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Partial results regarding obtaining of 'Lollo Bionda' lettuce on perlite substrate

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Abstract Partial results concerning the obtaining of ‘Lollo Bionda‘ lettuce on perlite substrate are in this research. Lettuce (*Lactuca sativa* L.) is a important vegetable in Romania. An aim of lettuce crop is yield. The research of this paper has aimed at obtaining of ‘Lollo Bionda‘ lettuce on perlite substrate in a glass greenhouse. The study has been carried out in a Hortinvest Research Center greenhouse at the University of Agronomic Sciences and Veterinary Medicine of Bucharest, in 2016 and 2017 years, on a variety of lettuce (‘Lollo Bionda’ from the Sementi company). Perlite (2 and 4 mm) has been the unconventional crop substrate. The fertilization has been done in several variants: chemical (green universal 23+06+10+2,7MgO + microelements) and with some products (Formulex, Iguana and Vermiplant). Higher average values (2016-2017) have been recorded for the fertilized variant with Formulex on 2 mm perlite substrate (17.5 leaves/plant) and the chemical fertilized variant on 4 mm perlite substrate (19.41 leaves/plant). The higher average values are observed for the plants cultivated on the substrate with a granulation of 4 mm for all the fertilizated variants compared to the plants cultivated on the substrate with a granulation of 2 mm. The unconventional soilless lettuce crop system, the ‘Lollo Bionda‘ variety on perlite substrate, has good results in the greenhouse conditions from Romania.

Key words

greenhouse, lettuce, cv. ‘Lollo Bionda‘, soilless culture, unconventional system

Lettuce (*Lactuca sativa* L.) is a very popular vegetable for fresh consumption both in Romania and other geographical areas. Climate change and degraded land surfaces have led to the finding of alternatives to avoid field crops (Ismail et al., 2017; Melillo et al., 2014) crops and very high temperatures lead to the emergence of flower stalks [12].

In the absence of an optimal soil, it is recommended the lettuce growing in different soilless systems, on different natural substrates.

Bradley and Marulanda (2001) as well as Sheikh (2006) who consider that modern soilless systems are superior to field production systems and Drăghici et al. (2019) that lettuce cultivation technologies in the unconventional system are constantly evolving because the production obtained is high quantitatively and qualitatively compared to that obtained in the conventional system.

Light quality is very important for salad cultivation. The use of additional LED lighting leads to increased production (Li Q. and Kubota, 2009), a faster growth rate of plants but also the accumulation of a lower amount of nitrates and higher amounts of vitamin C [18].

Grewal (2011) focused on some research on the efficient use of water and nutrients as well as the recycling of wastewater

Excessive use of nitrogen fertilizers can lead to the accumulation in the edible part, beyond the allowed limits, of nitrites and nitrates at the same time and to the pollution of the ecosystem. Proper salad growth is achieved in the presence of nitric and ammoniacal nitrogen [22].

Ciofu et al. 2004 consider that optimal fertilization with phosphorus fertilizers accelerates the early formation of lettuce heads, and potassium fertilizers to the formation of qualitatively superior heads. Proper nutrition with calcium and magnesium positively influences the production and resistance of plants to disease and the quality of water used to prepare the nutrient solution and the treatments applied to it lead to the safety and quality of salad obtained in the unconventional systems [9].

Organic fertilizers positively influence the production and decrease the nitrite content (Cheng-Wei Liu et al., 2014), compared to the variants obtained under mineral fertilization conditions.

Murshidul et al., (2008), appreciated that increasing the concentration of NO_2^- reduced plant height, fresh and dry biomass yield, also the number of leaves.

Tabaglio et al., (2020) mentioned that Lettuce (*Lactuca sativa* L.) is a leading greenhouse-grown vegetable and also estimates that suspending fertilization 2–4 days before harvesting lettuce grown in the NFT system can reduce NO_3 accumulation by about 29–58%.

Marinov et al. 2010, in studies on a lettuce crop in the solarium, argued that excessive nitrogen fertilization leads to deep soil pollution.

An aim of the lettuce crop is yield. The lettuce crop in the soilless system has a superior yield compared to the conventional crop. Al-Kinani et al. (2021) have experienced the soilless lettuce crop, in NFT, Ebb and Flow systems. The earliness and production of lettuce have good results in this system.

Bradley and Marulanda (2001); Sheikh (2006) have researched the soilless crop system because it is superior to the yield system on the field. This system reduces the requirements of terrain, water, and nutrients, there is no use the herbicides, and the pesticides are natural barriers to vegetables [4].

Carmassi et al., (2005) and Bar-Yosef, (2008) have investigated several perlites and zeolite substrates for lettuce (*Latuca sativa* var. *capitata*) and have obtained significant production increases. Similar aspects were mentioned in the studies conducted by Ayșe Gül et al. (2005) as well as Langenhoven, (2016). The experience of this paper has aimed the identify technology for obtaining of 'Lollo Bionda' lettuce on perlite substrate (2-4 mm) in a glass greenhouse at the University of Agronomic Sciences and Veterinary Medicine of Bucharest in Romania.

Material and Method

The research of this paper has aimed the obtain of 'Lollo Bionda' lettuce on perlite substrate. The study was carried out in a greenhouse condition at the University of Agronomic Sciences and Veterinary Medicine of Bucharest, in 2016 and 2017 years, on a variety of lettuce ('Lollo Bionda' from the Sementi Company). Perlite of 2 mm and 4 mm has been the crop substrate. The fertilization has been done in several variants: Chemical (green universal 23+06+10+2,7 MgO and microelements); Formulex; Iguana; and Vermiplant.

Biological material

The research has been conducted on 'Lollo Bionda' lettuce (*Lactuca sativa*). `Lollo Bionda' is a variety with large green leaves and wrinkled leaves and can be grown both in the greenhouse, other protected areas and in the field.

Figure 1. 'Lollo Bionda' lettuce

Crop substrate

Mattresses filled with perlite in two variants perlite, with a grain size of 2 mm and 4 mm in diameter, were used as culture support.

a.

b.

Figure 2. Jiffy peat pots (a.)
and mattresses with perlite (b.)

Nutrition conditions

The fertilization has been done in several variants:

Formulex containe azot 2.4%; nitrate azote 2.19%; ammoniacal azote 0.21%; phosphorus pentoxide 0.85%; potassium oxide 3.36%; calcium oxide 1.85% and some microelements: boron 0.0108, cobalt 0.0006; copper Fe chelate 0.0025; mangnesium 0.0131; molybdenum 0.0012; and zinc chelate 0.0036.

Iguana is an organic product, certified, which contains NO_3 3.00%, P_2O_5 1%, K_2O 3%.

Liquid Vermiplant is obtained by the red earthworms aid from California, through to composting manure from cattle, sheep, pig and horses in a ratio of almost 100%.

Results and Discussions

The leaves number per 'Lollo Bionda' lettuce plant cultivated on perlite substrate (2 mm) is presented in figure 3. The average data for the period 2016-2017 showed that the average number of leaves formed per plant during the two years of cultivation was between 17.04 leaves in the version fertilized with Vermiplant and 17.5 leaves in the version fertilized with Formulex. It was found that in 2016 the number of leaves formed on the plant was lower than in 2027, in the case of all experimental variants of fertilization. In 2016, the lowest values were recorded for the chemically fertilized version (16.33 leaves) and the highest for the Iguana fertilized version (17.25 leaves). In 2017, the total number of leaves was 18.33 leaves in the chemically fertilized variant and with Formulex. The lowest values regarding the number of leaves were recorded in the variant fertilized with Iguana (17.25 leaves/plant).

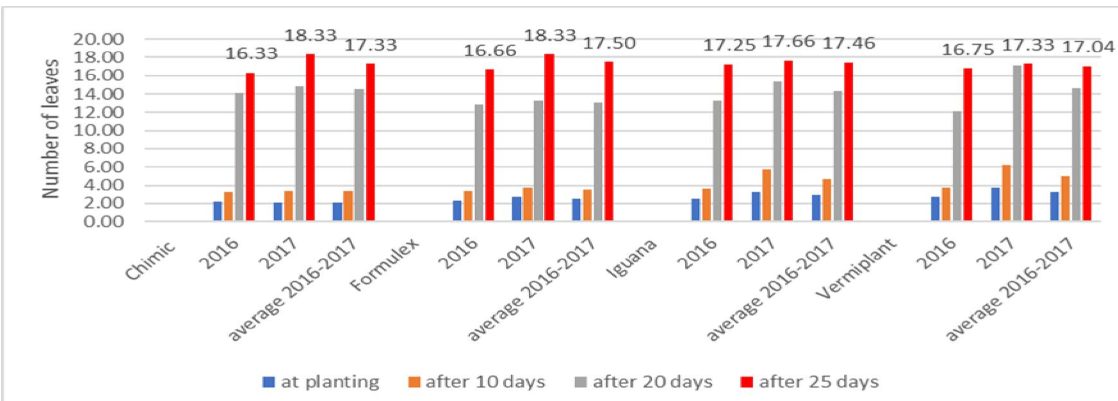

Figure 3. Evolution of the number of leaves on lettuce plants 'Lollo Bionda' variety on plants grown on the substrate with a grain size of 2 mm and signification (Duncan test)

If the plants were grown on a 4 mm granular perlite substrate, it was found that the number of leaves did not vary much between fertilization options. The fewest leaves were recorded in the version fertilized with Vermiplant (18.33 leaves/plant). Most leaves were formed in the chemically fertilized version (19.41 leaves/plant).

Following the evolution of the leaves in the variants fertilized with Formulext and Iguana, it was found that the differences were not very large, this being 18.79 leaves/plant and 19.00 leaves/plant. The leaves number for 'Lollo Bionda' lettuce plant cultivated on perlite substrate (4 mm) is presented in figure 4.

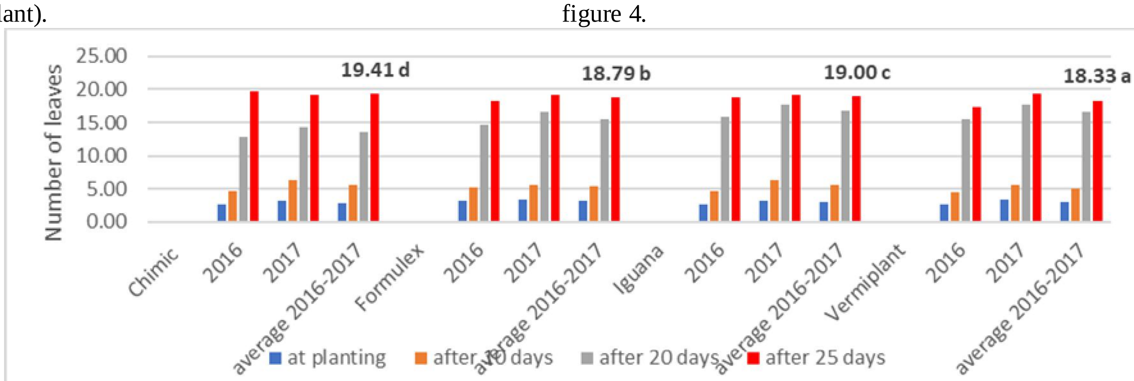

Figure 4. Evolution of the number of leaves on lettuce plants 'Lollo Bionda' variety on plants grown on the substrate with a grain size of 4 mm and signification (Duncan test)

Figure 5. Lettuce plants were obtained on perlite substrate with 4 mm diameter and lettuce plants were obtained on perlite substrate of 2 mm and chemically fertilized

The values for the average mass of 'Lollo Bionda' lettuce plants on perlite substrate (2 and 4 mm) are shown in Figure 5. It was found that in 2016 the lowest average mass of plants was recorded in plants grown on perlite substrate with a grain size of 2 mm and fertilized with Vermiplant. In 2017, the lowest average mass of plants, 166.85 g was also recorded at Vermiplant. On average, for the two years, lettuce plants with average masses of 152.35 g were obtained for the variant cultivated on a 2 mm perlite substrate and fertilized with Vermiplant (152.35 g) and 153 g / plant for the chemically fertilized variant. Analyzing, by comparison, the data on the average mass of the plants, it was found that on the perlite substrate with a grain size of 4 mm, the mass of the plants was higher compared to those obtained on the perlite substrate with a grain size of 2 mm.

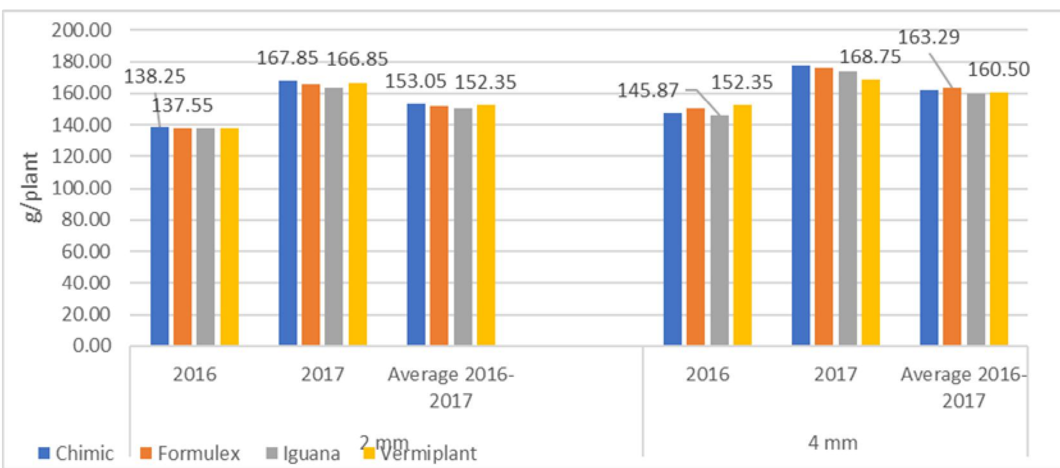

Figure 5. Average mass of 'Lollo Bionda' lettuce plants on perlite substrate (2 and 4 mm)

Analyzing the relationship between the type of substrate and the fertilizers used, it was found that on average for the period 2016-2017, no significant differences were observed between the experimental variants on the average mass of plants ($R^2 = 0.1691$) which shows that in the case of the substrate of 2 mm perlite, the average mass of lettuce plants varied very little when I applied different fertilizers. In the case of perlite substrate with a grain size of 4 mm, the influences were much more obvious ($R^2 = 0.4901$). This may lead to the appreciation that larger-grained perlite can influence plant size (figure 6).

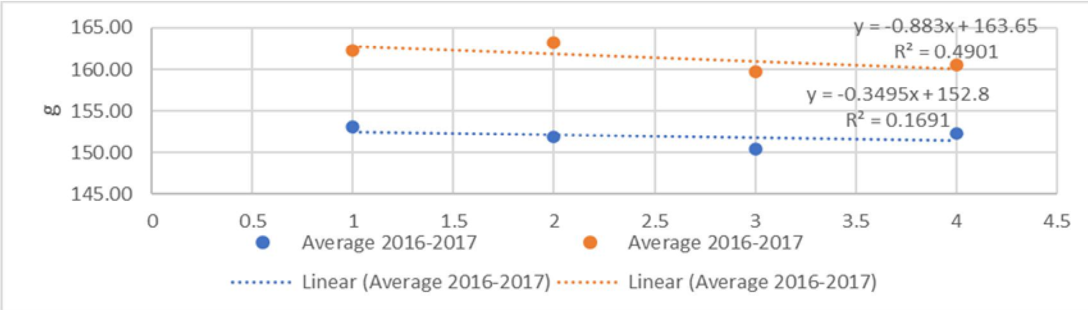

Figure 6. The influence of substrate and fertilizers on the average mass of lettuce plants

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Conclusions

The experience of this research has identified a technology for obtaining the 'Lollo Bionda' lettuce on perlite substrate and different fertilization variants.

The experimental variants cultivated on perlite have shown that the lettuce crop yield depends on the nutritional conditions and substrate type (2 or 4 mm perlite).

The higher average values (2016-2017) were recorded for the fertilized variant with Formulex on 2 mm perlite substrate and the chemical fertilized variant on 4 mm perlite substrate.

The higher average values are observed for the plants cultivated on the substrate with granulation of 4 mm for all the fertilized variants compared with the plants cultivated on the substrate with granulation of 2 mm.

'Lollo Bionda' lettuce grown on perlite substrate and fertilized chemical or with Iguana, Formulex, and Vermiplant is recommended for the crop in the greenhouses from Romania.

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