

CONTRIBUTIONS TO THE IMPROVEMENT OF THE FERTILITY REGIM ON A SWEET PEPPER CROP

CONTRIBUȚII LA ÎMBUNĂTĂȚIREA REGIMULUI DE FERTILIZARE LA O CULTURĂ DE ARDEI GRAS

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Abstract. *The research conducted within this study aimed to evaluate the influence of fertilization simultaneously with drip irrigation in a crop of peppers established in a tunnel. Trials were organized in a tunnel belonging to the Vegetable discipline, located in "V. Adamachi" Didactic Farm, in Iasi. The purpose of the research was to evaluate the effect of the fertilization method, using conventional fertilizers, applied to the soil surface by spraying, and based on micro-organisms, simultaneously with drip irrigation, compared to the unfertilized version. Thus, after fertigation, there were found differences concerning the plant height, the number of flowers and fruits on a plant, the average weight of fruit and the production per hectare. The production obtained by the Brilliant F1 pepper cultivar in the fertigation version was of 85.850 kg / ha.*

Keywords: fertigation, sweet pepper, yield, tunnel

Rezumat. *Cercetările efectuate în cadrul acestei lucrări au avut drept scop evaluarea influenței fertilizării concomitent cu irigarea prin picurare într-o cultură de ardei amplasată într-un solar. Experiențele au fost organizate într-un solar aparținând disciplinei de Legumicultură, situat în Ferma Didactică "V. Adamachi", din județul Iași. Scopul cercetărilor a fost de a evalua efectul metodei de fertilizare, folosind îngrășăminte clasice, aplicate prin împrăștiere pe suprafața solului, și pe bază pe microorganisme, concomitent cu irigarea prin picurare, comparativ cu varianta nefertilizată. Astfel, după fertirigare, s-au constatat diferențe în ceea ce privește înălțimea plantelor, numărul de flori și fructe pe plantă, greutatea medie a fructelor și a producției la hectar. Producția obținută de cultivarul de ardei Brilliant F1, la varianta fertirigată, a fost de 85,850 kg/ha.*

Cuvinte cheie: fertirigare, ardei, producție, solar

INTRODUCTION

Fertigation, a modern concept of agricultural technique, is the method by which the fertilizing substances are distributed to the plants simultaneously with the irrigation water (Biolan *et al.*, 2010).

Fertigation is usually associated with localized irrigation, although it may be associated with any other irrigation method. By fertigation, a synergistic effect

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is obtained, the water improving the absorption of the fertilizer, at the same time, this one making the use of water efficient (Țenu, 2004).

The basics of an efficient and rational fertigation are knowing the crop's nutritional requirements (minerals and hydro), the soil's fertility and the quality of the irrigation water, combined with an efficient management of the irrigation technique.

Fertigation, as a method of fertilizer application, is supported by a number of advantages, such as: the increase of the nutrient absorption by plants, the reduction of the amount of nutrients, the reduction of water consumption due to the increase of the roots volume capacity to retain and store water; the application of nutrients can be controlled according to the phenophase growth; the reduction of the root risk of contracting communicable diseases through the contaminated soil and the elimination of the soil erosion. The bell pepper (*Capsicum annuum L. convar. grossum L.*) is a vegetable plant, rich in antioxidants, phenolic compounds, especially PCA - p-coumaric acid (Dimitriu *et al.*, 2016), vitamin C (150-300 mg/100g) and carotenoids (1.8 to 4.5 mg/100g) (Hoble, 2010).

Pepper has high water requirements during the growing season, due to the poorly developed root system and the abundant biomass exposure to the strong perspiration (Tanaskovik, 2013). In the case of sweet pepper, the amount of fertilizer has a distinctly significant influence on the differences in the total yield (Stan *et al.*, 2006).

The cultivar is an important factor for a successful fertilization, along with drip irrigation. This one must be suitable for the salt stress conditions (Stoleru *et al.*, 2012).

MATERIAL AND METHOD

The research was carried out in a semicircular tunnel, located in the "V. Adamachi" Didactic Farm, within USAMV Iasi, with an area of 270 m². The studied plants belong to the *Brillant F1* sweet pepper cultivar and are grouped into four experimental versions (tab. 1), on tapes, the distance between the tapes being of 90cm and the distance between the plants in a row, of 45 cm, resulting a density of 31740 plants/ha (fig. 1). The protection tape for the experiment was established with the same, unfertilized hybrid.

Table 1

Experimental versions (2016)

Experimental version	Fertilization methods
V ₁	Drip fertigation, using soluble fertilizers
V ₂	Classic fertilization, by spreading on the soil surface and incorporated
V ₃	Microorganisms fertilization, by spraying on the soil and incorporated
V ₄	Unfertilized (Mt)

For the irrigation of the plants, a drip irrigation line was used, with the tapes' diameter of 16 mm and the distance between the drainers of 10 cm. During the growth cycle, it has been administered an amount of water equivalent to 5600 m³/ha, the watering being carried out every other day, in the time range 8⁰⁰ - 10⁰⁰ or 7⁰⁰ - 9⁰⁰, based on the recorded temperature.

In order to perform the experiments, a fertigation facility was designed and built within the disciplines of Agricultural Engineering, consisting of a water tank with constant

watering, with a capacity of 20 tonnes; a tank for preparing the concentrated solution of fertilizer, an automatic system of watering programming and a watering line (fig. 1).

The plants in the V_1 version were fertilized along with drip irrigation, twice a week, the fertigation being carried out in the morning. It was used Nutrispore[®] fertilizer - NPK (MgO) 10/30/10 - 300 kg / ha, NPK Nutrispore[®] (MgO) 10/30/15 - 425 kg/ha and NPK 12-48-8 Nutrispore[®] - 400 kg/ha. In order to have a good fertigation, the plant nutrition has been carried out periodically, twice a week, between two consecutive waterings.

The plants in version 2 were chemically fertilized, by spreading, on the surface of the soil, in each plant area, in the equivalent of 200 kg/ha NPK 20-20-20 Cristaland[®], applied during basic fertilization; 250 kg/ha Cristaland[®] NP 15-50 + 2MgO, applied in the floral button phase (the first inflorescence) and 200 kg/ha of NPK 9-18-27 + 2 MgO Cristaland[®], applied in the first fruit phenophase.

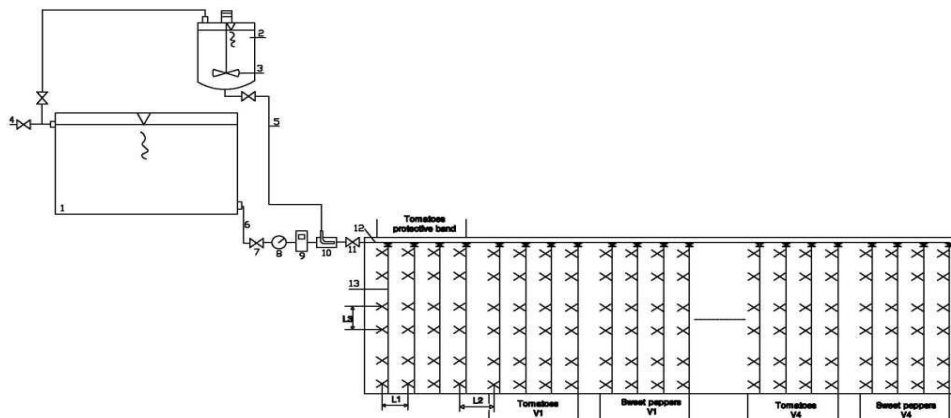


Fig. 1 The scheme of trial organization

1- buffer water tank; 2- tank for the preparation of the fertilizer watering solution; 3- stirrer; 4 – connection for supplying the buffer water tank; 5 – connection for supplying the fertilizer solution; 6 – connection for supplying the irrigation facility; 7 and 11 – valves; 8 – flowmeter; 9 – programmer; 10 – ejector for mixing water - solution of fertilizer; 11 – watermeter; 12 – main pipeline; 13 –dropping pipeline; L1 – distance between rows on a tape (60 cm); L2 – distance between tapes (80 cm); L3 – distance between plants in a row (45 cm).

The plants in the V_3 version were fertilized with a micro-organism based fertilizer, Micoseed[®] MB, by spreading, in each plant area, in the equivalent of 60 kg/ha, applied in order to prepare the ground, 2-3 days before planting the peppers. According to the data from the specialty literature, Micoseed MB[®] is a fertilizer based on *Glomus sp.*, *Beauveria sp.*, *Metarhizium sp.* and *Trichoderma sp.* (Stoleru *et al.*, 2014). In this version, during the growing season, there were also applied two fertilizations with Nutryaction[®] 2, in the amount of 5 L/ha, to stimulate the biological activity of the microorganisms.

In the V_4 control version, there have been applied drip irrigations, under the same conditions as in the V_1 , V_2 and V_3 versions.

Weekly, biometric measurements were performed, by which the dynamics of the plant growth has been determined, following the height of the plant, the number of flowers and the number of related flowers/fruits.

The sweet pepper plants were carried for according to data from the specialty literature (Ciofu *et al.*, 2004; Stoleru *et al.*, 2014). The processing of the experimental data was carried out using the analysis of the version (ANOVA), by calculating the limit differences (Leonte, 1997).

RESULTS AND DISCUSSIONS

Experimental results concerning the sweet pepper plant growth indicators

The dynamics of the sweet pepper plant height in 2016 is shown in figure 2. Seven biometric measurements were performed every 7 ... 10 days, starting with the third week after planting. The *Brilliant F1* sweet pepper cv. presents an indeterminate growth, being used for two crops. The average height obtained after the measurements was of 42.2 cm.

From figure 2 it can be seen that, at the beginning of the growing season (7-27/05/2016), although the growth was constantly in all the four versions, the most significant increase of the *Brilliant F1* hybrid occurred in the fertiligated version, V_1 , registering a value of 33.6 cm.

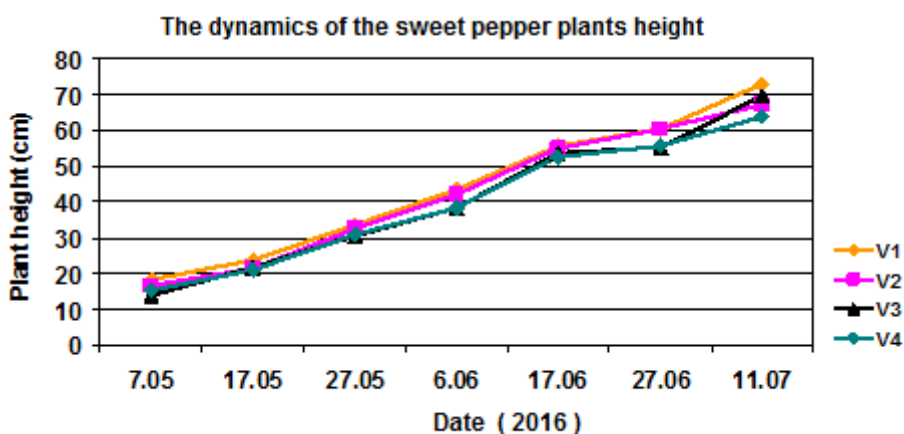


Fig. 2 The graph of plant height dynamics

The data presented in Fig. 2 shows that, in the unfertilized version, V_4 , the plant height was lower at the beginning of the growing season compared to the fertilized versions.

In the second half of the growing season, it can be seen that in the V_1 (fertiligation) and V_2 (classic), the growth remained constant and close in value, with a medium value of 55.6 cm or 55 cm. In the V_3 and V_4 versions, the plant height was lower, with medium values of 53.6 and 52.6 cm.

At the end of the growing season, the average height of sweet pepper plants ranged from 63.6 cm in the unfertilized version - V_4 , till to 72.8 cm in the fertiligated version - V_1 .

The results concerning the productivity of the sweet pepper plants are given in table 2. The average number of flowers on sweet pepper sprout ranged from 1.52, registered in the control version (V_4), till to 4 flowers, obtained in the fertigated version (V_1).

Concerning the average number of fruits per plant, it ranged from 4.45 in the unfertilized version - V_4 , up to 11.30, in the fertigated version - V_1 . Medium values close to the version 1 were made in the classic fertilization version - V_2 (9.55 cm).

Regarding the average weight of the *Brilliant F1* sweet pepper fruit, it ranged from 100.45 g in V_4 (unfertilized) to 131.81 g in V_1 (fertigated).

Table 2

Results concerning the dynamics of the pepper plant development (2016)

Experimental version	Average number of flowers on the sprout	Average fruit number in a plant	Average fruit weight (g)
V_1	4	11.3	131.81
V_2	3.52	9.55	102.22
V_3	2.96	4.85	101.15
V_4	1.52	4.45	100.45

Experimental results concerning to the yield of sweet pepper (2016)

The results concerning the yield of pepper in 2016 are shown in Table 3. The production of sweet pepper within the experiment ranged very widely, from 55,870 kg/ha in the control version - V_4 , up to 85,850 kg/ha in the fertigated version - V_1 .

Table 3

Results concerning the production of sweet pepper (2016)

Experimental version	Total production (kg/ha)	Relative production (%)	Difference compared to the control (kg/ha)
V_1	85850	153.7	29980***
V_2	64814	116.0	8944*
V_3	56530	101.2	660 ^{ns}
V_4	55870	100.0	0

DL 5% = 4896 kg/ha; DL 1% = 15520; DL 0,01% = 22472

The difference compared to the control version, of 29980 kg/ha, is considered positive very significant. A positive significant difference was also achieved in the classic fertilized version, of respectively 8944 kg/ha.

The microorganism fertilized version - V_3 , realised a non significant difference from the control version, respectively of 660 kg/ha.

CONCLUSIONS

1. At the beginning of the growing season, the highest values of plant height were obtained in the V_1 version, of 33.6 cm, and, by the end of the growing season, the biggest increases in the height of plants, of 72.8 cm, were recorded in

V_1 and in V_3 , of 69.6. This is mainly due to phenophases uniform distribution of nutritional elements.

2. The average number of fruits per plant ranged from 4.45, in the unfertilized version V_4 , till to 11.3, in the fertigated version - V_1 . Medium values close to V_1 were realised in the classic fertilized version - V_2 (9.55).

3. The weight of the *Brillant F1* sweet pepper fruit ranged from 100.45 g in V_4 till to 131.81 g, in V_1 .

4. The yield of sweet peppers within the experiment ranged from 55.870 kg/ha in the control version - V_4 , up to 85.850 kg/ha in the fertigated version - V_1 , which indicates that the fertigated version made a better distribution of the fertilizers in time and space, in the root system, the distribution being performed uniformly during the growing season.

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