Atriplex nummularia の生育初期の成長に及ぼす土壌水分・塩分の影響
Effects of soil moisture and salinity on growth at early stage of *Atriplex nummularia*

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1. Introduction

Population growth and economic pressure for food production have contributed significantly to the expansion of the farmland degraded by salinity soils[1)]. The salinization of soils directly affects agricultural production and the environment by reducing the quality of the soil which in turn reduces the production capacity, thereby increasing food insecurity mainly in arid and semi-arid areas.

Phytoremediation is a technology to restore the environment contaminated with substances and residues, using plants which have potential to stabilize these substances and structures and to accumulate them. In addition to being a green method, this technology does not cause any damage to the environment, has low costs, and achieves excellent results. Effectiveness of this technology would be evaluated with growth of plant and amount of substances accumulated in plant body. This study aimed to evaluate effects of soil moisture and salinity on growth at early stage of the *Atriplex nummularia*.

2. Material and methods

The experiment was conducted in a laboratory. The plants used in this study are the *Atriplex nummularia* and were grown from seed. A seedling of the plant was transplanted in a pot which was filled with 1.950 kg of soil and was added 170 grams of chemical fertilizer, NPK 8:8:8 composition. Five treatments with three or four replications in which electrical conductivity was different were provided. Soil moisture of treatments H0 and H1 were kept almost constant of 0.44 $m^3 \cdot m^{-3}$, and that of treatments M1, M2 and M3 decreased gradually from 0.44 to 0.40 $m^3 \cdot m^{-3}$ due to less watering. Soil parameters such as volumetric water content and electrical conductivity of soil water were measured using the TDR 315L Soil Moisture Monitor (C-M1001, Climatec, Inc.). Electrical conductivity of soil water σ_w at the beginning of experiment were shown in Table 1.

Table 1. Electrical conductivity of soil water at the beginning of experiment.

Treatment	σ_w(dS・m^{-1})
H0	1.0
H1	3.0
M1	3.2
M2	4.1
M3	6.4

Pots were arranged on a shelf in a randomized block design and were moved to next position when measurements were conducted. They were irradiated with a light emitting diode device from 6AM to 7PM. For irrigation, which took place two or three times in a week, distilled water was added to keep the soil moisture intended, and there was no drainage during the experiment. Plant growth was evaluated by

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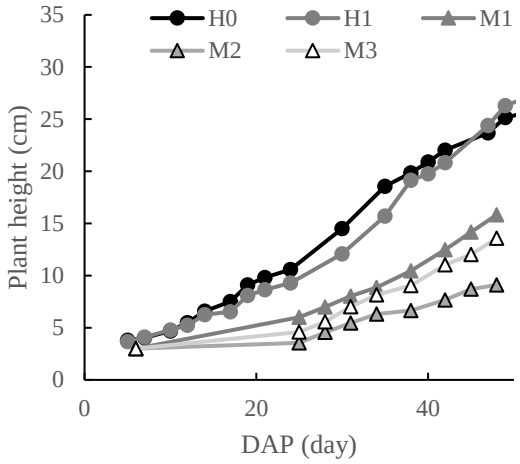

Fig.1 Time course in average plant height after transplanting.

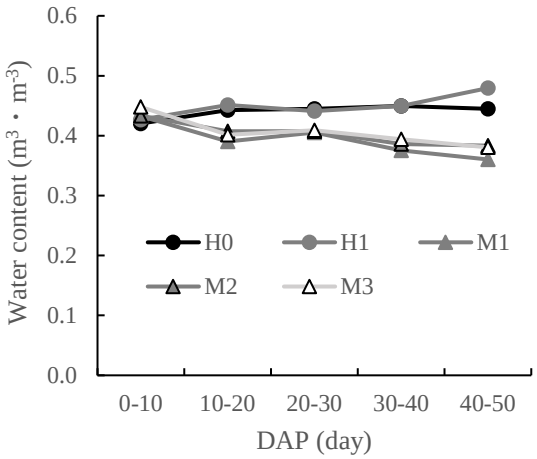

Fig.2 Water content averaged in every ten days after transplanting.

measuring plant height, and irradiance and air temperature were measured. Evapotranspiration was estimated by change of pot weight.

3. Results and Discussion

Fig 1 shows that growth of the *Atriplex nummularia* in the higher soil moisture treatments is generally faster compared to the lower soil moisture, indicating that water availability can significantly influence growth. Additionally, the different soil salinity among treatments M1, M2, and M3 may contributed to differences in plant growth. These results underscore the critical importance of soil moisture for plant development during the early growth stage of this plant.

Although there were no significant variations in soil water content among treatments during the first 10 days of the experiment as shown in Figure 2, soil moisture near surface of treatments M1, M2 and M3 might be less than those of treatments H0 and H1 because of less water added. Smaller plant height (Fig. 1) and lower evapotranspiration (Fig. 3) of treatments M1, M2 and M3 during the first 10 days might occur due to less soil moisture near surface.

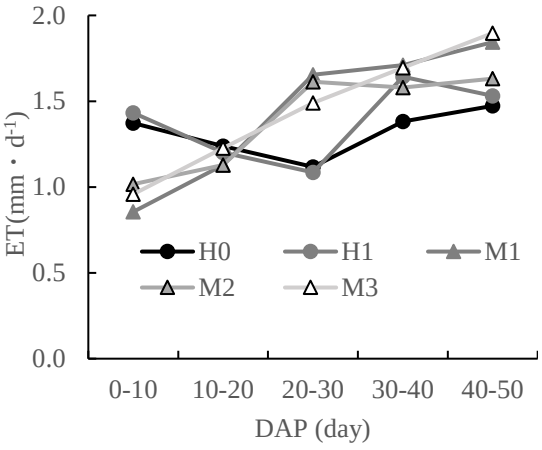

Fig.3 ET averaged in every ten days after transplanting.

Since root system activated during twenty days after transplanting, evapotranspiration of treatments M1, M2 and M3 greater than treatments H0 and H1. This result indicates that soil electrical conductivity levels may influence evapotranspiration of the *Atriplex nummularia*.

Reference

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