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Study Result of Drought Resistant Strawberry Varieties in Greenhouse Condition

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Abstract: *Drought resistance of strawberry varieties was evaluated with morphology of leaf and root and physiological traits, and it was estimated with dry leaf weight index, root length index, and root weight index. Dry weight index and water uptake efficiency of leaf of strawberry plant under drought pressure decreased during studies. Among the studied varieties, the variety Sulhyang showed the most dry leaf weight index of 67%, and water uptake efficiency of 65%. According to our studies, the variety Sulhyang is providing good result in drought resistance with morphological parameters, and its water consumption during drought is good. Also looking from result of water uptake efficiency, Sulhyang is able to recover water loss. Alternatively, it was clearly seen from morphological and physiological parameters that drought persistence of variety Bors was lower than Sulhyang under drought stress.*

Keywords: *Strawberry, drought resistance, morphology, physiology, index, stress*

1. BACKGROUND

Drought and aridityare of the most common environmental factors affecting plant growth and productivity. Reduced water availability induces numerous physiological and biochemical changes in all plant organs, such as reduced gas exchange in leaves, reduction of carbon assimilation. Also, changes in the distribution of photo assimilates can reduce vegetative growth and severely retard the development of plant reproductive organs [4].The physiological status of the strawberry plants was assessed by measuring water potential and gas exchange rate in the leaves.

Water deficiency significantly decreased leaf water potential of all the cultivars examined. In the situation when the water content in a growing medium is insufficient to provide the adequate plant supply, the water loss through transpiration reduces the water potential in tissues. Such reaction was observed in many plant species both under field and protected conditions [3,5]. Cultivar 'Elsanta' was able to maintain a higher potential in comparison to the two others [4].

Genotypic differences in drought tolerance have been observed for various crop species [2]. However, there is still a lack of information about morpho-physiological behavior of different strawberry cultivars under limited water availability. Therefore, the main objective of this study was to examine the response of strawberry varieties to drought stress by evaluating their changes of morphological and physiological parameters.

Only a few exotic strawberries were selected depending on their biological traits and adapted in the country. Stress tolerances such as cold, drought and heat have not been studied on strawberry plants. For this reason, some morphological and physiological traits of two strawberry varieties for drought resistance were studied.

2. MATERIALS AND METHODS

The experiment was carried out in a greenhouse of Institute of Plant and Agricultural Sciences, Darkhan-Uul, Mongolia on two strawberry varieties, Korean Shulhyang and Canadian Bors. 40 days strawberry cuttings were selected and treated with 20% Polyethylene Glycol-6000 (PEG-6000) to induce artificial drought stress. 0.6 M Pa or 120 gr of 20% PEG was dissolved in 1.5L distilled water to prepared solution.

The strawberry cuttings were planted in 2.5 liter pots with artificial soil. Control cuttings were watered with 150 ml of distilled water and the other half is treated with 150 ml of 0.6 MPa PEG. The plants were observed 2, 6, 10, 14 days after treatment. For selecting drought resistance cuttings based on root length, root weight, leaf weight and dry weight indices plants were collected after 14 days when the stress was serious.

The following equation was used for calculation.

After 14 days cuttings were harvested and their root weight and length stress tolerance indexed were measured: $\text{LWSPI}\ (\%) = \frac{\text{Leaf weight of stressed plants}}{\text{Leaf weight of control plants}} x100$

$$\text{RLSI}\ (\%) = \frac{\text{Root length of stressed plants}}{\text{Root length of control plants}} \text{x}100$$

$$\text{RWSI}\ \% = \frac{\text{Root weigh of stressed plants}}{\text{Root weigh of control plants}} \text{x}\ 100$$

After drying the leaves in oven at 70^0C for 24 hours, the dry matter stress tolerance index was recorded as follows:

$$DMSPI\ \% = \frac{\text{Dry weight of stressed leaves}}{\text{Dry weight of control leaves}} \text{x}100$$

Water was withheld for last new leaves were taken from each variety and then weighed immediately. Then at room temperature they were kept for one night in test tube containing 30 ml of distilled water. The water was removed from the leaves surfaces and leaves were weighed again to obtain turgid weight (saturated weight). Their dry weight was determined after placing leaves in oven at 70^0C for 24 hours. Relative saturation deficit was determined as follows:

$$RSD\ \% = \frac{\text{Satureted weight} - \text{Fresh weight}}{\text{Satutered weight}} \text{x}100$$

To measure plant's drought resistance by water uptake efficiency, Leaves of all varieties of plants, which had blossomed at last, were cut and steamed. Then at room temperature they were kept in test tube containing 30 ml of distilled water. After 24 hour, leaves were weighed again and moisture was masured. Water uptake efficiency was determined by following formula.

$$WUE\% = \frac{\text{Satureted weight} - \text{After cutting weight}}{\text{Satutered weight}} \text{x}100$$

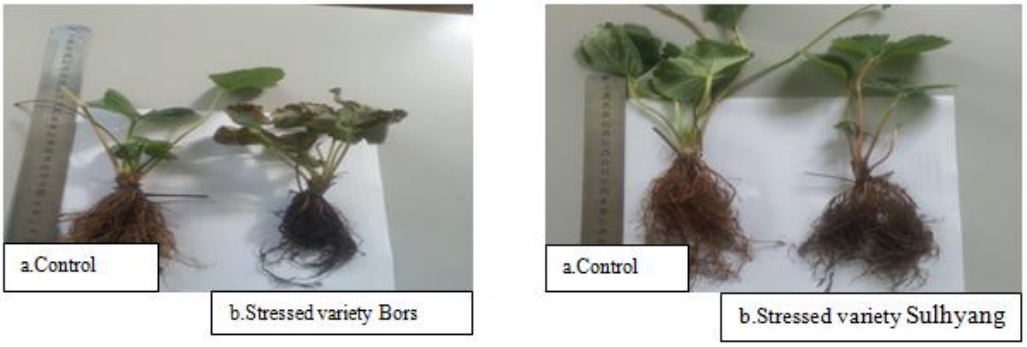
3. Result and Discussion

In our study, Sulhyang variety from Korea showed better morphological traits such as leaf weight, root length and root weight index for drought resistance than the variety Bors.

Table1. *Morphological parameters of the control and treated strawberry varieties*

№	Variety	Control	Leaf weigth of stressed plant index ,%	Treated, %	Root length of stressed plant index, %	Root weigth of stressed plant index , %
1	Bors	100	60.0	40.0	66.6	51.0
2	Sulhyang	100	75.0	25.0	79.4	92.8
Average		100	67.5	32.5	73.0	71.9

After planting of cuttings in a 2.5L pot, Bors variety showed wilt 2 days after. Serious wilt occurred 10-14 days after on both varieties. During the stress, the leaf area and weight decreased. Root development reduction was high in Bors variety that its root length index 33.4% lower than the control and 13% than the Sulhyang. For root weight index, the control was 49% and Sulhyang was 41.8% higher than the Bors (Table1, Pic1).



Picture1.2. *Stressed leaf and root of strawberry plant*

Table2. *Dry matter index and water uptake efficiency of treated strawberry varieties*

№	Varieties	Dry matter index,%	Water uptake efficiency,%
1	Bors	50.0	40.0
2	Sulhyang	67.0	65.0
	Average	58.5	52.5

Two of physiological traits, dry matter index and water uptake efficiency were 67% and 65% in Sulhyang variety which is 17% and 25% higher than the Bors, respectively (Table2).

4. CONCLUSION

As the study demonstrates, Sulhyang variety had better performance including leaf weight, root length, root weight, dry matter and water uptake efficiency in drought condition than then Bors, Bors variety's morphological and physiological parameters were very sensitive to drought condition.

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