RESEARCHES CONCERNING THE USE OF THE MIXED PERENNIAL GRASSES AND LEGUMES IN ORDER TO OBTAIN HIGH YIELDS OF FOODER WITH A LOW CONSUMPTION OF NITROGEN FERTILIZERS

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Abstract

One of perennial grasses, orchard grass (*Dactylis glomerata*) achieve the highest fodder yields under high doses of nitrogen ($N_{200-250}$), and in the current economic conditions because of the price of fertilizers and their effect on feed and the environment it is necessary to use simple mixtures of grasses and legumes which will ensure high yields with consumption as low nitrogen fertilizer. Orchard grass (*Dactylis glomerata)* is best associated with alfalfa (*Medicago sativa*). Researches conducted in Suceava during period 2007-2009 revealed the role of perennial legumes in simple mixtures with perennial grasses in order to achieve higher yields. The results show through using of alfalfa mixed with orchard grass dry higher yields are obtained. In the first year we obtained an yield increase of 15% when I added 25% alfalfa and an yield increase on 31% when I added 50% alfalfa. In the second year the increases were on 11% when I added 25% alfalfa, 38% when I added 50% alfalfa and 40% when I added 75% alfalfa. In the third year the yield increases were 33% from the addition of 25% alfalfa and 47% when I added 50% alfalfa.
The high doses of nitrogen fertilizers (N_{75-100}) determine the higher forage production but influenced the decrease of the alfalfa proportion in the mixture, which mean a weaker feed from quality point of view.
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Key words: mixture, alfalfa, orchard grass, nitrogen

Perennial grasses sown in pure growing are among the crops that can give high yields, but their extension is conditioned by using of very high doses of nitrogenous fertilizers. To remove this obstacle has been introduced simple or complex mixtures between grasses and legumes, which have led to higher production then single crops of legumes and grasses, and while achieving the highest amounts of protein per hectare (Moga and collab, 1981, 1986). Researches in the recent decades have clarified a number of issues concerning the competition phenomenon between species which led to the best composition of simple mixtures for different growing areas from our country.

In our country it is known that among the perennial grasses, the alfalfa is most closely associated with orchard grass (Moga and collab., 1996).

An important role in profitableness of the forage plants it is to choose a balanced ratio between the plant protein (legumes) and energy plants (grasses), which together should provide 130-140 g of protein digestible in each nutrient unit (Moga and collab ., 1993, Zamfir, 2004).

In order to elucidate of some technical and economic aspects of using simple mixtures of alfalfa and orchard grass into the north of Moldova area, has initiated an experimental device with different nitrogen fertilizer funds.

MATERIAL AND METHOD

The research was conducted in ARDS of Suceava, in 2007-2009, a faeoziom cambic soil with a clay content of 31.6% in the 0-20 cm layer, weak acid in water pH = 5.6 - 5.8, containing 3.0% humus, medium in phosphorus and potassium supplied.

It was used an experiment with two factors:

Factor A – crop: a1 = 100% orchard grass; a2 = 75% orchard grass + 25% alfalfa; a3 = 50% orchard grass + 50% alfalfa; a4 = 25% orchard grass + 75% alfalfa.

Factor B-nitrogen fertilizers: b1 = N0; b2 = N50; b3 = N75; b4 = N100.

Following varieties were used: Selena variety – alfalfa; Ovidiu variety - orchard grass.

The fertilizers were applied in single doses, in the spring before the plants start growing and harvesting was done at the beginning of flowering of first species.

The interpretation of experimental data was done by variance analysis method.

Climatic conditions during the experiment period (2007-2009) are presented in Table 1, which shows that the annual average temperatures were 1.6^0 higher than average multiannual, the positive deviations occurring mainly in the hot season and rainfall indicates values on 721.5 mm in 2007, 887.0 mm in 2008 and 649 mm in 2009 versus 586.8 mm what represent the average multiannual.

The highest values of the rainfall surplus than the multiannual average was occurred in July (87.5 mm), October (34.8 mm) and August (15.2 mm). In conclusion we can say that the experimental period (2007-2009) was warmer and rainier than the multiannual average.

RESULTS AND DISCUSSIONS

Green mass production presented in the *table 2* shows that the lowest average yield of only 26,820 kg / ha was recorded in pure growing of orchard grass, in the conditions when were not applied nitrogenous fertilizers.

By using of alfalfa alongside orchard grass were achieved the increases statistically assured, achieving an increase in unfertilized variants on 4370 kg /ha green mass was when was added at sowing 25% alfalfa, 9380 kg / ha green mass was obtained when it used at sowing 50% alfalfa and 11403 kg/ha green mass when it used at sowing 75% alfalfa.

The average of Factor A shows that the increases of green mass statistically assured at variants with 50% and 75% alfalfa in the mixture was obtained.

The average of Factor B shows that very significant increases at all doses of nitrogen has been achieved, on 9538 kg / ha at N_{50}, 15538 kg/ha at N_{75} and 21660 kg/ha at N_{100}.

Dry matter production presented in *table 3* reveals how the two experimental factors were determined its level. Thus at orchard grass in unfertilized pure growing, a production of 4330 kg / ha was registered and by adding of nitrogen from at this crop, production increases of 2884 kg / ha at N_{50}, 3882 kg / ha at N_{75} and 5397 kg /ha at N_{100} were obtained.

When we added 25% alfalfa the production increase of 1448 kg/ha at the unfertilized variant was achieved and by applying increasing doses of nitrogen the production increases grew to 5744 kg/ha. The addition of 50% and 75% alfalfa, the production increases caused by fertilizer were lower.

It shows that the average unit has achieved an increase of dry matter, statistically assured only if the mixture of 50% orchard grass + 50% alfalfa.

Average of factor A indicates dry substances increases, statistically assured only of the orchard grass mixture in the 50% proportion + 50% alfalfa.

Average of factor B indicates dry substances increases, statistically assured on 35% at N_{50}, 55% at N_{75} and 70% at N_{100}.

The species participations in production accomplished is presented in Table 4, from which it notes that in the first year the alfalfa participation exceeded the percentage of alfalfa seeds used in sowing, because the development of this species is much greater than orchard grass development. Also it noted the increase of alfalfa weight has been influenced by nitrogenous fertilizers.

In the second year yield the participation percentage of those two species was closely to the seeds mixture percentage, and nitrogen effects on alfalfa participation was diminished compared to first year. In the third year the alfalfa participation was lower and high doses of nitrogen fertilizers led decreases the alfalfa participation in achieving of production.

The economic efficiency. The data from table 5 shows when orchard grass been grown in pure growing proved to be optimal variant the fertilization application on N_{100}.

It is noted that the average yield was superior to the other alternatives; the economic indicators and the consumption of fuel and labor have been favorable. Regarding the specific consumption of energy, it has been higher than in the other variants, due to higher nitrogen dose (intensive), which eventually led to obtaining a lower efficiency.

At the feed mixture consisting of 75% orchard grass and 25% alfalfa, the best variant, in terms of average production achieved, economic indicators and the consumption of labor and energy, was the N_{100} has been applied. But, thanks to higher specific energy consumption due nitrogen, energy efficiency was lower than other alternatives.

Table 1

The climatic conditions during research period 2007 - 2009

Specification	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average or total
Monthly average temperatures ^{0}C													
2007	3,7	-0,6	5,9	9,2	16,3	19,9	21,5	19,7	13,5	8,7	0,9	-2,6	9,7
2008	-3,1	3,3	4,9	9,6	13,7	18,3	19,2	20,0	13,0	9,7	3,8	0,6	9,4
2009	-2,6	-1,2	2,3	10,8	14,7	17,7	20,4	18,9	15,7	8,7	5,5	-2,3	9,1
average 2007-2009	-0,6	0,5	4,4	9,9	14,9	18,6	20,4	19,5	14,1	9,0	3,4	-1,4	9,4
Multiyear average	-4,1	-2,3	1,2	8,0	13,7	16,9	18,4	18,3	14,2	8,4	2,4	-1,9	7,8
Deviation ±	-3,5	-2,8	+3,2	+1,9	+1,2	+1,7	+2,0	+1,2	-0,1	+0,6	+1,0	-0,5	+1,6
Precipitations - mm													
2007	10,1	45,2	41,8	32,9	53,9	30,7	105,8	169,0	67,4	87,0	43,4	34,3	721,5
2008	5,7	23,9	15,9	135,2	91,5	99,2	301,6	72,3	60,4	43,4	8,0	29,9	887,0
2009	45,3	19,0	29,2	8,4	82,2	154,9	120,8	30,8	40,2	62,6	18,6	37,1	649,1
Average 2007-2009	20,4	29,4	29,0	58,8	75,9	94,9	176,1	90,7	56,0	64,3	23,3	33,8	752,5
Multiyear average	24,2	25,6	36,2	48,2	80,2	93,6	88,6	62,8	40,8	29,5	30,6	26,5	586,8
Deviation ±	-3,8	+3,8	-7,2	+10,6	-4,3	+1,3	+87,5	+27,9	+15,2	+34,8	-7,3	+7,3	+165,7

Table 2

The green mass yield (kg/ha) obtained at the orchard grass and alfalfa mixtures on different nitrogen funds

Variant	Green mass yield (kg/ha)			The average yield(kg/ha)	Difference		Signification
	2007	2008	2009		kg/ha	%	
a_1b_1	8980	33880	37600	26820	-	100	
a_1b_2	12190	47350	53760	37760	10946	141	xxx
a_1b_3	18070	55610	58760	44146	17326	165	xxx
a_1b_4	19980	69120	70050	53050	26230	198	xxx
a_2b_1	13240	38940	41390	31190	4370	116	x
a_2b_2	14420	49638	58490	40849	14029	152	xxx
a_2b_3	18150	63594	64550	48765	21945	182	xxx
a_2b_4	20390	74510	73740	56213	29393	210	xxx
a_3b_1	15040	50070	43490	36200	9380	135	xxx
a_3b_2	16970	61510	58668	45716	18896	170	xxx
a_3b_3	18260	70150	63650	50687	23867	189	xxx
a_3b_4	20920	81010	69410	57113	30293	213	xxx
a_4b_1	16410	54600	43660	38223	11403	143	xxx
a_4b_2	17560	66660	54540	46253	19433	172	xxx
a_4b_3	19440	72860	60670	50990	24170	190	xxx
a_4b_4	21680	71450	64964	52698	25878	196	xxx
DL 5%	309	4832	4798		3313		
DL 1%	414	6936	6880		4743		

The average of factor A

Fact. A	2007	2008	2009	Average (kg/ha)	Difference		Signification
					kg/ha	%	
a_1	14805	51490	55042	40446	-	100	
a_2	16550	56670	59542	44254	3808	109	
a_3	17798	65685	58804	47429	6983	117	xxx
a_4	18773	66939	55958	47223	6777	117	xxx
DL 5%	155	6148	5620		3974		
DL 1%	222	6860	6380		4487		

The average of factor B

Fact. B	2007	2008	2009	Average (kg/ha)	Difference		Signification
					kg/ha	%	
b_1	13418	44373	41535	33109	-	100	
b_2	15285	56290	56365	42647	9538	129	xxx
b_3	18480	65554	61907	48647	15538	147	xxx
b_4	20743	74023	69541	54769	21660	165	xxx
DL 5%	154	6652	6042		4283		
DL 1%	217	7260	7160		4879		

Table 3

The dry substances yield (kg/ha) obtained at the orchard grass and alfalfa mixtures on different nitrogen funds

Variant	The d.s. yield(kg/ha)			Average yield (kg/ha)	Difference		Signification
	2007	2008	2009		kg/ha	%	
a_1b_1	1850	5784	5356	4330	-	100	
a_1b_2	2300	8187	11155	7214	2884	167	xxx
a_1b_3	2890	9627	12119	8212	3882	190	xxx
a_1b_4	3180	11826	14175	9727	5397	225	xxx
a_2b_1	2130	6396	8807	5778	1448	133	xxx
a_2b_2	2510	8165	12119	7561	3231	175	xxx
a_2b_3	3280	10602	13191	9024	4694	208	xxx
a_2b_4	2950	12333	14940	10074	5744	233	xxx
a_3b_1	2420	7998	8696	6371	2041	147	xxx
a_3b_2	2810	9396	11760	7989	3659	185	xxx
a_3b_3	2880	10815	12782	8826	4496	204	xxx
a_3b_4	3210	12567	13703	9827	5497	227	xxx
a_4b_1	1980	8082	8656	6249	1919	144	xxx
a_4b_2	3090	9915	10639	7881	3551	182	xxx
a_4b_3	3130	11990	12008	9043	4713	208	xxx
a_4b_4	2960	10725	13008	8898	4568	205	xxx
DL 5%	121	840	733		565		
DL 1%	163	1106	1029		766		

The average of factor A

Fact. A	2007	2008	2009	Average (kg/ha)	Difference		Signification
					kg/ha	%	
a_1	2305	8856	10701	7287	-	100	
a_2	2718	9374	12264	8119	832	111	
a_3	2830	10194	11735	8253	966	113	x
a_4	2790	10178	11055	8008	721	110	
DL 5%	62	1264	1286		840		
DL 1%	89	1438	1396		974		

The average of factor B

Fact. B	2007	2008	2009	Average (kg/ha)	Difference		Signification
					kg/ha	%	
b_1	2095	7065	7879	5680	-	100	
b_2	2678	8916	11418	7671	1190	135	xxx
b_3	3075	10789	12525	8786	3106	155	xxx
b_4	3075	11863	13957	9632	3952	170	xxx
DL 5%	61	1586	1460		1036		
DL 1%	82	1645	1592		1106		

Table 4

The species participation in the yield achieving (%)

Mixture	Nitrogen doses	2007		2008		2009	
		Orchard grass	alfalfa	Orchard grass	alfalfa	Orchard grass	alfalfa
Orchard grass 100 %	N_0	100	-	100	-	100	-
	N_{50}	100	-	100	-	100	-
	N_{75}	100	-	100	-	100	-
	N_{100}	100	-	100	-	100	-
Orchard grass 75 %+ alfalfa 25 %	N_0	55	45	70	30	75	25
	N_{50}	52	48	65	35	80	20
	N_{75}	48	52	60	40	82	18
	N_{100}	50	50	58	42	86	14
Orchard grass 50 %+ alfalfa 50 %	N_0	38	62	48	52	52	48
	N_{50}	32	68	44	56	54	46
	N_{75}	25	75	42	58	60	40
	N_{100}	22	78	40	60	62	38
Orchard grass 25 % + alfalfa 75 %	N_0	15	85	30	70	35	65
	N_{50}	13	87	28	72	38	62
	N_{75}	10	90	25	75	44	56
	N_{100}	10	90	25	75	45	55

Concerning the obtained results from data of feed mixture consisting of 50% orchard grass and alfalfa 50%, it shows that the best choice proved those fertilized with N_{75} and N_{100}, in terms of average production, consumption and economic indicators of labor and fuel. However the specific energy consumption is higher and energy yields are lower compared with the other two variants.

Regarding the feed mixture consisting of 25% orchard grass and 75% alfalfa, in terms of economic indicators, the variants which highlight are N_{50} and N_{75}.

The specific consumption of fuel and labor are slightly higher, but the specific energy consumption and therefore energy efficiency are more favorable compared with fertilized N_{100} variant.

Table 5

The main technical-economics and energetic indicators obtained at the fodder mixtures comprises from perennial legumes and grasses on the different nitrogen fertilizers levels, Suceava, 2007-2009

Specifications	Units	Pure growing of orchard grass 100%				75% orchard grass+ 25% alfalfa				50% orchard grass+ 50% alfalfa				25% orchard grass+ 75% alfalfa %			
		N_0	N_{50}	N_{75}	N_{100}	N_0	N_{50}	N_{75}	N_{100}	N_0	N_{50}	N_{75}	N_{100}	N_0	N_{50}	N_{75}	N_{100}
Yield average	g.m.. t/ha	26,8	37,7	44,1	53,1	31,2	40,8	48,8	56,2	36,2	45,7	50,7	57,1	38,2	46,3	51,0	52,7
	d.s. t/ha	4,33	7,21	8,21	9,73	5,78	7,56	9,02	10,07	6,37	7,99	8,83	9,83	6,24	7,88	9,04	8,90
Yield costs	Lei/t	64,1	59,3	58,2	54,4	59,1	57,6	56,2	53,3	56,3	55,4	53,5	52,9	54,0	55,0	53,3	54,2
Net income +subsidy	Lei/t	6,5	8,5	8,3	10,3	10,4	9,4	9,3	10,9	11,4	10,4	11,4	11,2	12,9	10,6	11,5	10,5
Rate of profit	%	10,1	14,4	14,3	19,0	17,5	16,3	16,6	20,5	20,3	18,8	21,2	21,1	23,9	19,3	21,6	19,4
Labor consumption	hours/ tg.m.	0,659	0,617	0,604	0,583	0,635	0,609	0,596	0,578	0,619	0,599	0,586	0,577	0,610	0,598	0,585	0,583
Fuel consumption	l/t	3,057	2,895	2,824	2,765	2,965	2,864	2,811	2,749	2,901	2,851	2,804	2,771	2,867	2,846	2,776	2,794
Specific energy consumption	Kwh/t	55,4	89,6	98,9	102,0	52,3	85,3	93,0	98,2	49,8	80,2	90,5	97,5	48,8	79,5	89,7	102,6
Achieved energy	Kwh/t	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850
Energetic profitableness	True energy/Cons. energy	15,34/1	9,49/1	8,59/1	8,33/1	16,25/1	9,96/1	9,14/1	8,65/1	17,07/1	10,60/1	9,39/1	8,72/1	17,42/1	10,69/1	9,48/1	8,28/1

CONCLUSIONS

The feed production at mixture of orchard grass and alfalfa was superior to pure growing, the optimal proportion being on 50% orchard grass + 50% alfalfa.

Nitrogen fertilizer determined production increases in all types of mixture and at pure growing of orchard grass.

The participation degree of alfalfa in achieving of the fodder production in frame of the experimented mixtures was higher in the first two years of exploitation and lower in the third year in particular at higher doses of nitrogen N_{75} and N_{100}.

From point of economically view the most advantageous concerning the average feed yield, economic indicators and the consumption of labor and fuel, was registered with N_{100} at pure growing of orchard grass and mixture of 75% orchard grass + 25%alfalfa, at N_{75} and N_{100} with mixture of 50% orchard grass + 50% alfalfa and N_{50}-N_{75} with mixture of 25%orchard grass + 75% alfalfa.

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