplje i koja je vlasnik ili održivač sorte. Proizvodnja, dorada i plasman semena industrijske konoplje regulisani su Zakonom o semenu. Tehnologija proizvodnje semenske konoplje u mnogim elementima je istovetna sa agrotehnikom konoplje za proizvodnju zrna. Međutim, postoje i određene specifičnosti koje su karakteristične samo za proizvodnju semenskog useva. Najveće razlike su u načinu setve, merama nege i načinu i vremenu žetve.

KLJUČNE REČI: industrijska konoplja, semenarstvo, sertifikovano seme

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