The effect of low temperature during germination stage on seeds germination characteristics of 12 cultivars of spring rapeseed (*Brasicca napus* L.)

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Abstract

An experiment was performed in 2005 in the seed laboratory of Tehran University to study the effect of low temperature during germination stage on seeds 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 four replications. Treatments were consisted of first factor in two levels: 1-germination in standard conditions.2-germination with coldness as a pretreatment. Second factor was 12 cultivars of spring rapeseed. Germination in standard conditions was done at 25°C and for performing coldness pretreatment; seeds in swelling form were set within a period of 5.days at.5°C temperature and then transferred to 25°C temperature. In the basis of the results, the effect of germination conditions was significant on seedling dry weight, length of radicles and seedling, number of normal and abnormal seedlings, seed vitality, germination rate and seedling vigor index.(at the level of.0.001).and length of plumules.(at the level of.0.01)..Seedling, which was grown in standard conditions, had lower dry weight due to higher respiration and faster growth. Seed vitality, length of radicles and seedling, number of normal seedlings, germination rate and reduction of seedling weight due to daily respiration was higher in standard conditions and length of plumules, seedling vigor index and number of abnormal seedlings was greater in seeds under treatment of coldness. Second factor was influenced on some characters such as seedling dry weight, seedling vigor index (at the level of 0.001).and length of plumules and seedling, number of normal seedlings and length of radicles, number of abnormal seedlings.(at the level of 0.01),.too..OPTION500.and.RG405/02 cultivars had the greatest and KIMBERLY, HYOLA330 and AMICA cultivars had the lowest seed weight, seedling dry weight, length of radicles, total length of seedling and seedling vigor index. Also.RG405/02.and OPTION500.cultivars had the highest and.RGSOO3.and.ORS3150-3006.cultivars had the lowest final germination. Interaction effect was only significant on the length of plumules. Length of plumules of.RGSOO3.cultivar showed a significant increase in coldness treatment in comparison with standard conditions. RG405/02.seeds, in consequence of higher seed weight, could generate higher seedling dry weight, length of radicles and seedling, missing dry matter amount during germination due to respiration and seed vitality, in both standard and coldness conditions.

Key words: Rapeseed, cold test, 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).

Standard germination and cold tests have special importance among seed tests. In germination test, suitable conditions must be provided for the most germination, but because of the difference between field and laboratory conditions, some test such as cold test is planed to make it closer to the natural conditions of the field (Eliass and copeland 1997).

It is tried to represent field spring sowing especially in Europe where humid and cold soil have.

Nijestein (1985) declared that cold test is one of the most important and useful methods in Mays seed vitality. Type of the soil and soil humidity are effective on the germination percentage in the field, not on the germination speed.

Fiala (1987) explained that in Austin, cold test is performed as Mays standard vitality test in seed control and certification laboratories.

In early spring when temperature be low, seeds cannot germinate but swelling and is attacked by fungi.

In cold and humid areas, just seeds germinate which have high vitality and good vitality. In this test, cold effect on seed germination of twelve spring cultivars of rapeseed is studied by comparison between standard and cold test to select the best cultivar.

Materials and Methods

To study the effect of cold test 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. Cultivars consisted of RGS003, AMICAA, OPTION500, HYULA401, HYULA330, HYULA308, KIMBERLY, ORS3150-3006, RG405/02, RG4403, RG405/03, and PP401.

Cold test and standard germination were performed according to standards of International Seed Test Association (ISTA) to determine vitality and some characteristics related with germination in cold conditions and to compare it to normal conditions (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. Seeds related to standard germination exposed to 20-30 degree of centigrade temperature in germinator for seven days. Seeds related to cold test after setting in 5±2 degree of centigrade for five days were transferred to 20-30 degree of centigrade. (Anonymous 2003).

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(Anonymous, 2003)

Daily germination speed that is opposite of the mean of daily germination were counted, too (Maguire 1962). At the end of test performing, final vitality were determined. Also, the number of normal and abnormal seedlings were become clear on the base of standards of International Seed Test Association (Abdul-Baki and Anderson 1973). to determine the seedling vitality, 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] were used to determine seedling vigor index

After normality test, obtained data were analyzed by SAS (ver. 6, 12) software and Duncan method was used to compare the means.

Table: Analysis of variance

Source of variance	d.f	MEAN SQUARE							
		Abnormal embryo	Dry weight	vigour	*Radicle length*	*plomule length*	*Total length*	*Sidling vigor index*	*Normal embryo*
Test (A)	1	137.76**	0.001944**	*73.5***	14.884**	8.050*	4.960 **	*24.200***	*412.51***
Cultivar (B)	11	9.53 n.s	0.000276**	*4.1**	2.774*	0.607*	5.949 **	*2.884***	*51.24**
A*B	11	22.08 n.s	0.000226 n.s	*8.5* n.s	2.360 n.s	1.102**	2.732 n.s	*2.032* n.s	*37.28* n.s
Error	72	15.19	0.000051	*3.0*	0.997	0.220	1.146	*0.526*	*18.45*

Results and Discussion

According to the results, the effect of germination conditions was significant on seedling dry weight, the length of radicle and seedling, the number of normal and abnormal seedlings, seed vitality, seed germination speed and seedling vitality at 0.001, and the length of plumule at 0.01 levels. The effect of cultivars on seedling dry weight seed vigor index at 0.001 and the length of radicle, plumule and seedling, the number of normal seedlings and seed vitality at 0.01level was significant, too.

The seedlings have grown in cold conditions (2.51mg) had higher seedling weight than the seeds in standard conditions (2.01mg). Due to reduction of activities and respiration becoming lost the substances in the result of respiration.

It seems higher seed growth in standard conditions is the result of being high metabolism and more simple transmission of substances from storage tissues to growing seedling due to nonexistence of stress.

Between cultivars, RG405/02 (2.81 mg) and OPTION500 (2.80 mg) cultivars and HYULA330 (1.92 mg) and AMICA (1.96 mg) cultivars had the highest and lowest dry weight seedling, respectively.

Higher initial food reserve of RG405/02 and OPTION500 caused to increase seedling dry weight. Seed vitality was higher in normal conditions than cold situations, significantly.

Standard test conditions were more proper for seedling growth than seeds exposed to swelling under coldness.

According to the results, RG405/02 (96.4) and AMICA (96.1) had the highest and RGS006 (89.5) and ORS3150 (88.9) had the lowest seed vitality and there was high correlation between seed weight and seed vitality. In addition, the seeds in standard conditions were better than cold conditions about some traits such as the length of radicle, plumule and seedling. The reasons of it were growth, metabolism, and not exposing swelling seedling to cold conditions. OPTION500 due to have greater food reserve and AMICA due to have less food reserve had the tallest and the shortest length of radicle, plumule and seedling, respectively.

The radicle, plumule and seedling growth can be a standard to estimate seedling growth ability.

RGS003 had an intense reduction in plumule growth in cold conditions that its reason was low viability of this cultivar.

The seeds could have higher seedling vigor index in standard conditions than cold conditions. The reasons of being higher in seedling vigor index, in normal condition, were greater reserve substances, higher germination percent, and better growth. Also,. OPTION500 and RG405/02 had the greatest and AMICA had the lowest seedling vigor index between cultivars.

Totally, RG405/02 was better in the most of traits in both conditions (standard and cold) due to higher ability and greater storage materials.

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