INFLUENCE OF DIFFERENT ORGANIC TYPES OF FERTILIZERS ON MAIZE YIELD IN THE CRIŞURILOR PLAIN

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Abstract

The paper is based on the researches carried out in Agricultural Research and Development Station Oradea. The lupine, the classic green manure in Romania was studied in comparison with the mixture lupine+oat, lupine+oat+rape and vetch+oat+ryegrass, rape+oat and in comparison with rape, manure 25t/ha, manure 50t/ha and control. The researches were carried during 2001-2007 on the preluvosoil from Agricultural Research and Development Station Oradea. Four sowing periods were studied, too. The research results emphasize a better physical properties (structure, bulk density, penetration rezistance and hydraulic conductivity) in the variant with Lupine+oat and Lupine+oat+rape in comparison with the variant with Lupine pure crop; the yield gains obtained were bigger statistically assured, too. The results obtained in the variant with manure 25 t/ha are very close by the results obtained in the variants with Lupine mixture. The best results were obtained in the variant with manure 50 t/ha. The sowing period after 15 July determined the decrease of the green manure yield and the decrease of the maize yield.

Keywords: manure, green manure, water use efficiency, maize

INTRODUCTION

The use of the green manure, especially legumineous, is known in Antique Greece and Roman Empire (Eliade Gh. et al., 1983, Borza I. and Stanciu A., 2010). The researches carried out in the second part of the XX century emphasized some problemes regarding the use of the green manure because the legumineous have a low C/N report including into the soil of the green manure determined the explosive microbiological processes and stabil humus mineralization is higher, the soil humus reserve decrease rapidly and an oposite effect is obtained (Toncea, 1999, Sârca C. and Goia M., 2002, Ciobanu Gh., 2003, Samuel A.D. et al., 2006, 2008, Domuţa C. et al., 2007a, 2010).

Roger (1976), quoted by Domuţa C. and Sabău N.C. (2001) considers that the green manure failure is determined by the use of the pure vegetale crop with cellulase low content. Roger purposed the mixture vetch+rye+ryegrass. In Romania the vetch in mixture with oath, is a very known fodder and Domuţa C. (2005, 2007b, 2008) researched the mixtures lupine+oat+rye, lupine+rye+rape and lupine+millet+oat; the research results emphasized better results in comparison with lupine pure crop and vetch+oat+ryegrass, respectivelly.

MATERIAL AND METHODS

The researches were carried out in Agricultural Research and Development Station Oradea on the preluvosoil during 2001-2007. On the ploughed land the colloid clay is of 31.5%, bulk density is of 1.41 g/cm^3, hydraulic conductivity is of 21.0 mm/hour; field capacity is of 24.2%, wilting point is of 9.2% and easily available water content is of 19.2%; the total hydrostabil macroagregates is of 47.3%. The main chemical properties of the preluvosoil on the ploughed land: pH of 6.9, humus of 1.8%, total nitrogen 0.128, mobil phosphorum of 22.0%, mobile potassium of 120.6 ppm.

The experiment was placed in 2001 and two factors were studied:

Factor A: green manure type

a_1 control; a_2 lupine; a_3 vetch+oat+ryegrass; a_4 lupine+oat; a_5 lupine+oat+rape; a_6 rape; a_7 rape+oat; a_8 manure, 25 t/ha; a_9 manure, 50 t/ha

Factor B: sowing period of the green manure

b_1 July, 15th; b_2 August, 1st; b_3 August, 15th

The surface of the experimental plots: 100 m^2. Number of repetitions: 4.

The green manure was harvested at the lupine flowering. After arvesting, the green manure stayed 5 days like mulch on the soil surface; it was included into the soil by ploughland.

The water use efficiency was determined like report between yield and water consumption. Water consumption was determined by soil water balance on 0-150 cm (Brejea R., 2009, 2010).

Yield data was calculated by variance analysis method (Domuța C., 2006b).

RESULTS AND DISCUSSION

The influence of the sowing period on green manure yield

The sowing of the green manure in 15th July determined the biggest green manure yield in the all variant studied. The biggest yield (41.3 t/ha) was registered in the variant with lupine+oat+rape. The sowing in 1st August determine a smaller yield but the difference (1.8 t/ha) is unsignificant statistically. The sowing in 15th August determined the yield losses very significant statistically in the all variant of green manure. In average of the sowing period, the biggest green manure yield was registered in the variant with lupne+oat+rape but in comparison with lupine pure crop the difference is unsignificant statistically; in the variant with Lupine+oat the difference is significant statistically and in the variants with vetch+oat+rygrass, rape+oat and rape the differences in comparison with the control (lupine) are negative and very significant statistically (table 1).

Table 1

The influence of the sowing period on green manure yield (t/ha), Oradea 2005

Green manure variant	Sowing period			Average on the green manure
	15.07.	01.08.	15.08	
1. Lupine	41.0	41.3	29.6	37.3 ^{Ct}
2. Vetch+oat+ryegrass	28.6	35.7	8.9	24.4 ^{ooo}
3. Lupine+oat+rape	41.1	43.2	30.0	38.1^{-}
4. Lupine+oat	37.9	33.6	28.6	33.4 ^{o}
5. Rape+oat	27.0	21.6	16.3	21.6 ^{ooo}
6. Rape	30.4	15.3	20.3	22.1 ^{ooo}
7. Average on the sowing period	34.3^{Ct}	31.8^{-}	22.3^{ooo}	-

	Green manure	Sowing period	Sowing period x Green manure	Green manure x Sowing period
LSD 5%	2.30	3.20	5.28	2.92
LSD 1%	3.49	5.62	9.74	4.83
LSD 0.1%	5.60	7.36	12.74	6.95

The influence of the green manure fertilization on maize yield

In the first year of the green manure effect both in the variants with N_0P_0 and in the variant with $N_{120}P_{90}$, the biggest yield maize was obtained in the variants seeded in 15th July. (table 2)

Table 2

The influence of the green manure fertilization (1st year of effect) on maize yield (kg/ha), Oradea 2006

Type of green manure	Sowing datum of green manure					
	15th July 2001		30 th July 2001		15th August 2001	
	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$
1. Control	4695	6055	4572	5996	4678	6012
2. Lupine	5185	6585	5016	6328	4820	6286
3. Vetch+oat+ryegrass	5520	6970	5385	6693	4696	6036
4. Lupine+oat	5610	7005	5435	6728	4826	6296
5. Lupine+oat+rape	5760	7195	5510	7068	4876	6312
6. Rape	48.92	6378	4768	6215	4886	6270
7. Rape+oat	5138	6660	4858	6436	5012	6310
Average on the chemical fertilization	5432	6692	5078	6495	4828	6218
8. Manure, 25 t/ha	5926	7350				
9. Manure, 50 t/ha	6456	7930				

	Green manure		Annual fertilization		Annual fertilization x Green manure		Green manure x Annual fertilization	
	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$
LSD 5%	1.79	1.87	1.81	1.94	2.37	2.41	2.54	2.60
LSD 1%	2.47	2.65	2.38	2.56	3.76	3.62	3.18	3.24
LSD 0.1%	3.98	4.12	4.15	4.38	5.26	5.39	4.96	5.14

In the second year of the green manure effect the differences registered in comparison with the control were smaller. The sense of the differences was the same with the sense from 1st year of green manure effect on maize yield. (table 3)

Table 3

The influence of the green manure fertilization (2nd year of effect) on maize yield (kg/ha), Oradea 2007

Type of green manure	Sowing datum of green manure					
	15th July 2003		30 th July 2003		15th August 2003	
	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$
1. Control	3073	4210	2938	4280	3018	4312
2. Lupine	3345	4620	3312	4690	3176	4474
3. Vetch+oat+ryegrass	3680	4980	3790	5020	3098	4382
4. Lupine+oat	3776	4910	3710	5080	3162	4488
5. Lupine+oat+rape	3832	5140	3990	5110	3182	4472
6. Rape	32,58	4580	3110	4420	3168	4502
7. Rape+oat	3420	4796	3480	4640	3196	4574
Average on the chemical fertilization	3483	4748	3475	4749	3101	4457
8. Manure, 25 t/ha	4012	5142	A Factor: green manure			
9. Manure, 50 t/ha	4730	6020	B Factor: annual fertilization			

	A		B		BxA		AxB	
	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$	N_0P_0	$N_{120}P_{90}$
LSD 5%	1.4	2.1	0.76	1.5	1.76	1.59	1.97	2.14
LSD 1%	2.78	3.76	1.68	2.94	2.96	2.58	2.58	3.02
LSD 0.1%	4.52	5.22	3.12	4.21	4.92	4.26	4.78	5.14

The green manure influence on water use efficiency in maize

In the first year of the green manure effect, the smallest quantity of maize yield obtained for 1 m^3 water used was obtained in the control both in N_0P_0 and in $N_{120}P_{90}$ background, 1.11 kg/m^3 and 1.44 kg/m^3. Comparing the green manure type, the biggest value of the water use efficiency were obtained in the variant with lupine+oat+rape, 1.37 kg/m^3 in the variant with the background N_0P_0 and 1.71 kg/m^3 in the variant with the background $N_{120}P_{90}$ the biggest yield were obtained in the variants with manure (table 4)

Table 4

The influence of the green manure on maize water use efficiency (1st year of effect), Oradea 2006

Type of green manure	1st year of effect			
	N_0P_0		$N_{120}P_{90}$	
	kg/m^3	%	kg/m^3	%
1. Control	1.11	100	1.44	100
2. Lupine	1.23	111	1.56	108
3. Vetch+oat+ryegrass	1.31	118	1.65	115
4. Lupine+oat	1.33	120	1.64	114
5. Lupine+oat+rape	1.37	123	1.71	119
6. Rape	1.16	105	1.51	105
7. Rape+oat	1.22	109	1.58	110
8. Manure, 25 t/ha	1.51	136	1.74	121
9. Manure, 50 t/ha	1.68	151	1.88	131

In the second year of the effect, the sense of differences regarding the values of the water use efficiency are the same like in the first year of the effect but the values are smaller (table 5)

Table 5

The influence of the green manure on water use efficiency in maize (2^{nd} year of effect), Oradea 2007

Type of green manure	2^{nd} year of effect			
	N_0P_0		$N_{120}P_{90}$	
	kg/m^3	%	kg/m^3	%
1. Control	0.89	100	1.22	100
2. Lupine	0.97	109	1.34	109
3. Vetch+oat+ryegrass	1.07	120	1.44	118
4. Lupine+oat	1.09	122	1.42	116
5. Lupine+oat+rape	1.11	125	1.49	122
6. Rape	0.95	107	1.33	109
7. Rape+oat	0.99	111	1.39	114
8. Manure, 25 t/ha	1.16	130	1.49	122
9. Manure, 50 t/ha	1.37	154	1.75	143

CONCLUSION

The second cycle of the researches carried out in Agricultural Research and Development Station Oradea permeted to have the following conclusions:

- The seeding of the green manure in 15^{th} August determined to obtain the smallest yield of green manure and seeding in 15^{th} July the biggest yield were obtained in all 6 variants of green manure. The yield obtained in the variant with lupine+oat+rape and lupine+oat had a value very close to the value from the variant with lupine.
- All the 6 green manure type determined the maize yield gain in comparison with control in the first and second year of the effect. In lupine+oat+rape and in lupine+oat, the maize yield gains obtained were bigger the yield gains obtained in the variant with lupine pure crop both in the background N_0P_0 and in the background $N_{120}P_{90}$. In the variants with lupine+oat+rape and lupine+oat the yield obtained was bigger than the yields obtained in the variant with vetch+oat+rygrass. In the variants with manure 25 t/ha and manure 50 t/ha were obtained the yields bigger than the yields obtained in the variants with green manure.
- All the 6 type of gren manure determined the improve of the water use efficiency both in the first year of the effect and in the second year of the effect. The mixture of the lupine (lupine+oat+rape, lupine+rape) determined the bigger values of the water use efficiency than the values obtained in lupine pure crop. The biggest values of the water use efficiency were obtained in the variants with manure.

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