PHENOTYPIC CORRELATIONS BETWEEN PRODUCTIVITY ELEMENTS OF RED CLOVER (*TRIFOLIUM PRATENSE* L.)

CORELAȚII FENOTIPICE ÎNTRE ELEMENTELE DE PRODUCTIVITATE LA TRIFOIUL ROŞU (*TRIFOLIUM PRATENSE* L.)

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REZUMAT

Studiul corelațiilor între elementele de productivitate ale trifoiului roşu (producția de masă verde, fân şi sămânță) este un aspect foarte important pentru programele de ameliorare în vederea obținerii de cultivare cu productivitate ridicată.
Corelații pozitive, asigurate statistic, au fost observate la ambele grupe de ploidie, între producția de masă verde şi fân în ambii ani de vegetație. Corelații negative au fost identificate între producția de sămânță şi producția de masă verde la prima coasă a anului al doilea, în cazul diploizilor şi între producția de sămânță şi producția totală de masă verde şi fân a anului întâi de vegetație, în cazul tetraploizilor

Cuvinte cheie: trifoi roşu/corelații fenotipice/elemente de productivitate/ cultivare dipliode şi tetraploide

ABSTRACT

Studying the correlations between productivity elements of red clover (green matter, dry matter and seed yield) is a very important aspect of breeding programs because it helps obtaining highly productive cultivars.
Positive correlations, statistically assured, were observed between green and dry matter yields in both years of vegetation, for both groups of ploidy. Negative correlations were noticed between seed yield and first cut green matter yield in the 2nd year, for diploids and between seed yield and total green and dry matter in the 1st year, for tetraploids.

Key words: red clover/phenotypic correlations/productivity elements/ diploid and tetraploid cultivars

Manuscript received: 5 May 2003.
Accepted for publication: 6 June 2003.

JOURNAL
Central European Agriculture
ISSN 1332-9049

DETAILED ABSTRACT

Correlations are important for the breeder in order to associate all the possible valuable features in the newly created genotypes. The issue of correlations in red clover is still open and it may play an important part for the success of the breeding programs since it allows the elimination of the invaluable biological material even at very early stages and, on the other side, the selection of the valuable genotypes is faster and more accurate.
Studying the correlations between productivity elements of red clover (green matter, dry matter and seed yield) is a very important aspect of the breeding programs because it helps obtaining highly productive cultivars.
To identify these correlations our study was carried out in Cluj-Napoca, between 2000-2001, on a germplasm collection of 45 diploid and 22 tetraploid cultivars, originating from Europe, Asia, America and Oceania.
The green matter, dry matter and seed yield in the first and second year were determined individually for each cultivar. The correlation of the productivity elements was done according to the ploidy groups, using the Bravis-Pearson model of calculating the correlation coefficient
Positive correlations, statistically assured, were observed between green and dry matter yields in both years of vegetation, for both groups of ploidy. Negative correlations were noticed between seed yield and first cut green matter yield in the 2nd year, for diploids and between seed yield and total green and dry matter in the 1st year, for tetraploids.

INTRODUCTION

Correlations are important for the breeder in order to associate all the possible valuable features in the newly created genotypes. The study of correlations in red clover has developed a lot lately considering the biological characteristics of the plant and the great number of internal and external factors that influence them. So far many of the studies have calculated different correlation coefficients between morpho-physiological characteristics **(**Savatti and Magyarosi, 1969; Savatti, 1973; Moisa, 1996), productivity and quality **(**Savatti and Magyarosi, 1969; Savatti, 1973; Mansat, 1996; Muntean, 2002**),** but only statistically assured ones were useful for breeding programs. However, these correlations should not be over appreciated since they can be influenced by other factors, others than genetic correlations (Savatti, 1973).

The purpose of the study of the correlations between productivity elements of red clover (green matter, dry matter and seed yield) is to find out the intensity of these relationships and to help obtaining highly productive cultivars. These correlations have been studied by Lindhard (1921), Nessler (1931), Schwelger et all (1963) Holm (1966), Friden (1966), Mansat et all (1966), Bond (1968), Goral (1968), Savatti (1973), Zapletalova (1993), Berg and Leath (1996), Venuto et all (1996), Jancys (1998), Vliegher et all (1998), but the results have sometimes been contradictory.

The issue of correlations in red clover is still open and it may play an important part for the success of the breeding programs since it allows the elimination of the invaluable biological material even at very early stages and, on the other side the selection of the valuable genotypes is faster and more accurate (Muntean, 2002).

MATERIAL AND METHOD

The research was carried out in the ecological conditions of the University of Agricultural Sciences and Veterinary Medicine - Cluj-Napoca and it lasted for 2 years (2000-2001). We examined 45 diploid genotypes and 22 tetraploid ones belonging to different varieties *expansum* Haussk, *var*. *serotinum* and *var. subnudum* Witte, subvar. *praecox* and *intermedium.*

The productivity elements taken into consideration for identifying correlations were: first year total green matter yield, second year first cut green matter yield, second year second cut green matter yield, second year total green matter yield, first year dry matter yield, second year dry matter yield and second year seed yield. For identifying these elements we used 10 m^2 trial plots for each cultivar. The calculation of correlations was done according to ploidy groups and using the Bravis-Pearson model of calculating the correlation coefficient (Ceapoiu, 1968).

RESULTS AND DISCUSSION

DIPLOID CULTIVARS

Examination of diploid red clover cultivars pointed out very significant positive correlations between total green and dry matter yields in both years of vegetation (Table 1). There was very significant positive correlations between the total green matter yield of the first year and that of the second year (first cut, second cut and the total one), which leads to the conclusion that the most productive forms can be selected even in the first year of vegetation.

The seed yield was positively correlated with total green matter in the first year, the second cut green matter yield in the second year, as well as with the dry matter yield but the correlation coefficients were not statistically assured (Table.1). As increasing seed yield is one of the most important objectives of red clover breeding, its correlations with the other productivity elements shoud be reevaluated in the future (for diploid forms) in order to be used in the breeding programs.

Table 1. The phenotypic correlation coefficients between productivity elements studied in the diploid red clover (*Trifolium pratense* L.) cultivars

Productivity elements	First cut green matter yield in the 2nd year	Second cut green matter yield in the 2nd year	Total yield of green matter in the 2nd year	Total yield of dry matter in the 1st year	Total yield of dry matter in the 2nd year	Seed yield in the 2nd year
Total yield of green matter in the 1st year	0.512***	0.644***	0.675***	0.950***	0.616***	0.120
First cut green matter yield in 2nd year		0.388**	0.895***	0.546***	0.866***	-0.123
Second cut green matter yield in 2nd year			0.758***	0.566***	0.613***	0.173
Total yield of green matter in 2nd year				0.661***	0.910***	-0.002
Total yield of dry matter in 1st year					0.728***	0.154
Total yield of dry matter in 2nd year						0.064

r 5% = 0,288 r 1% = 0,372 r 0,1% = 0,465

TETRAPLOID CULTIVARS

The correlation coefficients calculated for the tetraploid cultivars have shown that this group also has very significant positive correlations between total green and dry matter yields in both years of vegetation (Table 2). Compared to diploids, these cultivars did not have any statistically assured correlations between the green matter yields in the two years, which suggests that selection for highly productive forms cannot start in the first year. However, there were some statistically assured correlations between first and second cut yields in the second year, as well as between these and the total green matter in the second year.

Unlike the diploids, the results obtained in the tetraploids show that seed yield was significantly positively correlated with the second cut green matter yield in the second year, with the total green matter yield in the second year and with the total dry matter yield in the second year (Table 2). The positive correlations, statistically assured between seed yield and second cut green matter yield (2nd year) and total dry matter yield (2nd year) were also identified in more studies (Savatti, 1973; Moisa, 1996) which shows that they can be used successfully for indirectly increasing the seed yield in tetraploids.

Table 2. The phenotypic correlation coefficients between productivity elements studied in the tetraploid red clover (*Trifolium pratense* L.) cultivars

Productivity elements	First cut green matter yield in the 2nd year	Second cut green matter yield in the 2nd year	Total yield of green matter in the 2nd year	Total yield of dry matter in the 1st year	Total yield of dry matter in the 2nd year	Seed yield in the 2nd year
Total yield of green matter in the 1st year	0.384	0.313	0.371	0.876***	0.293	-0.411
First cut green matter yield in 2nd year		0.795***	0.956***	0.391	0.855***	0.366
Second cut green matter yield in 2nd year			0.938***	0.334	0.846***	0.459*
Total yield of green matter in 2nd year				0.386	0.898***	0.431*
Total yield of dry matter in 1st year					0.518**	-0.324
Total yield of dry matter in 2nd year						0.423*

r 5% = 0,423 r 1% = 0,537 r 0,1% = 0,652

CONCLUSION

OVERALL

The interaction between the studied morpho-physiological characteristics was proved by the different intensities of the correlation coefficients.

Correlation coefficients calculated for red clover have shown the existence of very significant positive correlations between total green and dry matter, in both years of vegetation. This aspect proves that green matter highly productive cultivars are rich as well in nutritive elements.

More than that, positive, statistically assured correlation coefficients between total dry matter in the first and second year suggest that identification of valuable forms for dry matter is possible in the first year.

In the second year of vegetation, there were positive correlations, statistically assured between red clover forage productivity elements, which is a favorable aspect for breeding programs because green matter highly productive forms can be selected even at the first cut.

DIPLOID CULTIVARS

Positive correlations that existed between red clover green and dry matter yield in the first and second year prove that the most productive forms can be selected starting with the first year of vegetation.

TETRAPLOID CULTIVARS

The seed yield of red clover was positively correlated with total green and dry matter in the second year; therefore, we can indirectly increase seed yield by selection for green matter highly productive forms in the 2nd year of vegetation.

REFERENCES

[1]. Berg, C.C.; Leath, K.T., 1996, Responses of red clover cultivars to Stemphylium leaf spot, Crop-Science, 36: 1, p.71-73; 12 ref
[2]. Bond, B.A., 1968, Variation between tetraploid red clover plants in corolla tube length and heigh of nectar, J. Agric., Sci, 71, p. 113-116
[3]. Ceapoiu, N.; 1968; Metode statistice aplicate în experienţele agricole şi biologice, Ed. Agro-Silvică, Bucureşti
[4]. Friden, P., 1966, Some studies on bumbble bees in captivity, Bee World, 47 (1), p. 151-166
[5]. Goral, S., 1968, Wplyw noktarowanieioblotnowodon na osadzonie nasion u di i tetraploidalnoj konczyny czerwonej (*T. pratense* L.), I. Nactarowanie. Rocz. Nauk. Roln. Ser. A. Rosl. 94, p. 457-473
[6]. Holm, S.N., 1966, The utilization and management of bumble bee for red clover and alfalfa seed production, A. Rev. Ent. 11, p. 155-158
[7]. Jancys, Z, 1998, Relationship between the resistance of red clover, *Trifolium pratense* L., to oxalate and to *Sclerotinia trifoliorum* Erikss, Biotechnology in plant breeding. Proceedings of a scientific conference, Lithuanian University of Agriculture, Vilnius, Lithuania, 8-9 October 1998, p.71-76, 9 ref.
[8]. Lindhard, E.; 1921; Der Rotklee (*Trifolium pratense* L.), bei naturlicher und kunstlicher und kunstlicher zuchtwahl, Pfl. zuchtung 8, 85-120
[9]. Mansat, P., Picard, J.; Barthon F., 1966, Value of selection at diploid level before tetraploidization, X Inter. Grass. Congr., Finland.
[10]. Moisa, F.; 1996, Studiul variabilităţii unor caractere cantitative şi însuşiri calitative la trifoiul roşu (*Trifolium pratense* L.) în vederea ameliorării lui; Teză de doctorat, USAMV Cluj-Napoca
[11]. Muntean, L.; 2002, Studiul resurselor genetice de trifoi roşu *(Trifolium pratense* L.*)* în vederea ameliorării; Teză de doctorat, USAMV Cluj-Napoca
[12]. Nessler, H.; 1931; Der rotklee (*Trifolium pratense*), Wiss. Arch. Landw. A 5, p. 647
[13]. Savatti, M., 1973, Contribuţii la biologia trifoiului roşu (*Trifolium pratense* L.) în vederea ameliorării, Teză de doctorat, Institutul agronomic Cluj
[14]. Savatti, M.; Magyarosi, T., 1969, Corelaţii între caracterele morfologice şi însuşirile productive ale trifoiului roşu (*T. pratense* L.), Lucr. ştiinţ. vol xxv, Seria Agricultură, Inst. Agr. Cluj
[15]. Schwelger et all., 1963, Die Kennblattgrosse bei tetraploiden Rotklee (*Trifolium pratense* L.) ales Mermal zur Fruhselection auf Ertrag, Pfl. zuchtung, 50, 1, p. 199-231
[16]. Venuto, B.C.; Smith,R.R.; Grau, C.R., 1996, Temperature dependent reaction and selection response of two red clover populations to Fusarium wilt, Crop-Science, 36: 6, p.1477-1481; 18 ref
[17]. Vliegher, A.DE.; Van Waes, C.; Carlier, L.; De Vliegher, A.; 1998, Quality evaluation of red clover varieties in Belgium, Rasteniev"dni-Nauki. , 35: 9, p.729-730; 3 ref
[18]. Zapletalova, I., 1993, Production ability of red clover (*Trifolium pretense* L.) cultivars, Plant-Genetic-Resources (Slovakia). Czechoslovak board on plant genetic resources, annual report 1992, p. 24-27. 5 tables; 3 ref

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