CHEMICAL RISK ASSESSMENT ON RUNNER BEAN (*PHASEOLUS COCCINEUS* L.)

EVALUAREA RISCULUI CHIMIC LA CULTURA DE FASOLE MARE (*PHASEOLUS COCCINEUS* L.)

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Abstract: *Runner beans is very few studied in Romania, but the importance of this specie consist of high nutrient value: hydrocarbon - 7.7%, protein - 2.4%, vitamins, minerals and fiber. Currently runner bean crop, like all vegetable species, is undergoing a number of chemical factors like: pesticides, fertilizers and hormons.The aim of this study assessing chemical risk factors on runner bean crop in NE region of Romania. Content level of contaminants vary depending on the variety, but the obtained values not exceeding the maximum limits admitted by regulation, but some contaminants are at maximum levels. This requires especially where conventional monitoring system value pods residues so that consumption would not pose a risk.*
Key words: runner bean, yield, nitrates, nitrites, heavy metals

Rezumat: *Fasolea mare este foarte puţin studiată în Romania, însă importanţa alimentară ridicată este dată de conţinutul în: hidrocarbonaţi - 7,7%, proteine - 2,4%, vitamine, săruri minerale şi fibre. În prezent cultura de fasole mare, la fel ca toate speciile legumicole, este supusă acţiunii unui număr mare de factori de natură chimcă (pesticide, fertilizanţi, hormoni). Studiul de faţă a avut ca scop evaluarea factorilor de risc chimic asupra culturii de fasole mare, în condiţiile zonei de NE a Romaniei. Nivelul conţinutului de contaminanţi variază în funcţie de soi la acelaşi regim de fertilizare, însă valorile obţinute nu depăşesc limitele maxime admise de Reglementarea UE. Datorită faptului că unii contaminanţi sunt la nivel maxim, este necesară o permanentă monitorizare a valorii reziduurilor, astfel încât consumul de păstăi să nu reprezinte un risc pentru organismul uman.*
Cuvinte cheie: fasole mare, producţie, nitraţi, nitriţi, metale grele

INTRODUCTION

The tradition for growing vegetables, aspects of the natural environment and the socio-economic favors organic vegetable production in Romania (Stoleru, 2013). In this case the risk factors of organic production are in a low share and a relatively low degree of intensity. From this point of view, chemical risk factors can endanger food safety vegetables (Cucu, 2010). Chemical risk factors are

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represented by the totality of chemical pollutants that cause environmental damage (Munteanu *et al*., 2011; Munteanu *et al*., 2012).

Some of polluting chemicals include: pesticides, chemical fertilizers of synthetic and detergents derived from domestic and commercial activity (Hura, 2006).

Vegetables contain variable quantities of nitrites / nitrates and heavy metals that come from the environment. Fertilization with organic fertilizers favors the growth of nitrate content in products. Accumulation of heavy metals in plant products requires knowledge of soil and groundwater contamination with these chemicals polluting. Toxic metals in vegetables due to arrive in agriculture treatments, acid rain, etc (Cucu, 2010; Munteanu *et al.,* 2012).

Food degradation under the action of chemicals occurs from the use of irrational fertilization practices in agriculture (Stoleru, 2013).

FAO and WHO have shown that although state chemical pollution is different from one area to another crop plants, animals and man are affected by chemical contamination universally. So, quantitative analysis and discovery and toxicology of heavy metals in crops, animals and endangering human health quality have led to serious concern lately (Stefan *et al.,* 2013; Hamburda *et al*., 2016).

Heavy metals get into the soil after depositing particulates in the atmosphere, irrational waste storage, and due to agricultural activities consisting of misuse of fertilization methods. Heavy metals are a risk factor in organic farming because they have property to bio-accumulate, to accumulates in certain tissues and organs in plants and animals (Hura, 2006) and to solubilize combinations in which the soil.

The aim of this study was to conduct studies and research on which to highlight the influence of chemical risk on large bean crop in terms of the natural environment of the "V. Adamachi" farm.

MATERIAL AND METHOD

Experimental site

The experiments were carried out in the V. Adamachi, Iasi county, during 2016. The crop was established in a tunnel, on the area of 400 sm. The maintenance works were applied in accordance with the scientific literature (Munteanu *et al*., 2010; Indrea *et al.,* 2012; Hamburdă *et al.,* 2016; Dumitrescu *et al.,* 1997). Iasi area is characterized in terms of climate with average temperatures of 9.6° C and rainfall around 537 mm annually (Munteanu *et al*., 2010). The experience was organized in a split plot designed in randomized blocks, with 3 repetitions on each version. Each variant of the repetition included 40 plants.

For the fertilization system eas used a fertilizer from gamaNutrispore, in an amount of 300 kg/ha, applied in two times, 150 kg/ha at soil preparation and 150 kg/ha in the phenophase of flowering (Stoleru, 2013).

Nutrispore is a fertilizer containing 20 % of nitrogen, phosphorus andrihyde, potassium oxide, boron (B) 0,012%, iron (Fe) 0,012%, manganese (Mn) 0,01%, zinc(Zn) 0,003%, obtained by homogenization with a small amount of chlorine. Nutrispore range is obtained from the use of high quality raw materials to ensure the rapid solubility in the absence of residues.

Biological materials

Materials used consist in four large varieties of runner beans, from UK, namely: Lady Di, Desiree, Polestar, White Apollo.

Determination of contaminants

Nitrate and nitrite in vegetable products is determined using a spectrophotometer, or fotoclorimetrului with reagents such as: a saturated solution of borax, potassium ferrocyanide, zinc acetate, Griess reagent.

The principle of the method consists in quantifying the degree of intensity of color compound nitric occurred as a result of reaction diazotation of sulphanilic and nitrite in acid aqueous sample to sample and coupling with alfanaftilamina in order nitrite dosing.

Determination of heavy metals

In order to determine the content of heavy metals in plant products was carried out by a dry method thereof mineralization.

The principle of the method consists in the minimizing of the organic substance from the sample by carbonization and incineration electric furnace at 500 ° **C,** to yield the ash is introduced into the dilute hydrochloric acid.

RESULTS AND DISCUSSIONS

The production of runner beans are satisfactory, with tolerable differences depending on each variety. The lower production of 11.272 kg/ha was obtained in the Desiree variety. Production averages close to average variety experiment were obtained on White Apollo 13.991 kg/ha and Lady Di variety which produced 14.381 kg/ha. The highest value of production was achieved at Polestar variety with a quantity of 23.633 kg/ha, production is considered positive compared with experiment average (15.819 kg/ha).

Table1

Yield of runner bean

Cultivar	Total production (kg/ha)	Relative production (%) than average	Differences to the average (kg/ha) and signfication
Lady Di	14381	90.9	-1438^{ns}
Desiree	11272	71.25	-4547^{oo}
Polestar	23633	149.3	7814^{***}
White Apollo	13991	88.44	-1828^{o}
Mean of yield	15819	100	0^{ns}

Ns - non significant; o-negative significant; oo-negative distinct significant; ***-positive very significant

Results on the content of nitrites and nitrates in samples of runner beans

The amount of nitrates in each specific bean variety exceeds 100 mg/kg fresh weight, so the first option to obtain a content of 125.56 mg/kg, the variety Desiree was determined a nitrate content which fall in the value of 146.11 mg/kg, in the third variant was determined containing 110.09 mg/kg, and the White variety Apollo was obtained containing 123.78 mg/kg dry weight, compared to the limit of 4000 mg / kg according Regl. 396/2005.

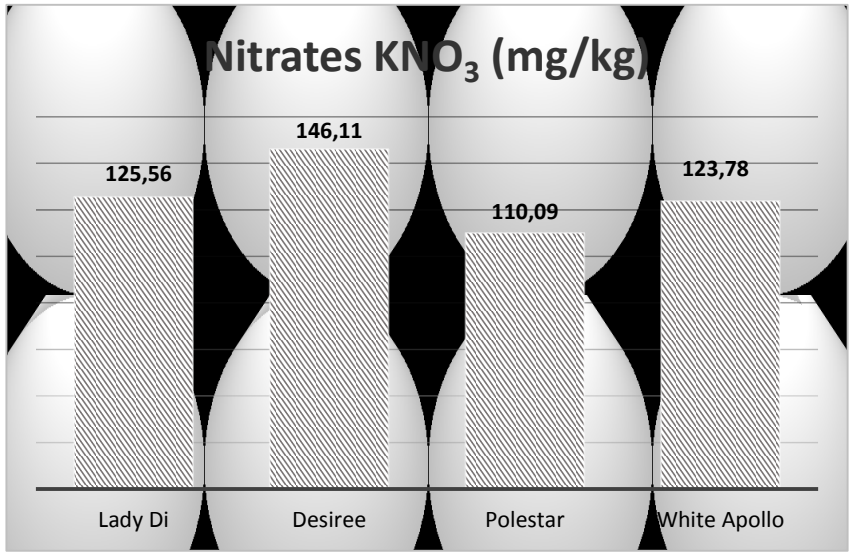

Fig.1 The nitrate content from runner bean under Nutrispore fertilization

Regarding the content of nitrite in four versions analyzed, recorded values were determined as 2.08 mg/kg dry weight, compared to the maximum limit of 20 mg/kg. Thus, in first variant were obtained 1.02 mg/kg, the Desiree variety solution was obtained with a determination value of 0.89 mg/kg, as a result of analysis on the sample to obtain a variety Polestar content of 2.07 mg/kg nitrite, and the Apollo cultivar White was obtained in a yield of 1.34 mg/kg nitrite.

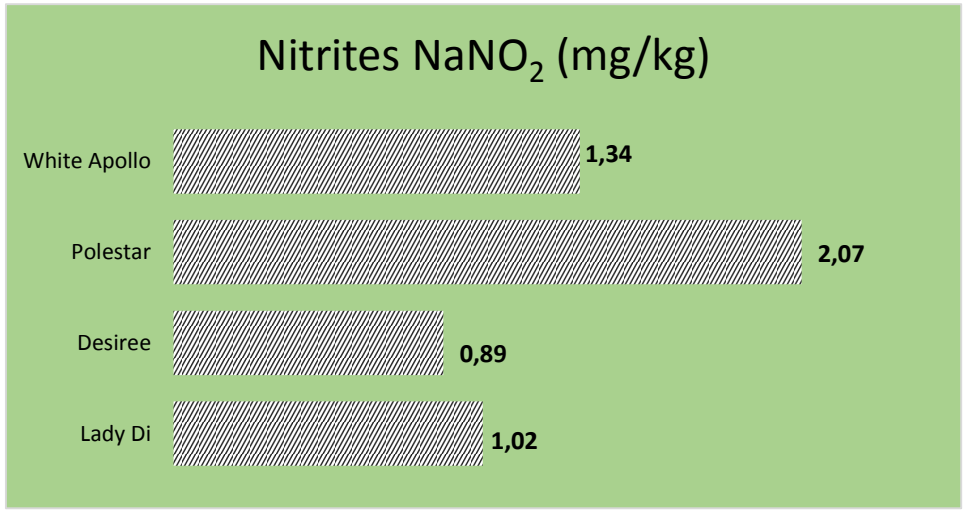

Fig. 2 The nitrites content from runner bean under Nutrispore fertilization

Results on the content of heavy metals in samples of runner beans

The content of heavy metals varies according to the variety, with the exception of the level of Cd is less than 10 mg/kg every control sample. The largest quantities were obtained for Cr and Zn, recorded values of over 100 mg / kg for each variety under analysis. Thus, the Cr level of the variety Lady Di sample of 130 mg/kg, the variety Desiree is 107 mg/kg variety Polestar is 127 mg/kg and 118 is the Apollo cultivar White mg/kg. Zinc content determined for each probe was 133 mg/kg variety White Apollo and Lady Di, 135 mg/kg variety Desiree and 137 mg/kg variety Polestar.

The level of Pb and Ni in the analyzed samples, ranging from 51-57 mg/kg, and the content with between 44-48 mg/kg.

Table2

Heavy metals content from runner bean

Cultivar	Cr (mg/kg)	Ni (mg/kg)	Cu (mg/kg)	Zn (mg/kg)	Cd (mg/kg)	Pb (mg/kg)
Lady Di	130	56	48	133	<10	54
Desiree	107	53	44	135	<10	53
Polestar	127	55	46	137	<10	57
White Apollo	118	57	45	133	<10	51

The variations content produced each variant were almost identical profile. The highest value was obtained with the variety Lady Di 48 mg/kg, and the smallest variety Desiree, namely 44 mg/kg.

Zn content obtained from analyzes on variants in the research, is between 133-137 mg/kg. The largest amount was determined on the variant variety with a value of 137 mg/kg, and the smallest on the variety Lady Di.

The values of lead in the analyzed samples, ranging from 51-57 mg/kg. The lowest value was obtained on variant Apollo White variety, 51 mg/kg.

CONCLUSIONS

Content level of heavy metals, nitrites and nitrates varies depending on the variety of runner bean, but not exceeded the maximum limit of regulation.

Even if values quantities of heavy metals, nitrates and nitrites determined from plant material subjected to the experiment are within the legislative, considerable changes can occur on them unless a system complies with specific technologies for sustainable agriculture.

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