EFFECT OF SEED STORAGE ON INTEGRITY OF GRASS GERMPLASM

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ABSTRACT
Experiment on estimation of qualitative changes in populations of meadow fescue (*Festuca pratensis* Huds.) after seed storage in different conditions were taken. Phenotypical traits for plants derived from seeds stored during 54 months in two different kind of storage conditions were compared. Storage of meadow fescue seed during 54 months in unfavourable conditions resulted in decrease of initial germination as well as in increase of abnormal seedlings and variation. Germination of seed samples stored in cold and dry conditions remain at the initial level. Results of the above experiment prove great variability of tested samples in case of reaction to unfavourable storage conditions. No close relation between decreased germination and intensity of phenotypical changes was observed. However, decrease in germination below 35% resulted (in case of few accessions) in chlorophyll aberrations, faster flowering, shorter inflorescences and reduced viability of pollen grains.

KEYWORDS
seed storage, seed ageing, germplasm integrity, meadow fescue

INTRODUCTION
Seed storage is the most commonly accepted way of long-term germplasm preservation. Maintenance of the genetic integrity of seed populations during storage is an important aspect of preservation (Ross, 1984b). Numerous experiments clearly established that as seed sample viability decreases during storage, changes in plant population derived from seed sample increases (Harisson, 1966; Durado and Roberts, 1984; Ross, 1984a, b; Stoyanova, 1992; Zurek, 1994). It becomes clear that germplasm collections in seed banks are in danger of losing quality and integrity of genetical composition. The following experiment was undertaken to determine the effects of different seed storage conditions on the germination as well as on the occurence and the nature of phenotypical changes in a plant population of grass species - meadow fescue (*Festuca pratensis* Hudson).

MATERIALS AND METHODS
Fourteen accessions (thirteen wild ecotypes and one cultivar) of meadow fescue originating from one year of harvest (1984) were randomly selected from grass collection in Bydgoszcz. Before storage, seeds were dried up to 7% of relative humidity. Each accession was then divided into two subsamples: one being stored in hermetic glass jars in constant temperature and moisture (**constant conditions**) and the other one stored in paper bag in unheated store room (**various conditions)**. Germination control was undertaken before storage and after 54 months. Seedlings during the last germination test were planted into small pots and further evaluated in the greenhouse for: presence of chlorophyll abberations, number of days from sowing to establishment of second leaf, third leaf and first tiller. After 5 months the plants were planted into the field - 100 plants per subsample in a distance of 50cm x 50cm in four replications (25 plants per replication). During vegetation the plants were evaluated for: heading and flowering date (expressed as number of days from 01.04), plant height during heading and flowering, length of inflorescence, number of florets and branches in inflorecence, viability of pollen grain, length of leaves (flag and 2nd), width of internodes (for flag and 2nd leaf).

RESULTS AND DISCUSSION
Seed germination. Storage under the various conditions strongly reduced seed germination capacity of stored samples (Table 1). Significant increase in standard deviation for germination capacity was also reported - from 3.31 for initial value to 22.16 after 54 months of storage in various conditions (6.95 for 54 months storage in constant conditions).

Morphological abnormalities. Seedlings with symptoms of chlorophyll deficiency were observed during seedling evaluation in germination test. According to Durado and Roberts (1984) such seedlings with chlorophyll abberations were classified as 'albina' and in the above experiment were reported mostly in seeds from various conditions and reached nearly 11% of all abnormalities noted. During further evaluation of young plants growing in greenhouse a few 'striata' mutants were reported. They occurred mostly in samples where presence of 'albina' seedlings was reported.

Seedling development. Differences among average values obtained for seedlings derived from seed samples stored in different conditions increased together with time from day of sowing. Seedlings from samples stored in constant conditions entered all phases faster. In case of 2nd leaf phase significant difference was 0.7 day, for 3d leaf phase - 1.4 day and for beginning of tillering - 2.1.

Plant growth and development in field conditions. Initial differences between plant populations from differently stored seed samples as was mentioned in the case of seedling evaluation were not so clear in the case of mature plants. In case of 4 ecotypes (i.e. 28.6% of all tested), faster heading and flowering dates were reported for plants derived from seeds stored in various conditions. Such reaction was also reported by the author for perennial ryegrass plant population derived from strongly aged seeds (to 1.5% germination capacity). Faster heading was also accompanied with shorter inflorescence as well as decreased pollen grain viability (Zurek, 1994). In the above experiment similar reaction was observed for plant population derived from seeds aged from 91% to 5% of germination capacity. Lidtke and Mikolajczak (1983) observed similar reduction in length of inflorescence for meadow fescue plants derived form seeds aged from 95% to 23%.

CONCLUSIONS
Obtained results indicated that seed viability reduction as an effect of their long term storage in unfavourable conditions caused some changes, which were detected in the pedigree of aged seeds. As it was shown in Table 1 for some traits, population derived from aged seeds were significantly different as against population from unaged seeds whereas for other traits no changes were detected. To explain above relations it is essential to assume the random initial selection of genotypes from seed population at the begining of ageing process. Such selection is not conditioned by genetical factors that determine seed longevity. According to Ross (1986) and Stoyanova (1992) selection of genotypes from seed population (i.e. seed sample) is the effect of decreased germination capacity. Further decrease of germination eliminate genotypes much susceptabile for unfavourable storage conditions and at the same time - select much resistant genotypes characterized by a group of phenotypical traits. Observed changes could be of dual nature: natural selection and mutation effect (i.e. decrease of pollen grain viability). But selection is likely of greater importance than mutation in altering the genetic structure of a germplasm accession (Ross, 1984a).

It is possible to select the group of traits indicating the selective

pressure of unfavourable storage conditions:
• phases of seedling development,
• phenological phases,
• height of plants at the beginning of heading,
• length of inflorescence,
• viability of pollen grain.

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Table 1
Mean values, standard deviation [*in square brackets*] and t-test results for trait observed in plant populations derived from seeds stored in different conditions.

Trait designation	Storage conditions:		T-test results:	
	constant	various	t-value	p
Germination capacity (%):				
initial	94.8 [*3.31*]			
after 54 month storage	93.0 [*6.95*]	35.0 [*22.16*]	108.567	**
Chlorophyll aberrations (%):				
'albina' - seedlings	0.0077	0.471		
'striata' - young plants	0.0160	0.645		
No. of days to tillering start	25.6 [*3.29*]	27.7 [*3.81*]	-18,540	**
No. of days to 3rd leaf emergence	20.4 [*2.11*]	21.8 [*2.99*]	-16,480	**
No. of days to 2nd leaf emergence	14.1 [*2.17*]	14.8 [*2.66*]	-9,627	**
No. of days to flowering	85.6 [*4.92*]	85.1 [*4.23*]	2,940	*
Length of inflorescence (cm)	17.5 [*2.01*]	18.4 [*2.28*]	-2,339	*
Height at the peak of flowering	98.4 [*10.73*]	99.4 [*10.44*]	-2,250	*
Viability of pollen grain (%)	89.2 [*13.82*]	81.7 [*14.50*]	2,211	*
Width of 1st node (mm)	1.5 [*0.19*]	1.6 [*0.21*]	-2,060	*
Width of 2nd node (mm)	1.9 [*0.22*]	1.9 [*0.25*]	-1,855	n.s.
Height at the peak of heading	68.8 [*12.53*]	69.4 [*11.52*]	-0,884	n.s.
No. of florets	36.1 [*7.94*]	36.5 [*6.53*]	-0,086	n.s.
Lenght of 2nd leaf (cm)	16.0 [*3.80*]	16.1 [*4.21*]	-0,403	n.s.
No. of days to heading	64.4 [*4.21*]	64.3 [*4.09*]	0,393	n.s.
No. of inflorescence branches	15.1 [*1.79*]	15.0 [*1.62*]	0.339	n.s.
Lenght of flag leaf (cm)	9.4 [*2.16*]	9.3 [*2.19*]	0,319	n.s.

n.s. - difference among means not significant
* - significance of difference among mean values at P=95%
** - significance of difference among mean values at P=99%