THE CONTRIBUTION OF SOME ECOLOGICAL FACTORS ON BIOMETRIC MEASUREMENT RESULTS FROM *LINUM USITATISSIMUM* L.

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Abstract: *Flax is a medicinal plant used since ancient times originates from the Indian area. In the past it was so valuable that it was used as currency. Although currently it does not have the same value, flax is used for its medicinal, decorative and textiles qualities. For the early settlers of America, flax was indispensable. Flax seeds were used as food and to produce oil. Today, flax is widely cultivated for seed oil production. Some growers appreciate the plant for its great blue flowers and some are harvesting the seeds for consumption, especially for herbal teas. In blooming, pollination and fecundation phase, thermal oscillations hinder fecundation, formation and maturation of flax seeds. Under optimum conditions of moisture in the soil, the root system can provide to the plants enough water for covering growth phases. Water shortages during the growth of the stem, causes significant production declines due to reduced stem height and leaf area (the number of leaves per plant is reduced). Excess of moisture in blooming phase, causes plant fall and reduces production. Excess of precipitation in the maturity phase determines culture weeding, loss of production and oil. Flax works well on soils with medium texture, deep, with high fertility, well-structured, well supplied with water, weakly acidic to neutral reaction, plane without dales, easily accessible during the growing season. The paper presents the values of some biometric measurements (number of branches, number of capsules/plant and number of seeds/capsule) obtained in five varieties of flax oil approved in Romania, under the influence of some ecological factors, in order to determine if these values depend on the studied factors. The five flax varieties used in this experience were Lirina, Floriana, Florinda, Iunia 96 and Alexin sown at different densities of 600 germinable seeds/m², 800 germinable seeds/m² and 1000 germinable seeds/m². The number of branches, had an average ranging from 7.46 at Iunia 96 variety to 8.46 at Alexin variety. Given overall environmental conditions, Florinda variety obtained the best results. The studied flax varieties had a good degree of adaptability to climatic conditions in the area where the experience was conducted.*

Key words: *flax, ecological factors, temperature, precipitations, biometric measurements*

INTRODUCTION

Flax (*Linum usitatissimum* L.) is grown for its stems from which textile fibers are removed and for its seeds from which is extracted a fat oil used both in painting and in medicine, for manufacturing various cosmetic creams.

Oil flax is grown for its seeds which provide a drying oil with multiple industrial uses: manufacturing paints and varnishes (80% of total production), linoleum, oilcloth, in printing industry for the manufacture of special inks (V. Tabără, 2005).

Resulting cakes after oil extraction are very valuable (34-37% protein substances, 30% carbohydrate, 8% fat, being employed especially in feeding dairy cows and horses (Gh. Bîlteanu, 2001).

Stems remaining after threshing are baled and used as raw material for cellulose and paper, or for tow extraction. Linseed crops that formed long stems (wet and cool weather) can also provide a fiber crop, shorter, used for coarser fabrics.

From an agronomic point of view, flax is among the best prior plants to the other cultures, and very good prior plant for barley and winter wheat (Muntean L.S. et al., 2008) and in Western Plain of Romania is an economically efficient crop and important under technological aspect (A. Barbură, 2004).

MATERIAL AND METHODS

The following varieties of the species *Linum usitatissimum* L. were used in the experience: Lirina, Floriana, Florinda, Iunia 96 and Alexin.

Seeding was done on three different densities: 600 g.s. / m², 800 g.s. / m² and 1000 g.s. / m².

The research was conducted in the pedoclimatic conditions of the Didactic and Research Base Timişoara.

In the area where the experience was situated, the soil unit is a brown mollic eutricambosol moderate gleyed soil, moderate decarbonated on medium/coarse fluvial deposits, medium loam/medium loam, with the following morphological characterization on horizons:

Ap = 0-27 cm: medium loam, dark brown, wet, medium polyhedral moderately developed, medium porous, poorly compacted, friable;

Am = 27-45 cm: medium loam, dark brown, wet, small polyhedral moderately developed, medium porous, medium compacted, friable;

ABg1 = 45-60 cm: medium loam, brown, dark brown, very rare rust spots, wet, moderately developed, small porous, moderately compacted, friable;

BVg2 = 60-85 cm: medium loam, brown with rare rust and purple spots (10 %), wet, large polyhedral moderately developed, medium porous, moderately compacted, friable;

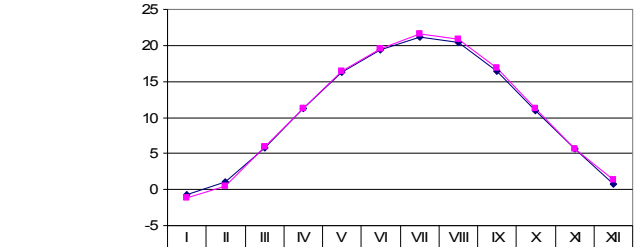
BCg2 = 85-100 cm: medium loam, yellowish brown with rare rust and purple spots (12 %), wet, large polyhedral weak developed, medium porous, moderately compacted, friable;

CKg3 = 100-149 cm: fine sandy loam, yellow with purple and rust spots (20 %), wet, very friable, very weak effervescence;

CKg4 = 149-170 cm: medium sandy loam, yellow-purple, wet, very friable, very weak effervescence;

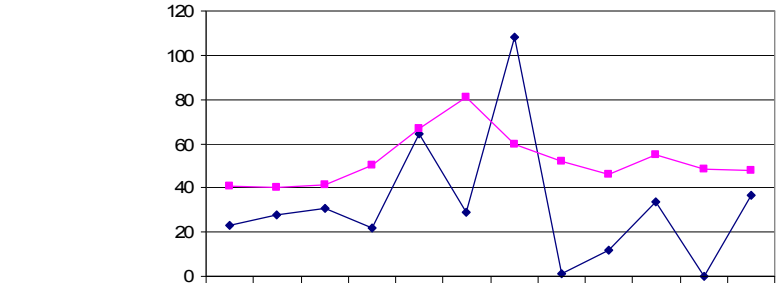
CKgr = 170-200 cm: coarse sand, purple-gray, wet, non-cohesive, very weak effervescence.

Characterization of climatic conditions was based on existing meteorological records from Timisoara weather station.



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Year 2011	-0,7	1,1	5,8	11,2	16,3	19,4	21,1	20,4	16,5	11	5,6	0,8
Multiannual average	-1,2	0,4	6	11,3	16,5	19,6	21,6	20,8	16,9	11,3	5,7	1,4

Fig. 1 - Monthly average temperature (°C) recorded at Meteorological Station Timişoara in 2011 compared to the multiannual average



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Year 2011	23,3	28	31	21,9	64,5	28,7	108	1,3	11,7	33,8	0,2	36,9
Multiannual average	40,9	40,2	41,6	50	66,7	81,1	59,9	52,2	46,1	54,8	48,6	47,8

Fig. 2 - Monthly average precipitations (mm) recorded at Meteorological Station Timişoara in 2011 compared to the multiannual average

The seeding was done in the first decade of April at a space beetwen the rows of 25 cm and a depth of 3-4 cm.

After harvesting, the following biometric measurements were carried out: number of branches, number of capsules/plant and number of seeds/capsule.

RESULTS AND DISCUSSIONS

Analyzing the data presented in Figure 1, it appears that temperatures recorded at Timişoara meteorological station in 2011 have monthly averages that are below the multiannual average. Except for January and February when temperatures were somewhat of higher values than the multiannual average. From the first decade of April, temperatures began to meet flax requirements, so that the seeding of this crop could be made at the beginning of the month.

In April, average monthly temperature exceeds 11 °C, in the third decade there has been even an average of 15.9 °C, temperature very favorable for rapid emergence of flax.

In May and June when growth and flax plant formation is taking place, the temperatures record a slight decrease compared to the multiannual average: 16.3 °C in May, -0.2 °C lower than the multiannual average, respectively 19.4 °C in June, -0.2 °C lower than the multiannual average of the area.

During the period of maturity of the capsules, in July, the monthly average temperature was 21.1 °C, with a negative deviation from the multiannual average of -0.5 °C. In terms of average temperatures achieved, crops benefit from a very favorable thermal regime. This is only if these temperatures are accompanied by favorable rainfall regime. If rainfall is lower, the thermal regime achieved during 2011 especially during the growing season becomes excessive and causes the characteristics of a dry year affecting both the growth and the development of crops.

An overview of the regime of precipitation recorded at Timisoara meteorological station (Figure 2) in the analized period compared to the multiannual average, shows that 2011 was a drought year due to poor rainfall regime. With the exception of July when there was a surplus of precipitation, in all other months there is an acute shortage of moisture. This moisture deficit reaches -34.4 mm in September, -48.4 mm in November, -50.9 mm in august, and even -52.4 mm in June.

The results of soil analyzes from the area where the experience was situated are presented in Table 1:

Table 1

Results of soil analyzes from the experience area

Analyzed element	Measurement unit	Value
pH in water	unit. pH	6.05
Mobile phosphorus	ppm	69.14
Mobile potassium	ppm	194.4
Total nitrogen	%	0.19

As it can be seen from the data presented in Table 1, the soil reaction in the area where flax was cultivated is slightly acid. In this case, we can not talk about unfavorable conditions for growth and development of flax since the favorable conditions or even the affordability (tolerance) ones, generally fall between pH values of 6.0 to 7.2.

Nitrogen fertilizers that can be applied given the reaction conditions encountered are: ammonium nitrate, urea, ammonia water, and even ammonium sulfate.

Phosphorus and potassium supply can be appreciated as medium to good in terms of the amounts recorded in the area.

The most important action that can be taken is fertilization with manure which contributes to decomposition and blocking toxic compounds and elements, and at the same time it prevents the loss of potassium and nitrogen by leaching, helping to increase the soil organic matter supply.

Average biometric measurement results for each studied variety, under the influence of ecological factors are presented in Table 2:

Table 2

Average biometric measurement results under the influence of ecological factors

Biometric measurement		Variety				
		Lirina	Floriana	Florinda	Iunia 96	Alexin
Number of branches	**X**	**8.23**	**8.2**	**8.23**	**7.46**	**8.46**
	S^2	3.12	2.42	1.28	1.92	3.16
	S	1.65	2.52	1.12	1.35	1.76
	Sx	0.52	0.47	0.35	0.42	0.55
	S%	20.97	18.58	13.79	18.19	20.87
Number of capsules/plant	**X**	**18.13**	**18.3**	**19.66**	**19.53**	**18.3**
	S^2	7.97	1.80	2.15	1.60	14.78
	S	2.41	1.32	1.41	1.25	3.36
	Sx	0.76	0.41	0.44	0.39	1.06
	S%	13.31	7.28	7.19	6.45	18.80
Number of seeds/capsule	**X**	**9.4**	**9.43**	**9.9**	**9.83**	**8.9**
	S^2	0.62	0.71	0.51	0.50	1.04
	S	0.78	0.84	0.70	0.65	1.00
	Sx	0.24	0.26	0.22	0.22	0.31
	S%	8.38	8.96	7.18	7.18	11.45

Analyzing the data presented in this table, we can see that temperatures during growth and plant formation, slightly lower than the multiannual average, influenced the number of branches, their average ranging from 7.46 at Iunia 96 variety to 8.46 at Alexin variety.

Number of capsules/plant was affected by the lack of rain in April and May, months of the emergence, growth and development phases of flax. Temperatures recorded in July, in the full period of maturity of the capsules, were lower than the multiannual average and were accompanied by a surplus of precipitation regime. Considering all these aspects, we can say

that the number of capsules/plant, with an average ranging between 18.13 at Lirina variety and 19.66 at Florinda variety respectively the number of seeds/capsule, with an average ranging between 8.9 at Alexin variety and 9.9 at Florinda variety, are two indicators that have produced good results under the given circumstances. So, given environmental conditions, Florinda variety obtained the best results.

Besides the influence of environmental conditions on biometric measurements, we also wanted to determine whether seeding density has an effect over the three analyzed indicators because according to literature, seeding density strongly influences the flax oil production (V. Tabără, 2005). For flax, the crop density is a crucial element of production. Depending on plant density, the other elements of productivity are formed: number of branches, number of capsules per plant and number of seeds per capsule.

Biometric measurement results under the influence of seeding density are shown in Table 3:

Table 3

Biometric measurement results under the influence of seeding density

Biometric measurement	Seeding density	Variety				
		Lirina	Floriana	Florinda	Iunia 96	Alexin
Number of branches	600 g.s./m²	7.3	7.9	7.7	7.0	8.0
	800 g.s./m²	9	8.5	8.6	7.9	8.8
	1000 g.s./m²	8.4	8.1	8.2	7.6	8.4
Number of capsules/plant	600 g.s./m²	17.6	18.1	19.3	19.1	17.3
	800 g.s./m²	18.7	18.6	20.2	20.1	18.8
	1000 g.s./m²	18.1	18.2	19.8	19.5	18.0
Number of seeds/capsule	600 g.s./m²	9.3	9.1	9.7	9.6	8.1
	800 g.s./m²	9.5	9.5	10.1	10	9.5
	1000 g.s./m²	9.4	9.4	9.9	9.8	9.0

Regarding the number of branches, the best results were obtained from Lirina variety at a seeding density of 800 g.s./m², density that gives enough space for the harmonious development of the plant.

In contrast, the number of capsules/plant showed the best results in Florinda variety (20.2) and Iunia 96 (20.1) at a seeding density of 800 g.s./m². At the density of 800 g.s./m², Florinda variety showed the best results also at the number of seeds/capsule (10.1).

Analyzing all the data obtained we can conclude that Florinda variety best adapted to the environmental conditions recorded in 2011 and had the best results.

CONCLUSIONS

The studied flax varieties had a good degree of adaptability to climatic conditions in the area where the experience was conducted.

The conditions for growth and development of flax were favorable in terms of soil; the soil reaction in the area where flax was cultivated is slightly acid.

In May and June when growth and flax plant formation is taking place, the temperatures record a slight decrease compared to the multiannual average which influenced the number of branches.

During the period of maturity of the capsules, in July, the monthly average temperature was 21.1 °C, with a negative deviation from the multiannual average of -0.5 °C; the studied flax varieties produced good results under the given circumstances.

The year 2011 was a drought year due to poor rainfall regime. With the exception of July when there was a surplus of precipitation, in all other months there is an acute shortage of moisture.

The number of branches of the studied varieties is a good one ranging between 7.46-8.46.

Number of capsules/plant was affected by the lack of rain in April and May, months of the emergence, growth and development phases of flax.

Number of capsules/plant, had an average ranging between 18.13 at Lirina variety and 19.66 at Florinda variety.

Number of seeds/capsule, had an average ranging between 8.9 at Alexin variety and 9.9 at Florinda variety.

The seeding density influence the results of biometric measurements.

In terms of seeding density, the best results were obtained for flax at 800 g.s. / m².

In the climatic conditions of 2011, the best results were recorded in Florinda variety.

ACKNOWLEDGEMENTS

The results of this study are part of a PhD program, having as theme: "The contribution of some ecological and technological factors in quality formation of the production in flax oil", funded by the European Social Fund, the Pilot Program PhD Research Scholars Support Contract from the POSDRU/CPP107/DMI 1.5/S/80127, under the leadership of the distinguished university professor Georgeta Pop.

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