MORPHOLOGICAL CHANGES IN BEAN (*PHASEOLUS VULGARIS* L.) UNDER SALINITY STRESS

U.X. Ikramova
U.R. Mahmudovich
Institute of Genetics and Experimental Plant Biology, Academy of Sciences of the Republic of Uzbekistan, Tashkent, e-mail: ikromova.umida@inbox.ru
S.U. Sharipov
Head of the Department of Agricultural Crop Agrotechnology and Plant Protection, Cotton Breeding, Seed Production and Cultivation Agrotechnologies Research Institute, Navoiy region.

Abstract
This study investigated the effect of salinity stress on the third leaf area and leaf number of red bean varieties and accessions. Our results showed that salinity negatively affected the bean plants, leading to a reduction in leaf number and a decrease in leaf area. This response can be explained by the toxic effects of salts under saline conditions, which limit nutrient uptake and disrupt normal growth.
Keywords: Bean, salinity, third leaf area, leaf number

Introduction
Currently, soil salinization in irrigated lands is one of the major global ecological problems, seriously affecting efficient land use, crop productivity, and food security. Salinization reduces fertility, particularly in arid regions, increasing the risk of food shortages [Zewdu, 2017].

Under saline conditions, the morpho-anatomical structure of leaves undergoes significant changes, which play an important role in plant adaptation mechanisms. Studies indicate that leaf cell thickness, length, area, diameter, and turgor are highly sensitive to salt stress [Rouphael, 2017]. These changes can help maintain photosynthetic efficiency and improve water retention. Experiments on *Atriplex patula* also showed that salt treatments increase the thickness of the epidermis and mesophyll, enhancing total leaf thickness, which likely reduces transpiration [Pandit, 2024]. Tajzadah et al. (2024) reported that peppermint plants exposed to

50 and 100 mM salinity showed significant reductions in key morphological traits. Compared to the control, plant height decreased by 11,76% and 23,53%, leaf number by 25,11% and 33,92%, leaf area by 24,76% and 56,37%, root length by 20,61% and

31,58%, root volume by 24,07% and 37,04%, and root diameter by 23,05% and 46,81%. Similarly, in chickpea, increasing salinity significantly reduced plant height, branch and leaf number, leaf area, and biomass, with many plants dying within four weeks under high salinity. Leaf number decreased by 65% and leaf area by 67% [Ehtaiwwesh, 2020]. In beans, increasing NaCl concentration reduced stem length, leaf area, and leaf number [Mi, 2024]

Materials and Methods.

The objects of the study were the Rovot variety and 128, 140, and 152 accessions of bean (*Phaseolus vulgaris L.).* Experiments were conducted under non-saline soils in Tashkent (control) and naturally moderately saline soils in Navoi (saline conditions). During the flowering stage, the number of leaves per plant and the third leaf area from the growth point were measured using standard methods.

Results and Discussion.

High yield in plants is often closely associated with larger leaf area, leaf mass, and chlorophyll content [Amonova, 2025].

Our results showed that salinity significantly reduced the number of leaves per plant during flowering.

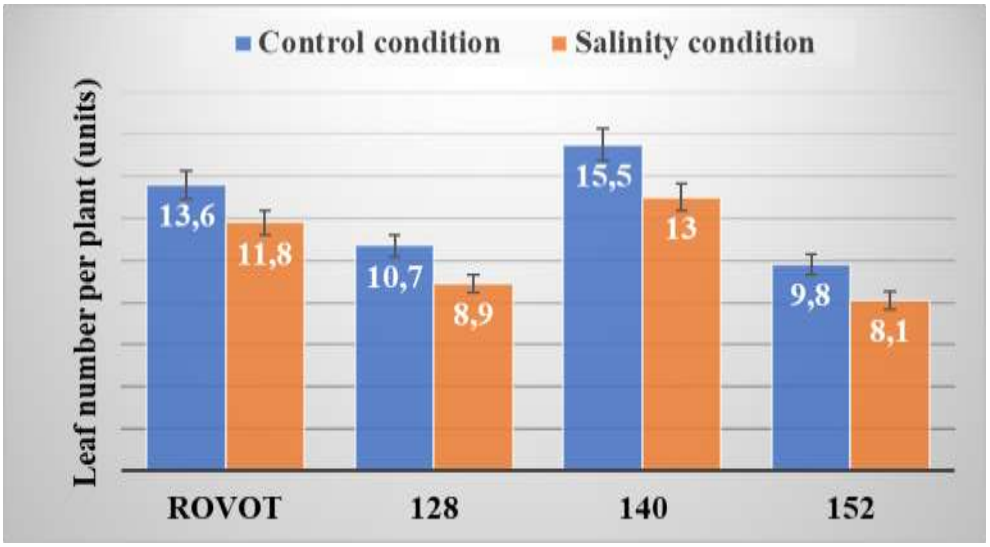

Figure 1. Effect of salinity stress on the leaf number per plant of bean varieties and accessions, units

In the Rovot variety, the number of leaves per plant decreased from 13,6 ± 0,17 (control) to 11,8 under saline conditions, a reduction of 13%. In the 140 accession, leaf number decreased by 16% under salinity, while the 128 and 152 accessions showed the greatest reduction of 17% compared to control plants (Figure 1).

Red bean varieties and accessions showed a reduction in the third leaf area under salinity stress. Among the varieties, the highest third leaf area under control conditions

was observed in the Rovot variety (46,1 ± 0,81 cm²), while the lowest was in accession 152 (35,6 ± 1,85 cm²) (Figure 2).

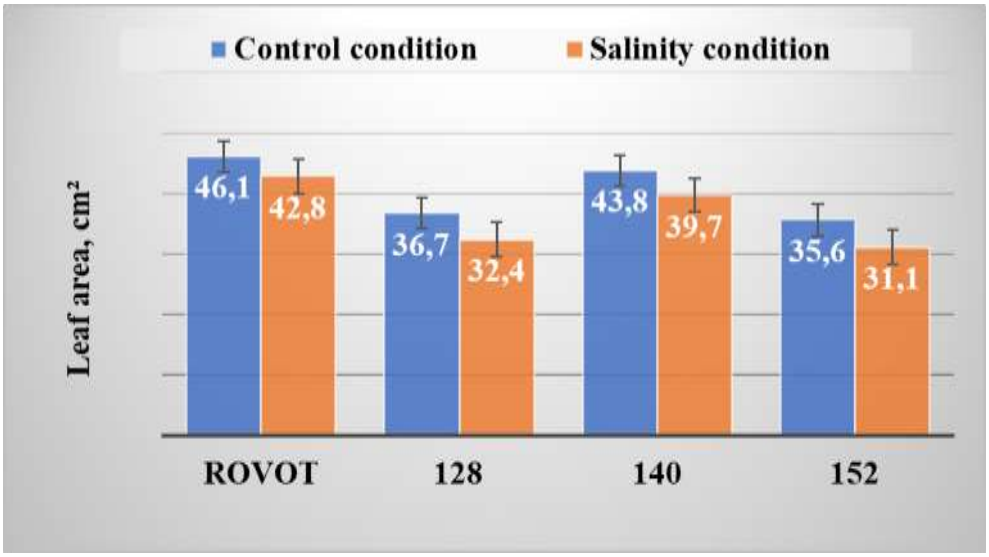

Figure 2. Effect of salinity stress on the third leaf area of bean varieties and accessions, cm²

Under salinity, the third leaf area decreased by 7,2% in the Rovot variety, 11,7% in accession 128, 9,3% in accession 140, and 12% in accession 152 compared to the control (Figure 2). According to our results, accession 152 had the smallest third leaf area under control conditions, and it remained the lowest under saline conditions as well.

Conclusion.

The results of this study indicate that salinity stress negatively affects the leaf morphological traits of red bean plants. The reduction in leaf number and leaf area under saline conditions can be explained by limitations in vegetative growth and photosynthetic activity. These findings are important for the selection of suitable and salt-tolerant bean genotypes for saline regions.

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