

Evaluation of old and new wheat varieties for their compatibility with canola in additive series of intercropping

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Received: April 2018 - Accepted: August 2019 - DOI: 10.22092/aj.2019.121409.1278

Extended Abstract

Koocheki, A., Nassiri Mahallati, M., Jafari, L., Khorramdel, S., Gholizadegan, A. -Evaluation of old and new wheat varieties for their compatibility with canola in additive series of intercropping
Applied Research in Field Crops Vol 32, No. 02, 2019- Page: 19-21: 130-155(in Persian)

Introduction: Wheat breeders have been constantly striving to develop new varieties with improved productivity and yield as well as higher resistance to pests and diseases. These varieties are being released frequently and replace the existing ones on the basis of their performance under open-field conditions. Intercropping has been widely applied to reduce soil erosion and water loss, to restore ecological balance, to improve radiation and nutrient use efficiency (Awal *et al.*, 2006; Brooker *et al.*, 2015), to raise land equivalent rate and to increase economic benefits (Gliessman, 1995). Therefore, intercropping is regarded as more productive than monoculture in terms of land use efficiency. Higher nutrient uptake and better water use efficiency have also been suggested as additional advantages associated with intercropping, however, they are needed to be evaluated for each different combination of crops used in intercropping systems. The objective of the present work was to determine the competitiveness of old and new wheat cultivars in mixed intercropping with canola in additive series and also to evaluate the yield, yield components, radiation use efficiency and land equivalent ratio of the wheat/canola intercropping under climatic conditions of Mashhad.

Materials and Methods: This experiment was conducted as factorial layout based on a randomized complete block design with three replications at the agricultural research station of Ferdowsi university of Mashhad, Iran during two growing

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seasons of 2014-2015 and 2015-2016. The first and the second factors were wheat varieties (the old: Roshan and Tabasi and the new: Parsi and Sirvan) and mixed intercropping ratios of wheat and canola in additive series (0:100, 25:100, 50:100, 75:100, 100:100 and 100:0), respectively. The investigated traits were as follows: seed, biological and straw yield of wheat and number of pods per plant, number of seeds per plant, 1000-seed weight, seed, biological and straw yield of canola, radiation use efficiency based on seed yield and total dry matter per area of land

The advantage of intercropping over monoculture was evaluated by using land equivalent ratio (LER). It is one of the common way of measuring yield advantages of intercrops over monoculture. LER is defined as the relative land area under monoculture that is required to produce the same yield achieved in the intercrop. LER for the wheat-canola intercrop was computed on the basis of seed yield in both monoculture and intercrop, as the sum of partial LER value for wheat and canola. The statistical software program SAS 9.1 was used to perform analysis of variance. All the means were compared according to least significant test ($p \leq 0.05$)

Results and Discussion: The results showed that the highest wheat yield and yield components, except for 1000-seed weight, were obtained under monoculture. By increasing the proportion of canola to 75%, a significant decrease was observed in seed yield and biological yield of wheat. There was a significant increase in seed yield of new wheat varieties compared to Tabasi as an old variety while the biological yield was not affected by the variety. As compared to the other wheat variety, in the presence of the new variety Sirvan, seed and biological yield and radiation use efficiency of canola were significantly increased. However, among the different wheat varieties, there was no significant difference in radiation use efficiency. The maximum land equivalent ratio (1.41) was achieved with 25% canola+100% wheat.

Conclusion: The results revealed that the yields of wheat and canola were significantly affected by mixed intercropping ratios and wheat varieties in which the yield of both crops was reduced due to competition. However, due to the distinct characteristics of these two crop plants in terms of water consumption and utilization of radiation and nutrient resources, land use efficiency was increased in their intercrop. Radiation use efficiency and land equivalent ratio indices indicate that the intercropping of old and new wheat varieties and canola is more efficient than their monoculture. New varieties of wheat appear to perform better when intercropped with canola. However, there were no significant differences in radiation use efficiency and land equivalent ratio between the old and the new wheat varieties.

Acknowledgement: This research (32693) was funded by Vice Chancellor for Research of Ferdowsi University of Mashhad, which is hereby acknowledged.

Keywords: Mixed intercropping, radiation use efficiency, additive replacement, oil crops, Poaceae

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