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Improving Barley Production by Optimising Water and Nitrogen under Land and Water Limiting Conditions

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Abstract

Traditionally, water and nitrogen fertiliser applications have been overused due to the need ensuring adequate agricultural productivity for an increasing rate of population. However, this cannot be continued due to the limitation of water resources and the environmental damages. Hence, for production maximisation, it is important to calculate the optimal amounts of applied water and nitrogen. The aim of this study was to calculate the optimal amount of water and nitrogen for barley under limited water and land conditions. This experiment was performed with 4 levels of irrigation regimes (0, 50, 75, and 100% irrigation requirement) as main plot and 4 nitrogen fertiliser levels (0, 70, 140 and 210 kg N ha⁻¹) as subplots using spilt plot design with 3 replications and their effect was investigated on barley (cv. Reyhaneh 0–3).

The relations between benefit (grain and straw) and cost per unit area were derived as a function of irrigation depth and applied nitrogen. The optimal amounts of water and nitrogen were obtained 0.51 m and 179 kg N ha⁻¹, respectively, under land limited condition (by maximising the net benefit per unit area), and 0.30 m and 276 kg N ha⁻¹ for water limited condition (by maximising the ratio of net benefit per unit area to the amount of applied water), respectively. It was concluded that the increase of nitrogen fertiliser can enhance plant production under water limited condition. The amounts of water and nitrogen obtained for water limited condition were not related to water price.

Keywords: Barley, land limit, optimisation, water limit