Optimization of Water and Nitrogen Application in Corn Fertigation

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Abstract

Optimization of water and nitrogen application decreases production costs, conserves resources, and reduces environmental pollution which occurs as a result of excessive use of these resources. The objective of this study was to optimize applied water and urea in corn fertigation. A field experiment was carried out in furrows, having 165m length and 0.006 m/m slope, in Karaj. The corn hybrid 370 double-cross was planted on June 2008 and 2010. The experiments were carried out according to a factorial arrangement based on randomized complete block design with 4 replicates. Four levels (0, 60%, 80%, and 100%) of the recommended fertilizer value and four levels (60%, 80%, 100%, and 120%) of irrigation water requirement were applied. Fertilizer treatments were accomplished at four critical stages of the growth (before cultivation, seven-leaf stage, shooting stage, and flowering stage). In this study, an analysis of crop yield production, cost and revenue functions, and profit maximization was conducted to determine the optimal water and nitrogen use. The results of multiple regression at 5% level showed that the relationship between the grain yield and the amount of each of the inputs of water and nitrogen was a quadratic function (R²=0.83 and ME=15.53%). The optimal level of urea consumption was dependent on applied water. By increasing the amount of irrigation water, the optimum level of fertilizer consumption is increased. When land is limiting, use of full irrigation (940 mm) and 375 kg/ha urea leads to maximum income. When water is limiting, the optimum amounts of applied water and urea were 774 mm (77% of water requirement) and 357 kg/ha (90% of urea recommendation), respectively.

Keywords: Production function, Optimal water, Revenue function.

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