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UF/IFAS PEER REVIEWED HS1404

Use of Recycled Potting Medium for Containerized Production of Squash[1]

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Introduction

Vegetable growers are keen on cost-cutting measures to increase profitability. Containerized vegetable production can be done in a shade-house or garden, and it often requires commercial potting media. Although expensive, potting media are lightweight and provide high water- and nutrient-holding capacities, and thus they are widely used by growers. On average, a grower can spend approximately $3,600 annually (3 seasons) on potting media for a shade-house with a capacity of 800 pots (estimates from cucurbit shade-house production at the UF/IFAS Tropical Research and Education Center [TREC]). Growers often discard or compost the potting media after a single season due to issues such as diseases, pests, and weeds. However, old potting media could be reused for containerized production if appropriately sterilized and amended with fertilizer salts. The current study was conducted to determine the feasibility of using sterilized recycled potting medium amended with fertilizer salts for containerized production of squash.

Description of the Study

Commercial potting medium, Pro-line C/B (Jolly Gardener Inc., Poland Spring, ME), was used in the experiment. This medium contains a mix of Canadian sphagnum peat, processed pine bark fines, coarse perlite, and medium vermiculite. Yellow Crookneck, a popular summer squash cultivar for gardeners in Florida, was used in the study. It has a bush growth habit and produces a harvest within 35 to 50 days. The potting media, both new and used, were amended with either PowerPak (N:P:K; 20-20-20) inorganic fertilizer (Southern Agricultural Insecticides, Palmetto, FL) or Bat Guano (N:P:K; 10-3-1) organic fertilizer (The Espoma Company, Millville, NJ). Prior to nutrient amendment, the used potting medium was sterilized at 90°C for approximately 5 hours using an electric Pro-Grow™ soil sterilizer (Durable Greenhouse & Nursery Equipment LLC, Phoenix, AZ) to suppress pathogens, insects, and weeds (Figure 1).

Six treatments were used in the study: (i) new potting medium only (NPM), (ii) NPM with organic fertilizer (NPM_G), (iii) NPM with inorganic fertilizer (NPM_NPK), (iv) sterilized recycled potting medium only

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(RPM), (v) RPM with organic fertilizer (RPM_G), and (vi) RPM with inorganic fertilizer (RPM_NPK). There were five reps per treatment. Seeds were sown in 10" plastic pots with drain holes. The plants were drip-irrigated twice daily with approximately 2 liters of water per pot (Figure 2).

Figure 1. Sterilizing used potting medium in an electric Pro-Grow™ soil sterilizer.
Credits: Geoffrey Meru, UF/IFAS

Figure 2. The different potting medium treatments tested in the study.
Credits: Marie Dorval, UF/IFAS

Recommended fertilizer application for squash is between 75 to 150 pounds of nitrogen per acre. For this experiment, both the organic and inorganic fertilizers were applied at a rate of 150 lb of nitrogen/acre. Both fertilizers are water-soluble and thus were dissolved in water before application. The fertilizer solution was applied weekly by pouring around the base of the plants until the recommended rate of N was achieved 6 weeks later.

Pesticides were applied weekly to all treatments. This included two multiaction fungicides (Quadris Flowable, Bravo Weather Stik), three insecticides (Sivanto Prime, an acetylcholine imitator, Ramon 0.83 EC, an insect growth regulator, and Assadi 30 SG, a multiaction insecticide), and one systemic activated resistance (SAR) mimic (Actigard 50 WG).

Data Analysis

Data for average fruit length, average fruit weight, average fruit diameter, and yield (bushels/acre) were recorded for each treatment. To get accurate mean/standard deviations for fruit quality data (diameter, length, and weight), entries from dead plants or plants that did not set fruit were considered missing. However, yield data was considered zero for dead plants or plants that did not set fruit. At the end of the trial, two potting medium samples per treatment (each 100 g) were collected for nutrient analysis and sent to the UF/IFAS Extension Soil Testing Laboratory. Different elements were analyzed including potassium (K), ammonium (NH_4N), nitrate nitrogen (NO_3N), organic matter (OrgMat), phosphorous (P), total Kjeldahl nitrogen (TKN, organic-bound nitrogen and nitrogen in ammonia/ammonium), and pH. All the data collected for the six treatments were subjected to a one-way analysis of variance. Significant differences among the treatments were determined using the Tukey HSD test at 5% significance level. All statistical analysis was performed using SAS software version 9.4.

Findings

HORTICULTURAL PERFORMANCE

The results of the analysis of variance showed that there were significant differences among the treatments for all the traits evaluated. New potting medium without any fertilizer was the least prolific across all the parameters evaluated, with all the plants dying before fruit set, perhaps due to insufficiency of key nutrients required for plant development. There was a nonsignificant trend in yield between the new potting medium and the recycled potting medium when either an organic (Guano) or inorganic (NPK) fertilizer was added (Table 1). Amendment of new potting medium with Guano or NPK improved horticultural performance (yield and fruit diameter, length, and weight) when compared to new potting medium without any fertilizer (Table 1). Overall, the three best treatments across all the traits were (1) new potting medium amended with NPK, (2) recycled potting medium amended with NPK, and (3) recycled potting medium amended with Guano.

POTTING MEDIUM NUTRIENT ANALYSIS

Nutrient analysis revealed that treatments based on recycled potting medium had significantly higher organic matter and potassium when compared to treatments with new potting medium (Table 2), possibly due to plant and fertilizer residues from the previous season. Recycled potting medium amended with Guano had the highest NO_3N (nitrate) and TKN level, whereas recycled potting medium amended with NPK had the highest amount of phosphorus. All the treatments had a pH close to 7.0, which is slightly above the ideal range (pH 5.5–6.8) for growing squash. Among the treatments, new potting medium without fertilizer was the most alkaline with a pH of 7.5.

Potential Use of Recycled Potting Medium for Winter Squash Production

We adopted sterilized recycled potting medium amended with NPK for routine production of winter squash in the shade-house at TREC. Preliminary results indicate that this medium can adequately support plant development through fruit maturity (Figure 3). The seeds extracted from mature fruits are normal and successfully propagate.

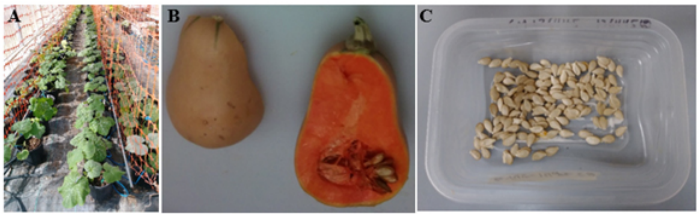

Figure 3. Use of recycled potting medium in the greenhouse (A), mature winter squash fruit obtained from a plant grown in the medium (B), and seed extracted from a mature fruit (C).
Credits: Geoffrey Meru, UF/IFAS

Conclusions

New potting medium and recycled potting medium amended with NPK were the most prolific among the treatments tested. Interestingly, recycled potting medium without fertilizer performed better than new potting medium without fertilizer, which may be explained by residual nutrients from the previous season. Further research is required to explore the economic benefits of using recycled potting medium and to determine the number of times this medium can be reused while maintaining its viability.

Table 1. Summary statistics for all the treatments and the recorded parameters. *Means followed by the same letter within columns are not significantly different (P < 0.05).*

Treatment	Min	Mean	Max	Min	Mean	Max
	Yield (bushels/acre)			Average fruit diameter (mm)		
New potting medium	0	$0^{c} \pm 0$	0	N/A	N/A	N/A
New potting medium + Guano	0	$47.98^{bc} \pm 47$	105.4	27.2	$30.35^{b} \pm 2$	33.1
New potting medium + NPK	0	$135.49^{a} \pm 88$	226.7	32.2	$37.99^{a} \pm 4$	41.5
Recycled potting medium	0	$42.84^{bc} \pm 73$	169	17.1	$20.74^{c} \pm 5$	24.3
Recycled potting medium + Guano	0	$104.92^{ab} \pm 71$	192.5	27.8	$32.70^{ab} \pm 4$	36.6
Recycled potting medium + NPK	0	$110.99^{ab} \pm 76$	207.2	23.1	$30.45^{b} \pm 6$	39.52
	Average fruit length (mm)			Average fruit weight (g)		
New potting medium	N/A	N/A	N/A	N/A	N/A	N/A
New potting medium + Guano	58.9	$74.62^{b} \pm 13$	82.7	15.2	$21.76^{b} \pm 6$	28.7
New potting medium + NPK	73.0	$91.76^{ab} \pm 17$	109.7	27.6	$46.05^{a} \pm 14$	61.7
Recycled potting medium	55.4	$56.03^{c} \pm 0.8$	56.6	12.3	$29.15^{b} \pm 23$	46
Recycled potting medium + Guano	80.9	$91.53^{ab} \pm 9$	102.9	22.3	$35.70^{ab} \pm 13$	52.4
Recycled potting medium + NPK	89.1	$108.05^{a} \pm 18$	128.2	24.2	$37.76^{ab} \pm 13$	56.4

Table 2. Analysis of major nutrients across the six treatments. *Means followed by the same letter within columns are not significantly different (P < 0.05).*

Treatment	K (mg/KG)	NH_4N (mg/KG)	NO_3N (mg/KG)	OrgMat (%)	P (mg/KG)	TKN (mg/KG)	pH
New potting medium	230.1^{bc}	13.2^{ab}	13.5^{d}	65.1^{b}	182.3^{c}	5503.0^{d}	7.5^{a}
New potting medium + Guano	163.9^{c}	9.2^{b}	49.3^{c}	61.3^{c}	249.2^{c}	7983.6^{b}	7.3^{b}
New potting medium + NPK	325.5^{b}	10.6^{ab}	59.9^{c}	64.3^{b}	935.2^{b}	6432.5^{cd}	7.0^{c}
Recycled potting medium	512.7^{a}	34.0^{a}	45.2^{c}	74.7^{a}	627.2^{bc}	5956.7^{cd}	7.2^{b}
Recycled potting medium + Guano	571.2^{a}	25.1^{ab}	306.0^{a}	72.6^{a}	1055.7^{b}	9202.9^{a}	7.0^{c}
Recycled potting medium + NPK	640.5^{a}	34.7^{a}	96.5^{b}	72.1^{a}	2038.4^{a}	6605.8^{c}	7.1^{c}