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Topping Industrial Hemp (*Cannabis sativa L.*) to Facilitate Mechanical seed Harvest in Short Supply Chain Systems

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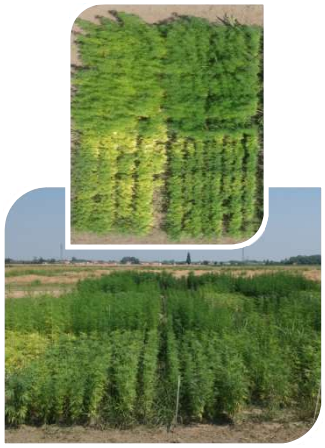
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Introduction

Italian production of industrial hemp seed for human and animal consumption is predominantly managed within short supply chain systems. The limited cultivated areas preclude the economic investments required to purchase dedicated harvesting machinery. Crop's height and unevenness pose significant challenges to mechanical seed harvesting using conventional, even modified, agricultural equipment. Topping (removal of the apical shoot) is a well-established agronomic practice, especially in the seed production chain (sugar beet/fodder, cabbage, chicory). This practice reduces and uniforms plant height, improves harvestability, and with the resulting branching, potentially increases yield.



Objectives: This trial aims to study topping on hemp to evaluate the plant's morphological response to this cultivation technique for facilitating seed harvesting with non-specialized machinery currently used by small-scale producers.

Materials and Methods

A field trial was conducted in 2023 at the experimental farm of CREA Cereal and industrial crops Rovigo (45°04'45.4"N – 11°45'57.3"E). The trial was set up with two monoecious hemp varieties, Futura 75 and Codimono, and two different plant management techniques, topped and non-topped, with three replicates for each combination (12 plots of 10 m^2). The trial was sown on April 19th, with 30 kg ha^{-1} of seed and a 25 cm row spacing. During the growing cycle, 50 units of nitrogen were applied; no irrigation was performed, and no herbicide or pesticide treatments were used. Topping was performed manually on June 8th at a height of approximately 50/60 cm at phenological stage 1010 (V. Mediavilla et al. 1998). After topping, the heights of 20 plants per plot were measured until flowering, the end of the vegetative cycle (Fig. 1). At the end of the production cycle (September 27th), 1 m^2 of crop was harvested from each plot, and the height and diameter at the collar were measured on 10 plants. All harvested plants were air-dried and then manually threshed. The resulting plant material was stabilized in an oven at 30°C and then sorted using mechanical and manual equipment to obtain seeds free of foreign matter. Yield and weight per 1,000 seeds were recorded.



Topping of *Cannabis sativa L.*

Results

Topping significantly reduced plant height at harvest by an average of 32.7 cm, from 254.5 and 250.6 cm on untopped plants to approximately 221.8 cm and 227.6 cm on Futura 75 and Codimono, respectively (Fig. 1). The height reduction between the two treatments was numerically lower than expected, presumably due to the significant spring rainfall (Fig. 2), which allowed the topped plants to quickly recover from the stress of the cut and grow at the same rate as the untopped stems. Topping increased the mean number of secondary stems per plant (+0.8, min 1 to max 3), with most plants having two branches (Tab. 1). As expected, plant height was significantly lower in topped plants. Morphological changes caused by topping did not result in differences in stem diameter at the base, which was similar in all treatments.



Fig. 1 - Growing of topped vs untopped plant during the growing season

	Codimono		Futura 75	
	Untopped	Topped	Untopped	Topped
N° plant harvested per 1 m^2	44	37	26	35
Plant height (cm)	250.6 ± 42.5	227.5 ± 30.7	254.5 ± 33.1	221.8 ± 23.5
N° of secondary stems after topping	1	1.9 ± 0.38	1	1.8 ± 0.38
Stem diameter at soil level (mm)	9.5 ± 1.5	9.6 ± 1.7	9.0 ± 1.8	8.6 ± 1.1
Seeds production (Kg ha-1)	121	240.3	285	287
weight 1000 seeds g.	10.6	10.6	9.6	10.2

Tab. 1 Variability between morphological and productive traits in the tested hemp varieties, topped versus untopped.

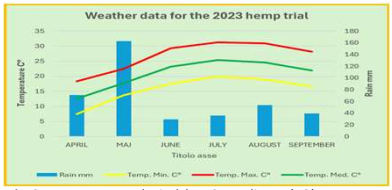


Fig. 2 - ARPAV meteorological data Concadirame (RO).

Seed production (Tab. 1) for the two varieties and between the two treatments showed no significant differences for the Futura 75 variety, while for the Codimono variety, seed production in the topping treatment doubled compared to the non-topping treatment, but the result was not considered significant due to variability among plots under both treatment regimes. Thousand-seed weight showed no significant differences between the varieties and treatments.

Conclusions: Topping influenced the final height of the plant and leveled the vegetative layer where seed production is concentrated. This approach could have interesting implications for crop management. Seed production in this 2023 trial yielded results that need to be confirmed in further trials in the coming years, including the test of this practice on other varieties.

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