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Hydrogel amendment to sandy soil reduces irrigation frequency and improves the biomass of Agrostis stolonifera

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Author(s)

Hillary Agaba, Lawrence J. B. Orikiriza, Joseph Obua, John. D. Kabasa, Martin Worbes, Aloys Hüttermann

ABSTRACT

Soil water potential indicates the water status of the soil and the need for irrigation. The effect of hydrogel amendment to the upper sand soil layer on water infiltration into the lower un-amended sand layer, irrigation frequency, water use efficiency and biomass production of Agrostis stolonifera was investigated. The upper 25 cm sand layer in three identical buckets was amended at 0.4%, 0.2% and a control (no hydrogel) while the lower 25 cm sand layer separated from the upper layer by a wire mesh in the same buckets was un-amended. Agrostis stolonifera seeds were sown in each bucket and adequately irrigated using a hand sprayer. Potential meter electrodes were inserted at three random positions in each of the buckets and subsequent irrigations were done when a pressure of 600 bars was recorded in any of the three treatments. Data were collected on irrigation frequency, water content in the lower layer, water use efficiency and biomass production of Agrostis stolonifera. The mean water potential in the lower 25 cm layer un-amended sand was significantly more negative in the 0.4% hydrogel than in the control. More water content (10%) was recorded in the lower layer under the control bucket than in either the 0.2% and 0.4% hydrogel amended buckets. The frequency of irrigation was three-fold in the control compared to the 0.4% hydrogel amended sand. The hydrogel amended sand significantly increased the shoot and root biomass of Agrostis stolonifera by 2.2 and 4 times respectively compared to the control. The 0.4% hydrogel amendment in sand increased the water use efficiency of grass eight fold with respect to the control. The hydrogel stimulated development of a dense root network and root aggregation that increased contact of the roots with moisture thus improving water use efficiency of hydrogel amended soil. The results suggest that hydrogels can improve sandy soil properties for plant growth by absorbing and keeping water longer in the soil matrix thus reducing watering frequency.

KEYWORDS

Sand; Water Use Efficiency; Hydrogel; Irrigation; Biomass; Agrostis Stolonifera

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