EFFECTS OF AN EXTRACT FROM MUNICIPAL WASTE WATER ON THE GROWTH OF BARLEY

A. D. Day, professor; F. R. Katterman, professor, and J. R. Wilson, former graduate student, Department of Plant Sciences

Summary

Barley (Hordeum vulgare L. var. 'Harlan II') was grown in pots in the greenhouse to test the effect of a chemical extract derived from municipal waste water. The chemical extract was tentatively identified as a N-6 ureido adenosine chromaphore and was applied to the barley in concentrations of 1, 2, and 3 mg/l. The barley was harvested at maturity and the growth components were tested to determine if the addition of waste water extract to barley irrigated with well water alone and barley irrigated with well water amended with N, P, and K fertilizers increased growth and yield.

Barley grown with municipal waste water produced as high yields as barley grown with well water and recommended commercial fertilizer. The addition of waste water extract to barley irrigated with well water amended with N, P, and K did not increase growth and yields.

Introduction

Human waste has long been used as an agricultural amendment. Today both the solid fraction of human waste, sludge, and the liquid part, waste water, are being investigated in respect to supplementary nutrient amendments. Data have been published which indicate that the use of municipal waste water as an irrigation treatment may increase growth (Day et al., 1979). In addition, it was reported that clarified municipal waste water contains a very stable organic chemical that seems to regulate plant growth (Katterman and Day, 1980). Because of the potential of increased growth, the possible plant growth regulator found in waste water was isolated and applied to barley. The objective of this research was to study the effects of municipal waste water extract on the growth and yield of barley.

Materials and Methods

In a Randomized Complete Block experimental design with four replications, 8-inch clay pots were filled with equal amounts of sterilized soil (69.4% sand, 23.1% silt, 7.5% clay). Seven seeds of 'Harlan II' barley were planted in each pot. On the ninth day after planting the plants were thinned to the four most uniform plants in each pot. On the 11th day after planting, the treatments with waste water extract were initiated.

All waste water was obtained at approximately the same time in the afternoon from the Roger Road Sewage Treatment Plant, Tucson, AZ. The waste water was stored in a closed plastic container for about 7 days before being renewed with a fresh supply. The container was wrapped

with aluminum foil to decrease the growth of algae.

Concentrations of extract of 1, 2, and 3 mg/l were used in this study. The reason for the specific values was that they were thought best for producing distinct growth reactions (Katterman and Day, 1980).

The specific derivation of the extract, tentatively identified as a N-6 Ureido Adenosine Chromaphore, from waste water was published previously (Katterman and Day, 1980). After synthesis, the extract was stored as a powder under dry conditions until time of use. It was found that when the extract was stored in a liquid state refrigeration was needed to prevent putrefaction. The extract was dissolved in regular well irrigation water and applied to the pots as an irrigation treatment.

The following table illustrates the type of treatment each pot received:

Treatment no.	Type of Treatment
1	well water alone
2	well water + extract (2.0 mg/l)
3	well water + recommended NPK for barley
4	well water + NPK equal to NPK in waste water
5	waste water alone
6	well water + NPK + extract, 1 mg/l (low)
7	well water + NPK + extract, 2 mg/l (medium)
8	well water + NPK + extract, 3 mg/l (high)

In order to compensate for the nutrients present in the waste water, the experimental treatments 6, 7, and 8 were amended with 25 mg/l of urea and 31 mg/l of potassium phosphate monobasic. The addition of urea and potassium phosphate monobasic to well water resulted in an amended well water which contained 16, 7 and 9 mg/l of nitrogen, phosphorus, and potassium, respectively.

The barley was grown to the mature seed stage under greenhouse conditions. At the hard dough stage of seed development watering was discontinued and the plants were allowed to dry out. At maturity, the plants were harvested and the following items recorded: plant height, heads/pot, seeds/head, seed weight, above-ground weight, below-ground weight, and grain yield. The standard analysis of variance was applied to all data and the Student-Newman-Keuls' test was used to compare treatment means.

Results and Discussion

Barley grown with well water alone and with well water plus 2 mg/l of waste water extract produced fewer heads per pot and a lower above-ground yield of plant material than did all other treatments. When barley is grown on disturbed land areas for reclamation purposes a high number of heads and a high above-ground weight of forage per unit area are usually desired. There were no significant differences between irrigation and fertilizer treatments in average plant height, number of seeds per head, seed weight, below-ground weight, and grain yield. These data indicate that barley utilized the fertilizer nutrients in waste water alone as effectively as it utilized the fertilizer nutrients in well water and commercial fertilizer in the production of plant growth and grain yield. The foregoing data indicate that the addition of waste water extract to the irrigation and fertilizer treatments used in this experiment did not significantly change the growth and yield of barley from the growth and yield obtained without the addition of waste water extract.

References

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