

*Proc. Fla. State Hort. Soc.* 117:267-274, 2004.

## GROWING AND MARKETING ARUGULA AT LOCAL GREEN MARKETS IN SOUTHEAST FLORIDA

KENNETH D. SHULER<sup>1</sup>, STEPHEN J. NIE  
AND PEI-ANN N. SHULER  
*Stephen's Produce*  
12657 158th St. North  
Jupiter, FL 33478

*Additional index words.* *Eruca vesicaria*, compost, farmers' market, garden

*Abstract.* **Stephen's Produce began in 1995 as a 0.03 acre market garden to supply the Jupiter Farms Green Market with a Saturday supply of "garden fresh" produce. The garden was expanded each year. In 2003-2004, 0.35 acres were under cultivation and clientele were being served at two weekend green**

**markets. Arugula was one of the 26 crops grown and has been included in the crop mix for the past four seasons. Planting schedules, growing and harvesting methods, yields, and sales figures will be discussed. For the 2003-2004 season, 31 plantings were made for the 32 week sales season which began 18 Oct and concluded 22 May. The crop averaged 44 days to harvest. Arugula was mostly cut and packed unwashed in zip lock storage bags containing 120 g net (4.23 oz) and sold for \$2.50 per bag or two bags for \$4.00. An average of 55 bags was sold each week for \$114 or \$1,425 per acre per day of growth.**

*The Beginning of Arugula Sales for Green Markets in Southeast Florida, 2000-2004.* Stephen's Produce was not the first vendor to offer arugula (*Eruca vesicaria*, subsp. *sativa*) for sale at green markets in Palm Beach County. Arugula was first made available at two south county green markets which were served by a commercial herb grower. That vendor stopped

---

<sup>1</sup>Corresponding author; e-mail: skshuler@aol.com.

selling at the green markets so that his son, who managed the green market sales, could concentrate more on the commercial farming business. Since we offered other leafy salad greens for sale (mizuna, lettuce, parsley, cilantro, Swiss chard, and spinach) our customers would sometimes ask if we grew arugula (Shuler et al., 2003a, 2003b). We decided to try to satisfy this market request and began making weekly test plantings of 'Astro II' (Johnny's Selected Seeds, Winslow, Maine) in January 2001. Either 'Astro II' or 'Astro' has been grown each of the past four years.

*Soil Preparation.* Garden preparation began in mid May shortly after harvest of spring crops was completed by pulling out the remaining vegetation (mostly weeds). Weeds which emerged over the summer were controlled by spraying with glyphosate (Roundup Ultra, Monsanto Company, St. Louis, Mo.) herbicide. The garden has been enlarged each season and is now 0.35 acres (37 raised beds approximately 100 ft long). Compost from the Palm Beach County Solid Waste Authority, locally available horse bedding/manure, and garden debris from the previous season were spread over the garden area each year, May-Aug. This past season 234 cubic yards of compost were spread over the garden to a depth of about 5 inches. Dolomitic limestone and broadcast fertilizer were spread and incorporated with a rotary tiller in Aug. Tilling also mixed the compost in with the underlying sand.

For the 2003-2004 season, 37 beds were formed in Aug. and Sept. to provide some protection from flooding after heavy rains. The beds ran north and south, were on 4 ft centers, and were approximately 5 to 6 inches high with 20 to 30 inch wide tops. Beds were made with a hand pushed wheel-hoe using the plow attachment. For each bed, multiple passes of the wheel-hoe were made. Starting where the bed was being formed, soil was thrown to the inside as each pass of the wheel-hoe was moved to the outside by a few inches. A rake was used to pull loose soil away from the alley area and up onto the sides and top of each bed. The loose soil on top was then raked level and the sides and top of the beds were walked on to firm up the loose soil so that the beds would not be worn down by rainfall.

*Irrigation.* For the 2000-01 season, each bed was fitted with a single line of Queen Gil International drip tape ("High Flow" tape with 4 inch emitter spacings rated at 64 gal per 100 ft/hr). The lines were laid on the bed surface and divided into two zones (9 and 11 beds each) which could be irrigated separately using a manual flow meter with an automatic shut-off. Untreated well water was used without filtering. Ball shut-off valves were attached to each line to allow for individual bed irrigation. Also, a household paper element sediment filter was added in-line to reduce emitter plugging by sediment.

For the 2001-02 season, battery powered automatic timers were used to turn water on and off in each zone (Melnor Electronic Aqua Timer, Melnor, Winchester, Va.). By having the drip line on the bed surface, it could be lifted easily and shifted between rows to accommodate crops planted 3 or 4 rows per bed. Because of the constrictions of having hose bibs as shut-off valves and the pressure drop across the sediment filter, only about 25% of the garden could be irrigated at once while maintaining the minimum 7 psi recommended for the drip tubing. Pressure was measured with a gauge attached to the far end of one drip line. The automatic timers were set to irrigate every 8 to 12 h at 30 to 45 min per cycle. The two zones were set to irrigate at different times and only half of the 21 shut-off valves were open at any one time. The shut-off

valves were manually switched after each irrigation, so the entire garden was irrigated once every 16 to 24 h.

For the 2002-03 season, a 100 mesh screen in-line sediment filter was used and the plumbing was reworked with ¾ inch PVC pipe to eliminate the hose bib constrictions. "Medium Flow" Queen Gil International drip tape was used with 4 inch emitter spacings (rated at 32 gal per 100 ft/hr). The garden irrigation setup remained in two zones of 12 and 13 beds each zone and each zone was irrigated at a different time. During high evapotranspiration periods in September and early October, each zone was irrigated three times per day for up to 45 min. each irrigation. Irrigation was reduced to as little as two times at 30 min each during cold periods in January and February. Timely irrigation was especially important for maintaining growth of newly emerged seedlings which needed constant and adequate surface moisture. The drip system was shut off after moderate to heavy rains.

For the 2003-04 season a second drip line was added to each bed to eliminate the need to physically move the drip line from side to side to accommodate crops planted 3 to 4 rows per bed. Also, a third irrigation zone was made to accommodate the 12 new beds.

*Crop Establishment with Direct Seeding.* Chlorpyrifos 1% bait (Mole Cricket Bait, Micro Flo Company LLC, Memphis, Tenn.) was sprinkled on the bed surface to control wire worms and cutworms. Approximately 250 lb/acre 23-0-23 top-dress fertilizer was also spread at this time (providing 57 lb/acre N and 49 lb/acre K and made from mixing 50% potassium nitrate with 50% ammonium nitrate). The row areas of the bed surface were loosened with the cultivator attachment of the wheel-hoe and raked level to further incorporate the insecticide and fertilizer amendments.

A hoe was pushed to open furrows about 1.5 inches deep for planting. Arugula seeds are relatively small and they were sown by either tapping the side of the seed bag or by pinching seed between thumb and index finger and dropping by hand. Where arugula was planted alone, it was usually seeded three rows per bed. Loose soil was pulled over the furrow and an automobile tire was rolled over the plant row to firm up the soil. After rolling, the effective depth of planting was judged to be about 0.5 inches. Plants were not thinned. On very wide beds arugula would sometimes be planted four rows per bed and on more narrow beds two rows per bed.

*Crop Scheduling.* After the second season, when we realized that we could effectively recut a planting several times, arugula was planted three to four weeks in succession followed by six to eight weeks of no plantings. Each bed was cut an average of three times every 14 to 28 days. For the 2003-04 season we switched back to making a planting each week. We felt that we could improve quality and consistency with once over harvests which would help eliminate problems with unpredictable bolting, weed contamination, leaf blemishes and general aging. With the expectation of only one harvest, we could now plant arugula one or two rows per bed along with snow peas, beans, or red radishes (Shuler et al., 2002a, 2002b, 2001a). Since it grew relatively quickly, arugula would usually be harvested before the other crops began shading it. The intent was that the beans and peas could take advantage of the extra space once the arugula was harvested. When arugula was planted next to snow peas, that space would not likely be planted again until the peas finished bearing. In such cases, the arugula was not pulled out after harvest but left to regrow for use whenever extra arugula was needed.

Because of seasonal differences in growth rates, late summer plantings were scheduled 7 d apart, fall plantings at 5 to 6 d intervals, and winter plantings for spring harvest at 7-10 d intervals. The schedule had to be compromised in Nov. when there was no free space left to plant. Planting then continued on a weekly basis in areas where crops had just been harvested. Occasionally a scheduled planting was skipped in Feb. or Mar. to accommodate the faster growth rate of the spring crop.

Since we did not know what the demand would be at the new Sunday markets, we started by harvesting the entire week's planting on Friday for the Saturday market in West Palm Beach. Having a market on Sunday took away the temptation to lower prices to sell out on Saturday. We could take any unsold arugula left over from the Saturday market to the Sunday markets. After we were able to get a feel for how much arugula we could sell at each market, we would leave some uncut for a Saturday evening harvest. If we then did not sell out at the Saturday market, we would leave the uncut portion remaining for harvest for the next week's market at West Palm Beach on Saturday. Sometimes these areas which had been skipped would still be left unharvested since we would prefer to have the younger leaves for sale. Whenever there was a shortage, we would go back to these unharvested areas as long as they had not been pulled out. There were also times, either because of excessive shading or poor stand, that extra leaves from the next week's planting would be cut early for this week's harvest. Also, if there weren't enough unsold bags for the Sunday markets, then Sunday's arugula would be cut from the next week's harvest area.

For the 2003-04 season, arugula was available for sale on all 32 market dates. Days to first harvest varied from 31 d for a 24 Sept. planting harvested 25 Oct. to 45 days for eight different plantings beginning with one made 18 Nov. for harvest on 2 Jan. Average days to harvest was 44 d (this represents the average of multiple harvest dates when a planting was cut over a period of two or more weeks). The last planting for the 2003-04 season was made on 6 Apr for the last market which was originally scheduled for 16 May. The Stuart market did not close on 16 May as planned so a portion of the last planting was saved for our last day at the expanded market, 23 May. More refinements for crop scheduling are planned for next season.

*Growing the Crop and Pest Management.* There is commercial production of arugula and other herbs and leafy greens

by two large commercial growers in Palm Beach County as well as a small shade house operation. The insecticide bait treatments made just before planting have been very effective for controlling wire worms and cutworms.

The most common weed problem for the 2003-2004 season was pigweed with smaller populations of purslane and miscellaneous grasses. After the garden had been initially planted over by late Oct., areas for arugula plantings were made in spots where crops had just been harvested. Weeds and crop debris from harvesting were pulled out and removed to provide a "clean" planting area for the new plantings. An effort was made to keep arugula plantings free of weeds so that they could be cut quickly without taking extra time to remove weeds which might grow up into the arugula canopy. Where flushes of pigweed emerged along with the arugula, weeds were usually pulled out by hand within three or four weeks. If only a few weeds grew, they were often left until they began grow over the top of the arugula and were then pulled out shortly before harvest.

Arugula seedlings have been lost to damping-off when seeds were sown too thickly and when irrigation or rainfall was excessive. Foliar diseases were not a major problem with arugula; however, there were times, especially during warm fall weather, when there were light infestations of bacterial leaf spots on older leaves. Leaf bronzing, which could render leaves unmarketable, occurred sporadically and was associated with cold weather, an occasional spray burn, or nutritional imbalances. Blemished leaves and weeds not removed at harvesting were picked out at bagging. Leaves produced during cool, moderate weather from Jan. to early Apr. usually had fewer blemishes. Mefenoxam (Ridomil, Syngenta, Greensboro, N.C.), chlorothalonil (Bravo, Syngenta, Greensboro, N.C.), and azoxystrobin (Quadris, Syngenta, Greensboro, N.C.) have been used occasionally for disease control.

After several cuttings, most plantings would eventually bolt making it difficult to just harvest leaves without the flower stalks.

Crops were usually sprayed every 7 to 10 d with a rotation of spinosad (SpinTor, Dow Agrosociences, Indianapolis, Ind.), emamectin benzoate (Proclaim, Syngenta, Greensboro, N.C.), and indoxacarb (Avaunt, DuPont, Wilmington, Del.). These products were especially effective for worm control. Aphids and worms were usually not a problem on arugula and would most

Table 1. Arugula production for Stephen's Produce for green markets in Southeast Florida, 2002-2003

Date planted	Harvest period	Days to harvest	# harvests	Harvest duration (days)	Days between harvests	Linear bed ft planted	# Bags harv.	# Bags/harv.	Lbs/acre	Lb/acre/day
14 Sept.	18 Oct.-20 Dec.	34-97	4	63	21	18	173.5	43.4	27,745	286
21 Sept.	25 Oct.-6 Dec.	34-76	3	42	21	18	118.5	39.5	18,950	249
28 Sept.	1 Nov.-10 Jan.	34-104	5	70	17.5	18	188	37.6	30,063	289
17 Nov.	3 Jan.-7 Feb.	47-82	3	35	17.5	16	75	25	13,493	165
26 Nov.	27 Dec.-2 Mar.	41-106	5	65	16.3	26	138	27.6	15,347	145
1 Dec.	17 Jan.-14 Feb.	57-85	3	28	14	18	130	43.3	20,789	245
8 Dec.	24 Jan.-28 Feb.	57-92	3	35	17.5	21	145	48.3	19,875	216
3 Feb.	7 Mar.-11 Apr.	32-67	6	35	7	29	135	22.5	13,400	200
11 Feb.	14 Mar.-18 Apr.	32-67	4	35	11.7	20	137	34.3	19,717	294
19Feb.	4 Apr.-25 Apr.	44-65	2	21	21	17	44	22	7,450	115
11Mar.	25 Apr.-17 May	45-67	2	22	22	10.5	58	29	15,900	237
26 Mar.	3 May -10 May	38-45	2	7	7	18	18	9	2,878	64
Totals					229.5	1,360				
Average of 12 plantings		41-79	3.2	38	18	19	113	32.4	17,065	215

Table 2. Arugula sales for Stephen's Produce at green markets in Southeast Florida, 2002-2003.

West Palm Beach	# arugula taken	# arugula sold	Total \$	Avg \$/bag	Time sold out	# arugula unsold or given away
19 Oct.	24	24	72	3.00	10:30	
26 Oct.	45	40	80	2.00		5
2 Nov. <sup>1</sup>	59	59	118	2.00	11:20	
9 Nov.	41	41	102.50	2.50	10:40	
16 Nov. <sup>1</sup>	23	23	56	2.49		
23 Nov. <sup>2</sup>	31	31	77.50	2.50	9:50 AM	
30 Nov.	49	44	110	2.50		5
7 Dec. <sup>1</sup>	51	38	95	2.50		13
14 Dec. <sup>1</sup>	40	29	72.50	2.50		11
21 Dec. <sup>2</sup>	57	54	135	2.48		3
28 Dec.	42	41	101	2.49	11:30	1
4 Jan.	45	45	102.50	2.28	12:30	
11 Jan.	38	38	95	2.50	11:20 AM	
18 Jan.	42	42	105	2.50	12:40 PM	
25 Jan.	45	42	105	2.50		3
1 Feb.	55	55	137.50	2.50	10:50 AM	
8 Feb.	39	39	97.50	2.50	11:40 AM	
15 Feb.	70	36	90	2.50		34
22 Feb.	47	44	110	2.50		3
1 Mar.	37	37	92.50	2.50	11:00 AM	
8 Mar. <sup>3</sup>	28	28	70	2.50		
15 Mar.	25	25	62.50	2.50		
22 Mar.	40	40	100	2.50	12:50 PM	
29 Mar.	42	36	90	2.50		6
5 Apr.	59	59	147.50	2.50		
12 Apr.	49	33	82.50	2.50		16
19 Apr. <sup>2</sup>	58	34	85	2.50		24
26 Apr. <sup>1</sup>	45	27	60	2.22		18
Total	1,226	1,084	\$2,652			142
Avg/wk 28 weeks	43.8	38.7	\$94.71	\$2.45		5.1
Palm Beach Gardens	# arugula taken	# arugula sold	Total \$	Avg \$/bag	Time sold out	# arugula unsold or given away
26 Jan.	18	18	45	2.50		
2 Feb.	14	14	35	2.50		
9 Feb.	18	18	45	2.50		
16 Feb.	34	28	70	2.50		6
23 Feb.	19	19	47.50	2.50		
2 Mar.	36	20	50	2.50		16
9 Mar.	15	15	37.50	2.50		
23 Mar.	13	13	32.50	2.50		
30 Mar.	18	17	42.50	2.50		1
6 Apr.	30	11	27.50	2.50		19
Stuart	# arugula taken	# arugula sold	Total \$	Avg \$/bag	Time sold out	# arugula unsold or given away
13 Apr.	16	15	30.50	2.03		1
20 Apr. <sup>4</sup>	24	10	20	2.00		14
27 Apr.	18	6	13.50	2.25		12
4 May	11	2	4	2.00		9
11 May <sup>5</sup>	7	7	14	2.00		
18 May	20	20	40	2.00		
Total	311	233	\$554.50			78
Avg/wk 16 weeks	19.4	14.6	\$34.65	\$2.38		4.9

<sup>1</sup>Sales affected by rainy or overcast weather.<sup>2</sup>Saturdays before Thanksgiving, Christmas and Easter.<sup>3</sup>WPB Boat Show affected availability of parking.<sup>4</sup>Easter Sunday.<sup>5</sup>Mothers' Day.

commonly be found building up on cruciferous crops first (Shuler et al., 2001b). Stinkbugs would sometimes be found in arugula and would be picked out by hand at harvesting or bagging. Malathion (Malathion Plus, Ortho, Marysville, Ohio) was added to the spray mixture on an as needed basis for stinkbug suppression. Imidacloprid (Provado, Bayer Corporation, Kansas City, Mo.) or pymetrozine (Fulfill, Syngenta, Greensboro, N.C.) would also be used as needed for aphid control.

*Harvesting and Washing.* Arugula was usually one of the last crops harvested before sundown on Friday evenings. Leaves with a small amount of stem were usually clear cut by the handfuls with a knife. As the handfuls of leaves were tossed into a bucket, any weeds and blemished leaves which were noticed were picked out. Usually two to three bushel buckets were filled. For the first several harvests during the first season, arugula leaves were washed before being placed in gallon sized plastic zip lock storage bags. Bags were sealed and then stored several hours or overnight in a household refrigerator to remove field heat. Some leaves became water soaked and lost their "fresh" appearance so washing was discontinued. Since then arugula leaves have been packed dry inside the storage bags. Most of the air was forced out of the bags which were only partially sealed at the top for storage in the refrigerator.

After several hours in the refrigerator, bags would be taken out and stored in a Styrofoam cooler with usually one or

two 7 lb bags of ice. Usually three to four bags of arugula would be placed on display and as bags were sold, the display area would be replenished with fresh bags out of the cooler. Bags which were not sold at the Saturday market would be taken back home where they were again stored in the refrigerator until time for loading for the Sunday market.

There were a few occasions, especially for the Stuart market, when arugula was pulled out by the roots and bunched or cut and bunched. At the Stuart market, bunched arugula seemed to move faster than bagged arugula. This could have been because of price; bagged arugula was sold at \$2.00-\$2.50 per bag compared to a bunch at \$1.50 each. Bunching arugula with roots was more time consuming since the lower leaves were also included. Blemished or yellowed basal leaves needed to be removed. With bagging, the cut would be made above these older, outer leaves and they would be left in the garden. Whenever arugula was bunched, the bunches would usually be stacked upright in a bucket or tray with a small amount of water.

*Marketing, Pricing, and Sales Techniques.* In addition to the green market in West Palm Beach, Fla., where Stephen's Produce has sold produce for the past six seasons, another market opened in January 2003 in Palm Beach Gardens, Fla. (Tables 1 and 2). This was a Sunday market open from 9 am to 1 pm and was closer to home than the West Palm Beach market.

Table 3. Arugula production for Stephen's Produce for green markets in Southeast Florida, 2003-2004 season.

Date planted	Harvest period	Days to harvest	# wks harvested	Harvest duration (days)	Days between harvests	Linear bed ft planted	# Bags harv.	# Bags/harv.	# Bunches harv.	Lbs/Acre	Lbs/acre/day
10 Sept.	17 Oct.-18 Oct.	37-38	1	1		26.5	57	57		6,707	177
17 Sept.	24 Oct.	37	1			19	55	55		9,027	244
24 Sept.	25 Oct.-16 Jan.	31-113	7	82	13.7	24.5	164	23.4	15	21,779	193
30 Sept.	1 Nov.-7 Nov.	32-38	2	6	6	26	36	18		4,258	112
6 Oct.	7 Nov.-20 Dec.	32-75	2	43	43	27	18	9	20	3,411	45
12 Oct.	21 Nov.-20 Dec.	40-69	3	29	14.5	27	41	13.7	10	5,344	77
20 Oct.	28 Nov.	39	1			18	41	41		7,103	182
26 Oct.	5 Dec.	40	1			18	48	48		8,315	208
29 Oct.	12 Dec.	44	1			18	55	55		9,528	217
5 Nov.	19 Dec.	44	1			17	24	24		4,402	100
12 Nov.	26 Dec.	44	1			27	72	72		8,315	189
18 Nov.	2 Jan.-9 Jan.	45-52	2	7	7	22.5	79	39.5		10,949	211
25 Nov.	9 Jan.-10 Jan.	45-46	1	1		28	67	67		7,462	162
2 Dec.	16 Jan.-14 Feb.	45-74	3	29	14.5	18	41	13.7		7,103	96
9 Dec.	17 Jan.-23 Jan.	39-45	2	6	6	16	66	33		12,863	286
16 Dec.	30 Jan.-6 Feb.	45-52	2	7	7	18	78	39		13,513	260
23 Dec.	6 Feb.-7 Feb.	45-46	1	1		15	59	59		12,265	267
30 Dec.	13 Feb.-14 Feb.	45-46	1	1		18	62	62		10,741	233
6 Jan.	20 Feb.-27 Feb.	45-52	2	7	7	17	73	36.5		13,390	258
13 Jan.	27 Feb.-28 Feb.	45-46	1	1		16	63	63		12,278	267
21 Jan.	5 Mar.	44	1			15	56	56		11,642	265
29 Jan.	13 Mar.-10 Apr.	44-72	3	28	14	32	148	49.3		14,422	200
11 Feb.	19 Mar.-26 Mar.	37-44	2	7	7	17	84	82		15,408	350
19 Feb.	26 Mar.-2 Apr.	36-43	2	7	7	15	77	38.5		16,007	372
25 Feb.	2 Apr.-9 Apr.	37-44	2	7	7	16	36	18		7,016	159
3 Mar.	9 Apr.	37	1			17	18	18		3,302	89
10 Mar.	16 Apr.-17 Apr.	37-38	1	1		18	64	64		11,087	292
17 Mar.	23 Apr.-14 May	37-58	2	21	21	18	75	37.5	20	14,992	258
24 Mar.	30 Apr.-8 May	37-45	2	8	8	21	30	15	15	5,740	128
1 Apr.						11					
6 Apr.	21 May	45	1			9			15	2,998	67
Totals					605.5	1,760		95			
Average of 31 plantings		40-50	1.7	10	13.6	19.5		33.2	15.8	9,472	188

Table 4. Arugula sales for Stephen's Produce at green markets in Southeast Florida, 2003-2004.

West Palm Beach	# arugula taken	# arugula sold	Total \$	Avg \$/bag	Time sold out	# arugula unsold or given away
18 Oct.	37	37	92.50	2.50		
25 Oct.	56	56	139.50	2.50		
1 Nov.	62	56	142.50	2.54		6
8 Nov.	40	40	100	2.50		
15 Nov.	16	16	32	2.00	8:37	
22 Nov. <sup>1</sup>	49	49	73.50	1.50		
29 Nov.	41	31	77.50	2.50		10
6 Dec.	48	48	120	2.50		
13 Dec.	55	21	52.50	2.50		34
20 Dec. <sup>1</sup>	64	64	128	2	12:10	
27 Dec.	72	57	114	2		15
3 Jan.	59	48	96	2		11
10 Jan.	67	64	134	2.09		3
17 Jan.	59	53	106	2		6
24 Jan.	47	47	94	2	12:37	
31 Jan. <sup>2</sup>	68	40	85	2.13		28
7 Feb.	55	55	115	2.09	11:15	
14 Feb.	56	56	112	2		
21 Feb.	62	53	106	2		9
28 Feb.	45	38	80	2.1		7
6 Mar.	40	40	84	2.1		
13 Mar.	73	59	120	2.03		14
20 Mar.	70	51	105	2.06		19
27 Mar.	51	47	97	2.06		4
3 Apr.	58	39	80	2.05		19
10 Apr.	53	48	100	2.08		5
17 Apr. <sup>1z</sup>	60	54	112	2.07		6
24 Apr.	75	36	78	2.20		39
Total	1,538	1,303	\$2,776			236
Avg/wk 28 weeks	55	46.5	\$99	2.13		8.4
Wellington	# arugula taken	# arugula sold	Total \$	Avg \$/bag	Time sold out	# arugula unsold or given away
2 Nov.	19.5	16.5	42.25	2.56		3
30 Nov.	9.5	8	20	2.5		1.5
7 Dec.	14	6	15	2.5		8
14 Dec.	15	7	14	2		8
21 Dec. <sup>1</sup>	15	3	6	2		12
Total	73	40.5	\$97.25			
Avg/wk 5 weeks	14.6	8.1	\$19.45	\$2.40		32.5
Stuart	# arugula taken	# arugula sold	Total \$	Avg \$/bag	Time sold out	# arugula unsold or given away
19 Oct	15	14	21	1.50		1
26 Oct	15	15	22.50	1.50		
7 Dec	14	9	22.50	2.50		5
14 Dec	19	15	22.50	1.50		4
21 Dec	15	10	15	1.50		5
28 Dec.	15	10	15	1.50		5
4 Jan.	11	11	22	2		
11 Jan.	22	18	34	1.89		4
18 Jan.	26	26	52	2	11:15	
25 Jan.						
1 Feb.	28	22	44	2		6
8 Feb.	22	22	44	2	12:20	
15 Feb. <sup>2</sup>	20	13	26	2		7
22 Feb.	20	20	42	2.10	11:40	
29 Feb	17	16	32	2		1

<sup>1</sup>Saturdays before Thanksgiving, Christmas and Easter.<sup>2</sup>Sales affected by rainy or overcast weather.<sup>3</sup>Easter Sunday.

Table 4. (Continued) Arugula sales for Stephen's Produce at green markets in Southeast Florida, 2003-2004.

Stuart	# arugula taken	# arugula sold	Total \$	Avg \$/bag	Time sold out	# arugula unsold or given away
7 Mar.	16	16	38	2.38		
14 Mar.	24	24	48	2		
21 Mar.	33	18	38	2.11		15
28 Mar.	28	17	34	2		11
4 Apr.	19	17	36	2.12		2
11 Apr.	15	2	5	2.50		13
18 Apr. <sup>3</sup>	23	23	46	2		
25 Apr.	40	19	41	2.16		21
2 May	30	13	26	2		17
9 May	15 bunch	15	22.50	1.5		
15 May	20 bunch	10	15	1.5		10
22 May	15 bunch	12	18	1.5		
Total	537	407	\$782			130
Avg/wk 26 weeks	20.7	15.7	\$30.08	\$1.92		5

<sup>1</sup>Saturdays before Thanksgiving, Christmas and Easter.

<sup>2</sup>Sales affected by rainy or overcast weather.

<sup>3</sup>Easter Sunday.

Stephen's Produce sold arugula at this market for 10 of 12 market Sundays from 19 Jan. to 6 Apr. when the market closed for the season. Another Sunday market also opened in Stuart, Fla. in 2003 and Stephen's Produce sold arugula at this market for six of six markets from 13 Apr. to 17 May 2003 when that market closed. The Stuart market was also open from 9 am to 1 pm and was about the same distance from home as the market in West Palm Beach. In fall 2003 another Sunday market opened in Wellington, Fla. Stephen's Produce began selling at this market on their opening day, 2 Nov., until sales were discontinued on 21 Dec. because of low sales. Sunday sales were made at both Stuart and Wellington for three weekends, 7 Dec. to 21 Dec. and continued at Stuart for the remainder of the season, ending on 22 May 2004 (Tables 3 and 4).

Bags of arugula were weighed on a gram balance as they were packed and contained at least 120 g net. They were usually priced at \$2.50 each and sold on a constant "special" of two bags for \$4.00. Special prices (\$1.50 to \$2.00 each and three bags for \$5) were also offered whenever there were large amounts of arugula left over from the Saturday green market. Although leaf samples were not displayed openly, samples were provided to anyone requesting a taste.

A display area was made with five large coolers which were raised off the ground by portable stands to a height of 29 inches at the front edge and lined up with their tops opened and supported from behind to form an inclined platform of the inside top surface. The produce display was covered by a tent which helped shield the vegetables from sunlight. The cooler holding arugula was usually not used to make up the display area but was kept accessible to Stephen's Produce staff.

*Production and Sales Figures.* Arugula sales averaged 32 to 55 bags per week (8.5 to 15 lbs) for the four year period, 2000-2004. Sales price per bag (120 gms) ranged from \$1.83 to \$2.96 (2001-02 season) and weekly value increased from \$81 to \$114 or \$3,655 for the 2003-04 season. The greatest value of arugula sold was for the 2 Nov. 2003 weekend when 73 bags were sold for \$185 at two markets. Where arugula is cut only once, approximately 19 linear bed ft planted with three rows per bed would be needed to produce 60 bags containing 120 gms per bag. If arugula is left to regrow for multiple harvests, about 27 linear bed ft planted with two rows per bed would produce an average of 60 bags per harvest for three harvests.

At an average of 40 d to harvest, 60 bags of arugula from 19 linear bed ft selling at \$2.15 per bag would produce \$1,847 per acre per day. A summary of arugula production and sales for the past four market seasons, 2000-2004, is provided in Tables 5 and 6.

*Customer Profile, Observations, and Customer Comments.* A wide range of customers purchased vegetables from Stephen's Produce. Customers included older retired couples, single men and women, and young families with children, as well as winter residents from the northern USA, Canada, and Europe.

For most of our customers, arugula was one of several items purchased. Many customers would take advantage of the "special" prices and buy two bags for \$4.00. A few customers would buy three or more bags. We found that some customers would prepare arugula alone while others mixed it with other salad greens. Customers often commented on the freshness of the arugula and that they could hold it in the refrigerator for over a week.

Table 5. Summary of arugula sales for Stephen's Produce at green markets in Southeast Florida over a four year period, 2000-2004.

Year	Location	Harvest and sales season	# of weeks	Total # arugula taken	Total # arugula sold	\$/bag	Total \$	\$/week	Unsold (% of total taken)
2000-01	WPB	17 Feb.-28 Apr.	11	562	489	\$1.83	\$893	\$81.18	13.1%
2001-02	WPB	3 Nov.-27 Apr.	28	954	887	\$2.96	\$2,626	\$93.79	7%
2002-03	WPB, PBG, Stuart	18 Oct.-17 May	31	1,536	1,316	\$2.44	\$3,205	\$103.39	14.3%
2003-04	WPB, Wellington, Stuart	18 Oct-22May	32	1,912	1,750	\$2.09	\$3,655	\$114.22	8.5%

Table 6. Summary of arugula production by Stephen's Produce for sale at green markets in Southeast Florida over a four year period, 2000-2004.

Year	Harvest and sales season	# wks planted	Linear bed ft planted/wk	Avg days to harvest	Duration of harvest	Avg # of harvests/ planting	Total bags	Total lb	Lb/ acre	\$/acre
2000-01	17 Feb.-28 Apr.	8	8.9	33-65	32	3	562	149	22,790	\$136,406
2001-02	3 Nov.-27 Apr.	24	10.3	38-66	29	3	954	278	12,226	\$114,404
2002-03	18 Oct.-17 May	12	19.1	41-79	38	3.2	1,536	360	17,065	\$157,577
2003-04	18 Oct.-22May	31	19.5	40-50	10	1.7	1,912	527	9,472	\$71,720

*Optimizing Production and Sales.* We may again try to bunch young arugula pulled out by the roots. If it can be grown relatively weed free and harvested before outer leaves yellow or become blemished, then less time will be needed for preparation. Shelf-life should be longer for rooted arugula than for cut arugula. We would recommend that customers remove the rubber band and store the arugula with a moist paper towel around the roots. Bagged arugula may continue to be offered to customers in West Palm Beach. An attempt will be made to more precisely seed arugula so that fewer seed are used. Although there would be fewer plants, each plant should have more stems and thicker stems which would make it easier to pull out. Also, there would be less chance for damping-off.

#### Literature Review

Shuler, K. D., S. J. Nie, and P-A. N. Shuler. 2003a. Growing and marketing spinach at local green markets in south Florida. Proc Fla. State Hort. Soc. 116:325-331.

Shuler, K. D., S. J. Nie, and P-A. N. Shuler. 2003b. Growing and marketing Swiss chard at local green markets in south Florida. Proc Fla. State Hort. Soc. 116:331-336.

Shuler, K. D., S. J. Nie, P-A. N. Shuler, and D. G. Shuler. 2002a. Production and marketing techniques for snow peas from Stephen's Produce "garden fresh" vegetables at local green markets in Palm Beach County, Florida. Proc Fla. State Hort. Soc. 115:161-166.

Shuler, K. D., S. J. Nie, P-A. N. Shuler, and D. G. Shuler. 2002b. Production and marketing techniques for beans from Stephen's Produce "garden fresh" vegetables at local green markets in Palm Beach County, Florida. Proc Fla. State Hort. Soc. 115:166-175.

Shuler, K. D., S. J. Nie, and P-A. N. Shuler. 2001a. The evolution of production, harvesting, and marketing techniques for radishes from Stephen's Produce "garden fresh" vegetables at local green markets in Palm Beach County, Florida. Proc Fla. State Hort. Soc. 114:219-224.

Shuler, K. D., S. J. Nie, and P-A. N. Shuler. 2001b. The evolution of production, harvesting, and marketing techniques for bok choy Chinese cabbage from Stephen's Produce "garden fresh" vegetables at local green markets in Palm Beach County, Florida. Proc Fla. State Hort. Soc. 114:224-231.