COST ACTION FA1204

Vegetable Grafting to Improve Yield and Fruit Quality

Under Biotic and Abiotic Stress Conditions

STSM Scientific Report

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1. Purpose of the STSM;

The aim of the performed study was to determine the response of different cucurbit genotypes against to salinity stress. The investigation was focused on finding some cucurbit genotypes overcoming the salinity. Many works have done to evaluate the performance of genotypes against salinity that could be used as rootstock and scion. Existence of differences in salt tolerance not only among different species, but also among the genotypes within species offers us an opportunity for identifying and developing salt-tolerant genotypes. And screening at the earlier stage can be an easier method to determine salt tolerant genotypes.

Salt stress is an important growth-limiting factor for most non-halophytic plants. Unfortunately, high level of salts cannot be tolerated by most crops, a fact that severely limits the use of salt affected soils. Salt affected soil is progressively being exacerbated by

agronomic practices such as improper irrigation and fertilization, especially in arid regions. At higher salt levels, the crop yields are reduced so drastically that crop cultivation is not economical without soil amendments. In many plant species soil salinity is known to reduce growth and development through osmotic stress, ion toxicity, mineral deficiencies and induced physiological and biochemical disorders in metabolic processes. The capacity to tolerate salinity is a key factor in plant productivity. However, species are varying widely in their ability to withstand salt stress.

2. Description of the work carried out during the STSM;

In order to identify the response of some cucurbit genotypes to salinity stress the experiment was carried out in an un-heated greenhouse (Richel, PE covered bitunnel) at Faculty of Agriculture Ege University in the autumn season of 2013 with sixteen genotypes.

Experiment 1:

The plants were grown in water culture. The seeds were sown in peat on the 16th of September. Before seed sowing, seed morphological characterization according to UPOV criteria & PCA were done. The germination rate of all genotypes were determined. Seedling vigor was also determined using the percent seed germination. Two weeks later, after the emergence of the second true leaves, plants were transferred to water culture supported by air, after the substrate on their roots were washed.

Genotype
1. *Cucurbıta pepo* var. *geromontia* 'Izobilna' F1
2. *Cucurbıta maxima* 'Plovdıvski' 48/4
3. *Cucurbıta moschata* Moschata 51-17
4. *Luffa cilindrica*
5. *Cucurbita ficifolia*
6. *Cıtrullus lanatus* 'Sultan' F1
7. *Citrullus lanatus* 'Nosztalgia' F1
8. *Citrullus lanatus* 'Lentus' F1
9. *Cucumıs melo* 'Vitalia' F1
10. *Cucumis melo* 'ZKİ' 1112 F1
11. *Lagenaria siceraria* 'Macis'
12. *C. maxima x C. moschata* RS 841
13. *C. maxima x C. moschata* TZ 148
14. *C. maxima x C. moschata* Nun 9075
15. *Cucumis melo* cv. 'Ceşme'
16. *Cucumis melo* cv. 'Kırkagaç'

The seedlings were transplanted in plastic pots (10 and 7 cm top and bottom diameters, respectively, and 9-cm height, with holes in the bottom) filled with perlite. Then they were placed into the foam plates put on top of light-proof brown plastic lateral pots (75 × 23 × 16 cm) with 18.75 cm distance, filled with nutrient solution, in a manner that the bottom of the cups touch the nutrition solution in 2 cm deep.

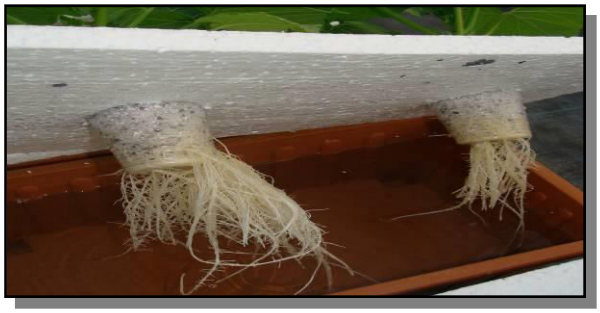
Four plants were planted in one pot. The plants were fed with the following nutrient solution:

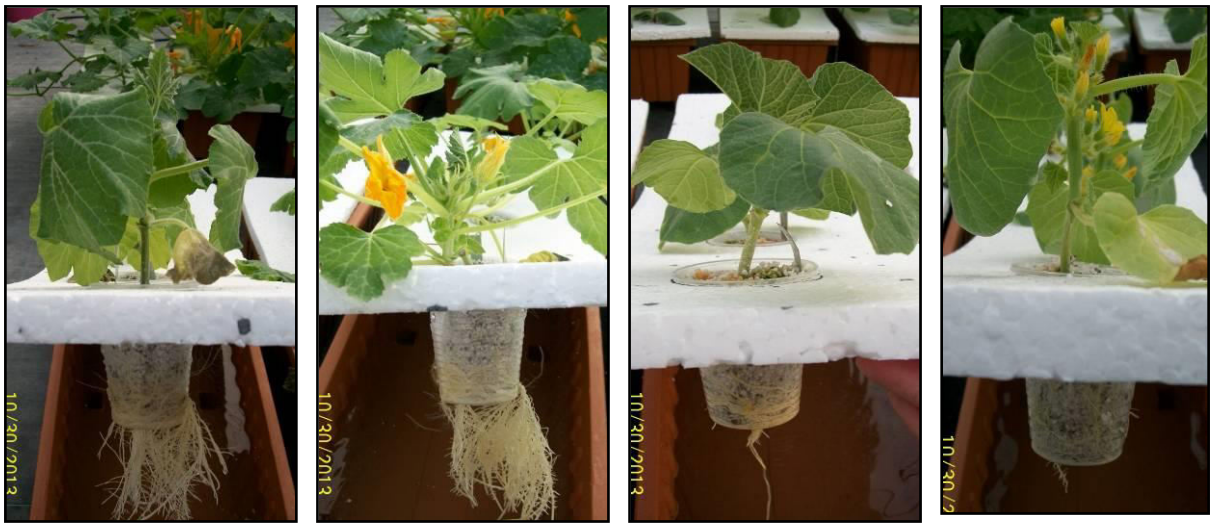
Nutrient element (mg/litre)											
N	**P**	**K**	**Ca**	**Mg**	**Fe**	**Mn**	**Zn**	**B**	**Cu**	**Mo**	**EC (dS/m)**
184	29	228	152	36	2	0.75	0.5	0.4	0.1	0.05	1.8-2.0

The aeration of the solution was ensured with aquarium pump. The solution in the vessels was replaced every week. The salinity treatment was initiated on the 14th October by

adding 50 mM NaCl to the nutrient solution. When seedlings reached to 4 - 5 leaf stages salt-treatment started and the NaCl concentration was increased by 50 mM with 2 days intervals until a final concentrations - 100 mM, respectively, 300 mM were achieved. Non-salt treated plants were kept under controls were fed with normal nutrient solution during this period. Salt-stressed plants were subjected to 100 mM and 300 mM NaCl for 7 days after completing the salt addition and then all plants, including controls, were taken for analyse.

The first and second removal periods were realized respectively at the 23rd and 31st October. The plants were classified for their salt tolerance by the visual appearance. Plants were scored for severity of salt susceptibility by 1-5 scale. Accordingly, (1) is scored as undamaged, healthy leaves or slightly involuted normal green leaves, (2) completely involuted green leaves, (3) moderately-excessively damaged dry leaves in addition to involuted green leaves, (4) (50 to 80%) drying damage on most leaves (50 to 80%), (5) drying damages on all leaves (Dasgan et al., 2002). Growing of seedlings was observed - plant length (cm), stem diameter (mm) at the middle section of the stem, leaf number and the shoot (stems and leaves) and root fresh weight (g) and dry weight (g) of the plants were measured. After the harvest, the shoot and root fresh weight parts of seedlings dried at 65°C for 48 hours, reweighed using a thermo ventilated oven, and stored pending chemical analysis.





Leaf disks were taken from the middle part of the leaves for measure the electrolite leakage (EL, %) and relative water content (RWC, %). The records were made during the 1st removal and the 2nd removal periods, 100 mmol NaCl and 300 mmol NaCl, respectively.

Also for ion determination, dry shoots and roots samples were extracted with 1N H_2SO_4. The extract was filtered prior to analysis. Na, K, Ca and Mg contents were determined in samples from shoots and roots at Soil Science Department. For chloride determination, dry materials from roots and shoots were determined by the silver ion titration method with an au chloridometer.

Experiment 2:

The effect of short-term salt stress was also studied. Thirteen *Cucurbit* genotypes were used (*Cucurbıta pepo* var. *geromontia 'Iz*obilna' F_1, *Cucurbıta moschata'* Moschata' 51-17, *C. maxima x C. moschata* Tr x Mos 5117 F_1, *Cucurbita ficifolia, Cıtrullus lanatus '*Sultan*'* F_1, *Citrullus lanatus '*Nosztalgia' F_1, *Citrullus lanatus '*Lentus' F_1, *Cucumıs melo '*Vitalia*'* F_1, *Cucumis melo '*ZKİ' 1112 F_1, *Lagenaria siceraria '*Macis*', C. maxima x C. moschata* RS 841, *C. maxima x C. moschata* Nun 9075, *Cucumis melo cv. '*Çeşme'). The experiment was conducted in an un-heated greenhouse at the same period.

Seeds were sown in peat in the 11th of October and put after that in germination room. The seeds germinated in the dark at a constant temperature - 25 ± 2° C and relative humidity - 75 %.

At the 14th October, germinated plants in small pots were replaced from the germination room in vessels in the greenhouse. There the plants were watered with nutrient solution in a vessels with constant humidity.

After two weeks (emergence of the first true leaves) seedlings were subjected to salinity stress. The NaCl concentration was increased by 25 mM daily until achieving a final concentration of 100 mM or 300 mM, respectively. Non-treated plants were used as control.

The indicators analyzed in the first experiment were also performed in the genotypes of this experiment. After the harvest, the shoot and roots of each plant were measured. Plant length (cm), stem diameter (mm) at the middle section, leaf number and the shoot (stems and leaves) and root fresh weight (g) and dry weight (g) were measured and stored for chemical analysis.

3. Description of the main results obtained;

Increasing salinity is accompanied by significant reduction in the fresh and dry weights of soots (leaves and stems) and roots; plant height, and the number of leaves per plant.

The results demonstrated that the values of the above mentioned parameters of some genotypes (*Citrullus lanatus* 'Sultan' F1, *Cucurbita maxima* 'Plovdivski' 48/4, *Citrullus lanatus* 'Nosztalgia' F1, *C. maxima x C. moschata* Nun 9075, *Cucumis melo* 'Vitalia' F1, *Cucumis melo* 'ZKİ' 1112 F1, *Cucumis melo* cv. Ceşme, *Cucumis melo* cv. Kırkagaç) were even higher at 100 mM concentration.

Salinity negatively affected growth at 300 mM treatments, but significantly increased fresh weight compared to non-treated plants that were challenged with salt stress. Although salinity decreased plant vigor at high concentrations in all of the studied materials, the indicators were statistically significant for all species. Reduction in number of leaves is a common attribute of plants growing under salt stress. The results of present study demonstrated a decline in overall growth of plants due to reduced dry root, shoot weight, number of leaves, and stem elongation. This decrease under salt stress may be due to the reduction in turgor potential that is pre-requisite for cell elongation in plants.

The data showed that the electrolyte leakage was significantly increased with the increasing salinity levels as compared to the control plants. NaCl treatment induced a reduction in leaves' RWC. Damage from salinity has been attributed principally to an excess of Cl^- and Na^+ accumulation in the leaves, provoking a nutritional imbalance, as these ions reduce the concentration of Ca, Mg and K .

For short-term salt stress the results revealed that salinity adversely affected the morphological and physiological and attributes of *Cucurbita* sp. They demonstrated a decline in overall growth of plants due to reduced dry root, shoot weight, number of leaves. They were negatively affected by the increased NaCl concentrations at the seedling stage.

4. Future collaboration with the host institution (if applicable);

Joint projects could be submitted for the international funds.

5. Foreseen publications/articles resulting from the STSM (if applicable);

The resulsts will be published in at least one scientific journal after completing the analysis. Additionally, some results will be presented at the 3rd Meeting Cost action FA1204 which will be held in Portugal on June. Also a part of the results can be presented ISHS Symposium on Vegetable grafting.

6. Confirmation by the host institution of the successful execution of the STSM;

The proposed activity in the STSM application has been completed and achieved successfully. The STSM Applicant, Ms Elena Topalova, has taken care of the experiments properly. She was involved in all stages (seed sowing, salt application, morphological characterization of seeds, measurements, analysis, nutrient analysis, etc.) of experiments. Moreover, she has participated in discussions that have been necessary for accomplishing the objectives proposed.

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7. Other comments (if any).