

## Abstract

Ecosystem services are very diverse and have ecological and environmental dimensions. Raising plant diversity through mixed cultivation will increase the population of soil microorganisms, and thus the microbial activity of the soil improves as one of the ecosystem functions. The purpose of this study was to evaluate the different patterns of intercropping, regulatory services, enhancement of nutrient uptake, and improvement of biological properties of the soil (the basis of some ecosystem services) as different ecosystem functions, and comparison them with sole cropping systems. To do this, a split-split plot experiment was conducted in a randomized complete block design with three replications at Chahartakhte station (located at Shahrekord Agricultural and Natural Resources Research and Education Research Center). This experiment was carried out during two cultivation years of 2016-2017 and 2017-2018. The experimental treatments consisted of: soil tillage system at three levels of conventional tillage (disk and moldboard plow), reduced tillage (disk and Fowler), and no-till as main factors; four levels of plant residues (0, 30, 60 and 90% of wheat residues) as sub-factors; and various patterns of corn (KSC 704) and pinto bean (in percent) intercropping in five levels (corn monoculture, bean monoculture, 2 rows of bean: 2 rows of corn; 1 rows of bean: 3 rows of corn, and 3 rows of bean: 1 row of corn) as sub-sub-factor. The results obtained from variance analysis of soil chemical properties indicated that the organic carbon content of the soil was increased in the no-till process, 90% of the plant residues, and the bean monoculture. The highest and lowest levels of organic carbon in intercropping systems were obtained from 3 bean rows: 1 corn row and one bean row: 3 corn row respectively. The phosphorus changes that occurred in the soil after the harvest indicated that the phosphorus changes resulted from the bean monoculture, no-till treatment and 90% plant residues. The results of this study indicated that in each year, the highest amount of microbial biomass carbon and soil microbial respiration, in both growth stages (60 and 100 days after planting), was observed in no-till treatment, 90% plant residues, and the intercropping with the proportion of 2 bean rows: 2 corn rows. Also, the results indicated that the lowest amount of metabolic quotient was obtained for the no-till treatment, 90% plant residues, and corn monoculture. The result of this study in term of carbon sequestration was observed in no-till treatment, 90% plant residues, and intercropping with the proportion of 2 bean rows: 2 corn rows. The results showed that the relative contribution of carbon in different plant organs compared to the total existing carbon in plants was different between various cereals and beans. As a result, the pure production of the corn was higher than the pure production of the bean and was able to allocate more carbon to its air organs. The results of the experiment indicated that the land parity ratio in all the different cultivars was more than one, reflecting the beneficial effect and

advantages of intercropping compared to the monoculture in both corn and bean plant in term of producing economic performance. Increasing the economic performance of plants is considered as an important economic activity of the ecosystem. The results of this study also showed that in general (and by considering the land equality ratio criterion), multi-cropping systems have higher economic performance than single-cropping systems. Corn was dominant with a competitive index larger than one in all plant treatments and the highest competition was intercropping with the proportion of 1 bean rows: 3 corn rows. In intercropping systems, the ratio of 2 bean rows: 2 corn rows was highest Relative crowding coefficient. Economic utility survey by monetary advantage index showed that, apart from the ratio of cultivation of 1 bean row: 3 corn rows in other ratios, intercropping is beneficial compared to monoculture.

Key word: Carbon Sequestration, Land Equivalent Ratio, Multiple Cropping, Nutrient Uptake.



University of Zabol  
Graduate School  
Faculty of Agriculture  
Department of Agronomy and Plant Breeding

**The Thesis Submitted for the Degree of Ph.D  
(in the field of Agroecology)**

Evaluation of some agroecosystem services in  
intercropping of corn and bean affected by wheat  
residues and tillage management systems

**Supervisor:**

Dr. M. Dahmardeh  
Dr. A. Morshedi

**Advisors:**

Dr. A. Ganbari  
Dr. S. Khorramdel

**By:**

Farideh Akbari

May 2019