3rd SEMINAR

Topic : **Water Stress Tolerance of French Bean (*Phaseolus vulgaris* L)**

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Venue : Sher-e-Bangla Agricultural University

Time : 11.00 a m to 12.30 p m

You are Cordially Invited to Attend the Seminar

Organized by : Bangladesh Society of Agronomy

In Collaboration with : Sher-e-Bangla Agricultural University

Participation fee: Free

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WATER STRESS TOLERANCE OF FRENCH BEAN (*Phaseolus vulgaris* L.)

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Abstract

French bean (*Phaseolus vulgaris* L.) is mostly grown under rainfed conditions and thus, suffers from substantial yield loss due to water stress at the end of the growing season (terminal drought). Under such conditions, it is necessary to identify and grow water stress tolerant genotypes for increasing yield and sustainability of French bean production. A number of experiments were conducted at the Environmental Stress Research Site of the Agronomy Department of Bangabandhu Sheikh Mujibur Rahman Agricultural University during 2005-2008 to identify water stress tolerant French bean genotypes and to understand water stress tolerance mechanisms of the crop. In the first experiment 46 French bean genotypes were screened against water stress imposed by withholding irrigation until appearance of wilting. Water stress caused an overall reduction in above ground biomass (TDM) by 42%, pods plant^{-1} by 37% and seed yield by 45%. Among the yield components, pods plant^{-1} showed the maximum genotypic variation due to water stress; whereas, seed size was relatively stable. Geometric mean of seed yield showed the strongest correlation with seed yield under water stress; while, the seed yield had weak relationships with relative yield and drought susceptibility index (DSI). Plant traits that significantly associated with seed yield were included in stepwise regression model. The model indicated that the TDM consistently contributed to seed yield prediction. Genotypes were grouped into four clusters. Maximum inter-cluster distance was observed between genotypes of cluster III and I. The genotypes of cluster III performed better in respect of all the 13 relative plant characters under study and the genotypes in cluster I performed very poor in all relative plant characters, except seed pod^{-1}. Important character responsible for genetic divergence was TDM in the vectors that exhibited important component of the divergence.

The growth, yield and yield contributing characters of seven selected French bean genotypes viz. BB24, BB43, BB45, BB41 and BB36 (relatively tolerant), BB04 and BARI bushbean-2 (relatively susceptible) were evaluated under water stress in the second experiment. Seeds of the genotypes were sown in plastic pots and the seedlings were grown with water of 50% (water limited) and 80% (well watered) of field capacity by weight throughout the growing season. The results showed that plant height, numbers of leaves, leaf area and shoot dry weight of all the genotypes were significantly affected by the water stress. However, the tolerant genotypes BB24 and BB43 performed better than the rest of the genotypes, and these characters were badly affected in susceptible genotypes. Root/shoot ratio increased due to the water stress and the genotypes BB24 and BB43 maintained better root/shoot ratio than the others. Water stress caused a decrease in total chlorophyll content and chlorophyll a/b ratio. Seed yield among the genotypes was reduced from 20 to 60% due to water stress. The largest reduction in seed yield was in the susceptible genotypes (59%); by contrast, the tolerant genotypes showed comparatively less yield reduction (30%). The yield reduction under the water stress was attributed mainly due to the reduction in pods plant^{-1}.

The third experiment was conducted with seven French bean genotypes viz. BB24, BB43, BB45, BB41 and BB36 (relatively tolerant), BB04 and BARI bushbean-2 (relatively susceptible) to quantify genotypic differences in leaf water status under water stress conditions. Midday drop of relative water content (RWC) decreased remarkably and the trend was more conspicuous in BB04 and BARI bushbean-2 compared to that in BB24 and BB43. The midday drop was negatively correlated with the seed yield. The whole plant transpiration rate was found minimal in BB24 and BB43 compared to the susceptible genotypes. The study revealed that water saturation deficit, water retention capacity, water uptake capacity and whole plant transpiration rate were negatively and significantly associated with yield, while positively related with RWC and yield under water stress conditions.

The fourth experiment was comprised of two tolerant (BB24 and BB43) and two susceptible (BB04 and BARI bushbean-2) genotypes and two moisture regimes (80% FC and 50% FC) throughout the growing season for analyzing the changes in biomass distribution, morpho-physiological characteristics, and water relations traits under water stress conditions. Water stress decreased the partition of dry matter to shoot while increased that towards root. Leaf area in four genotypes was markedly decreased by water stress and the decrease was the largest in the susceptible genotypes. Diurnal pattern of leaf water potential (LWP) and RWC reflected that those characters were lowered due to water stress. RWC was highly correlated with LWP in all the genotypes, though the relationship was distinct in BB24 and BB04. Stomatal density was increased, whereas its aperture was decreased due to water stress. Stomatal aperture was larger in BB04, while that was smaller in BB24. Paraheliotropic leaf movement was prominent in BB24. Midday drop of RWC showed negative significant correlation with pod setting ratio. The highest cell membrane injury in the PEG test was observed in susceptible genotypes. The lowest membrane damage by heat was observed in BB24. The tolerant genotypes exhibited higher amount of proline and soluble sugars than the susceptible ones.

It was concluded that French bean genotypes exhibited a great variation in their water stress tolerance. The tolerance to the stress of some genotypes was associated with better water relations, less cell membrane injury and greater amount of proline and sugar content compared to susceptible ones.