

Worm castings stimulates germination of seedlings for aquaponics system

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Abstract

A series of trials was conducted to test the effect of small quantities of vermicompost on the growth of three leafy vegetables grown in oasis cubes for aquaponic production. The vegetables were: 1) red amaranth, 2) pak-choi, and 3) Chinese mustard green. Two vermicomposts were used: a) worm castings from cow manure, and b) worm castings from a vegetarian food source. These were compared with: c) commercial organic compost and d) a control with no compost added. Compost was applied at the rate of 210 mg (0.007 oz) per cube (1 seed per cube). Results showed compost treatments enhanced germination and growth rates, with the greatest response observed from cow manure worm castings. The incorporation of small quantities of compost into seedling production would shorten the time from seeding to transfer of the grow out phase by 7-10 days when using Oasis® cubes.

Introduction

Interest continues to grow with regard to reducing Hawaii's carbon footprint, producing and consuming locally grown food, composting, and generally conserving resources in food production. This trend has notably increased the interest in aquaponics. Aquaponics is a method of raising fish and recirculating the water to grow vegetables. For more information on aquaponics in Hawaii, see the article by Tamaru et al. in the Spring [2011 issue of Hanai'Ai](#).

A critical part of the aquaponic system is the germination and early growth stage of plants prior to transference into the grow-out phase. A simple project was designed to evaluate the value of worm castings or potting media on germination and growth rates of three common vegetables. Vermicompost has been demonstrated to stimulate plant growth (Aracon et al., 2003; [Pant et al., 2009](#))

Materials and Methods

Three common Asian vegetables were chosen for this study:

1. red amaranth (*Amaranthus cruentus*, RA),
2. pak-choi (*Brassica rapa*, BC) and
3. mustard green (*Brassica juncea*, MG).

The four treatments were:

- a) Oasis® cube alone (control, C),
- b) Oasis® cube with worm castings from composted cow manure (B),
- c) Oasis® cube with worm castings from vegetable and fruit scraps (V) and
- d) Oasis® cube with commercial organic compost (M).

The Oasis® cube is a synthetic form product engineered into a sheet that has 96 cubes (3.8 cm sq. with 1.1 cm hole in the center, Figure 1). In each cycle of experiment, a sheet was used for one vegetable specie and the four treatments: C, B, V, M. A seed was dropped in the chamber (hole) and for treatments B, V, M; approximately 0.21g of the respective media was added. Upon completing the seeding, each sheet was carefully labeled, placed on a tray and wetted with tap water. The trays were set in dark room for 24 hours and then taken out and rested on a table top for the next 2-3 weeks. Three cycles were performed. The trays were checked daily and watered to ensure the plantings did not dry out. A successful germination was defined as the seedlings emerging above the surface of the oasis cube. Measurements of plant height, leaf length and leaf width were taken on days 4, 7 and 11 following seeding. The treatments were arranged in a randomized complete block design with 4 replications.



Figure 1. Differences in growth rates of vegetable seedlings treated with vermi-compost vs. control.

Results and Discussion

Germination rates were higher for treatment groups versus control. The germination rates of all vegetables were generally improved with the addition of compost. This impact was most notable in the pak-choi and mustard greens, where germination was poor in the control treatment.

Germination rates and subsequent seedling growth benefitted from the addition of small amounts of compost. Composted cow manure-based worm compost was generally most beneficial of the composts to plant growth (Figure 2). Apparent species differences in response to compost between Amaranth and the *Brassica* vegetables should also be further investigated.

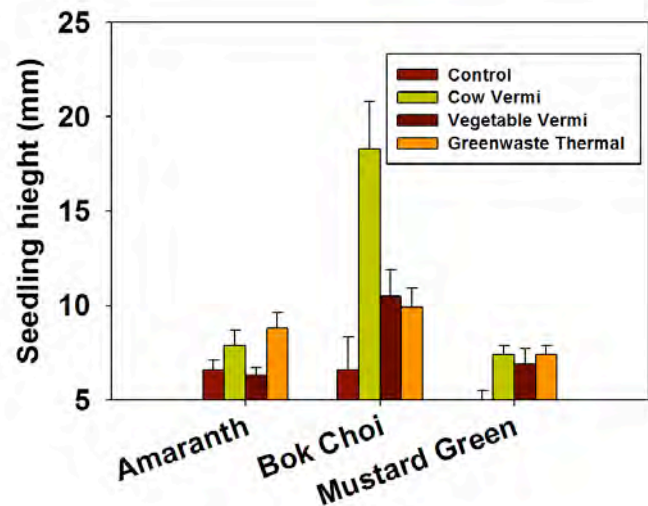


Figure 2. Seedling height 11 days after germination (mean \pm SE).

No nutrient analysis was performed on the worm castings or commercial media in this study. However, analysis on a dry weight basis of worm castings from Hawaii have ranged from 1.2 - 2.0% N with a significant proportion (e.g. 10%) of nitrogen present as nitrate ([Hana'Ai, Fall '09](#)). Nitrate can promote seed germination (Hendricks et al., 1974), and may have played a role in the results observed here. Multiple experiments using vermicompost have observed that 10-20% worm casting by volume in media yielded the best results with regard to plant growth and cost/benefit ratio. This preliminary study suggests that much smaller quantities of vermicompost may be utilized to enhance plant growth and reduce the growing time (seedling to harvest) of leafy vegetables in aquaponics systems when using oasis cubes.

References

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