Italian ryegrass (Lolium multiflorum L.) cultivation in cover crops system, in vegetation with some autumn forage legume species

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Abstract
In the cultivation system of the Italian ryegrass (wheat → annual autumn forage legume → Italian ryegrass), compared with the classic cultivation variant in the rotation wheat → Italian ryegrass, where the land remains discovered from wheat harvesting to ryegrass planting, almost 2.5 months, the forage yield increases with 29.6 – 73.0 % according to legume species and yield utilization, by introducing peas or autumn vetch between the wheat and the Italian ryegrass. By introducing legume species within the rotation system, the ryegrass yield increases with 4.94 – 5.11 t/ha DM, in the case of autumn forage peas, and with 3.76 – 5.77 t/ha DM, in the case of autumn vetch, according to the method of utilization of the legume biomass.

Keywords: Cover crops, forage legume, *Lolium multiflorum*.

1. Introduction

The permanent land cultivation within a forage producing system presents a series of advantages compared with the conventional agricultural system: complexity of crops structure, increase of positive effects of the agricultural rotation systems, limitation of introduction into soil of noxious, pollutant substances, inhibition of erosion processes, soil fertility enhancement, etc [1 - 4].
The objective of this work is to present the cover crops-type characteristic that defines some annual autumn forage legumes (peas and autumn vetch) within the productivity of the entire crop succession applied on the same land, in different structures.

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2. Materials and methods

The researches were performed during 2009 – 2010, at the Research Centre for Pastures and Forage Plants, Banat's University of Agricultural Sciences and Veterinary Medicine Timişoara, by planting a bifactorial experience, with the following graduations: A – Structure of crops in rotation: a_1= Wheat + Italian ryegrass (wheat harvested on 10 July; Italian ryegrass planted on 10 September); a_2= Wheat + Forage peas + Italian ryegrass (wheat harvested on 10 July; Peas planted immediately after wheat harvesting; Italian ryegrass planting after the incorporation of peas, on 20 September); a_3= Wheat + Peas incorporated in soil + Italian ryegrass (wheat harvested on 10 July; Peas planted immediately after wheat harvesting; Italian ryegrass planting after peas incorporation, on 20 September); a_4= Wheat + Vetch for forage + Italian ryegrass (wheat harvested on 10 July; peas planted immediately after wheat harvesting; Italian ryegrass planting after peas incorporation, on 20

September); a_5= Wheat + Vetch incorporated in soil + Italian ryegrass. B – Doses of Nitrogen-based fertilization for the entire crop rotation system b_1= N_0; b2= N_{100}; b_3= N_{200}.
The planting was carried out in four replications, and the fertilization was applied at the preparation of the germination bedding at the beginning of September 2009. In the variants with biomass incorporation, we minced the vegetal material and introduced it into the soil with the disk harrow.

3. Results and discussion

Within the forage plant structure, the Italian ryegrass is considered to be an intensive species which generates big yields, of superior quality, only in special technological conditions. In this viewpoint, our researches proved that the Italian ryegrass generates big dry matter yields only under an optimal fertilization with Nitrogen-based fertilizers (Table 1).
To obtain a yield of over 12 t/ha DM, it is necessary to apply a N_{200} dose which generates the achievement of a mean quantity of 32.4 kg DM/1 kg s.a. Nitrogen.
To increase the cultivation efficiency of the Italian ryegrass and, at the same time, to provide a total land covering during an agricultural year, we introduced in our researches the annual autumn legume crop, in rotation with the following structure: wheat → annual legume → Italian ryegrass. The mean results obtained, presented in Table 2, prove that, compared with the classic cultivation variant in the rotation wheat → Italian ryegrass, where the land remains discovered from wheat harvesting to ryegrass planting, almost 2.5 months, the forage yield increases with 29.6 – 73.0 % according to legume species and yield utilization. On the whole, by incorporating the biomass produced by peas and vetch into the soil as green fertilizer, we may obtain the biggest Italian ryegrass yield.
The synthesis results presented in Table 3 shows the cumulated dry matter yield obtained during an agricultural year, consisted of the Italian ryegrass yield and the annual legume yield, compared with the Italian ryegrass yield obtained in the classic technological system (wheat → Italian ryegrass). So, if we do not apply N fertilization, compared with the control variant cultivated in the system wheat → Italian ryegrass, in the variants including the autumn forage peas crop, the yield growths range between 4.94 – 5.11 t/ha DM, and in the variants with autumn vetch, between 3.76 – 5.77 t/ha DM, according to the method of legume utilization. This represents a variant of Italian ryegrass cultivation without application of Nitrogen-based fertilizers.
On the whole, in the variants whose forage yield is used for animal nutrition, we may obtain the biggest cumulated yield. If the Italian ryegrass is fertilized in these variants with a dose of $N_{100\text{-}200}$ the cumulated DM yields, during an agricultural year, attain the value of 15 t/ha.

Table 1. Influence of Nitrogen-based fertilization on Italian ryegrass yield (dry matter)

N doses	t/ha	diff. t/ha	%	Significance
N_0	5.76	-	100	
N_{100}	10.11	4.35	175.5	***
N_{200}	12.24	6.48	212.5	***
$DL_{5\%}$= 1.49		$DL_{1\%}$= 2.04%	$DL_{0,1\%}$= 2.75	

Table 2. Influence of preceding plant on Italian ryegrass yield (dry matter)

Structure of rotations	t/ha	diff. t/ha	%	Significance
Wheat + Italian ryegrass	6.64	-	100	
Wheat + Peas for forage + Italian ryegrass	9.71	3.07	146.2	**
Wheat + Peas incorporated + Italian ryegrass	11.49	4.85	173.0	***
Wheat + Vetch for forage + Italian ryegrass	8.61	1.97	129.6	
Wheat + Vetch incorporated + Italian ryegrass	10.41	3.77	156.7	**
$DL_{5\%}$= 1.98	$DL_{1\%}$= 2.88%		$DL_{0,1\%}$= 4.33	

Table 3. Influence of preceding plant and Nitrogen-based fertilization on dry matter yield in Italian ryegrass

Structure of rotations	N doses *)	Peas and vetch yield (dry matter, t/ha)	Italian ryegrass yield **)				DM yield cumulated in an agricultural year		
			t/ha	diff. t/ha	%	Significance	t/ha	diff. t/ha	%
Wheat + Italian ryegrass	b_1= N_0	-	3.01	-	100		3.01	-	100
	b_2= N_{100}	-	7.03	4.02	233.5	***	7.03	4.02	233
	b_3= N_{200}	-	9.82	6.81	326.2	***	9.82	6.81	326
Wheat + Peas for forage + Italian ryegrass	b_1= N_0	2.51	5.61	2.60	186.3	**	8.12	5.11	270
	b_2= N_{100}	2.51	10.74	7.73	356.8	***	13.25	10.24	440
	b_3= N_{200}	2.51	12.77	9.76	424.2	***	15.28	12.27	507
Wheat + Peas incorporated + Italian ryegrass	b_1= N_0	-	7.95	4.94	264.1	***	7.95	4.94	264
	b_2= N_{100}	-	12.42	9.41	412.6	***	12.42	9.41	412
	b_3= N_{200}	-	14.12	11.11	469.1	***	14.12	11.11	469
Wheat + Vetch for forage + Italian ryegrass	b_1= N_0	3.36	5.42	2.41	180.1	***	8.78	5.77	292
	b_2= N_{100}	3.36	9.12	6.11	302.9	***	12.48	9.47	415
	b_3= N_{200}	3.36	11.29	8.28	375.1	***	14.65	11.64	486
Wheat + Vetch incorporated + Italian ryegrass	b_1= N_0	-	6.77	3.76	224.1	***	6.77	3.76	224
	b_2= N_{100}	-	11.28	8.27	374.7	***	11.28	8.27	374
	b_3= N_{200}	-	13.18	10.17	437.8	***	13.18	10.17	437

**) $DL_{5\%}$= 1.49 $DL_{1\%}$= 2.04% $DL_{0,1\%}$= 2.75

*) The N fertilization was applied in the Italian ryegrass

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4. Conclusions

In the cultivation system of the Italian ryegrass (wheat → annual autumn forage legume → Italian ryegrass), compared with the classic cultivation variant in the rotation wheat → Italian ryegrass, where the land remains discovered from wheat harvesting to ryegrass planting, almost 2.5 months, the forage yield increases with 29.6 – 73.0 % according to legume species and yield utilization, by introducing peas or autumn vetch between the wheat and the Italian ryegrass.

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