RESEARCH RELATED TO THE ROOT AND FOLIAR FERTILIZATION IN THE STRAWBERRY STOLONS

Bucurean Eva *, Popovici Mariana**

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: evabucurean08@yahoo.com,
*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: mariana_mediu@yahoo.com

Abstract

In this work observations were made related to the chemical and organic fertilization of the soil to the foliar fertilization and to the effects of these types of fertilization upon the number of stolons obtained from a hectare.

The productions of the stolons is an important link in the technology of strawberry culture. The strawberry runners are set for a period of one year so during the vegetation period the soil needs to be extremely well supplied with nourishing elements so that the production of the stolons be a good one in what the quantity and the quality are concerned.

The obtained results show the fact that both the chemical and organic fertilization as well as the foliar fertilization have positive effects upon the stolon production.

Key words: strawberry, fertilization, fertilizers, stolon production

INTRODUCTION

Although the strawberry has a great capacity to adapt itself, its adaptation is limited by a number of factors whose influence is reflected upon the production. The production is economical in the regions where factors like: temeprature, light humidity and soil are over the critical points of the species (Chira Lenuța, 2000).

The temperature. The strawberry plants do not have the air organs protected in order to resist at low temperatures like other tree species that have at least a superficial insulating layer and the root system is also superficial which makes them easily affected by frost. In general the extreme temperatures like huge frost during the winter, the late ones during the spring and the excessive heat during the summer influence in a negative way the growing as well as the ripening of the strawberry. In our country's conditions the strawberry can stand temperatures of -15 up to -25 C degrees for a few days, this duration being tightly related to the soil type, to the thickness of the snow layer and to the ground position and orientation.

In what the cold resistance of the stolons is concerned, in refrigeration conditions, it is known that the cultivated strawberry types have got different requests, the temperature during the stolon storage influences the size, the fruit production, the ripening period and the duration of fruit maturation.

The summer days with extremely high temperatures and with powerful heatstroke produce burns at the leaves' level and it does not allow the normal development and normal ripening of the fruit, these extreme temperatures also trouble the formation of the floral buds (Cepoiu N., C.Manolache, S.Țepordei, 2006).

The water. The strawberry culture is possible in conditions of rainfall containing between 500 - 900 mm yearly but the distribution of these rainfalls is important during the vegetation period which is March – October. Being a plant with superficial rooting the stawberry very often needs rainfalls separated from the hot days. The short period of drought is felt by the plants as its production and quality considerably diminishes.

The light. The cultivated strawbery can stand the semi-shadow but high and superior quality productions are obtained on sunny fields that totally lack shadow.(Diaconeasa M., A. Baciu, Mirela Iliescu, 2003).

The majority of the strawberry types of plants flourish and ripe once a year being called of short day as they differentiate the ripe buds in the days when there are approximately 12 hours of light. The growth of the stolons takes place in the long days that have a big enough quantity of heat. (Modoran I. I.Bos, Gh. Herțea, 1987).

The soil. The strawberry plant has got high requests in what the fertilization is concerned as well as in what the humidity report and that of the soil aeration is concerned. The best soil for the stawberry culture is the sandy, clay type, midLSDe and compact, slightly acid with a pH of 5,5 – 6,5 rich in nourishing elements and with a sufficient humidity.(Paşca Felicia, Constanța Bologa, 1995).

The strawberry is one of the species that presents a special nourishing and economical interest due to its high potential production, to the fruit quality, to the high content of C vitamin and to other useful substances in nourishment.

Having a short height of 15 – 40 cm under a compact or rare form, the strawberry can be cultivated in very small places from the house garden but also on big areas in free land, in greenhouses or in solariums.

MATERIAL AND METHOD

In order to see the effect of the different fertilizers and the applied doses on the number of stolons obtained at the surface unit in a strawberry runner culture and on their quality, observations were made in this sense in the period 2008 -2009 in Salard.

The type of soil on which the experiences were organized , meaning a brown clay –alluvial type with a pH of 5,8, humus/mold 1,1%, clay 25 %, P_2O_5- 52 ppm, K_2O-176 ppm, on the width of 0-40 cm, the depth of the groundwater over 2 m.

We have followed the way the strawberry behaves in order to obtain stolons in different conditions of fertilization: organic and chemical on the ground and soil fertilization with liquid chemical fertilizers.

The following variants have been organized:

1.Using foliar fertilizers:

V_1 – untreated witness

V_2- F 231 0,3%

V_3- F 231 6%

V_4 - F 411 0,3%

V_5 – F 411 0,6%

V_6 – Folifag 0,1%

V_7 – Folifag 0,3%

2. Fertilization of the soil with organic fertilizers (manure) and with residue fertilizers (ash thermo) in the following variants.

V_1 – untreated witness

V_2 – 30 t/ha ash

V_3 – 40 t/ha ash

V_4 – 30 t/ha manure + 30 t/ha ash

V_5 – 30 t/ha manure + 40 t/ha ash

V_6 – 40 t/ha manure

V_7 – 40 t/ha manure + 30 t/ha ash

V_8 – 40 t/ha manure + 40 t/ha ash

The mix of manure and ash has been punched for a year. The fertilizers were administrated during winter and the harvesting of the stolons was done in September.

3.The fertilization of the stolons's soil with phosphorus chemical fertilizers (concentrated super phosphate) or with nitrate (ammonium nitrate) in the following variants) :

V_1 – untreated witness

V_2 – Phosphorus 120 kg/ha

V_3 – Phosphorus 230 kg/ha

V_4 - Nitrate100 kg/ha

V_5 – Nitrate 50 kg/ha

The phosphorus had been applied in autumn and the nitrate in the early spring.

The Red Gauntlet and the Senga Sengana types were used. The experience was organized in blocks at random in four repetitions each variant.

RESULTS AND DISSCUSIONS

1.The application of some technology through which the fertilization was done only in foliar led to obtaining a production of 402 – 557 thousands of pieces of stolons/hectare only at the Red Gauntlet type.

Table 1

The stolon production obtained after applying the foliar fertilizers at the Red Gauntlet type

Variant	Concentration (%)		Production (thousands of pieces)	Relative production (%)	Difference	Signification
	The beginning of the thread issue	At the binding of the first stolons				
V_1- untreated witness	-	-	373	100	-	-
V_2 -F 231	0.3	0.3	504	135.1	+131	xxx
V_3-F 231	0.6	0.6	402	107.8	+29	-
V_4 -F 411	0.3	0.3	557	149.3	+184	xxx
V_5 -F 411	0.6	0.6	531	142.3	+158	xxx
V_6 -Folifag	0.1	0.1	513	137.5	+140	xxx
V_7 -Foligag	0.3	0.3	424	113.7	+51	xx

LSD 5% =29,19;
LSD 1% = 40,3;
LSD0,1% = 54,48

The best effect was obtained by applying the F411 fertilizer which has a higher content of nitrate fact which favorized a better vegetation and obtaining of a higher number of rooted stolons. This fertilizer can be used in good conditions in a concentration of 0,3%.

The F231 fertilizer gives good results if it is used in a concentration of 0,3% then the stolon production is of 504 thousand pieces on a hectare.

The Folifag foliar fertilizer contains beside the macro elements a great number of micro elements.

Applying this fertilizer in a concentration of 0,1% had as a result a production of 513 thousand pieces of stolons /hectare, with 37,5% more than the witness variant.

2.The application of organic fertilizers has had a very good effect. It has been noticed that applying 30 tons of manure/hectare punched with 30 tons of ash/hectare led to a very good development of the plants, a powerful emission of the threads and 90% of the total of obtained stolons have had an excellent rooting.

Significant results have been obtained for the variant fertilized with 40 tons of manure/hectare, with a percent of 89,1% first quality stolons for the variants fertilized only with ash or in the case of fertilization with high quantity of compost significant production increases have not been registered.

Table 2

The stolon production obtained in 2008 for the Senga Sengana type

Variant	Stolon production						
	1st Quality		2nd Quality	Total thou sand of pieces	Relative production %	Difference	Significance
	Thou sand of pieces	%					
V_1-untreated witness	810	87.1	120	930	100	-	-
V_2 – 30 t/ha ash	750	80.6	180	930	100	0	-
V_3- 40 t/ha ash	810	89.0	100	910	97.8	- 20	-
V_4 -30 t/ha manure + 30t/ha ash	1000	90.9	100	1100	118.3	+170	xxx
V_5 -30 t/ha manure + 40 t/ha ash	1000	90.9	100	1100	118.3	+170	xxx
V_6 -40 t/ha manure	937.5	89.1	115	1052.5	113.2	+122.5	xx
V_7 -40 t/ha manure + 30 t/ha ash	875	88.2	117.5	992.5	106.7	+62.5	-
V_{8} - 40 t/ha manure + 40 t/ha ash	812.5	93.1	60	872.5	93.8	- 57.5	-

LSD 5% = 68.8;
LSD 1% = 97.35;
LSD 0.1% = 131.4

3. The fertilization of the soil with chemical fertilizers with phosphorus or with nitrate has had as a result the obtaining of high stolon production. The best results have been obtained by the fall fertilization of the stolon culture with phosphorus fertilizers using 120kg/hectare, situation in which the production was with 81,2% more than the witness variant in year 2008 and with 61,4% more than the witness in 2009.

The exceeding of the production for the witness variant with 24,95% and with 16,7% in the conditions of applying 230kg of phosphorus/hectare

does not justify the financial efforts that must be done in comparison with the previous variant.

Very good results have been obtained by applying 100kg of nitrate/hectare in early spring, fertilization which led to obtaining high stolon production exceeding the witness variant with 73,8% in the conditions of the year 2008 and with 49,8% respectively in the conditions of the year 2009. The application of 50 kg of nitrate/hectare has brought a production increase of 38,6% in 2008 and of 42,75% in 2009.

Table 3

The stolon production obtained in the conditions of phosphorus or nitrate fertilization for the Red Gauntlet type in 2008

Variant	Stolon production (thou sand of pieces /ha)					
	1st Quality Thousand of pieces	2nd Quality	Total	Relative production %	Difference	Significance
V1- untreated witness	522.2	140	662.2	100	-	-
V_2 – Phosphorus 120 kg/ha	1037	163	1200	181.2	+537.8	xxx
V_3-Phosphorus 230 kg/ha	694.4	132.7	827.1	124.9	+164.9	xxx
V_4 - Nitrate100 kg/ha	888.9	262	1150.9	173.8	+488.7	xxx
V_5 - Nitrate 50 kg/ha	731.5	186.5	918.0	138.6	+255.8	xxx

LSD 5% = 76.3;
LSD 1% = 107.1;
LSD 0.1% = 151.2

Table 4

The stolon production obtained in the conditions of phosphorus or nitrate fertilization for the Red Gauntlet type in 2009

Variant	Stolon production (thou sand of pieces /ha)					
	1st Quality Thousand of pieces	2nd Quality	Total	Relative production %	Difference	Significance
V1- untreated witness	480.2	190.5	670.7	100	-	-
V_2 - Phosphorus 120 kg/ha	835.0	247.3	1082.3	161.4	+411.6	xxx
V_3- Phosphorus 230 kg/ha	634.3	148.7	783.0	116.7	+112.3	xxx
V_4 - Nitrate100 kg/ha	789.8	315.3	1005.1	149.8	+334.4	xxx
V_5 - Nitrate 50 kg/ha	742.5	214.4	956.9	142.7	+286.2	xxx

LSD 5% = 23.3;
LSD 1% = 32.7;
LSD 0.1% = 46.2

CONCLUSIONS

The application of organic fertilizers has had positive effects upon the stolon production, the variant which had the highest production being the one to which manure punched with ash had been applied (30+30 tons/hectare) or with manure 40 tons/hectare.

The chemical fertilization of the soil in stolon cultures with phosphorus fertilizers applied in autumn in a dose of 50 – 100 kg/hectare has as an effect to favor a good vegetation and to obtain a high stolon production for the Red Gauntlet type.

In the situations in which an incorrect fertilization of the soil had been done , in the stawberry stolon cultures foliar fertilizers can be successfully used, these fertilizers are to be applied in two doses as follows: at the beginning of the thread issue and at the binding of the first stolons in order to obtain as many stolons with a well developed root system.

REFERENCES

1. Bireescu L., M. Istrate, G.Grădinariu, Geanina Bireescu, V. Petrescu, 1999, Cercetări privind prevenirea şi limitarea poluării chimice a mediului prin utilizarea îngrăşămintelor foliare în pomicultură, Lucrări ştiinţifice, Anul XXXXII, USAMV Iaşi;
2. Budoi Gh., 2001, Agrochimie II, Îngrăşăminte, tehnologii, eficienţă, Editura Didactică şi Pedagogică, Bucureşti;
3. Bologa Constanţa, I.Man, 1994, Comportarea unor soiuri de căpşun, în condiţiile din nord-vestul ţării, Lucrări ştiinţifice ICPP Piteşti, vol XVII;
4. Borlan Z., C.Hera şi colab.,1994, Fertlitatea şi fertilizarea solurilor, Editura Ceres, Bucureşti;
5. Chira Lenuţa, 2000, Cultura arbuştilor fructiferi, Editura M.A.S.T., Bucureşti;
6. Cepoiu N., 2002, Pomicultură aplicată, Editura Ştiinţelor Agricole, Bucureşti;
7. Cepoiu N., C.Manolache, S.Ţepordei, 2006, Cultura căpşunului în câmp şi în spaţii protejate, Editura Ceres, Bucureşti;
8. Coman M., 1992, Variabilitatea genetică în cadrul genului Fragaria, Mapa documentară nr. 27, ICPP Piteşti;
9. Coman M., 1995, Cercetări privind variabilitatea genetică în genul Fragaia şi detectarea unor genotipuri superioare de căpşun, Teză de doctorat, U.S.A., Bucureşti;
10. Davidescu Velicica, D. Davidescu, 1999, Compediu de agrochimie, Editura Academiei Române, Bucureşti;
11. Diaconeasa M., A. Baciu, Mirela Iliescu, 2003, Cultura căpşunului, Editura Mihai Duţescu, Craiova;
12. Gavriluţă I., Adriana Alexandrescu, Gh. Budoi, L. Bireescu, Geanina Bireescu, 1999, Eficienţa economică a fertilizării foliare în pomicultură, Lucrări ştiinţifice, Anul XXXXII, USAMV Iaşi;
13. Liteanu C., Gh. Rădulescu, M. Moise, 1982, Unele aspecte privind îngrăşămintele chimice cu solubilizare lentă în sol şi păstrarea echilibrului biologic din agro-ecosisteme, Ecologie şi protecţia ecosistemelor, sub redacţia Ionescu A. şi colab;

14. .Mărghitaş, Marilena, M.Rusu, 2003 – Utilizarea îngrăşămintelor în agricultură, Editura Academic Pres, Cluj-Napoca;
15. Modoran I. I.Bos, Gh. Herţea, 1987, Stabilirea felului şi a cantităţii de îngrăşăminte organo-minerale la căpşun, Lucrări ştiinţifice, I.C.P.P., vol V;
16. Paşca Felicia, Constanţa Bologa, 1995, Eficienţa îngrăşămintelor chimice cu NPK, în culturile de căpşun fertilizate la început cu îngrăşăminte organice, Ecotehnologii şi biotehnologii în cultura căpşunului, Satu Mare;
17. Paşca Felicia, 1995, Contribuţii privind influenţa fertilizării radiculare şi foliare asupra creşterii şi rodirii căpşunului, Ecotehnologii şi biotehnologii în cultura căpşunului, Satu Mare;
18. Radu Dana Gina, I. Boboescu, 2007, Managementul tehnico-economic al culturii arbuştilor fructiferi şi procesarea fructelor, Editura Eurobit, Timişoara;
19. Spiridon V., 2008, Arbuşti fructiferi, Editura Alex-Alex, Bucureşti;
20. Teodorescu A., M. Coman, 1988, Zonarea sortimenului de căpşun în România, Horticultura nr. VII, Bucureşti;