Applying Genetic Algorithms in Determining Optimal Cropping Pattern in Different Weather Conditions in Qazvin Plain

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Abstract

Due to its biological nature and high dependence on regional condition, agriculture is the largest consumer of water resources in many countries. Hence, today, agricultural water management plays an important role in the use of water resources of these countries. The present study used Genetic Algorithm to optimize cultivation area, allocate irrigation water, and maximize profits gained from the cultivation of some crops under various weather conditions in Qazvin Plain (located in the north west of the central plateau of Iran), where some of the required water is obtained from Taleghan dam. In this study, different probability levels of rainfall, evaporation, and input flow of optimization were combined under four different weather conditions. The results showed that in normal, wet, dry, and hot - dry weather conditions, the profit earned from the new cultivation pattern introduced by the model was much more than that of the current pattern. Moreover, following this new pattern could mostly result in lower water consumption in this sector, such that the volume of water stored in the dam reservoir at the end of the operation in wet, normal, dry, and hot-dry conditions would increase by, respectively, 262045.2, 2862686.6, 273089 and 955542 m^3. The results showed that the cultivation area of sugar beet in every of the four different condition was reduced (over 80%) because of its high water requirement and low yield, therefore, its cultivation is not recommended under any weather conditions in the studied area. Following the new cropping pattern delivered by this model, the farmers' profit in wet, normal, dry, and hot-dry conditions would increase by, respectively, 2.81%, 2.62%, 1.34%, and 1.53% compared to the prevailing pattern.

Keywords: Metahuristic Algorithm, Optimization, Agricultural Water Management.