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Study of germination traits of 20 genotypes of monogerm and polygerm sugar beet through analysis at osmotic situation

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Abstract

Research was done according to germination indicators and experimental growth as factorial in form of random block plan In order to categorize genotypes of monogerm and polygerm of sugar beet at laboratory. 14 traits were evaluated. Three factors with high amounts were selected among others which have encompassed 83.17 percent of initial data variance. Results showed that sharing coefficient of most traits were high, so number of selected factors was appropriate and selected factors could justify traits changes desirable. First factor have been justified about 40.69 percent of initial variables, so that FGP, CVG, GRI, MDG, RS and MTG had positive and negative coefficient. So this factor was introduced as germination indicators. Second factor have been justified 26.91 percent of changes. Cotyledon length, root length, seedling fresh weight, seedling dry weight, root dry weight and total dry weight influenced on this factor, so it was called growing indicator. Finally, third factor have been justified 15.51 percent of changes. Root fresh weight and total fresh weight influenced on this factor. Totally, these three factors have evaluated a specific trait against others.

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Introduction

Beta sugar beet and vulgaris kind are in chenopodiaceae group. Vulgaris includes horticultural beet, fodder beet, chard and sugar beet. In all these groups the number of chromosomes in a diploid equal to 18 (18 - 2n) (Cooke and Scott, 1998 and Karimi, 2001). Sugar beet is one of strategic products in the country and has high feed efficiency. This product supply part of human needs directly through producing sugar and indirectly through providing animal feeds. In addition, molasses is byproduct of the sugar beet and is obtained at alcohol industry and is used at pharmaceutical. Sugar is a political and economic product and Due to severe dumping since World War II has seen the highest volatility which continues until now (Hosseini and Pour Ebrahim, 2006). Tension concept at plant includes negative effect on live or non-vital factors at environment on normal mechanism of plant which cause to disturbance on dry product and reducing performance (Fischr and Wood, 1989). Dryness tension is one of most important abiotic to decrease crop products (Farshadfar and Mohammad, 2005). Dryness is an extended and unexpected phenomenon at most land which can decrease grain performance and stability. Germination is one of sensitive stage to dryness tension. When plant development is faced to some problems at dryness, trait germination modification is one of important purpose (Bayomi et al 2008). Germination process is controlled by harmonic and environmental factors and light, oxygen, temperatures and availability of water play important role among other factors (finch et al, 2001). Germination ability of grain is increased at humidity situation, so performance is increased. Some of physiological and agricultural features of plant play important role at their tolerance against dryness and these features are used at selecting dryness tolerant genotypes. Grain germination ability and seedling development at lack of humidity is one of most important features related to dryness tolerance (Baalbaki et al, 1999). Analysis to factors is one of effective statistical methods to decrease Correlated variables into a few main hypothetical factors. Analysis to factors is used effectively to understand relationship and performance structure and morphological traits (Tousi Mojarad et al, 2005). Final judgeship about correlation coefficient is not done With regard to complex trait relationship together and it is necessary to use statistical methods to understand traits relationship. Analysis to factors is one of effective methods to decrease data volume and resulting through data which show high correlation between initial variables (Mollasadeghi, 2011). Purpose of this study is to find way of relating this trait to apply them at selecting numbers.

Fig. 1. Test steps.

Material and methods

We referred to sugar beet institute at Karaj province in order to prepare grains; Bracteole was done after receiving grains (table 1) and was categorized to monogerm and polygerm group at Ardebil sugar beet and grain institute. This study was performed on March -2012, tension at laboratory in form of polyethylene glycol 6000 osmotic dryness with 30% concentration. Experiment was done as factorial in form of random design three times. In this study, trait coefficient of germination, germination density, germination indicator, germinated average period, percent of final germination, routine germination, Cotyledon length, seedling weight, seedling fresh weight, plumule fresh weight, root fresh weight, plumule dry weight, and seedling dry weight were evaluated. For this purpose the filter paper with a 70 cm length and 13 cm width were prepared and seeds were placed on it at a 1.5 cm distance, then 10 ml of solution was added to the paper to stick together and do not move out of the seeds, then papers were rolled gently and placed at pipe with 5 cm diameter and 14 cm height. Pipe with rolled paper were placed at 4

liter plastic plate and 300 cc of solution were added, then samples were maintained at germinator for 15 days at 20 to 23 centigrade degree and 70 percent humidity. During these 15 days, second, third, fourth, fifth, eighth, thirteenth, fifteenth germination was done. Among plots 15 seedlings were selected randomly and their traits were examined and at the end of period to achieve dry weight of samples 70 degree oven for 48 hours were used (Fig. 1).

Table 1. Genotypes used in this study.

Number	Germ type	Name of genotype	Number	Germ type	Name of genotype
1	Poly Germ	30881-88	11	Poly Germ	31270
2	Poly Germ	30883-88	12	Poly Germ	31267
3	Mono Germ	30906	13	Mono Germ	31290
4	Mono Germ	30908	14	Mono Germ	31291
5	Mono Germ	30915-88	15	Mono Germ	31262
6	Poly Germ	30919-88	16	Mono Germ	31266
7	Poly Germ	30920-88	17	Poly Germ	30923-89
8	Poly Germ	30922	18	Poly Germ	Jolge
9	Poly Germ	86213-89	19	Poly Germ	MSC2*7233-P29
10	Poly Germ	31269	20	Poly Germ	7233-P29

whereas at the end of last day, indices for germination and seedling growth such as final germination percentage (FGP), coefficient of velocity of germination (CVG), germination index (GI), germination rate index (GRI), mean germination time (MGT), velocity of germination (Rs) and mean daily germination (MDG). The calculations were done using the following equations:

Coefficient of velocity of germination (CVG):

$$CVG = 100 \times \sum Ni / \sum NiTi$$

Where, Ni is the number of germinated seeds for each day, Ti is number of days as of the start of experiment, Germination index (GI):

$$GI = (13 \times N1) + (12 \times N2) + ... + (1 \times N13)$$

where, N1 and N2 and ... are the number of germinated seeds in first and second days, respectively, and so forth; numbers 10, 9 and ... are weights applied on the number of germinated seeds at first and second days and so forth.

Germination rate index (GRI):

$$GRI = G1/1 + G2/2 + ... + Gx/x$$

G1 = germination percentage at first day

G2 = germination percentage at second day and so forth

Mean germination time (MGT): (Andalibi et al., 2005)

$$MGT = \sum NiTi / \sum Ni = 100 / CVG$$

Where, Ni is number of germinated seeds for each day, Ti is number of days as of the start of experiment, Final germination percentage (FGP): (Al-Mudaris, 1998; Gharineh et al., 2004)

$$FGP = Ng / Nt \times 100$$

Where, Ng is total number of germinated seeds, Nt is total number of evaluated seeds, Germination speed (Rs): was estimated based on Magour method and by using the following equation, (Rajabi and Poustini, 2005)

$$Rs = \sum Si / Di$$

Where, Si is the number of germinated seeds in ith day, Di is day number to nth counting Mean daily germination (MDG), which is an index of daily germination and is calculated using the following equation:

MDG = FGP/d

SPSS software was used to analysis to factors method.

Results and discussion

Considering the fact that the relations among traits are complicated, the final deduction cannot be made based on simple correlation analysis and it requires multivariate statistical methods to understand the

relationships between traits much better. Among all, analyzing to factor is an effective statistical way in reducing the amount of data and draw conclusions from data that show high correlation between the original variables. The analysis on the measured traits was performed by main components method. Then the factor rotation was performed using Varimax method. As can be seen in Table 3, the factor analysis was done based on Eigen values greater than one, and taking into account four factors. These 2 factors generally explained and justified 83.17 percent of the dada variation in this scenario.

Table 2. Factorial coefficient of laboratory trait to evaluate 20 sugar beet after varimax at dryness situation.

Traits	Factor			Communalities
	1	2	3	
CVG	0.565	0.728	0.221	0.898
GRI	0.504	0.835	0.136	0.97
MDG	-0.163	0.704	-0.01	0.523
RS	-0.543	-0.686	-0.243	0.825
MTG	0.567	0.726	0.222	0.899
FGP	0.116	0.838	-0.051	0.718
Cotyledon length	0.865	0.253	-0.026	0.812
Root length	0.833	0.36	0.059	0.827
Seedling fresh weight	0.905	0.031	0.119	0.834
Root fresh weight	-0.076	0.091	0.978	0.97
Dry weight of seedling	0.767	-0.02	0.382	0.734
Root dry weight	0.801	0.336	-0.145	0.775
total fresh weight	0.337	0.093	0.901	0.934
Total dry weight	0.936	0.133	0.222	0.925
Total	5.697	3.767	2.181	
% of Variance	40.69	26.91	15.58	
Cumulative %	40.69	67.6	83.17	

The criterion of selecting these factors was the number of roots larger than 1 and since the number of basic variables used in analyzing to factor was 14, according to the formula F< (P+1)/2 (In which P And F represent the number of variables and factors respectively), 3 factors for this experiment were appropriate according to the presented principles (Toosi Mojarrad, et al, 2005). The traits with a same mark in a subset of one factor, all are under the influence of an unknown factor with a same direction and in other words they affect that factor with unknown nature and with a same direction. Every factor has not an individual existence; however, it is the result of all traits and processes that affect that particular factor (Mansuri and Soltani Najafabadi, 2004).

First factor have been justified about 40.69 percent of initial variables, so that FGP, CVG, GRI, MDG, RS and MTG had positive and negative coefficient. So this factor was introduced as germination indicators. Second factor have been justified 26.91 percent of changes. Cotyledon length, root length, seedling fresh weight, seedling dry weight, root dry weight and total dry weight influenced on this factor, so it was called growing indicator. Finally, third factor have been justified 15.51 percent of changes. Root fresh weight and total fresh weight influenced on this factor. Mir

Mosavi et al (2006) reported at analysis to factor with least root, 4 factors are efficient for 14 traits. In this analysis, three factors have justified 83.17 percent of all data changes.

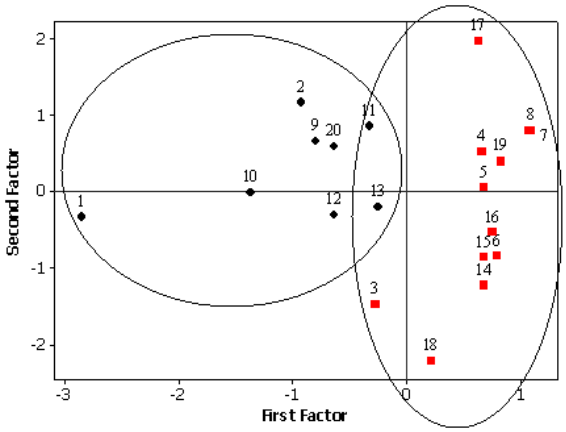

Fig. 2. Genotype dispersion according to first and second factor.

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