RESEARCH ON WATER CONSUMPTION AND PRODUCTION OF RED CLOVER ON A EROSIONAL ARRANGED LAND IN CHINTENI, CLUJ COUNTY

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Abstract

As it is known fodder legumes applied irrigation is one of the key measures that are to be taken both in arid and semi-arid and sub-humid areas, where only two or three waterings can get big bonuses harvest inexpensively.The result was two-way experience for both red clover in pure culture and for its mixture with lolium perenne (perennial ryegrass). For these cultures were determined the productions obtained for experiments located on slope applying differentiated fertilization.The results highlight once again the importance of water factor in producing forages of perennial grasses, which as we know the phyto-mass recover several times during the growing season.

Key words: erosion, water consumption, irrigation, perennial herbs

The study concerning the water consumption and production in the culture of *Trifolium pratense* both in pure state and in its mixture with *Lolium perene*, were made between 2010 – 2012, on a piece of land specially arranged for fighting soil erosion and sliding.

MATERIAL AND METHOD

The aim of the studies was to make evident that water is a main limitative element of the production, having an even more important role in the case of fodder plants, especially perennial ones, where the green mass is remade several times during the vegetation period. The experiment was carried out on a pasture land at Chinteni, 15 km from Cluj-Napoca. Chinteni being part of the great geographical unit of the Somes platform, a subdivision of the "Chinteni Hills".

Red clover was used for this experiment Select 1 (created and approved by N Giosan, M. Savatti, L. Buda, I. Resmerita, C. Velea), variety that represents an abundant foliage with a 18-19 % of gross protein dry matter.

On the arranged surface with a 370 m altitude and a medium slope of 9% (*fig.1*) draining works were performed, in the influential zone of the surface subdued to sliding (*fig.2*) as well as works to get a compensation slope on the neighboring ravine.

If we follow the data registered by weather station which is in middle of the arranged surface (*tab.1*) we can see that in the studied interval there were some significant changes: after a warm and very rainy period in 2010 (S) there came a droughty year 2011 (F.S.) and 2012 was an extremely droughty year (F.S.).

Following simultaneously the precipitations and the thermic aspect of the weather (*tab.2*) we notice in the warm period of vegetation a growth of the monthly medium temperature from one hydrological year to the other, while in the cold period of vegetation a decrease of this.

The experiment in discussion was bifactorial, based on the method of subdivided lots in three repetitions. Factor A is the culture and factor B is the used fertilizing system, having at our disposal an unfertilized agro found and another one fertilized whit $N_{50}P_{90}$ s.a./ha.

The species used within the two cultures under observation were Gloria for the Lucerne, and respectively *Lolium perene* - *Mara*, used in the mixture with *Trifolium pratense* in a 1:1 proportion due to its competitivity.

Figure 1 **Ravine from the experimental field**

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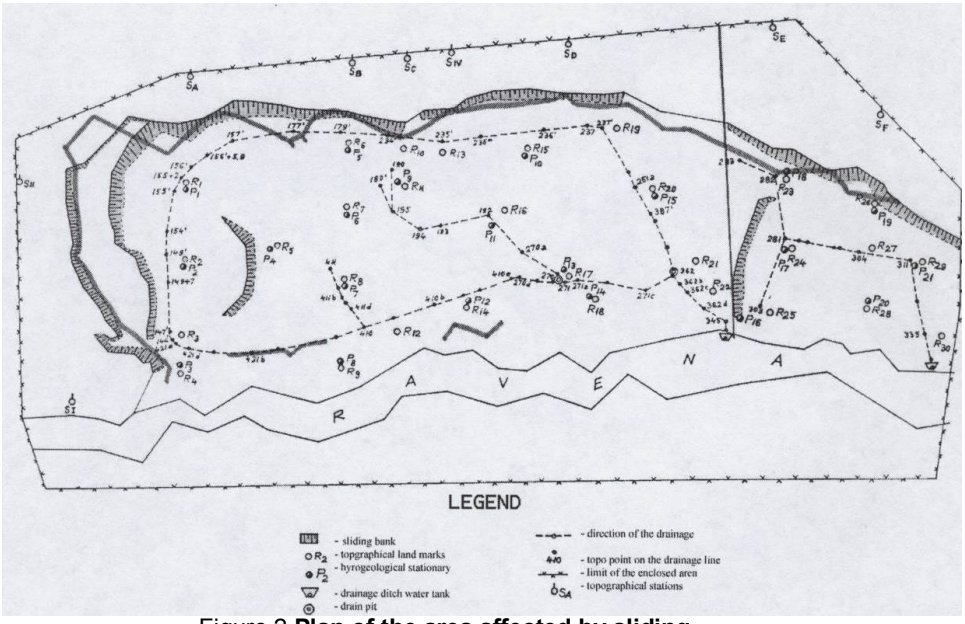

Figure 2 **Plan of the area affected by sliding**

Table 1

Monthly precipitations and the water from a pluviometric view point compared to the average multi-annual values registered by the weather station of the University of Agricultural Sciences Cluj – Napoca (mm), 2009 – 2012.

Hidrological period	Month												Cold period	Warm period	Hydrologic year
	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX			
2009-2010	21,8	26,7	12,6	15,7	7,8	16,4	31,2	26,5	47,2	85,6	21,3	67,3	101,0	279	380,1
qualificative	F.S.	S	E.S.	E.S.	E.S.	F.S.	S	E.S.	F.S.	N	E.S.	P	F.S.	S	F.S.
2010-2011	12,5	28,4	10,4	9,7	6,5	18,3	25,7	24,3	31,7	67,2	52,3	41,7	85,8	242,9	328,7
qualificative	E.S.	P.M.S.	E.S.	E.S.	E.S.	F.S.	E.S.	E.S.	E.S.	F.S.	S	N	E.S.	F.S.	E.S.
2011-2012	38,4	37,3	17,5	18,3	12,3	19,5	27,3	31,7	45,5	51,6	41,7	47,2	143,3	245,1	388,4
qualificative	P.M.S.	P	F.S.	F.S.	F.S.	S	E.S.	E.S.	E.S.	E.S.	E.S.	N	S	F.S.	F.S.
Multiannual average	39,3	31,2	29,6	25,8	24,3	26,8	46,0	76,4	89,6	82,9	67,8	42,4	177,0	405,1	582,1

Legend:

E.P. – excessively rainy
F.P. – very rainy
P – Rainy
P.M.P. – a little more rainy
PMS – a little more droughty
S – droughty
FS – very droughty
E.S. – excessively droughty

Table 2

The average monthly temperatures and characteristics of the weather from a thermic point of view compared to the average multiannual values registered by the meteo station of the USAMV Cluj – Napoca (^{0}C), 2009 – 2012

Hidrological period	Month												d p er	m p er	Hydrologic year
	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX			
2009-2010	14,2	5,4	-2,1	-3,7	-2,3	7,4	11,3	14,3	18,3	21,3	22,3	15,3	3,2	17,2	10,2
qualificative	F.C.	C	R.C	N	N	C	C	N	N	N	C.S	C.S.	C	C.S.	C
2010-2011	11,4	4,2	-3,2	-4,4	-1,7	8,3	9,7	17,6	20,5	24,5	23,5	13,7	3,0	18,3	10,4
qualificative	C.S.	C.S.	R.C.	N	N	C	C.S.	C.S.	C.S.	C	C	N	C.S.	C	C
2011-2012	12,3	6,7	-2,7	-1,7	-4,2	6,9	10,5	18,4	22,3	23,7	25,7	16,8	2,9	19,6	11,2
qualificative	C	C	R.C	C.S	R	C	C.S.	C	C	C	F.C	C.S.	C.S	F.C	F.C.
Multiannual average	9,3	3,3	-1,6	-4,1	-1,6	3,7	9,1	14,2	17,7	19,5	18,6	14,3	1,5	15,7	8,6

Legend:

C.S. – warm
C – Very warm
FC – hot
EC – excessively hot
RC – a cool
R – cold
FR – very cold
E.R. – excessively cold

In order to determine the water consumption we took the water balance from the soil an average value for the three repetitions. At the beginning and at end of the vegetation period and in between, bimonthly, we checked the water reserve with the help of drying closets. The soil samples taken were from profiles of 0-10, 10-20, 20-40, 40-60, 60-80, 80-100, 100-125 and 125-150 cm; we used the values of humidity as ponderate mediums for the depth of 1.5 m, and for

the apparent density the value of 1.38 t/m^3, as it resulted from the pedological studies.

The dry products were obtained by using the relation established by Budiu (2) covering two stages in the calculation. In the first stage we found out the percentage of dry substance out of the green mass with a 75 % humidity applying the relation (1).

$$SU\% = \frac{F\ (100 - U)}{1000} \quad (1)$$

where:
F – stands for the quantity of hay resulting from the drying in the air of the sample of 1 kg green mass, in grams
U – humidity of the hay sample in %

In the next stage we can find out easily the production of dry substance (S.U.) per ha, with the relation (2).

$$SU\% = \frac{SU\% \times MV}{1000} \quad (2)$$

where:
SU – production of dry substance in kg/ha
NV – production of greenmass in kg/ha

RESULTS AND DISCUSSIONS

The obtained results – show that water consumption was cca. 10% bigger in the case of mixtures (*Trifolium pratense* + *Lolium perene*) than in the pure culture (*Trifolium pratense*), and during June and July consumption was 20-40% bigger than in the other months of the warm period of vegetation (*tab. 3*).

As far as average productions obtained in three years of vegetation at the unfertilized variant are concerned we can conclude that the *Trifolium pretense* yielded 18% greater product at first harvesting than at second mowing, while at the mixture between *Trifolium pretense* and *Lolium perene* this difference was 24% (*fig.3*).

Table 3

Total water consumption and ways of covering it in the warm periods of the years 2010, 2011 and 2012 at Chinteni – Cluj for the studied cultures (m^3/ha)

Year	Culture	Total consumption	Monthly water consumption and ways of covering it											
			IV		V		VI		VII		VIII		IX	
			From the soil	From precip.	From the soil	From precip.	From the soil	From precip.	From the soil	From precip.	From the soil	From precip.	From the soil	From precip.
2010	*Trifolium pratense*	5106	230	312	680	265	540	472	560	856	120	213	185	673
			Σ = 542		Σ = 945		Σ = 1012		Σ = 1416		Σ = 333		Σ = 858	
	Trifolium pratense+ Lolium perene	5251	270	312	740	265	640	472	420	856	160	213	230	673
			Σ = 582		Σ = 1005		Σ = 1112		Σ = 1276		Σ = 373		Σ = 903	
2011	*Trifolium pratense*	4754	230	257	630	243	670	317	530	672	110	523	155	417
			Σ = 487		Σ = 873		Σ = 987		Σ = 1202		Σ = 633		Σ = 572	
	Trifolium pratense+ Lolium perene	5124	245	257	720	243	680	317	720	672	170	523	160	417
			Σ = 502		Σ = 963		Σ = 997		Σ =1392		Σ = 693		Σ = 577	
2012	*Trifolium pratense*	5136	320	273	660	317	720	456	630	516	215	417	140	472
			Σ = 593		Σ = 977		Σ = 1176		Σ = 1146		Σ = 632		Σ = 612	
	Trifolium pratense+ Lolium perene	5396	360	272	740	317	710	456	680	516	270	417	185	472
			Σ = 633		Σ = 1057		Σ = 1166		Σ = 1196		Σ = 687		Σ = 657	

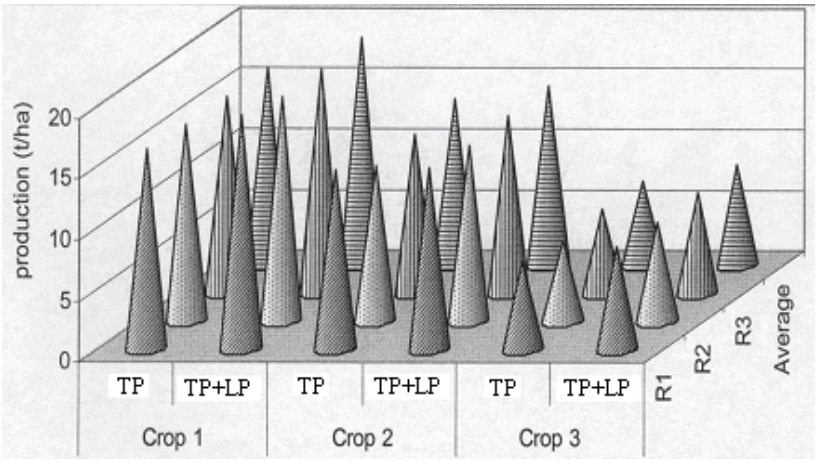

Figure3 **Average production in fertilized conditions ($N_{50}P_{90}$) in the warm period of vegetation of years 2010 – 2012 (*Trifolium pratense+ Lolium perene* (t/ha)**

When the two cultures were fertilized with $N_{50}P_{90}$, the pure *Trifolium pratense* gave 26% less production at second mowing and 59% at third moving than at the first harvesting, *Trifolium pratense* and *Lolium perene* yielded 31%, respectively 62% less second and third crops as compared to the first.

CONCLUSIONS

From the obtained results concerning the amount of total water consumption during the three experimental years we concluded that both in case of *Trifolium pratense* and in its combination with *Lolium perene* water consumption was 20 – 50% bigger in June and July in the interval between the beginning and end of the warm vegetation period.

- As for production we could witness during the experimental years a gradual decrease from the first mowing towards the last one, although the water consumption until the first harvest was cca 17% bigger than in second one.
- Drawing a parallel between total water consumption and the production in the three years of experiment we can say that *Trifolium pratense* yielded a cca 17% smaller crop than its combined variant with *Lolium perene,* proving thus the positive influence of gramineea for plants cultivated on sloppy terrains.

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