Producing and Marketing Strawberries for Direct Market Operations

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SUMMARY. The costs associated with growing, harvesting and marketing strawberries (*Fragaria xananassa*) using the plasticulture production system were estimated to be \$13,540/acre (\$33,457/ha). Net revenue analysis showed that growers would have to charge at least \$0.85 and \$1.40/lb (\$1.87 to \$3.09/kg) for pick-your-own (PYO) and prepicked fruit, respectively, and sell 12,000 lb of berries per acre (13,449.9 kg·ha⁻¹) to cover this expense. Break-even analysis indicated that growers would have to charge a PYO price of \$0.65/lb (\$1.43/kg) and \$1.20/lb (\$2.64/kg) for prepick berries and sell a minimum of 15,041 lb/acre (16,858.4 kg·ha⁻¹) to cover the projected expenses. However, if a grower received \$0.95 and \$1.50/lb (\$2.09 and \$3.31/kg) for the PYO and prepicked fruit, respectively, he/she would only have to sell 10,622 lb of berries per acre (11,905.4 kg·ha⁻¹) to break even. It was assumed that an average of 11.6 lb (5.26 kg) of fruit

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would be sold to PYO customers and an average of 7.1 lb (3.22 kg) would be sold to customers who visited the fruit stand. Under these assumptions, the breakeven yield of 14,724 lb/acre translates into a requirement to sell fruit to at least 1,539 customers per acre (3,802.8 customers/ha) at the lowest combination of prices while a yield of 10,398 lb/acre converts to a minimum of 1,087 customers per acre (2,685.9 customers/ha) at the higher prices. Customers were also surveyed at direct market operations in Spring 1999 to gain insight into consumer demographic characteristics, why customers select a specific PYO or prepick direct market strawberry outlet, average expenditures per customer, typical driving distances to direct market strawberry operations, and the effectiveness of advertising. Middle age, middle-income customers living within 10 miles (16.1 km) of the farm comprised the largest percentage of customers surveyed at the PYO operations, while middle age, high-income individuals who also live within 10 miles of the fruit stand were the largest group of respondents at the fruit stands. PYO customers spent an average of \$10.30, and prepick consumers spent an average of \$9.40 per visit. Less than 23% of all the respondents said that advertising influenced their shopping decision while >77% indicated that any type of advertisement did not influence their decision. Overall, convenient location was easily the major reason that customers decided to patronize a specific direct market outlet while personal referrals were second.

Current and potential strawberry growers need production, marketing, and financial information to make informed decisions about entering, leaving, or expanding existing operations. Like all business owners their main objective should be to make a profit in order for their farms to be financially successful. Ideally, growers would keep detailed records that would serve as a reference when estimating their production, harvest, and marketing costs, but this typically does not happen. Marketing is also a key factor in the success of horticultural enterprises that sell produce directly to the final consumers. Direct marketers who can target their potential customers, know why consumers buy their products and can attract customers to their operations are better prepared to provide the goods and services necessary to be

successful. However few direct market growers have the resources necessary to conduct extensive consumer surveys to discover information that will help improve their marketing efforts.

Therefore, this report has two overall purposes. The first is to provide information about the costs and returns of growing, harvesting and marketing strawberries at direct market operations. The second is to identify direct market strawberry customers and present information about their buying behavior. Specific objectives of this report are as follows:

1. Estimate the costs associated with growing, harvesting and marketing strawberries for a typical direct market operation using the strawberry plasticulture production system.
2. Evaluate the effects of varying prices and yields.
3. Identify and characterize direct market strawberry customers.
4. Identify the key factors that influence consumer purchase decisions.
5. Discuss the effectiveness of advertising on influencing consumers to visit direct market strawberry operations.

Materials and methods

To accomplish the budgeting objectives, a complete cost model for a plasticulture production system was developed for a 5-acre (2.0-ha) strawberry planting (Safley et al., 2003). Production practices were based on above average management practices recommended by North Carolina State University extension and research horticultural specialists, tempered with real world practices.

It was assumed that all the machinery and equipment were purchased new at 2001 purchase prices. The machinery and equipment used in this budget reflects machinery components that can be used for other farming enterprises in addition to growing strawberries on a typical diversified farm. Therefore the machinery expenses reflect the equipment costs for a total farm business and not just for strawberry production. The exceptions to this are the fumigation and irrigation equipment, which was used solely for strawberry production. The overhead irrigation system was a hand-moved sprinkler system used primarily for frost and freeze protection and the drip irrigation system was used for soil moisture.

Input prices were obtained from

local dealers who regularly supply North Carolina strawberry growers. Because land values vary throughout the state, a land charge was not included in this budget however growers should include a land charge that is representative of current land values in their region. Hired employees were paid \$8.25/h while the owner/operator was compensated at a rate of \$16.39/h. These labor rates include workers' compensation, unemployment, FICA taxes and other overhead expenses as well as the base wage rate and were meant to be representative of the true costs of labor and not just the base wage rate.

The harvest season was assumed to last 6 weeks starting in the third week of April and continuing through May. The marketing process obviously bears a cost and this cost will vary considerably depending on the marketing system producers decide to use. In this study it was assumed that all of the fruit would be sold at the farm with two-thirds of the strawberries sold through the PYO operation and one-third sold at the fruit stand. A labor charge of \$1.15/4-qt (3.8-L) basket was added to the cost of the prepick strawberries; while supervision labor was compensated at a rate of \$8.25/h. Supervision tasks included overseeing the pickers and checkout operations as well as the general management of the direct market operations.

The customer survey was conducted at eight direct market strawberry operations throughout the state during Spring 1999 (Safley et al., 2002). These operations represented typical strawberry operations across North Carolina in the major production areas from the coastal to the mountain regions. Since normal harvest dates vary by region, the surveys were completed in April in the coastal area, May in the Piedmont region, and June in the Mountain region. Enumerators visited each location for 6 continuous days, Monday through Saturday, to interview the customers. Each operation offered the customers two options for buying strawberries. They could either pick their own strawberries from the grower's field or they could buy prepicked strawberries at the grower's fruit stand.

The survey was divided into two segments. The first segment was administered when the customer arrived at the direct market operation. This part focused on their previous experi-

ence of picking strawberries, if they planned to pick their own fruit or buy prepicked fruit, and the effect advertising had on their decision to visit the operation where they were interviewed. The second part was conducted as the customers left the operation and concentrated on their actual purchases, how the berries were to be used, the quality of the fruit and services received at the strawberry operation, and the socioeconomic characteristics needed to identify the various market segments. Although some respondents did not answer every question, a total

of 1,665 usable questionnaires were collected.

Results

The total harvest, marketing, and production costs using the plasticulture production system were estimated to be \$13,540/acre (Table 1). Expenses were separated into six production phases: 1) land preparation, 2) preplant operations, 3) transplant and postplant operations, 4) dormant phase, 5) preharvest, and 6) harvest operations. Preplant operations were the most expensive procedures costing an

estimated \$4,399/acre (\$10,869/ha), or 32.5% of the total costs, while harvest operations were the second most expensive phase costing \$3,262/acre (\$8,060/ha), or 24.1% of the total. Preharvest operations accounted for 17.5% of the total costs at \$2,369/acre (\$5,854/ha) and transplant and postplant operations comprised 14.9% of the total at \$2,015/acre (\$4,979/ha). Overall materials accounted for 49.8%, or \$6,750/acre (\$16,579/ha), of the total estimated expenses, labor costs made up slightly over 38%, or \$5,180/acre (\$12,800/ha), and the

Table 1. Estimated costs per acre needed to produce, harvest and market strawberries (*Fragaria xananassa*) at a direct-market operation in North Carolina using the plasticulture production system.

Operation	Labor (\$/acre) ^a	Machinery (\$/acre)	Materials (\$/acre)	Total (\$/acre)
Land preparations				
Treat old crop with paraquat	14.85	20.52	7.38	42.75
Remove and dispose plastic	158.40	68.80	0.00	227.20
Disking	2.52	5.86	0.00	8.38
Liming	0.00	0.00	26.00	26.00
Planting soybeans ^b for cover crop	24.75	89.13	39.33	153.21
Total land preparation costs (\$)	200.52	184.31	72.71	457.54
Preplant operations				
Ordering plant material, fumigant, plastic mulch (10% deposit)	5.74	0.00	219.80	225.54
Rotovating cover crop	56.04	118.02	0.00	174.06
Pull greenhouse shade cloth	4.95	0.00	187.74	192.69
Set-up misting system	9.48	0.00	0.00	9.48
Plug supplies (tips, trays, soil)	2.06	0.00	1,884.44	1,886.50
Stick runner tips for plugs	315.81	0.00	0.00	315.81
Handling trays	33.01	0.00	0.00	33.01
Subsoiling	14.85	8.15	0.00	23.00
Disking (break up soil clods)	2.52	5.86	0.00	8.38
Moisten soil media	8.25	0.00	0.00	8.25
OH ^x irrigate and fertilize plugs (20N-8.8P-16.6K)	8.25	0.84	0.72	9.81
Spray for two-spotted spider mites ^c with hexakis	8.25	0.17	28.00	36.42
Assembling irrigation system	99.00	2.04	0.00	101.04
Irrigating for fumigation	0.83	7.61	0.00	8.44
Rotovating for fumigation	28.03	59.01	0.00	87.04
Preplant fertilization (ammonium nitrate, potassium sulfate, triple super phosphate) ^w	7.43	10.42	48.46	66.31
Preplant fumigation (methyl bromide+chloropicrin) (67%+33%)	39.34	288.06	873.70	1,201.10
Seed annual ryegrass ^d in aisles	0.84	0.63	11.00	12.47
Total preplant costs (\$)	644.68	500.81	3,253.86	4,399.35
Transplant and postplant				
Transplant plugs and replant	255.75	39.18	0.00	294.93
Irrigating plug establishment (three applications)	101.48	169.53	0.00	271.01
Drip irrigation (three 2-h applications)	4.95	30.96	0.00	35.91
Spray for two-spotted spider mites with bifenthrin	4.58	6.92	248.00	259.50
Collect tissue sample	2.06	0.00	4.00	6.06
Winterize drip system	16.50	0.00	0.00	16.50
Apply floating row covers	50.48	2.04	1,079.00	1,131.52
Total transplant and postplant costs (\$)	435.80	248.63	1,331.00	2,015.43
Dormant period				
Internet and weather service (annual fee, \$)	0.00	0.00	83.88	83.88
Remove and reapply row covers	297.00	0.00	0.00	297.00
White-tail deer ^e control	24.75	0.00	96.25	121.00
Ordering containers, fertilizers, etc.	12.30	0.00	0.00	12.30
Remove row cover, dead foliage, mow leaves	478.50	6.30	0.00	484.80
Dormant spray (captan)	2.29	3.46	14.00	19.75
Scout for two-spotted spider mites	16.39	0.00	0.00	16.39
Total dormant costs (\$)	831.23	9.76	194.13	1,035.12

costs linked to owning and operating the equipment comprised almost 12%, or \$1,611/acre (\$3,981/ha).

MONTHLY EXPENSES. The estimated monthly expenses for the major cost categories give growers an idea of their potential cash flow obligations (Table 2). Production costs in August and September totaled \$4,761/acre (\$11,764/ha), or 35.2% of the total expenses, and the operations in April and May cost \$3,683/acre (\$9,100/ha), or 27.2% of the total. Preplant, transplant, and postplant operations comprised most of the expenses in August and September while the harvest operations made up the ma-

jority of the costs in April and May. March expenditures were \$1,473/acre (\$3,640/ha), or almost 11% of the total costs, and November expenses totaled \$1,266/acre (\$3,128/ha), which was slightly >9% of the total.

NET REVENUE. Net revenue will depend on the marketable yield and the price growers receive for their strawberries. As in most farming operations, growers can have a tremendous influence on their crop yields. The better job they do in caring for the crop, the more likely they will have higher yields of high quality fruit. However, the local markets will determine the maximum price for which growers can sell their

berries. The consumer survey revealed that there was significant variation in the prices the eight cooperating growers charged for their PYO and prepicked strawberries. PYO prices ranged from \$0.70 to \$1.05/lb (\$1.54 to \$2.31/kg) and averaged \$0.88/lb (\$1.94/kg) for the eight operations while prepicked prices ranged from \$0.90 to \$1.71/lb (\$1.98 to \$3.77/kg) and averaged \$1.38/lb (\$3.04/kg) (Table 3). The smallest price gap between the two types of direct market outlets was \$0.20/lb (\$0.44/kg) at Location 1 where the owner charged \$0.70/lb for PYO berries and \$0.90/lb for prepicked fruit. Conversely, the largest

Table 1 (continued). Estimated costs per acre needed to produce, harvest and market strawberries (*Fragaria × ananassa*) at a direct-market operation in North Carolina using the plasticulture production system.

Operation	Labor (\$/acre) ^z	Machinery (\$/acre)	Materials (\$/acre)	Total (\$/acre)
Preharvest				
Pull plants through plastic	123.75	0.00	0.00	123.75
Herbicide aisles with paraquat and crop oil concentrate	2.29	3.46	10.15	15.90
Scout for mites, clipper weevil, and ants ^y	65.56	0.00	0.00	65.56
Spray for two-spotted spider mites with bifenthrin (two applications)	4.58	6.92	248.00	259.50
Connect drip system	49.50	0.00	0.00	49.50
Check OH irrigation system	8.20	0.00	0.00	8.20
Inject mefenoxam (two applications)	32.78	27.36	210.00	270.14
Spray for clipper weevil with chlorpyrifos	2.29	3.46	11.60	17.35
Tissue sample (three applications)	6.18	0.00	12.00	18.18
Pull plants and weeds	82.50	0.00	0.00	82.50
Inject fertilizer (Sul-Po-Mg, boron, liquid nitrogen) ^w	16.39	13.68	169.30	199.37
Reapply row covers for freeze	198.00	0.00	0.00	198.00
Freeze protection-OH irrigation (four applications)	52.44	399.98	0.00	452.42
Botrytis fruit rot ^v control with captan	2.22	3.78	14.00	20.00
Polination with honeybees ^y	0.00	0.00	70.00	70.00
Inject fertilizer (Sul-Po-Mg, liquid nitrogen)	16.39	13.68	168.83	198.90
Botrytis fruit rot control control with fenhexamide	2.29	3.78	51.56	57.63
Inject fertilizer (Sul-Po-Mg, calcium nitrate) ^w	16.39	13.68	19.29	49.36
Spray for two-spotted spider mites with abamectin	2.29	3.46	83.04	88.79
Botrytis fruit rot control with fenhexamide and powdery mildew ^v with myclobutanil	2.29	3.78	74.06	80.13
Inject fertilizer (potassium nitrate) ^w	16.39	13.68	14.54	44.61
Total preharvest costs	702.72	510.70	1,156.37	2,369.79
Harvest				
Picking supervision and fruit stand baskets	693.00	0.00	466.90	1,159.90
Prepick harvest expense	1,534.10	0.00	0.00	1,534.10
Drip irrigation (six applications = 18 h)	19.68	92.88	0.00	112.56
Spray for two-spotted spider mites with abamectin	2.29	3.46	83.04	88.79
Botrytis fruit rot control with captan	2.29	3.78	14.00	20.07
Collect tissue sample	2.06	0.00	4.00	6.06
Inject fertilizer, potassium nitrate ^w and calcium nitrate (two applications)	32.78	27.36	26.73	86.87
Evaporative cooling – OH (three applications)	24.60	22.83	0.00	47.43
Botrytis fruit rot control with fenhexamide and powdery mildew with myclobutanil (two applications)	4.58	3.78	148.12	156.48
Disassemble irrigation system	49.50	1.03	0.00	50.53
Total harvest costs	2,364.88	\$155.12	742.79	3,262.79
Total harvest and production costs				13,540.02

^z\$1/acre = \$2.47/ha, 1 acre = 0.405 ha.

^ySoybean (*Glycine max*), two-spotted spider mite (*Tetranychus urticae*), annual ryegrass (*Lolium perenne*), white-tail deer (*Odocoileus virginianus*), strawberry clipper weevil (*Anthonomus signatus*), red fire ant (*Solenopsis wagneri*), honeybee (*Apis mellifera*).

^wOH = overhead.

^wAmmonium nitrate = 34N-0P-0K, potassium sulfate = 0N-0P-36.5K-1Mg-18S, triple super phosphate = 0N-22P-0K-12Ca-1S, Sul-Po-Mg = 0N-0P-17.8K-10.5Mg-21S, boron = 0N-0P-0K-20B, liquid nitrogen = 30N-0P-0K, calcium nitrate = 15N-0P-0K-19Ca-1Mg, potassium nitrate = 13N-0P-35.5K.

^vCausal organisms of botrytis fruit rot and powdery mildew are *Botrytis cinerea* and *Sphaerotheca macularis*, respectively.

Table 2. Estimated monthly equipment, material and labor costs per acre needed to produce, harvest, and market strawberries at a direct-market operation in North Carolina using the plasticulture production system.

Year and month	Equipment costs (\$/acre) ^z	Materials costs (\$/acre)	Labor costs (\$/acre)	Total monthly costs (\$/acre)
First year				
June	184	78	200	462
July	0	225	6	231
August	132	2,077	435	2,664
September	577	967	553	2,097
October	34	132	34	200
November	5	1,208	53	1,266
December	0	5	297	302
Second year				
January	10	115	518	643
February	24	262	254	540
March	345	722	406	1,473
April	159	405	617	1,181
May	141	554	1,807	2,502
Total cost	1,611	6,750	5,180	13,541
Total cost (%)	11.9	49.8	38.3	

^z\$1/acre = \$2.47/ha.

price gap was \$0.79/lb (\$1.74/kg) at Location 8 where the PYO strawberry price was \$0.92/lb (\$2.03/kg) and the

Table 3. The prices charged for pick-your-own and prepick strawberries at eight North Carolina direct-market operations that participated in a consumer survey during the 1999 strawberry season.

Location	Pick-your-own price (\$/lb) ^z	Prepick price (\$/lb)
1	0.70	0.90
2	1.05	1.33
3	0.85	1.25
4	1.00	1.40
5	0.80	1.25
6	0.85	1.50
7	0.90	1.67
8	0.92	1.71
Average	0.88	1.38

^z\$1.00/lb = \$2.20/kg.

prepick price was \$1.71/lb. On average, the price differential between the PYO and prepicked fruit was \$0.49/lb (\$1.08/kg).

The growers who cooperated in the consumer survey were not specifically asked how they set the prices for their PYO and prepicked berries. However when these price spreads were presented, some growers offered that they set the price spread based on the additional costs that they thought they incurred by selling the fruit at the roadside stand. Another grower said that he set his prepick price based on the price charged at the local grocery store. It is interesting to note that 89% of the customers who were surveyed at Location 1 purchased prepick strawberries. It was also obvious that most of the cooperators were not aware of the prices that the other growers charged for their fruit, possibly due to the physi-

cal distance between the operations. Not surprisingly some of the growers indicated that they were going to rethink their prices for the next season when they saw the price data.

Since prices and yields can vary drastically, the projected net revenues were calculated for various combinations of direct market prices and marketable yields (Table 4). Direct market prices ranged from a low of \$0.65/lb for PYO strawberries and \$1.20/lb for prepicked strawberries to a high of \$0.95 and \$1.50/lb for PYO and prepicked fruit, respectively. Yield estimates ranged from a low of 8,000 lb/acre (8,966.6 kg·ha⁻¹) to a high of 24,000 lb/acre (26,899.8 kg·ha⁻¹).

It was estimated that growers would not receive a positive net return at any of the price combinations used in this analysis if they only achieve a yield of 8,000 lb/acre using the plasticulture production system. Given a marketable yield of 12,000 lb/acre, growers would only receive a positive return if the PYO price was equal to or greater than \$0.85/lb and the prepick price was \$1.40/lb or higher. Positive net revenues were also projected for all of the price combinations if yields of 16,000; 20,000; or 24,000 lb/acre (17,933.2; 22,416.4; or 26,899.8 kg·ha⁻¹) were attained.

BREAKEVEN YIELDS. It is also important for strawberry growers to determine their breakeven yields, or the minimum volume of fruit that they must sell to cover their projected production, harvest, and market costs. Selling less fruit than the breakeven yield will result in a deficit financial position while selling more than the breakeven yield will generate enough revenues to cover the estimated expenses. Therefore the breakeven yields were calculated for each combination of

Table 4. Estimated net revenues per acre for strawberries grown in North Carolina using the plasticulture production system for varying pick-your-own and prepick prices and marketable yields.

Pick-your-own prices (\$/lb) ^y	Prepick prices (\$/lb)	Marketable yield (lb/acre)				
		8,000 (\$/acre) ^x	12,000 (\$/acre)	16,000 (\$/acre)	20,000 (\$/acre)	24,000 (\$/acre)
0.65	1.20	-5,077	-2,193	691	3,576	6,460
0.70	1.25	-4,677	-1,593	1,491	4,576	7,660
0.75	1.30	-4,277	-993	2,291	5,576	8,860
0.80	1.35	-3,877	-393	3,091	6,576	10,060
0.85	1.40	-3,477	207	3,891	7,576	11,260
0.90	1.45	-3,077	807	4,691	8,576	12,460
0.95	1.50	-2,677	1,407	5,491	9,576	13,660

^x1.0 lb/acre = 1.12 kg·ha⁻¹.

^y\$1.00/lb = \$2.20/kg.

^z\$1.00/acre = \$2.47/ha.

Table 5. Estimated breakeven strawberry yields per acre that must be sold to cover production, harvest and marketing costs for various combinations of pick-your-own and prepick prices assuming two-thirds of the yield was sold at a pick-your-own operation and one-third was sold at a fruit stand.

Pick-your-own Strawberry price (\$/lb) ^z	Prepick strawberry price (\$/lb)	Breakeven yield (lb/acre) ^y
0.65	1.20	15,041
0.70	1.25	14,066
0.75	1.30	13,209
0.80	1.35	12,451
0.85	1.40	11,775
0.90	1.45	11,169
0.95	1.50	10,622

^z\$1.00/lb = \$2.20/kg.

^y1.0 lb/acre = 1.12 kg·ha⁻¹.

Table 6. The total number of pounds per acre and the estimated number of customers that must buy strawberries at direct-market operations to achieve the breakeven yields for the prices listed in Table 5 assuming pick-your-own customers buy an average of 11.6 lb (5.26 kg) per visit and prepick customers buy an average of 7.1 lb (3.22 kg) per visit.

Required sales volume to break even			Number of customers to break even		
Break-even yields (lb/acre) ^z	Pick-your-own sales (lb/acre)	Prepicked sales (lb/acre)	Pick-your-own sales (no./acre) ^y	Prepicked sales (no./acre)	Total sales (no./acre)
15,041	10,027	5,014	865	707	1,572
14,066	9,377	4,689	809	661	1,470
13,209	8,806	4,403	760	621	1,381
12,451	8,301	4,150	716	585	1,301
11,775	7,850	3,925	677	553	1,220
11,169	7,446	3,723	642	524	1,166
10,622	7,081	3,541	611	499	1,110

^z1 lb/acre = 1.12 kg·ha⁻¹.

^y1 person/acre = 2.5 people/ha.

direct market prices used in this study. This breakeven analysis also assumed that two-thirds of the marketable yield was sold through the PYO operation and one-third was sold as prepicked berries at the fruit stand.

Obviously the lower the prices charged at each direct market outlet the larger the volume of fruit that must be sold to cover the estimated costs. For example, a PYO price of \$0.65/lb combined with a price of \$1.20/lb for prepick berries means that growers would have to sell a minimum of 15,041 lb of fruit per acre (16,585.3 kg·ha⁻¹) to cover the projected expenses (Table 5). However, if a grower can receive \$0.95 and \$1.50/lb for the PYO and prepicked fruit, respectively, he would only have to sell 10,622 lb of berries per acre (11,905.4 kg·ha⁻¹) to breakeven.

MARKET ANALYSIS. A shortcoming of this analysis is that a market was assumed to exist and be accessible. That is, it was assumed that a sufficient number of consumers from the local marketing area would patronize the direct market outlets to make straw-

berry production a viable option. If this situation does not exist, actual costs increase as the volume of unsold fruit rises because the money spent to produce, harvest and market unsold berries will not generate any revenue to flow back into the business. Therefore an analysis was performed for each price combination to give growers a rough idea of the number of customer sales that would have to be generated to cover total costs.

Two basic assumptions had to be made to calculate these estimates. First, two-thirds of the strawberries were again sold through PYO operations and one-third was sold as prepicked berries at a fruit stand. Second, PYO customers bought an average of 11.6 lb of strawberries per visit and prepick consumers purchased an average of 7.1 lb. These were the average volumes of fruit purchased by customers at the eight direct markets in 1999.

The estimated volume of strawberries that must be sold through each direct market outlet and the associated number of customers that are needed to buy strawberries at these outlets

are shown in Table 6. Given a PYO price of \$0.65/lb and a prepick price of \$1.20/lb, it was estimated that 865 customers would have to buy 10,027 lb/acre (11,238.5 kg·ha⁻¹) of berries at the PYO operation and 707 customers must buy 5,014 lb/acre (5,619.8 kg·ha⁻¹) at the fruit stand for the grower to sell a breakeven volume of 15,041 lb/acre. If the grower charged a PYO price of \$0.95/lb and a prepick price of \$1.50/lb, the number of customers needed to sell the breakeven volume of 10,622 lb/acre decreases considerably. In this case 611 customers would have to buy 7,081 lb/acre (7,936.6 kg·ha⁻¹) at the PYO operation and 499 consumers must purchase 3,541 lb/acre (3,968.8 kg·ha⁻¹) at the fruit stand to sell the breakeven volume. So based strictly on the conditions set forward in this study and depending on the actual price combination charged for the strawberries, a grower must attract between 1,110 and 1,572 customers per acre (2,742.8 and 3,884.4 customers/ha) to breakeven.

CUSTOMER PROFILES. It is obvious then that marketing is a critical element

Table 7. Demographic information for the customers surveyed in 1999 at eight North Carolina direct-market strawberry operations where customers could either pick their fruit at the pick-your-own operation or buy prepick berries at the fruit stand.

Parameter	All customers (%)	Pick-your-own customers (%)	Fruit stand customers (%)
Age (years)			
<18	0.6	0.6	0.3
18–24	2.5	3.3	1.9
25–44	34.5	43.1	25.2
45–54	18.3	15.2	21.8
55–64	16.9	14.3	19.7
≥65	27.2	23.5	31.1
Average	51.7	49.2	54.3
Household income (\$)			
<15,000	7.8	9.1	6.5
15,000–29,999	16.8	14.7	18.9
30,000–44,999	21.5	23.8	19.3
45,000–59,999	15.2	15.0	15.2
60,000–74,999	17.3	18.9	15.4
≥75,000	21.4	18.5	24.7
Adults working ≥40 h per week			
None	29.6	27.1	32.4
1	40.0	43.9	36.0
2	25.6	24.3	26.7
3–4	4.1	3.8	4.3
>4	0.7	0.9	0.6
Distance traveled (miles ²)			
0–4.9	21.3	20.4	22.6
5–9.9	33.3	35.6	30.9
10–19.9	27.9	28.8	27.0
20–49.9	12.9	12.1	13.3
≥50	4.6	3.1	6.2
Average			
Including customers traveling ≥50	19.7	17.5	23.5
Excluding customers traveling ≥50	9.9	9.8	9.9

²1.0 mile = 1.61 km.

to the success of a direct market operation. Knowing who their customers are, why they buy strawberries, and why they select a specific outlet can help direct market operators generate the volume of traffic needed to break even and be successful. The consumer survey revealed that the typical PYO customer was between 25 and 44 years

old, had an annual household income between \$30,000 and \$44,999, and at least one family member worked 40 h or more per week (Table 7). The second largest age group was 65 years old or older and the second most frequent income category was \$60,000 to \$74,999/year. However a significant number of customers earned \$75,000/

year or more and ranked a close third. Excluding those who drove over 50 miles (80.5 km), the average number of miles customers drove to the operation was 9.8 miles (15.77 km), with 35.6% driving between 5 and 9.9 miles (8.1 and 15.93 km) and 28.8% driving between 10 and 19.9 miles (16.1 and 32.03 km).

The normal prepick customer was also between 25 and 44 years old and had a household income of \$75,000/year or more with at least one family member working 40 h or more per week. The second largest age group was 65 years old or older and the second most frequent income category was \$30,000 to \$44,999/year. The average age was 54.3 years old and over 32% of the customers were retirees. Again excluding those who drove over 50 miles, the average mileage prepick customers drove to the fruit stand was 9.9 miles, with 30.9% driving between 5 and 9.9 miles and 27.0% driving between 10 and 19.9 miles.

Females shopping alone made up the largest population of shoppers followed by shopping parties composed of males shopping alone, male and female couples, and females with children (Table 8). Most females and males that were alone bought berries at the fruit stand while the majority of the shopping parties that included children frequented PYO operations. In fact, females who came with children comprised the second largest group that picked their own strawberries.

Overall, a third of the respondents had never previously visited the direct market operation where they were interviewed while two-thirds were repeat customers, having either picked and/or purchased strawberries at the same farm before (Table 9). PYO

Table 8. Composition of the shopping parties interviewed at eight North Carolina direct-market operations in 1999 where the customers could either pick fruit at the pick-your-own operation or buy berries at the fruit stand.

Members in the shopping party	All customers (%)	Pick-your-own customers (%)	Fruit stand customers (%)
Adult female	30.8	13.1	17.6
Adult male	19.4	6.9	12.5
Adult female and male	17.2	8.2	9.0
Adult female with one or more children	13.1	10.3	2.8
Two or more adult females	8.0	4.3	3.7
Adult female and male with children	3.3	2.7	0.6
Two or more adult males	3.2	1.3	1.9
Two or more adult females with children	2.9	2.3	0.6
Adult male with children	1.7	0.8	0.9
Two or more adult males with children	0.4	0.3	0.1
Total	100.0	50.2	49.8

Table 9. Picking history of the customers interviewed at eight North Carolina direct-market strawberry operations in 1999 where the customers could either pick fruit at the pick-your-own operation or buy berries at the fruit stand.

Question	All customers (%)	Pick-your-own customers (%)	Prepick customers (%)
Is this your first visit to this farm?			
Yes (new customers)	33.0	39.1	25.7
No (repeat customers)	67.0	60.9	74.3
Did you buy or pick strawberries on this farm earlier this year?			
Yes (at least the second visit this season)	45.2	42.4	47.8
No (first visit this season)	54.8	57.6	52.2
Have you visited any other direct-market operation this year to buy or pick strawberries?			
Yes	11.5	11.3	11.5
No	88.5	88.7	88.5

Table 10. Intended use of the strawberries purchased by the customers interviewed at eight North Carolina direct-market strawberry operations in 1999.

Intended use ^a	All customers (%)	Pick-your-own customers (%)	Fruit stand customers (%)
Consume as fresh fruit	88.3	88.6	88.4
Freeze the fruit	26.5	35.4	17.3
Process as jam or jelly	10.5	14.2	6.5
Other	9.2	9.9	8.7

Table 11. The quantity of strawberries purchased by the customers interviewed at eight North Carolina direct-market strawberry operations in 1999.

Quantity (lb)	Pick-your-own customers bought this quantity of fruit (%)	Fruit stand customers who bought this quantity of fruit (%)
1–5 ^a	24.2	53.1
6–10	36.1	29.8
11–15	20.7	9.7
16–20	7.7	4.1
>20	11.3	3.3
Average	11.6	7.1

^a1.0 lb = 0.45 kg.

Table 12. Consumer's ranking of the most important factors that influenced their decision to purchase strawberries at eight North Carolina direct-market operations in 1999.

Factor ^a	All customers (rank)	Pick-your-own customers (rank)	Fruit stand customers (rank)
Freshness	1	1	1
Taste	2	2	2
Firmness	3	3	3
Fruit color	4	4	4
Fruit size	5	5	5
Price	6	6	6

operations accounted for the highest percentage of new customers, 39.1%, and the prepick fruit stands had the largest percentage of repeat customers, 74.3%. Slightly more than 42% of the repeat PYO customers had picked strawberries earlier in the season at the same operation compared to 47.8% of the prepick buyers who had purchased

berries at the same fruit stand. Just over 11% of the consumers had either picked or bought strawberries at other direct market operations earlier in the year.

PURCHASE PATTERNS. Not surprisingly, the vast majority of the customers planned to consume the strawberries fresh (Table 10). Freezing the berries was the second most popular use and

processing the fruit for jam or jelly was the third most prevalent use. A larger percentage of the PYO customers intended to process the strawberries compared to the prepicked customers. More than 35% of the PYO customers were going to freeze the strawberries versus 17.3% of the prepick customers, and 14.2% of the PYO consumers were going to use the fruit to make jam or jelly versus 6.5% of the prepick customers.

As was previously discussed, PYO customers picked an average of 11.6 lb and prepick customers bought an average of 7.1 lb of fruit (Table 11). Exit interviews disclosed that 36.1% of the PYO customers picked 6 to 10 lb (2.7 to 4.5 kg) of berries while 53.1% of the prepick customers bought between 1 and 5 lb (0.5 to 2.3 kg) at the fruit stand. It is also significant to note that 39.7% of the PYO consumers picked 11 lb (5.0 kg) or more of strawberries compared to 17.1% of the prepicked consumers who purchased the same amount of berries at the fruit stand.

When asked to rank how important six factors were relative to their decision to purchase strawberries, both sets of customers ranked these factors in the same order (Table 12). Freshness was the most important factor while taste was ranked second, fruit firmness was third, fruit color was fourth, fruit size was fifth and price was ranked last. It was not surprising, therefore, that good fruit quality was the major reason consumers said that they decided to pick more strawberries than they had anticipated (Table 13) and poor quality was the primary cause for their decision to pick less fruit than expected (Table 14). Consumers who discovered that the strawberries were easier to pick than they had expected ranked the ease of picking as having a positive impact on

Table 13. Reasons customers picked more strawberries than they expected to pick at eight North Carolina pick-your-own strawberry operations in 1999.

Reason	Customers	
	(no.)	(%)
Good fruit quality	112	57.7
Easier to pick than expected	49	25.3
Good fruit size	15	7.8
Low prices	9	4.6
Other	9	4.6

Table 14. Reasons customers picked fewer strawberries than they expected to pick at eight North Carolina pick-your-own strawberry operations in 1999.

Reason	Customers	
	(no.)	(%)
Poor fruit quality	23	31.1
Fields were too picked over—not enough fruit	13	17.6
Too hot to pick	5	6.8
Small fruit size	3	4.0
Too hard to pick strawberries	3	4.0
Fields were too muddy	1	1.4
High prices	0	0.0
Other	28	35.1

Table 15. Amounts customers spent for strawberries at eight North Carolina pick-your-own strawberry operations in 1999.

Amount spent (\$)	All customers (%)	Pick-your-own customers (%)	Fruit stand customers (%)
0	0.1	0.0	0.3
1–10	70.5	66.7	75.1
11–20	20.7	24.6	16.2
21–30	5.7	6.1	5.1
31–50	1.9	1.8	2.1
>50	1.1	0.8	1.2
Average	10.20	10.30	9.40

how much fruit they eventually picked while picked over fields or the lack of strawberries had the second largest negative impact on consumer picking decisions.

While price did not have a major

impact on the amount of strawberries the consumers purchased, statistical analysis indicated that price had a major impact on their decision to either pick their fruit or buy the berries at the fruit stand. That is, customers who thought

that the price of the prepick berries was too high relative to the price of the PYO berries, decided to pick their fruit rather than buying the strawberries at the fruit stand. Conversely, if consumers felt that there was relatively little difference between the two prices they opted to buy their berries at the fruit stand rather than picking the fruit.

Overall, the average amount of money consumers spent for strawberries was \$10.20, with PYO customers spending an average of \$10.30 and prepick customers spending an average of \$9.40 (Table 15). Two-thirds of the PYO customers spent between \$1 and \$10 while one-third spent \$11 or more compared to about three-fourths of the prepick customers who spent less than \$10 and almost one-fourth who spend more than \$11.

ADVERTISING. When asked what prompted their visit to the farm where they were interviewed, <23% of all the respondents said that advertising influenced their shopping decision while >77% indicated that their decision was not influenced by any type of advertisement. Of the 379 customers who were influenced by a specific advertisement, 208, or 56.8% of these respondents, said that the advertisement that prompted their visit to the farm was posted on either a sign or billboard (Table 16). Newspaper advertisements had the second largest impact with a 22.4% response rate while direct mailers were a distant third with 5.7%. Newspaper inserts, radio commercials, and commercial television advertisements each recorded a response rate of <2.0%. Only two people referred to an advertisement on cable television and two individu-

Table 16. Consumer response rates to different types of advertisements promoting eight North Carolina direct-market strawberry operations in 1999.

Type of advertisement	Customers who responded to an advertisement	
	(no.)	(%)
Signs or billboards	208	56.8
Newspaper advertisement	82	22.4
Direct mail brochure, flyer or postcard	21	5.7
Newspaper insert	7	1.9
Radio commercial	5	1.4
Commercial television advertisement	3	0.8
Cable television advertisement	2	0.6
Internet Web page	2	0.6
Yellow Pages advertisement	0	0.0
Association or NCDA&CS ² pick-your-own directory	0	0.0
Other	36	9.8

²North Carolina Department of Agriculture and Consumer Services.

Table 17. Key Information contained in the advertisements that attracted customers to one of eight North Carolina direct-market strawberry operations in 1999.

Key information in the advertisement	All customers (%)	Pick-your-own customers (%)	Fruit stand customers (%)
Fresh strawberries	62.4	62.3	63.6
Farm location	33.0	34.3	29.0
Strawberry prices/sale	0.6	0.4	0.9
Coupons	0.6	0.0	1.9
Hours of operation	0.3	0.0	0.9
Other	3.1	3.0	3.7

als located the direct market operation via the Internet. Yellow page ads and the PYO directory published by the strawberry association and North Carolina Department of Agriculture and Consumer Services (NCDACS) were not mentioned by anyone. However, there is subsequent evidence that more consumers are now using the Internet to locate direct market operations. During the 6-week strawberry season in 2003, there were >8,000 visits to NCDACS's new Internet farm market directory, "NCFarmFresh.com" (NCDACS, 2003).

When asked what information in the advertisement attracted them

to the strawberry operation, 62.4% of the customers said that the phrase "fresh strawberries" influenced their decision and 33% said that information about the location of the farm affected their decision (Table 17). Publicizing information about strawberry prices and the hours of operation or offering redeemable coupons collectively only persuaded 1.5% of these respondents to visit a direct market outlet.

Since a large portion of the customers did not respond to an advertisement, it could also help growers promote their market operations if they know why these individuals decided to buy berries at their farm. Customers

whose visit was not motivated by advertising were presented a list of possible reasons for selecting a direct marketing outlet and asked to select the primary reason that influenced their decision to stop at the operation. First-time PYO customers said that the convenient location of the farm was the primary reason that influenced their decision about where to pick strawberries and a referral from a family member or friend was second (Table 18). Convenient location was also the most significant factor that influenced repeat PYO customers' decision to return to the same operation, more than doubling the percentage of buyers who listed fruit quality. Furthermore, convenient location was the major reason that influenced prepick customers to visit the fruit stands. More than 36% of the first-time consumers and over 39% of the repeat customers listed this factor as the main reason for selecting a fruit stand (Table 19). In addition, 19% of the first-time customers just happened to drive by the fruit stand and decided to stop while 18.3% selected the fruit stand based on a referral from

Table 18. The primary reasons first-time customers decided to pick berries at one of eight North Carolina pick-your-own strawberry operations in 1999 compared to the repeat customers interviewed at the same operations.^z

Reason for shopping	First-time customers		Repeat customers	
	Rank	(%)	Rank	(%)
Convenient location	1	34.0	1	45.6
Personal referred	2	28.7	3	15.1
Strawberry quality	3	11.2	2	16.4
Family outing	4	2.7	6	2.2
Farm experience	5	2.1	5	2.4
Drove by and decided to stop	6	1.8	4	3.8
Strawberry variety/selection	---	0.0	7	0.8
Low prices	---	0.0	---	0.0
Exercise	---	0.0	---	0.0
Buy a large volume of strawberries	---	0.0	8	0.3
Other	NA	19.5	NA	13.4

^zThis question was only asked to those customers who said that their decision to visit the direct-market operation was not prompted by an advertisement.

Table 19. The primary reasons first-time prepick customers decided to buy strawberry at one of eight North Carolina fruit stands in 1999 compared to the repeat customers interviewed at the same operations.^z

Reason for shopping	First-time customers		Repeat customers	
	Rank	(%)	Rank	(%)
Convenient location	1	36.6	1	39.3
Drove by and decided to stop	2	19.0	5	8.4
Personal referred	3	18.3	3	11.4
Strawberry quality	4	10.5	2	19.2
Farm Experience	5	2.6	4	9.0
Strawberry variety/selection	6	0.7	6	1.2
Family outing	6	0.7	7	0.6
Low prices	---	0.0	8	0.4
Exercise	---	0.0	---	0.0
Buy a large volume of strawberries	---	0.0	9	0.2
Other	NA	11.6	NA	10.3

^zThis question was only asked to those customers who said that their decision to visit the direct-market operation was not prompted by an advertisement.

Table 20. The daily percentage of pick-your-own and fruit stand customers who completed a consumer survey at one of eight North Carolina direct-market operations in 1999.

Day ^z	Pick-your-own customers (%)	Fruit stand customers (%)
Monday	10.3	11.0
Tuesday	13.3	11.1
Wednesday	14.5	13.3
Thursday	13.5	22.1
Friday	24.5	25.7
Saturday	24.1	16.8

^zSurveys were not conducted on Sundays.

Table 21. The amount of time pick-your-own and fruit stand customers spent at one of eight North Carolina direct-market strawberry operations in 1999.

Time spent at the direct market	Pick-your-own customers (%)	Fruit stand customers (%)
<15 min	33.8	90.2
15–30 min	18.3	6.6
31–45 min	16.1	1.1
46–60 min	19.1	0.6
>60 min	12.7	1.5

Table 22. The average dollar expenditures pick-your-own and fruit stand customers spent at one of eight North Carolina direct-market strawberry operations in 1999 compared to the amount of time they spent picking berries or buying fruit at the fruit stand.

Time spent at the direct market	Pick-your-own customers (\$/customer)	Fruit stand customers (\$/customer)
<15 min	7.52	9.78
15–30 min	9.67	9.52
31–45 min	8.53	13.07
46–60 min	12.44	10.36
>60 min	17.00	16.13

family members or friends. The second most frequent factor for repeat prepick customers was the quality of the strawberries followed by referrals.

PEAK TRAFFIC DAYS. While determining the peak consumer traffic periods was not an objective of this study, the total number of completed surveys per day was directly related to the volume of customer traffic and gives some insight into the busiest days of operation. For PYO operations, Friday barely edged out Saturday as the busiest day of the week with 24.3% of the total respondents compared to 24.1%, so in reality, there was no difference between these two days (Table 20). The shopping pattern for the prepick operations, on the other hand, followed the typical commercial supermarket-shopping pattern for strawberries. That is, sales start slow on Monday and Tuesday, build up on Wednesday and Thursday, peak on Friday, and drop

off on Saturday.

Over 90% of the customers who purchased prepick strawberries at the fruit stands completed their transactions within 15 min while 6.6% of the shoppers took between 15 to 30 min to make their purchases (Table 21). It is interesting to note that many of the customers who were recorded as staying longer than 30 min at the fruit stand initially started picking strawberries at the PYO operation. These individuals grew tired of picking and finished buying the volume of berries they wanted at the fruit stand where they completed the second part of the interview.

Predictably, the majority of the PYO customers stayed at the farm longer. While about one-third of the pickers took <15 min to pick their berries and checkout, slightly >19% of the consumers needed between 46 and 60 min to complete their transactions and almost 13% stayed longer than an

hour. Also not surprisingly, the PYO customers who picked longer typically spent more money (Table 22). The average amount PYO customers spent gradually increased from an average of \$7.52 for those who stayed less than 15 min to \$17.00 for those individuals who stayed longer than an hour. The only exception to this trend was the consumers who stayed between 31 and 45 min who spent an average of \$8.53 per customer.

Conclusions

The total annual harvest, marketing, and production costs for the plasticulture production system were estimated to be \$13,540/acre with material inputs accounting for 49.8%, or \$6,750/acre, of the total costs. Labor costs made up slightly over 38%, or \$5,180/acre, of the total and the costs associated with owning and operating the equipment comprised almost 12%, or \$1,611/acre.

Net revenue analysis revealed that growers would have to charge at least \$0.85 and \$1.40/lb for PYO and prepicked fruit, respectively, and sell a minimum of 12,000 lb of strawberries per acre to cover the estimated costs. Breakeven analysis also indicated that growers would have to sell a minimum of 15,041 lb/acre at the lowest combination of direct market prices considered in this study and at least 10,622 lb/acre at the highest prices to cover total expenses. It was further assumed that an average of 11.6 lb of fruit would be sold to PYO customers and an average of 7.1 lb would be sold to customers who visited the fruit stand. Under these assumptions, the breakeven yield of 15,041 lb/acre translated into a requirement to sell fruit to at least 1,572 customers per acre at the lowest combination of prices while a breakeven yield of 10,622 lb/acre converted to a minimum of 1,110 customers per acre at the highest prices.

Middle age, middle-income customers living within 10 miles of the farm comprised the largest percentage of customers surveyed at the PYO operations. However customers with lower household incomes generally accounted for the largest average expenditures. Middle-age, high-income individuals who also live within ten miles of the fruit stand were the largest group of respondents at the prepick operations whereas customers with household incomes greater than

\$60,000/year typically accounted for the greatest expenditures. The initial site selected for the direct market operation can have a long-term effect on the success, or failure, of the business. Therefore growers should locate as close to population areas that closely resemble the demographic characteristics of consumers identified in this study. Managers should also monitor the demographic changes within these market areas so they can adjust their operations to meet their customers' changing requirements.

Overall, convenient location was the major reason that customers decided to patronize a specific direct market outlet while a personal referral was second. Since word-of-mouth, or referrals by family members or friends, are so important in attracting new customers, growers who satisfy their customer's expectations in terms of fruit quality and service will have a comparative advantage in attracting new consumers. Satisfied customers give positive referrals if they are pleased with the product and service. Conversely, customers who have purchased poor quality fruit or received poor customer assistance normally share their negative experiences with an even greater number of people. Given that 67% of the patrons are repeat customers, growers could incorporate these individuals into their marketing strategy by actively encouraging their regular customers to tell their friends about the operation. For example, growers could provide brochures about the direct market operation for customers to give to their friends or discount incentives could be given to regular customers to bring in new customers.

Impulse buying was the second most important reason that affected first-time customers' decision to select a fruit stand. That is, customers happened to be driving by a fruit stand, found the operation attractive, and decided to stop. This high percent-

age of impulse buyers reinforces the importance for direct market operators to select a convenient location for their business and to use good signage to attract customers. It also supports the notion that managers should be sensitive to how their operation is viewed by the public. Other research has shown that neat, clean direct market operations with ample parking, safe entries and exits off and onto the highway and attractive fruit displays help persuade customers to stop at these businesses.

Customers, whose shopping trip was prompted by an advertisement, said that the phrase fresh strawberries or the information about the farm location in the advertisement attracted them to the direct market operation. Managers should highlight this information in any print and radio advertisement and ensure that this information is clearly visible in their signage. Emphasizing the availability of fresh prepicked strawberries may also be beneficial because some potential customers may not realize that local strawberry producers also operate a fruit stand. While there is no guarantee that any form of advertisement will be effective, other consumer studies have found that retail managers who repeatedly focused their media ads on a simple, specific message, recorded higher response rates than those who did not.

Although Fridays and Saturdays are still the preferred shopping days, a large percentage also find other days convenient. Managers should assess individual market areas, determine when their customers prefer to shop and adjust their operating hours accordingly. Further inquiry into why average expenditures decreased if customers left the PYO operations between 31 and 45 min, indicated that this is the approximate time frame where some consumers become hot and tired of picking berries. Growers may be able to negate this tendency by placing

comfort stations where customers can sit down to rest and get a drink of water at strategic locations in the strawberry field. In other situations, the owner may be able to direct customers to the fruit stand where they can buy any additional berries that they may have intended to purchase.

The cost data can serve as a guide to assist individuals who are currently growing strawberries, those considering entering the direct market strawberry business, or professionals who are advising strawberry growers make more informed business management decisions. However as a final caveat, growers and professionals should remember that any budget is only a guide and is not a substitute for individuals calculating their own cost and estimating their own breakeven yields. Costs vary from one producer to another because of market conditions, labor supply, age and condition of the machinery and equipment, managerial skill, land costs and many other factors. Since every situation is different, it is highly recommended that each grower estimate their individual production, marketing, and harvest costs based on their own production techniques, price expectations, and local market situation.

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