Contrasting Effects of Vermiculture-based Fertilizers on Growth of *Brassica oleracea* var. *sabellica*

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Abstract: Organic fertilizers not only maintain soil fertility but enhance the biological activity of the soil, which improve the efficiency of nutrient use by the plants. Vermicompost, a nutrient-rich organic fertilizer made by composting earthworms can be used in the preparation of aqueous extracts known to increase crop yield and plant health. Vermicompost was produced through cultivation of red wriggler worms (*Eisenia fetida*), a common composting species and used in the preparation of aqueous fertilizing mixtures. Kale (*Brassica oleracea* var. *sabellica*), a leafy vegetable known for its high nutritional properties, was grown in an organic garden at St. Thomas University. Plants were fertilized with one of three vermicompost-based solutions containing different combinations of organic additives, such as fish emulsion, corn syrup and/or a seaweed blend. Mixtures were prepared weekly and applied, in 4 gal. doses to the plants in each study group twice a week over the course of 10 weeks. Upon harvest, the height, wet weight, and dry weight of the plants were measured. ANOVA and Tukey test analysis showed a significant positive effect on all vermicompost-treated plants compared to the control. Kale plants receiving the mixture T1 (a combination of vermicompost and fish emulsion) resulted in significantly greater height, and dry weight in comparison to the other treatments.

Keywords: *Eisenia fetida; kale; vermicompost; worm tea*

Introduction: For many societies around the world, environmental and financial conditions often present barriers to agricultural stability, making the development of affordable and reasonably manageable agricultural techniques for such groups a complex process. Vermicompost, a waste by-product resulting from the breakdown of organic material by earthworms, is among the most promising of soil enrichment materials. Analyses have shown it to be rich in various nutrients such as potassium, nitrate, and calcium [1], as well as several phytohormones [2]. Earthworms are generalist organisms which serve as primary decomposers alongside fungi and soil bacteria, and their feeding behavior assists in the improvement of soil quality through their tunneling (which helps maintain an aerated environment conducive to microbial and fungal growth) and the breakdown of organic matter into vermicompost [3]. *Eisenia fetida*, commonly known as the red wriggler worm, is a popular composting species. The cultivation of this species is a relatively inexpensive process, and can be conducted under a generous range of temperatures and conditions. As a result, a scientific interest in the agricultural potential of vermiculture has developed, particularly regarding the use of solutions derived from vermicompost, often referred to as "worm teas."

Materials and Methods: Worms were housed in a Worm Factory 360® vermicomposting unit. They were cultivated using a substrate composed of peat moss and shredded newspaper, and covered with regularly dampened newspaper. Chopped iceberg lettuce was provided on a weekly basis. Kale was planted in raised mounds in four independent beds containing a soil mixture of 1 part organic soil: 1 part sand. Seeds were planted one week prior to treatments.

All worm tea solutions contained 454 grams vermicompost and 3 tbsp fish emulsion in 4 gallons of chlorine-free water. In addition, Treatment 1 contained 3 tbsp unsulfured black-strap molasses, Treatment 2 received 3 tbsp dark corn syrup, and Treatment 3 contained 3 tbsp fish emulsion and 400 mL seaweed solution. In preparation of each fertilizer solution, compost was weighed and wrapped in mesh fabric bags which were tied with zip ties. Each fertilizer treatment was churned using aeration pumps, and

stored in plastic 5 gallon buckets. Treatments were applied twice per week. Kale plants were removed 9 weeks after initiation of treatments, washed in water and their length was measured. They were then placed in an incubator to dry at 70 °C for four days. Thereafter dry weight was recorded. ANOVA and Tukey analyses were performed on kale height data.

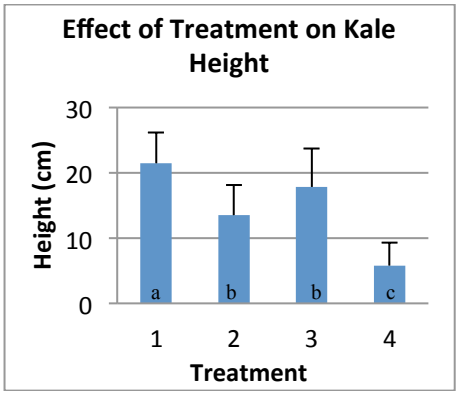

Fig. 1. Height of kale plants.

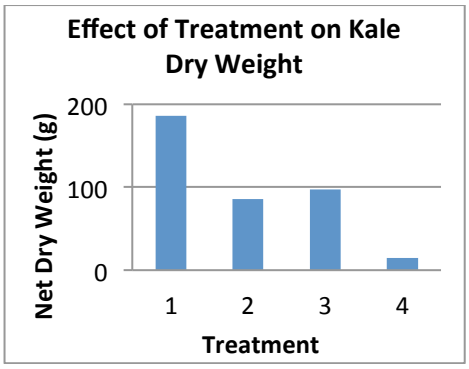

Fig. 2: Dry weight of kale plants.

Results and Discussion: Kale plants receiving worm tea solutions displayed significantly greater height increase over the control group (Fig. 1), pointing to the beneficial effects of using vermicompost-liquid fertilizers supplemented with additives. Treatment T1 resulted in a significantly greater height increase over T2 or T3 (which produced results comparable to one another). The average dry weights for all fertilizer treatments showed a notable increase over the control group, particularly in the case of treatment T1 (Fig.2). Treatment 1 contains unsulfured black-strap molasses as an additive. Molasses serves as a good source of carbohydrates, and is also high in calcium, magnesium, iron, and potassium, as well as in B-complex vitamins [4]. It is commonly incorporated as fertilizer in organic gardens because its high sugar content promotes the growth of beneficial soil microbes [5].

Conclusions: Treatment T1, which contained the unsulfured black-strap molasses additive, resulted in the greatest height growth, as well as a greater average weight increase among all vermicompost-based treatments.

Conflicts of Interest: The authors declare no conflict of interest.

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