Nitrogen Amount Transferred from Trifolium Resupinatum L. to Lolium Multiflorum L., under Cultivation in Association

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Abstract
The experimental display included a bifactorial experience, with different proportions of *Trifolium resupinatum* and *Lolium multiflorum*-based associations and different Nitrogen fertilization doses (N_0, N_{100}). The studies, performed during a 3-year period, made evident the dry matter yield, the total Nitrogen amount and the amount of transferred Nitrogen. According to association's floristic composition, the amount of N transferred from legume species, on the whole, was between 48 and 145 kg/ha, in the variants without fertilization, and between 36 and 99 kg/ha, in the variants fertilized with N_{100}.

Keywords: dry matter, *Lolium multiflorum,* total Nitrogenm, transferred Nitrogen, *Trifolium resupinatum*.

1. Introduction

Persian's clover cultivation in association (*Trifolium resupinatum L.*) has a great importance from an agri-biological viewpoint, due to the Nitrogen transfer (especially biologically-fixed Nitrogen – BFN) to the accompanying gramineae species [1, 2]. Some researches proved that the Persian clover fixes a Nitrogen quantity of 82.5 kg/ha, under conditions of pure crop [3].
This work presents the amount of Nitrogen transferred under conditions of cultivation in association of Persian clover with *Lolium multiflorum L.* and of Nitrogen-based fertilization.

2. Materials and methods

The researches were performed during 2006-2008, at Banat's University of Agricultural Sciences and Veterinary Medicine Timişoara, on an experimental display consisted of a bifactorial experience, with the following graduations: A – associations of *Trifolium resupinatum* + *Lolium multiflorum* (a_1= *Trifolium resupinatum* 100%, a_2= *Lolium multiflorum* 100%, a_3= *Trifolium resupinatum* 25% + *Lolium multiflorum* 75%, a_4= *Trifolium resupinatum* 50% + *Lolium multiflorum* 50% , a_5 = *Trifolium resupinatum* 75% + *Lolium multiflorum* 25%); B – Nitrogen doses ($b_1 = N_0$, $b_2 = N_{100}$).
The planting was performed every year, early in the spring (10-20 March); the biological material used was represented by the variety Maral of *Trifolium resupinatum* and Anca, of *Lolium multiflorum.*
We performed two harvestings each year, and the cutting was carried out at the beginning of the flowering phenophase. At the end of the vegetation period, before the last cutting, we performed botanic analyses with the gravimetric method.

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On the samples taken, we determined the total Nitrogen amount (Nt) every year, with the specific laboratory method.

The amount of Nitrogen transferred from legume plants to gramineae plants was estimated according to legume's percentage within the floristic structure of the association and to the Nt amount within the legume pure crop biomass, as follows:

N transf. (kg/ha) = [% legume in association x Nt legume pure (kg/ha)] / 100

The proportion of N transferred was calculated with the relationship:

% N transf. = [N transf. (kg/ha) x 100] / Nt association (kg/ha)

3. Results and discussion

The associated crops of legume and gramineae benefit, in the biomass production, by the amount of Nitrogen fixed by the gramineae plants within the association. This amount of Nitrogen transferred is correlated with the legume proportion within the floristic structure of the association.

The floristic composition of the associations between the two species was differentiated during the vegetation periods according to the initial floristic structure and to the N-based fertilization (Table 1).

In the variants that were not fertilized with Nitrogen, the mean values of the Persian clover proportion, recorded during the three experimental cycles, ranged between 19 and 57 %, according to the initial floristic structure of the associations. Successive to the application of N-based fertilizers (N_{100}), the legume proportion decreased to 14 – 39 %.

The export of total Nitrogen (Nt) exerted by the aerial biomass proves the Persian clover's importance in the associations with Italian ryegrass (Table 2). The pure Persian clover crop produced, without Nitrogen-based fertilization, 255 kg/ha N, and, successive to the N_{100}-fertilization, this decreased to 169 kg/ha. The Nitrogen difference of 86 kg/ha, generated from the amount of symbiotically-fixed Nitrogen, proves that the application of N-based fertilizers inhibits Nitrogen fixation. The biggest Nt amount in the plants from the variants planted in association, but not fertilized, of 235 kg/ha, was obtained in the variant with *Trifolium resupinatum* 75 % + *Lolium multiflorum* 25 %. In the variants fertilized with N_{100}, the maximal Nt amount, of 236 kg/ha, was obtained in the variant consisted of *Trifolium resupinatum* 50 % + *Lolium multiflorum* 50 %.

The estimation of the transferred Nt amount was performed due to the legume proportion within the floristic composition, determined at cutting, and to the Nt amount in the biomass obtained in the variant planted with pure Persian clover crop (Table 3). From this point of view, the mean amount of Nt transferred by Persian clover plants ranges between 49 and 151 kg/ha, in the not fertilized variants, and between 44 and 99 kg/ha in the variants fertilized with N_{100}. These variation limits are caused by the legume proportion within the floristic structure of the association. The researches performed by other researchers [4], on the same association type, showed a quantity of Nt transferred of 61-90 kg/ha, according to cutting date and N-based fertilization.

Of the total N amount available within the harvested forage biomass, 41-62 % originates in the amount of N transferred from Persian clover in the variants without fertilization and 22 - 51 % in the variants fertilized with N_{100}.

Table 1. Floristic composition in the associations *Trifolium resupinatum* + *Lolium multiflorum*

Variants		2006		2007		2008		Mean	
Nitrogen doses	Associations	*T.r.*	*L.m.*	*T.r.*	*L.m.*	*T.r.*	*L.m.*	*T.r.*	*L.m.*
N_0	*Trifolium resupinatum* 100%	100	-	100	-	100	-	100	-
	Lolium multiflorum 100%	-	100	-	100	-	100	-	100
	T.r. 25% + *L.m.* 75%	18	82	21	79	17	83	19	81
	T.r. 50% + *L.m.* 50%	32	68	41	59	36	64	36	64
	T.r. 75% + *L.m.* 25%	56	44	63	37	52	48	57	43
N_{100}	*Trifolium resupinatum* 100%	74	-	72	-	66	-	71	29
	Lolium multiflorum 100%	-	100	-	100	-	100	-	100
	T.r. 25% + *L.m.* 75%	12	88	16	84	15	85	14	86
	T.r. 50% + *L.m.* 50%	27	73	34	66	29	71	30	70
	T.r. 75% + *L.m.* 25%	39	61	43	57	34	66	39	61

Table 2. Amount of total Nitrogen (Nt) in the biomass of the associations of *Trifolium resupinatum* + *Lolium multiflorum*

Variants		2006	2007	2008	Mean
Nitrogen doses	Associations				
N_0	*Trifolium resupinatum* 100%	254	221	291	255
	Lolium multiflorum 100%	73	60	80	71
	T.r. 25% + *L.m.* 75%	106	121	97	108
	T.r. 50% + *L.m.* 50%	232	198	248	226
	T.r. 75% + *L.m.* 25%	235	214	256	235
N_{100}	*Trifolium resupinatum* 100%	162	181	166	169
	Lolium multiflorum 100%	236	198	255	229
	T.r. 25% + *L.m.* 75%	178	161	148	162
	T.r. 50% + *L.m.* 50%	244	248	216	236
	T.r. 75% + *L.m.* 25%	195	168	217	193

Table 3. Amount of N transferred from *Trifolium resupinatum* to *Lolium multiflorum*

Variants		N transferred (kg/ha)				% N transferred from the Nt amount from biomass			
Nitrogen doses	Associations	2006	2007	2008	Mean	2006	2007	2008	Mean
N_0	*Trifolium resupinatum* 100%	-	-	-	-	-	-	-	-
	Lolium multiflorum 100%	-	-	-	-	-	-	-	-
	T.r. 25% + *L.m.* 75%	46	46	49	48	43	38	51	44
	T.r. 50% + *L.m.* 50%	81	90	105	92	35	46	42	41
	T.r. 75% + *L.m.* 25%	142	139	151	145	60	65	60	62
N_{100}	*Trifolium resupinatum* 100%	-	-	-	-	-	-	-	-
	Lolium multiflorum 100%	-	-	-	-	-	-	-	-
	T.r. 25% + *L.m.* 75%	30	35	44	36	17	22	30	22
	T.r. 50% + *L.m.* 50%	69	75	84	77	28	30	39	33
	T.r. 75% + *L.m.* 25%	99	95	99	99	51	56	46	51

4. Conclusions

Persian clover cultivation in association with the Italian ryegrass contributes to the increase of Nt in the forage biomass obtained, according to the proportion of this in the floristic composition, with 48 – 145 kg/ha in the not fertilized variants and with 36 – 99 kg/ha in the variants fertilized with N_{100}.

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