

## STUDY OF THE CORRELATION OF SOME GROWTH PARAMETERS AT DIOECIOUS HEMP

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**Abstract:** The present paper deals with the study of the correlation of some growth parameters to 10 biocotypes of dioecious hemp (*Cannabis sativa* L) at A.R.D.S. Lovrin. Ten biocotypes were studied, four of which are established varieties created at A.R.D.S. Lovrin (Lovrin-110, Silvana, Armanca și Teodora) and six perspective lines (Zak-127xLv-110, Lv-428/01, S33/08 R, Lv-434x406CS/04, S354/15, Lv-149 CS/16). From the existing biological material, the dioecious hemp variety Silvana was chosen as a control. A monofactorial experience, having as a factor the existing biological material, was placed in the field of the laboratory for the improvement of dioecious hemp. The four parameters studied and presented are: the total length of the plant, the length of the inflorescence, the technical length and the diameter of the stem of the hemp plants, parameters that were influenced by the climatic conditions of the studied years 2020-2021. Compared to the blank variant, five of the six lines of perspective stand out in terms of the superiority of the technical length of the stem, two of them with very significant positive differences, statistically provided for the probability of transgression 0,1 %.

**Keywords:** dioecious hemp, variety, plant length, inflorescence length, technical length, diameter.

### INTRODUCTION

Hemp has been grown since ancient times mainly because of the fiber it contains. It is a complex plant that we can fully capitalize on using the rest of the plant from which it results: wood, seeds and their derivatives (funnel, oil, tow, cosmetics and food, etc.), which even if they are of secondary importance from an economic point of view, we can benefit from the qualities that hemp offers us (Carus, 2016; Struik, P.C, 2000; Baldini, 2020.). Hemp is one of the most sustainable crops, with high organic and agricultural yield. It can help sequester carbon, uses less water and agrochemistry than other fiber crops. For the best fiber production, an effective quality analysis system would allow improved genotypes to be selected and agrotechnics to be optimised (Amaducci, 2015).

Hemp has a vigorous, erect, glandular stem of dark green color, covered with small and tough secretory bristles. The stem (aerial part) of hemp, compared to the roots, develops much faster in the first period of development and for this reason hemp is quite sensitive to dryness. When hemp is grown on a deep and well-ventilated soil, long fibers predominate, due to the fact that the fibers in the primary layer develop more. The height of the stem differs by variety and vegetation conditions, from 0.60 m to 4 m, and in special conditions it can grow up to 6-8 m (Angelini, 2016; Callaway, 2002).

The total content of the fibres in the stem constitutes an appropriation of the variety, which only by improvement work can be increased. In seed hemp, grown at a lower density, through the free development of the plant, the stem will be thicker and the woody part develops more, but it does not favor the increase in the number of fibrous bundles (Forgo L., 1957). The disadvantage is when processing because the fibers are hard, they separate harder, are less valuable and a much smaller amount of fiber is obtained than from thin stems. It is very important to know the technical length of hemp plants, because the longer the technical length of the stem, that variety is richer in fiber and more valuable for the textile industry (Faux et al., 2013; Bertoli et al., 2010; Hall et al., 2013; Tang et al., 2016; Panda, 2021).

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In addition to the genetic factor, the agronomic factor has a special role in the growth and development of plants, in ensuring its productivity and quality (Agapie, 2016; Agapie, 1017).

In the case of seed hemp cultivation, rarely sown, the diameter is between 7.0 mm and 20.0 mm, in the conditions of the south of the country, while in the case of fiber hemp, the diameter of the stems is between 2.6-6.0 mm. Isolated under special growing conditions, plants have been identified in which the diameter of the stem varies in the range of 40- 60 mm (Ceapoiu N., 1958). The diameter of female plants is larger than that of male plants, the latter being influenced by the duration of the day (Borthwick, 1954).

The purpose of this work consists in studying and evaluating some growth parameters (plant length, inflorescence length, technical length, diameter) at 10 biocotypes of dioecious hemp, four varieties and six perspective lines, which were influenced by the climatic conditions of the years 2020-2021.

## MATERIAL AND METHODS

This study conducted between 2020-2021, was conducted at A.R.D.S Lovrin. Within the experimental field of the hemp improvement laboratory, a monofactorial experience was placed, having as a factor the existing biological material, placed according to the randomized block method, with a distance between the 70 cm and 50 cm between the plants in a row. The four growth parameters studied and presented are: the total length, the length of the inflorescence, the technical length and the diameter of the hemp stems.

The climatic conditions of 2020 and 2021 were characterized based on the weather records existing at the Agricultural Research and Development Station Lovrin.

The climatic conditions during this period are shown in Figure 1 and Figure 2.

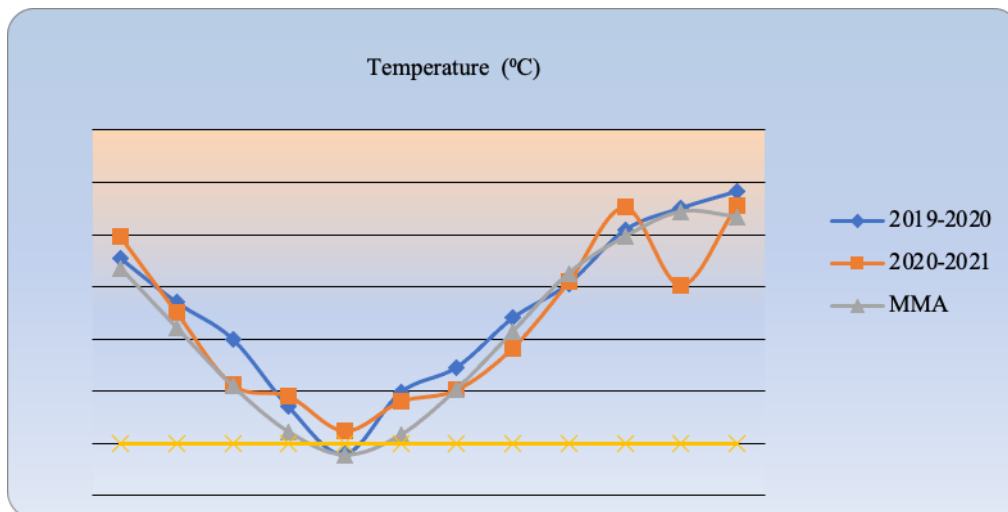


Figure 1. Temperatures between 2019 – 2020 and 2020 – 2021

The agricultural year 2019-2020, is part of the climatic evolution of the last years, being characterized by a particularly hot autumn with a deviation of  $0.9^{\circ}\text{C}$  in September,  $2.4^{\circ}\text{C}$  in October and  $4.5^{\circ}\text{C}$  in November. In the spring, the warmest months were March with a deviation of  $2^{\circ}\text{C}$  and April with a deviation of  $1.3^{\circ}\text{C}$  from the multiannual monthly average.

The average annual temperature was  $12.5^{\circ}\text{C}$ ,  $1.60^{\circ}\text{C}$  higher than the 70-year multi-year average ( $10.90^{\circ}\text{C}$ ). The largest deviations from the average were reported in the autumn and spring months.

Thus, the agricultural year 2020-2021 is characterized by a warm autumn with a deviation of  $3^{\circ}\text{C}$  in September,  $1.48^{\circ}\text{C}$  in October and  $0.14^{\circ}\text{C}$  in November, values above the multiannual monthly average.

The average annual temperature was  $12.3^{\circ}\text{C}$ ,  $1.40^{\circ}\text{C}$  higher than the 70-year multi-year average ( $10.90^{\circ}\text{C}$ ). The largest deviations from the average were reported in the autumn and winter months (Fig. 1).

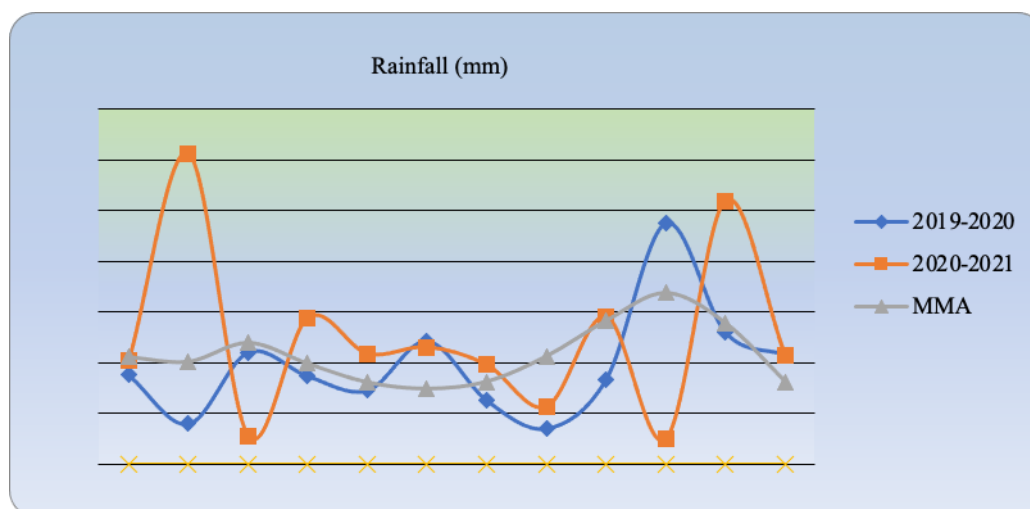


Figure 2. Precipitation between 2019–2020 and 2020-2021

From the analysis of the data on the pluviometric regime, from the agricultural year 2019-2020, it results that in its entirety it was an atypical year, the quantities of water in the precipitation registering values below the multiannual monthly average in most months. Autumn 2019 was extremely poor in precipitation, registering a deficit of 37.4 mm between September and November. The drought installed in the spring months had unfavorable effects on the hemp crop.

Ten biocotypes were studied, four of which are established varieties created at A.R.D.S. Lovrin (Lovrin-110, Silvana, Armanca and Teodora) and six perspective lines (Zak-127xLv-110, Lv-428/01, S33/08 R, Lv-434x406CS/04, S354/15, Lv-149 CS/16).

From the existing biological material was chosen the variety of dioecious hemp Silvana as the control .

The statistical interpretation of the obtained data was performed according to the variance analysis method, ANOVA (using the Poly Fact program) and the correlations method (EXCEL).

## RESULTS AND DISCUSSIONS

Data on strain length on the ten biocotypes studied are presented in Table 1.

**Table 1. Table of comparisons for stem length**

No. crt.	Variant	Stem length (cm)	100%	Difference +/-	Meaning
1	Silvana	275,00	100,0	0,00	Mt.
2	Lovrin-110	269,50	98,0	-5,50	-
3	Armanca	272,00	98,9	-3,00	-
4	Teodora	290,00	105,5	15,00	*
5	Zak-127xLv-110	282,00	102,5	7,00	-
6	Lv-428/01	271,00	98,5	-4,00	-
7	S33/08 R	276,50	100,5	1,50	-
8	Lv-434x406CS/04	272,00	98,9	-3,00	-
9	S354/15	281,00	102,2	6,00	-
10	Lv-149 CS/16	280,50	102,0	5,50	-

LSD 5% - 13.6; LSD 1% - 18.67; LSD 0.1% - 25.42

Analyzing the table, there is a variation in the length of the stem that varies between 290.00 cm for the variant 4 - the Teodora variety and 269.50 cm for the variant 2 - the Lovrin-110 variety. The variant 4- Teodora variety is highlighted, with a difference from the control of 15 cm and 5.5% .

Variants 5-Zak-127xLv-110, 7-S33/08 R, 9-S354/15 and 10-Lv-149 CS/16 recorded positive differences from the control, ranging from 1.5 cm to 7 cm, values not statistically insured.

The length of the inflorescence is shown in Table 2, the data obtained being reported to the blank.

**Table 2. Table of comparisons for inflorescence length**

No. crt.	Variant	Inflorescence length (cm)	100%	Difference +/-	Meaning
1	Silvana	113,50	100,0	0,00	Mt.
2	Lovrin-110	108,00	95,2	-5,50	-
3	Armanca	113,50	100,0	0,00	Mt.
4	Teodora	98,50	86,8	-15,00	-
5	Zak-127xLv-110	120,50	106,2	7,00	-
6	Lv-428/01	85,50	75,3	-28,00	00
7	S33/08 R	88,50	78,0	-25,00	00
8	Lv-434x406CS/04	85,50	75,3	-28,00	00
9	S354/15	80,00	70,5	-33,50	000
10	Lv-149 CS/16	83,00	73,1	-30,50	000

LSD 5% - 15.25; LSD 1% - 20.91; LSD 0.1% - 28.46

The largest length of the inflorescence is recorded in the Silvana and Armanca varieties, both by 113.5 cm. Compared to these, all other variants recorded lower values.

Lines 6.7 and 8 record negative values, distinctly significant from the experience witness. Thus, the variant 6-Lv-428/01 with an inflorescence length of 85.5 cm, the variant 7-S33/08 R with 88.50 cm and the variant 8-Lv-434x406CS/04 with 85.50 cm Table 2.

**Table 3. Table of comparisons for technical length**

No. crt.	Variant	Technical length (cm)	100%	Difference +/-	Meaning
1	Silvana	162,00	100,0	0,00	Mt.
2	Lovrin-110	162,50	100,3	0,50	-
3	Armanca	159,00	98,1	-3,00	-
4	Teodora	190,50	117,6	28,50	**
5	Zak-127xLv-110	182,50	112,7	20,50	*
6	Lv-428/01	185,50	114,5	23,50	**
7	S33/08 R	188,50	116,4	26,50	**
8	Lv-434x406CS/04	174,00	107,4	12,00	-
9	S354/15	201,00	124,1	39,00	***
10	Lv-149 CS/16	197,50	121,9	35,50	***

LSD 5% - 16.10; LSD 1% - 22.08; LSD 0.1% - 30.06

The technical length – shown in Table 3, shows that most of the values are from significant to very significantly positive compared to the Silvana blank. The highest value at the technical length is presented by the variant 9-S354/15 with a technical length of 201.00 cm and 24.1 % respectively, and the variant10- Lv-149 CS/16 with 197.50 cm exceeding the Silvana blank by 21.9 %, very significantly positive values. Then there are distinctly significant positive values in variant 4 - Teodora variety with 190.50 cm, variant7- S33/08 R with 188.50 and variant 6- Lv-428/01 with 185.50 cm.

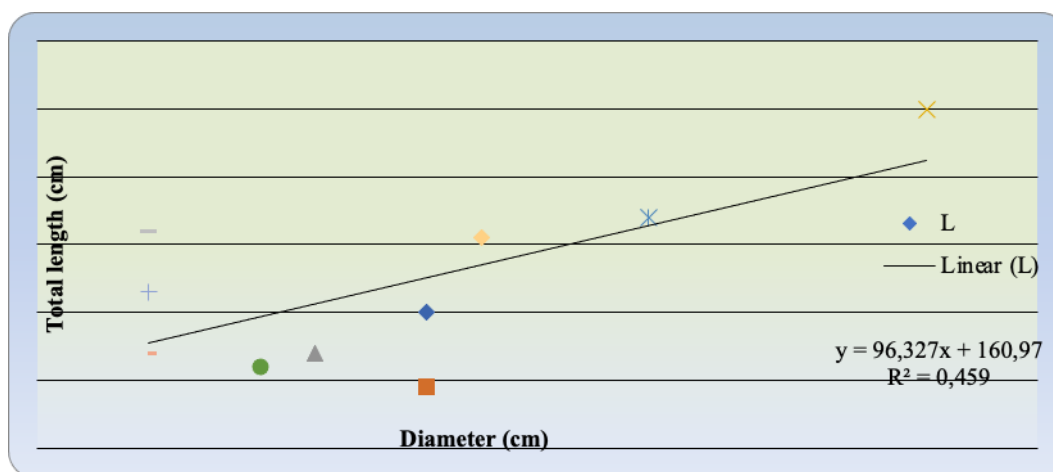
**Table 4. Table of comparisons for stem diameter**

No. crt.	Variant	Stem diameter (cm)	100%	Difference +/-	Meaning
1	Silvana	1,21	100,0	0,00	Mt.
2	Lovrin-110	1,21	99,7	0,00	-
3	Armanca	1,19	98,1	-0,02	-
4	Teodora	1,30	107,2	0,09	-
5	Zak-127xLv-110	1,25	103,0	0,04	-
6	Lv-428/01	1,18	97,2	-0,03	-
7	S33/08 R	1,16	95,6	-0,05	-
8	Lv-434x406CS/04	1,16	95,9	-0,05	-
9	S354/15	1,16	95,6	-0,05	-
10	Lv-149 CS/16	1,22	100,8	0,01	-

LSD 5% - 0.13; LSD 1% - 0.17; LSD 0.1% - 0.24

The fourth parameter – Stem diameter – is shown in Table 4, where all values are insignificant, not statistically insured. However, variant 4- Teodora records the highest value with 1.30 cm, respectively 7.2 % and the lowest varianate values 7- S33/08 R, 8-Lv-434x406CS/04 and 9-S354/15 compared to the witness Silvana.

Regarding the correlation that is established between the analyzed parameters, shown in Figure 3, a positive correlation between the length of the stem and its diameter is observed, given by the upward trend of the regression line and the value of the correlation coefficient R<sup>2</sup> = 0.459.



**Figure 3. Correlation between total length and diameter**

Figure 4 indicates that there is no linear correlation between the two parameters, technical length and diameter.

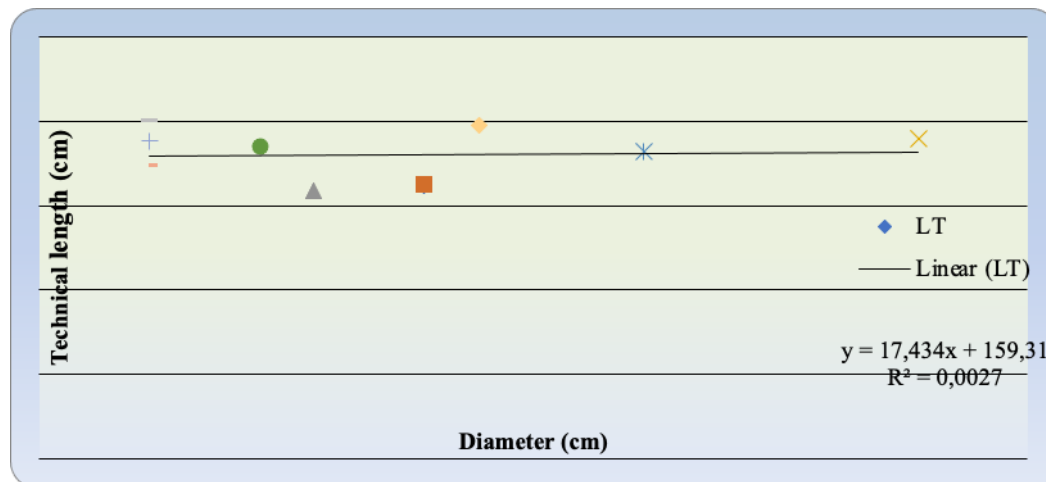


Figure 4. Correlation between technical length and stem diameter

## CONCLUSIONS

From the analysis of the 10 bioecotypes of dioecious hemp (*Cannabis sativa* L), four varieties and six lines of perspective, it is concluded that the values of the studied parameters varied depending on the experimental year.

We can say that from the values regarding the length of the stem, the Theodora variety stands out with a difference from the control of 15 cm and 5.5% respectively. At the length of the inflorescence the highest value is recorded in the Silvana and Armanca varieties, both by 113.5 cm. For the technical length high values, it records the variants 9-S354/15 of 201,00 cm, respectively 24.1 % and variant 10- Lv-149 CS/16 with 197.50 cm. Teodora variety, at the diameter of the stem, registers the highest value with 1.30 cm and 7.2 % respectively statistically uninsured.

Between the length of the stem and the diameter, a positive correlation is established, given by the upward trend of the regression line and the value of the correlation coefficient  $R^2 = 0.459$ .

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