THE BEHAVIOUR IN MIXTURES OF SOME ANNUAL FORAGE SPECIES

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Abstract: *Introducing the culture of foreign varieties of forage plants can not be made without prior testing in different pedological and climatic conditions comparatively to the origin countries in order to determine their value in terms of production and quality, so that the main purpose of the paper is establish which are the main characters that compete to achieve production yields per and what is the competition capacity of these species when are grown in mixture with other species. Knowing the biological particularities of forage plants is a first step in genetic researches in and amelioration, or in technology research to increase the quantity and quality of feed (OPROI CRISTINA, 2005). OPROI CRISTINA (2005), claims that a simple calculation of the annual forage production can be done by multiplying the number of plants per hectar, with the number of shoots / plant, with weight of shoots at each harvest year. Of great importance are and some other characters: leaf surface, dry matter assimilation rate expressed phenotypically by a regeneration and rapid growth, rich sprout, stature high, diseases and unfavorable environmental conditions resistance. The same author says that the tiller is the basic element of fodder production. The tillers number on a plant is a fundamental attribute, related to force, photosynthetic capacity, the nutrition space and is a character with a strong variability. Referring to the term 'biological density ZAHONNE"(1985), says that optimum achieve of this depends largely on the competitive value of the partner in the mixture, so that binary associations, when of one the partners may be replaced with other one more vigorously, the fodder production increases(VARGA P. et all., 1997). As biological material we used a variety of Italian ryegrass var. westerwoldicum and three varieties of annual clovers:- Lolium multiflorum var. Westerwoldicum; - Wesley variety; - Trifolium alexandrinum - Miriam variety; - Trifolium incarnatum - Tardivo variety; - Trifolium resupinatum - Gorby variety. At these species were analyzed main quantitative elements which contribute to achieving the total plant production in two variants: unfertilized - $N_0P_0K_0$ and fertilized - $N_{100}P_{50}K_{50}$ and harvesting was done in phenopheses 69 (at full flowering). A special importance of this work is the fact that through these researches are brought significant contributions to the knowledge of main productivity elements, so that when these species will be cultivated, in determining the seeding density must be taken in account these characteristics to favorize a better plants development.*

Key words*: *Lolium multilforum, Trifolium alexandrinum, Trifolium incarnatum, Trifolium resupinatum, production

INTRODUCTION

Introducing in culture some foreign varieties of forage plants can not be done without a prior testing in different pedological and climatic conditions against the origin countries, in order to determine their value in terms of production and quality, so the purpose of this paper is to establish which are the main production characters who compete to achieve the production per plant and which is the competition ability of these species when are grown in mixture.

Knowing the biological particularities of forage plants represents a first step in genetic and amelioration researches, or in technology researches to increase the quantity and quality of feed (OPROI CRISTINA, 2005).

OPROI CRISTINA (2005), says that a simple calculation of the annual forage production can be done by multiplying the number of plants per hectare, with the number of tillers / plant,

with the weight of shoots at each harvest per year. Of a great importance are and some other characters: leaf area, dry matter assimilation rate expressed phenotypically by rapid growth and regeneration, rich sprout, high size, resistance to diseases and unfavourable environmental conditions.

Referring to the term ‘’biological density’’ ZAHONNE"(1985), said that achieving its optimum value depends largely on the competitive value of the partner in the mixture, so that in binary associations, when one of the partners may be replaced with other one more vigorously, the fodder production is increasing (VARGA P. et all., 1997).

Establishing the rapport of seeding between the components of a binary mixture, of fodder plants presents a particular importance, because it determines the operating mode and fertilization of culture.

The importance of this work is that through these researches are brought significant contributions to the knowledge of productivity key elements, so that when these species will be cultivated, at the determination of seeding density must take into account these characteristics to favour a better development of plants.

MATERIAL AND METHODS

The experience was settled at The Experimental Didactic Station of The University of Agricultural Sciences and Veterinary Medicine of Banat, Timisoara. The settlement area is in West Plane of Romania and the soil on witch the experiences have been placed is a chambic chernozem.

As biological material we used a variety of Italian ryegrass var. westerwoldicum and three varieties of annual clovers:

- *Lolium multiflorum var. westerwoldicum - Wesley variety*
- *Trifolium alexandrinum - Miriam variety*
- *Trifolium incarnatum - Tardivo variety*
- *Trifolium resupinatum - Gorby variety*

At these species were analyzed main quantitative elements which contribute to achieving the total plant production in two variants: unfertilized - N0P0K0 and fertilized - N100P50K50 and harvesting was done at full flowering.

RESULTS AND DISCUSSIONS

If you extrapolate the graphical representation of the production elements, for the four studied species, we get a chart that helps us make a better picture on the robustness of the species that are used in the mixtures composition (fig. 1).

Lolium multiflorum var.westerwoldicum is the most representative from phenotypical point of view, even if in which it regards the plant height this is passed by Berseem clover, and in which it regards the foliar surface is passed by Crimson clover, but still it has the biggest tillers number (38,9) (fig. 1).

If we analyse the annual legumes utilised in the mixtures, from the robustness point of view, can be observed that the most representative plant is Berseem clover, because it has the biggest height of plats (51,59 cm) and 7,5 tillers, that is bigger than the number of Crimson clover (6,6 tillers), but lesser than the number of tiller of Persian clover (8 tillers).

Berseem clover has a foliar surface/leaf of 6,89 cm^2, bigger than of Persian clover (2,95 cm^2), but smaller than of Crimson clover (12,17 cm^2).

So, we can claim that Berseem clover, develops a very well individualised plant, from the analysed production elements point of view and the production per plant is bigger comparatively with the other annual legumes.

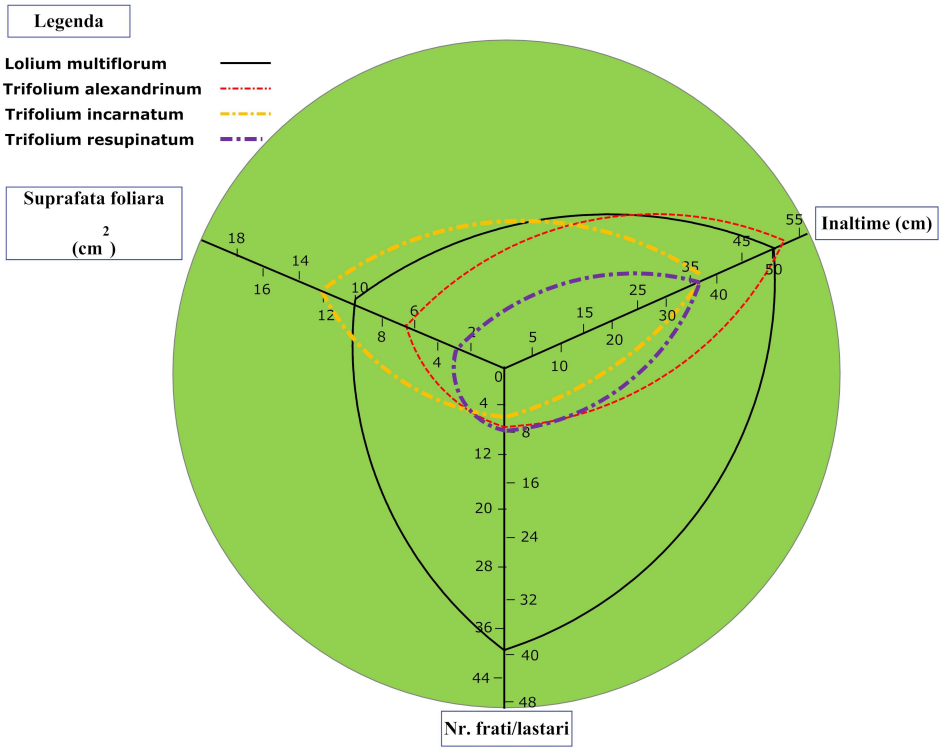

Fig. 1 Graphic representation of the main quantitative elements of the species used in annual mixtures, at full flowering, the unfertilized variant (2006 - 2008)

Crimson clover is characterised by the fact that it has the biggest foliar surface/leaf of 12,17 cm^2, but it has the smallest height (35,43 cm) from the three studied annual clovers.

Persian clover is representative through the plant's shunt having a number of 8 tillers, but the smallest foliar surface/leaf of 2,95 cm^2.

By fertilisation takes place the increase of all production elements, at all four studied species. Although, the production elements have raised, the growth have been done proportionally, without major modifications between species, comparatively to unfertilised variant.

The biggest plant grow has even in this phenophase Italian ryegrass, because at this specie have been raised the most the theree production elements that have been analysed. (fig. 2).

So from here can result the fact that Italian ryegrass has a better response to chemical fertilization, compared with annual clovers.

In terms of dry matter yields obtained from both at pure cultures and at mixtures, the best production results were achieved at mixtures of Italian ryegrass and *Trifolium alexandrinum*, all three variants of mixture getting better results production against the witness experience, and better also against the pure cultures of the species that they comprise.

The highest dry matter production was obtained from the mixture of L.m.50% + T.a.50 % of 6.76 t/he DM, being significant distinct bigger against the witness (average experience) (Table 1).

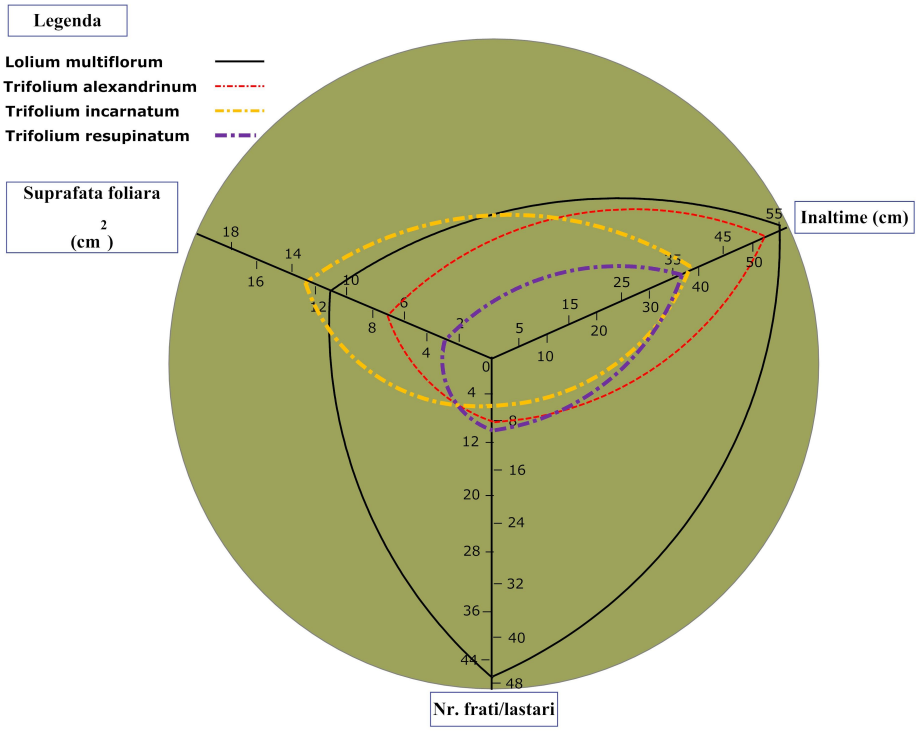

Fig. 2 Graphic representation of the main quantitative elements of the species used in annual mixtures at full flowering, the fertilized variant (2006 - 2008)

Pure culture of crimson clover obtained the lowest production of 2,9 t/he DM, being very significant smaller against the witness.

Small dry matter production was obtained and at mixture L.m.25% + T.i.75% (3,26 t/he DM) being significantly distinct smaller against the witness (Table 1).

It is noted that production of this mixture is lower than that of Italian ryegrass, but is higher than that of crimson clover (pure culture).

A good reaction in mixture had variant L.m.50% + T.i.50% which showed a dry matter production of 5,0 t/he DM, equal with the average experience and higher than of Italian ryegrass and crimson clover (pure culture).

Regarding the mixtures formed of Italian ryegrass and persian clover - can be seen that all three variants of the mixture have obtained higher yields than the average experience, and also higher than pure cultures of species they comprise.

Of these mixtures the highest dry matter production was obtained at L.m.50% + T.r.50% - of 6,16 t/he DM, being significantly higher than average experience (witness) (Table 1).

In fertilized variant again the forage mixture L.m.50% + T.a.50% achieved the highest dry matter production of 7,43 t/he, superior production to all other experimental variants, being very significant higher than the witness of experience (Table 2).

Table 1

Dry matter production (t/ha) obtained at full flowering, unfertilized variant
(average 2006-2008)

No.	Variant	Average Prod. (t/he)	%	Diff.	Signif.
1.	*Lolium multiflorum*	4,43	88,6	-0,57	-
2.	*Trifolium alexandrinum*	5,40	108,0	0,40	-
3.	*Trifolium incarnatum*	2,90	58,0	-2,10	000
4.	*Trifolium resupinatum*	4,46	89,2	-0,54	-
5.	L.m.75%+T.a.25%	6,13	122,6	1,13	*
6.	L.m.50%+T.a.50%	6,76	135,2	1,76	**
7.	L.m.25%+T.a.75%	5,63	112,6	0,63	-
8.	L.m.75%+T.i.25%	4,46	89,2	-0,54	-
9.	L.m.50%+T.i.50%	5,00	100,0	0,00	-
10.	L.m.25%+T.i.75%	3,26	65,2	-1,74	00
11.	L.m.75%+T.r.25%	5,43	108,6	0,43	-
12.	L.m.50%+T.r.50%	6,16	123,2	1,16	*
13.	L.m.25%+T.r.75%	5,06	101,2	0,06	-
14.	Media experienței	5,00	100,0	Martor	-
Dl 5% = 0.86 t/ha Dl 1% = 1.22 t/ha Dl 0.1% = 1.78 t/ha					

Lowest dry matter production was enlisted in pure culture of crimson clover (3.5 t/he DM). Small dry matter production was obtained also at mixture L.m.25% + T.i.75% of 3,86 t/he being ensured statistically as very significant lower.

Table 2

Dry matter production (t/ha) obtained at full flowering, fertilized variant
(average 2006-2008)

No.	Variant	Average Prod. (t/he)	%	Diff.	Signif.
1.	*Lolium multiflorum*	5,53	99,46	-0,03	-
2.	*Trifolium alexandrinum*	5,90	106,11	0,34	-
3.	*Trifolium incarnatum*	3,50	62,94	-2,06	000
4.	*Trifolium resupinatum*	4,96	89,20	-0,60	-
5.	L.m.75%+T.a.25%	6,66	119,78	1,10	**
6.	L.m.50%+T.a.50%	7,43	133,63	1,87	***
7.	L.m.25%+T.a.75%	6,06	108,99	0,50	-
8.	L.m.75%+T.i.25%	4,90	88,12	-0,66	-
9.	L.m.50%+T.i.50%	5,50	98,92	-0,06	-
10.	L.m.25%+T.i.75%	3,86	69,42	-1,70	000
11.	L.m.75%+T.r.25%	6,06	108,99	0,50	-
12.	L.m.50%+T.r.50%	6,70	120,50	1,14	**
13.	L.m.25%+T.r.75%	5,46	98,20	-0,10	-
14.	Media experienței	5,56	100,00	Martor	-
Dl 5% = 0.76 t/ha Dl 1% = 1.08 t/ha Dl 0.1% = 1.56 t/ha					

Interesting is the behaviour of mixtures of Italian ryegrass and Persian clover because two of the mixture variants (L.m.50% + T.r.50% and L.m.75% + T.r.25%) obtained higher dry matter yields than average experience and pure cultures of component species, and the third variant (L.m.25% + T.r.75%) obtained better results than just pure culture of Persian clover.

From the mixtures of Italian ryegrass and persian clover the best production results were obtained at mixture L.m.50% + T.r.50%, of 6,7 t/he, being significant distinct higher than witness experience.

From behaviour analysis of the four species, cultivated in pure culture and in mixture, for three years, in Timisoara's conditions, can be noticed the fact that in percentage of 50%:50% between species have been obtained the best dry matter productions, in fertilised variant and also in unfertilised variant (fig. 3).

In average for the three experimental years (2006-2008), the best dry matter productions productions have been obtained at mixtures realised from Italian ryegrass var. westerwoldicum and Berseem clover, in both fertilisation variants.

The biggest dry matter production have been registered at mixture L.m.50%+T.a.50%, of 6,76 t/he D.M. in unfertilised variant, respectively 7,43 t/he D.M. in fertilised variant (fig. 3).

In unfertilised variant, the dry matter production of the three mixtures between Italian ryegrass and *Trifolium alexandrinum* is passing the dry matter production, also at Italian ryegrass and also at *Trifolium alexandrinum*, in pure culture, and also the average of experience.

At mixtures between Italian ryegrass var. westerwoldicum and Crimson clover, in average for the three years, the biggest dry matter productions have been obtained at L.m.50%+T.i.50% of 5,0 t/he D.M. in unfertilised variant and of 5,5 t/he D.M. in fertilised variant (fig.3).

Good dry matter production have been obtained and at mixture L.m.75%+T.i.25% of 4,46 t/he D.M. (unfertilised variant), respectively 4,9 t/he D.M. (fertilised variant).

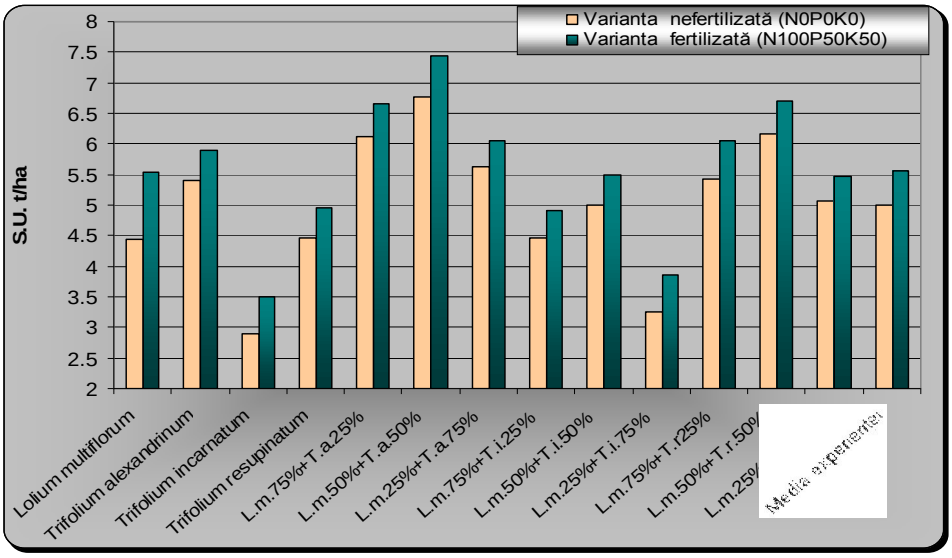

Fig. 3.Dry matter production obtained at full flowering, during the experimental cycle 2006-2008

The best dry matter productions, at mixtures of Italian ryegrass var. westerwoldicum and Persian clover, in average for the three years, have obtained L.m.50%+T.r.50%, with a production of 6,16 t/he D.M. in unfertilised variant and 6,7 t/he D.M. in fertilised variant.

The production of this mixture have been fallowed by L.m.75%+T.r.25% with an average production of 5,43 t/he D.M. in unfertilised variant and 6,06 t/he D.M. in fertilised variant.

We can say that all mixture variants have answered positively at fertilisation, but the best answer had Italian ryegrass var. westerwoldicum and the mixtures in which this one is in equal proportion with annual clovers.

CONCLUSIONS

Lolium multiflorum plant is the most representative in phenotype terms, even if in which it regards the plant height is exceeded by *Trifolium alexandrinum*, and in which it regards the leaf surface is exceeded of crimson clover, still has the highest number of tillers (38.9).

From the annual clovers, the most representative is *Trifolium alexandrinum* plant because it has the highest plant height (51,59 cm) and has a number of 7,5 tillers, higher than crimson clover (6,6 tillers), but lesser than Persian clover (8 tillers).

It was noted that chemical fertilizers application in dose of $N_{100}P_{50}K_{50}$ led to increase of all production elements at all four species, Italian ryegrass remaining best externalized, phenotypically speaking.

The best dry matter production in both fertilization types were obtained at all types of mixtures when species were in proportion of 50%: 50% (L.m.50% + T.a.50%, L.m.50% + T.i.50% and L.m.50% + T.r.50%) because at this mixture proportions, at Italian ryegrass, and also at annual clovers managed to have an adequate number of tillers per plant, this character contributing in the greater extent to achieve the weight at all four plant species.

The highest dry matter yields were recorded at mixture L.m.50% + T.a.50%, of 6,76 t/he DM in the unfertilized variant, respectively 7,43 t/he DM in the fertilized variant.

BIBLIOGRAPHY

1. COJOCARIU LUMINIŢA, MOISUC A., SĂRĂŢEANU VERONICA, HORABLAGA M., MATEOC-SÎRB T., ŞTEFAN V., 2003 - Diferent manifestation of some morphological features influenced by phenophasis in *Lolium multiflorum* species, Analele Universitatii din Oradea, Agricultura-Horticultura, vol.IX,anul IX, Ed.Univ. din Oradea;
2. DRAGOMIR N., PEŢ I., DRAGOMIR CARMEN, 2005 – Pajişti şi plante furajere, Tehnologii de cultivare, Editura Eurobit, Timişoara;
3. DUKE J.A., 1981 - Handbook of Legumes of World Economic Importance, Pleni Press, N.Y.p. 345;
4. OPROI CRISTINA, 2005 – Studiul unor particularităţi agrobiologice şi tehnologice la Trifoiul alexandrin (*Trifolium alexandrinum*), Teză de doctorat, USAMVB Timişoara
5. VARGA P., MOISUC AL. SAVATTI M., SCHITEA M., OLARU C., DRAGOMIR N., SAVATTI M. JR., 1998 - Ameliorarea plantelor furajere şi producerea seminţelor, Ed. Lumina.