3-2017

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INTRODUCTION: The potential exportation of macronutrients in the harvested part of each crop is an important aspect to consider for programming the restitution of these mineral elements, avoiding their exhaustion in the soil (RAIJ, 2011). The aim of this study was to evaluate the potential exportation rates of nutrients by the harvested pods in a snap bean genotype with indeterminate growth habit, providing theoretical basis for the recommendations of restitution fertilization in the production systems with the cultivation of this vegetable crop.

MATERIAL AND METHODS: The experiment was carried in a greenhouse covered with polyethylene (150 μm thickness) in State University of Londrina – UEL, Londrina, PR, Brazil (23º23'S, 51º11'W and 566 m of altitude). Seeds of snap bean, Topseed® cv. "Líder" with indeterminate growth habit and cylindrical pods, sown at May 15, 2016, in plastic pots filled with sand as substrate and spaced 0.6 m between lines and 0.3 m between plants. Each pot received five seeds and thinning performed when the seedlings reached V1 stage (emergence). In total, 200 plants grown in four rows of pots. The application of nutrients was performed with a fertigation system for a better control of their supply. This system, the substrate and preparation of nutrient solution was the same utilized by Almeida et al, (2016).

The macronutrients concentrations in the vegetative phase were: 72; 10; 62.5; 112; 12 and 16 mg L^{-1} of N, P, K, Ca, Mg and S, respectively; and for micronutrients: 1.374; 0.507; 0.372; 0.315; 0.054 and 0.0054 mg L^{-1} of Fe, Zn, Mn, B, Cu and Mo, respectively. These concentrations resulted in 1.0 dS m^{-1} of electrical conductivity (EC) of nutrient solution. In the reproductive phase, all the nutrients had doubled concentrations, providing an EC of 2.0 dS m^{-1}.

The harvests of fresh pods manually performed at 56, 63 and 72 days after emergence (DAE). The fresh pods were weighed (FPW, g pot^{-1}) at each harvest and then dried in ventilated oven at 55 ºC for 72 h, obtaining the dry weight (DPW, g pot^{-1}). The pods humidity (PH, %) was obtained by the equation 1: PH = ((FPW – DPW)/FPW) x 100

The dried pods were ground in Willey mill, submitted to acid digestion and the nutrients contents in the dry matter (g kg^{-1}) analyzed according to the methods contained in Silva (2009). The results of the contents of nutrients in dry weight basis (NDWB, g kg^{-1}) together with the pods humidity (PH, %), enabled to obtain the nutrients contents in fresh weight basis (NFWB, g kg^{-1}), using the equation 2: NFWB = NDWB x ((100 - PH)/100).

This represents the rate of nutrient exportation, which was expressed in g ton^{-1} of fresh pods harvested (mean of the three harvests), multiplying NFWB by 1000.

RESULTS AND DISCUSSION: Among the macronutrients, higher rates of exportation were observed for N followed by K. In the sequence, P and Ca, which were not different, while S and Mg had the lowest exportation rates (Figure 1).

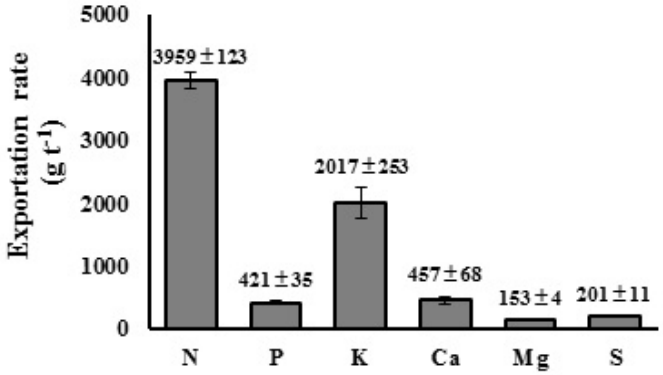

Figure 1. Exportation rates of macronutrients nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulfur (S) in fresh pods of snap bean with indeterminate growth habit. Bars represent the standard deviation.

Soratto et al. (2013), studying common bean cultivated for grain harvest (dry bean), observed exportation rates averaging from 25 (N), 4 (P), 15 (K), 2 (Ca), 2 (Mg) and 2 (S) kg t^{-1} of grains. Results regarding the exportation rates of nutrients are very scarce for snap bean, but the data obtained in this study demonstrates that they are quite lower than dry bean. Faquin and Andrade (2004) presented values of exportation rates for snap bean with flattened pods close to the obtained in this study for cylindrical pods.

For other vegetable crops, such as potato (Fernandes et al., 2011) and carrot (Cecílio Filho and Peixoto, 2013), the exportation rates are also lower in magnitude than dry bean, as seen in the present study for snap bean. This is due to the major yield of these crops (several tons per hectare), especially because of their higher moisture content, which dilutes the content of nutrients in the fresh weight basis. For example, the mean of pods humidity obtained in this study was 90.87 ± 1.34 %.

CONCLUSION: Considering that snap bean with indeterminate growth habit may attain high yields of fresh pods, such as 20 to 35 ton ha^{-1}, the exportation of nutrients with the harvest, especially for N and K, may represent significant amounts and must be considered for managing of the fertilization of production systems in which this crop is inserted.

REFERENCES

ALMEIDA, L.H.C.; FRATONI, M.M.J.; FREGONEZI, G.A.F.; TAKAHASHI, H.W.; (2016). Nutritional assessment of potassium in tomato (*Lycopersicon esculentum Mill.*) by direct reading of fruit sap. Afr. J. Agric. Res. Vol. 11(14), pp. 1245-1256.

CECÍLIO FILHO, A.B.; PEIXOTO, F.C. 2013. Acúmulo e exportação de nutrientes em cenoura 'forto'.Revista Caatinga, Mossoró, v.26, n.1, p.64-70.

FAQUIN, V.; ANDRADE, A.T. 2004. Nutrição mineral e diagnose do estado nutricional das hortaliças. Lavras: UFLA/FAEPE. 88p.

FERNANDES, A.M.; SORATTO, R.P.; SILVA, B.L. 2011. Extração e exportação de nutrientes em cultivares de batata: I – Macronutrientes. Revista Brasileira de Ciência do Solo, Viçosa, v.35, p.2039-2056.

RAIJ, B. 2011. Fertilidade do solo e manejo de nutrientes. Piracicaba: IPNI. 420p.

SORATTO, R.P.; FERNANDES, A.M.; SANTOS, L.A.; JOB, A.L.G. 2013. Nutrient extraction and exportation by common bean cultivars under different fertilization levels: I – Macronutrients. Revista Brasileira de Ciência do Solo, Viçosa, v.37, p.1027-1042.