THE STUDY OF THE MAIN PRODUCTION CHARACTERS DEPENDING ON DOSE OF CATTLE MANURE APPLIED TO ITALIAN RYEGRASS

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Abstract: *The purpose of this paper is to analyze the main production characters of the Italian ryegrass, under the influence of some doses of cattle manure. It is intended the cultivation of Italian ryegrass varieties, from which the whole plant is used in animal feeding, both as green fodder and dry fodder, so that the production elements to be the best expressed. [9]. Therefore the research directions to increase the Italian ryegrass productivity are directed towards increasing the vegetative mass that provides a large quantity of feed. [2]. The researchers in agricultural fields work with biological materials with a great variability, with many uncontrollable environmental influences because the most studied characters represent the result of complex interactions between plant genotype (often heterogeneous itself) and many factors that determine the soil fertility, plant water supply, degree of infestation with various diseases and pests etc.. The production of feed is determined by the all aerial vegetative parts of the plants, which consist of several morpho-anatomical elements. A simple calculation of the yearly production of forage can be done by multiplying the number of plants per hectare, the number of shoots / plant, the weight of shoots and the number of harvests per year. Of great importance for production are also other characters such as foliar surface, assimilation rate of dry matter, phenotypically expressed by regeneration and fast-growing, shoot richness, plant height, resistance to diseases and to unfavorable environmental conditions [7]. The shoots represent the basic element of fodder production as grain is the basic element of wheat production. Numerous, vigorous and rapidly growing shoots means a high production of forage. The shoot number of a plant is a very important character, with a pronounced variability. [3]. The plant height is one of the main objectives in improvement programs because it is responsible for the production of feed. The higher total surface of the leaves in relation to the development of stem, flowers, seeds and root is, the larger production of dry matter will be. The results regarding the main production characters studied in bearded ryegrass, depending on applied doses of cattle manure, in conditions of Timisoara, can be summarized as following: the Italian ryegrass valuates very well the cattle manure. The greatest values of the analyzed characters there were registered at the maximal dose of cattle manure - 80 t/ha. However, from economically point of view, we not recommend this doze, because very well results could be obtain up to dose of 60 t/ha.*

Key words: italian ryegrass , number of shoots per plant, plant height, foliar surface, plant weight

INTRODUCTION

Lolium multiflorum L. cultivation is mentioned from the beginning of XIX century, for the first time in Italy, and then was spread in all European countries and in entire world [1].

In Romania, it is cultivated for a long time ago, but the cultivated area in the last time registered a decreasing of this crop area.

The spreading of this plant culture is influenced by certain great biological features as shooting capacity and regeneration, some of the most important.

Lolium multiflorum L. is a forage plant with short vegetation period, high digestibility and palatability that make it valuable and important in the forage systems. This plant is used sometimes to create a rapid cover of a surface, or when there is necessary to obtain forage

quantities in a short time. Some of the features of *Lolium multiflorum* L. are: high yield potential, rapid installation; can be used on wet soils [4,5].

MATERIAL AND METHODS

The experiments were performed in the experimental field of the discipline of Meadow and forage plant cultivation from the Experimental Didactic Station of the University of Agricultural Sciences and Veterinary Medicine of the Banat Timisoara. The soil where the experiments had been placed is a cambic chernozem.

The evolution of climatic resources within the period 2007-2009 distinguishes their oscillatory character, with notable deviations from the multi-annual mean value.

Table 1

The monthly mean temperatures (°C) registered at Meteorological Station of Timişoara

SPECIFICATION	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2007	4,4	5,5	8,6	12,7	18,3	22,4	24,22	23,0	14,8	10,7	4,2	
2008	1,02	3,71	7,62	12,4	17,8	21,6	21,9	22,6	15,4	12,25	7,07	
2009	-1,1	1,4	6,6	14,7	18,0	20,1	23,1	22,9	19,0	11,6	7,3	3,2
Multi-annual means	-1,2	0,4	6,0	11,3	16,4	19,6	21,6	20,8	16,9	11,3	5,7	1,4

The temperatures recorded in the air and soil had high values in all three experimental years. The monthly means of air temperature exceeded the multi-annual means, the mean temperature being under the multi-annual mean (table 1). All these high temperatures, on the background of non-uniformly ranged precipitations during the vegetation period (table 2) led to production oscillations in the years of research.

Table 2

The monthly mean precipitations (mm) registered at Meteorological Station of Timişoara (2007-2009)

SPECIFICATION	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2007	26,4	92,0	56,8	4,2	69,4	65,2	46,4	65,0	62,1	53	13,8	
2008	21,00	8,8	61,4	44,7	49	157	45,7	24,8	51,5	14,8	43,1	
2009	28,3	25,4	48,2	22,8	44,8	110,9	40,4	28,4	4,8	80,4	102,1	79,4
Multi-annual means	40,9	40,2	41,6	50,0	66,7	81,1	59,9	52,2	46,1	54,8	48,6	47,8

The plant cultures had been seeded in the springtime (2007-2009) in closed rows, using the kind Wesley of *Lolium multiflorum* var. Weaterwoldicum.

The cattle manure had been applied in the autumn in doses of 20, 40, 60, 80 t/ha. We analyzed the main characters and features of the Italian ryegrass in the phenophase 61 – at the beginning of blooming (uniform decimal code BBCH – for grasses - U. MEIER, 2001).

For the sake of simplicity, in our statistical analysis, the quantity of manure, number of shoots per plant, plant height, foliar surface and plant weight were respectively noted as Gr, NrFr, H, S, GrT. The statistical analysis has been performed by STATISTICA 8 package [6, 8].

RESULTS AND DISCUSSIONS

For the Italian ryegrass from which is used in animal foraging the whole plant, both as green plant and hay, there is in view the cultivation of kinds with production element the best expressed. Of great importance are the characters: foliar surface, shoot number, plant height. Therefore, for the Italian ryegrass the productivity directions are pointed toward increasing of vegetative mass which will assure a large quantity of forage.

In the figure 1, we present the ratio between plant height and shoot number. It can be observed on the picture that the largest number of shoots had been registered in the variant with 80 t/ha of cattle manure, where also had been observed the largest height of the shoots

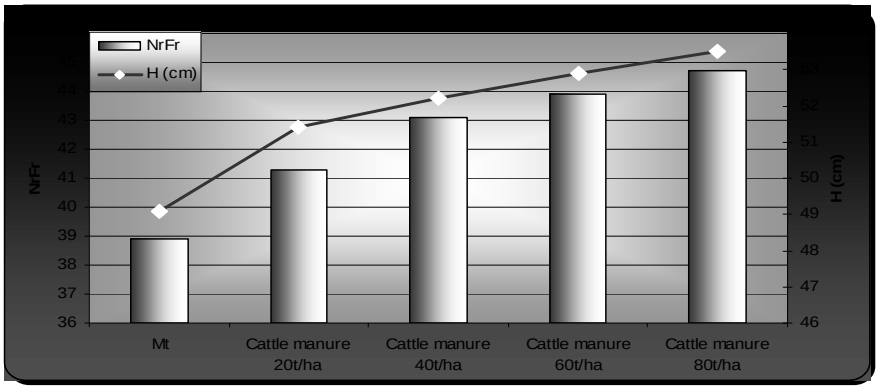

Figure no. 1. Ratio between shoot number and shoot height at Italian ryegrass

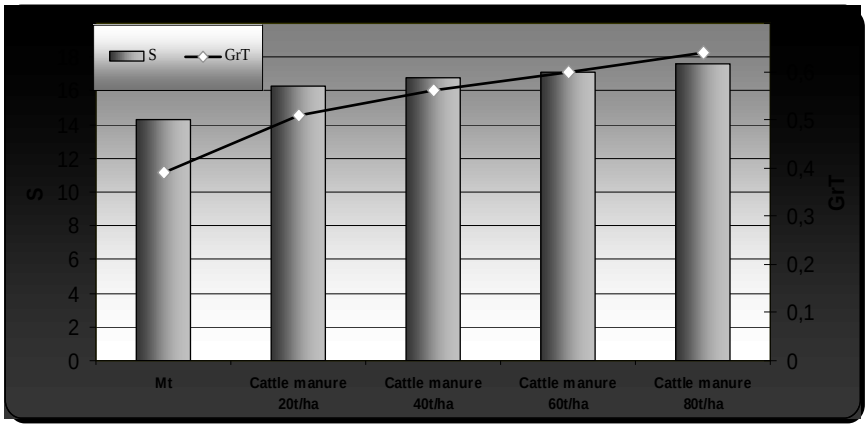

Figure no. 2. Ratio between foliar surface/plant and plant weight at Italian ryegrass

The larger is the total surface of the leaves related to stem development, flower, seed and root development, the largest will be the yield and the dry substance. The photosynthesis and its relation with the yield present a special interest, practically being the unique physiological process through which the green plants synthesize their own organic substances aided by light.

In the case of Wesley kind of bearded ryegrass, the foliar surface of the analyzed variants were comprised between 14.3 cm² in the control variant and 17,6 cm² in the variant with 80 t/ha of cattle manure.

As can be observed in the figure 2, the plant weight of bearded ryegrass, in the specific conditions of Timişoara, progressively increases by applying the fertilizers consisting of cattle manure and also concomitantly with the increasing of foliar surface (figure 2).

The goal of this paper is to test the functional dependence of the main production characters of the Italian ryegrass on different quantities of cattle manure.

A linear regression analysis of the shoot number per plant depending on different quantities of manure was performed in order to test whether the shoot number per plant is statistically significant (Table 3).

Table 3

Univariate Tests of Significance for NrFr

Effect	Univariate Tests of Significance for NrFr				
	SS	Degr. Of Freedom	MS	F	P
Intercept	2605,686	1	2605,686	5904,122	0,000005
Gr	20,164	1	20,164	45,689	0,006615
Error	1,324	3	0.441		

It was determined that the proportion of variance for the shoot number per plant (2605) was statistically significant (F=5904, df=1) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance.

The regression equation $y=b_0+b_1x$ is the linear equation used to fit the best straight line to the data (Figure 3). The dependent variable NrFr was expressed (Table 4) as the equation: NrFr = 39,54 + 0,071*Gr.

The 95% confidence interval for the slope 0,071 was (+0,03, +0,10) which represents the lower and upper bounds for the unstandardized regression coefficient. We noted that the 95% confidence interval does not include 0 suggesting that the slope is significantly different than 0 which means there is a linear relationship between Gr and NrFr.

Table 4

Parameter Estimates

Effect	Parameter Estimates					
	NrFr Param.	NrFr Std.Err	NrFrt	NrFrP	-95,00% Cnf.Lmt	+95,00% Cnf.Lmt
Intercept	39,54000	0,514587	76,83829	0,000005	37,90235	41,17765
Gr	0,07100	0,010504	6,75935	0,006615	0,03757	0,10443

In fact, the strong positive linear correlation was reported by the Pearson coefficient r=+0,96 and determination coefficient r^2=0,93 (Figure 3).

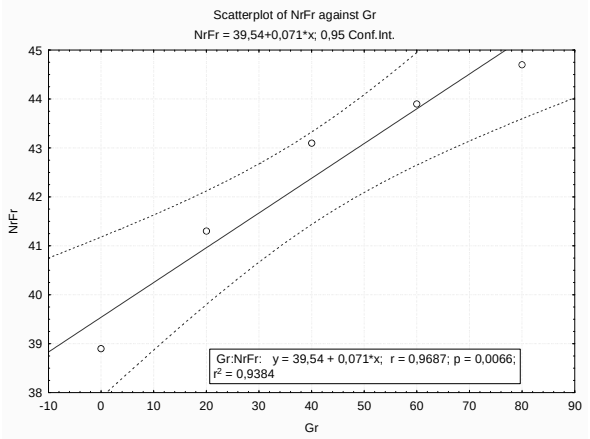

Figure 3 – Scatterplot of NrFr against Gr

A linear regression analysis of the plant height of plant depending on different quantities of cattle manure was also performed in order to test whether the plant height is statistically significant (Table 5).

Table 5

Univariate Tests of Significance for H

Effect	Univariate Tests of Significance for H				
	SS	Degr. of Freedom	MS	F	P
Intercept	4126,763	1	4126,763	11265,05	0,000002
Gr	10,609	1	10,609	28,96	0,012568
Error	1.099	3	0.366		

It was determined that the proportion of variance in the plant height (4126) was statistically significant (F=11265, df=1) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance.

The regression equation $y=b_0+b_1x$ is the linear equation used to fit the best straight line to the data (Figure 4). The dependent variable H was expressed (Table 6) as the equation: H = 49,76 + 0,051*Gr.

Table 6

Parameter Estimates

Effect	Parameter Estimates					
	H Param.	H Std.Err	H t	H P	-95,00% Cnf.Lmt	+95,00% Cnf.Lmt
Intercept	49,76000	0,468828	106,1369	0,000002	48,26798	51,25202
Gr	0,05150	0,009570	5,3814	0,012568	0,02104	0,08196

The 95% confidence interval for the slope 0,051 was (+0,02, +0,08) which represents the lower and upper bounds for the unstandardized regression coefficient. We noted that the 95% confidence interval does not include 0 suggesting that the slope is significantly different than 0 which means there is a linear relationship between Gr and H. In fact, the strong positive linear correlation was reported by the Pearson coefficient r=+0,95 and determination coefficient r^2=0,90 (Figure 4).

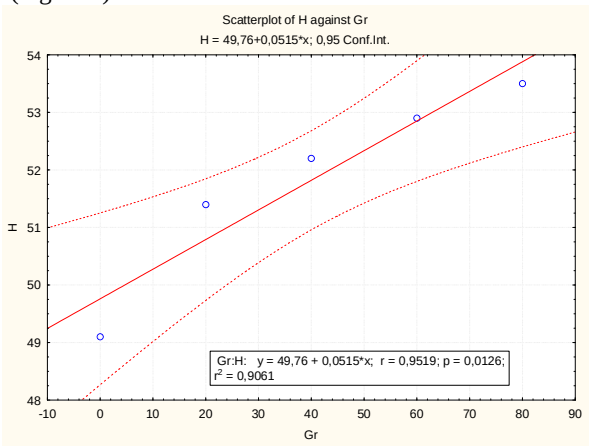

Figure 4 - Scatterplot of H against Gr

To test whether the plant weight is statistically significant (Table 7) a linear regression analysis of the plant weight depending on different quantities of cattle manure was also performed. It was determined that the proportion of variance in the plant weight (0,29) was statistically significant (F=343, df=1) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance.

Table 7

Univariate Tests of Significance for GrT

Effect	Univariate Tests of Significance for GrT				
	SS	Degr. of Freedom	MS	F	P
Intercept	0,296807	1	0,296807	343,7915	0,000342
Gr	0,034810	1	0,034810	40,3205	0,007901
Error	0.002590	3	0.000863		

The regression equation $y=b_0+b_1x$ is the linear equation used to fit the best straight line to the data (Figure 5). The dependent variable GrT was expressed (Table 8) as the equation: H = 0,422 + 0,002*Gr.

Table 8

Parameter Estimates

Effect	Parameter Estimates					
	GrT Param.	GrT Std.Err	GrT t	GrT P	-95,00% Cnf.Lmt	+95,00% Cnf.Lmt
Intercept	0,422000	0,022760	18,5412	0,000342	0,349569	0,494431
Gr	0,002950	0.000465	6,34984	0,007901	0,001472	0,004420

The 95% confidence interval for the slope 0,002 was (+0,001, +0,004) that represents the lower and upper bounds for the unstandardized regression coefficient. We noted that the 95% confidence interval does not include 0 suggesting that the slope is significantly different than 0 which means there is a linear relationship between Gr and GrT. In fact, the strong positive linear correlation was reported by the Pearson coefficient r=+0,96 and determination coefficient r^2=0,93 (Figure 5).

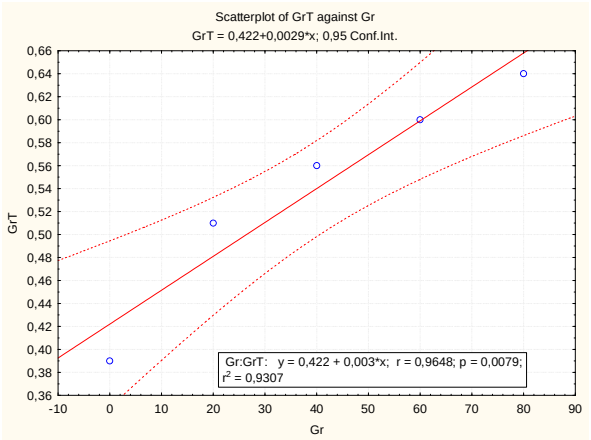

Figure 5 – Scatterplot of GrT against Gr

A linear regression analysis of the foliar surface of plant depending on different quantities of cattle manure was performed in order to test whether the foliar surface is statistically significant (Table 9).

Table 9

Univariate Tests of Significance for S

Effect	Univariate Tests of Significance for S				
	SS	Degr. Of Freedom	MS	F	P
Intercept	372,0060	1	372,0060	1081,413	0,000062
Gr	5,4760	1	5,4760	15,919	0,028196
Error	1,0320	3	0,3440		

It was determined that the proportion of variance in the foliar surface (372) was statistically significant (F=1081, df=1) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance.

The regression equation $y=b_0+b_1x$ is the linear equation used to fit the best straight line to the data (Figure 6). The dependent variable S was expressed (see Table 10) as the equation: S = 14,94 + 0,037*Gr.

Table 10

Parameter Estimates

Effect	Parameter Estimates					
	S Param.	S Std.Err	S t	SP	-95,00% Cnf.Lmt	495,00% Cnf.Lmt
Intercept	14,94000	0,454313	32,88484	0,000062	13,49417	16,38583
Gr	0,03700	0,009274	3,98981	0.028196	0,00749	0,06651

The 95% confidence interval for the slope 0,037 was (+0,007, +0,06) that provides the lower and upper bounds for the unstandardized regression coefficient. We noted that the 95% confidence interval does not include 0 suggesting that the slope is significantly different than 0 which means there is a linear relationship between Gr and S. In fact, the strong positive linear correlation was reported by the Pearson coefficient r=+0,91 and determination coefficient r^2=0,84 (Figure 6).

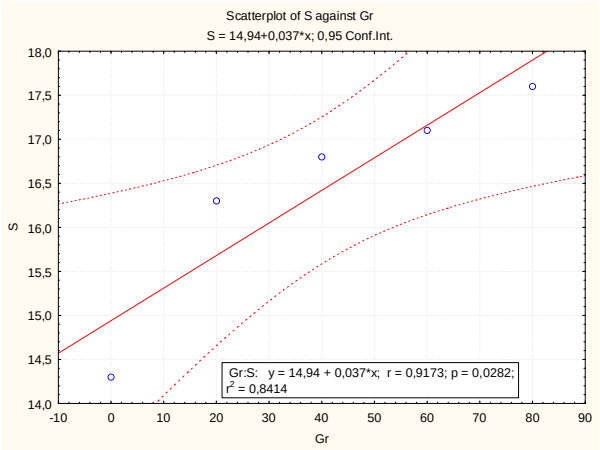

Figure 6 – Scatter plot of S against Gr

CONCLUSIONS

The results regarding the main production characters studied in bearded ryegrass, depending on applied doses of cattle manure, in conditions of Timisoara, can be summarized as following:

- The Italian ryegrass valuates very well the cattle manure. The greatest values of the analyzed characters there were registered at the maximal dose of cattle manure - 80 t/ha. However, from economically point of view, we not recommend this doze, because very well results could be obtain up to dose of 60 t/ha.

- There are strong positive linear correlations between the manure dose and main production characters of the Italian ryegrass. Based on these correlations we determined the functional dependence by the regression line equations between the manure dose and the number of shoots per plant, high waist, plant weight and foliar surface of plant respectively. The 95% confidence intervals and the statistical significance of the models were pointed out.

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