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Effects of Mg/Ca Sulfate on Seedlings of Forage Crops Under Abiotic Stress

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[Introduction]

Low or high temperature, water shortage or over watering, high concentration of salt, heavy metals and among others are described as an abiotic stress and plants are living harsh condition ever since their emergence. Growth processes within the seed are chemical reactions activated by the moisture, oxygen, and temperature. This study was carried out to investigate the effects of Magnesium and Calcium sulfate on seedlings of forage crops under salinity stress.

[Material and Methods]

The experiments were performed from June 2021 to August 2021 in growth chamber at Chungnam National University. Seeds of *Medicago sativa*, *Trifolium pretense*, *Festuca arundinacea* were planted in plastic seedling trays (110 ml) containing horticulture soil and 50 seeds were planted per hole. Experimental treatments were: Control ((CON) no stress, no additional application of $CaSO_4$ or $MgSO_4$); Salinity stress ((100 NaCl) 100 mM NaCl); Calcium sulfate ((5 CS) 5 mM, (7.5 CS) 7.5 mM, (10 CS) 10 mM) and Magnesium sulfate ((0.5 MS) 0.5 mM, (1 MS) 1 mM, (2 MS) 2 mM) and salinity stress plus Calcium/Magnesium sulfate (5 CS + NaCl, 7.5 CS + NaCl, 10 CS + NaCl, 0.5 MS + NaCl, 1 MS + NaCl, 2 MS + NaCl). Treatments started after seeds were sown and applied for three days and experiment run for 20 days under 30°C with 16h light/8h dark photoperiod. Data analysis included two-way ANOVA was carried out to detect the treatments and species, and one − way ANOVA to detect treatments and Duncan's test was used to estimate the least significant range between means ($p < 0.01$). All measurements represent the means and standard errors (SE).

[Results and Discussion]

Salinity stress and high temperature had a strong inhibitory effect on germination, seedling growth through osmotic stress, ion-specific phytotoxic effects and oxidative stress. Our results suggests that salinity stress had great effects on seedling growth and Mg/Ca sulfate were increased the seedling growth even under salinity stress. As expected, seedling growth was decreased when NaCl applied but additional MgSO4 and CaSO4 application increased the seedling growth. The highest total biomass was found in 10 CS and the lowest was found in 0.5 MS and Mg/Ca + Salinity treatments were higher than control in *Medicago sativa*. For the *Trifolium pratense*, total biomass was higher in 1 MS + NaCl and 2 MS + NaCl than the other treatments and control the lowest was found in 100 NaCl treatment. In the case of *Festuca arundinacea*, total biomass was lower than comparing other species because this species is cool − season forage crop. The highest value was found in 1 MS + NaCl, and the lowest value was observed in 7.5 CS + NaCl. The effect of salinity stress on root and shoot height was significant for all three species and Ca and Mg sulfate treatments was increased the height of shoot and root for all species under salinity stress. Furthermore, seedling biomass and height were significantly affected by all treatments in all three species ($p < 0.001$). Therefore, maintaining an adequate supply of calcium and magnesium in saline soil solutions is an important factor in controlling the severity of specific ion toxicities, particularly in crops which are susceptible to sodium and chloride injury.

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