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INFLUENCE OF STORAGE CONDITIONS AND SEED TREATMENT ON GERMINATION ENERGY AND SEED GERMINATION OF MAIZE HYBRIDS

UTJECAJ UVJETA SKLADIŠTENJA I TRETIRANJA SJEMENA NA ENERGIJU KLIJANJA I KLIJAVOST SJEMENA HIBRIDA KUKURUZA

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ABSTRACT

After seed processing of OS maize hybrids (Ossk 430, Ossk 499, Ossk 602 and Ossk 617) 500 kg of seed was taken from each hybrid and treated in mobile sprayer in the following treatment variances: T-1 (A.I. carboxine+tiram, dosage 500 ml/100 kg of seed), T2 (A.I. fludioxonyl+M-metalaxyl, dosage 100ml/100kg of seed), T-3 (A.I. carboxin+tiram, dosage 500ml/100kg of seed + A.I. imidacloprid, dosage 0,6l/100 kg of seed). After the treatment seed was packed into PWC bags and from each treatment seed samples were made for concrete, floor storage (S-1) and concrete floor storage with termoisolation (S-2). Germination energy and seed germination of all variances of seed treatment were determined at the beginning of storaging (C-1), after 12 months of storaging (C-2) and after 24 months of storaging (C-3). The highest germination energy and seed germination were with seed of hybrids OSSK 499 and OSSK 430,while hybrids OSSK 602 and OSSK 617in all seed treatments had lower germination energy (4-7%) and seed germination (3-5%). Seeds of maize hybrids which were storaged into floor concrete storage with termoisolation in conditions of lower temperature and relative air humidity had better quality compared to seed storaged into floor concerete storage. Research results show significance of storage treatment, storage conditions and hybrids on germination energy and seed germination during storaging of 24 months (P<0,001).

Key words: *maize, germination energy, seed germination, storage duration, seed treatment.*

REZIME

Poslije dorade sjemena OS hibrida kukuruza (Ossk 430, Ossk 499, Ossk 602 i Ossk 617) je svakog hibrida odvojeno je 500 kg sjemena, koje je tretirano u protočnom zaprašivaču u sljedećim varijantama tretmana: T-1 (aktivna tvar karboksin+tiram, doza 500 ml/100 kg semena), T2 (aktivna tvar fludioksonil+M-metalaksil, doza 100ml/100kg semena), T-3 (aktivna tvar karboksin+tiram, doza 500ml/100kg sjemena+ aktivna tvar imidaklopirid, doza 0,6l/100 kg semena). Poslije tretiranja, sjeme je upakirano u PWC vreće i od svakog tretmana sjemena su napravljeni uzorci sjemena za betonsko, podno skladište (S-1) i podno, betonsko skladište s termoizolacijom (S-2). Energija klijanja i klijavost sjemena svih varijanti tretmana sjemena je utvrđena pri početku skladištenja (V-1), nakon 12 mjeseci skladištenja (V-2) i nakon 24 mjeseca skladištenja (V-3). Najveća energija klijanja i klijavost sjemena bila je kod sjemena hibrida OSSK 499 i OSSK 430, dok su hibridi OSSK 602 i OSSK 617 u svim tretmanima sjemena imali manju energiju klijanja (4-7%) i klijavost sjemena (3-5%). Sjeme hibrida kukuruza koje je skladišteno u podno betonskom skladištu s termoizolacijom u uvjetima snižene temperature i relativne vlage zraka manje je izgubilo na kvaliteti od sjemena hibrida kukuruza koje je skladišteno u betonskom podnom skladištu. Rezultati istraživanja ukazuju na značajan utjecaj tretmana, uvjeta skladištenja i hibrida na energiju klijanja i klijavost sjemena tijekom skladištenja od 24 mjeseca (P<0,001).

Ključne riječi: *kukuruz, energija klijanja, klijavost, vrijeme skladištenja, tretman sjemena.*

INTRODUCTION

Due to increased and significant pest incidence seed needs to be protected and treated with suitable fungicides and insecticides. By choosing the suitable insecticide and optimal dosage of preparation for seed treatment we can reduce pest incidence and in that way secure optimal field emergence and planting density. With that we create preconditions for maximal exploitation of genetic potential of the cultivar. Treatment of seed of maize hybrids with insecticides is still not common practice and is usually done upon buyers request. After selling seasonal seed supplies of processed-natural seed, seed treated with fungicides or with fungicides and insecticides usually remain. Such seed is kept in different storage conditions and sometimes loses germination energy and seed germination and can not be used as seed material. According to the literature data quality of seeds is influenced by: genotype of the cultivar, damage of grains in processing, manner and period of grain storage, packaging, favorable water content, conditions and duartion of storaging, pesticide influence, temperature at which seeds are preserved, biochemical degradation of seed tissue, disease and pests incidence (*Singh et al., 2003; Deshmukh et al., 2004; Sisman et al., 2005; Hudec, 2006; Šimić et al., 2008, 2009; Pavlov et al., 2010; Vujošević et al., 2010*).

Treatment of seeds of maize hybrids is necessary and protects seed from influence of pests, provides better plant density compared to seed not treated with insecticides and increases positive influence of insecticides on economical characteristics of maize. Therefore it is very important to develop research which will investigate influence of seed treatment on germination energy and seed germination in given storage conditions. The aim of this research was to obtain presumptions about the importance of genotype influence, seed treatment and storage conditions and duration of storage on germination energy and seed germination of seeds of maize hybrids. By choosing better technological solutions it would be possible to preserve seed quality and significantly reduce amount of seeds discharged due to loss of determined quality level.

MATERIAL AND METHOD

After seed processing of OS maize hybrids (Ossk 430, Ossk 499, Ossk 602 and Ossk 617) we determined germination energy and seed germination of naturally processed (selected) seed at the beginning of storaging (control). From each hybrid we separated 500 kg of seeds which were treated in mobile sprayer Gustafson S100 in the following treatment variances: T-1 (active ingridient carboxine+tiram, dosage 500 ml/100 kg of seeds), T2 (active ingridient fludioxonyl + M-metalaxyl, dosage 100ml/100kg of seeds), T-3 (active ingridient carboxine+tiram, dosage 500ml/100kg of seeds+ active ingridient imidacloprid, dosage 0,6l/100 kg of seeds). After treatment, seeds were packed into PWC bags and from each seed treatment we created four different treatments for both storage conditions; S-1(floor storage, air temperature 10-20 ^{0}C and relative air humidity 60-75%) and S2 (floor storage with termoisolation, air temperature10-15^{0}C and relative air humidity 60-65%). Germination energy and seed germination of all variances of seed treatment was determined at the beginning of storaging (C-1), after 12 months of storaging (C-2) and after 24 months of storaging (C-3). Every six months for both storage conditions and each treatment 1,5 kg of seed samples were taken from both storage conditions for laboratory analysis (ISTA-Manual on sampling methods and examination of seed quality NN 24/05). From each seed sample working sample was prepared in laboratory and planted in four repetitions. 100 grains of maize hybrid were planted into moistened filter paper in four repetitions. Filter paper was rolled up and placed into growing chambers at 25˚C with 12 hour day/12 hour night regime. After four days germination energy (%) was determined and after seven days total germination of seeds by counting germinated seeds. Temperature and relative air humidity were recorded daily with digital thermometer (Oregonscientific, THG-312). Statistical processing of obtained data was done with ANOVA – analysis of variance computer software. Significance of obtained differences was determined with F test and least significant difference of germination energy and seed germination were obtained with LSD test.

RESULTS AND DISCUSSION

Obtained research results show influence of treatment, storage conditions and hybrid on decrease of germination energy and seed germination of maize hybrids. Differences in seed quality depending on seed treatment are statisticaly very significant (Table 1). Influence of treatment is not the same with each hybrid and seed of better germination energy and seed germination has better tolerance to pesticide application. The highest germination energy and seed germination (90-92 %) were with seed of hybrids OSSK 499 and OSSK 552, while hybrids OSSK 602 and OSSK 617 in all variances of research had significantly lower germination energy (4-7 %) and seed germination (3-5 %). Seeds of maize hybrids storaged in floor concrete storage with termoisolation in conditions of lower temperature and relative air humidity had better seed quality compared to seeds storaged in floor concerete storage. Seeds of hybrids OSSK 499 and OSSK 552 maintained high seed quality in both types of storage and storage conditions during 24 months, while seeds of hybrids OSSK 602 and OSSK 617 maintained seed quality only in storage conditions S-2. Hybrid OSSK 602 maintained legally regulated germination level only for 12 months in both storage conditions. This hybrid had the lowest germination energy (7-22 %) and seed germination (7-14 %) rate.

Table 1. Influence of treatment and storage conditions on germination energy and seed germination of maize hybrids (%)

Seed treatment	Ossk 499				Ossk 552				Ossk 602				Ossk 617			
	S1		S2		S1		S2		S1		S2		S1		S2	
	EN	GE	EN	GE	EN	GE	EN	GE	EN	GE	EN	GE	EN	GE	EN	GE
Beginning of storage- c1																
Control	91	95	91	95	93	95	93	95	90	94	90	94	93	94	93	94
T-1	93	95	93	95	95	95	95	95	93	94	93	94	94	95	94	95
T-2	90	92	90	92	92	92	92	92	89	90	89	90	91	92	91	92
T-3	90	92	90	92	90	90	90	90	88	91	88	91	90	92	90	92
After12 months of storaging - c2																
Control	88	92	90	91	86	92	90	91	88	90	89	90	86	90	90	92
T-1	88	90	91	92	89	91	91	92	89	91	90	90	88	91	90	93
T-2	85	87	88	90	85	88	89	90	85	87	88	89	85	88	88	90
T-3	83	82	86	88	84	85	85	88	80	85	87	86	85	86	86	87
After 24 months of storaging - c3																
Control	87	90	89	90	88	90	89	90	76	83	84	86	86	90	88	90
T-1	88	90	90	91	86	91	89	92	78	85	87	88	88	91	90	91
T-2	82	87	86	88	83	86	86	87	72	74	82	82	85	88	86	88
T-3	80	82	83	87	82	86	84	85	68	70	77	80	81	80	84	86

Table 2. Analysis of variance

Source of variation	Germination energy			Seed germination		
	F-test	LSD-test		F-test	LSD-test	
		0,05	0,01		0,05	0,01
Hybrid (A)	34.255**	3,17	5.74	21.458*	2.11	3.42
Treatment (B)	526.367**	5.44	6.07	412.357**	3.24	5.73
Storage (C)	412.314**	7.17	8.25	304.656**	6.48	7.23
Interaction (ABC)	327.357**	3.12	4.26	169.752*	5.77	6.42

Law on seeds and planting material (NN 24/05) and Manual on seed trafficking (NN 55/11) regulate that minimal germination of seeds according to internationally recognized laboratory analysis (ISTA) placed on the market can not be lower than 90%. Our results emphasize seed treatment and time period of storaging as important factors for seed storaging. At the beginning of storaging all maize hybrids had legally allowed germination for seed trafficking and after 12 months of storage, depending on the hybrid and seed treatment, they lose legally regulated germination of 90 % and can not be placed on the market (germination from 82 to 89 %). Storaging in controlled conditions (S2) with treatment T1 maintains seed germination after 24 months of storaging, except for hybrid OSSK 602 (germination energy from 77 to 85 % and germination from 77 to 88 %).

Analysis of variance confirmed the hypothesis that selection of fungicide and insecticide, together with storage conditions (optimal air humidity and lower air temperatures) enables longer seed preservation (*Sisman and Delibas, 2005; Hudec, 2006*). In accordance to our research we can conclude that due to grain chemical content and pericarp damage during seed processing (grain formation) grain storaging is time limited.

CONCLUSION

Based on the research of influence of treatment and conditions of storage on maize hybrids we can conclude the following:

1. The highest germination energy and seed germination in all treatment variances and conditions of storage had hybrids OSSK 499 and OSSK 552.
2. Maize hybrids OSSK 602 and OSSK 617 in all treatment variances had significantly lower germination energy (4-7 %) and seed germination (3-5 %).
3. Seeds of maize hybrids which were storaged in floor concrete storage had lower germination energy (3-7 %) and seed

germination (4-17 %) compared to floor concrete storage with termoisolation.

4. Seeds of maize hybrid OSSK 617 maintained seed quality only in floor concrete storage with termoisolation.

5. Hybrid OSSK 602 had the smallest decrease of germination energy (7-22 %) and germination (7-14 %)in all storage and treatments conditions.

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