

GROWING AND MARKETING SPINACH AT LOCAL GREEN MARKETS IN SOUTH FLORIDA

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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. By 2002-2003, 0.25 acres were under cultivation and clientele were being served at two weekend green markets. 'Melody' spinach (*Spinacia oleracea*) has been included in the crop mix for five seasons. The sandy garden soil was amended with compost and horse manure/bedding and irrigated via drip tubing. Open beds on 4 feet centers were made each year and an insecticidal bait and fertilizer were applied preplant. For the 2002-2003 season, three main plantings of spinach were made at weekly intervals from 2-16 October with the intention of cutting each bed every 21 days. Spinach was direct seeded two rows per bed and first harvest was made 22 November. Spinach was

usually cut Thursday evenings, washed, bagged, weighed, and stored in a refrigerator until Friday night when bags were moved into a Styrofoam cooler with ice for transport to the market. Spinach was sold in gallon size freezer bags containing 0.33-0.4 lb net per bag at \$2.00-\$2.50 per bag. From the initial three plantings plus a smaller fourth planting made on 2 December, an average of 24.4 lbs of spinach valued at \$142 were sold each week for 22 weeks.

The Beginning of Spinach Sales for Palm Beach County Green Markets, 1998-99. Spinach (*Spinacia oleracea*) was first offered for sale by Stephen's Produce on 6 Feb. 1999, at the green market in West Palm Beach, FL. For the first 2 weeks, a total of 13 bags with 20 leaves per bag were sold for \$1.00 each. For the next 8 weeks, leaf count per bag was increased to 24-27 leaves per bag and bags were sold for \$2.00 per bag. For the 1998-99 season, a total of 75 bags were sold over a 10 week period for \$136 with the last sale being made on 17 April. Spinach leaves were cut and washed on Friday evening and stored overnight in a refrigerator for the Saturday market.

Why spinach? The first crop of spinach that was planted in 1998 was grown to be an ingredient in home made fish food, not for sale at the green market. Our 11 year old son Stephen had a large omnivorous tropical fish with a large appetite. To feed the 'pacu,' Stephen began making his own fish food and spinach was one of the ingredients. After seeing the relative high price of spinach purchased from the grocery, we

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decided to try to grow our own for use in the fish food. The 'All American' variety 'Melody' was selected and a partial bed was planted. Since there was excess production after leaves had been harvested for making fish food, we decided to see if our customers at the green market would be interested in fresh, clean spinach. Because sales were so robust after the first two weeks at \$1.00 per bag, the price was increased to \$2.00 per bag on 27 Feb. when there were 18 bags for sale (the weekly high amount for the season). During the 1998-99 season, Stephen's Produce sold out of spinach each week.

Soil Preparation. Garden preparation began shortly after the spring crops were completed in late April with the removal of remaining vegetation (mostly weeds) by either pulling or spraying with glyphosate (Roundup Ultra, Monsanto Company, St. Louis, Mo.) herbicide (Shuler et al., 2001a, b). The garden was enlarged each season. Compost from the Palm Beach County Solid Waste Authority and locally available horse bedding and manure were spread over the garden area each year in May and June (Table 1). Dolomitic limestone and broadcast fertilizer were spread and incorporated with a rotary tiller in August (Tables 2 and 3). Tilling also mixed the compost in with the underlying sand.

Beds were made with a hand pushed wheel-hoe using the plow attachment. For each bed, multiple passes of the wheel-hoe were made on each side of 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. For the 2002-2003 season, 25 105 ft long beds were formed over a 17 d period (14-31 Aug.) to provide some protection from flooding after heavy rains. The beds ran north and south, were on 4 feet centers, and were approximately 5 to 6 inches high with 20 to 30 inch wide tops (Shuler et al., 2002a, b).

Irrigation. During 1998-99, when the garden was relatively small, it was irrigated mostly at night by moving around a single overhead sprinkler. After the garden was enlarged to 0.1 acre for the 1999-2000 season, drip irrigation was used. Each bed was fitted with a single line of Typhon tape (18 inch emitter spacing rated at 0.37 gal/hr at 10 psi). 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.

For the 2000-01 season, Queen Gil International drip tape was used ('High Flow' tape with 4 inch emitter spacings rated at 64 gal per 100 ft/hr). The same two zones were used; however, 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 Elec-

tronic 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 three or four 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 3/4 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.

Crop Establishment with Direct Seeding and Transplanting. Either chlorpyrifos 1% bait (Mole Cricket Bait, Micro Flo Company LLC, Memphis, Tenn.) or diazinon 5% (Diazinon Soil & Turf Insect Control Granules, Realex, St. Louis, Mo.) bait was sprinkled on the bed surface to control wire worms and cutworms. Approximately 250 lb/acre 23-0-19 (e.g., 23-0-23) topdress 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 bed surface was loosened with the cultivator attachment of the wheel-hoe and raked level to further incorporate the insecticide and fertilizer amendments.

The end of a hoe was pushed into the loose soil to make holes for hill planting the spinach seeds. 'Melody', an 'All American' semi-savoy spinach variety, was planted two to three seeds per hill, in hills spaced 7 to 9 inches apart, two rows per bed. Seeds were covered to a depth of about 1/2 to 3/4 inch. After planting, an automobile tire was rolled over the plant row to firm up the soil. Emerged seedlings were not thinned.

Since spinach growth is relatively slow and the leaves would not cover over the row for up to 35 to 40 d, one planting of a single row of radishes was often made between the two rows of spinach. The moderate competition for light helped the radishes produce longer leaves.

Crop Scheduling. Since 2000-01, there has been a concerted effort to have spinach as early as possible, to have as continuous a supply as possible, and to extend the season as late into the spring as possible. Periods of unusually hot weather have made it difficult to have marketable spinach for all 28 weeks of the green market season.

Table 1. Amount of nutrients supplied by "AllGro" compost to 10,395 sq ft garden area (4.2 plots per acre) surface applied 19 May to 20 Aug. 2002 and rototilled.

Material	Amount applied (lb)	Rate per acre (ton)	N (lb/acre)	P (lb/acre)	K (lb/acre)
"AllGro" compost (1.8-0.2-0.6) (e.g., 1.8-0.5-0.7)		283.5	10,206	1,247	3,294

Table 2. Soil amendments broadcast Aug. 2002 to 3,915 sq ft of newly developed garden area (11.1 plots per acre) and roto-tilled August and September 2002.

Material	Amount applied (lb)	Rate per acre (lb)	N (lb/acre)	P (lb/acre)	K (lb/acre)
Dolomitic limestone	135	1,500			
10-2-4 with minor elements (e.g., 10-5-5)	72	800	80	17.6	33.2
Triple super phosphate (0-20-0) (e.g., 0-46-0)	29	326	0	66	0
Ammonium nitrate (33-0-0)	18	200	66	0	0
Potassium nitrate (13-0-38) (e.g., 13-0-46)	36	400	52	0	153
Minors package	3.6	40			
Total			198	84	186

Table 3. Soil amendments broadcast August 2002 to 6,000 sq ft of old garden area (7.26 plots per acre) and roto-tilled August and September 2002.

Material	Amount applied (lb)	Rate per acre (lb)	N (lb/acre)	P (lb/acre)	K (lb/acre)
Dolomitic limestone	75	545			
10-2-4 with minor elements (e.g., 10-5-5)	56	407	41	9	17
Triple super phosphate (0-20-0) (e.g., 0-46-0)	24	174	0	35	0
Ammonium nitrate (33-0-0)	12	87	29	0	0
Potassium nitrate (13-0-38) (e.g., 13-0-46)	21	152	20	0	58
Minors package	4.5	32.7			
Total			90	44	75

An early planting of spinach has usually been made in early September in an attempt to provide leaves for market in early November. Either hot weather or excessive soil moisture has either delayed or killed these early plantings such that they tend to be ready for first cut about the same time as the main plantings made in late September and early October. Because of the difficulty in getting and maintaining a good stand of spinach in September and early October, seedlings were grown in flats seeded at the same time as the field plantings were made. These seedlings are used to fill in where direct seeded plants have died so that as full a stand as possible was maintained in the field.

In 2002-03, three main plantings of spinach were made at weekly intervals; 2, 9, and 16 Oct., with the plan to harvest

from a single planting every third week. Spinach can generally be harvested at intervals closer than every 21 d so future planting schedules may be made for harvests at 14 d intervals. Two supplemental plantings were scheduled for 2 Dec. and 14 Jan. The 14 Jan. planting was not made because there was no available space left for planting at that time. Harvests from the first three main plantings made in October were expected to extend into mid-April with light April harvests being supplemented by the planned 14 Jan. planting which was not made. Unseasonably hot weather in late February and early March ended production from the October plantings in early March.

The earliest harvest of spinach in 2000 was made on 10 Nov. from spinach planted 7 Sept. and 23 Sept. (64 and 48 d to harvest, respectively). The latest harvest in 2000 was made on

Table 4. 'Melody' spinach production for Stephen's Produce at the green market in West Palm Beach, Fla., 2000-2001 season.

Date planted	Spinach harvest period	Days to harvest	No. of harv.	Harvest duration (days)	No. bags harvested	Pounds harvested
7 Sept.	10 Nov.-19 Jan.	64-135	7	71	55	18.2
23 Sept.	10 Nov.-16 Feb.	48-146	13	98	172	56.8
30 Sept.	24 Nov.-1 Dec.	55-62	2	14	25	8.3
14 Oct.	24 Nov.-15 Mar.	41-152	16	111	275	90.9
22 Oct.	8 Dec.-16 Feb.	46-117	11	71	83	27.4
29 Oct.	8 Dec.-27 Feb.	40-121	12	81	126	41.6
4 Nov.	8 Dec.-23 Feb.	34-111	12	77	149	49.2
26 Nov.	19 Jan.-22 Mar.	54-116	10	62	165	54.5
24 Dec.	9 Feb.-22 Mar.	47-88	7	41	193	63.8
7 Jan.	22 Feb.-13 Apr.	46-96	8	50	155	51.2
21 Jan.	8 Mar.-29 Mar.	46-67	4	21	44	14.5
4 Feb.	13 Apr.-27 Apr.	59-73	2	14	14	4.7
18 Feb.	29 Mar.-13 Apr.	39-54	3	15	37	12.2
5 Mar.	27 Apr.-27 Apr.	47-47	1	1	12	3.9
Total					1,505	497
Avg. of 14 plantings		48-99	7.7	52	250	35.5
Avg. per week of sales (24 weeks)					62.7	20.7

Table 5. 'Melody' spinach sales for Stephen's Produce at the green market in West Palm Beach, Fla., 2001-02.

2001-02 Date	Bags sold	Total \$	Time sold out	Bags unsold or given away
17 Nov. ^z	29.8	74.50	8:30 AM	
24 Nov.	58.5	146.25	12:23 PM	3.5
1 Dec.	48	120	12:40 PM	1
8 Dec.	52.5	131.25	11:45 AM	4.5
15 Dec.	35	87.50		31
22 Dec. ^z	46	115	11:00 AM	2
29 Dec.	54	135		7
5 Jan.	57	129.50	1:10 PM	2
12 Jan.	54	135	10:24 AM	5
19 Jan.	41	102.50	9:25 AM	2
26 Jan.	68	170		19.6
2 Feb.	72	180		11
9 Feb.	55	157.50		13
16 Feb.	73	176.50	12:30 PM	
23 Feb.	62.75	158		17
2 Mar.	60.5	151	12:33 PM	
9 Mar.	60	149.50	1:00 PM	
16 Mar.	82	187		11
23 Mar.	59	135		18
30 Mar. ^z	63	157.50	11:26 AM	
6 Apr.	19	47.50	8:35 AM	2
13 Apr.	29	72.50	10:08 AM	2
20 Apr.	12	30	8:50 AM	
27 Apr.	4.5	11.50	7:15 AM	
Total	1,195	2,960		152
Avg. per week (24 weeks)	49.8	123.30	11:55 AM ^y	6.3

^zThe Saturday before Thanksgiving, Christmas, and Easter.

^yFor days when spinach did not sell out, 1:00 pm was used.

28 April from plantings seeded 16 Jan. and 6 and 13 Feb. More refinements for crop scheduling are planned for next season.

Growing the Crop and Pest Management. There was no commercial production of large leaved spinach in South Florida. There was commercial harvesting of baby spinach for 'spring mix' on the organic soils in the Everglades Agricultural Area.

The insecticide bait treatments made just before planting have been very effective for controlling wire worms and cutworms.

The most common weed problems for the 2002-2003 season were pigweed and carpetweed with light populations of

purslane, nutsedge, and a few miscellaneous grasses. Beds for spinach were usually pre-irrigated to encourage a flush of early weed growth which was sprayed with glyphosate a week before planting. Spinach was usually weeded shortly after first cut and periodically throughout the long harvest season.

Nematodes have not caused any crop losses in spinach. Renewing the garden with additions of 'clean' compost each year has helped reduce the chance for nematode infestations.

It was common to have some bacterial lesions on older spinach leaves for the first few harvests in mid to late Nov. and again when temperatures and humidity increased in April.

Table 6. 'Melody' spinach production for Stephen's Produce at the green market in West Palm Beach, Fla., 2001-2002 season.

Date planted	Spinach harvest period	Days to harvest	No. of harv.	Harvest duration (days)	Linear bed ft planted	Bags harv. (no.)	Pounds per acre	Lbs/acre per day ^z
21 Sept.	Died from flooding caused by heavy rain							
6 Oct.	16 Nov.-18 Apr.	41-194	18	153	72	341	17,016	87.7
13 Oct.	23 Nov.-18 Apr.	41-187	16	146	54	483.5	32,186	172.1
20 Oct.	29 Nov.-24 Jan.	40-89	6	49	63	125	7,130	80.1
2 Dec.	25 Jan.-18 Apr.	54-138	10	84	30	241	28,859	209.1
2 Feb.	21 Mar.-25 Apr.	47-75	4	28	15.5	61	14,052	187.4
Total					234.5	1,252		
Avg. of five plantings		45-137	11	92	46.9	250	19,179	140
Avg. per week of sales (24 weeks)					9.8	52.2		

^zBased on the number of days to final harvest.

Table 7. 'Melody' spinach sales for Stephen's Produce at the green markets in south Florida, 2002-03.

West Palm Beach	Bags sold	Total \$	Time sold out	Bags unsold or given away
23 Nov. ^z	40	100	10:30	
30 Nov.	41	102.50	11:20	
7 Dec.	72	170		2
14 Dec.	28	70		52 ^y
21 Dec. ^z	64	160	1:00	3.5
28 Dec.	80.8	170	12:40	2
4 Jan.	53	110	10:35	2
11 Jan.	86	177	11:20	
18 Jan.	64	133		49
25 Jan.	72	148	12:10	5
1 Feb.	78	164.50	11:35	8.7
8 Feb.	90	190		23
15 Feb.	77	160		23
22 Feb.	68	143		43
1 Mar.	59	128		17
8 Mar.	42	84	?	
15 Mar.	8	20	?	
22 Mar.				
29 Mar.				
5 Apr.	7	17.5	?	
12 Apr.	15	37.5	9:00	1
19 Apr. ^z	24	60	9:50	1
26 Apr.	19	47.50		16
Total	1,088	2,393		248
Avg./wk (21 wk)	51.8	113.95	12:21 ^x	11.8
Palm Beach Gardens	Bags sold	Total \$		Bags unsold or given away
23 Nov.				
30 Nov.				
7 Dec.				
14 Dec.				
21 Dec.				
28 Dec.				
4 Jan.				
11 Jan.				
19 Jan.		35	70	11
26 Jan.		36	72	
2 Feb.		56	120	4
9 Feb.		63	138	1
16 Feb.		50	105	2
23 Feb.		43	91	
2 Mar.		35	75	2
9 Mar.		15	30	
16 Mar.				
23 Mar.				
30 Mar.				
6 Apr.				
Stuart	Bags sold	Total \$		Bags unsold or given away
13 Apr.				
20 Apr. ^x				
27 Apr.	9	18		7
4 May	9	22.50		
Total	351	742		27
Avg./wk (10 wk)	35	74.20		2.7

^zThe Saturday before Thanksgiving, Christmas, and Easter.

^yDamaged by improper cooling.

^xFor days when spinach did not sell out, 1:00 PM was used.

^zEaster Sunday.

These leaves are usually clipped off and discarded during harvest or weeding. Leaves produced during cooler weather from mid-December to March were usually free of lesions. 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.

The typical irrigation regime maintained for the garden may have provided excessive amounts of water which were not needed by the established spinach plants. In the spring some plants developed constrictions of the lower stem which were likely related to the high soil moisture and subsequent disease development at the soil line. These injured plants usually died back. Spinach leaves tended to become smaller by late March and early April for the plants seeded in October.

Even though worms have not been a serious pest of spinach, plants were usually sprayed every 7 to 10 d with a rotation of spinosad (SpinTor, Dow Agrosciences, Indianapolis, Ind.), emamectin benzoate (Proclaim, Syngenta, Greensboro, N.C.), and indoxacarb (Avaunt, DuPont, Wilmington, Del.). Leafminers were also not considered a pest of spinach and would have been controlled by the SpinTor and Proclaim which were both labeled for leafminer suppression. Aphids were an occasional pest on spinach and were treated with imidacloprid (Provado, Bayer Corporation, Kansas City, Mo.).

Harvesting and Washing. Spinach leaves were usually cut individually with clippers at the stem and tossed into a picking bucket. As each bucket was filled it was moved out of the sun to the garage where the leaves were washed by submersion in a utility sink. If the spinach was not to be washed immediately, water was sprinkled over the leaves to help prevent wilting. Spinach was usually cut by daylight on Thursday evenings, washed, packed in gallon sized Ziplock freezer bags, and stored in a refrigerator until Friday night when the bags were transferred to a Styrofoam cooler with one or two 7 lb bags of ice for transport to the market Saturday morning. The bags of spinach were weighed after water was drained out and usually weighed 5.3 to 6.3 oz net per bag as measured on a triple beam balance.

Generally only the largest leaves were cut such that leaves could be cut again in one to three weeks. Most of the quality control was done at harvest; however, leaves were also examined during washing and packing. After packing, bags were only partially sealed to allow for air exchange.

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 five seasons, another market opened in January 2003 in Palm Beach Gardens, Fla. This was a Sunday market opened from 9 AM to 1 PM and was closer to home than the West Palm Beach market. Stephen's Produce sold spinach at this market for eight 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. this season and Stephen's Produce sold spinach at this market for two of the six market Sundays from 13 Apr. to 17 May 2003. The Stuart market was also opened from 9 AM to 1 PM and was about the same distance from home as the market in West Palm Beach.

The package size of 5.3 to 6.3 oz was chosen because that amount of spinach fit loosely and rather flat in the gallon sized freezer bags. It was also similar to sizes found in grocery stores. Customers seemed satisfied with the package size as there were no complaints about it.

A display area was made with four large coolers which were raised off the ground by portable stands to a height of

Table 8. 'Melody' spinach production for Stephen's Produce for three green markets in south Florida, 2002-2003 season.

Date planted	Spinach harvest period	Days to harvest	No. of harv.	Harvest duration (days)	Linear bed ft planted	Bags harv. (no.)	Pounds per acre	Lb/acre per day ^z
15 Sept.	Pulled up: weak plants, poor root system, foliar disease							
2 Oct.	22 Nov.-6 Mar.	51-155	8	104	60	373	25,678	166
9 Oct.	29 Nov.-6 Mar.	51-148	8	97	60	475	31,419	212
16 Oct.	5 Dec.-6 Mar.	50-143	7	93	63	524	33,831	237
2 Dec.	8 Feb.-13 Mar.	68-101	5	33	21	100	19,566	194
14 Jan.	Scheduled planting date; was not planted because there was no space							
19 Feb.	3 Apr.-17 Apr.	43-57	3	14	29	7	906	16
25 Feb.	3 Apr.-24 Apr.	37-58	4	21	65	52	2,862	49
19 Mar.	24 Apr.-24 Apr.	36-36	1	1	119	17	514	14
26 Mar.	24 Apr.-24 Apr.	29-29	1	1	158	10	228	8
Total for four plantings (2 Oct.-2 Dec.)				204	1,472			
Avg. of four plantings (2 Oct.- 2 Dec.)		55-137	7	82	51	368	29,255	214
Avg. per week of sales (21 weeks)			9.7	70				

^zBased on the number of days to final harvest.

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. A single line of three or four bags of spinach were placed beside lines of other bagged produce such as French beans, snap beans, snow peas, and arugula. The displayed bags of spinach were 'restocked' as customers bought bags off the display. Remaining bags of spinach were held in the cooler with ice until shortly before being sold unless they were being stored in one of the coolers which had been opened to make up the display area. Since it was one of the better selling items of produce, spinach usually sold relatively fast and often sold out rather quickly when supplies were less than normal. However, at times of peak production, unsold bags of spinach would be taken back home and returned to the refrigerator until Sunday morning for sales at the Sunday market or for give away on Monday.

Spinach was sold by the bag, beginning at \$1.00 per bag for the first two weeks of the 1998-99 season. Since then spinach has been sold at \$2.00 to \$2.50 per bag (\$5.00-\$7.50/lb). Prices for spinach have been fairly constant for the past 5 years. When spinach supplies were high, 'specials' of two bags for \$4.00 or three bags for \$6.00 were offered. Stephen's Produce was the only vendor offering large leaves of spinach for sale at any of the green markets over the 5-yr period.

Bags of spinach were usually sold one or two at a time. Occasionally customers would buy three or even four bags at once. Instead of holding over 'extra' spinach which did not

make a full bag, one partial bag of spinach would be sold last for less than full price. For a few customers, spinach was their only purchase.

Production and Sales Figures. During the 2000-2001 season, sales of spinach averaged 62 bags per week (20.5 lb) for \$113 per week (Table 4). During the 2001-2002 season, sales of spinach averaged 56 bags per week (18.5 lb) for \$123 per week (Tables 5 and 6). For the 2002-2003 season, sales averaged 65 bags per week (24.2 lb) for \$142 per week (two markets per week for nine of the 22 weeks) (Tables 7 and 8). The greatest amount of spinach offered for sale was 155 bags on 17 Feb 2001 (150 bags were sold for \$282). The highest seasonal sales were for the 2002-03 season when spinach was available for 22 of 29 weeks of the market. During 2002-03, sales of 1,439 bags (535.7 lb) totaled \$3,134.

During 2002-03, total production from a single bed measuring 4 ft wide and 63 ft long (252 sq ft or 172.86 plots per acre) was 524 bags with a net weight of 195.7 lb. The bed was harvested seven times over a 93 d period and averaged 75 bags (28 lb) per harvest for the harvest period from 5 Dec. to 8 Mar. Selling spinach at the average price of \$2.18 per bag or \$5.84/lb resulted in an average value of \$197,461/acre or \$1,381/acre per day over the 143 d growing and harvesting period for this bed. The seasonal average for all plantings of spinach was \$171,244/acre or \$15.36 per linear ft of bed or \$1,252/acre per day for the 156 d growing and harvesting season.

A summary of spinach production and sales for the past five market seasons, 1998-99 to 2002-03 is provided in Tables 9 and 10.

Table 9. Summary of 'Melody' spinach sales for Stephen's Produce at green markets in south Florida over a five year period, 1998-2003.

Year	Location	Harvest and sales season	No. of weeks	Total bags sold	Bags per wk	\$ per bag	Total \$	\$ per wk	\$ per lb	Unsold bags/wk	Un-sold (% of total)
1998-99	WPB	6 Feb.-17 Apr.	10	75.5	7.6	\$1.81	\$137	\$14	\$5.47	0	
1999-00	WPB	18 Dec.-29 Apr.	18	478	27	\$2.03	\$970	\$54	\$6.14	0.8	3%
2000-01	WPB	11 Nov.-28 Apr.	24	1,405	58.5	\$1.93	\$2,717	\$113	\$5.86	3.9	6%
2001-02	WPB	17 Nov.-27 Apr.	24	1,195	49.8	\$2.48	\$2,960	\$123	\$7.49	6.3	11%
2002-03	WPB, PBG, Stuart	23 Nov.-4 May	22	1,439	65.4	\$2.18	\$3,134	\$142	\$5.85	1.2	2%

Table 10. Summary of production for 'Melody' spinach grown by Stephen's Produce for sale at green markets in south Florida over a five year period, 1998-2003.

Year	Harvest and sales season	No. of weeks	Days to final harvest	Duration of harvest	Total bags	Bags per wk	Total lb	Area (sq ft)	Lb per acre	Lb per acre/day	\$ per acre	\$ per acre/day
1998-99	6 Feb.-17 Apr.	10			75.5	7.6	25					
1999-00	18 Dec.-29 Apr.	18	98	52	478	27	158					
2000-01	11 Nov.-28 Apr.	24	99	52	1,405	58.5	464					
2001-02	17 Nov.-27 Apr.	24	137	92	1,195	49.8	395	938	19,179	140	138,093	1,011
2002-03	23 Nov.-4 May	22	137	82	1,439	65.4	536	816	29,255	214	171,244	1,252

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, young families with children, as well as winter residents from the northern USA, Canada, and Europe.

When asked, customers would share how they ate or prepared the spinach—most ate it raw in salads. Customers often commented on the excellent taste of the spinach and that it did not have any sand in it like much of the store bought spinach. Occasionally they would store it for a week before eating it. There was very little or no waste, as all leaves were usually edible.

Optimizing Production and Sales. Based on average sales of 56 bags per week in 2001-02 at the green market in West Palm Beach and an average sales of 35 bags per week in 2002-03 at the green market in Palm Beach Gardens, it is estimated that Stephen's Produce could sell an average of 91 bags of spinach per week over a 22-24 week harvest period. Space devoted to growing spinach would need to be increased by 30% to reach this goal (an increase from 3 beds to 4 beds at 60 linear ft per bed). Planting two beds (480 sq ft) per week for two consecutive weeks in early October would provide the bulk of this sup-

ply. Additional spinach planted in Dec. and Jan. would supplement the early plantings as they decrease in production in late Mar. and Apr. Projected sales of 91 bags per week would gross approximately \$200/week or \$4,800 for a 24 week sales period.

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