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SHORT COMMUNICATION

EFFECT OF BIOSLURRY EFFLUENT ON SEEDLING GROWTH OF SWISS CHARD (*Beta vulgaris* L.)

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ABSTRACT

Glasshouse experiments to evaluate the effect of bioslurry effluent on seedling growth of Swiss chard (*Beta vulgaris* L) were conducted in summer 2017 and winter 2018 at Dohne Agriculture Development Institute, Stutterheim, Eastern Cape, South Africa. Two cultivars of Swiss chard, Star 1801 and Fordhook giant, were planted in 200 cavity trays using a hygromix commercial growing medium incorporated with fertilizer treatments at different rates of bioslurry: no incorporation (control), 50% bioslurry, 100% bioslurry, 200% bioslurry and the recommended rate of 2:3:4 (30) NPK fertilizers. In the glasshouse the experiments were arranged in a randomized complete block design (RCBD) which was replicated three times. At four weeks after germination, ten (10) seedlings per treatment were destructively sampled randomly to determine the plant growth and biological mass parameters: i) Seedling height, shoot and root height; ii) Seedling mass; iii) Fresh shoot and fresh root mass as well as their dry mass; iv) Nutrient content of leaves. The results indicated that fertilization with 100%Bioslurry produced significantly taller seedlings and shoot height, while the shortest seedlings were obtained from the recommended inorganic fertilizer. Fertilization with 200%Bioslurry and the control treatment produced significantly higher biological yield compared to other treatments. The interaction between fertilizer treatments, cultivar and season indicated that summer season performed better compared to winter in seedling growth and development, and Fordhook giant fertilized with 100% and 200% bioslurry was superior compared to Star 1801. Fertilization with 50% bioslurry resulted in seedlings with higher sodium, while the seedlings grown in the control treatment showed higher copper content. The highest manganese was obtained from the seedlings fertilized with the inorganic fertilizer. It is therefore, concluded that fertilization with bioslurry at 100% and 200% bioslurry application rates enhanced the growth and quality of Swiss chard seedlings.

Key words: Bioslurry effluent, seedling growth, Swiss chard, cultivars, biological yield ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 23 No. 8 August 2023 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

INTRODUCTION

Swiss chard is consumed in many parts of the world including South Africa for its high nutritious properties and low costs of production [1,2]. Swiss chard is a very good source of vitamin A, K, C, magnesium and manganese [1]. Hence, it plays a significant role in supplementing the nutritional needs of rural communities of the Eastern Cape where its leaves and stalks are often cooked and served as side dish with staple foods [3]. Seedling characteristics are the principal determinants of quality and yield in vegetables production. Hence, a strong and healthy seedling is a prerequisite for successful vegetable production [4]. Seedling producers use soilless growing media such as vermiculite and hygromix, hence the incorporation of fertilizer materials, to speed up the seedling growth [5]. Fertilization with N, P and K is required to develop a stocky and vigorous seedling ready for transplant in the field. However, commercial soil nutrient sources are expensive for small-scale farmers. Application of organic fertilizers such as vermicompost and bioslurry as soil amendments could possibly be an effective alternative for growth of quality seedlings [6]. Hence, this study was undertaken to evaluate the effect of bioslurry on seedling growth, biological yield and nutrient composition of Swiss chard seedlings.

MATERIALS AND METHODS

Two glasshouse experiments were conducted to evaluate the effect of bioslurry effluent on seedling growth of Swiss chard between summer 2017 and winter 2018 at Dohne Agriculture Development Institute (32°31’ 34.077” S; 27°27’ 37.473” E) in Stutterheim, Eastern Cape, South Africa. Two cultivars of Swiss chard, Star 1801 and Fordhook giant, were planted in 200 cavity trays using a hygromix commercial growing medium incorporated with fertilizer treatments at different rates of bioslurry: control (no fertilizer incorporation), 50% bioslurry, 100% bioslurry, 200% bioslurry and the recommended rate of 2:3:4 (30) NPK fertilizers. In the glasshouse the experiments were arranged in a randomized complete block design (RCBD) and replicated three times. At four weeks after germination, ten (10) seedlings per treatment were destructively sampled randomly to determine the plant growth and biological mass parameters namely: i) Seedling height, shoot and root height, which were measured using a 30 centimetre ruler; ii) Seedling, fresh shoot and fresh root mass as well as their dry mass, which were measured using (Adam CBW-3KG) scale in grams. The dry mass was obtained by drying the samples in an oven at 65°C for 48 hours; and iii) Nutrient content of leaves, which was determined using the Kjeldahl method at Dohne Analytical laboratory.

RESULTS AND DISCUSSION

The results (Table 1) showed that fertilization with 100% bioslurry produced significantly taller seedlings (16.33 cm) and shoot height (8.72 cm), while the shortest seedlings were obtained from the recommended inorganic fertilizer. Haile *et al*. [6] reported the tallest kale seedling when 100% bioslurry was applied compared to other treatments. The shoot height was improved by the application of 100 and 200% bioslurry, while NPK application showed poor seedling height responses. Islam *et al*. [7] reported an increase in shoot height when 10t/ha and 20t/ha of bioslurry was applied. Seedlings grown in the control treatment produced the longest roots and the shortest roots were obtained from those grown with NPK fertilizer. Findings agreed with Fu *et al.* [8] who reported that if the nutrient dose is given, the plant root growth rate decreases due to nutrient availability at the root level. Results (Table 1) showed that seedlings grown at 200% bioslurry and the control treatment produced significantly higher shoot and root mass compared to other treatments. This high shoot mass at 200% bioslurry could be associated with the high levels of potassium (K), which regulates several plant processes that generally improve plant biomass. This is confirmed by Haile *et al*. [6] who reported that an increase in root mass and dry matter in Brassica oleracea crops increased due to increased applications of K+ fertiliser. The interaction between fertilizer treatments, cultivar and season indicated that the summer season (December) performed better compared to winter (June) in seedling growth and development, and Fordhook giant fertilized with 100% and 200% bioslurry was superior compared to Star 1801. Results (Table 2) showed that fertilization with 50% bioslurry resulted in seedlings with higher sodium (Na), while the seedlings grown in the control treatment showed higher copper (Cu) content. The highest manganese (Mn) was obtained from the seedlings fertilized with inorganic fertilizer. According to Islam *et al*. [7] the nutritive value of Swiss chard is characterised by higher level of Na.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The results of this study showed that 100% and 200% bioslurry application rates performed better compared to other treatments in enhancing the seedling growth and quality. However, the control treatment performed better compared to the inorganic fertilizer treatment. Furthermore, seedlings grown with bioslurry and control exhibited a relatively higher nutritional content than those grown with inorganic fertilizer. Future studies on suitable application methods and stages of development for bioslurry using different media might be beneficial to seedling producers.

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Table 1: Effect of fertilization on seedling height, Fresh seedling mass, fresh shoot and root mass and dry shoot and root mass on Swiss chard seedling at four weeks after seedling emergence

Treatment	SH (cm)	SM (g)	Sh (cm)	RH (cm)	FSM (g)	FRM (g)	DSM (g)	DRM (g)
Control	16.07ab	1.57	7.98c	8.1a	1.08a	0.47a	0.11a	0.03a
50%Bio	15.68b	1.28	8.09bc	7.77b	0.90b	0.34c	0.08c	0.03a
100%Bio	16.33a	1.42	8.72a	7.73b	1.05a	0.34c	0.09ab	0.03a
200%Bio	16.22ab	2.73	8.43ab	8.05ab	1.12a	0.41b	0.10a	0.03a
NPK	13.34c	0.92	7.29d	6.07c	0.79c	0.13d	0.08c	0.02b
Mean	15.52	1.584	8.102	7.544	0.988	0.338	0.092	0.028
Cv (%)	0.07	0.38	0.06	0.19	0.13	0.34	0.13	0.14
p Value	0.000	0.143	0.000	0.000	0.000	0.000	0.000	0.019

SH=Shoot height, SM= Seedling mass, Sh=Shoot height, RH= Root height, FSM=Fresh shoot mass, FRM=Fresh root mass, DSM= Dry shoot mass, DRM=Dry root mass

Values in a column followed by the different letter are significantly different at P≤ 0.05. p Value: probability value, Cv (%): coefficient of varience

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Table 2: Fertilization effect on Nutrient Content of Swiss Chard Seedlings

	(%)			(mg/kg)			
	K	**Ca**	**Mg**	**Na**	**Cu**	**Fe**	**Mn**
Control	1.76	3.08	0.96	364.3^{d}	15.1^{ef}	1048.8	213.0^{a}
50% Bio	1.73	3.19	0.85	434.5^{a}	11.7^{cd}	730.4	149.6^{ab}
100% Bio	0.83	2.39	0.86	398.0^{d}	11.3^{cd}	1339.9	167.1^{ab}
200% Bio	0.63	1.97	0.92	311.9^{d}	7.8^{a}	641.3	232.1^{a}
NPK	1.12	1.53	0.51	223.6^{b}	10.8^{bc}	531.7	351.4^{d}
Mean	1.214	2.432	0.82	346.46	11.34	858.42	222.64
Cv (%)	0.38	0.26	0.19	0.21	0.21	0.34	0.32
P Value	0.366	0.172	0.090	0.028	0.002	0.124	0.000

Values in a column followed by the different letter are significantly different at P≤ 0.05. p Value: probability value, Cv (%): coefficient of varience

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