

# INFLUENCE OF THE PRODUCT FURIA ON THE MORPHOLOGICAL CHARACTERISTICS OF PLANTS AND FRUITS OF LONG PEPPER GROWN IN SOLARIUM

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## ABSTRACT

*Furia is a product of plant origin, easily assimilated by cultivated plants. It is composed of organic nitrogen, organic carbon of plant origin, potassium oxide and fulvic acid. The experiment performed in a cold solarium had as objective the influence of this product on the main morphological characteristics of long pepper plants and fruits. The results obtained showed a positive influence of the product on the growth in height of pepper plants, the increase in fruit length and diameter and the increase in the average number of fruits per plant. The biofertilizer is accredited for use in organic horticulture.*

## INTRODUCTION

Pepper (*Capsicum annuum L.*) is among the most popular and preferred vegetable species crops in the world but also in Romania. This species, in our country, at the level of 2018 had a national production of 229,662 t with an average per ha of 12,775 kg. (<http://statistici.insse.ro>). The interest for this species is growing due to the high profit in general, and especially the nutritional value very important for human health (Dinu et al., 2018; Sun et al., 2017; Dinu et al., 2013; El-Hifn and El-Sayed, 2011).

It is known that chemical fertilizers increase the yield of horticultural crops, because plants use these nutrients directly, but these fertilizers also produce undesirable effects on the horticultural ecosystem such as: soil and microbial flora degradation, groundwater contamination and air pollution (Chaudhry et al., 2009; Kaur et al., 2008). Consumers and horticultural producers have become more aware of how vegetables are produced and whether food poses a risk to human health in terms of pesticide residues. Unlike

conventional production systems where plant nutrition is based on the use of synthetic and well-balanced fertilizers for plant absorption using soil analysis (Popescu and Dinu, 2019) organic horticulture is based on an agro-integrated system that uses organic fertilizer (Dorais, 2007). Organic fertilization has been shown to improve soil physical characteristics and nutrient retention in greenhouse soils (Scotti et al., 2016; Willekens et al., 2014).

The use of humic fertilizers to increase plant growth and yields has been the subject of many research studies over time. Humic substances can be characterized as humic acids, fulvic acids and humus based on water solubility depending on pH (Hartz and Bottoms, 2010). The effects of humic substances on the physicochemical properties of the soil include stabilization of soil structure (Hartz and Bottoms, 2010) and increased cation exchange. Chen and Aviad, (1990) found that optimizing root growth has been attributed to improved soil structure, stimulation of soil microflora, and auxin-like effects. Humic and fulvic acids play

an important role in soil fertility and plant nutrition. Soils rich in humic substances or fertilized with them influence the growth of plants, making them more stress tolerant, healthier, lead to high yields and superior nutritional quality of the harvest (Pettit, 2004).

It is also known that foliar application of humic acids has a rapid impact on the supply of plants according to their requirements. The use of humic acid spray on the leaves of tomato plants is one of the modern methods used to improve plant growth and productivity, due to their direct role in increasing the content of chlorophyll, lycopene, essential enzymes involved in organizing metabolic events or activating antioxidants (Dinu et al., 2015). Therefore, a higher resistance of plants to stress conditions is obtained (Cerdána et al., 2009), as well as a higher productivity in such conditions (Hounscome et al., 2008). Serna et al. (2012) found that spraying pepper plants with a mixture of amino acids led to an increase in the efficiency of photosynthesis and thus to a very good vegetative growth. Sarojnee et al. (2009) and Korkmaz et al. (2012) found that the use of amino acids, also in a pepper crop, led to a pronounced increase in plant height, number of arms and dry weight of shoots, especially after 50 days of treatment, compared to untreated plants.

The aim of this study was to observe the effect of Furia fertilizer, an organic fertilizer based on fulvic acids on the morphological characteristics of plants and fruits of long pepper grown in solarium.

## MATERIAL AND METHOD

The study was conducted in a cold solarium, and the experience was bifactorial: the factor "a" was represented by technology, having two graduations: a1-V1 - the classic technology of pepper cultivation in solariums and a2-V2 - foliar fertilization supplement with the FURIA product, in a concentration of 0.25%, and the factor "b" was represented by the long pepper varieties: b1-Bogdan, b2-Lung de

Ișalnița, b3-Lung românesc, b4- Doljan, b5-Cosmin, b6-Fermier, b7- Kaprima F1. 3 treatments were applied at intervals of 15 days (Table 1). The observations consisted of biometric determinations on pepper plants and fruits. The biometric determinations concerned the height of the stem (cm), the height of the plant (cm), the length of the fruit (cm), the diameter of the fruit (cm), measured at the base of the fruit, the average weight of the fruit and the number of fruits per plant. In order to highlight the effectiveness of foliar fertilizer, the comparison of the results was made against the witness.

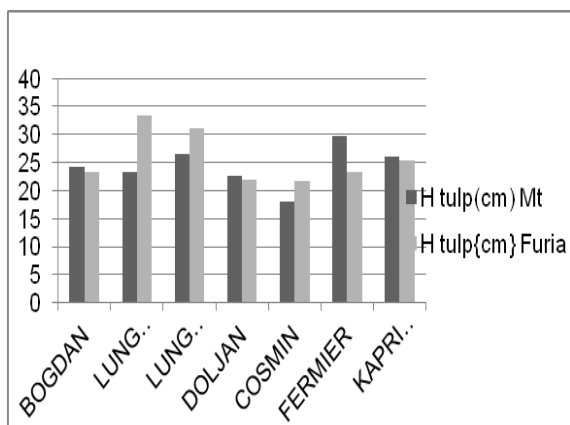
## RESULTS AND DISCUSSIONS

From the data recorded and compared to the witness, it was observed that the FURIA foliar fertilizer had, in most cases, a positive effect on the main morphological characteristics analyzed for the pepper varieties studied.

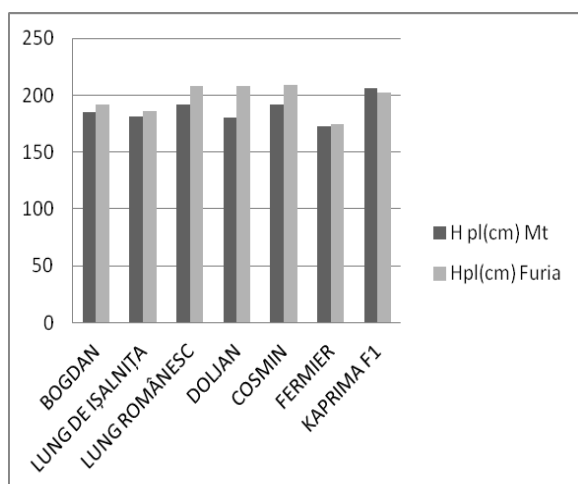
The height of the stem, measured from the root to the first branch, varied from 18.0 cm (Cosmin) to 29.8 cm (Fermier), for non-fertilized variants and from 21.6 cm also at Cosmin to 33.4 cm at Lung de Ișalnița, for the variants fertilized with Furia. There is a variation of growth, between genotypes in both non-fertilized and fertilized variants, which demonstrates the influence of the cultivar on this growth character (Figure 1). However, it is observed that the same unfertilized cultivar had higher values than the fertilized one, this being explained by the effect of the fertilizer which determined a decrease of the distance between the nodes. The cultivars that were influenced by the fertilizer were: Bogdan, Doljan, Fermier and Kaprima F1. Fury fertilizer increased the height of long pepper stalks, claims also made by Sarojnee et al., 2009 and Korkmaz et al., 2012.

The height of the plant showed higher values in most foliar fertilized varieties, compared to the witness, except for the hybrid Kaprima F1, with a negative difference of 4 cm compared to

the control (Figure 2). These data are in agreement with those obtained by Chooneea et al., (2009) on tomatoes or Talat and Youssef (2002) on *Ocimum basilicum*.



**Fig.1. The height of the stem of long pepper cultivars**



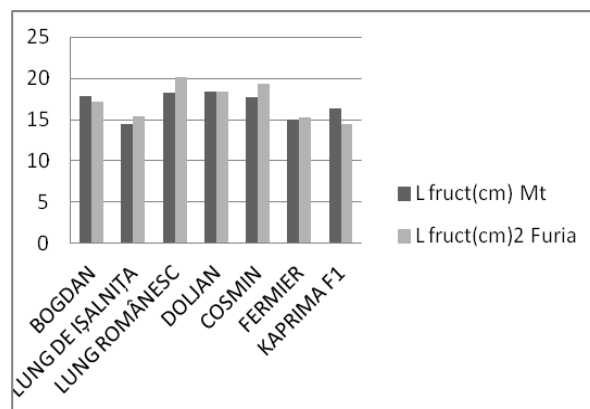
**Fig.2. Average height of long pepper plants / cultivar**

The Doljan cultivar registered the largest difference in plant height growth compared to the witness variant (+ 28 cm), followed by Cosmin (+16.8 cm) and Lung româneșc (+16 cm). There is no positive correlation between stem growth and plant growth.

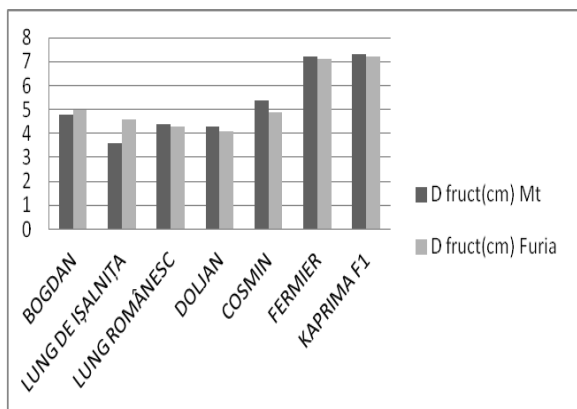
*The influence of fertilizer on the morphological characteristics of long pepper fruits.*

The length of the fruit does not show significant differences between the two technological variants (Figure 3). The

average length of the fruits from the non-fertilized variants varied from 15 cm at Fermier to 18.4 cm at Doljan, and at the variants fertilized with Furia from 15.3 cm at Fermier at 20.2 cm at Lung româneșc. The foliar treatment positively influenced the fruit length in the cultivars Lung româneșc (+2 cm), Cosmin (+1.7 cm), Lung de Ișalnița (+1 cm) and Fermier (+0.3 cm), compared to the non-fertilized variants. Chooneea et al., (2009) conducted a study on peppers with foliar fertilizers based on humic acids and found that the fertilizer caused an increase in the length and diameter of the fruits. The diameter of the fruit, measured at the base of the fruit, does not show significant differences between the two technological variants, in the vast majority of cases, only Lung de Ișalnița has a positive difference of 1 cm from the control (Figure 4). The diameter of the fruit had values between 3.6 cm at Lung de Ișalnița and 7.3 cm at Kaprima F1 at the unfertilized witness and between 4.1 cm at Doljan and 7.2 cm Kaprima F1. It can be said that the fertilizer caused the fruit to deform.

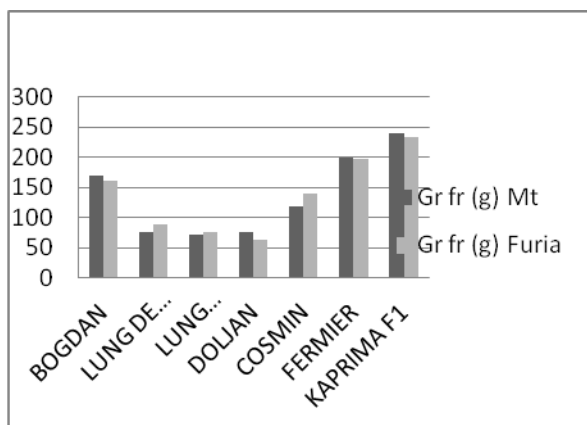


**Fig.3. Average length of fruit / cultivar**



**Fig. 4. Average diameter of fruit / cultivar**

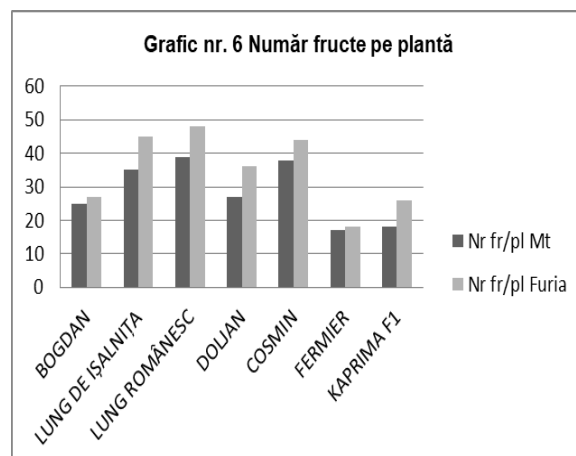
Regarding the average weight of the fruit, it registered values by a few grams lower in the variant that benefited from foliar treatment, compared to the unfertilized control (Figure 5), except for the cultivars Cosmin (+22 g), Lung de Ișalnița (+13 g), Lung Româneșc (+4 g). Fertilizer application was not effective for all cultivars in terms of average fruit weight, a statement also supported by Hartz and Bottoms (2010) in a tomato crop.



**Fig. 5. Average weight of long pepper fruits / cultivar**

The number of fruits per plant, a character that influences the productive capacity of a pepper cultivar, has increased in the case of additional application of Furia foliar fertilizer, for all pepper cultivars studied. There was a significant variation from 17 fruits / plant at Fermier to 39 fruits / plant at Lung Româneșc in the non-fertilized variants and from 18 fruits / plant at Fermier at 48

fruits / plant at Lung Româneșc, at the fertilized variants (Figure 6).



**Fig. 6. Average number of fruits / plant / cultivar**

The increase of the average number of fruits / plant was also observed by Serna, et al., (2012) in a culture of bell pepper grown in a greenhouse and foliar fertilized with biostimulators. The difference from the witness is one fruit / plant at the farmer Fermier at 10 fruits / plant at the Lung de Ișalnița cultivar. A higher number of fruits per plant were recorded in cultivars in which the average weight of the fruit showed lower values.

## CONCLUSIONS

Application of the biostimulator Furia in a long pepper crop grown in a cold solarium caused a significant increase in plant height, fruit length and diameter, as well as the average number of fruits / plant.

The results of this research support the application of biostimulators based on fulvic acids, to stimulate plant growth and increase the marketable yield of long pepper fruits, with minimal risks harmful to the environment and farm workers.

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Table 1

**Long pepper cultivars studied**

| VARIETY          | PROVENANCE<br>variety | FRUIT COLOR AT MATURITY |               |
|------------------|-----------------------|-------------------------|---------------|
|                  |                       | technicalities          | physiological |
| BOGDAN           | SCDL Ișalnița         | Yellowish green         | Red           |
| LUNG DE IȘALNIȚA | SCDL Ișalnița         | Dark green              | Dark red      |
| LUNG ROMÂNESC    | SCDL Ișalnița         | Yellow-greenish         | Red           |
| DOLJAN           | SCDL Ișalnița         | Yellow-greenish         | Orange        |
| COSMIN           | ICDLF Vidra           | Dark green              | Dark red      |
| FERMIER          | SC Mefim Agro SRL     | Dark green              | Dark red      |
| KAPRIMA F1       | Holland Farming       | Dark green              | Dark red      |