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EFFECT OF HARVEST DATE ON SEED VIABILITY OF DIFFERENT SUNFLOWER GENOTYPES

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SUMMARY

Effect of harvest date on seed viability has been examined in 3 different sunflower genotypes. Harvesting started 7 days after fertilization. It was done 10 times, at 3-4-day intervals. Seed moisture was determined before each harvest. Trials were conducted in India and Serbia. Seed viability was determined 3 months after the harvest. Genotype ranking regarding seed viability, was not the same in the two locations; higher average seed germination was registered in Serbia. There were no significant increases in seed viability once the average seed moisture at the time of harvest reached 41% (India) and 48% (Serbia). Differences existed between the locations in minimum and maximum daily temperatures. Regression analysis showed that highest seed germination rates were reached when seed moisture content at harvest went below 32%, in most cases when seed moisture reached 22-23%.

Key words: sunflower, seed germination, seed moisture content, air temperature

INTRODUCTION

The process of seed forming and filling, which starts right after pollination, is actually a set of physiological processes aimed at enabling the seed to germinate after a rest period. Many authors have studied sunflower seed viability and dormancy period, i.e., the number of days after flowering (DAF). Jančić and Pap (1983) found that highest increase in viability occurred in the period 20-40 DAF; Maeda et al. (1987) found that highest viability was achieved when performing harvest at 30 DAF. Šepetina and Rogoževa (1971) had reported similar results. They also claimed that viability starts to go down 30-35 DAF, mainly because of the occurrence of diseases.

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Since differences in the environment and genotypes used make the seed viability results unsuitable for comparison, researchers prefer moisture content in seed over DAF as a more reliable indicator. So, Rađenović (1989) asserted that maximum viability is achieved 30-35 DAF, at seed moisture of 22-36%, but he added that there is no significant increase in viability after the seed reaches the moisture of 49-53%. Crnobarac (1987) found high viability already at moisture level of 57%.

Regarding the effect of air temperature on the process of maturation, opinions are split between those authors who argue that low temperatures in the period of maturation tend to improve viability (Bewley, 1979) and those who claim that seed produced under warm conditions is superior in viability, especially if harvested early, 28-31 DAF (Crnobarac, 1987).

Early harvest dates increase seed dormancy (Crnobarac, 1987), and such seed loses viability faster (Gypta and Kole, 1982). Viability of the seed harvested up to 19 DAF starts to decrease after 6 months, if it was harvested 22 DAF after 18 months, and if it was harvested 34 DAF after 36 months (Crnobarac and Marinković, 1994).

The aim of this study was to determine the behavior of three sunflower genotypes grown under different conditions regarding the influence of early harvest date on seed viability.

MATERIALS AND METHODS

Experiments were established in two locations: in Hyderabad (India) and at Rimski Šančevi (S&M). Three genotypes - female lines of sunflower hybrids - were tested: Ha-26, OCMS-98 and OCMS-74. The trials set up in random block design were replicated three times. Conventional cultivation practices were applied.

The first harvest was performed 7 days after the end of flowering. Subsequent harvests took place at 3-4-day intervals till full maturity. A total of 10 harvests were performed. Immediately after harvest, seed moisture was determined by the method of drying at 105^{o}C till constant weight. Seed viability was determined by the method of filter paper, 3 months after harvest.

Meteorological data were received from local meteorological stations. Experimental data were statistically processed by the analysis of variance of two-factorial trial and by regression analysis.

RESULTS AND DISCUSSION

In India, the line Ha-26 achieved the highest average seed viability (Table 1). This value was not significantly different from that achieved with the line OCMS-98, however, both of these lines had significantly higher seed viability than the line OCMS-74. Highest average seed viability was realized in the 10th harvest date, at the average seed moisture of 10.8%. From the 7th date on, when the average seed mois-

ture reached 40.63%, there were no significant increases in seed viability. In the case of the line Ha-26, the plateau was achieved in the 5th date, at the average seed moisture of 46.28%. In the case of the lines OCMS-98 and OCMS-74, the plateau was achieved in the 5th and 7th dates, at the average seed moistures of 48.18% and 41.00%, respectively.

Table 1: Seed viability (%) of different genotypes at different harvest dates in India

Genotype	Harvest date										Average
	1	2	3	4	5	6	7	8	9	10	
Ha-26	0.0	7.7	44.3	65.7	95.0	97.7	97.0	95.7	97.7	99.3	70.0
Ocms-98	0.0	1.0	11.7	76.7	94.0	94.7	99.3	98.3	99.9	99.7	67.5
Ocms-74	0.0	0.0	0	50.3	40.7	60.0	94.0	98.7	99.7	99.7	54.3
Average	0.0	2.9	18.7	64.2	76.6	84.1	96.8	97.6	99.1	99.6	63.9

LSD	Genotype	Harvest date	Genotype × date
5%	4.38	8.00	13.85
1%	5.83	10.64	18.43

In Serbia, the line OCMS-98 achieved the highest average seed viability (Table 2). This value was not significantly different from that achieved with the line Ha-26, however, both of these lines had significantly higher seed viability than the line OCMS-74. Highest average seed viability was realized in the 9th harvest date, at the average seed moisture of 19.2%. From the 5th date on, when the average seed moisture reached 47.90%, there were no significant increases in seed viability. In the case of the line Ha-26, the plateau was achieved in the 4th date, at the average seed moisture of 50.14%. In the case of the lines OCMS-98 and OCMS-74, the plateau was achieved in the 3rd and 5th dates, at the average seed moistures of 66.25% and 43.22%, respectively.

Table 2: Seed viability (%) of different genotypes at different harvest dates in Serbia

Genotype	Harvest date										Average
	1	2	3	4	5	6	7	8	9	10	
Ha-26	79.0	76.0	85.7	96.7	96.3	98.7	96.3	97.3	99.7	99.0	92.5
Ocms-98	77.3	84.0	94.0	90.7	99.7	98.7	99.3	99.9	99.3	98.7	94.2
Ocms-74	55.7	67.0	80.3	80.7	963	98.7	99.7	99.7	99.9	99.7	87.8
Average	70.7	75.7	86.7	89.3	97.4	98.7	98.5	99.0	99.7	99.1	91.5

LSD	Genotype	Harvest date	Genotype × term
5%	3.64	6.65	11.52
1%	4.85	8.85	15.32

The regression analysis showed that the theoretical maximum of viability in the line Ha-26 was achieved at seed moistures of 23.03% and 21.66% in India and Serbia, respectively (Figure 1). Coefficients of determination were high in both locations. The theoretical maximum of viability in the line OCMS-98 was achieved at seed moistures of 11.70% (along with a somewhat lower coefficient of determina-

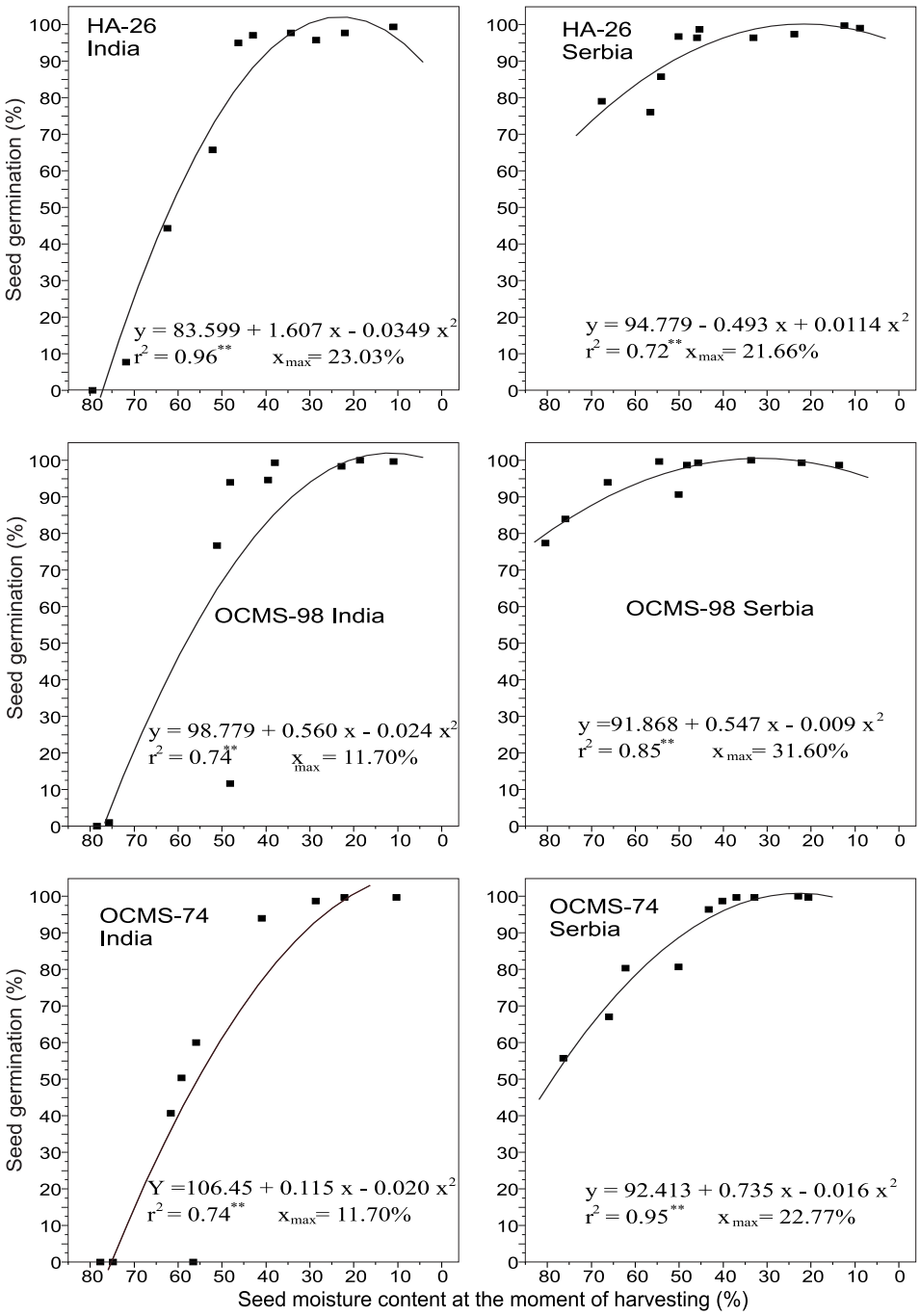

Figure 1: Effect of seed moisture at the moment of harvest on seed viability

tion) and 31.6% in Indiji and Serbia, respectively. The theoretical maximum of viability in the line OCMS-74 was achieved at seed moistures of 22.82% and 22.77% in India and Serbia, respectively. Positions of the curves indicated that, in Serbia, high seed viability was achieved early during the period of maturation.

In India, differences between minimum and maximum air temperatures during the period of maturation were higher than in Serbia (Figure 2). The maximum temperatures were more or less steady but the minimum ones kept increasing. In Serbia, air temperatures were higher than those in India at the initial stages of maturation but after a fortnight they began to go down. There was no heavy rainfall in either location. Daylength was significantly longer in Serbia than in India.

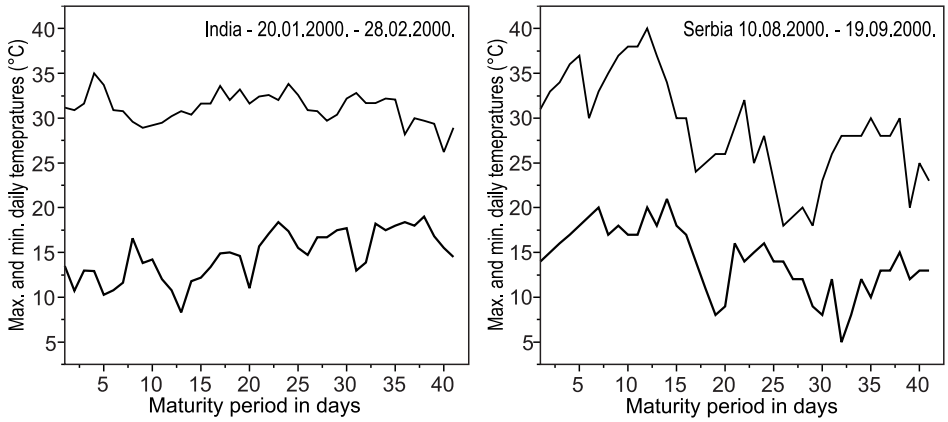

Figure 2: Minimum and maximum daily temperatures at the time of full maturity

High seed viability was achieved early, at high values of seed moisture, which is in agreement with the results of Crnobarac (1987) and Rađenović (1989). The earlier attainment of high viability in Serbia may be due to the high air temperatures in the first two weeks after pollination, which evidently accelerated plant metabolic processes over the rates that took place in India. Differences among the genotypes in the date of attainment of high viability at maturity persisted in both locations, indicating that the characteristic is under genetic control and that it came to expression despite the different environmental conditions. The observed differences should be taken into account in breeding and seed processing. The early attainment of high viability is important in breeding, to accelerate the production of new generations; however, it may pose problems with prolonged dormancy (Crnobarac, 1987). In seed production, care should be exercised with early harvest because, in addition to prolonged dormancy, early harvest may accelerate the loss of viability during storage compared with conventional harvest dates (Gupta and Kole, 1982; Crnobarac and Marinković, 1994).

CONCLUSIONS

Highest values of average seed viability were registered in the genotypes Ha-26 in India and OCMS-98 in Serbia. The difference between these two values was not significant.

Highest values of average seed viability were registered in the seed harvested in the 10^{th} date (India, average seed moisture 10.8%), and the 9^{th} date (Serbia, average seed moisture 19.2%).

In India, there were no significant differences in average germination after the average seed moisture reached 40.63%, and in Serbia after the average seed moisture reached 47.90%.

In both locations, the genotype OCMS-98 could be harvested with the highest seed moisture level (48.18% and 66.25%) without significant influence on viability.

Generally, in Serbia, sunflower seed became viable at earlier harvest dates than in India.

REFERENCES

Bewley, J. D. (1979): Physiological aspects of desiccation tolerance. Annual Review of Plant Physiology, 30, 195-238

Crnobarac, J., Marinkovic, B. (1994): Uticaj ekoloških faktora, genotipa i vremena berbe na posležetveno dozrevanje suncokreta. Selekcija i semenarstvo, Br. 1, 119-125

Crnobarac, J. (1987): Uticaj ekoloških faktora vlage i temperature u ontogenezi na fiziološka i biološka svojstva semena suncokreta. Magistarski rad, Poljoprivredni fakultet Novi Sad

Gupta, K., Kole, S. (1982): Maturity and seed quality in sunflower: physiobiochemical assessment through accelerated ageing. Proc. 10^{th} Inter. Sunflower Conf., 112-115

Jančić, V., Pap, J. (1983): Uticaj ontogenetske starosti na kvantitativna svojstva semena kod sorti i hibrida suncokreta. Naučni skup Čovek i biljka, Matica Srpska, Novi Sad

Maeda, J. A., Ungaro, M. R. G., Lago, A. A. D. O., Razera, L. F. (1987): Maturation and quality of sunflowers. Bragantia, 46 (1), 35-44

Rađenović, B. (1989): Uticaj vremena berbe na energiju klijanja, klijavost i vlagu semena suncokreta sorti VNIIMK i Peredovik u uslovima navodnjavanja na zemljištu tipa smonice (vertisol). Semenarstvo, 6, 11-12, 321-332

Шепетина, Ф., Рогожева, М. (1971): Когда лучше убирать подсолнечник в Тамбовской области. Зерновые и масличные культуры, Но. 9, 17-19

INFLUENCIA DE LA FECHA DE SIEGA EN GERMINACIÓN DE LA SEMILLA EN DIFERENTES GENOTIPOS DE GIRASOL

RESUMEN

Influencia de la fecha de siega en germinación de la semilla fue investigada en tres genotipos de girasol diferentes. La siega fue empezada 7 días después de la polinización. Hubo 10 siembras, con intervalos de 3-4 días. La humedad de la semilla fue determinada antes de cada siembra. Las investigaciones fueron llevadas a cabo en India y en Serbia. La germinación de la semilla fue determinada 3 meses después de la siembra. El ranking de genotipos según la germinación de semilla, no era el mismo en dos localidades investigadas – la germinación promedia fue más alta en Serbia. No hubo más incremento de germinación significante debido a que la humedad de la semilla

durante la siega, había alcanzado 41% (India) y 48% (Serbia). Las diferencias entre las localidades existían en las temperaturas diurnas mínimas y máximas. El análisis de la regresión demostró que la mayor germinación fue lograda cuando la humedad de la semilla durante la siega, estaba debajo de 32%, y en la mayoría de los casos, cuando la humedad alcanzaba 22-23%.

CONSÉQUENCE DE LA DATE DE LA RÉCOLTE SUR LA VIABILITÉ DE LA GRAINE DE DIFFÉRENTS GÉNOTYPES DE TOURNESOL

RÉSUMÉ

La conséquence de la date de la récolte sur la viabilité de la graine a été examinée chez 3 différents génotypes de tournesol. La récolte a commencé 7 jours après la fertilisation. Il y a eu 10 récoltes à intervalles de 3-4 jours. L'humidité de la graine était établie après chaque récolte. Les essais ont été faits en Inde et en Serbie. La viabilité de la graine était déterminée 3 mois après la récolte. Le classement du génotype selon la viabilité de la graine n'a pas été le même dans les deux localités ; une moyenne de germination de la graine plus élevée a été enregistrée en Serbie. Il n'y a pas eu d'augmentations significatives pour ce qui concerne la viabilité de la graine quand l'humidité moyenne de la graine au moment de la récolte atteignait 41% (Inde) et 48% (Serbie). Il y a eu des différence entre les localités dans les températures minimales et maximales quotidiennes. L'analyse de régression a montré que les taux les plus élevés de germination étaient atteints quand le contenu d'humidité à la récolte descendait sous 32%, dans la plupart des cas quand l'humidité atteignait 22-33%.