

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

COJOCARIU Luminita, Al. MOISUC, I. SAMFIRA, N. M. HORABLAGA, V. D. LALESCU, M. F. MARIAN

*Banat's University of Agricultural Sciences and Veterinary Medicine from Timișoara
Calea Aradului, no. 119, Romania
Email: luminitacojocariu@yahoo.com*

Abstract

The goal of this paper is to find a functional dependence of the main production characters of the Italian ryegrass based on different quantities of cattle manure in order to get the technical maximum.

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 Italian ryegrass, depending on applied doses of cattle manure, in conditions of Timișoara, can be summarized as following: the Italian ryegrass values very well the cattle

manure. The greatest value of the plant weight 0,64 kg was registered at 90 t/ha of cattle manure, the greatest value of the foliar surface was registered at 68,91 t/ha of cattle manure, the greatest value of the plant height was registered at 84,58 t/ha of cattle manure and the greatest value of the shoot number of plant was registered at 93,57 t/ha.

Keywords: italian ryegrass , number of shoots per plant, plant height, foliar surface, plant weight, technical maximum.

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 METHOD

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.

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).

Table 1

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

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	24,2	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	12,2	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

Table 2

The monthly mean precipitations (mm) registered at Meteorological Station of Timișoara (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

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.

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 denoted by G, NrFr, H, S, Gr. The statistical analysis has been performed by STATISTICA 8 package [6, 8].

RESULT AND DISCUSSION

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

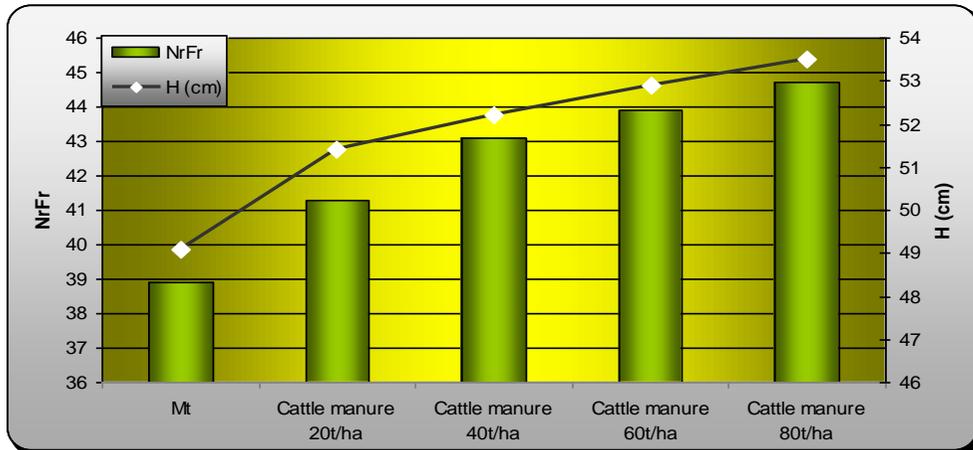


Figure no. 1. Ratio between shoot number and shoot height at Italian ryegrass

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 Italian 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 Italian ryegrass, in the specific conditions of Timișoara, progressively increases by

applying the fertilizers consisting of cattle manure and also concomitantly with the increasing of foliar surface.

However, it is important to know for which dose of cattle manure these production elements are able to express the maximal value.

The goal of this paper is to find a functional dependence of the main production characters of the Italian ryegrass based on different quantities of manure in order to get the technical optimum.

A parabolic regression analysis of plant weight based on different quantities of manure was performed (see

Table 3). It was determined that the proportion of variance in the plant weight (0,1785) was statistically significant (F=679,

df=1) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance

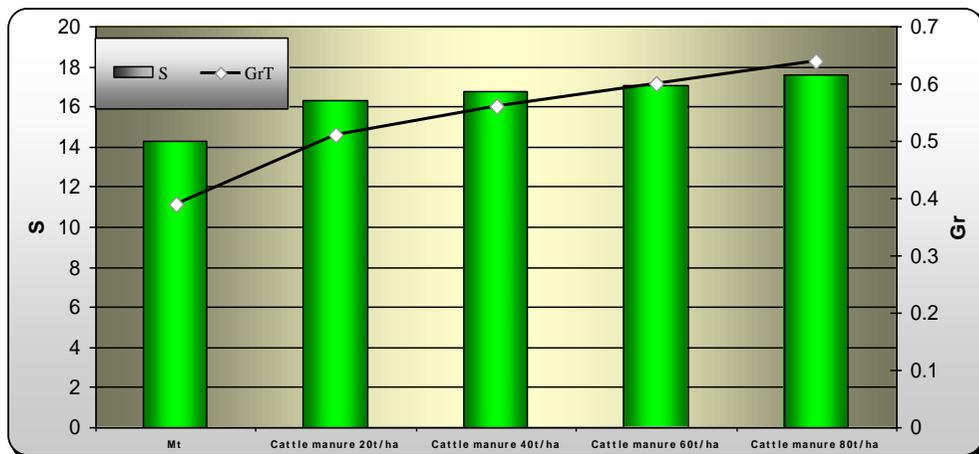


Figure no. 2. Ratio between foliar surface/plant and plant weight at Italian ryegrass

Tabel 3

Parabolic regression analysis of the plant weight based on the manure quantity - ANOVA

Effect	Univariate Tests of Significance for Gr				
	SS	Degr. of Freedom	MS	F	P
Intercept	0.178537	1	0,178587	679.4053	0,001469
G	0009310	1	0 009310	35.4204	0.027090
G^2	0.002064	1	0.002064	7.8533	0.107239
Error	0 000526	2	0 000263		



Figure no. 3. Parabolic line regression of the plant weight based on the manure quantity

The regression equation $y=b_0+b_1x+b_2x^2$ was used to fit the best parabolic line to the data (see Figure 3). The dependent variable Gr was expressed as the equation

$$Gr = 0,3977 + 0,0054*G - 0,00003*G^2,$$

The strong positive linear correlation, after the linearization, was reported by the Pearson coefficient $r=+0,99$ and determination coefficient $r^2=0,98$. The local extreme for the parabolic line in Figure 1 was obtained by calculating the

first derivative of the quadratic function above and has the value 90.

A parabolic regression analysis of the foliar surface based on different quantities of manure was performed (see Table 4). It was determined that the proportion of variance in the foliar surface (236,81) was statistically significant ($F=1575$, $df=1$) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistical significance.

Tabel 4

Parabolic regression analysis of the foliar surface based on the manure quantity - ANOVA

Effect	Univariate Tests of Significance for S				
	SS	Degr. of Freedom	MS	F	P
Intercept	236,818	1	236,818	1575.786	0.000634
G	2.2019	1	2.2019	14.652	0,061975
G ²	0.7314	1	0.7314	4,867	0.158128
Error	0.3006	2	0.1503		

The regression equation $y=b_0+b_1x+b_2x^2$ was used to fit the best parabolic line to the data (see Figure 4). The dependent variable S was expressed as the equation

$$S = 14,4829 + 0,0827*G - 0,0006*G^2,$$

The strong positive linear correlation, after the linearization, was reported by the Pearson coefficient $r=+0,97$ and determination coefficient $r^2=0,95$.

The local extreme for the parabolic line in Figure 2 was calculated by vanishing the first

derivative of the quadratic function above and has the value 68.91.

A parabolic regression analysis of the plant height based on different quantities of manure was performed (see Table 5). It was determined that the proportion of variance in the plant height (2739,65) was statistically significant ($F=24461$, $df=1$) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistical significance.

The technical maximum of the main production characters depending on dose of cattle manure applied to italian ryegrass

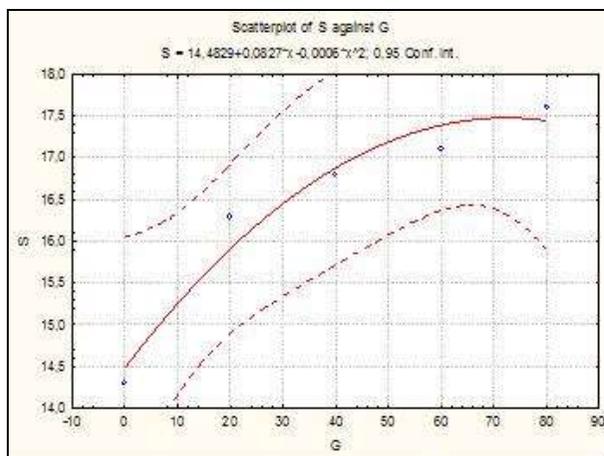


Figure no.4. Parabolic line regression of the foliar surface based on the manure quantity

Tabel 5

Parabolic regression analysis of the plant height based on the manure quantity - ANOVA

Effect	Univariate Tests of Significance for H				
	SS	Degr. of Freedom	MS	F	P
Intercept	2739.651	1	2739.651	24461.17	0,000041
G	3 316	1	3.316	29.60	0,032158
G^2	0.875	1	0,875	7.81	0.107712
Error	0.224	2	0.112		



Figure no.5. Parabolic line regression of the plant height based on the manure quantity

The regression equation $y=b_0+b_1x+b_2x^2$ was used to fit the best parabolic line to the data (see Figure 5). The dependent variable H was expressed as the equation

$$H = 49,26 + 0,1015 \cdot G - 0,0006 \cdot G^2$$

The strong positive linear correlation, after the linearization, was reported by the Pearson coefficient $r=+0,99$ and determination coefficient $r^2=0,98$. The local extreme for the parabolic line in Figure 3 was calculated by vanishing the first derivative of the quadratic

function above and has the value 84.58.

A parabolic regression analysis of the shoot number of plant based on different quantities of manure was performed (see Table 6). It was determined that the proportion of variance in the shoot number of plant (1711,97) was statistically significant ($F=53499$, $df=1$) for p value under 0,05 (95% confidence interval), where the F ratio provided the test of statistically significance.

Tabel 6

Parabolic regression of shoot number of plant based on the manure quantity - ANOVA

Effect	Univariate Tests of Significance for NrFr				
	SS	Degr. of Freedom	MS	F	P
Intercept	1711.978	1	1711,978	53499.32	0.000019
G	5523	1	5 623	172,60	0,005744
G^2	1260	1	1260	39,37	0024469
Error	0.064	2	0.032		

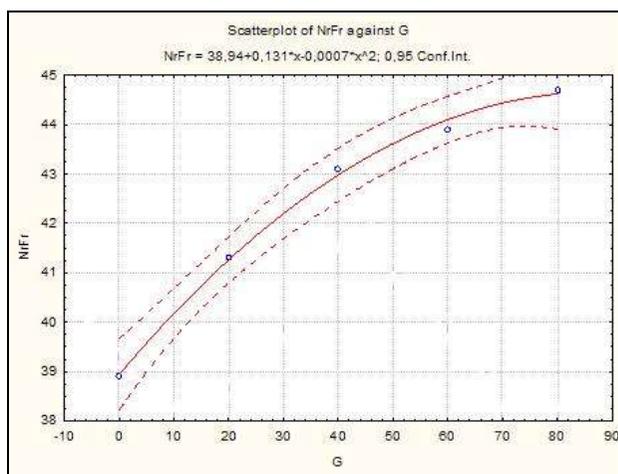


Figure no.6. Parabolic line regression of shoot number of plant based on the manure quantity

The regression equation $y=b_0+b_1x+b_2x^2$ was used to fit the best parabolic line to the data (see Figure 6). The dependent variable NrFr was expressed as the equation

$$\text{NrFr} = 38,94 + 0,131 * G - 0,0007 * G^2,$$

The strong positive linear correlation, after the

linearization, was reported by the Pearson coefficient $r=+0,99$ and determination coefficient $r^2=0,99$. The local extreme for the parabolic line in Figure 4 was calculated by vanishing the first derivative of the quadratic function above and has the value 93.57.

CONCLUSIONS

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

- The Italian ryegrass values very well the cattle manure. The greatest value of the plant weight 0,64 kg was registered at 90 t/ha of cattle manure, the greatest value of the foliar surface was registered at 68,91 t/ha of cattle manure, the greatest value of the plant height was registered at 84,58 t/ha of cattle manure and the greatest value of the shoot number of plant was registered at 93,57 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.

After linearization, there are strong positive correlations between the manure dose and the main production characters of the Italian ryegrass. Based on these correlations we determined the functional dependence by the regression parabolic 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.

This study presents a remarkable practical importance, because it allows us to recommend the dose of cattle manure for which is possible to obtain the maximal production at *L.m.* in the specific conditions from Banat.

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