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EFFECT OF DESICCATION DATE ON OIL CONTENT IN SUNFLOWER SEED*

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SUMMARY: The trial was conducted at Rimski Šančevi experimental field in 2009 in order to assess the effect of chemical desiccation on oil content in seed of three sunflower inbred lines (L1, L2 and L3). Reglone forte (2 l/ha) was used for desiccation. Desiccant application was performed at 7-day intervals from the end of flowering to harvest maturity. Seed moisture content was measured prior to each treatment. Seed oil content was determined after harvest. The three lines showed highly significant differences in seed oil content. The highest oil content was found in L3, the lowest in L2. The highest oil content was obtained with the treatment done 21 days after flowering (DAF), when seed moisture was 45.6%. There was no subsequent increase in oil content. Regression analysis showed that the three lines achieved maximum oil content at different seed moisture levels at the time of desiccation (19% to 39%).

Key words: *desiccation, oil content, sunflower, seed moisture.*

INTRODUCTION

Desiccation as an agrotechnical measure was introduced in agricultural practice several decades ago. The basic idea is to accelerate plant drying in order to make the crop ready for early harvest. The measure is advantageous in cool climates, where spring crops often mature in late fall, when weather conditions make harvest difficult. Chemical desiccation largely solves the problems occuring in mechanized sunflower harvest (Miklič et al., 2001). Desiccation is recommendable for sunflower production, especially seed production, because early harvest reduces seed loss, facilitates the har-

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vest, makes additional seed drying unnecessary and prevents adverse effect of frost on seed germination (Đukić et al., 2006). Early harvest reduces the intensity of occurence of parasites of the head (Maširević and Glušac, 1999). Desiccation is particularly important for double cropped sunflowers (Liović et al., 2010).

Desiccation timing is associated with physiological maturity of plants. Physiological maturity is defined as the moment when assimilate supply to seed is completed and when contact between seed and parent plant is disrupted. In the sunflower, this moment is counted by the number of days after flowering. This method is unreliable because the sunflower head flowers in concentric circles and it is difficult to determine when precisely each flower ends flowering. Besides, beginning of physiological maturity varies widely depending on the genotype and weather conditions. Visual methods for determining the beginning of physiological maturity are based on color change of the reverse side of the head, bottom leaves drying or bracts drying (Kaya et al., 2004) and they are subjective. The best method is obviously the one related to the moisture content in seed (Miklič et al., 2006).

The sunflower (*Helianthus annuus*) is an important crop due to its high oil content in seed. Sunflower oil is an exceptional edible oil which is widely used in human nutrition. It is used directly for cooking and as an ingredient in a variety of food products (Jevtić et al., 1986). Oil synthesis in sunflower seed begins soon after pollination and it gradually intensifies (Vratarić et al., 2004). It is important to determine how the date of desiccation affects oil content, i.e., what is the optimal date for its performance.

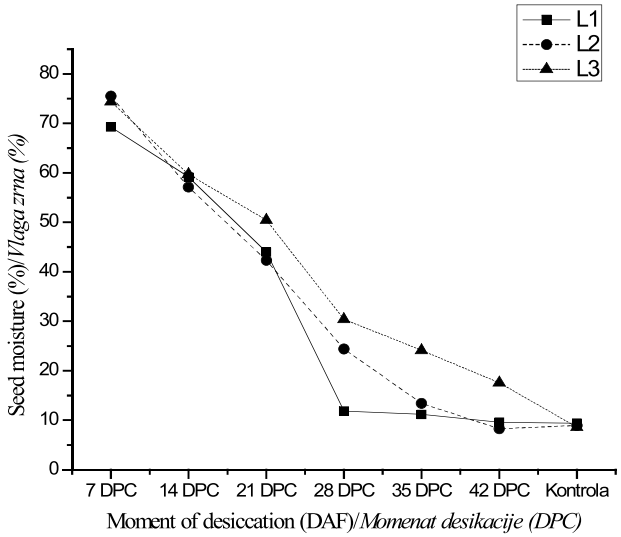
MATERIAL AND METHODS

The trial was conducted at Rimski Šančevi experimental field in 2009. It included three new cytoplasmic male sterile lines of sunflower developed at Institute of Field and Vegetable Crops (L1, L2 and L3). Desiccation was performed with Reglone forte (2 l/ha) applied at 7-day intervals from the end of flowering (DAF) to harvest maturity. Treatments were performed with a knapsack sprayer. Seed samples from several sunflower heads were collected directly before each treatment in order to test the moisture content in seed at the time of treatment. Seed moisture was determined in the laboratory by the conventional gravimetric method. When harvest time was reached, 12 heads were taken from each treatment for making average samples for seed oil content analysis. The analysis was performed by the conventional Soxhlet method in three replications.

The obtained results were statistically processed. The analysis of variance of two factorial experiment (split-plot design) and the regression analysis were used. Significance of regression was tested with the F-test.

RESULTS AND DISCUSSION

The highest average moisture content in seed at the time of desiccation was found in the line L3 (37.9%), the lowest in the line L1 (30.64%). The graph shows that the rate of seed moisture reduction was the fastest in the line L1 and the slowest in the line L3 (Graph 1).



Graph. 1. Moisture content in seed at the time of desiccation
Graf. 1. Sadržaj vlage u semenu u momentu desikacije

The highest average oil content was found in the line L3 (42.97%), the lowest in the line L2 (38.15%). The differences in the average oil content among the three lines were highly significant (Table 1).

Table. 1. Seed oil content (%)
Tabela. 1. Sadržaj ulja u semena(%)

Line-L *Linija-L*	Desiccation time -R / *Rok tretiranja -R*							Average *Prosek* (L)
	7 DAF	14 DAF	21 DAF	28 DAF	35 DAF	42 DAF	Control *Kontrola*	
L 1	35.66	43.73	41.56	40.77	37.24	37.73	37.03	39.10
L 2	29.56	35.87	41.40	39.68	40.29	40.34	39.89	38.15
L 3	32.52	39.04	43.45	45.57	46.38	46.99	46.83	42.97
Average *Prosek* (R)	32.58	39.55	42.13	42.00	41.30	41.69	41.25	-

LSD	L	R	L*R	R*L
5%	0.11	0.55	0.89	0.96
1%	0.18	0.74	1.20	1.29

The treatment 21 DAF, when seed moisture was 45.6%, brought the highest average oil content (42.13%). The lowest oil content (32.58%) was found in the treatment 7 DAF. The average oil content in the treatment 21 DAF was highly significant in relation to those achieved in the treatments 7 DAF, 14 DAF, 35 DAF and the control. No significant difference in average oil content was registered among the treatments 21 DAF, 28 DAF and 42 DAF. Miklič (2001) found the highest oil content in the control, while after the treatment 21 DAF, at seed moisture of 44.34%, there was no significant increase in oil content, which is consistent with the results of our experiment. On the other hand, Radić (2006) found the highest oil content much later, 42 DAF, Rana et al. (1990) report-

ed of finding the highest oil content 45 DAF, while Baydar and Erbas (2005) found the highest oil contents 30 and 35 DAF, after which dates the content decreased slightly.

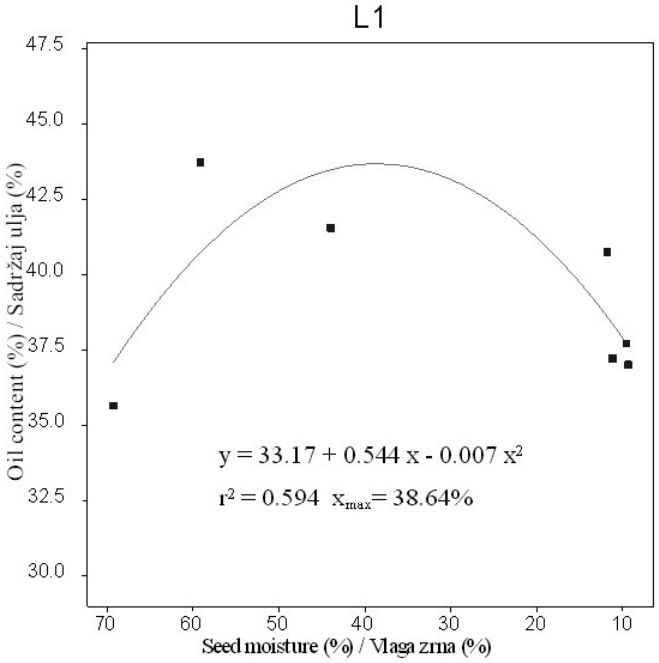
In the case of the line L1, the highest oil content was obtained with the treatment 14 DAF (43.73%), the lowest with the treatment 7 DAF (35.66%). The treatment 14 DAF had a highly significant oil content in relation to all other treatments and the control. The highly significant decrease in oil content may be attributed to the increase in seed weight upon the completion of oil accumulation, which lowered the proportion of oil in the total seed weight.

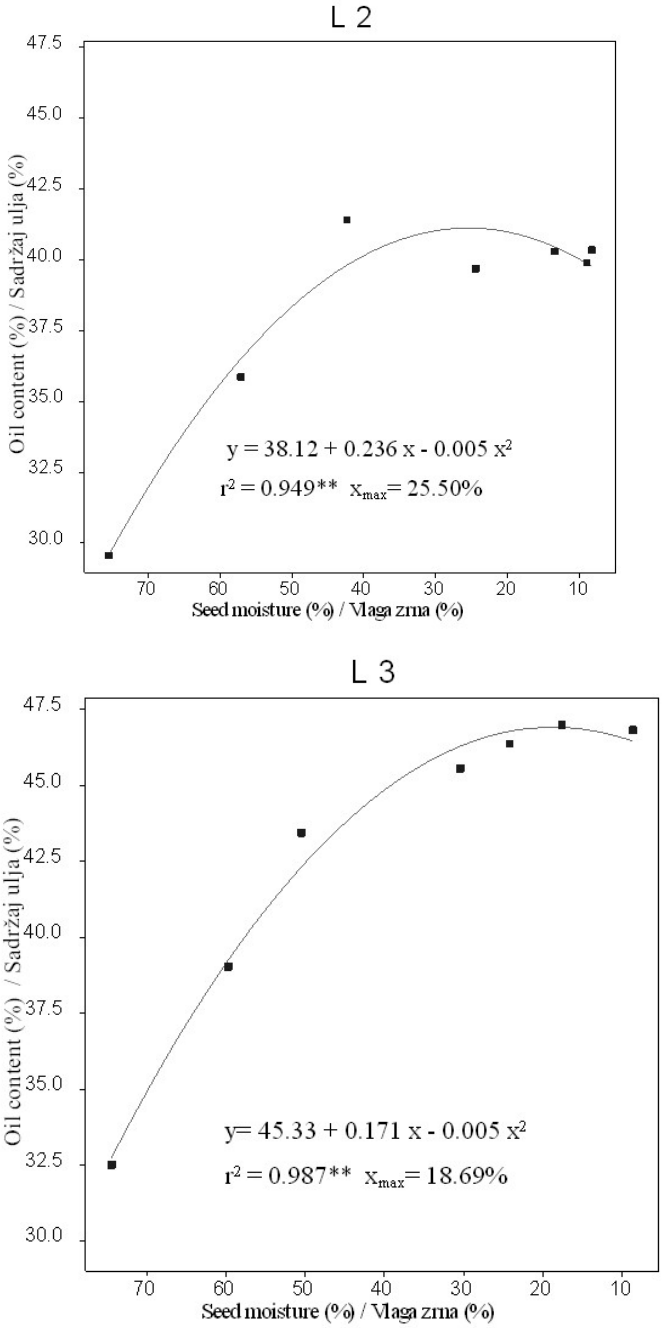
In the case of the line L2, the highest oil content was obtained with the treatment 21 DAF (41.4%), the lowest with the treatment 7 DAF (29.56%). The treatment 21 DAF had a highly significant oil content in relation to the treatments 7 DAF, 14 DAF, 28 DAF and the control, and significant in relation to the treatments 35 DAF and 42 DAF.

In the case of the line L3, the highest oil content was obtained with the treatment 42 DAF (46.99%), the lowest with the treatment 7 DAF (32.52%). The treatment 42 DAF had a highly significant oil content in relation to the treatments 7 DAF, 14 DAF and 21 DAF, and significant in relation to the treatment 28 DAF. The treatments 35 DAF, 42 DAF and control showed no significant difference in oil content.

In the case of treatments 7 DAF and 14 DAF, the highest oil content was registered in the line L1 (35.66% and 43.7%), and it was highly significant in relation to other two lines.

In the case of all other treatments and the control, the line L3 had the highest oil content (43.45%, 45.57%, 46.38%, 46.99% and 46.83%). Oil content in the line L3 was highly significant in relation to other two lines.





Graph 2. Effect of seed moisture at the time of desiccation on oil content

Graf. 2. Uticaj vlage zrna u momentu desikacije na sadržaj ulja

The regression analysis showed that the oil content in the three lines was differently affected by seed moisture level at the time of desiccation (Graph 2). The greatest impact was observed in the line L3, medium in the line L2 and lowest in the line L1, 0.987 **, 0.949** and 0.594, respectively. Those impacts in the lines L2 and L3 were highly significant, while the effect of moisture content on oil content in the line L1 could not be explained by the quadratic regression. The regression curve exhibited maximum oil contents in L1, L2 and L3 at moisture contents of 38.64%, 25.5% and 18.69%. Similarly, Miklič et al. (2001) and Radić (2006) found a significant effect of seed moisture at the time of desiccation on oil content in sunflower seed.

CONCLUSION

The following conclusions were drawn on the effect of desiccation timing on oil content in sunflower seed.

The differences in average oil content between the three lines were highly significant. The highest oil content was found in the line L3, the lowest in L2.

The treatment 21 DAF, at seed moisture of 45.6%, brought the highest oil content. There was no further increase in oil content with the later treatments.

The three lines achieved maximum oil contents at different seed moisture levels at the time of desiccation, from 19% to 39%.

The results of this study seem to indicate that oil accumulation in sunflower seed ends well before harvest maturity.

REFERENCES

BAYDAR, H., ERBAŞ, S.: Influence of Seed Development and Seed Position on Oil, Fatty Acids and Total Tocopherol Contents in Sunflower (*Helianthus annuus* L.). Turkish Journal of Agriculture & Forestry, 29:179-186, 2005.

ĐUKIĆ, N., MIKLIČ, V., STEFANOVIĆ, D., MALIDŽA, G.: Desikacija u proizvodnji suncokreta. Biljni lekar, 34(4-5)419-425, 2006.

JEVTIĆ, S., MILOŠEVIĆ, R., ŠUPUT, M., MUSTAPIĆ, Z., GOTLIN, J., UZUNOSKI, M., KLIMOV, S., ĐORĐEVSKI, J., SPANRING, J., MILETIĆ, N.: Posebno ratarstvo. Beograd, 1986

KAYA, Y., BALTENSPERGER, D., NELSON, L., MILLER, J.: The Determining Physiological Maturity Time in Sunflower. Trakya Univ J Sci, 5(1)1-10, 2004.

LIOVIĆ, I., MARTINOVIĆ, J., BILANDŽIĆ, M., KRIZMANIĆ, M., MIJIĆ, A., ŠIMIĆ, B.: Desikacija u redovnoj i postrnoj sjetvi suncokreta. Poljoprivreda, 16(1)13-19, 2010.

MAŠIREVIĆ, S., GLUŠAC, D.: Desikacija i njen značaj u suzbijanju prouzrokovača bolesti semenskog suncokreta. Zbornik naučnih radova. XIII savetovanje agronoma, veterinara i tehnologa, Arandjelovac. 1999.

MIKLIČ, V., DUŠANIĆ, N., CRNOBARAC, J.: Uticaj vremena desikacije na neke parametre kvaliteta hibridnog semena suncokreta. Zbornik radova - Naučni institut za ratarstvo i povrtarstvo Novi Sad, 35:251- 258, 2001.

MIKLIČ, V., MAŠIREVIĆ, S., ŠKORIĆ, D.: Hemijska desikacija u proizvodnji hibridnog semena suncokreta. Zbornik naučnih radova Instituta PKB Agroekonomik, 12(1-2)87-95, 2006.

MIKLIČ, V.: Uticaj momenta desikacije na semenski kvalitet i prinos suncokreta. Doktorska disertacija. Poljoprivredni fakultet, Novi Sad, 2001.

RADIĆ, V.: Effect of maturation period on seed quality; optimum time for desiccation in sunflower (*Helianthus annuus* L.) genotypes. Helia, 29:145-152, 2006.

RANA, M. A., OZAIR, C. A., KHAN, M. A., SHAFIULLAH: Effect of maturity stages and desiccant application on seed yield and oil quality of sunflower (*Helianthus annuus* L.). Crop Research (Hisar) 3(1)40-50, 1990.

UTICAJ VREMENA DESIKACIJE NA SADRŽAJ ULJA U SEMENU SUNCOKRETA

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Izvod

Ogled je postavljen 2009. godine na Rimskim Šančevima sa ciljem da se ispita uticaj hemijske desikacije na sadržaj ulja u semenu kod tri roditeljske linije suncokreta. Desikacija je vršena preparatom *Reglone forte* (2 l/ha) svakih 7 dana od završetka cvetanja i oplodnje do žetvene zrelosti. Pre svakog tretmana utvrđena je vlažnost semena. Sadržaj ulja u semenu utvrđen je po dostizanju žetvene zrelosti. Između sve tri linije utvrđena je visoko značajna razlika u sadržaju ulja u semenu. Najviši sadržaj ulja utvrđen je kod linije L3, a najniži kod linije L2. Kod tretmana izvršenog 21 dan posle cvetanja (DPC), pri vlazi semena od 45,6 %, utvrđen je najviši sadržaj ulja, posle čega nije utvrđen rast sadržaja ulja. Regresionom analizom, kod sve tri linije, maksimum sadržaja ulja utvrđen je pri različitoj vlažnosti semena u momentu desikacije, od 19 % do 39 %.

Ključne reči: desikacija, sadržaj ulja, suncokret, vlaga semena.

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