THE INFLUENCE OF GREEN FERTILIZATION ON THE WEIGHT OF SEEDS FROM SIX VARIETIES OF *LINUM USITATISSIMUM* FOR OIL EXTRACTION

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Abstract: The paper presents partial results of the research regarding the influence of some technological factors on the evolution of the *Linum usitatissimum* culture in the specific conditions of Transylvania. This research has the main focus on the influence of green fertilization on the production of linseed for oil. The experiments underlying the research were located in the vicinity of Sibiu. Six varieties of *Linum usitatissimum* (Alexin, Geria, Lirina, Cristina, Fluin, Elan FD) were tested under different fertilization conditions (unfertilized, green fertilizer, mineral fertilizer) to determine their influence on the quality of linseeds for oil extraction.

Keywords: *Linum usitatissimum*, flax, linseed, fertilization, green fertilization, oil extraction

INTRODUCTION

The earliest evidence of humans using wild flax fibers as textile was discovered in the Dzudzuana Cave, located in Georgia, and it was dated to the Upper Paleolithic, 30,000 years ago (Kvavadze et al., 2009). To counteract the losses caused by climate change, farmers around the world are giving up large areas of wheat, corn, sunflower or rape cultures to grow plants that seem to adapt better to the whims of nature. Flax for oil is one of the cultures which is increasingly demanded in the food industry. With the exception of traditional uses, flax is mostly used in food (pastry and bakery), on the one hand for its pleasant taste and on the other for its therapeutic (medical) effect with multiple benefits on human health (Știri Agricole, 2014). Intake of flaxseeds in daily diet may reduce the risk of cardiovascular diseases and may have anticancer effects (breast, prostate and colon cancers). The residues remaining after the oil extraction, containing 35-40% protein and 3-4% oil, could be a rich source to feed the livestock (Jhala and Hall, 2010), thus contributing to circular economy.

In 2014, the world production of flax (linseed) was 2.65 million tonnes, led by Canada with 33% of the global total. Other major producers were Kazakhstan, China, Russia and the US. Romania produced 2567 t and ranks 24th in the global producers list, while in the European Union is the 7th producer country following the UK, France, Sweden, Belgium, Germany, and Poland (FAO, 2014).

MATERIAL AND METHODS

The experimental factors studied were: Factor A-variety with 6 graduations (A1 - Alexin, A2 - Geria, A3 - Lirina, A4 - Cristina, A5 - Fluin, A6 – Elan FD) and Factor B fertilization with 4 graduations (B1 - unfertilized, B2 - fertilized with green fertilizer facelia, B3 - fertilized with double amount of green fertilizer (facelia + black mustard), B4 - mineral fertilizers). A green fertilizer is improperly said, because it brings the soil much more than nutrition. Seen as an ameliorator it reacts with the "soil life" and stimulates by optimizing the biochemical and physical traits, followed by an optimized manifestation of the relations

between the crop plant - soil – atmosphere and better use of vegetation factors, water, CO2, nutrients in full correlation with the crop consumption curves (Berca, 2011). The green fertilizers used are facelia and black mustard.

Facelia plant (*Phacelia tanacetifolia*) is used as a green fertilizer due to the amount of biomass produced at the surface unit, high protein content, low claims to pedo-climatic factors, and mostly because it brings many nutrients by incorporating it into the soil, fixes nitric nitrogen to the root due to their high density. Buried to the ground at the end of the flowering period, facelia brings to the soil the equivalent of 30 tons of manure per hectare (Ion, 2008). The variety used is Balo.

Black mustard (*Brassica nigra*) as a green fertilizer is used for the its benefits in: erosion control, suppressing weeds and soil pests, and scavenging nutrients. Black mustard cover crops are known for their rapid growth, that will result in a well-suited soil capture of nitrogen (N) remaining after the crop harvest. (Clark, 2012). The variety used is ITC 21.

The experimental field is located in Sibiu County (Transylvanian Depression), on the agricultural land managed by the State Institute for Variety Testing and Registration - Sibiu Center. Since the study has as a research factor the fertilization, two of the fertilizations being the organic fertilization represented by the green fertilizers, from 2016 the facelia and the black mustard have been cultivated in a pure culture established on the field surface for the organization of the experiments with flax in 2017, in 2017 were set up for 2018, and in 2018 for 2019.

The amount of green fertilizer obtained in 2016 was: facelia 6 kg /sqm; black mustard 6.5 kg /sqm. The amount of green fertilizer obtained in 2017 was: facelia 7 kg /sqm; black mustard 5.6 kg /sqm.

MMB (Mass of 1000 seeds) determination is performed by randomized counting 8 repetitions of 100 seeds stored in the vessel until weighting. Each sample was weighted in grams with as many decimals according to SR 7713 and then the variance, standard deviation and variation coefficient were calculated. Where the coefficient of variation is not more than 6 for grass and fodder seeds and more than 4 for the other species, MMB is calculated with decimal. MMB = X x 10 (X = the mean value of repetitions).

RESULTS AND DISCUSSIONS

In each of the two experimental years, 2017 and 2018, quantitative and qualitative determinations of production were made in order to assess the degree of influence of each of the two experimental factors and their graduations on the weight of 100 seeds. In 2017 (table 1), the factor B3 (Facelia+Mustard) has the biggest influence on the mean weight of 100 linseeds on all 6 variants of *Linum usitatissimum*, the second influence on all 6 variants has B2 (Facelia), the third is B4 (mineral) and the last one is B1(unfertilized). The order of the variants for the mean weight of 100 linseed is: **A1-**Alexin, **A4**-Cristina, **A2**-Geria, **A6**-Elan FD, **A5**-Fluin, **A3** - Lirina. In 2018 (table 2), the factor B3 (Facelia+Mustard) has the biggest influence on the mean weight of 100 linseeds on all 6 variants of *Linum usitatissimum*. The second influence on variants (A1 - Alexin, A2 - Geria, A3 - Lirina) has B2 (Facelia), the third fertilisation that has an influence is B4 (mineral) and the last one is B1(unfertilized). The second influence on variants (A4-Cristina, A5-Fluin, A6-Elan FD) has B4 (mineral), the third fertilisation that has an influence is B2 (Facelia) and the last one is B1 (unfertilized). The order of the variants for the mean weight of 100 linseed is:**A1-**Alexin, **A4**-Cristina, **A5**-Fluin, **A2**-Geria, **A6**-Elan FD,**A3** - Lirina.

Table 1

The mean weight of 100 linseeds for 2017

Factor A - VARIETY	Factor B-FERTILIZATION			
	B1-Unfertilized	B2-Facelia	B3-Facelia+Mustard	B4-mineral
	Mean	Mean	Mean	Mean
A1 - Alexin	8.84	9.26	9.35	9.01
A2 - Geria	7.06	7.4	7.43	7.24
A3 - Lirina	6.61	6.79	6.83	6.78
A4 - Cristina	7.49	7.66	7.72	7.63
A5 - Fluin	6.95	7.03	7.15	6.99
A6 – Elan FD	6.92	7.06	7.2	6.95

Table 2

The mean weight of 100 linseeds for 2018

Factor A - VARIETY	Factor B-FERTILIZATION			
	B1-Unfertilized	B2-Facelia	B3-Facelia+Mustard	B4-mineral
	Mean	Mean	Mean	Mean
A1 - Alexin	7.93	8.24	8.38	8.19
A2 - Geria	6.49	6.79	6.9	6.74
A3 - Lirina	6.41	6.44	6.51	6.41
A4 - Cristina	7.04	7.1	7.19	7.15
A5 - Fluin	6.44	6.75	7.03	6.8
A6 – Elan FD	6.53	6.63	6.8	6.78

CONCLUSIONS

Following the analysis of the results of the experiments conducted in Sibiu, it was proven that the green fertilizers facelia and black mustard had the biggest influence on the mean weight of 100 linseeds. Out of the six studied *Linum usitatissimum* varieties the top two biological material are represented by Alexin and Cristina. In 2017 the mean weight of 100 linseeds is bigger than the mean weight from 2018.

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