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RESEARCH CONCERNING MORPHOLOGY AND PRODUCTIVITY OF SOME STRAWBERRY VARIETIES MULTIPLIED BY BIOTECHNOLOGY

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Abstract

Strawberry (Fragraria grandiflora) production has been developed in the past 10 years due to superior economic advantages and relatively simple culture technology. Easily commercialization on the market and industrial products obtained by processing, make from strawberry (Fragaria grandiflora) culture a passion and a profitable business. Were studied very old strawberry (Fragaria grandiflora) varieties and new Romanian varieties that could be grown all over the world. Variety Red Gauntlet is a productive variety with quality fruits and production can reach 20 t/ha (cultivated in V2 variant) and 36 t/ha (cultivated in V4 variant). The new varieties are very productive and can produce in optimal conditions of culture 40 t/ha (Delicious and Viva). The same performance has and the variety Mara. Fruit production increased with the application of organic fertilizer and soil mulching material. New varieties have a very high yield potential and technological measures stimulated the production and fruit quality.

Key words*: strawberry, variety, productivity.*

INTRODUCTION

The strawberries and cherry fruits are the first fruit who arrive to ripening (May-June). Strawberries are early species, producing fruit in the first year after planting, if the plants
are planted in July. Its possible to obtain a earlier production or the later than that obtained in the field. By using varieties with continue fructification (with several harvests per year) we can get strawberries and autumn until October.

With a low hight (15-40 cm) the strawberries can grow in very small spaces in the garden, and on large surfaces or in greenhouses. Strawberry production in greenhouses and solariums has some advantages and disadvantages (Lieten, 2001).

Was made observations on morphological characteristics of the five varieties of strawberry fruit featured for quality and yields per hectare.

The morphological characteristics studied were plant vigor, inflorescence structure and average fruit weight. Productivity was determined for each variety studied to highlight the influence of genetic material on productivity.

Plant height is used as a criterion of vigour (Bologa, 1997).

MATERIALS AND METHODS

The strawberry varieties studied were obtained in the laboratory using artificial culture medium (Murashige & Schoog) and acclimatized in the field.

They were studied five varieties of strawberry (Gorella, Red Gauntled, Delicious, Viva and Mara), grown in four variants:

V1 - classic culture system directly into the ground;

V2 - land cover with agro-textile material mulch). Agro-textile material was installed in the planting moment;

V3 - classical culture fertilized with organic fertilizer (leaf compost);

V4 - culture with agro-textile mulch and fertilized with organic fertilizer.

The Gorella variety is a very old variety, created in the Netherlands in 1960, particularly appreciated for its qualities.

The Gauntlet Red variety was obtained and introduced in culture in England in 1957, it is well known and appreciated in our country.

The Delicious variety is a romanian variety (Dana x Red Gauntlet) obtained at SDP Satu Mare (Romania), homologated in 2003, and has big fruits dark-red colored.

Viva is a romanian variety (Addie x Red Gauntlet) obtained at SDP Satu Mare (Romania), homologated in 2003.
Mara is a romanian variety (Pajaro x Red Gauntlet) obtained at SDP Satu Mare, Romania, homologated in 2003. The fruit matures in the first 20 days of June.
The fertilization was made in the spring before flowering.
The trials were conducted in the years 2014 - 2016 in the field of Faculty of Horticulture in Bucharest.
Planting was carried out in early September 2014, and data on the morphology and productivity varieties were registered in 2015-2016.
Planting was done in simple rows distances 40 x 25 (100000 plants/hectare).
Observations concerning the vigor were made when the plants reached full development by measuring plant height from ground level.
The number of inflorescences per plant and the number of the flowers in the inflorescence was determined by counting them.
The average weight of the fruit was obtained by weighing the output of each plant in relation to the number of fruit formed on the plant.
Using the production obtained on the plant and number of plants on hectare we calculated the yields.

RESULTS AND DISCUSSIONS

In 2019, after planting (September) was applied to the specific technology (irrigated by drip and protection against diseases and pests) and observations began in 2020. Planting was carried out at the optimum time, and after resumption of vegetation were made measurements concerning the foliage developments.
The vigor of the plant is influenced by the culture system. The V3 and V4 variants promotes plant growth due to organic fertilizer.

Table 1. The vigor of studied varieties (average 2020-2021)

Variety	Plant height (cm)				No. leaves per plant			
	V1	V2	V3	V4	V1	V2	V3	V4
Gorella	38	42	40	45	8	6	7	6
Red Gauntlet	28	37	40	40	5	5	5	5
Delicios	30	34	35	35	7	7	6	5
Viva	26	26	30	32	8	7	6	6
Mara	25	28	30	35	7	6	7	6

Table 2. Echeloning the flowering to strawberry (average 2020-2021)

Variety	Opening of the first flowers			
	V1	V2	V3	V4
Gorella	14.V	9.V	12.V	9.V
Red Gauntlet	12.V	8.V	10.V	9.V
Delicios	12.V	8.V	12.V	8.V
Viva	14.V	10.V	12.V	10.V
Mara	14.V	10.V	11.V	10.V
	Staggering blooming (Nr. of days)			
Gorella	11	9	10	12
Red Gauntlet	10	13	12	12
Delicios	8	9	10	10
Viva	8	6	9	9
Mara	7	7	8	10

Table 3. The study of strawberry inflorescences (average 2020-2021)

Varierty	Inflorescence length (cm)				The average number of flowers on inflorescence			
	V1	V2	V3	V4	V1	V2	V3	V4
Gorella	17	16	20	25	11	10	11	13
Red Gauntlet	18	15	18	22	9	10	12	12
Delicios	15	17	19	24	9	9	11	13
Viva	20	23	20	26	6	8	9	10
Mara	16	17	20	21	8	10	10	13

Table 4. The flowering capacity

Varierty	Nr. inflorescences per plant			
	V1	V2	V3	V4
Gorella	1	1	2	2
Red Gauntlet	2	2	2	2
Delicios	2	2	2	2
Viva	3	2	3	3
Mara	2	2	2	2

Number of flowers open was different from one variety to another and was influenced on culture solution. The fertilizing with organic fertilizer, influenced the number of flowers formed (V3 and V4). The fertilization has not affected the number of inflorescences formed by each variety. Viva Variety formed the lower number of flowers / inflorescence, but formed the big fruits in V4 variant.

Table 5. Elements of productivity (average 2020-2021)

Variety	Nr. fruits per plant				The average weight of the fruit (g)			
	V1	V2	V3	V4	V1	V2	V3	V4
Gorella	11	10	15	17	12	15	17	17
Red Gauntlet	11	10	14	18	18	20	20	20
Delicios	18	18	18	20	16	18	20	20
Viva	18	16	18	20	14	17	19	20
Mara	16	19	20	19	12	14	18	21

The productivity is determined by the size of the inflorescence, the number of flowers on inflorescence and the weight of the fruit. The studied varieties formed 1-3 inflorescences per plant. The strawberry is a species with high productive potential. The production is influen-

ced by variety, culture system and climatic conditions during the growing season.
The quantity of fruits obtained on plant depends on the size and number of fruit formed per plant.

Table 6. Production of strawberries depending on the variant of culture (2020-2021 average)

Variety	The yield /plant (g)			
	V1	V2	V3	V4
Gorella	132	150	225	289
Red Gauntlet	198	200	280	360
Delicios	288	324	360	400
Viva	252	272	342	400
Mara	192	280	360	399
Media	212.4	245.2	313.4	369.6

Table 7. Production of strawberries (average 2020-2021)

Variety	The yield (kg/m^2)			
	V1	V2	V3	V4
Gorella	1,32	1,50	2,25	2,89
Red Gauntlet	1,98	2,00	2,80	3,60
Delicios	2,88	3,24	3,60	4,00
Viva	2,52	2,72	3,42	4,00
Mara	1,92	2,80	3,60	3,99
Media	1,82	2,45	3,14	3,69
	The yield (t/ha)			
Gorella	13,2	15,0	22,5	28,9
Red Gauntlet	19,8	20,0	28,0	36,0
Delicios	28,8	32,4	36,0	40,0
Viva	25,2	27,2	34,2	40,0
Mara	19,2	28,0	36,0	39,9
Media	21,24	24,52	31,3	36,9

Applying organic fertilizers (V3) ensures high yields. If organic fertilization is associated with mulching with agro-textile we can obtain the highest yields. The Red Gauntlet variety in these conditions very well and Romanian varieties have achieved production of 40 t / ha. In the field conditions, without a adequate technology, who no ensuring all factors of vegetation at the optimum level, is not use full capacity of production of the variety.
To achieving high yields of fruit per unit area are important a number of factors, including variety, cultivation technology and climatic conditions.
Harvests in the 4 experimental variants have demonstrated that a biennial crop of strawberries is very cost effective. The use of organic fertilizers stimulate capacity of fruiting and material agro-textile control the weeds, fruit damaged and preserves soil moisture.

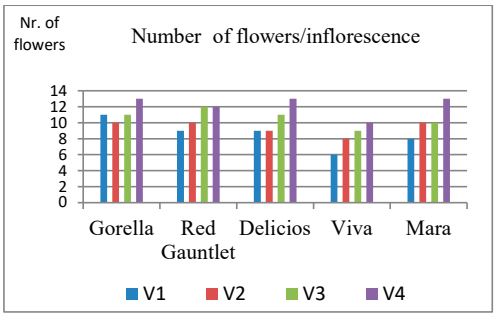

Figure 1. The fructification capacity

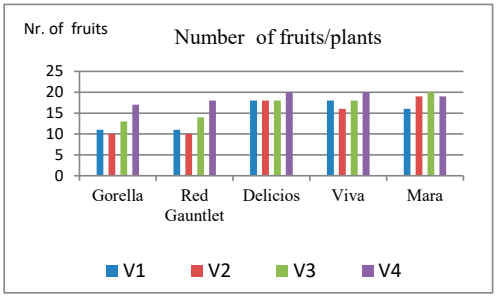

Figure 2. The fructification capacity

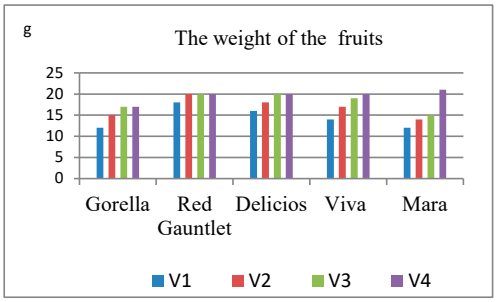

Figure 3. The average weight of the fruits

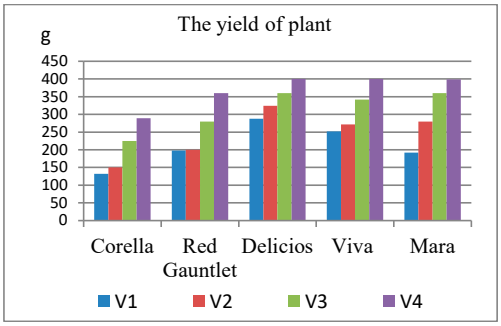

Figure 4. The plant fructification capacity

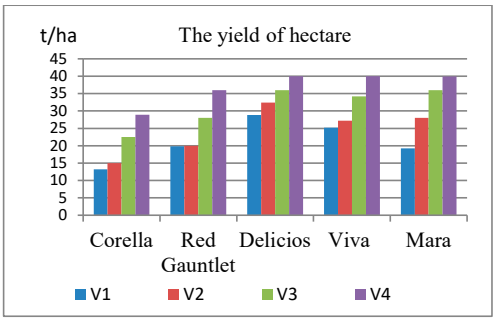

Figure 5. The potential yield per hectare

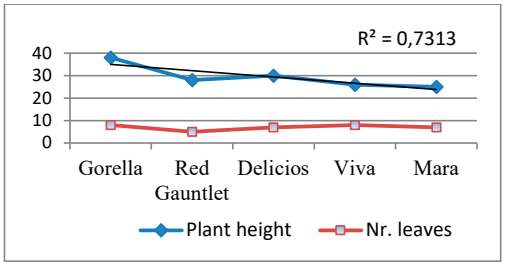

Figure 6. The correlation between plant height and number of leaves per plant (V1)

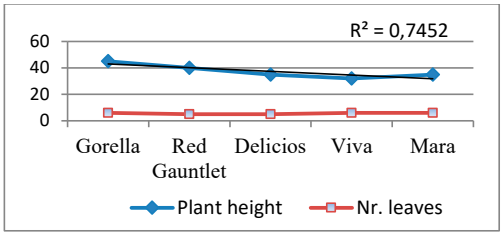

Figure 7. The correlation between plant height and number of leaves per plant (V4)

The analysis of the correlation between the different characteristics showed that there is a direct correlation between plant height and number of leaves per plant in each variant and there is no correlation between other characteristics analyzed.

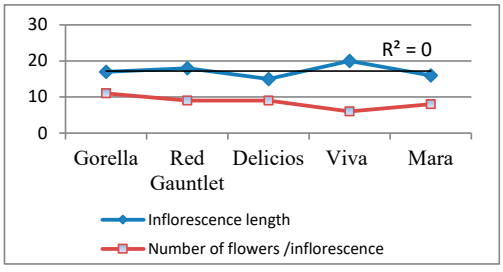

Figure 8. The correlation between inflorescence length and number of flower per inflorescence (V1)

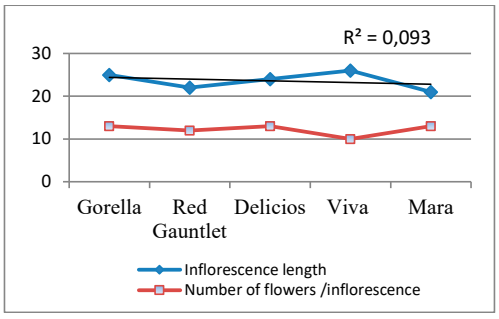

Figure 9. The correlation between inflorescence length and number of flower per inflorescence (V4)

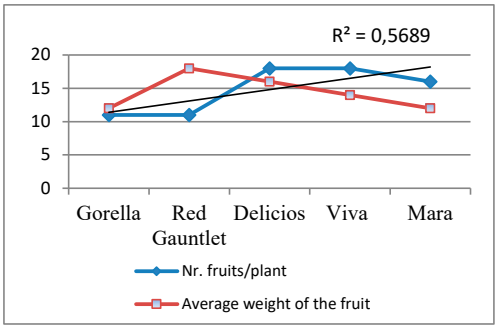

Figure 10. The correlation between number of fruits per plant and average weight of the fruit (V1)

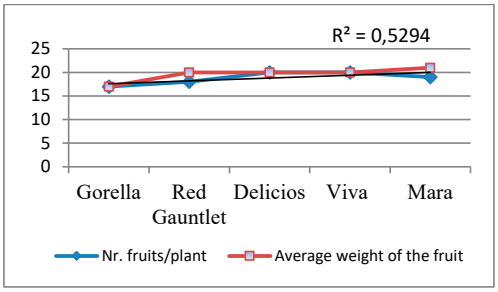

Figure 11. The correlation between number of fruits per plant and average weight of the fruit (V4)

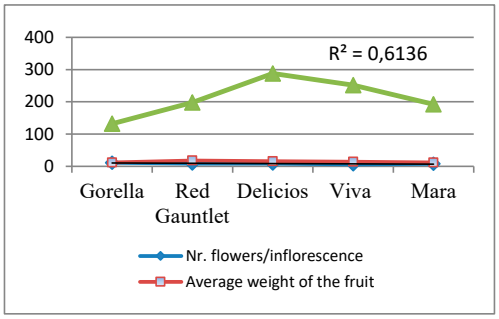

Figure 12. The correlation between number of flowers per plant, the average weight of the fruit and the yield per plant (V1)

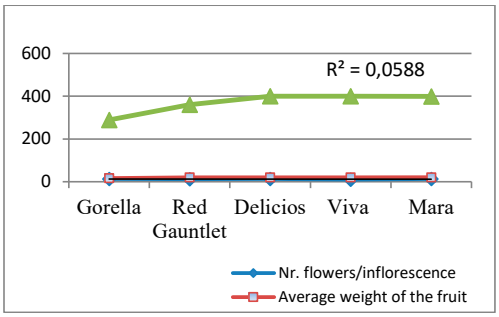

Figure 13. The correlation between number of flowers per plant, the average weight of the fruit and the yield per plant (V4)

CONCLUSIONS

The quality of the biological material used influences greatly the percentage of gripping. The biological material used had a planting gripping between 96-98%.

In the classical culture of strawberries are produced high yields of fruits, but culture variant with agro-textile and organic fertilization provides very high yields.

Fruits obtained in V2 variant were higher compared to fruit obtained in conventional culture (V1 variant), but higher values provides variants V3 and V4.

Among the varieties studied, the most productive varieties were Delicios and Viva (40 t/ha in variant V4) and Mara (39.9 t/ha).

The variety with the lowest production was the variety Gorella (13.2 t/ha in the classical system of culture).

Strawberry production remains a profitable crop, regardless of the manner of obtaining the fruit, because investments are recovered from the first crop of fruit.

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