The effect of storekeeping in germination stage on seeds germination of 12 cultivars of spring rapeseed

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Absract

An experiment was performed in 2005 in the seed laboratory of Tehran University to study the effect of Storekeeping during germination stage on seed germination characteristics of 12 cultivars of spring rapeseed. The experimental design used for this study was factorial in the form of randomized completed design with 4replication. Treatments were consisted of: First factor in two levels: 1-germination in standard conditions (by standard test) 2-germination by accelerated aging test for restoration of conditions of stored seeds. Second factor was 12 cultivars of spring rapeseed. Germination in standard conditions was done at 25°C temperature. In the beginning, for performing accelerated aging test, dry seeds set at 41°C temperature and saturation humidity within a period of 3 days and then were transferred to 25°C temperature. In the basis of the results, the effect of first factor was significant on seedling dry weight, length of radicles, length of seedling, number of normal seedlings, seed vitality, seedling vigor index, at probability level of 0.001, and number of abnormal seedlings and hard seeds at probability level of 0.01, but it did not have significant effect on the length of plumules. Seedling which was grown under accelerated test had lower dry weight due to high respiration during the stages before main growth. Seed vigor, length of radicles, length of seedlings, number of normal seedlings, seedling and seed vigor index were higher during standard conditions. Number of abnormal seedlings and hard seeds were higher in the seeds under the accelerated test. It seems more number of the seeds that set under accelerated test, due to warm stress, went to obligatory dormancy, and produced more number of abnormal seedlings, too. Also second factor influenced on some characters such as seedling dry weight, seedling vigor index, length of radicles and plumules and seedling, seed vitality, seedling vigor, at probability level of 0.001 and Number of hard seeds at probability level of 0.05. RG405/02, HYOL308, and OPTION500 cultivars in consequence of seed weight were higher in the most characters such as seed vigor, seedling dry weight, number of normal seedlings, seedling vigor index. According to the interaction effect of treatments, the seeds with higher weight of thousand of seeds and lower oil percentage are more suitable for storekeeping and damage during the storekeeping time less

Key words: Rapeseed, Storekeeping, Germination, Vitality

Introduction

Seed quality is very important in agricultural crops products and as a reproduce, organ of plants and the most important factor of production, and optimum yield of these plants is impressed by this parameter (Fox 2001 and Johnson 2001). The bad seed does not achieve success in agriculture. Small and injured seeds with non-equilibrium nutritious produce faint seedlings in the farm, which are very sensitive to the diseases, have high mortality and low yield (Hunter. et al. 1994). Genetic characterization, vigor, strength of germination, power, humidity amount, storing quality and age of seeds are used to determine the seed quality (Fox 2001). The simplest method is vigor determination in vitro system to estimate the seed quality. Seeds, which have good vigor, germinate 90-100% in vitro germinated ones, are 90-85% in the field, which are cultivated well. Any decrease in germination percentage is lead to the decrease in green percentage in the field severely (Magurie 1962).

Among rapeseed seed test, standard germination and accelerated aging tests are the most applicable ones. in standard germination test suitable conditions must be considered for seeds till the most germination happen, but in accelerated aging test, seeds exposed to 41 degree centigrade temperature and 100% relative humidity in 3 days and without water absorbing and then they are measured in germination test. Accelerated aging test is simple and useful for any species. Seeds, which after this test have had good germination, have higher viability than the other seeds.

Accelerated aging test is one of the most important seed viability tests (ISTA 1983). This test is declared as a method for estimating the seed storing (Magurie 1962). In this test, seeds are exposed to humid conditions with high temperature, which cause reduction in viability and this reduction is severe in quality seeds.

In accelerated aging test, humidity of the environment must be controlled because it will be effective in germination results. Accelerated aging test, demonstrate relative storing capability of different species.

Changes, which appear in germination with different seed quality and appear after an exact period, have correlation with changes, which appear in storing time.

Tests on maize (Allen and Morgan 1975) and sunflower (Preti et al. 1994) demonstrate that accelerated aging test of seedling in farm have high correlation. Different estimating after storing time and among different seeds can obtain of this test.

Purpose of this test is comparing seeds of different cultivars in standard germination and accelerated aging tests and recognition of storing differences between cultivars.

Materials and Methods

To study the effect of storekeeping on seed germination of high crop cultivars of spring rapeseed, an experiment was performed as a factorial design in the base of complete randomized blocks with four replications. First factor was kind of test that consisted of Standard germination test and accelerated aging test. The second factor was cultivars that consisted of RGS003, AMICAA, OPTION500, HYULA401, HYULA330, HYULA308, KIMBERLY, ORS3150-3006, RG405/02, RG4403, RG405/03, PP401.

The seeds exposed to standard germination test to determine vitality according to standards of International Seed Test Association (ISTA) (Anonymous 2001).

For this purpose, 400 seeds (100 numbers in 4 replications) selected randomize. Then they were weighing and set on germination paper in the closed plastic dishes and exposed to 20-30 degree centigrade temperature in germinator for seven days.

To perform accelerated aging test, two plastic boxes were used that one of them had been set into other box. The size of two box was different. one tulle were set on the smaller box and seeds set on the tulle. Water was shaded into larger box and smaller box was set into the larger. seeds not to be in contact with water directly(McDonald & Phoneendranath, 1978). at the end, larger box were completely closed and exposed to 41 degree of centigrade for 72 hours in oven (Elias & Copeland, 1997). After humidity-temperature stress, seeds set into the plastic boxes on humid paper and exposed to 20-30 degree of centigrade in germinator. the number of germinated seeds, the number of hard seeds,. the number of normal and abnormal seedlings, the length of radicle, plumule and seedlings and seedling fresh and dry weight were counted after seven days(). the number of germinated seeds were counted daily and some characteristics such as mean of daily germination that is the index of daily germination speed, were calculated using the formula of International Seed Test Association(ISTA) (Anonymous, 2003). Daily germination speed that is opposite of the mean of daily germination were counted, too(4). At the end of test performing, final vitality(the number of germinated seeds in 7^{th} day) were determined. Also, the number of normal and abnormal seedlings were become clear on the base of standards of International Seed Test Association(Anonymous, 2001). to determine the seedling vigor, 30 normal seedlings from every replications were selected and the length of seedlings and the fresh weight of it were measured by scaled ruler by centimeter and exact weighting machine by gram, respectively.

After drying the seedling in 75 degree of centigrade for 24 hours in oven, exact weighting machine were used to measure seedling dry weight. Also, the relation of [vitality*seedling dry weight] and [vitality* mean of total length of seedling/100] were used to determine seedling vigor index and seed vigor index, respectively (Abdul-Baki and Anderson 1973).

Results and discussion

On the base of results, the effect of germination conditions factor was significant on dry weight seedling, the length of radicle and seedling, number of normal seedling, seed and seedling vigor index at 0.001 and on number of hard seeds and abnormal seedlings at 0.01 level, but was not significant on the length of plumule, daily germination speed, the mean of daily germination and the seedling weight reduction during germination. Also, the effect of cultivars factor was significant on dry weight seedling,

Seedling vigor index, the length of radicle, plumule and total seedling, daily germination speed and seedling weight reduction during germination at 0.001 level. The interaction effect of two factors was significant on seedling vigor index, number of hard seeds and the length of radicle and seedling t 0.01, too. Dry weight seedling obtained of seeds setting in standard conditions (3.44 mg) was higher than seeds setting in accelerated aging situations (3.11mg). Humidity-temperature situations, caused to higher respiration and making aging in seeds. Due to it, the weight of seedlings that obtained of accelerated aging test reduced. Between cultivars, RG405/02 (3.71) and HYULA308 (3.62) had the highest and AMICA (2.91) had the lowest dry weight.

The length of seedling (14.61cm) and radicle (12.9cm) in standard conditions were higher than the length of seedling (9.8cm) and radicle (7.1cm) in accelerated aging test. it seems, seed aging caused to reduce the viability. Between cultivars, HYULA308 had the highest and AMICA the lowest length of radicle (13.6 & 6.2cm, respectively). The seeds had higher vitality in standard conditions (96.25%) than Aging situations (91.2%). The reasons of it were greater seed dormancy and aging. RG405/02 (98.25%) and AMICA (89.5%) had the highest and lowest vitality, respectively.

Seedling vigor index was higher in standard conditions (0.271) than aging situations (0.242) that its reasons have been making stress in seedlings before growth, reduction of storage substances and seed aging.

HYOOLA308 (0.281) and RG405/02(0.284) had the highest and AMICA (0.234) and pp401(0.216) had the lowest seedling vigor index.

With comparison of interaction effect of mentioned indexes were found out that the cultivars with more tiny seeds and less storage, not only have had less vitality, seedling vigor index and length of radicle and seedling in standard conditions, but also have had greater reduction about above traits and the reason of it have been aging in accelerated aging situations. Therefore, it seems, the seeds with higher seed weight (1000) could protect their growth ability in better storekeeping conditions.

According to the results, the number of hard seed and abnormal seedling were higher in accelerated aging situations than standard conditions. Humidity-temperature stress caused to increase the hard seeds due to dormancy and aging seed. it is clear that aging seed caused to increase the number of abnormal seedlings. between cultivars, AMICA due to have weak seeds have exposed to humidity- temperature stress more than others and have produced greater abnormal seedlings(16.5) and hard seeds(9.4) in accelerated aging situations, but HYULA308 due to higher viability have had less number of abnormal seedlings,

and hard seeds in the same situations.

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Table: Analysis of variances

Source of variance	d.f	MEAN SQUARE								
		Abnormal embryo	Dry weight	vitality	*Radicle length*	*plomule length*	*Total length*	*Sidling vigor index*	*Normal embryo*	*hard seed*
Test (A)	1	132.41**	0.00211***	*70.5***	18.284***	8.050$^{n.s}$	9. 650 ***	*62.52***	*625.51***	0.012**
Cultivar (B)	11	9.53$^{n.s}$	0.00221***	*4.1**	12.445***	9.564***	5.949 **	*3.851***	*51.24**	0.0091*
A*B	11	5.08$^{n.s}$	0.00226$^{n.s}$	*3.5*$^{n.s}$	2.360$^{n.s}$	1.102**	2.732$^{n.s}$	*2.032*$^{n.s}$	*37.28*$^{n.s}$	0.0021$^{n.s}$
Error	72	13.12	0.0011	*3.20*	1.99	0.220	1.146	*0.9 26*	26.32	0.0061