The influence of different soil moisture conditions and nitrogen rates on the forage grasses productivity

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The economic and environmental importance of forage crops, their response to climate extremes and productivity are of high importance but still are little studied. The vegetative experiment was carried in 2020 at a greenhouse of Vytautas Magnus University Agriculture Academy Open Access Joint Research Center of Agriculture and Forestry.

The aim of the study was to estimate the effect of different soil moisture conditions and nitrogen rates on the red clover and forage timothy mixture productivity.

Treatments of the experiment: Factor A: soil moisture conditions: 1) lack of soil moisture (drought), 2) optimal soil moisture conditions, 3) excess of soil moisture (waterlogging); Factor B: nitrogen rates: 1) $N_{25}P_{60}K_{90}$ (background fertilization), 2) $N_{25}P_{60}K_{90}$ + N_{60}, 3) $N_{25}P_{60}K_{90}$ + N_{120}. The mixture of red clover (*Trifolium pratense* L.) 'Vyčiai' and forage timothy (*Phleum pratense* L.) 'Gintaras II' was grown in the vegetative containers (7.5 l, 0.047 m^2 area). The imitation of drought and waterlogging was performed twice: at the seedling stage and during the intensive growth of the plants.

Results

Under drought conditions above-ground dry biomass of red clover and forage timothy mixture decreased on average by 39.6 and 45.4%, compared with the optimal soil moisture and waterlogging conditions, respectively. Under waterlogging conditions with increasing nitrogen rates the above-ground dry biomass of forage grasses mixture decreased by 15.5 and 19.0%, respectively, compared to the lowest nitrogen rate. Under waterlogging conditions at the lowest nitrogen application rate root dry biomass of forage grasses mixture was significantly by 2.1 times higher than under drought conditions. A significant, positive and strong correlation (r = 0.86, P < 0.01) was found between above-ground dry biomass and root dry biomass of red clover and forage timothy mixture. The lowest above-ground and root dry biomass of red clover and forage timothy mixture was found under drought conditions.

Keywords: drought, waterlogging, nitrogen rate, red clover, forage timothy, productivity.

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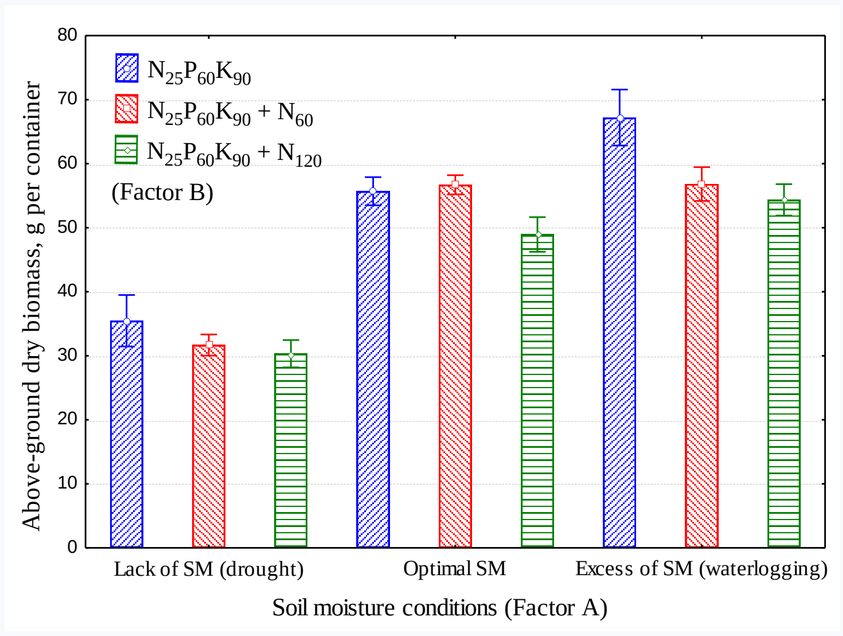

Figure 1. Above-ground dry biomass of red clover and forage timothy mixture, 2020.

Note. SM – soil moisture. The differences between the averages of treatments, marked by not the same letter (a, b, c), are significant (P < 0.05). Whiskers indicate standard error of the mean.

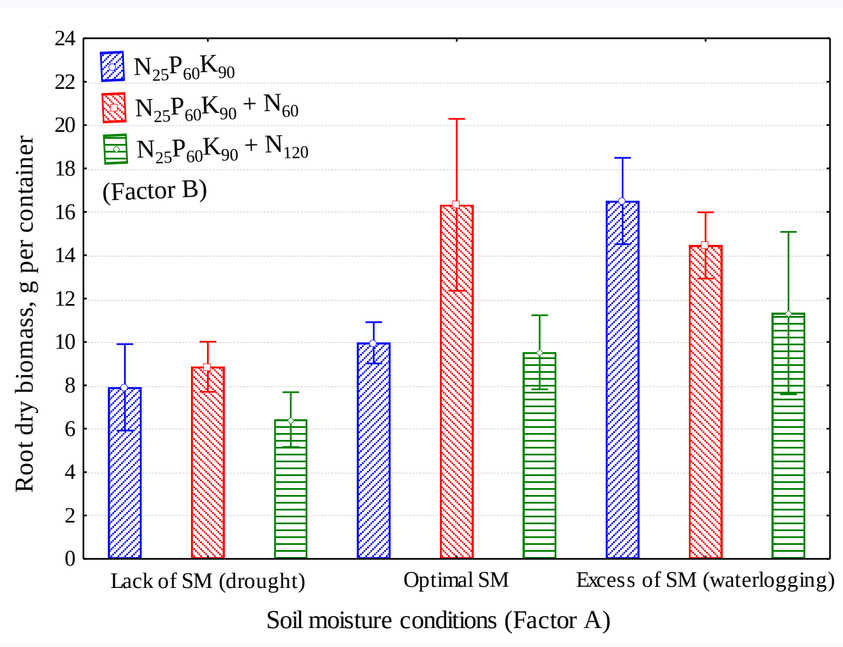

Figure 2. Root dry biomass of red clover and forage timothy mixture, 2020.

Note. SM – soil moisture. The differences between the averages of treatments, marked by not the same letter (a, b, c), are significant (P < 0.05). Whiskers indicate standard error of the mean.

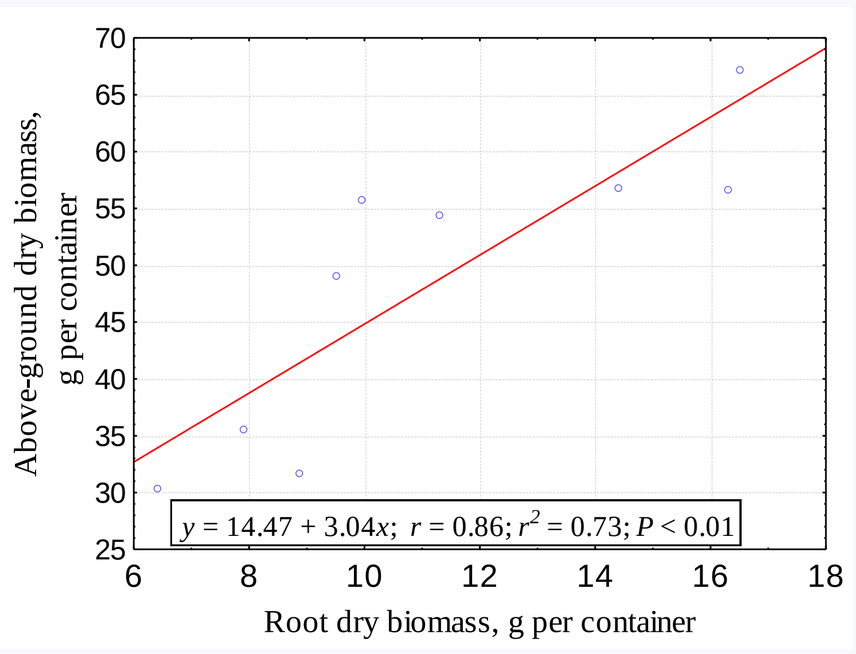

Figure 3. Correlation between above-ground dry biomass and root dry biomass of red clover and forage timothy mixture, 2020.

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