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Evaluation of soybean varieties under drought stress in the farm

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ABSTRACT: The importance of soybean in agronomic systems is mainly due to the ability of plants to use atmospheric nitrogen through symbiosis with microorganisms in the soil. Studies have shown that different varieties within a species are different in terms of the nodulation and nitrogen fixation efficiency. In this study, 8 lines and varieties of agronomic soybean were compared in order to identify the most appropriate varieties. Simple correlation coefficients between traits showed a positive correlation between wet and dry weight of root nodules and seed yield per unit area and also showed positive correlation between nitrogen content of grain and plant with seed yield per plant unit. Stepwise regression analysis was performed by determination of nitrogen content of plant as dependent variable and traits such as biological yield, plant height and grain yield per plant remained in the model (R^2 = 0.93). Analysis of correlation coefficients indicated that the direct effects of biological and seed yield on plant nitrogen rate were most remarkable and the most effect was related to biological yield.

***Keywords*:**

INTRODUCTION

Soybean is accounted to second rank in the world in terms of cropping area of oilseeds (12). In Iran, soybean with cropping area of 640 thousand hectares and approximately 400 thousand tons of production is considered as the most important crop between oilseeds (1). There are certain strains of bacteria (Rhizobium ciceri) that cause the formation of bacterial glands in soybean and a few species of wild relatives. Mentioned race is classified and labeled Mesorhizobium ciceri (8 and 12). This bacterium enters to soybean through the hairy roots. Pink swollen glands can easily be seen in the appropriate farm 10-15 days after soybean cultivation on seedling roots. Glands are initially spherical or cylindrical, but then are branch and form multiple lips (2 and 11).

Excessive moisture like what there is in water logging situation has a detrimental effect and moisture deficit also has similar negative effects on nitrogen fixation (3 and 12). Nitrogen fixation at 25 ° C occurs better than 30, 32 or 35 ° C (1) and it is also reduced in soils rich in nitrogen. Soil pH is less than pH = 6.0 also have a negative effect on nitrogen fixation, because the nitrogen fixation is a process induced symbiosis between host and bacterial. The factor that disrupts plant growth, likely will be affected on N fixation, therefore to achieve the maximum activity of Rhizobium, soybean should be planted in favorable condition (10). According to the necessity of achieving superior genotypes of cultivars which have higher performance in dry conditions in the West Highlands, this study was performed with aims (A) investigate the genetic diversity of phonological and morphological traits associated with biological nitrogen fixation and (B) determine the genotypes with high performance products of nitrogen fixation and (c) determine the relationships between traits.

MATERIALS AND METHODS

In this study, 8 lines and soybean varieties were planted in RCB design in four replications on 12 April. Each experimental unit consisted of 5 two-meter line and spacing was 10 × 25. Agronomic traits such as plant height, number of primary branches, number of secondary branches, number of pods per plant, number of seeds per pod, 100-grain weight, biological yield, number of nodes in root, nodule dry weight, grain yield per unit plant and seed yield per unit area was conducted. The rate of grain nitrogen and plants nitrogen of each genotype were measured and recorded by method Asghar et al (2000). Morphological traits measured after the arrival of remaining plants at

1/87 sq. m. Statistical computations including variance analysis and mean comparison of traits was performed using LSD and determine the phenotypic correlation coefficient, their analysis and regression analysis was performed using standard software.

RESULTS AND DISCUSSION

The variance analyses of traits showed that all traits except number of primary branches, and harvest index (significant at the 5% level), had difference at 1% level. The highest and lowest coefficients of variation were related to the fresh weight of the root node and the number of pods per plant. Significant difference ($P < 0.01$) between early lines and late-type lines verify in dry weight of the root and grain nitrogen content on the results of other researchers (Rupyla et al, 1984; Singh and Saksna, 1999). In general early lines in terms of traits associated nitrogen fixation were better than the delayed-type lines. But genotype No. 6 (l17) was distinguished from other lines in the same group and had higher nitrogen and plant content from the best early line. Mean comparison of cultivars showed that, these two genotypes in terms of nitrogen content in grain dry matter were in two distinct classes of statistical and higher than the other lines. Lines No.2 and 3 were statistically placed better than other varieties in a statistical class in terms of grain yield per unit area. But the mean of lines 13 was higher than the others in terms of seed yield per plant. There was a strong and positive correlation between the plant nitrogen concentration and grain nitrogen content. These two traits showed positive and significant correlations with biomass and grain yield per plant. Correlation of grain nitrogen and harvest index was also positive and significant at the 5% level. Strong and positive correlation between grain yield and fixation nitrogen has been emphasized by other authors (3 and 10). In the present study, the correlation between grain nitrogen content and plant with grain yield was found significant per plant unit plant and insignificant in unit area. Perform the experiment in dry conditions seems to be the reason for this findings. Pazdernik et al (10) have shown that there is a close correlation between grain yield and fixation nitrogen ($r = 0.99$) and selecting one will bring genetic improvement in the other.

In analysis of the correlation coefficients, the amount of plants nitrogen that can be a consequence of the different characteristics in this study, were considered as a handicapped variable and three traits biological yield, seed yield per plant and plant height as the cause variables. The variables were selected based on the model obtained from the stepwise regression. Results of this analysis indicated that the direct effect of biomass yield was positive on plant nitrogen and negative on other traits. The biomass yield had the highest significant positive direct effect on grain nitrogen. Significant and correlation between these two traits ($r = 0.933$) show the close relationship between them. Singh and Saksna (12), the yield correlation of biologic with total plant nitrogen content in soybean have been reported positive and significant ($r = 0.88$). Negative and significant effect of grain yield per plant on the amount of nitrogen in the dry matter of grain has been compensated by the indirect effect through biomass yield, so that correlation of this trait with grain nitrogen is positive and highly significant. The direct effect of plant height on plant nitrogen was negative and significant, but there was no correlation between these two traits. The residual effects were not significant in this analysis, in other words 93/4% of the variation in plant nitrogen in this study were identified by traits included in the model.

In these study genotypes 8 and 33 with having higher grain yield have well efficiency of nitrogen fixation. Using these lines in the future examines and as crosses parents are recommended in breeding programs.

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