EFFECTS OF SALINITY, N-NUTRITION AND HUMIDITY ON PHOTOSYNTHESIS AND PROTEIN METABOLISM OF CHLORIS GAYANA KUNTH.

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KEY WORDS

Chloris Humidity Nitrogen Nutrition Photosynthesis Rhodes grass Salinity

SUMMARY

Under high atmospheric humidity, Rhodes grass plants responded favourably to an increase in nitrate fertilization. Under low atmospheric humidity an optimum point was reached at lower N-treatment. Plants' growth was improved by a salinity treatment of up to 100mM, at high atmospheric humidity. A higher salt concentration cancelled the favourable effect of added nitrate.

The rise in yield which follows salt or nitrate treatments is apparently combined with an increase in activity of the key photosynthetic enzymes, Phosphoenol pyruvate carboxylase and Ribulose biphosphate carboxylase. A similar rise in activity is seen in nitrate reductase, a key enzyme in nitrogen metabolism. Evidently, all three enzymatic systems are not damaged in high salt treatments, and the potential photosynthetic capacity remained practically uneffected in all treatments. As no correlation could be found between transpiration and growth curves, it is assumed that the supply of CO₂ is also unhampered. Thus, the major negative effect of salinity, seems to be on protein synthesis, which eventually leads to disturbed growth.

INTRODUCTION

Rhodes grass (Chloris gayana Kunth.) is a perennial salt excreting C₄ plant³,10. It grows on a wide range of soils and tolerates various climatic conditions as well as high salinity and alkalinity. Rhodes grass is an important forage grass and is widely cultivated all over the subtropical region⁵,⁶.

High concentrations of NaCl combined with high N-fertilization had a negative effect on growth and tillering and thus eventually on the plants' yield. Under such conditions the yield decreased as the plants have aged⁶. The question

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thus arises, what and where are the salt damages which reduce Rhodes grass yields?

In the following investigation the effects of salinity, NO₃-nutrition, and of transpiration rates on various metabolic processes as well as on Rhodes grass yields, were investigated.

**MATERIALS AND METHODS**

**Plant material and nutritional treatments**

Rhodes grass plants were grown under controlled conditions (25°C, 7 x 10^3 ± 10% erg x cm⁻² x sec⁻¹, 17 hours photoperiod). Air relative humidity was kept 35%-40% in the dry treatment and 90%-95% in the wet one.

Plants were grown for one month on 25% Hoagland's nutrient solution ⁷, with no NaCl and with NO₃⁻ being kept at 4 meq. At that age the plants were given the proper nitrate and salt treatments. Salt concentration was increased gradually (50 meq every two days) until the desired concentration was reached. At the age of 45 days the plants were harvested 15 mm above ground level (0 harvest). Following this harvest the plants were divided into two groups; one was moved to the dry chamber, whereas the second one was taken into the humid chamber.

Nitrate fertilization was given in concentrations of 4, 19 or 34 meq, in addition to 0, 50, 100 or 200 meq NaCl.

**CO₂ exchange measurements**

Gas exchange measurement was made with an IRGA, in a system described by Horwitz and Samish ⁸. CO₂ exchange was studied before each harvest within the controlled chamber at 25°C high humidity and irradiation at the total intensity of 10⁵ erg x cm⁻² x sec⁻¹.

Net photosynthesis was calculated on the basis of the leaf dry weight as well as of the leaf area.

**Transpiration**

Transpiration of the plants was measured by weighing individual containers with plants and estimating the amount of transpired solution. Transpiration rate was calculated on the basis of leaf dry weight as well as of leaf area.

**Enzyme activity**

Enzyme activity was measured in the second young but fully-expanded leaf.

Activity of Phosphoenol pyruvate carboxylase (PEP-Case) was investigated as according to Beer et al. ²

Activity of Ribulosebiphosphate carboxylase (RuBP-Case) was investigated as described by Buchanan and Schurmann ⁴ and activity of Nitrate reductase (NR) was carried out according to Bar-Akiva et al. ¹