Field Production

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Organic Production of *Photinia melanocarpa* [(Michx.) Robertson and Phipps] as an Alternative Fruit Crop

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Significance to Industry: This research investigates the organic field production, specifically nitrogen (N) fertility requirements, of the mid-Atlantic native species black chokeberry [*Photinia melanocarpa* (Michx.) Robertson and Phipps, until recently in the genus *Aronia*] as an alternative fruit crop. While agronomic row-crop values have recently improved, the increasing cost of production offsets sustainable profits for smaller farms. Increasing the palette of alternative crops and their uses is one way to keep small family farms solvent and in production, in light of pressures from encroaching suburban development. Organic production is a method for increasing the marketability and value of a food product. Chokeberry is a relatively easy plant to produce organically. This research forms part of a larger sustainable alternative crop production research program.

Nature of Work: Chokeberry is a genus of shrubs in the Rose family (*Rosaceae*) having two distinct species in the eastern United States, the black and red chokeberries [*Photinia pyrifolia* (Lam.) Roberstson and Phipps]. Another less distinct form, the purple chokeberry [*Photinia floribunda* (Lindl.) K.R. Robertson & Phipps], has been the subject of some controversy as to whether it is a separate species or a hybrid cross between red and black chokeberry (1, 7). Chokeberry nomenclature is confusing both because the word chokeberry is so similar to chokecherry (*Prunus virginiana* L.) and because the scientific name has undergone several changes in the past 40 years. The fruits of chokeberry are botanically more like apples (pomes) than berries, and range from 6 to 10 mm in diameter. The fruit was consumed by eastern Native Americans, yet was considered unpalatable by the colonists (2). In the 1900's, eastern Europeans recognized the plant's potential and took specimens to their homeland where varieties were selected for optimal fruit production. (9).

Chokeberry is a landscape quality plant with no serious associated pests and diseases (4). Because of this, it is an ideal candidate for organic fruit production. Additionally, black chokeberry fruit has nutraceutical qualities, heightening its marketability and sales potential as a value added product. Due to health-promoting effects, there is currently great interest in fruits and vegetables that contain high concentrations of flavonoids, considered potent antioxidants (6, 10). In a recent study (13) black chokeberry was shown to contain high levels of flavonoids including anthocyanins and proanthocyanidins, having a very high Oxygen Radical Absorbance Capacity (ORAC) compared to other foods (8). A number of research institutions and government agencies have promoted the production of black chokeberry as an alternative crop (3, 9, 5). In Eastern Europe, chokeberry products include juices, extracts, coloring agents, and wine (12).

In this study, two European cultivars of *P. melanocarpa*, 'Viking' and 'Nero', are presently being evaluated for yield potential under organic production. The 'Viking' cultivar was planted as 24 month-old seedlings. The 'Nero' cultivar was planted as 12 month-old seedlings. The two different age groups were planted due to availability issues. Two blocks containing 2 rows with 2 meter mow strips separating the rows, each having 25 plants (19 'Nero' and 6 'Viking') placed one meter apart, were planted in April 2006. Blocks were determined based on the available field irrigation system. The soil was fallow for longer than a 5 year period before this research was initiated. Initial fertility for establishment was 6 grams (0.2 oz) of N per plant, using McGeary's (Lancaster, PA) 5-3-4 ($N\text{-}P_2O_5\text{-}K_2O$) commercially-available organic N source. This rate was based on greenhouse fertility studies (11). After the first season's establishment period, rows were fertilized with either 3 grams (0.1 oz) or 6 grams (0.2 oz) of N per plant, beginning in October 2006. The same fertility rates were continued for each row again in the spring and fall of 2007, but no fertilizer was applied during the spring of 2008. In this completely randomized block design study, fruit yield in 'Viking' was determined and compared between the two N treatments.

Before harvest, plants were identified according to their row and position in that row. Berries were harvested the last week of August 2008 from each plant, and immediately weighed. Fresh fruit weight was statistically analyzed using ANOVA (SAS Institute Inc., Cary, NC).

Results and Discussion. Twenty four 'Viking' chokeberry plants yielded a total of 60 kg (132 lbs) the third growing season after planting at an average of 2.8 kg (SE± 0.25) per plant (6.2 lbs) fertilized with 3 grams N, and an average of 2.2 kg (SE ± 0.16) per plant (4.8 lbs) receiving 6 grams N, respectively. Plants receiving only 3 grams of N had significantly greater yield ($P < 0.01$) than plants receiving 6 grams N. Since plants fertilized with greater N did not respond with greater yield, there seems to be no need for N fertilization other than minimal maintenance fertility for these age plants.

During the 40-month period since the chokeberries were planted, an average of 24 and 15 grams of N were applied per plant as a high and low treatment, respectively. Averaged over a 12-month period, the low-N plants received 4.5 grams of N (1.6 oz), suggesting that chokeberry can be grown with N fertilizer input of less than 16 kg N/hectare per year (14.3 lbs N/acre) or a yearly application of 4.5 grams N per plant for 3 years after establishment. Continued studies will determine if greater N input is needed to sustain yield as plants grow older and larger.

The 'Nero' cultivar yielded a total of 141 kg (311 lbs), but because of this cultivar's age, Nero's yield was too inconsistent throughout the rows for comparison. Total yield was 201 kg (440 lbs) from both cultivars (100 plants) after the third season (28 months after planting). Based on the planting density of both cultivars, one hectare would have a yield of over 7000 kg (6500 lbs/acre), within the first three seasons after planting.

Fruit was harvested from the cymes by hand. Harvesting time was approximately 1 hour per 10 kg. Total time for harvest was approximately 20 hours for all plants. Cleaning berries, the most labor-intensive part of the harvest process, took approximately 5 hours hour per 10 kg for a total of 100 hours. Ten kg of berries yielded approximately 7.5 liters of juice in 1.25 hours with a 10 liter steam juicer. A commercial juicing system would be more efficient. The time invested to harvest, clean and process berries into juice totaled over 7 hours. This time investment would not be profitable. Efficiency in harvesting and cleaning should be improved to 1 hour per 10 kg of berries. In 2008, approximately 150 liters of juice could have been processed with this 200 kg yield.

After the juice is produced, it can be used for a variety of value-added products like jelly, wine, flavorings and nutraceutical extracts. Currently, Kaden Biochemicals, GmbH. (Hamburg, Germany) has developed a chokeberry extract in the form of a dietary supplement. Chokeberry's cosmopolitan success as an ingredient bodes well for its potential as an alternative crop in Maryland and regionally, but the main challenge is increasing public awareness and the development of marketable value-added products.

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