The impact of nitrogen in red clover and lucerne swards on the subsequent spring wheat

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Introduction

In practise, organic farmers and producers use national standards or regulations for organic farming; however, to choose the right technologies or their elements adapted to local conditions is not so easy. They need to keep agriculture profitable and make it sustainable for the future.

In organic farming or low input farming systems, legumes are very important as N suppliers for cereals, in especial in organic crop farming.

Legumes also are substantial because they in crop rotations could be an effective tool for a replacement of use a new expensive nitrogen fertilisers, although they are developed and offered in the market as an organic. Also as tool for improvement of subsequent crop grain quality and even soil fertility.

Materials and methods

Field experiments were conducted on a loamy *Endocalcari-Epihypogleyic Cambisol* in Dotnuva, Lithuania and were aimed to assess the impact of legumes on the subsequent spring wheat in a crop rotation.

Experimental design

Red clover + perennial ryegrass

Red clover + perennial ryegrass+ Barley for grain (Bgr)

Red clover + perennial ryegrass+ Barley for whole crop (Bwc)

Red clover + perennial ryegrass+ Pea for whole crop (Pwc)

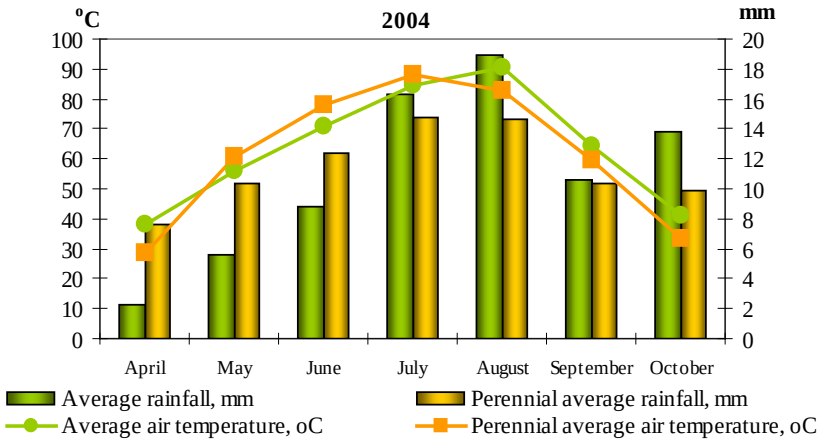
Lucerne + perennial ryegrass

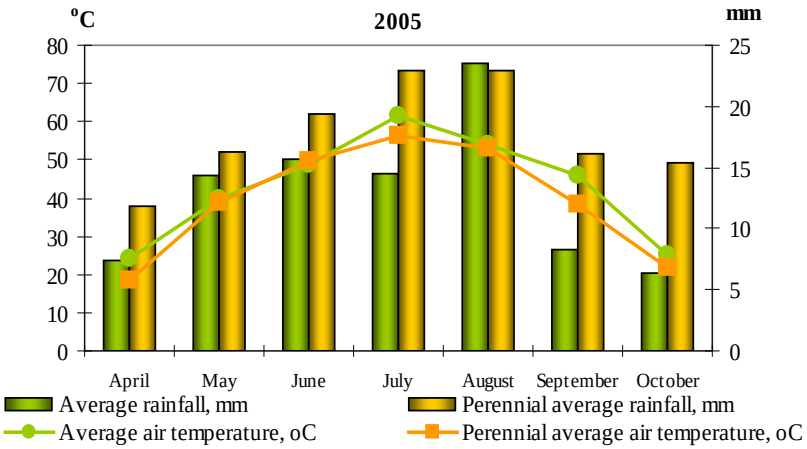
Lucerne + perennial ryegrass+ Barley for whole crop (Bwc)

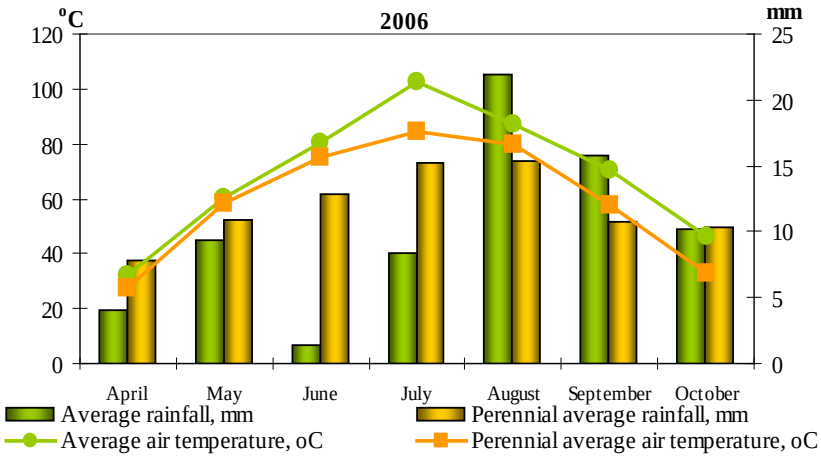
Lucerne + perennial ryegrass+ Pea for whole crop (Pwc)

Perennial ryegrass

The weather conditions during the 2004-2006







Results

Impact of sward composition and sowing method on yield of swards over two years, kg DM ha^{-1}

Treatment	DM yield (1 exp), kg ha^{-1}	DM yield (2 exp), kg ha^{-1}
Rcl+Pr	8916	10334
Rcl+Pr+Bgr	11064	9530
Rcl+Pr+Bwc	11866	10887
Rcl+Pr+Pwc	10499	10388
Lc+Pr	13236	9803
Lc+Pr+Bwc	12179	7848
Lc+Pr+Pwc	14408	8810
Pr	4872	4207
LSD_{05}	1257.0	771.0

Note. *Rcl-red clover, Lc-lucerne, Pr-perennial ryegrass, Bgr-barley for grain, Bwc-barley for whole crop, Pwc-peas for whole crop.*

Results

Dry matter (DM) of swards roots (soil depth 0-25 cm) and above ground biomass, t ha^{-1}

Treatment	Roots			Above ground biomass			Total
	Legumes	Grasses	Forbs	Legumes	Grasses	Forbs	
Rcl+Pr	2.38	0.64	0.12	1.26	0.37	0.00	4.77
Rcl+Pr+Bgr	3.08	1.21	0.02	1.46	0.86	0.01	6.63
Rcl+Pr+Bwc	2.92	0.60	0.02	1.31	0.59	0.00	5.45
Rcl+Pr+Pwc	2.58	1.31	0.00	1.28	1.10	0.00	6.26
Lc+Pr	2.87	1.73	0.00	0.97	1.09	0.00	6.66
Lc+Pr+Bwc	2.38	1.33	0.20	0.71	1.00	0.04	5.64
Lc+Pr+Pwc	2.50	1.90	0.20	0.81	1.77	0.01	7.02
Pr	-	2.07	0.03	-	2.11	0.01	2.80
						LSD_{05}	2.325

N o t e. *Rcl-red clover, Lc-lucerne, Pr-perennial ryegrass, Bgr-barley for grain, Bwc-barley for whole crop, Pwc-peas for whole crop.*

Results

Incorporated swards residues (DM, t ha^{-1}) in soil and nitrogen amount (kg ha^{-1}) in dry matter of roots (soil depth 0-25 cm) and above ground biomass, 2005

Treatment	DM, t ha^{-1}	N in roots			N in above ground biomass			Total N amount
		Legumes	Grasses	Total	Legumes	Grasses	Total	
Rcl+Pr	4.77	66	6.3	72	28	5.3	33	105
Rcl+Pr+Bgr	6.63	75	12	87	31	9.6	41	128
Rcl+Pr+Bwc	5.45	68	7.4	75	31	8.3	39	114
Rcl+Pr+Pwc	6.26	61	15	76	29	14	43	119
Lc+Pr	6.66	76	19	95	23	16	39	134
Lc+Pr+Bwc	5.64	65	12	77	16	12	28	105
Lc+Pr+Pwc	7.02	62	17	79	20	22	42	121
Pr	2.80	0	28	28	0	14	14	42
LSD_{05}	2.325	34.4	13.3	36.3	12.6	6.5	14.4	48.1

Note. *Rcl-red clover, Lc-lucerne, Pr-perennial ryegrass, Bgr-barley for grain, Bwc-barley for whole crop, Pwc-peas for whole crop.*

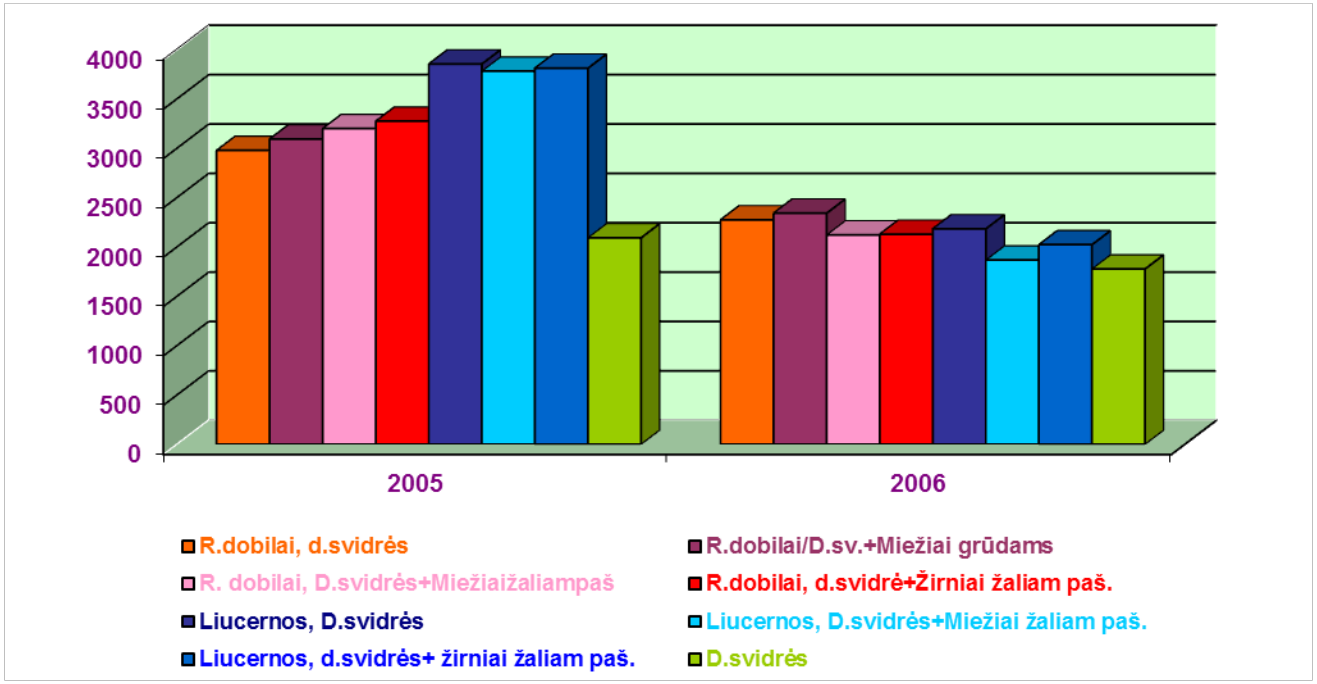
Results

Spring wheat yield, nitrogen and crude protein concentration after different pre-crops, 2006

Treatment	Grain yield, kg ha^{-1}	N in spring wheat, kg ha^{-1}	Protein in grain g kg^{-1}
Rcl+Pr	2274	63.1	131
Rcl+Pr+Bgr	2342	84.0	145
Rcl+Pr+Bwc	2121	69.3	142
Rcl+Pr+Pwc	2128	74.0	145
Lc+Pr	2183	78.1	146
Lc+Pr+Bwc	1866	72.8	148
Lc+Pr+Pwc	2022	73.9	147
Pr	1776	64.9	136
LSD_{05}	185.4	7.46	

N o t e. *Rcl-red clover, Lc-lucerne, Pr-perennial ryegrass, Bgr-barley for grain, Bwc-barley for whole crop, Pwc-peas for whole crop.*

Results



Impact of pre-crops (legume species) on spring wheat yield, kg ha

Results

N input and accumulation in spring wheat yield after different pre-crops, 2006

Treatment	N input, kg ha^{-1}	N in spring wheat, kg ha^{-1}	N difference (risk), kg ha^{-1}
Rcl+Pr	105	63.1	43
Rcl+Pr+Bgr	128	84.0	43
Rcl+Pr+Bwc	114	69.3	46
Rcl+Pr+Pwc	119	74.0	45
Lc+Pr	134	78.1	55
Lc+Pr+Bwc	105	72.8	32
Lc+Pr+Pwc	121	73.9	48
Pr	42	64.9	- 23
LSD_{05}	48.1	7.46	50.6

N o t e. *Rcl-red clover, Lc-lucerne, Pr-perennial ryegrass, Bgr-barley for grain, Bwc-barley for whole crop, Pwc-peas for whole crop.*

Conclusions

Nitrogen content incorporated with the aboveground biomass and roots of legumes was 2.5-3 times higher than that of grasses. There was no significant difference in the amount of N incorporated with red clover /ryegrass and lucerne/ ryegrass swards, however the highest total amount of nitrogen was left by lucerne/ryegrass that grew without a cover crop.

The effect of red clover/ryegrass and lucerne/ryegrass swards on the grain yield of spring wheat and on N accumulation in grain fluctuated depending on different DM yield and different amount of N incorporation and at the same time this effects could have been resulting by different accumulation of N in the soil and also weather conditions.

Thank you for your attention