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DETERMINATION OF THE TRAITS IN LEGUMINOUS CROPS UNDER SALINE CONDITION

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Abstract

In this study, the variability and determination of genetic traits for winter legume crop varieties the Vostok-55 (*Pisum arvense* L) and Mirzachul-1 (*Vicia villoza Roth* L) were investigated under moderate saline soil condition. Results show that the weight of the bean was marked as variable and highly deterministic, and the height of the plants was the most stable. The selection of plants based on these traits is a most effective way in salinity. Both variety the forage pea Vostok-55 and vetch Mirzachul-1 is a highly recommended as a sideration and forage crop in saline lands.

Key words: *variability, Soil salinity, correlation, Green manure, forage crops.*

INTRODUCTION

Improving grain yield and quality of legumes is one of the major priorities in arable lands. It is predicted to increase the grass production of forage crops to 330–335 million tons that included an annual grass crops from 38 to 57 million [1].

It should be noted that an animal husbandry is experiencing a chronic lack of feed protein. Reference shows, the average estimates for feed proteins in animal husbandry is approximately 26 million tons, in fact, it is about 18-20 million tons in Russia [2].

One major advantage to solve a protein problem is the expansion of legume crops, like forage pea, vetch et cetera. Harvested legume plants contain up to 20-25% protein on dry weight, and over 25% in grain. The amount of basic essential amino acids reaches 65-80 g or more per 1 kg of dry matter [3].

Winter leguminous crops are considered an important component for intermediate crops. There are ample examples that vetch with wheat, rye, and triticale intercropping results in increase 15–20% the absorption of nutrients from the soil intensively than in individual cropping of these crops. In addition, the protein and oil contents of cereals were enhanced around 1-3% and 0.5-1.5% respectively [4].

The main advantage of legumes is an increase the fertility in soil and enhances yields due to the nitrogen fixation. It has been established that the vetch leaves fixed from 130 to 390 kg nitrogen per hectar in soil [5].

Soil salinization is known to reduce the plant productivity. According to reference, the accumulation of intermediate products such as ammonia, a number of amino acids, diamines are occurred in plants under saline soils which are toxic affected to plant growth [6]. As a results, the plant growth and development are seriously suppressed, therefore a decrease in productivity between 70% and 85% of yield.

Salinity has affecting 15-30% of land worldwide where directly influence to agriculture. It also threats to human health, ecosystems, and national economies [7].

One of rational method to improving salt tolerance is a use the saline soil for selection of tolerant crop lines. In this case, legumes would be good candidate crop. In study we aimed to investigate the variability and determination in traits of leguminous crops under salinity in the Syr Darya region (Syr Darya region belongs to the Mirzachul desert) where more than 90% of the irrigated land affected by salt stress. In this region, 219 169 ha lands are less, 53544 ha land are moderate and 5314 ha lands are strong affected by salt stress.

MATERIALS AND METHODS

The experiment was carried out at experimental station of Gulistan State University, located in the Syrdarya region (Uzbekistan). Soil was classified as medium salinity. Two forage legume varieties were used in our research. The Vostok-55 is a variety of pea from the species *Pisum arvense* L that created by repeated selection from collection No.141 (authors: Mazurin S.A) and Mirzachul-1 is a variety of vetch from the species *Vicia villosa Roth* L that created by multiple selection in saline field from the local Vicia villoza Roth population (authors T. Kuliev, H. Kushiev, K. Toderich, A. Eshkuvatov). Field experiment was designed individual three biological replicates for both conditions.

Statistical analysis was performed by using the SPSS -14 program [8]. Averages of data were compared using correlation coefficient **(r**) and the coefficient of determination **r** ^{2} (**r** ^{2} - squared correlation coefficient) averaging to all the matrices (R^2m), according to individual traits (R^2ch). Variability of traits were determined by the coefficient of variation -C V (%) [9].

RESULTS AND DISCUSSIONS

Our first data indicated that the soil salinization significantly influenced to quantitate traits of pea and vetch varieties. The height of the vetch variety was 109.6 cm in moderate saline soils and fodder peas showed as a 48.99 cm (See Table.1). The average number of beans in forage pea was 5.8 and 5.5 in vetch. The productivity of one plant was obtained as 0.89 g in forager pea and 0.61 g in vetch. The yield of forage pea and vetch showed 11-12 c/ha and 5-6 c / ha of grain, respectively in saline soil.

Analyzing of the agronomic traits were showed that the mass of seeds from the 1st plant (6), the first bean weight (9) and the weight of 1000 seeds (7) were highly variable and determined in forage pea Vostok-55 under salinity. In this stressed condition, the variability of these traits occurs in accordance with other traits. The plant height (1), length of bean (3), harvest index (8), width of bean (4) were shows as medium variable and determinate characters. The number of beans from the 1st plant (2) is highly variable and weakly determined. The variability of these traits depends to the external environmental conditions

Table-1. Analysis of potential characters in legumes under saline condition. Here, X- average, r^2- coefficient determination, CV- coefficient variation.

№	Traits	Vostok-55			Mirzachul-1		
		X±	**r^2**	**CV, %**	**X±**	**r^2**	**CV, %**
1	Plant height , (sm)	48.9±1.35	0.14	15.4	109,6±1,2	0.12	6.1
2	Number of beans per plant	3.8±0.16	0.09	41.0	5,50±0,20	0.29	28.7
3	Length of bean (sm)	3.73±0.10	0.28	14.5	2,80±0,06	0.14	11.3
4	Width of bean (mm)	0.84±0.04	0.22	11.7	0,67±0,02	0.07	14.1
5	Thickness of bean, (mm)	0.51±0.01	0.11	11.9	0,47±0,02	0.16	12.4
6	Mass of per plant (g)	0.89±0.03	0.27	51.2	0,61±0,04	0.31	32.1
7	Weight of 1000 seeds (g)	60.5±0.23	0.32	29.1	29,6±1,51	0.19	27.8
8	Harvest index (%)	67.8±1.84	0.27	8.8	65,6±1,51	0.16	17.3
9	First bean weight (g)	0.35±0.22	0.34	35.4	0,17±2,07	0.22	25.6
10	Number of seeds per bean	4.1±0.23	0.16	23.6	4,10±0,17	0.11	23.3
	Average	-	**0.22**	**24.2**	-	**0.17**	**19.8**

Results of vetch Mirzachul-1 shows, the mass of seeds from the 1st plant (6), and the number of beans (2) and the first bean weight (9) were highly determined. The plant height (1), length of bean (3), width of bean (4), thickness of bean (5), and harvest index (8) were medium-variable and determinate characters. In addition, the number of beans (2) was highly deterministic and variable in Mirzachul-1 to compare Vostok-55.

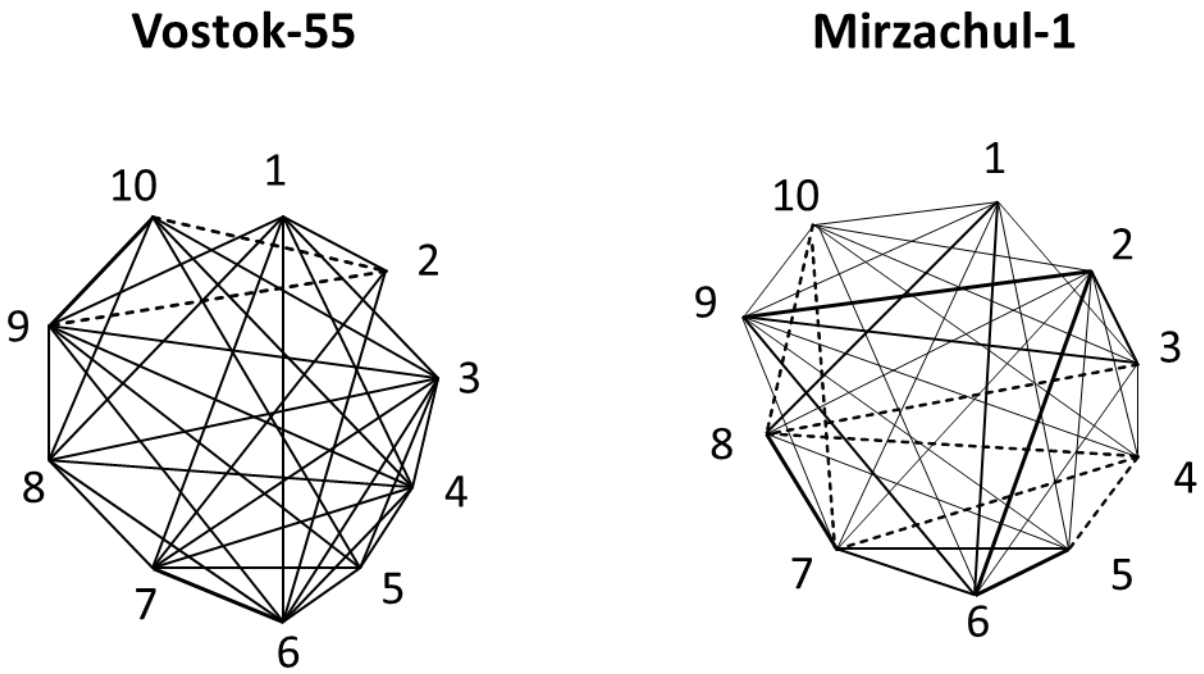
According to Rostova (2002) the seed productivity is a major indicator for the systemic adaptive variability of organisms [9]. This means that the selection based on these trait would help to create a salt tolerant genotypes.

Based on our results, it is argued that the mass of the bean is an ecological and biological systemic indicator that reflects the consistent variability of the genotype in a heterogeneous environment. Plant height, the length, thickness and width of bean could provide a biological indicator. The number of beans is directly involved to plant productivity that meaning a environmental indicator. The variability of this trait is determined mainly by the influence of external environmental factors.

The coefficient of determination (square correlation coefficient-r^2) shows the consistency of the traits. There is a positive link between the correlation coefficient and the coefficient of

determination (See Figure.1). A less correlation estimates were found between the plant height (1) and the number of beans (2), the length of the bean (3), the width of the bean (4), the mass of seeds from the 1st plant (6), weight of 1000 seeds (7), harvested index (8) and the first bean weight (9) 5 in Vostok-55 genotype. The correlation coefficient between these traits was obtained from 0.3 to 0.5. It means, tall plants are more productive in saline soils. Between the length (3) and the width (4) of beans, the mass of seeds from the 1st plant (6), weight of 1000 seeds (7), the yield of grain (8) and the mass of beans (9) marked as moderate correlation. A strong correlation was observed between the mass of seeds from one plant (6) and weight of 1000 seeds (7), as well as the mass of first bean (9) and the number of seeds per bean (10) where the correlation coefficient was more than 0.7. However, the data of plant height (1) was indicated a weak correlation with other traits, including the number of beans (2), a thickness of the bean (5), a weight of 1000 seeds (7), a harvested index (8), the mass of beans (9) and the number of seeds per bean (10) in Mirzachul-1 vetch. A strong correlation was observed between the number of bean (2) and the mass of seeds from the 1st plant (6) and the mass of first bean (9).

Figure. 1. Correlations in multiple traits of legumes in salinity. Here, the numbers indicates: Plant height (1); cm; Number of beans per plant (2); Length of bean (3); Width of bean (4); Thickness of bean (5); Mass of per plant (6); Weight of 1000 seeds (7); Harvest index (8); First bean weight (9); Number of seeds per bean (10). R = 0.3-0.5; r = 0.5-0.7; r> 0.7 r = -0.3-0.5



Correlation analyzes showed that the average determination level for forage pea is 0.22, for vetch was a -0.17 (See Table.1). Rostova et all (2002) showed, the level of correlation is increased under adverse environmental conditions. Therefore, the correlation between the traits of forage pea increased than vetch in saline condition. This indicates that the salt tolerance of

the wiki compared to fodder peas. Similar results were obtained by Trofimov I.T. et al. 2010. According to the authors, vetch plant is a resistance to drought and salinity among leguminous crops [10].

Cereal crops are not only increase the soil fertility; it is also improves the reclamation state of saline soil. This is due to salt accumulation properties of plants. It has been established that the stems of salt tolerant plants accumulate more chlorine ion than unstable [11]. For example, the triticale accumulates 0.19 kg /ha of chlorine ions from soil. The forage pea accumulate about 1.81 kg /ha and vetch is 2.16 kg / ha, respectively. It means that legumes are more likely to remove chlorine ions from the soil, resulting in improved the reclamation state of saline soils.

Based on the obtained data, the winter legumes (forage pea, vetch) crops can grow well in conditions of slightly saline soils. Desirably this crops are used as a component and intermediate cropping with cereals (triticale, rye, barley). Hence, it use for animal as a feed in early spring. In addition, legumes enrich the soil with organic substances that increase the fertility of saline soils, resulting in increased crop yields.

Conclusions

1. Leguminous crops of forage pea and vetch can be recommended as a sideration and forage crop for growing in the salinity lands.
2. In salinity conditions, the weight of beans is a most effective way in selection procedure.

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