

Effect of Rice-Duck Co-Cultivation on Rice Yield, Water Productivity and Weed Control in Different Cultivation Systems

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ABSTRACT Rice-duck cultivation is an integrated farming technology which could increase rice production, grain quality, and ecological sustainability in paddy fields. One of the main strategies in sustainable agriculture is the use of optimal cultivation systems in agricultural systems which could increase the range of adaptation of rice to flooding depth and degree of moisture control. Rice-duck cultivation could be effective for weed control as well as reducing environmental pollution which is caused by herbicides and providing the development of environmentally-friendly agriculture.

The traditional and conventional cultivation systems have been faced with problems such as permanent flooding of paddy fields, soil erosion, resistance to pests and pathogens and weeds to chemical pesticides, and environmental pollution. Moreover, they require a lot of labor and water and high energy, which has increased the need to pay attention to new approach. Studies have showed that the application of effective methods in water productivity, including SRI methods, improved irrigation management in the field and decreased drainage water, soil permeability, and the consequences of conventional cultivation, while increasing soil fertility (with ducks) can significantly increase water productivity.

The aim of this study was to investigate the effect of duck application and weed control in different planting systems on yield and abundance of dominant weeds under field conditions.

Materials and Methods The experiment was conducted as a split-plot factorial trial in a randomized complete block design with three replications during the two years 2017-2018 and 2018-2019 at Guilan University. Treatments included three different cultivation systems (conventional, improved, and SRI) as the main factor, and factorial combinations of two duck densities (no use and 750 ducks ha⁻¹) and three treatments for weed control (no weed control, and one and two weedings) as the sub-factors. The experiment had three replications, and the length of each plot was 4.5 meters and the width was 4 meters.

In order to carry out the experiment, first plowing the land was done to a depth of 20 to 25 cm with a rotator, and then puddling with a tiller was done according to the custom of the farmers of the region. In all plots, 80% of the recommended fertilizer was applied in SRI system adjusting for the values of the cow manure applied.

Results and Discussion The results showed that abundance and dry biomass of weeds (umbrella sedge, barnyard grass, knot weed and arrowleaf) were significant among the planting systems. In all planting systems, 750 ducks ha⁻¹ with one or two weedings caused complete reduction of umbrella sedge, barnyard grass, knot weed, and arrowleaf compared to non-use of ducks. 750 ducks ha⁻¹ compared to no ducks in conventional, improved, and SRI planting systems increased the yield of grain by 21.6%, 20.8% and 30.8%, respectively. Also, the application of 750 ducks ha⁻¹ compared to no duck use in the conventional, improved and SRI cultivation systems increased water productivity by 34.8%, 33.0%, and 38.7%, respectively. There was no significant difference between different levels of weed control in treatments with 750 ducks ha⁻¹ in terms of water productivity.

Conclusions In general, duck use increased plant growth, improved performance of rice, and finally increased rice yield by proper weed control in the field with muddy water and beaks, as well as adding manure to the paddy field. According to the results of this study, probably it is appropriate to use the SRI rice cultivation system, doing an initial hand weeding to control dominant weeds and stocking 750 ducks per ha to improve rice production and to increase water productivity in rice fields of Guilan province.

Keywords: Hashemi cultivar, rice-duck system, SRI cultivation system, weeding

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