



Screening for Drought Tolerance of Common Bean using Several Selection Indices

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Abstract: Yield losses due to drought effect can be increased by interaction with other associated stress factors such as high temperatures. Different selection indices based on grain yield were developed and used for the assessment of common bean germplasm for drought tolerance. The aim of this study were to assess the yield reaction to drought stress for six Romanian cultivars of common bean using 16 tolerance indices, in order to establish the efficiency of these selection criterion and the cultivars with good tolerance to drought. The biological material for this research was composed by six Romanian cultivars of common bean studied at USV Timisoara during 2022-2024, under different levels of drought stress. Given the obtained results, several indices: yield index, stress tolerance index, stress susceptibility percentage index, mean productivity, drought resistance index and geometric mean productivity shows very high positive correlations with yield under both conditions of stress and non-stress, indicating that they can be effectively used for the selection of genotypes with promising yields under different water stress conditions. Star and Diva cultivars showed a moderate tolerance to drought, registering reasonable levels of plant yield under different environmental conditions.



Introduction

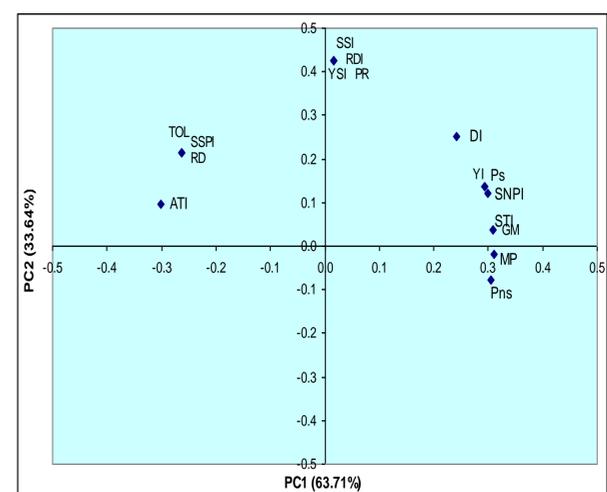
Common bean (*Phaseolus vulgaris* L.) is considered the most important food legume; however, drought stress caused significant seed yield losses in around 60 % of the global bean production areas. Under the unfavourable climate change from last decades, there is necessary to intensify the breeding activities to improve tolerance to different drought conditions in order to assure the food security at a large scale. Several indirect techniques have been proposed for the assessment of drought tolerance; however, seed yield is considered the most reliable indicator because it directly represents the harvest obtained under certain conditions

Material and Method

Six Romanian cultivars of common bean (Ami, Ardeleana, Avans, Diva, Star and Vera) were selected for this study. The experience was organized using a randomized block design in three replications, with plots composed of three rows spaced at 50 cm. The results from 2022 was considered as yields under non stress conditions while the results from 2024 as yields under stress conditions. Based on the yields from the two different years, 16 tolerance indices were calculated and used for the selection of cultivars.

Results and Discussions

For a better interpretation of the relationships, similarities and divergences between the different drought tolerance indices, a graphical analysis was performed based on the first two principal components, which comprise a large part (97.35%) of the total variability. Thus, it is observed that the analyzed statistical indices are grouped into three categories.

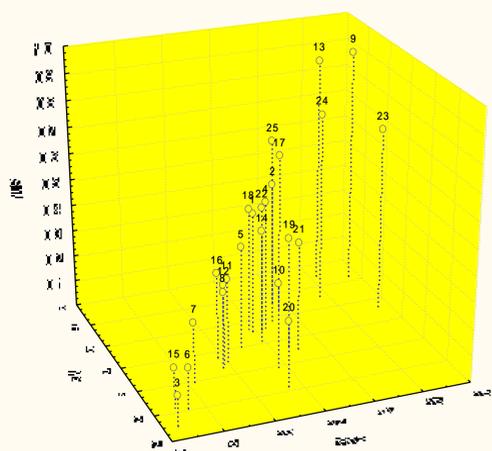


Biplot of first two principal components for the drought tolerance index

The first group includes the indices: DI, YI, SNPI, STI, GM, MP, which show very close and statistically assured positive correlations with both production under stress conditions and under conditions free of water stress, indicating that they can be used with high efficiency for the selection of genotypes with superior yields under different water stress conditions.

Conclusions

Based on the obtained results Avans and Star cultivars exhibit superior behavior under water stress registering superior values for most of all selection indices.



3D graphic of STI, Pns and Ps index for yield/plant of bean genotypes