RELATIONSHIPS BETWEEN GERMINATION AND VIGOR TESTS WITH FIELD EMERGENCE OF SUNFLOWER IN IRAN

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ABSTRACT

In order to estimate the seedling emergence of sunflower cultivars, this research was conducted in both laboratory and field. The treatments were four sunflower cultivars (Record, Euroflor, Hysun and Azarghol) and three levels of seed germination(below standard or 80%, standard or 80% and above standard or 90%).The results indicated that increase of seeds germination in standard germination test caused the increase of normal seedlings percent and also the seedling weight and length vigor indices. Record cultivar and With high germination percent had a significant difference with other cultivars in most measured traits in laboratory and the reason is probably their genetic structure and less seed deterioration of these cultivars. The final seedling emergence at field was correlated with seedling weight and length vigor indices at laboratory. The normal seedlings number (germination percent) in standard germination test was correlated with final field emergence of seedlings. Therefore, by calculation the normal seedlings percent, we can predict the seed's potential for seedling production and establishment at field.

Key words: Germination, seed vigor, sunflower.

INTRODUCTION

The planting of high quality seed is an important factor of successful agriculture due to rapid and uniform seedling emergence and also higher establishment and achieving proper plant density which results in higher yield (TeKrony and Egli, 1993). The influence of seed vigor on seedling field emergence and establishment was assessed and specified that seed vigor affects the seedling field establishment, seedling emergence rate and it's uniformity which all of these factors, potentially can influence the accumulation of dry matter in plant population and therefore the yield (Heydecker, 1977).

The germination test determines the germination ability of seeds in a seed lot which it's results can be used for comparison of different seed lots quality and also estimation of required seed rate for planting (Anonymus, 2011). The study of germination test of 94 soybean's seed lots in laboratory and the results of seedling field emergence of same seed lots indicated that low germination caused the low seedling emergence and percent at a field (Delouche and Baskin, 1973). This research was conducted in order to estimate the seedling emergence of sunflowers cultivars with germination test.

MATERIALS AND METHODS:

In order to evaluation the correlation of seed germination with seed seedling field emergence of sunflower cultivars, a research was conducted in both laboratory and field in 2012. The treatments were four sunflower cultivars including Record, Euroflore, Hysun and Azarghol with three levels of seed germination as standard seed germination (85%) , above standard (the highest germination percent of each cultivar) and below standard level (80%) which were produced in 2011. The study was conducted as a factorial experiment based on completely randomized design for laboratory tests and as a factorial experiment with 2 factors based on randomized complete block design with 3 replications for field tests. The standard germination test was conducted according to rules of the international seed testing association (ISTA) (Delouche and Baskin, 1973). Two indices including seedling length vigor index and seedling weight vigor index were also were determined by Abdol-baki and Anderson approach (Abdul-Baki and Anderson, 1973). In order to estimate seedling field emergence percent and related traits; the seeds were sown and evaluated in experimental field of seed and plant certification and registration institute. The seedling field mergence index was determined by approach of Ram *et al*., 1998. The resulted data were analyzed by MSTAT-C software and the mean comparison was done by Duncan multiple range test. The correlation of measured traits was calculated by SPSS software and the charts were drawn by Excel software.

RESULTS:

The analysis of variance results of the standard germination test (table 1) indicated that the interaction of cultivar× germination ability was highly significant in all the traits. The normal seedlings from seeds of Record cultivar with 90 percent had the highest normal seedlings of 79%. However the lowest normal seedlings of 31 percent obtained from seeds of Record and Uroflor with 80 percent germination ability.

Table 1- The analysis of variance (mean squares) of studied traits at standard germination test.

S.O.V	df	Normal seedlings percent	Abnormal seedlings percent	Final germination percent	Seedling length vigor index	Seedling weight vigor index
Cultivar	3	1102.69**	835.657**	84.889**	634535.16**	100.416**
Germination	2	2692**	708.861**	10.33ns	361738.17**	761.967**
Cultivar × Germination	6	346.66**	158.713**	57.889**	81488.10*	56.54**
Error	24	9.361	10861	12.222	11526.19	9.124
Coefficient of variation) %(		5.49	13.62	3.76	12.6	12.96

ns,* and ** , respectively are non significant and significant at 1% and 5% level of probability

The maximum number of normal seedlings was obtained from seeds with 90 percent germination and the lowest was recorded in seeds with 80 percent germination (table 3). The highest abnormal seedlings of 49 percent observed from seeds of Hysun with 80 percent germination. The seeds of Record with 90 percent germination ability had the lowest abnormal seedlings percent of 8% (table 3). The maximum final germination percent (98%) belonged to seeds of Hysun with 80 percent germination ability. the lowest percent of final germination of 83 percent was recorded for Urofor with 90 percent of germination (table 3). The highest seedling length vigor index of 1220.200 was obtained from Azargol with 85 germination percent and the lowest was 374.800 from seeds of Hysun with 80 percent germination (table 3). The seeds of Record cultivar with 90 percent germination indicated the highest seedling weight vigor index of

34.6 and the lowest amount of 10.9 was observed in seeds of Uroflor with 80 percent of germination (table 3).

Table 2- The analysis of variance (mean squares) of studied traits at field.

S.O.V	df	seedling vigor index	Seedling emergence index	Final seedling emergence
Block	2	360.821 ^{ns}	22.886 ^{ns}	181.963^{ns}
Cultivar	3	623.215 **	2.861 ^{ns}	16.671^{ns}
Germination	2	968.160 **	26.258 ^{ns}	41.790 ^{ns}
Cultivar × germination	6	246.281**	7.265 ^{ns}	64.744 ^{ns}
Error	22	2436.838	9.278	74.162
Coefficient of variation(%)		15.37	11.59	11.40

ns,* and ** , respectively are non significant and significant at 1% and 5% level of probability

Table 3- The mean comparison of studied traits at standard germination test.

Cultivar	Germination (%)	Seedling weight vigor index	Seedling length vigor index	Final germination percent	Abnormal seedlings number	Normal seedlings number
Azargol	80	21.4de	1172.53ab	90^{cd}	14^{d}	63^{de}
	85	26.7cd	1220.20a	94^{abc}	22^{c}	67^{cd}
	90	28.8bc	1150.53ab	98^{ab}	16^{d}	70^{bc}
Record	80	13.5fg	558ef	93^{abc}	35^{b}	31^{h}
	85	30.9abc	1000.73bc	87^{de}	18^{cd}	72^{b}
	90	34.6a	865.06cd	95^{abc}	8e	79^{a}
Hysun	80	14.0fg	374.80f	98^{a}	49^{a}	31^{h}
	85	16.7ef	499.14f	95^{abc}	36^{b}	39^{g}
	90	26.6cd	726.53de	97^{a}	30^{b}	51^{f}
Euroflor	80	10.9g	531.86f	94^{abc}	33^{b}	31^{h}
	85	22.5d	886.66cd	91^{bcd}	15^{d}	61^{e}
	90	33.2ab	1211.20a	83^{e}	15^{d}	73^{b}

The results of field's variance analysis (table 2) specified that the interaction of cultivar×germination ability was highly significant for all of the measured traits except of final seedling emergence and seedling emergence index. The highest seedling vigor index at field was 501.4 that observed at seeds of Record with germination ability of 80 percent and the lowest seedling vigor index at field recorded 163.6 at seeds of Azarghol with 80 percent germination (Table 4).

Table 4- The mean comparison of interaction of measured traits at standard germination test

cultivar	germination	Azargol	Record	Hysun	Euroflro
Vigor index	80	163.6^{e}	501.4^{a}	434.8^{a}	343.9^{cd}
	85	279.5^{d}	293.2^{d}	401.3^{bc}	282.3^{d}
	90	332.6^{cd}	264.8^{d}	262.6^{d}	295^{d}

The final field seedling emergence had high positive correlation with seedling weight vigor and seedling length vigor indices. The seedling vigor index at field showed positive and high significant correlation with seedling length vigor index and normal seedlings percent (table 5).

Table 5-The correlation of seedling emergence and seed vigor assessment at standard germination test.

	1	2	3	4	5	6	7	8
1.final seedling emergence	1							
2.seedling emergence index	0.82**	1						
3 .seedling field vigor index	0.126	0.136	1					
4.normal seedling	0.105	0.253	0.64**	1				
5.abnormal seedling	-0.005	-0.116	0.64**	-0.88**	1			
6.final germination	0.229	-0.208	0.232	-0.370*	0.416*	1		
7.seedling length vigor index	0.387*	0.382*	0.95**	-0.55**	0.610**	0.299	1	
8..seedling weight vigor index	0.52**	0.62**	0.178	0.032	0.194	0.21	0.382*	1

* and ** , respectively are significant at 1% and 5% level of probability

LITERATURE

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