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# THE INFLUENCE OF SEED STORAGE ON GERMINATION OF TALL FESCUE DURING AFTER-RIPENING PERIOD
# UTICAJ ČUVANJA SEMENA VISOKOG VIJUKA NA KLIJAVOST TOKOM POSŽETVENOG DOZREVANJA

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## *ABSTRACT*

*After the harvest of tall fescue seed dormancy is present, indicating the reduction of germination. In conventional storage conditions for seed storage, we investigated the influence of three different ways of packaging (paper bags, canvas bags and plastic bags) to change the germination of seeds immediately after harvest, after 30, 60 and 90 days. After 30 days seed dormancy is reduced by 1 to 3% and germination was increased by 2-3%, while the impact of packaging had no significant effect.The decreasing trend in seed dormancy and increased germination even after 60 days continued in the same percentages. After 90 days of storage the contents of dormant seed was reduced to 22-35% and germination was increased to 65-72%.*

***Key words**: Tall fescue, seed, storage, packaging.*

## *REZIME*

*Odmah po ubiranju semena visokog vijuka seme je sa povećanom vlagom i sa smanjenom klijavošću što uslovljava prisutnost dormantnog semena. Stoga je nakon dosušivanja semena na 12% vlažnosti u klasičnim skladišnim uslovima za čuvanje semena, ispitivan uticaj tri različite ambalaže (papirne kese, platnene kese i PVC kese) na promenu klijavosti semena, odmah nakon ubiranja, nakon 30, 60 i 90 dana. Na tri ispitivane partije semena visokog vijuka, odmah nakon žetve je utvrđeno 35 – 46 % dormantnog semena, što je uslovilo početnu klijavost od 59 do 64%. Nakon 30 dana, dormantnost semena se smanjila za 3,4% a klijavost se povećala za 2,5 %, dok tip ambalaže nije imao značajan uticaj. Trend smanjenja dormantnosti semena i povećanja klijavosti se i nakon 60 dana nastavio u istim procentima. Tip ambalaže u ovom periodu nije konstatovan od značajnog uticaja. Nakon 90 dana čuvanja semena utvrđeno je smanjenje dormantnog semena na 29-33 % i povećanje klijavosti na 71-77 %. U onom periodu, seme čuvano u PVC anbalaži je imalo značajno veću klijavost na dve od tri ispitivane partije semena, što je omogućilo zadovoljenje zakonske regulative za stavljanje semena u promet i korišćenje za setvu u jesenjem setvenom roku iste godine kada je i ubrano. Seme čuvano u papirnoj i platnenoj anbalži kod sve tri partije je imalo manju klijavost od 75% i nije se moglo koristiti u komercijalne svrhe.*

***Ključne reči:** Visoki vijuk, seme, čuvanje, pakovanje-anbalaža.*

## INTRODUCTION

Tall fescue is one of the most important forage grasses, which often became part of the grass-legume mixtures, while the cultivation as pure crops is rare case. This species has very good adaptability to environmental conditions and high yielding forage (Lazarević et al. 1998). Tall fescue also has high seed yield (Stanisavljević et al. 2008). After harvest, the seeds of perennial weeds and wild species of the family Poaccae characterized period of seed dormancy (Kon, 2007). Seed dormancy can be caused by the material of the surrounding tissues of the embryo, they are permeable barriers that prevent taking water or gas exchange, and mechanical barriers that prevent the spread of embryos or those that prevent germination (Bewley 1997). Also in the embryo we can find enzymes, indicating that depression is a product of genes that affect the seed dormancy (Dyer et. al. 1993). All this causes reduced germination of the seeds immediately after harvest: French ryegrass 57% (Stanisavljević et al 2010b), the cat's tail, 75% (Stanisavljević et al 2008). Seed dormancy and reduced germination of seeds immediately after harvesting of perennial forage grasses even in the same class differed: 60% of meadow fescue, tall fescue 65%, 61% red fescue (Stanisavljević et al. 2010).

Thus, seed dormancy is caused by genetics and physiology factors that are characteristic of certain species of seed plants, but on the dormancy and germination affected by storage conditions and their interactions during post harvest ripening (Jusic and Bass, 1987, Walters et al., 2005, Kostic et al 2007, 2009).

During the ripening period, we can reduce amount of dormant seed and increased germination, which will determine, after the harvest in June, the possible use of the seeds for sowing in the autumn or in the spring of next year. In natural meadow communities presence of dormant seed can affect the germination delay or lack of germination in late autumn which can cause germination in the spring when environmental conditions are favorable thus have a positive impact on the maintenance of grass species in the meadow communities (Stanisavljević et al. 2010a ).

The aim of this study was to investigate the effect of different packaging on seed storage and changing of germination during post harvest ripening in conventional storage conditions.

## MATERIAL AND METHODS

After harvesting the seed (in mid-June) the three seed lots of tall fescue cultivars, K-20, is within three days are dried to 12% humidity. Seed germination (%) and seed dormancy (%) were immediately measured. Determination of seed germination and dormant seed were measured every 30 days during period of 90 days for all three ways of packaging, paper bags, canvas bags and plastic bags. During the review period the seeds were stored in a conventional warehouse conditions in which each day determined the maximum temperature (º C) and maximum relative humidity (%), minimum temperature (º C) and minimum relative

humidity (%), mean daily temperature (º C) and mean daily relative humidity (%) based on which values are calculated for each month (Table 1).

*Table 1. Maximum and minimum temperature and relative air humidity values in seed storage rooms.*

| Month | Temperature (ºC) | | | Relative air humidity (%) | | |
|---|---|---|---|---|---|---|
| | Aver. | Min. | Max. | Aver. | Min. | Max. |
| June | 20 | 15 | 24 | 63 | 45 | 80 |
| July | 23 | 16 | 30 | 64 | 48 | 80 |
| August | 24 | 17 | 31 | 68 | 52 | 84 |
| September | 12 | 9 | 23 | 74 | 65 | 82 |

For germination, 4x100 seeds from each replicate were tested on filter paper (TP) according to the ISTA rules (International Seed Testing Association, 2008). After a pre□chill treatment at 5°C for 5 days, seeds germinated at alternating temperatures of 30/20°C (30°C for 8 hours of light and 20°C for 16 hours of dark). The final count of normal seedlings was made after 14 days.

## RESULTS AND DISCUSSION

The collection of seeds of tall fescue in the conditions of Serbia was done in mid-June, when is dispersal of seeds was dispersed in natural meadow communities (Stanisavljević et al. 2007). This seeds can be used for sowing in autumn in the same year, in spring sowing next year or in a subsequent term sowing, with respect to the legislation by which the minimum germination of tall fescue to 75% (Službeni list br. 47/87). According to Kon et al. (2007) seeds of forage grasses and weeds are characterized by the presence of dormant seeds immediately after collection or drop-out, which causes reduced germination, which varies greatly depending on the species. The period of dormancy of seeds depends on the genetic and physiological potential of species (Bewley 1997). It also depends on the conditions in storage and interacting environmental factors during seed storage (Merritt et al. 2003).

In some commercial species (mainly vegetables) the seed dormancy was reduced or almost non-existent through the process of breeding, while in perennial grass seed dormancy through breeding has not decreased (Adkins et al 2002).

In tests conducted at the Institute for forage crops are logged in Krusevac immediately after harvesting and drying of tall fescue seed had an average germination of 61.3% with the difference in germination depending on the seed lots by 5%. Proportion of dormant seeds was 42% with a margi of 35% (Table 2). According to earlier investigations conducted by Stanisavljević et al (2010 a) seed germination of tall fescue seed immediately after harvest was 65%. In this investigation, almost the same germination was determined in only one seed lots (Tab.2).

*Table 2. Seed germination of tall fescue immediately after harvesting and drying*

| Germination (%) | | | | Dormant seeds (%) | | | |
|---|---|---|---|---|---|---|---|
| P1 | P2 | P3 | Meaan | P1 | P2 | P3 | Meaan |
| 64 | 59 | 61 | 61,3 | 35 | 42 | 36 | 37.7 |

The tests on the seeds of meadow fescue showed that the germination of seed lots varied from 63% to 67% immediately after harvest (Djukanovic et al. 2010).

For perennial ryegrass germination of seeds of Bartwingo variety immediately after harvesting was 85.8% and after 90 days stored at 10ºC and storage at -20ºC germination was 81.7%. Germination of the Calibra variety immediately after harvest was 68.5%. After 90 days of storing at 10ºC germination was 79.0%, and the seed kept at -20ºC germination was 72.5% (Roznan et al (2007). In storage of seeds up to 9 months at a temperature of 10 º C and -20 ° C, the germination of seeds of perennial ryegrass varieties Bartvingo was 83.0% and 86.8% and that of varieties Vectra from 69% to 72.8% (Roznan et al 2010).

For tall fescue seed testing after 30 days of the classic guarded storage conditions (Table 1) and three different containers, germination increased by an average of 2.5%, dormant seed decreased by 3.4% and the impact of packaging for storing seeds had significant effect ($p \leq 0.05$). In the next 30 days or 60 days from seed collection, germination increased by 6% and 8.5%, seed dormancy decreased by 3.4% and 8.3%, but the impact of packaging for keeping seeds or in this period had no significant effect (table 2.3.4).

*Table 3. Impact of packaging on seed germination of tall fescue 30 days after harvest*

| Way of keeping | Germination (%) | | | | Dormant seeds (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | P1 | P2 | P3 | Meaan | P1 | P2 | P3 | Meaan |
| Papir bags | 65 a | 61 a | 63 a | 63.0 | 33 a | 36 a | 35 a | 34.7 |
| Canvas bags | 64 a | 63 a | 65 a | 64.0 | 34 a | 37 a | 33 a | 34.7 |
| PVC | 66 a | 62 a | 65 a | 64.3 | 32 a | 35 a | 34 a | 33.6 |
| Way of keeping | 65.0 | 62.0 | 64.3 | 63.8 | 33.0 | 36.0 | 34.0 | 34.3 |

After 90 days of storage, seed germination, on average, increased by 4.1% and dormancy decreased by 69% compared to the fixed value of 60 days (Tab.4 and 5). Seeds stored in PVC containers exhibited an average of 2.7 % higher germination than that from paper and canvas packing. But for the two lots (P1 and P3) the impact of packaging for storage was higher accompanied with the statistical significance ($p \leq 0.05$) (Table 5).

*Table 4. Impact of packaging on seed germination of tall fescue 60 days after harvest*

| Way of keeping | Germination (%) | | | | Dormant seeds (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | P1 | P2 | P3 | Meaan | P1 | P2 | P3 | Meaan |
| Papir bags | 70 a | 69 a | 69 a | 69.3 | 28 a | 29 a | 31 a | 29.3 |
| Canvas bags | 72 a | 63 a | 73 a | 69.3 | 30 a | 33 a | 28 a | 31.3 |
| PVC | 74 a | 69 a | 74 a | 72.3 | 26 a | 31 a | 29 a | 28.7 |
| Way of keeping | 72.0 | 67.0 | 72.0 | 69.8 | 28.0 | 31.0 | 29.3 | 29.4 |

Respecting legislation on turnover of seed (minimum 75% germination) seeds of the two lots (P1 and P3) that was stored in PVC bags fulfilled the requirements for placing on the market (77% germination), while seeds stored in the other two packages did not meet the criteria for marketing.

*Table 5. Impact of packaging on seed germination of tall fescue 90 days after harvest*

| Way of keeping | Germination (%) | | | | Dormant seeds (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | P1 | P2 | P3 | Meaan | P1 | P2 | P3 | Meaan |
| Papir bags | 74 b | 71 a | 74 a | 73,0 | 23 a | 25 a | 23 a | 23.7 |
| Canvas bags | 74 b | 72 a | 73 b | 73,0 | 24 a | 23 a | 21 a | 22.7 |
| PVC | 77 a | 73 a | 77 a | 75,7 | 20 a | 22 a | 21 a | 21.0 |
| Mean | 75.0 | 72.0 | 74.7 | 73.9 | 22.3 | 23.3 | 21.7 | 22.5 |

During ripening and aging of seed, bags for seed packaging have a role to prevent moisture which is one of the main reasons for the loss of germination. Tests on bean seeds showed that the

polyethylene and aluminum foil materials were effective in preventing the adoption of external moisture, while the paper packaging materials showed poor seed efficiency (Wilson and McDonald 1992).

## CONCLUSION

Tall fescue seed immediately after harvest and drying is characterized with a lot of dormant seeds, which causes reduced germination. Way of storage after 30 and 60 days had no significant effect on germination, but after 90 days, the impact of PVC bags for storing seeds had a significant impact on increasing the germination of seeds of two seed lots, which fills the law conditions to put the seeds in the market and use for planting.

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