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EXPERIMENTAL RESULTS CONCERNING TEMPORARY GRASSLANDS WITHIN SUSTAINABLE FARMING SYSTEM IN ROMANIAN PLAIN

GH. MOTCĂ*, N. DINCĂ*, ANA-MARIA GLĂVAN*, NICOLETA OLTENACU*, IZABELA IVANOVICI*, GH.L. BURICESCU**

*University of Agronomic Sciences and Veterinary Medicine of Bucharest
**SC Agricover SA, Scanteia Station of Ialomita

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Abstract

Definitory elements of temporary grasslands sustainable cropping technology in Romanian Plain are: fertilization restrictive systems and the structure of graminaceae and perennial leguminous mixtures adjusted to this system.

For this purpose, it was founded an experimental station within the Didactical Farm Moara Domneasca of USAMV Bucharest, on reddish preluvosoil. There were studied 3 variants of mixtures, in different proportions, among the most adjusted varieties to the growing conditions in this area (Dactylis glomerata 40-50-60% and Medicago sativa 60-50-40%), as well as 3 variants of mineral restrictive fertilization with N 0-50-100 and P_2O_5-50.

As it results from the experimental data during 2006-2008, among the three years, there are essential differences concerning the achieved production. Thus, while the first two years production is 7-9 t/ha DM, during the third year the yield doubles itself (14-16 t/ha DM), as a consequence of the precipitations higher level and of their better distribution, especially during the first harvest.

On the basis of the obtained results in the system of sustainable agriculture in Romanian Plain, there are recommended mixtures with a share of minimum 50% Medicago sativa, with mixed use or only by harvesting, in the unirrigated crop, fertilized with only 50 kg/ha P_2O_5. For grazing, there are recommended mixtures where Medicago sativa's share is smaller than 50%, fertilized with 50 kg/ha N and 50 kg/ha P_2O_5. For both variants, there are obtained yields over 10 t/ha DM, of superior quality, effective as well from economic point of view as ecological one.

INTRODUCTION

In the future, in the system of sustainable agriculture, the importance of temporary grasslands in Romanian Plain, won't diminish, but on the contrary. As well on the areas with degraded permanent grasslands (rather narrow), but especially on the arable fields, the establishment of temporary grasslands becomes an extremelly necessary measure for all agricultural exploitations which owe herbivourous animals livestock.

One of the most difficult issues in temporary grasslands technology from plain areas is cropping in unirrigated regime, which becomes risky in the droughty years [1, 2, 3].

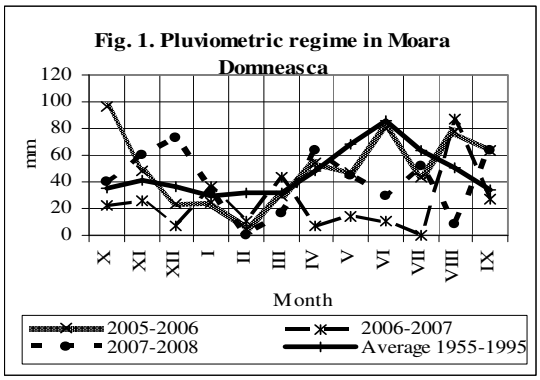
In the present work, there are presented the results obtained during 2006-2008 within an experiment with technological variants (mixtures and fertilization) conceived for a sustainable cropping system, with low inputs, accessible to most of the agricultural exploitations in Romanian Plain, especially to the ones from the area with reddish preluvosoil.

MATERIAL AND METHODS

Research was effected within the Experimental Didactic Farm Moara Domneasca, farm owed by the University of Agronomic Sciences and Veterinary Medicine Bucharest.

Soil. The representative soil for the experimental field and for oak area, from the South of the country, belongs to the preluvosoil kind, to reddish subtype, having the following characteristics: loamy-clayey texture, medium humus content in A horizon (2.77%) and relatively high in A/B (about 1.2%); slight neutral-acid reaction in A horizon (pH 6.29-6.64); phosphorus content, of 17 ppm P_{AL} (poorly - mediumly supplied); potassium content, of 184 ppm K_{AL} (well supplied).

Climate. As a multiannual average, in the area of the experimental field, precipitations sum up 556.1 mm. During the vegetation period (March-September), there is a waterfall of 380 mm as an average. Relative humidity of the air is of 78.6%, and during the vegetation year 73%. In comparison with the normal climate regime of the area where, the experimental field is situated, the research years characterized themselves, this way: 2006 was a normal year, but completely lacked of snow, 2007, an extremely droughty year and 2008, a most normal during the first half and droughty afterwards (figure 1).



Experimental factors. Factor A: Mixture: *Dactylis glomerata* - Poiana variety + *Medicago sativa* - Magnat variety.

a1 - *Dactylis glomerata* 40%+*Medicago sativa* 60%;
a2 - *Dactylis glomerata* 50%+*Medicago sativa* 50 %;
a3 - *Dactylis glomerata* 60%+*Medicago sativa* 40 %.

Factor B: Fertilization: b1-N-0 P_2O_5-50; b2-N-50 P_2O_5-50; b3-N-100 P_2O_5-50.

Fertilization system: P_2O_5-50 applied in the autumn; N-50 applied in the spring; N100, applied in fractions such as: N-50 in the spring + N-50 after the first harvest.

RESULTS AND DISCUSSION

Dry matter yields. On the basis of the data presented in table no.1, it is estimated that the average production of the 3 experimental years is very high for the conditions of unirrigated crops in Romanian Plain.

Table 1

Dry matter yields

Mixture	Fertilization variant	t/ha				%		
		2006	**2007**	**2008**	**Average**	**2006**	**2007**	**2008**
Dactylis glomerata 40% *Medicago sativa* 60%	N0P50	9.22	9.28	15.65	**11.38**	27	27	46
	N50P50	7.58	7.90	14.68	**10.05**	25	26	49
	N100P50	8.47	8.40	15.77	**10.88**	26	26	48
	Average	**8.42**	**8.53**	**15.37**	**10.77**	26	26	48
Dactylis glomerata 50% *Medicago sativa* 50%	N0P50	9.51	8.60	15.47	**11.19**	28	26	46
	N50P50	8.66	7.89	15.98	**10.84**	27	24	49
	N100P50	8.17	8.14	16.77	**11.03**	25	25	50
	Average	**8.78**	**8.21**	**16.07**	**11.02**	27	25	48
Dactylis glomerata 60% *Medicago sativa* 40%	N0P50	7.03	7.64	14.6	**9.76**	24	26	50
	N50P50	7.15	7.62	16.62	**10.46**	23	24	53
	N100P50	7.47	7.23	16.52	**10.41**	24	23	53
	Average	**7.22**	**7.50**	**15.91**	**10.21**	24	24	52

The reference potential level of graminaceae and perrenial leguminous mixtures, from unirigated areas in Romanian Plain, established by our research staff, during 2006-2008, on the basis of the experimental results, from the latest 20 years [4], reaches on average of 7 t/ha dry matter. Out of the data achieved during 2006-2008, it is acknowledged that for all the experimental variants, the dry matter yield surpassed this reference level, reacing up to 11.38 t/ha DM. The other fertilization variants achieved yields comprised between 10 t/ha DM and 11 t/ha DM.

Maximum yield (11.9-11.38 t/ha DM) was achieved with the mixtures of *Medicago sativa* in proportion of 50-60%, for the variant fertilized only with 50 kg/ha P_2O_5.

As it results from the experimental data, among the three years, there are essential differences concerning the achieved yield. Thus, while the production of the first two years is of 7-9 t/ha DM, the third year, the yield doubles itself (14-16 t/ha DM), as a consequence of the higher precipitations level and of their better distribution, especially during the first harvest. 2008 year raised the average production level over 3 years to 10-11 t/ha.

The influence of the mixture type. In comparison with the mixture no. 2, formed of *Dactylis glomerata* 50% and *Medicago sativa* 50% (11.02 t/ha DM as an average, in the experimented fertilization variants) as a control element, only the mixture where the proportion of *Medicago sativa* variety decreases to 40% (mixture no. 3) achieves 7% lower yield (respectively 0.81 t/ha DM), significantly statistically assured (table 2).

Table 2

Mixture influence upon dry matter yields

Mixture	Dry matter yield		Difference (t/ha)	Significance
	t/ha	%		
Dactylis glomerata 40% *Medicago sativa* 60%	10.77	98	-0.25	-
Dactylis glomerata 50% *Medicago sativa* 50%	11.02	100	-	Mt.
Dactylis glomerata 60% *Medicago sativa* 40%	10.21	93	-0.81	0

LSD 5% = 0.59 t/ha LSD 1% = 0.89 t/ha LSD 0.1% = 1.43 t/ha

On vegetation years, a lower productivity of the mixture no. 3 was recorded only in 2006, first year of vegetation. The mixture with a bigger proportion of *Medicago sativa* (mixture no. 1) makes no significant difference during any of the research years. These results make us right to assert that in the given experimental conditions, between the two variants associated in the mixtures, the leguminous plants are the ones which differentiate the production potential of the vegetal layer, depending on their share in the mixture structure.

Fertilization influence. During 2006-2008, the azote fertilization led to a significant diminishment level of dry matter yield in comparison with the azote unfertilized variant, as an average, on mixtures, due to the alfalfa higher percent of participation to the flower composition (table 3).

Comparing the fertilization variants, depending upon the used mixture, it results that the unfertilized with azote variant is superior to other variants within mixtures no. 1 and 2 and makes no statistic difference for mixture no. 3.

Table 3

Fertilization influence upon dry matter yields

Fertilization variant	Dry matter yield		Difference (t/ha)	Significance
	t/ha	%		
N0P50	10.78	103	-	Mt.
N50P50	10.45	100	-0.33	00
N100P50	10.77	103	-0.01	-

LSD 5% = 0.18 t/ha LSD 1% = 0.25 t/ha LSD 0.1% = 0.34 t/ha

On the basis of the production results, one may estimate that the mixtures with a share of minim 50% *Medicago sativa* (mixtures no. 1 and 2) with mixed use or only by threshing, are recommended in the unirrigated crop in fertilization system with only 50 kg/ha P_2O_5. The mixture with thehigher than 50% participation of the variant *Dactylis glomerata* (mixture no. v3), especially used for grazing achieves yields close to the mixtures where *Medicago sativa* prevails, only within the variants fertilized with 50-100 kg/ha N together with 50 kg/ha P_2O_5. But we estimate, that even the mixture with 40% *Medicago sativa* may be cultivated without azote fertilization, however taking into account the high level of yield (10.21 t/ha DM), but especially the economic and ecological effectiveness, which is obtained in the the system of use in the animal feed by grazing.

Yield distribution on harvesting cycles. During the 3 research years, there were obtained 2 harvests in the first year and 3 harvests in the other years. Also, it resulted, that during all the years, neither the mixture kind, nor the fertilization variant significantly influences the gathering dymamics of dry matter during the vegetation period. For the normal regime, of 3 harvests per year, in conditions of irrigation shortage, for the first harvest, it was obtained between 53% and 70% out of the total production, for the second harvest 20-25%, and for the third harvest, 10-27%.

Botanical composition. Due to the strong challenging capacities of the alfa-alfa, which surpasses the one of the cocksfoot for the first harvesting cycle, alfalfa is prevailing in mixture no. 1 for all fertilization variants, and in mixture no. 2, for the variant N_0P_{50} (45-57%). In mixture no. 3, the dominant species is cocksfoot for all fertilization variants.

Species from other botanical families don't usually surpass 10-15% gravimetrical participation to either mixture and fertilization variant.

CONCLUSIONS

1. As it results from the experimental data during 2006-2008, in the climate conditions of the preluvosoil areas, nearby the capital, temporary grasslands may achieve average yields of 10-11 t/ha DM, using a simple technology (low inputs), without negative impact upon the environment and the primary (animal) and secondary (human being) consumer. At the same time, the experimented cropping system improves the natural soil fertility and it ensures sustainability of effective exploitation within the agriculture system practiced in the area.
2. In the circumstances of the acentuated lack of precipitations in the experimental period, it was demonstrated the adequate behaviour of analysed mixtures even in the unirigated crops.
3. The technological basic links for the sustainable crop of temporary grasslands in the unirrigated cropping in Romaninan Plain are: mixtures of perennial graminaceae and leguminous with mixed usage or only for by threshing, formed of *Dactylis glomerata* together with minimum 50% *Medicago sativa*, fertilized with only 50 kg/ha P_2O_5. For grazing, there are recommended the mixtures with the smaller than 50% involvement of *Medicago sativa*, fertilized with 50 kg/ha N and 50 kg/ha P_2O_5.
4. In the given experimental conditions, between the two varieties associated within the mixtures, *Medicago sativa* is the variety which diferentiates the production potential of the vegetal layer, depending on its share in the mixture structure.

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