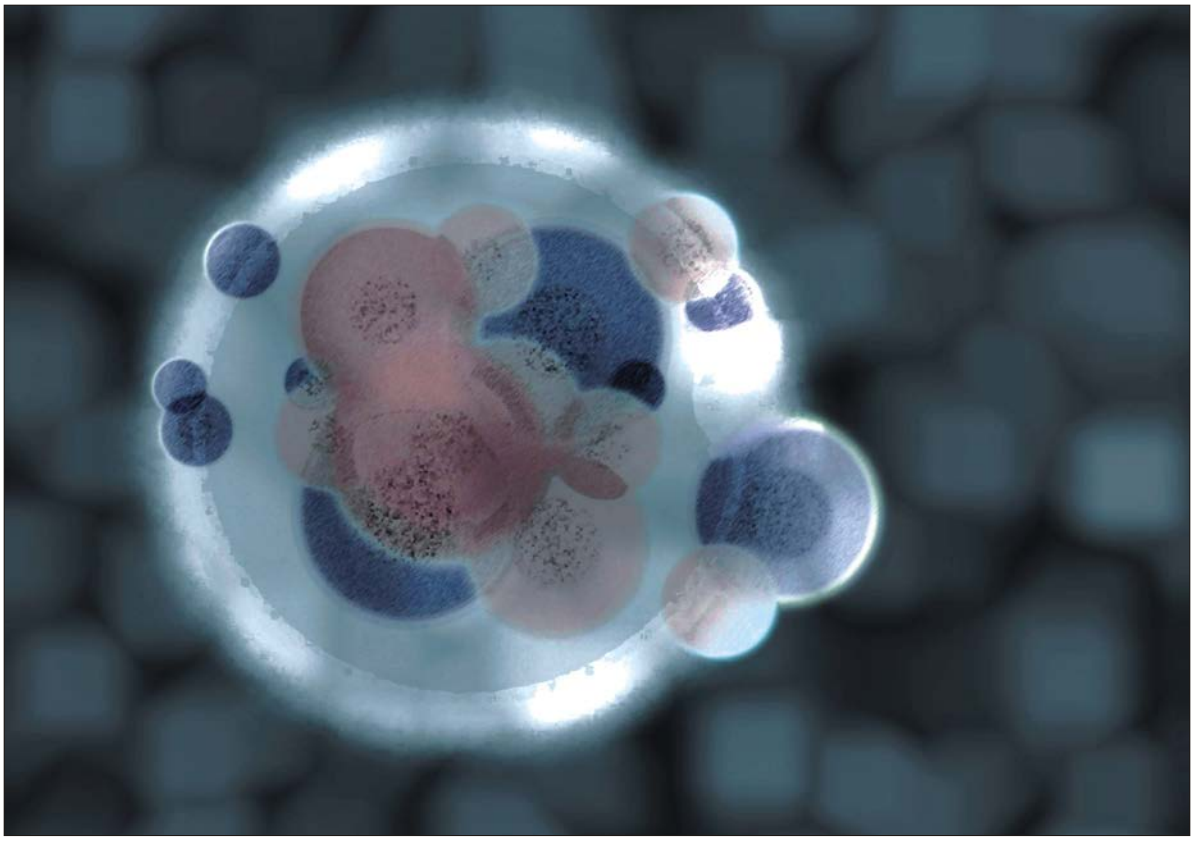

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Survey on Seed Decay during their Germination of Some Forages from their Aged Seeds

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Abstract: The objective of this experiment was to know the viability of several forage crops of aged seeds. The period of the present experiment was long and it ranged around 50 days (45, 36, 55 days; nearly 1.5, 1 and 2 months, respectively, for 1983, 1991 and 1997 produced seeds) in the autumn of 2006. Except for two species of reed canarygrass (*Phalaris arundinacea*) and sorghum hybrid (*Sorghum bicolor* (L) Moench), the seeds produced in 1983 decayed above the level of (1/2 of seeds decay). Their tolerance of the seeds produced in 1991 to decay seemed to be strong as follows; reed canarygrass (*Phalaris arundinacea*) = Kentucky bluegrass (*Poa pratensis*)>sorghum hybrid (*Sorghum bicolor*)>white clover (*Trifolium repense*). In the seeds produced in 1997 white clover, one of leguminous forages, decayed at a level of (2/3 of seeds), so the leguminous species decayed more than all other gramineous species.

Key words: Gramineous species, leguminous species, *Phalaris arundinacea*, *Poa pratensis*, seed decay, *Sorghum bicolor*, *Trifolium repense*, viability

INTRODUCTION

There are several questions for seed vitality (Jayasuriya *et al*., 2012; Kandil *et al*., 2012; Rajashekar *et al*., 2012), or pollen vitality (Baloch *et al*., 2000, 2001; Kwon *et al*., 2005; Raeisi *et al*., 2011; Tamnet *et al*., 2011; Youmbi *et al*., 2011). Decaying is a matter of germination or not? For the seeds, is there possibility of life after the long preserve of some 20 years? In order to know whether the seed is alive or not, we did this decaying investigation during the germination experiment. While time elapse, some germinated seed (or plant) start to decay the others remain growing. If the seed does not decay, this means the seed keeps normal living ability to express its life through germination? Or does it continue to be dead without decaying? Is there difference of seed decaying between leguminous and gramineous plants? And does it depend on seed size?

We have carried out several experiments on seed viability of some forages; Preliminary investigation on germination rate and growth of aged seeds (An *et al*., 2007), germination test on several forage seeds with different produced year (Park *et al*., 2007), germination and growth of old alfalfa (*Medicago sativa* L.) seeds on soil (Park and Kim, 2009). Park *et al*. (2007) wrote; alfalfa (*Medicago sativa* L.), older seed of 1983 than the previous report, showed a higher germination rate of 5-8% (experimenting period of October 9-November 23, 2006, mean daily temperature from 18.7 to 1.7°C) and sorghum hybrid (*Sorghum bicolor*×*S. bicolor*) appeared a somewhat higher germination rate of 6-11% (experimenting period of October 17-November 23, 2006, daily mean temperature from 17.9 to 1.7°C) (An *et al*., 2007).

Old alfalfa (*Medicago sativa* L.) seeds which had been stored for 23 years at ordinary temperature under sealed-up conditions were tested for germinability and seedling establishment. Five percent of seeds germinated on soil and some of the seedlings germinated grew to a state of establishment. Therefore, this result presents evidence for the high ability of the aged alfalfa seeds to maintain viability and vigor (Park and Kim, 2009).

Therefore, we wanted to know if there is a relation of preserving period to the viability of the seeds. In other words, there is a difference of decaying types among the different preserving periods (seeds produced in 1983, those in 1991 and those in 1997). And this time, we tried to find out the level of decay of seeds of forage species during the germination with different preserving periods (Park *et al*., 2012).

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MATERIALS AND METHODS

Kumsan-gun, where Joongbu University situates, ranged geographically about E 127° and N 36°. The data of daily mean temperature was taken from Korea Meteorological Administration (home page: www.kma.go.kr). The mean daily temperature ranged from 18.7 to 1.7°C on October 9-November 23, 2006 (45 days; nearly 1.5 months for Table 1) and the mean temperature on October 17-November 23, 2006 of the district ranged from 17.9 to 1.7°C (36 days; nearly 1 month for Table 2). And the mean temperature ranged from 18.7 to 1.7°C on September 29-November 23, 2006 of Kumsan district (55 days; nearly 2 months for Table 3).

This experiment was carried out under the air temperature condition. The experimental place was a laboratory room of the Department of Companion Animal and Animal Resources Science at Joongbu University. As shown in our previous report (An *et al*., 2007), Petri-dish was used for the present test. While being different from our previous experiment, the Petri-dishes were preserved in a drying oven (FO-600M, Jeio Tech Co. Ltd., Daejeon). The purpose with the oven was in order to keep temperature about 20-25°C at daytime and its period of warming the seed was from October 3 through October 26, 2006.

Tested seeds were offered from the Division of Forage Crops, National Livestock Research Institute, Rural Development Administration (RDA) in Republic of Korea. Forage species produced in 1983 were as follows; alfalfa or lucerne (*Medicago sativa*), birdsfoot trefoil (*Lotus corniculatus*), white clover (*Trifolium repense*), Kentucky bluegrass (*Poa pratensis*), reed canarygrass (*Phalaris arundinacea*), sorghum hybrid (*Sorghum bicolor*), tall fescue (*Festuca arundinacea*) and weeping lovegrass (*Eragrostis curvula*). And the species produced in 1991 were white clover, Kentucky bluegrass, reed canarygrass, sorghum hybrid. The forage species produced in 1997 were as follows; birdsfoot trefoil, white clover, sorghum hybrid, sorghum sudan hybrid (*Sorghum bicolor*×*S. sudanense*), tall fescue and weeping lovegrass.

The seeds which had been produced in 1983 were preserved in a glass-bottle (Park *et al*., 2012), the seeds of 1991 in vinyl bag and the seeds of 1997 in Petri-dish. And the present experiment ranged around 50 days (36, 45, 55 days; nearly 1, 1.5 and 2 months) during the germination test in the autumn of 2006. Seed number of 100 was used, except for sorghum hybrid (Pioneer, 931) of 1991 and 1997 (50 grains, two times), were weighed, bedded and watered in Petri-dish (the diameter was 10 cm). Forage seeds produced in 1983 were seeded on October 9, 2006, those of 1991 were seeded on October 17, 2006 and those of 1997 were seeded on September 29, 2006, respectively.

Table 1: The decaying status during 45 days of several forage seeds produced in 1983*, **

Species	Decaying status (No. 100 grains^{-1}) on November 23, 2006***
Leguminous species	
Birdsfoot trefoil (*Lotus corniculatus*)	1/2 (50/100) of seeds decayed
Alfalfa (*Medicago sativa*)	1/2 (50/100) of seeds decayed
White clover (*Trifolium repense*)	Decayed completely (100/100) with white color
Gramineous species	
Kentucky bluegrass (*Poa pratensis*)	1/2 (50/100) of seeds decayed
Reed canarygrass (*Phalaris arundinacea*)	1/5 (20/100) of seeds decayed
Sorghum hybrid (*Sorghum bicolor*)	1/3 (30¡–35/100) of seeds decayed
Tall fescue (*Festuca arundinacea*)	1/2 (50/100) of seeds decayed
Weeping lovegrass (*Eragrostis curvula*)	Most of seeds decayed (70~80/100)

*: In Petri-dish, **: Seeded on October 9, 2006, ***: On November 25 and November 29, 2006, some photographs were taken and it was determined through observation and the photograph

Table 2: The decaying status during 36 days of several forage seeds produced in 1991*, **

Species	Decaying status (No. 100 grains^{-1}) on November 23, 2006***
Leguminous species	
White clover (*Trifolium repense*)	3/10 (30/100) of seeds decayed
Gramineous species	
Kentucky bluegrass (*Poa pratensis*)	Not decayed (0/100)
Reed canarygrass (*Phalaris arundinacea*)	Not decayed (0/100)
Sorghum hybrid (*Sorghum bicolor*)	1/4~1/5 (20~25/100) of seeds decayed

*: In Petri-dish, **: Seeded on October 17, 2006, ***: On November 25 and November 29, 2006, some photographs were taken and it was determined through observation and the photograph

Table 3: The decaying status during 55 days of several forage seeds produced in 1997*, **

Species	Decaying status (No. 100 grains^{-1}) on November 23, 2006***
Leguminous species	
Birdsfoot trefoil (*Lotus corniculatus*)	2/3 (60~70/100) of seeds decayed
White clover (*Trifolium repense*)	2/3 (60~70/100) of seeds decayed
Gramineous species	
Sorghum hybrid (*Sorghum bicolor*)	2/5 (40/100) of seeds decayed
Sorghum sudan hybrid (*Sorghum bicolor*×*S. sudanense*)	Decayed completely (100/100) with white color
Tall fescue (*Festuca arundinacea*)	1/10 (10/100) of seeds decayed
Weeping lovegrass (*Eragrostis curvula*)	1/2 (50/100) of seeds decayed

* : In Petri-dish, ** : Seeded on September 29, 2006, *** : On November 25 and November 29, 2006, some photographs were taken and it was determined through observation and the photograph

Decaying status was observed on November 23, 2006. And on November 25 and November 29, 2006, some 20 photographs were taken in order to know the germination status with a film camera (Autoboy3, Canon Co. Ltd., Japan) and the status of decay was decided both on observation and on those photographs. And the ratio of plants died during germination was obtained from the

data of Park *et al*. (2007) as follows: (the highest number of alive plant(s) during the germination experiment-the number of alive plant(s) on the last observation date during the experiment)/(the highest number of alive plant(s) during the germination experiment)×100 (%).

RESULTS AND DISCUSSION

Table 1 shows the decaying status of several forage seeds produced in 1983. (during 45 days; nearly 1.5 months) The level of 1/2 of alfalfa and 1/2 of birdsfoot trefoil seeds became rot during the experiment. In the Table leguminous species seemed to decay easier than the gramineous species and reed canarygrass became a little rot. Except for two species, reed canarygrass (*Phalaris arundinacea*) and sorghum hybrid (*Sorghum bicolor*), most of the forage seeds produced in 1983, they decayed above the level of (1/2 of seeds decayed). The alfalfa seeds produced in 1983 also showed a growth on the soil culture (Park and Kim, 2009).

In the present report, we only studied for the level of decay as a basic survey for the relation between not-decay and viability.

Table 2 shows the decaying status of several forage seeds produced in 1991. (during 36 days; nearly 1 month) They showed lower level of decay than those seeds produced in 1983 (Table 1). The decaying status ranged from the level of (not decayed) through (3/10 of seeds decayed). Similar to the results in Table 1, the leguminous species became rot more easily than the gramineous species. Reed canarygrass and Kentucky bluegrass did not decay. Therefore, their tolerance to decay seemed to be strong as follows; Reed canarygrass = Kentucky bluegrass>Sorghum hybrid>White clover. Kentucky bluegrass, Reed canarygrass showed 0% death ratio during the observation period.

Table 3 shows the decaying status of several forage seeds produced in 1997 (during 55 days; nearly 2 months). White clover decayed 2/3 of seeds, so the level of decay ranged above all gramineous forage species except for sorghum sudan hybrid. From Table 3, it was shown that Sorghum hybrid, Sorghum sudan hybrid, Birdsfoot trefoil, White clover died 40, 100, 65 and 65%, respectively. While Tall fescue and Weeping lovegrass showed the 10 and 50% death ratio during the period.

While the age seemed to be not so important for preservation, because sorghum hybrid seeds produced in 1997 showed weaker tolerance to decay (Table 3) than those seeds in 1991 (Table 2). On general, leguminous forage seeds were weaker to decay than gramineous seeds (Table 1-3). This may be from the fact that leguminous forage species contained higher protein than gramineous forage species did (Nelson, 1979).

Though it is not possible to say that all of those not-decayed seeds have their viability, the other seeds which did not decay succeeded in germination at some extent (Park *et al*., 2007). The seeds produced in 1983 had a higher tolerance to the decay than those in 1997. And the older seeds in 1983 had a power of the increase of germination at the final stage of the germination, while the younger seeds in 1997 showed a decrease at the last period in the study (Park *et al*., 2007).

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