BOOK OF PROCEEDINGS

Sixth International Scientific Agricultural Symposium
"Agrosym 2015"

AGROSYM 2015

Jahorina, October 15 - 18, 2015

Impressum
Sixth International Scientific Agricultural Symposium „Agrosym 2015“

Book of Proceedings
Published by
University of East Sarajevo, Faculty of Agriculture, Republic of Srpska, Bosnia
University of Belgrade, Faculty of Agriculture, Serbia
Mediterranean Agronomic Institute of Bari (CIHEAM - IAMB) Italy
International Society of Environment and Rural Development, Japan
Balkan Environmental Association, B.EN.A, Greece
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Maize Research Institute „Zemun Polje“ Serbia
Balkan Scientific Association of Agricultural Economics, Serbia
Institute of Agricultural Economics, Serbia

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Website:
http://www.agrosym.rs.ba

CIP - Каталогизација у публикацији

Народна и универзитетска библиотека
Републике Српске, Бања Лука

631(082)(0.034.2)

INTERNATIONAL Scientific Agricultural Symposium "Agrosym 2015" (6 ; Jahorina)
Book of proceedings [Elektronski izvor] / Sixth International Scientific Agricultural Symposium "Agrosym 2015", Jahorina, October 15 - 18, 2015 ; [editor in chief Dušan Kovačević]. - East Sarajevo =Istočno Sarajevo : Faculty of Agriculture =Poljoprivredni fakultet, 2015. - 1 elektronski optički disk (CD-ROM) : tekst, slika ; 12 cm

CD ROM čitač. - Nasl. sa nasl. ekrana. - Bibliografija uz svaki rad. - Registar.

ISBN 978-99976-632-2-1

COBISS.RS-ID 5461016

Original scientific paper
10.7251/AGSY1505373K

GERMINATION OF MAIZE HYBRIDS SEED STORED AFTER HARVEST

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Abstract

In this investigation used three maize hybrids that are belongs to different group of ripening: FAO 3, FAO 4 and FAO 6. The seed of those hybrids used for investigation of genotypic divergences for seed germination, energy of germination, content of abnormal emergence of seeds, content of dead seeds. Hybrid seed for analysis produced on the experimental field of the Institute of Maize in Zemun Polje, Belgrade. The viability of the maize hybrids seeds were determined in experimental analysis carried out in laboratory for quality of seed in the Maize Research Institute Zemun Polje, Belgrade. According to standard method on filter paper were estimated the values of seed germination. The three experiment of seed germination carried out: 2 months after harvest, 9 months after harvest and 18 months after harvest. In average for each test the highest percentage of seed germination were found for hybrid ZP FAO3: 92.75% for seed after 2 months of harvest, 92.00% for seed 9 monhts after harvest and 91.50% for seeds after 18 months of harvest. This hybrid had the lowest percentage of ungerminated seeds (2.75%) and the least content of dead seed (~5.00%). The lowest value of seed germination (86.33%) and the highest values of ungerminated seed (~3.00%) as well the highest content of dead seed (10.33%) had hybrid belongs FAO 4 group. The obtained results indicate differences of germination in analyzed maize genotypes.

Key words: *seed, germination, percentage, hybrid, maize*

Introduction

Value of seed germination is very important trait of genotypes and represent initial stage of plant development. The plant species potential for reproduction is determined with seed germination. Genetic potential for seed germination is different among cultivars and hybrids and expresed in interaction with environmental conditions. The process of seed germination require available water which is need for activating enzyme system and initiating growth and development of seedlings (ISTA 2010). Seed germination is the most important trait of quality and life cycle of seeds, depends of genotypes and environments, which determine efficiency of plant growth (Milošević and Malešević, 2004). In the aim to establish value of seed germination, developed different methodes for analysis of seed germination of different plant species as well as for maize (Milošević et al., 1994). The identification of quality of seed contribute to undestand its importance for economy. International seed trade represents one of the basic indicators of an economic status of a country. Seed production is among the most profitable activities in the field of agriculture, considering relation of areas under commercial seed production and high financial effect (Knežević et al., 2006). Methods for germination of maize seeds on filter paper and sand represent standard test under optimal humidity of supstrate, as well temperature and humidity of the environment. This methods used filter paper is very short and efficient for establishing of seed germintion. The standard test of germination healthy and unharmefull seeds under favorable laboratory condition give us useful information about seed germination capacity (Milošević et al., 2007). However, standard tests, often do not show realistic behavior of the seed under field conditions are still used. In the case of high doses of treatment by pesticides can use larger fraction of seeds for testing in sand. In purpose to establish seed germination for planting in cold field conditions used different type of vigor tests. Germination percentage of seeds in laboratory will give information that seeds can planted in field conditions and develop into normal plants. The growing of maize hybrids in different environment can be associated with variations in seed germination ability under the influence of environmental limiting factors as well soil fertility, climate (Kovačević et al., 2011; Ranieri et al., 2012). Several ecological and evolutionary factors can affect the process of seed germination, as well seed size which have an important evolutionary effects on plant reproduction of many plant species (Moles et al., 2006), and have influence to germination time, germination percentage and seedling vigor (Yanlong et al., 2007).

The aim of this work is study of variability of seed germination hybrids belongs to different maturity group and established differences of percentages of germinated seeds in laboratory conditions.

Material and Methods

The three maize hybrids, originated from Institute of maize Zemun Polje, Serbia (ZP-FAO 3. ZP-FAO 4 and ZP-FAO 6) were utilized for investigation. Four replicates of hundred seeds of each hybrids were used in laboratory tests. The standard germination test was conducted in rolled paper towels placed in germinator at 20°C (16 hours) and then at 30°C (8 hours) according to the rules of the International Seed Testing Association (2010). The germinator was set to provide light during the high-temperature cycle (8 hours) and to remain dark during the low-temperature cycle (16 hours). An initial count of germination percentage was 5th day and a final count 7th day after beginning of germination test.

For data analysis was taken Kruskall-Wallis's test, which is a non-parametric alternative one way of analysis of variance with different patterns. Results are converted into ranks, and comparing the middle ranks of each group. Statistical analysis was performed using the "R programming language" (The R Project for Statistical Computing, version 3.1.3) (R Development Core Team, 2015).

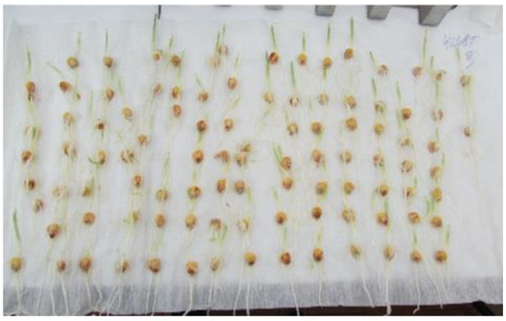
Results and Discussion

In this investigation obtained results showed variability of seed germination in laboratory conditions depends on hybrids and different length of storage time after harvest. The lowest value (86.10%) of seed germination energy, in average had the hybrid ZP FAO 4 and the highest germination energy (91.60%) had hybrid ZP FAO 3. Also in all test of grmination, the highest seed germination energy had ZP FAO 3 in test of two months after harvest - 92.25%, nine months after harvest-91.50% and 18 months after harvest 91.25%. The lowest energy of seed germination had hybrid ZP FAO 4, in test at two months after harvest - 86.75%, nine months after harvest-85.00% and 18 months after harvest 86.50%. Seed germination energy of hybrid ZP FAO 6 was in test at two months after harvest -86.50%, nine months after harvest-91.00% and 18 months after harvest 91.50% (table 1).

Table 1. Percentage of seed germination energy and percentage of seed germination

	Seed germination energy % after harvest			Average %	Value of seed germination % after harvest			Average %
Hybrid	2-months	9-months	18-months		2-months	9-months	18-months	
ZP FAO 3	**92.25**	**91.50**	**91.25**	91.60	92.75	92.0	91.50	92.08
ZP FAO 4	**86.75**	**85.00**	**86.50**	86.10	**87.50**	**85.75**	87.25	86.33
ZP FAO 6	**86.50**	**91.00**	91.50	89.66	**93.25**	**91.75**	90.25	91.75

The lowest value of seed germination (86.33%), in average had the hybrid ZP FAO4 and the highest value of germination (92.08%) had hybrid ZP FAO3. Also in all test of grmination, the highest percentage of seed germination had ZP FAO3, two months after harvest -92.75%, nine months after harvest-92.0% and 18 months after harvest 91.50%. The lowest seed germination had hybrid ZP FAO4, in test at two months after harvest -87.50%, nine months after harvest-85.75% and 18 months after harvest 87.25%. Seed germination energy of hybrid ZP FAO6 was in test at two months after harvest -93.25%, nine months after harvest-91.75% and 18 months after harvest 90.25% (table 1, picture 1.).
Data about differences between maize hybrids for seed germination reported in investigation of other genotypes (Milošević et al. 1994) depends of endosperm of seeds (Pajić et al., 1998) and in different environmental conditions (Meeks et al., 2013).



Picture 1. Test of seed germination in maize hybrids

Picture 2. Occurrence of abnormal seed germination and dead seeds

Table 2. Content of abnormal seeds and dead seeds of maize ZP hybrids

	Abnormal seed germination (%) after harvest			Average	Dead seed at germination % after harvest			Average
Hybrid	2-months	9-months	18-months		2-months	9-months	18-months	
ZP FAO 3	**2.75**	**2.75**	**2.75**	2.75	**4.50**	**5.25**	**5.25**	5.00
ZP FAO 4	**3.75**	**3.50**	1.75	3.00	**9.00**	**11.0**	11.0	10.33
ZP FAO 6	**2.25**	**2.25**	2.75	2.75	**4.50**	**6.00**	7.00	5.82

During the analysis of seed germination, abnormal germination of seed occured, and dead seed (picture 2). The value of abnormal seed germination was similar for the investigated maize hybrids, approximately 3% (table 2) However, the lowest percentage of dead seed had hybrid ZP FAO3 (5.00%) and ZP FAO6 (5.82%), while the highest content of dead seed had hybrid ZP FAO4 (10.33%) table 2.
The results of seed germination obtained by using standard method in the filter paper showed that the values obtained in three term after harvest are very few deviate for one hybrids, but there was differences between values obtained in the same test term after harvest for each analyzed hybrid of maize. For seed energy of germination and germination of seed were found differences between analyzed maize hybrids. The obtained values of χ^2 =1.96 for germination energy of seeds is with probability 0.5499 (figure 1), while for percentage of seed germination influence of genotype for computed χ^2 =0.11 is with probability 0.9465 (figure 2). On the base of obtained values of probability on the level of >0.05 differences between genotypes are not significnt.

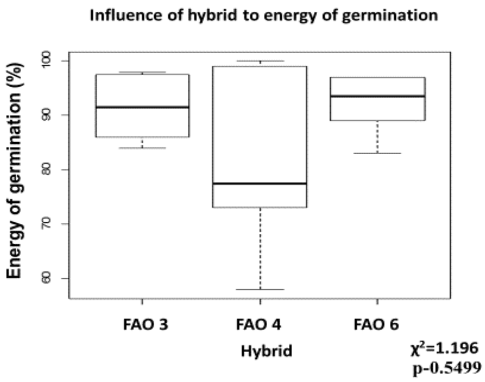


Figure 1. Effect of hybrids to germination energy

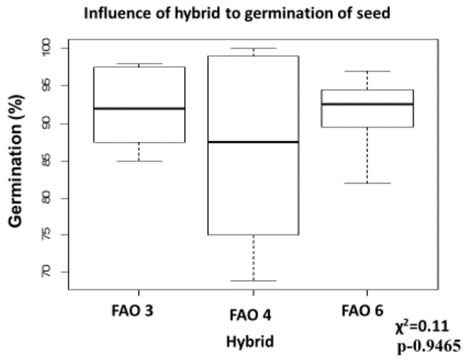


Figure 2. Influence of hybrids to germination

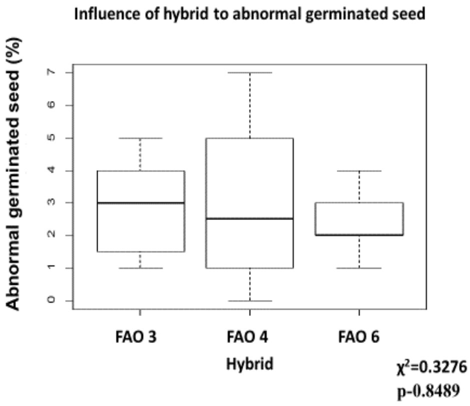


Figure 3. Effect of hybrids to occurence of abnormal seed germination

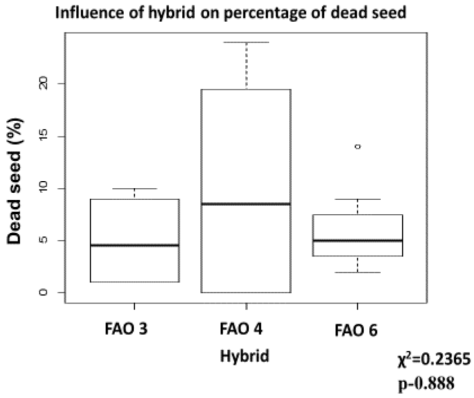


Figure 4. Influence of hybrids to occurence of dead seed

The differences between hybrids were not significant for occurence abnormal seed germination have probability 0.8489 for obtained values of χ^2 =03276 (figure 3) and for dead seed obtained values of χ^2 =0.11 was with probability 0.888 (figure 4).

Table 3. Kruskal-Wallis test for effect of seed storage time on traits of seed test germination in maize hybrids

Trait	χ^2	DF	p	Trait	χ^2	DF	p
Energy of germination	0,5888	2	0,745	Abnormal seeds	0,0378	2	0,9813
Percentage of germination	0,3464	2	0,841	Dead seed	0,4121	2	0,8138
χ^2-Chi square; DF-degree of freedom; p-probability							

The estimation of influence of different length of storage time after harvest on energy of seed germination, percentage of germination, content of abnormal germination of seeds and dead seeds presented in table 3. The obtained values of probability at level >0.05 for those traits indicate that included periods of storage seed after harvest do not have significant influence on seed germination. Storage time did not affect the values of seed germination, indicating that the seed is vital and that storage conditions were appropriate.

Conclusion

In this study were found differences among hybrids for seed germination energy, seed germination, occurence of abnormal seed germination and dead seed. In average the highest germination energy (91.60%) and germination of seed (92.08%) had ZP FAO3, and the lowest germination energy-86.10%, and germination-86.33% had maize hybrid ZP FAO4. The occurence of abnormal seed germination was the lowest (2.75%) in hybrid ZP FAO3. The lowest content of dead seed established in ZP FAO3 (5.00%) and the highest in ZP FAO4 (10.33%). Included length of storage time after harvest of seed did not have significant influence on expressed differences of seed germination which were stored in appropriate conditions. Germination testing in the laboratory is done under very favorable, controlled conditions (humidity, temperature, light). Such results can be a good indicator of seed germination in field conditions where they are usually unfavorable factors as temperature and humidity, the structure of soil and soil pests.

Acknowledgements

This investigation supported by Ministry of Education, Science and Technology Development of Republic of Serbia, Project TR 31092, and partly HERD program.

References

ISTA (2010): International Rules for Seed Testing. International Seed Testing Association, Switzerland.

Knežević, D., Mićanović, D., Zečević, V., Madić, M., Paunović, A., Djukić, N., Šurlan-Momirović, G., Dodig, D., Urošević, D. (2006): Breeding in function of seed providing for production biological valuable food. In Monograph “Improvement of agricultural production in Kosovo and Metohia” (editor, D. Knežević). pp. 71-87.

Kovačević, V., Šimić,D., Kadar,I., Knežević, D., Lončarić, Z. (2011): Genotype and liming effects on cadmium concentration in maize (Zea mays L.) Genetika, 43 (3):607-615.

Meeks, M., Murray, C. S., Hague, S., Hays, D. (2013): Measuring Maize Seedling Drought Response in Search of Tolerant Germplasm, Agronomy, 3:135-147

Milošević, M., Rajnpreht, J., Ćirović, M., Zlokolica, M. (1994): Methods for testing corn seed viability. Plant breeding and seed production, 1:179-182

Milošević, M., Malešević, M. (2004): Seed science. Institute of field and vegetable crops and National laboratory for seed testing, Novi Sad.

Milošević, M., Vujaković, M., Nikolić, Z., Ignjatov, M. (2007): Seed quality control. Science - basis of the sustainable development, Serbian genetic society, Belgrade, pp. 95-124.

Moles, A.T., Westoby, M. (2006): Seed size and plant strategy across the whole life cycle. Oikos, 113: 91-105.

R Development Core Team (2015): A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.

Ranieri, B.D., Pezzini, F.F., Garcia, Q.S., Chautems, A., França, M.G.C. (2012): Testing the regeneration niche hypothesis with Gesneriaceae (tribe Sinningiae) in Brazil: Implications for the conservation of rare species. Austral. Ecology, 37:125-133.

Yanlong, H., Mantang, W., Shujun, W., Yanhui, Z., Tao, M., Guozhen, D. (2007): Seed size effect on seedling growth under different light conditions in the clonal herb Ligularia virgaurea in Qinghai-Tibet Plateau. Acta Ecologica Sinica, 27:3091-3108.

Pajić, Z., Popović, R., Satarić, I. (1998): The effect of endosperm type on seed germination of maize (Zea mays L.). Breeding and seed production, 5(1-2): 69-72.