

Autumn Olive: A Potential Alternative Crop

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Abstract

Autumn olive (*Elaeagnus umbellata* Thunb.) is not commonly grown for its fruit in the U.S., except for the purpose of attracting wildlife. Due to its ability to fix nitrogen, drought and disease resistance, and tolerance of poor soil, autumn olive has been widely planted in distressed areas and along highways to prevent soil erosion. The edible fruit, brilliant red or yellow in color, is exceptionally high in the antioxidant carotenoid lycopene and several other carotenoids. Lycopene has been associated with prevention of certain chronic diseases, including prostate cancer.

INTRODUCTION

Autumn olive, a vigorous shrub or small tree, was introduced in the U.S. from Asia around 1830 as an ornamental plant (Dirr, 1983). It has been widely planted to prevent erosion and to provide screening along highways. The “berries” (pseudodrupes) have a pleasant, unique, sweet-tart flavor, and occur in abundance on branches of the previous growing season. Although the fruit is eaten in Asia (Parmar and Kaushal, 1982; Tanaka, 1976), there are few references to human consumption in the United States (Darrow and Yerkes, 1937; Reich, 1991). The fruit can be eaten fresh, or processed for preserves, condiments, fruit rolls and flavoring, or used as a substitute for tomato products. The deep red fruit color is due to the carotenoid lycopene (Fordham et al., 2001). Lycopene has been associated with the prevention of certain chronic diseases such as myocardial infarction (Kohlmeier et al., 1997) and different forms of cancer (Clinton, 1998), including prostate cancer (Giovannucci et al., 1995). Here we report lycopene levels for fruit from selected naturalized and nursery-grown plants.

MATERIALS AND METHODS

Samples of ripe autumn olive fruit from Hidden Springs Nursery, Cookeville, Tennessee, and selected naturalized plants from Howard County, Maryland, were analyzed at the Phytonutrients Laboratory, Beltsville Human Nutrition Research Center. Carotenoids were extracted from 5-g fruit samples by the procedure of Khachik et al. (1992). An internal standard (β -apo-8'-carotenal) was added to the extracts, and carotenoids were separated by HPLC with diode array detection using a 5 μ m reverse-phase C18 analytical column, isocratic conditions, and a flow rate of 0.80 mL min⁻¹. The mobile phase consisted of 65% acetonitrile, 25% methylene chloride, 10% methanol, 1 g L⁻¹ BHT, and 0.1 mL L⁻¹ of N,N-diisopropylethylamine. The precision and accuracy of the HPLC system were verified using Standard Reference Material from the U.S. National Institute of Standards and Technology. A more detailed description of the methods is presented in Fordham et al. (2001).

RESULTS AND DISCUSSION

Fruit size from sampled plants averaged 5 to 10 mm in diameter. Yield for mature plants has not yet been measured, but 4-year-old plants have yielded up to 8.8 kg of fruit.

The lycopene content per 100 g of fresh fruit from the naturalized plants ranged

from 15 to 54 mg and from 18 to 48 mg in red fruit from four nursery selections (Table 1). The yellow-fruited selection 'Charlie's Golden' was low in total carotenoids, and contained only 0.47 mg of lycopene per 100 g (Fordham et. al. 2001). The fruit also contained other carotenoids, including α - and β -cryptoxanthin, β -carotene, lutein, phytoene, and phytofluene (Fordham et. al., 2001). Fruit from a planting in Westmoreland County, Virginia, were found to have a lycopene content ranging from 30 to 68 mg per 100 g (data not shown).

Tomato and tomato products are the major sources of lycopene in the American diet. However, lycopene concentrations of wild autumn olive fruit are 5 to 20 times higher (Table 1) than published values for fresh tomato (3 mg per 100 g; U.S. Dept. of Agriculture, Agricultural Research Service; and Univ. of Minnesota, Nutrition Coordinating Center, 1998) and equal to or higher than that of tomato paste (29 mg per 100 g; Table 1). If the lycopene in processed autumn olive fruit is found to be bio-available, it would be an additional dietary source of this important antioxidant, and could be a valuable alternative for those sensitive to tomato products. Autumn olive plants require little or no pesticides or fertilizer, and tolerate poor soils. With the development of a suitable market for the fruit, autumn olive would be a low-maintenance cash crop for small or organic farms.

To study clonal differences in yield, growth habit, lycopene concentration, fruit size, adaptability for machine harvest, and other horticultural characteristics, plantings have been established at the Beltsville Agricultural Research Center, U. S. Department of Agriculture, Beltsville, Maryland. These plantings will also be used to evaluate and optimize cultural practices for long-term production. Future plans also include gathering additional germplasm from other geographical areas.

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Table 1. Mean amount and range of carotenoid contents in autumn olive fruit compared to tomato products. Values are presented for wild plants and selected cultivars.

Carotenoids (mg/100 g fresh weight)					
Source	Lycopene	β -Carotene	Lutein	Phytoene	Total
<u>Autumn olive</u>					
Wild plants	38.23	0.38	0.15	0.65	46.87
range (n=6)	15.0-54.0	0.24-0.60	0.11-0.29		
'Delightful'	29.68	0.17	0.07	0.39	36.37
'Jewel'	48.33	0.25	0.09	0.50	59.65
'Brilliant Rose'	29.59	0.10	0.05	0.52	41.36
'Sweet'n Tart'	17.87	0.03	0.06	0.39	34.81
'Charlie's Golden'	0.47	0.38	0.10	2.60	3.89
<u>Tomato products¹</u>					
Raw	3.02	0.39	0.13		
Range	0.88-4.20	0.11-0.70			
Whole, canned	9.71	0.09	0.04		
Range	9.27-10.14	0.07-0.23			
Paste	29.33	1.24	0.17		
Range	5.40-55.45	0.91-1.70			
¹ U.S. Dept. of Agriculture, Agricultural Research Service and Univ. of Minnesota, Nutrition Coordinating Center, 1998.					