INFLUENCE OF FERTILIZATION MANAGEMENT ON THE QUANTITY AND QUALITY OF WHITE CABBAGE

INFLUENȚA FERTILIZĂRII DIFERENȚIATE LA VARZA ALBĂ ASUPRA CANTITĂȚII ȘI CALITĂȚII PRODUCȚIEI

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Abstract: *The cabbage crops is one of the most important spectrum vegetable plants, this is demonstrated by the large area planted and yields obtained. The quality and quantity of white cabbage depend by variety, technology, fertilizer management, and maintenance. The purpose of this work has been to evaluate the influence of management fertilization on early cabbage production and the content of nitrites and nitrates. The favorable effect of fertilization regime on total production at Bourbone cultivar observed by different production from 43.363 t/ha in control to 69.376 t/ha at variant fertilized with Micoseed®. The nitrate content ranged from 0.34 mg/kg in control up to 0.72 mg/kg in the version organic fertilized. The nitrate content ranged from 48.11 mg/kg in control up to 162.14 mg/kg in version fertilized with Nutrifine®.*
Key words: *Brassica oleracea L., var. capitata L., f. alba DC; fertilizers; contaminants; yield*

Rezumat: *Cultura verzei este una dintre cele mai importante în spectrul plantelor legumicole, acest fapt este demonstrat de suprafața mare cultivată dar și de producțiile obținute. Calitatea producției de varză albă precum și cantitatea acesteia, diferă în funcție de soi, tehnologia de cultivare, îngrășăminte administrate, lucrări de întreținere precum și de condițiile meteorologice. Experința de față a avut ca scop studiul influenței fertilizării diferențiate a unei culturi de varză timpurie asupra producției totale si a conținutului de nitriți și nitrați. Efectul favorabil al fertilizării asupra producției totale la cultivarul Bourbone se observă din variația producției de la 43,363 t/ha în varianta martor la 69,376 t/ha varianta fertilizată cu Micoseed®. Conținutul de nitriți a variat de la 0,34 mg/kg în varianta martor până la 0,72 mg/kg în varianta fertilizată organic, iar conținutul de nitrați a variat de la 48,11 mg/kg în varianta martor până la 162,14 mg/kg în varianta fertilizată cu Nutrifine®.*
Key words: *Brassica oleracea L., var. capitata L., f. alba DC; fertilizanți; contaminanți; recoltă.*

INTRODUCTION

White cabbage is widespread in Romania (15% of the vegetable), being cultivated from early spring until late autumn, using adapted cultivation in this sense (Stan and Munteanu, 2001). White cabbage is resistant specie to low

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temperatures, which gives a good adaptation to climatic conditions and the possibility of extending cultivation conveer.

Early cabbage crop in the NE region of Romania can establish successful during 1-7 April in each year, were obtained production from 29.89 t/ha up to 31.01 t/ha, for a crop density of 47,619 pl./ha (Sabareanu-Stoleru, 2010). According to the weather conditions of every year, planting period can increase or decrease obtained production.

For other areas of Romania such Transylvania, at a density of 71,500 pl./ha, in the conventional system can achieve an average production of between 52-56 t/ha (Csok, 2009).

The cultivar for establishing the crop can also have a major role in achieving high productions (Indrea *et al.,* 2012).

In the cabbage crop system, the cultivar has a decisive influence on production, and the economic efficiency of crop. If in conventional crop be carried out studies on fertilizer influence on production if they are relatively few organic farming and worth studying because it prevents contamination production. The differentiated fertilization in organic agriculture has positive influence on pest control (Stoleru *et al.*, 2012)

MATERIAL AND METHOD

The experiment with early cabbage crop was carried out in an experimental plot at UASVM Iasi, during 2014.

The experimental crop was established in 7 April 2014, by seedlings of 45 days, with a distance design of 70 x 30 cm (N= 47°11'34,07" E= 27°32'59,63"). Seedlings were been produce in a greenhouse, according with specific literature (Stan and Munteanu, 2001; Indrea *et al.*, 2012).

The soil from the stationary is a mold chambic chernozem, easy antropic, whit the following physicochemical properties, in the substrate of 0-60 cm: clay 32 %, ph=7,11, EC=252.3 µS/cm2, $CaCO_3$=1.03%, OM=28.23 mg/kg, C/N = 5,20, N=4.53 g/kg, P=106.66 ppm, and CEC = 20.9 meq/100g.

The biological material was used the ***Bourbone F1***, recommended for early open field.

To achieve its purpose, treatments were applied fertilizers in organic farming systems organic and conventional as follows: Orgevit® = 1300 kg/ha (applied in five stages, the first stage in 20 April and the following 10 in 10 days), Nutrifine®=1100 kg/ha (like as Orgevit®) and Micoseed®=75 kg/ha (applied in three stages, the first stage in 20 April and the following 10 in 10 days, that the treatment 4 and 5 was used Nutryaction®=5 l/ha)

Micoseed® It is a fertilizer based on microorganisms, particularly based *Glomus sp.* Nutrifine® is a synthetic chemical complex like as NPK 20-20-20. Orgevit® is an organic fertilizer (100%) from chicken manure applied as drops.

The total yield and dynamic of production, according with fertilization schemes, was carried out by weigh the heads, for each harvest.

Fig.1 - Bourbone cultivar

The principle of humidity determination is based to loss of the drying oven at a temperature of 102°C, until a constant mass. The loss will be calculated as a percentage relative to the initial mass of the sample (Butnariu and Butu, 2014). Determination of heavy metals in vegetables is by dry mineralization. This consists in the destruction by carbonization and incineration (450-500°C) oven sample; ash being thus passed by dissolving in dilute hydrochloric acidan (Butnariu and Butu, 2014). The analyses of the heavy metals in cabbage have been made at the UASVM Iasi and UASVMB Timisoara.

The dates collected have been statistical analyzed by one-way analysis of variance (ANOVA) and least significant differences (LSD) at 5%, 1% and 0.1% confidence levels for production. For the contaminants, the statistical significance were carried, compared with maximum accepted limit (MAL).

RESULTS AND DISCUSSIONS

Production results from early white cabbage

In 2014, early white cabbage production ranged from 43.36 t/ha to 69.37 t/ha. In all experimental versions, the production was higher to the control un-fertilized. In the version biological fertilized with microorganisms, total production was the biggest is considered positive very significant.

In the versions organic and chemical fertilized, the total yields obtained were relatively similar, and are superior to control.

Table 1

The influence of fertilization on cabbage yield

Experimental version	Average head cabbage (g)	Total yield (t/ha)	Relatively yield *vs.* Control (t/ha)	Differences *vs.* Control (t/ha)
Bourbone x Nutrifine	1276.99	53.199	122.68	9.836**
Bourbone x Micoseed	1665.28	69.376	159.99	26.013***
Bourbone x Orgevit	1277.69	53.228	122.75	9.865**
Martor	1040.89	43.363	100.00	0

DL 5%=4,38t/ha; DL1%=6,63 t/ha; DL 0,01%=10,65 t/ha

- distinctly significant positive differences; *- very significant positive differences.

Results on nitrate and nitrite content on white cabbage

The nitrites content ranged from 0.34 mg/kg in control up to 0.72 mg/kg in the version organic fertilized. The nitrate content ranged from 48.11 mg/kg in control up to 162.14 mg/kg in version fertilized with Nutrifine®.

From the data obtained on fertilization regime on the content of nitrites and nitrates, we can say that regardless of the amount of fertilizer used and the type of early cabbage does not exceed the maximum acceptable limits, according with scientifically literature (Butnariu and Butu, 2014; Stoleru *et al.*, 2014).

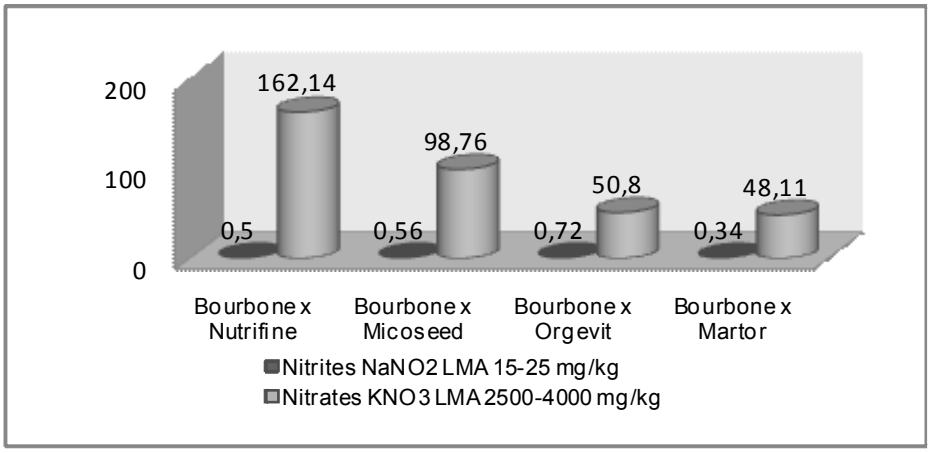

Fig.2 - The content of nitrites and nitrates in the white cabbage (mg/kg)

The influence of fertilization on the content of heavy metals in cabbage

The results on the influence of fertilization on heavy metal content are presented in Tabel 2. The values obtained for the heavy metals of each variant were compared with the MAL. The content of Cr range from 55 to 67 mg/kg, which shows that each version was exceeded MAL. Cu content varied from 31 to 37 mg/kg, which highlights that regardless of fertilization regime, the content of this element is not influenced.

The Pb element varied in the term of large limits, from 26 mg/kg in the biological version up to 52 mg in Control. In this version has been recorded and who is overcoming MAL who is 50 mg/kg.

Zn content rage from 118 mg/kg in chemical version up to 155 mg/kg.

Table 2

Heavy metal contents on white cabbage

Experimental version	Heavy metal content (mg/kg)			
	Cr	Cu	Pb	Zn
Bourbone x Nutrifine	55	37	48	118
Bourbone x Micoseed	56	33	26	132
Bourbone x Orgevit	67	35	35	139
Bourbone x Martor	58	31	52	155
MAL	**50**	**50**	**50**	**150**

CONCLUSIONS

The best production result was obtained in the version fertilized with Micoseed® (69,376 t/ha).

Regarding fertilization regime used in experimental version that regardless of the amount used has not influenced the content of nitrates and nitrites.

In most samples, the MAL for heavy metals was not exceeded. Values higher than the MAL were recorded for version control.

The presence of chemical contaminants in most versions, maintaining the support for monitoring investigations in order to protect human health.

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