

**Mineral Nutrients and Free-Polyamine Level in *Echinochloa crusgalli*
Subjected to Salt Stress**

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**염류처리에 의한 피(*Echinochloa crusgalli*)의 폴리아민 생합성과
무기양분 흡수**

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Objectives

To investigate an effect of rhizosphere ionic stress on the cytosolic free polyamine biosynthesis and uptake of mineral nutrients in barnyard grass(*Echinochloa crusgalli*), young seedlings were grown in a solution consisted of 50 mM to 100 mM NaCl or KCl, respectively.

Materials and Methods

Seeds of barnyard grass (*Echinochloa crus-galli*) were surface-sterilized with a 2% (w/v) solution of sodium hypochlorite, and then sown in silty loamy soil. After emergence, seedlings were transferred to a environmentally controlled chamber and grown for 15 days.

Saline solutions were artificially prepared by dissolving desired amount of NaCl and KCl with tap water to make 50 and 100mM solutions. Stresses were applied on 15-day-old plants and imposed at the beginning of the light period. Plants were collected at 1 and 3 day after exposure to salt stress and immediately stored at -70°C for further analysis.

Lipid peroxidation was measured as the amount of thiobarbituric acid reactive substances (TBARS) determined by the thiobarbituric acid (TBA) reaction as described by Heath and Packer(1968). For free polyamine determination, benzoyl-PAs was detected on LC-MS with slightly modification of Redmond and Tseng method(1979).

Results

- In shoots of barnyard grass, total amine levels were slightly decreased by both salt stresses. However, the ratio of putrescine to total amine was drastically reduced by NaCl whereas its ratio was enhanced by KCl. Lipid peroxidation also increased in NaCl treatment whereas there was not change in KCl treatment. These results demonstrate that a barnyard grass exhibit a tolerance to lipid peroxidation under KCl stress compared to NaCl.

- Uptake amount of K⁺ and Na⁺ was about 1.5 to 2.0 fold higher than control 1 day after saline treatments, and then decreased 3 day after stress treatment. It seemed that K-uptake was inhibited under extremely high concentration as like as 100 mM KCl. The ratio of monovalent to divalent(Na+K/Ca+Mg) was more profoundly reduced in KCl treated shoot.

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Table 1. Salinity effect on polyamine levels and MDA content in shoot of *Echinochloa crus-galli*. All data was estimated from plants obtained at 3 days after salt treatment

| Salt stress | Polyamine level (nmol g ⁻¹ fw) | | | | DA/total | MDA content (nmol g ⁻¹ fw) |
|-------------|---|------------|----------|-------|----------|---------------------------------------|
| | Putrescine | Spermidine | Spermine | Total | | |
| Control | 15 | 24 | 28 | 67 | 0.23 | 688 |
| NaCl | 50mM | 4 | 17 | 29 | 0.07 | 1,463 |
| | 100mM | 11 | 21 | 28 | 0.18 | 1,202 |
| KCl | 50mM | 18 | 26 | 16 | 0.31 | 748 |
| | 100mM | 16 | 19 | 17 | 0.31 | 797 |

Table 2. Contents of mineral nutrients in *Echinochloa crus-galli* affected by salt treatment

| Salt stress | N | P | K | Na | Ca | Mg | K+Na/ Ca+Mg | Mn | Cu | Fe | Zn | |
|-------------|-------|------|------|------|------|------|----------------|------|------|-----|-----|---------------|
| | | | | | | | | | | | | ----- % ----- |
| Control | 1.14 | 0.88 | 3.82 | 0.64 | 0.54 | 0.25 | 5.65 | 0.13 | 31 | 282 | 61 | |
| NaCl | 50mM | 1.07 | 0.42 | 6.04 | 0.87 | 0.98 | 4.94 | 0.11 | 28 | 419 | 101 | |
| | 100mM | 1.33 | 0.83 | 5.46 | 0.60 | 1.18 | 0.36 | 3.94 | 0.16 | 28 | 564 | 87 |
| KCl | 50mM | 1.58 | 0.37 | 4.77 | 0.49 | 1.59 | 0.43 | 2.60 | 0.27 | 28 | 571 | 86 |
| | 100mM | 1.85 | 0.86 | 3.71 | 0.36 | 1.69 | 0.49 | 1.87 | 0.42 | 23 | 530 | 70 |

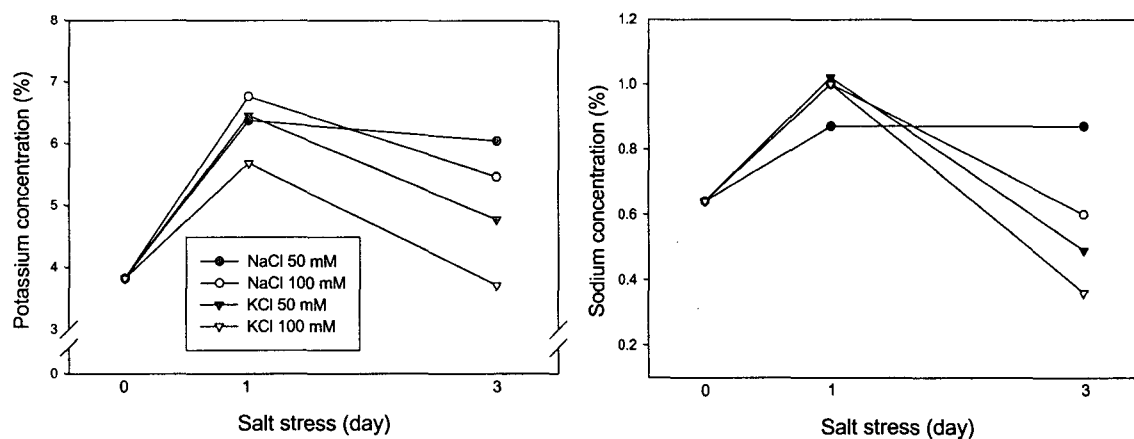


Fig. 1. Changes in the uptake pattern of K and Na at increasing date (day) with salt concentrations.