RESEARCHES REGARDING THE PRODUCTIVITY OF OAT-LENTIL INTERCROPPING IN THE ORGANIC AGRICULTURE SYSTEM

CERCETĂRI PRIVIND PRODUCTIVITATEA OVĂZULUI ŞI LINTEI ÎN CULTURĂ INTERCALATĂ ÎN CONDIŢIILE SISTEMULUI DE AGRICULTURĂ ECOLOGICĂ

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Abstract: *The paper present a research on the productivity of oat-lentil intercropping, for evaluating his adaptability on natural conditions of South Romania and ecological cultivation. The experiment was carried out in the spring of 2008, in Moara Domneasca Experimental Field, on reddish preluvosoil, in randomized variants, in 4 replications. The seeds used for experiments were ecological. Oat and lentil were sown in alternating rows, in 12.5 cm distance between rows, at a 3-4 cm depth. Oat had a density of 200 seeds/m^2 and lentil of 150 germinable seeds/m^2. It was determined productivity elements, land equivalent ratio and yields. Average grain yield for oat in monoculture was of 2386.5 kg/ha and in intercropping with lentil was of 1767.5 kg/ha. In monoculture, lentil yield was of 1403.3 kg/ha and in intercropping with oat, it was obtained 780.4 kg/ha. The value of the land equivalent ratio (LER) in the oat-lentil intercropping was 1.29, which means that it is a real advantage of this type of crop system comparatively with oat and lentil raised in monoculture.*

Rezumat: *Lucrarea prezintă o cercetare cu privire la productivitatea culturii intercalate ovăz-linte în vederea evaluării adaptabilităţii sale la condiţiile naturale din sudul României şi de cultivare ecologică. Experienţa cu ovăz şi linte în cultură intercalată a fost înfiinţată în primăvara anului 2008, în cadrul Fermei Experimentale Moara Domnească, pe un preluvosol roşcat, cu variantele randomizate, în 4 repetiţii. Seminţele utilizate pentru experimentare au provenit din material ecologic. Ovăzul şi lintea au fost semănate în rânduri alternative, distanţa dintre rânduri fiind de 12,5 cm iar adâncimea de semănat de 3-4 cm. Ovăzul a avut o densitate de 200 b.g./m^2 iar lintea de 150 b.g./m^2. În urma observaţiilor efectuate s-au determinat elementele productivităţii, raportul de productivitate al terenului şi producţia. Producţia la ovăzul cultivat în cultură pură a fost de 2386,5 kg/ha iar intercalat cu lintea s-au obţinut 1767,5 kg/ha. În cultură pură, lintea a avut o producţie de 1403,3 kg/ha iar intercalat cu ovăzul s-au obţinut 780,4 kg/ha.*

Key words: *intercropping, organic agriculture, oat, pea.*
Cuvinte cheie: *culturi intercalate, agricultură ecologică, ovăz, linte.*

INTRODUCTION

Focusing on crop yields level, famers increased the use of fertilizers, herbicides and insecticides, and they had a tendency towards monocrop systems that are easily managed and harvested mechanically (HORWITH B.,1985). However, as a result of increased soil erosion, and the cumulative effects of excess pesticide and fertilizer use, alternatives are being sought that could maintain or improve crop productivity and yields quality while minimizing negative environmental effects (OFORI F and all., 1987).

Organic agriculture seeks to use nature as model for designing agricultural systems. Since nature integrates plants and animals into a heterogeneous landscape, a major principle of organic agriculture is to create and maintain biodiversity. One of the unpolluted agricultural practices would be the implement of intercropping in the organic agriculture system.

Cereal-legume intercropping plays an important role in subsistence food production in both developed and developing countries, especially in situations of limited water resources (TSUBO et al., 2005). Plant growth factors such as light, water and nutrients are more completely utilized and converted to crop biomass by intercropping. Intercropping cereals and grain legumes can be very potential for both organic and conventional farmers because grain legumes such as lentil are rich in protein compared to cereal grain crops.

MATERIAL AND METHOD

The experiments with oat-lentil intercropping were carried out in Moara Domneasca Experimental Field, on reddish preluvosoil, in randomized variants in 4 replications. The seeds used for experiments were ecological. The oat (*Avena sativa* – Mures variety) was sown together with lentil cultivar (*Lens culinaris* – Slovenia provenience, *2007).*

Oat and lentil were sown in alternating rows, in 12.5 cm distance between rows, at a 3-4 cm depth. Oat had a density of 200 germinable seeds/m^2 and lentil of 150 germinable seeds/m^2. The spatial arrangement was as shown below (figure 1):

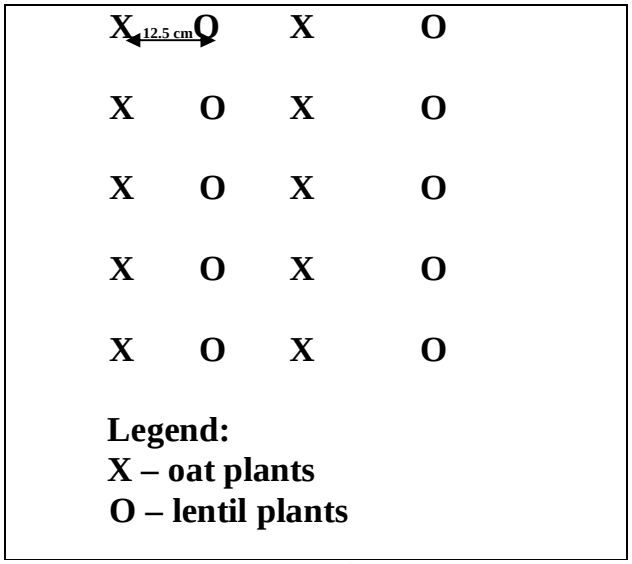

Figure 1. The spatial arrangement for oat – lentil intercropping

RESULTS AND DISCUSSIONS

A. Results for oat. The analysis of the productivity components of oat grown in monoculture and intercropped with lentil showed that, in monoculture, the panicle had an average length of 20.6 cm, with about 35 spikelets/panicle. In monoculture, oat formed 37 grains/panicle and the TGW was 21.5 g. When oat was intercropped with lentil, the panicle was shorter, respectively 19 cm, formed 32.5 spikelets/panicle and 35 grains/panicle; TGW was 20.2 g (table 1).

Based on the productivity components and the sowing density, there were determined the yields, both for oat grown in monoculture and intercropped with lentil. The average grain yield of oat grown in monoculture was of 2386.5 kg/ha, higher than the yield of oat intercropped with lentil, respectively 1767.5 kg/ha (figure 2).

Table 1

Productivity of components at oat grown in monoculture and intercropped with lentil

Productivity components	*Avena sativa* – oat	
	Monoculture	Oat-lentil intercropping
Panicle length (cm)	20.6	19.0
Total number of spikelets/panicle	35.0	32.5
Number of fertile spikelets/panicle	32.4	30.5
Number of steril spikelets/panicle	2.6	2.0
Number of grains/panicle	37.0	35.0
Number of grains/spikelet	1.14	1.14
Mass of grains/panicle (g)	1.5	1.39
1000-grain weight (TGW) (g)	21.5	20.2

B. Results for lentil. The analysis of the productivity components of lentil grown in monoculture and intercropped with oat showed that, in monoculture, the lentil had an average height of 45.5 cm, i.e. 1.9 cm higher than the lentil intercropped with oat.

In monoculture, the lentil stems formed an average of 17.8 pods/plant and around 12.2 fertile pods per plant. In intercropping, the lentil plants formed 16.7 pods/plant out of which 11.5 fertile pods.

As far as the number of seeds per plant is concerned, the lentil plants formed 14.8 seeds when grown in monoculture, i.e. 3.6 fewer than when intercropped with oat. The number of seeds/pod at the lentil plants grown in monoculture was of 1.2, with the seed weight per plant of 0.63 g. In intercropping with oat, the number of seeds/pod was 1.08, with the seed weight per plant of 0.5 g. TGW in monoculture was of 39.21 g, and when the lentil plants were intercropped with oat TGW was of 35.7 g (table 2).

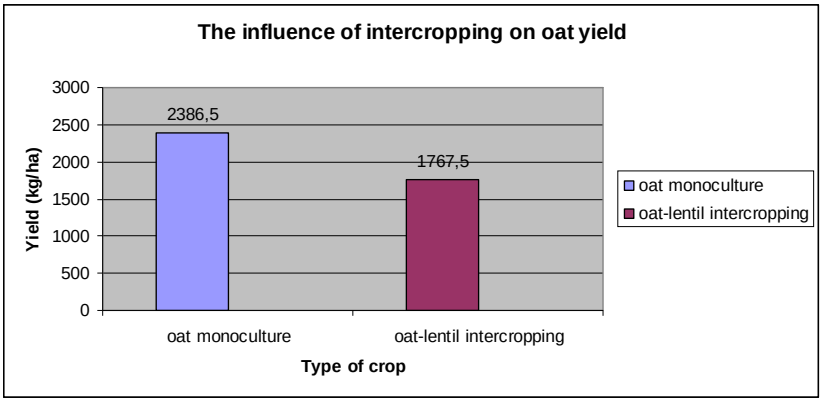

Figure 2. The influence of intercropping on oat yield

When grown in monoculture, the lentil plants had an average yield of 1403.3 kg/ha; when intercropped with oat, they had a yield of 780.04 kg/ha (figure 3). Thus, the lentil plants from the intercropping system had a yield lower by 623.26 kg than those grown in monoculture, due to the lower density of the crop and the competition for nutrients and water.

Table 2

Productivity of components at lentil grown in monoculture and intercropped with oat

Productivity components	*Lens culinaris* – lentil	
	Monoculture	Oat-lentil intercropping
Plant height (cm)	45.5	43.6
Number of pods/plant	17.8	16.7
Number of fertile pods/plant	12.2	11.5
Number of fruitless pods/plant	5.6	5.2
Number of grains/plant	14.8	12.5
Number of grains/pod	1.2	1.08
Grains productivity/plant (g)	0.63	0.5
1000-grain weight (TGW) (g)	39.21	35.7

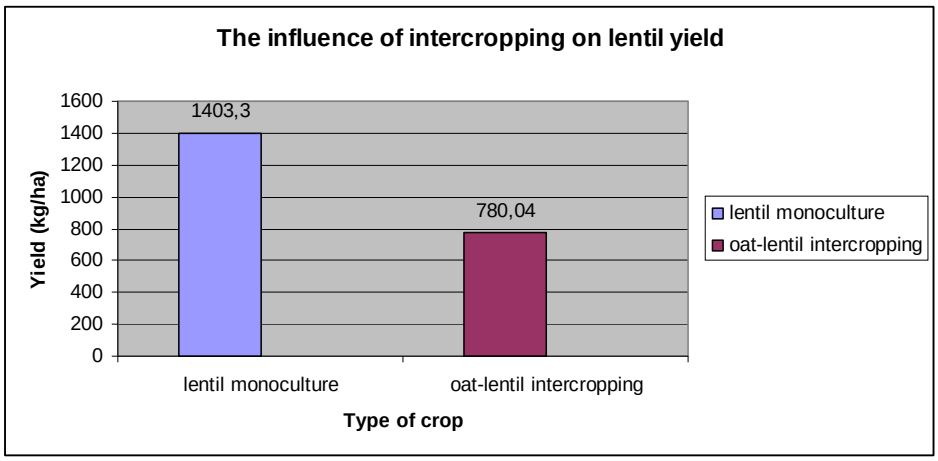

Figure 3. The influence of intercropping on lentil yield

The partial and total land equivalent ratio (LER) was also determined during the research. Thus, partial LER ranged between 0.55 for the lentil and 0.74 for the oat. The total LER was 1.29 which means that there is a real advantage of intercropping lentil with oat as compared to monoculture. For these value, 29% extra land would be necessary to produce the same yields of these two crops if they were to be grown as pure stands (table 3).

Table 3

Land equivalent ratio for oat intercropped with lentil

	Type of crop	Yields in intercropping (kg/ha)	Yields in monoculture (kg/ha)	Partial LER
Total LER	Oat	1767.5	2386.5	0.74
	Lentil	780.04	1403.3	0.55
	-	-	-	1.29

CONCLUSIONS

1. In monoculture, the oat plants developed better than those from the intercropping. This is due to the lower competition for soil water and nutrients, and light.

2. The average grain yield for oat grown in monoculture was 2386.5 kg/ha. In intercropping with lentil the oat yield was 619 kg smaller compared to monoculture, respectively 1767.5 kg/ha.

3. The lentil plants from the intercropping developed slower than those grown in monoculture. This means that, they compete with oat plants for water and nutrients, and for light.

4. When grown in monoculture, the lentil plants had a yield of 1403.3 kg/ha and intercropped with oat, their yield was 623.26 kg lower than in monoculture, respectively 780.04 kg/ha.

5. The value of the partial land equivalent ratio (LER) ranged between 0.55 for lentil and 0.74 for oat and the total LER was 1.29. Thus, intercropping lead to overall higher LER values, the land being better exploited when oat is intercropped with lentil.

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