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STUDY OF THE EFFECT OF ORGANIC FERTILIZER SIAPTON ON PRODUCTIVITY OF OIL ROSE (*Rosa damascena* Mill.)

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Abstract

The aimed of the study is to investigate the effect of nourishment and irrigation on the productivity of oleaginous rose (Rosa damascena Mill). *The study was conducted with a bio-fertilizer based on natural hydrolyzed Siapton proteins. The observations were carried out under irrigated and non-irrigated conditions. The field experiment was performed in the field of experience of the Institute for roses, aromatic and medicinal plants, Kazanlak, Bulgaria in the period 2015-2017. The treatment was done twice with in a period of 20 days, of foliage in the following variants: Siapton treated 1500 ml/ha, Siapton treated 2500 ml/ha, Siapton treated 3500 ml/ha. The biometric analysis shows an increase in mass and color diameter of the treated variants. The correlation relationships obtained indicate the degree of the influence of each indicator in the formation of yields in oleaginous rose under the irrigation conditions considered. The linear regression models are expressing the influence of the indicator of yield, enabling theoretically how to determine and also in which direction it have to be change this indicator contributes to improved yield.*

Key words*: damask rose, organic fertilizer, rose oil, irrigation, correlation.*

INTRODUCTION

Rose production is a traditional industry in Bulgaria. The oleaginous rose (*Rosa damascena* Mill.) Is a crop of priority economic importance to the country. According to the Ministry of Agriculture, about 4,500 ha are occupied by oleaginous rose. Bulgaria is the world-recognized supplier of the highest quality rose oil. Since the beginning of 2020 the law act guarantees the quality and price of Bulgarian oleaginous rose. The requirments for propagating matelia and the varietal of which can be produced rose oil has been advertised.
Extremely rich is the choice of cosmetics and food products created on the basis of rose oil and rose water from Bulgarian rose. Products from oleaginous rose is used in perfumery and cosmetics. The pharmaceutical oleaginous rose industry is included in drugs production for eyes, stomach, skin and dental diseases.
The climatic conditions in the country are favorable for obtaining high yields and quality rose oil. In addition, oleaginous rose plantations (*Rosa damascena* Mill.) Also perform anti-erosion functions (Kovacheva et al., 2010). Climate change towards global warming and drought has created a strain on water resources. Water deficit during crop vegetation impedes growth, development, productivity and quality of yields. Optimizing irrigation and nutrition in the oilseed rose (*Rosa damascena* Mill.) is a condition for improving productivity.
The application of soil absorber Terawet, when creating a new plantation, has a positive effect on the rate of uptake and survival of young plants during the growing season, established Kovacheva (2011). This can save the extra watering needed for young plants when planting. Soil improvers serve as a reservoir of soil moisture and reduce the risk of plant deaths in water shortages (De Boodt, 1990; Johnson and Leah, 1990; Yangyuru et al, 2006). Rose plants require well-aerated soils with a large humus horizon (Pal et al., 2013). Improving the diet influences the formation of vegetative growth of shrubs, Lambev points out in his study (Lambev, 2011). The use of Humus Life Universal in dose of 300 ml/da contributes to a 7% to 11% increase in rose yields.
Production efficiency is related to the application of appropriate modern agrotech-nical approaches in the cultivation of

oleaginous rose (*Rosa damascena* Mill.). Proper agrotechnology is a guarantee for obtaining a specific composition of rose oil and authentic rose aroma. All this involves soil tillage, pesticide treatment, and mechanization of the technological process is particularly important (Mihov et al., 2015; Bozhkov et al., 2017).

In this study, we aim to examine the effect of nourishment and irrigation on the productivity of the oleaginous rose (*Rosa damascena* Mill). Applying mathematical approaches to determine the correlation between qualitative indicators to make a more objective assessment. Using the possibilities of the regression analysis to express the influence between the indicators and the trends for improving the yield of pink color and rose oil.

MATERIALS AND METHODS

The field experiment was performed in the experimental field of the Institute for roses, aromatic and medicinal plants, Kazanlak, Bulgaria. During the period 2015-2017, the impact of a specialized bio-fertilizer on the vegetative growth and productivity of the oleaginous rose was tested. The study was conducted with a bio-fertilizer based on natural hydrolyzed proteins "Siapton". Observations were recorded under irrigation and non-irrigation conditions. The experiment is based on the Zade method (by the method of long plots), in four variants of five repetitions. Size of the test plot 25 m^2.

The field experiment was conducted under the conditions of leached forest soils. During the vegetation of oleaginous rose, variety "Svezhen", treatments with bio-fertilizer were carried out. The treatment was done by foliage twice with a period of 20 days in the following variants: Siapton treated -1500 ml/ha, Siapton treated 2500 ml/ha, Siapton treated 3500 ml/ha and untreated control. Irrigation is done through a drip irrigation system. From the beginning of the emergence of buttons to the end of flowering, waterings are implemented to maintain the water supply in the soil. By the irrigated variant irrigation rates were done by drip system as the soil moisture contents was maintained minimum in the range of 80 to 85% of the field capacity (FC) in the layer of 0-0.60 m. Dynamics of soil moisture in the layer 0-1.00 m was monitored periodically (once a week) by a weight method.

The bio fertilizer Siapton is a versatile organic fertilizer and biostimulant for leaf and soil applications containing amino acids and peptides. Ingredients: Total nitrogen 9.1%; organic nitrogen 8.7%; Ammonium nitrogen 0.4%; Organic carbon 25%; Total amino acids (of animal origin) 54.4%; Free amino acids 10.0%; Dry matter content 63%.

During the growing season, phenological observations and biometric measurements of the plants were carried out. In the rose plantation, harvesting during flowering is carried out manually. The analysis of the rose oil was recorded using a micro-distillation apparatus - a cleaver. Using gas-chromatophore analysis, the qualitative indicators of variants were established.

Test conditions: Column: capillary length 30 m, diameter 0.32 mm, film thickness of 1.0 μm, oven temp 70°C to 240°C at rise 8°C/min, isotherm at 240°C - 10 min, injector -300°C, detector 300°C. Standards/Validated Methods - Bulgarian State Standard (BSS) ISO 9842-2004, BSS ISO 11024-1.

The mathematical and statistical processing of the empirical data was performed through the SPSS statistical program.

RESULTS AND DISCUSSIONS

In the first and second years of the study, the average daily temperature values were close to those for a multi-year period (1978-2008). In the third year average daily temperatures above the normal were recorded. In terms of size and amount of rainfall, 2015 is favorable for the development of rose plants. Falling rainfall during the period of phenophase budding is in higher quantities, which, in combination with normal temperatures during this period, helps to lay more flower buds in rose bushes.

During the flowering period, precipitation amounts are lower than the norm for many years, but they are sufficient. In 2016, the amount of registered rainfall in May (209 mm) is three times higher than the norm (71 mm). The limited sunshine and the adverse distribution of rainfall have an adverse effect on the quality of rose oil. Meteorologically, the

third year is characterized by rainfall and temperatures close to the norm and favoring the development and flowering of rose bushes.
The analysis of biometric indicators shows an increase in the mass and color diameter of the control variants. The increased vegetation growth and the increase in blossom is due to amino acid fertilizer applications.
The statistical analysis is based on the results of biometric measurements on fresh blossom oleaginous roses - blossom diameter (DM) and blossom weight (Mass) and yield of rosy blossom and essential oil. The experimental data were processed by correlation and regression analysis, with the help of which the correlation between the studied parameters was established and evaluated.
Correlation coefficients expressing the relationship between the studied indicators are indicated in the correlation matrices (Tables 1 and 2).

Table 1. Correlation dependencies under non-irrigation conditions

Indicators	Mass	DM	Yield rose oil	Yield of rosy flower from damask rose (*Rosa damascena* Mill.)
Mass	1.00	0.965**	0.917*	0.897
DM		1.00	0.885	0.939*
Yield rose oil			1.00	0.960**
Yield of rosy flower from damask rose (*Rosa damascena* Mill.)				1.00

Table 2. Correlation dependencies under irrigation conditions

Indicators	Mass	DM	Yield rose oil	Yield of rosy flower from damask rose (*Rosa damascena* Mill.)
Mass	1.00	0.934*	-0.042	0.878
DM		1.00	-0.369	0.676
Yield rose oil			1.00	0.232
Yield of rosy flower from damask rose (*Rosa damascena* Mill.)				1.00

A strong positive correlation was found between Mass and DM, and rose oil yield and rose color, respectively, with correlation coefficients - r = 0.965 and r = 0.960. The correlation between mass and production of rose oil is less pronounced; DM and rosy blossom yield, respectively, with ratios - r = 0.917 and r = 0.939.
Regression analysis was performed at the biometric indicator rose blossom under natural moist supply and under irrigation conditions (Figures 1 and 2). In the figures shown blossom weight is X and blossom diameter is respectively Y.

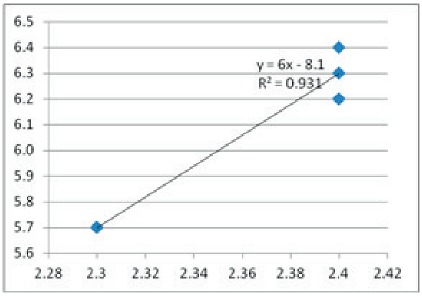

Figure 1. Linear regression model between Mass and DM under natural moist supply

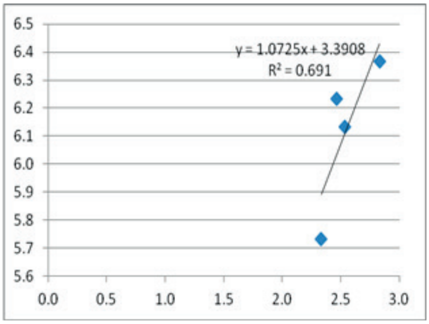

Figure 2. Linear regression model between Mass and DM under irrigation conditions

The correlation coefficient, R^2 is called the coefficient of determination, it shows what percentage of the variance of the resultant variable is explained by the effect of the factor variable. In our case, R^2 = 0.931, i.e. 93.1% of the yield under non-irrigation conditions and R^2 = 0.691, ie 69.1% of the yield under irrigation conditions. In the figures 3 and 4 shown rose oil yield is X and yield rose blossom is respectively Y.
As can be seen, the coefficient of determination is high, which means that the models describe well-observed values in the oleaginous rose. We can assume that the linear regression model is adequate.

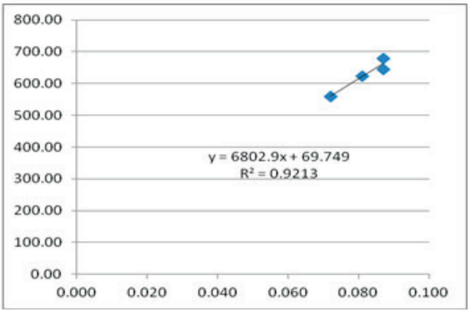

Figure 3. Linear regression model between rose oil yield and yield rose blossom under natural moisture supply

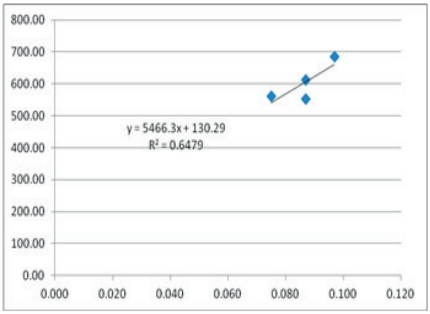

Figure 4. Linear regression model between rose oil yield and yield rose blossom under irrigation conditions

Table 3. Results of statistical processing of experimental data in the regression analysis performed, without irrigation

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std.
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
VAR00001	4	2.30	2.40	2.3750	.02500	.05000
VAR00004	4	558.27	677.70	625.8850	25.12120	50.24240
VAR00002	4	5.70	6.40	6.1500	.15546	.31091
VAR00003	4	.07	.09	.0818	.00354	.00709
Valid N (listwise)	4					

Table 4. Results of statistical processing of the experimental data in the regression analysis performed, under irrigation conditions

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
VAR00001	4	2.30	2.80	2.5250	.10308	.20616	.043
VAR00002	4	5.70	6.40	6.1000	.14720	.29439	.087
VAR00003	4	.09	.10	.0928	.00338	.00675	.000
VAR00004	4	552.87	685.97	603.1275	30.55917	61.11834	3735.451
Valid N (listwise)	4						

CONCLUSIONS

The obtain correlation dependences under irrigation conditions, shows that the degree of influence of each indicator in formation of oleaginous rose yields were considered. A strong positive correlation was found between blossom diameter and blossom weight (r = 0.965) and between rose oil yield and rose color (r = 0.960) under non-irrigation conditions. Correlation coefficient under irrigation conditions is the highest between blossom diameter and blossom weight (r = 0.934).

The linear regression models, is expressing the influence of indicator on yield per unit area, allow us theoretically how to determine and in which direction has to be change this indicators to improve yield.

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