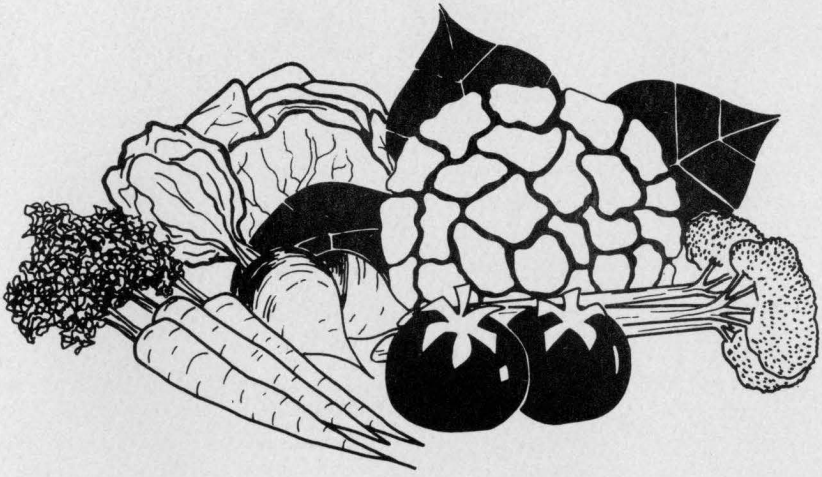
THE AGRICULTURAL POTENTIAL OF THE MIDDLE KUSKOKWIM VALLEY

A Suggested Development and Marketing Approach

by
Carol E. Lewis and John S. Lewis



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by

Carol E. Lewis
Associate Professor of Resource Management
Agricultural Experiment Station
University of Alaska
Fairbanks, Alaska 99701

and

John S. Lewis
Management and Marketing Consultant
Alaska Resource Methods
Management Consultants
Fairbanks, Alaska 99701

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Particular thanks is given Dr. Wayne C. Thomas, Associate Professor of Economics, Agricultural Experiment Station, University of Alaska, Fairbanks, Alaska, for his comments throughout the project and extensive review of this report.

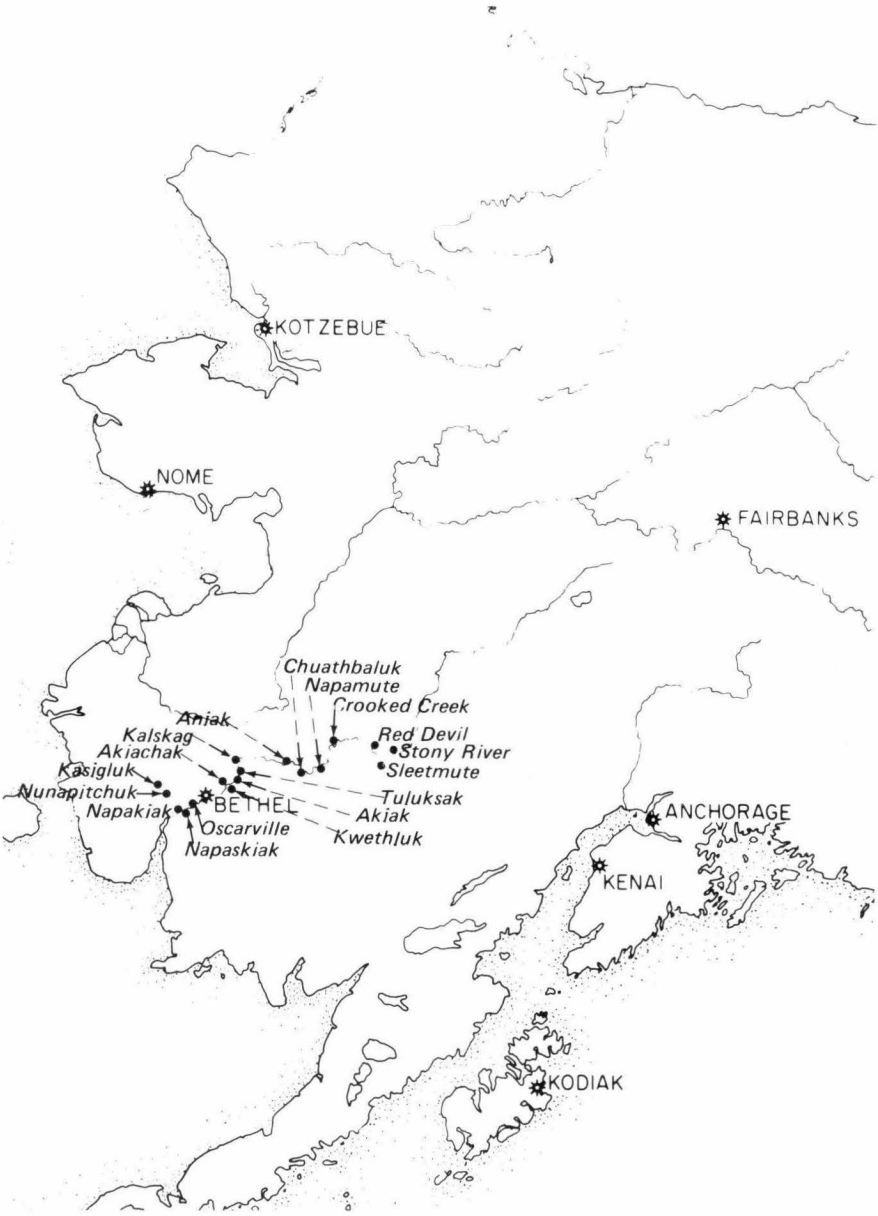

FIGURE 1: Marketing Area for Middle Kuskokwim Valley Produce.

CHAPTER 1

INTRODUCTION

Alaskans are concerned with the production of food. This is evident from the concern which has been expressed over the subsistence issue within the current Alaska lands legislation. The debate ponders who shall harvest the state's natural game resource and how the resource shall be harvested. Although this question is not settled, one point is coming to the fore: the game resource alone is not sufficient to satisfy the food needs of Alaska's growing rural population.

In recent months, interest has been expressed in the agricultural potential of the lands in areas of Alaska which are removed from major population centers and from connecting surface transportation routes. One area in particular in southwestern Alaska has made significant progress in agricultural development. The Kuskokwim Native Association has maintained a community garden since 1976 in Aniak on the Kuskokwim River (Figure 1) (Lewis, Thomas, and Wooding, 1978). This effort could be expanded using existing transportation corridors to supply not only the Kuskokwim River valley, but also several villages located away from the river.

The objective of this study is to provide an economic evaluation of the feasibility of producing and marketing vegetables in the Kuskokwim River valley area. Major considerations were the availability of markets, transportation, and a method of product distribution. All were based on production capability of the area and the capacity and time factors pertaining to vegetable storage.

The Kuskokwim River area is unique in comparison to many other rural areas in Alaska: vegetable production capability has been proven historically (Lewis, Thomas, and Wooding, 1978); transportation and distribution systems have been established by commercial air carriers; the area villages have a major population center; and delivery costs from a central point within the area to outlying villages are much less than those presently encountered in the distribution of agricultural products from Anchorage.

Based on historical production methods, six types of field vegetables can be grown successfully in the middle Kuskokwim Valley: potatoes, cabbages, turnips, rutabagas, broccoli, and cauliflower. Two crops, carrots and onions, have been successful in some years. In addition to the eight field crops, tomatoes have been grown successfully in greenhouses.

Several assumptions concerning physical facilities and management were made in formulating the costs presented in this study:

- Any land clearing which may be necessary and any land preparation such as initial fertilization are completed.
- Support facilities such as heated areas to repair machinery, electrical power, a sales office, and a vegetable packing area are available.
- Fertilization rates, seeding rates, and yields are based on the use of irrigation.
- Storage facilities are adequate to maintain the quality of the vegetables during the winter months and during the warmer period immediately following harvest.
- Vegetables are to be sold at wholesale prices to retail outlets only.
- In charge of both production and marketing, a grower-manager is to be employed with abilities to carry out good farm management practices, manage the vegetable distribution through communication with retail outlets and air carriers, and maintain an orderly marketing system to facilitate the flow of products, payments, and deliveries.

The costs of production in the form of capital budgets, annual budgets, and cash flow are given as is the production cost per pound for each vegetable crop. Market demand has been assessed for an area extending from Bethel and surrounding communities to villages as far upriver as Stony River. Marketing alternatives which include storage facilities, transportation services, method of distribution, and pricing policy are discussed. A complete system of production and marketing of vegetable crops which will satisfy consumer demand, bring vegetables to the retailer at a competitive wholesale price, and bring the producer a reasonable, positive return is presented.

The major portion of this study is concerned with production of field vegetable crops on a medium-size farm. This is not to imply that other agricultural ventures should not be considered in the future (Thomas, 1977). These might include large-scale vegetable production with truck farms specializing in one or two crops (Lewis, Thomas, and Wooding, 1978), controlled-environment crop produc-

tion for vegetables, flowers, and bedding plants with control levels varying from conventional greenhouses to environments using controlled lighting (Lewis, Thomas, and Norton, 1978), large-scale grain and forage production, largely for the export market (Lewis and Wooding, 1978), and livestock enterprises (Husby, 1980; Lewis, 1980). Development of the agricultural potential of the Kuskokwim region to the extent suggested by these alternatives would impact land use and lifestyle. These impacts must be carefully evaluated as plans are made for expansion.

CHAPTER II

YIELDS AND UNIT SIZE DETERMINATION

The 1977 market demand for produce in the Kuskokwim River area was used to determine the total poundage and types of crops which will be needed to supply a major portion of this market. The area required to produce this supply, both total acreage and acreage allotted to each crop, is directly related to the yields which can be expected. To determine the marketable yields, data from the Aniak garden project, the Agricultural Experiment Station at Fairbanks, and the Cooperative Extension Service at Fairbanks were used (Dinkel and Epps, 1978; Dinkel and Ginzton, 1976; Epps, 1971; Hassinger, 1977; Lewis, Wooding and Hassinger, 1978).

After determination of the marketable yields, acreages were allotted to each crop according to consumer demand with two exceptions, onions and tomatoes. It is not certain whether onions in marginal years will mature to a size which would be adequate to withstand long storage periods (Wooding, 1978). Therefore, the maximum acreage allotted to onions was 1.7 acres, sufficient to satisfy only 7% of the market demand. The other exception, tomatoes, is produced in greenhouses. The size of the greenhouses was determined by the number of seedlings required for the field crops. The greenhouse size, therefore, is not designed to meet the tomato market demand.

Even though good field and storage management practices may be followed, losses will be sustained. This will affect the amount of produce which can be marketed. These losses have been estimated from observations of the Aniak garden project and from unpublished data obtained from the Agricultural Experiment Station, Fairbanks, Alaska (Dinkel, 1978), and the Agricultural Research Service, Palmer, Alaska (Dearborn, 1977).

Using estimates of field and storage losses, production potential, and consumer preferences, acreage was allotted to each crop within garden units. Farm units of 24 acres in Aniak and 2 acres in Red

Devil were determined to be sufficient to meet the projected 1977 market demand. The Aniak garden in 1978 produced only 6 acres of vegetable crops. Therefore, acreage allotment to crops on 6 acres was included. Expansion would probably not be directly to a 24-acre farm. A 12-acre farm was included to allow a gradual increase to the maximum area. The information concerning the 2-acre area can be used if smaller villages wish to begin a commercial vegetable farm venture. Details of yields, acreage allotment, field and storage losses, and marketable product are summarized in Table 1.

Table 1: Yields, Acreage, and Marketable Product: all Farm Units

Crops	Acreage Allotted[a]	Yield (lbs)	Field Loss (%)	Storage Loss (%)	Marketable Product (lbs)
2 ACRES					
Potatoes	.60	18,000	18	10	13,284
Carrots	.30	8,730	25	10	5,893
Cabbage	.13	7,550	10	25	5,096
Onions[b]	.20	2,904	25	10	1,960
Turnips[c]	.08	3,485	37	10	1,975
Rutabagas[d]	.06	2,614	20	10	1,882
Broccoli	.30	5,227	20	10	3,763
Cauliflower	.12	2,356	20	10	1,697
Tomatoes[e]	26 plants	234	20	–	187
TOTAL[f]	1.8	50,866			35,550
6 ACRES					
Potatoes	2.1	63,000	18	10	46,494
Carrots	.8	23,280	25	10	15,714
Cabbage	.5	29,038	10	25	19,600
Onions[b]	.5	7,260	25	10	4,900
Turnips[c]	.3	13,069	37	10	7,410
Rutabagas[d]	.2	8,713	20	10	6,273
Broccoli	1.2	20,908	20	10	15,054
Cauliflower	.4	7,853	20	10	5,654
Tomatoes[e]	75 plants	675	20	–	540
TOTAL[f]	6.0	173,121			121,099

[a]Acreage allotments do not include a green manure crop, which for each unit is equal in size to the acreage allocated to potatoes (Lewis, Lewis, and Wooding, 1978).

[b]Although onions may not mature to a large size, 15% of the field loss may be recovered as a marketable green onion crop. Market demand was not estimated for greeen onions.

[c]The yields estimated include the turnip tops which make up 1/6 of the weight. This is included in the field loss of 37%. The green could be marketed, however, reducing this loss to 20%. Market demand was not estimated for turnip greens.

Table 1: Continued

Crops	Acreage Allotted[a]	Yield (lbs)	Field Loss (%)	Storage Loss (%)	Marketable Product (lbs)
12 ACRES					
Potatoes	4.2	126,000	18	10	92,988
Carrots	2.3	66,930	25	10	45,178
Cabbage	1.1	63,885	10	25	43,124
Onions[b]	.8	11,616	25	10	7,840
Turnips[c]	.7	30,493	37	10	17,289
Rutabagas[d]	.5	21,783	20	10	15,684
Broccoli	1.4	24,393	20	10	17,563
Cauliflower	1.0	19,633	20	10	14,136
Tomatoes[e]	147 plants	1,323	20	—	253,802
TOTAL[f]	12.0	364,733			253,802
24 ACRES					
Potatoes	8.3	249,000	18	10	183,762
Carrots	4.6	133,860	25	10	90,356
Cabbage	2.2	127,769	10	25	86,244
Onions[b]	1.7	24,684	25	10	16,660
Turnips[c]	1.3	56,631	37	10	32,110
Rutabagas[d]	1.1	47,923	20	10	34,505
Broccoli	2.8	48,786	20	10	35,125
Cauliflower	2.0	39,266	20	10	28,272
Tomatoes[e]	294 plants	2,646	20	—	2,117
TOTAL[f]	24.0	727,919			507,034

[d]The yields estimated do not include the tops.
[e]Tomato plants are assumed to bear at the rate of 3 pounds per plant per month for a 3-
[f]month period (Lewis and Thomas, 1977). Market demand was not estimated.
[f]Totals do not include the tomato crop.

CHAPTER III

PRODUCTION

In order to determine the cost of production for the vegetable crops, the following factors were considered:

greenhouses, machine storage, irrigation, and fencing
vegetable storage
large equipment
tillage practices
small equipment and miscellaneous field and marketing supplies
labor
seeds and seeding rates
fertilizer
herbicides and insecticides.

After these considerations, budgets were prepared for capital-investment cost, start-up cost, and annual operating and owner costs. In additon, a cash-flow chart was prepared for each farm size (Appendix C).

PRODUCTION FACTORS

Greenhouses and equipment storage are used for each farm unit. The greenhouses are wood-frame construction with double-wall polyethylene covering. The size is determined by the space necessary to accommodate broccoli, cabbage, and cauliflower seedlings. Minimal shelter is provided for machinery using wood-frame construction with a galvanized, sheet-steel exterior. The buildings are not insulated and no flooring is provided (Lewis, Lewis, and Wooding, 1978). Operating costs for these buildings include that for yearly replacement of the polyethylene for the greenhouse and a cost included under miscellaneous repairs of $100 to $300 depending on unit size for the machinery storage.

Irrigation systems are considered an integral part of each farm unit. A drip-type system fed by river water is less expensive than most

systems and is adequate (Hassinger, 1977; Turner et al., 1971). Repairs should be minimal if the drip hoses are removed in the fall and replaced in spring. Repair costs have been included under miscellaneous repairs.

Fencing was provided for animal predator control for all farm units. The material is 2 x 4-inch mesh welded wire with creosote treated wooden posts and gates. Again, repair cost is anticipated to be minimal and is included under miscellaneous repairs.

Vegetable storage facilities will be required if crops are to be marketed through the winter months. Those crops which will be stored are potatoes, cabbage, carrots, onions, turnips, and rutabagas. Several types of storage facilities can be used. However, because a large portion of the Kuskokwim River drainage is on a flood plain, aboveground storage is recommended (Epps, 1971). The size of the storage area is determined by the amount of produce which the market can absorb during the storage period. Because the major production and distribution point will be Aniak, this was assumed to be the location of the largest storage facility. As production expands to the upper Kuskokwim valley, additional storage will be needed in the Red Devil area. The storage facility sizes, amounts of produce to be stored, and the location of facilities is shown in Table 2. Storage units 20 x 20 feet with a capacity of 50 tons are recommended. In this way, storage capacity can be easily expanded, and, if different storage conditions for various vegetable varieties are needed, these can easily be accommodated. Also, as vegetables are removed from storage, single units can be closed down. Not all vegetable varieties can be stored throughout the winter. The length of time in which the vegetables can be stored and still maintain a high quality will depend on handling and storage conditions as summarized in Table 3. The hand-

Table 2: Size and Location of Storage Areas

Size of Production Area	Amount of Produce Stored[a]	Location of Storage Facility
6 Acres	40T	Aniak
12 Acres	88T	Aniak
24 Acres	177T	Aniak
12 + 2 Acres	112T	Aniak, Red Devil
24 + 2 Acres	189T	Aniak, Red Devil
2 Acres	12T	Red Devil

[a]Assumes 80% of the total yield for all crops except broccoli, cauliflower and tomatoes will be stored and assumes there will be a storage loss of 10% for potatoes, carrots, turnips, rutabagas, and onions and 25% for cabbage.

Table 3: Parameters for Vegetable Storage and Handling Procedures[a]

Crop	Storage Temperature	Humidity	Handling	Storage[d] Period (months)	Storage Loss (by weight)
Potatoes	32-38°F	Moderately Moist	Storage in bulk cribs. After harvest, cure by holding in moist air for 1—2 weeks at 60-75°F. Before sale, hold for 2 weeks at 50-60°F to facilitate sugar conversion to starch. (This holding period will generally be accounted for in the retail store.)	8	10%
Carrots Turnips Rutabagas	32-38°F	Moist	Wash and dry thoroughly. The vegetables which are to be marketed within a 1-1½ month period can be stored in open bins.[b] For longer storage, store in polyethylene, ventilated sacks in marketable quantities. Turnips and rutabagas give off odors but can be stored with other crops.[c]	6 (carrots) 3 (turnips) 3 (rutabagas)	10%
Cabbage	Near 32°F	Moderately Moist	Cabbage should not be washed, but should be freed of dirt by removing outer leaves. The heads which are to be marketed within a 1—1½ month period can be stored in open bins.[b] For longer storage, bag individually in polyethylene bags. Cabbage should be trimmed before sale.	4	25%
Onions	32-38°F	Dry	Onions grown from sets are difficult to keep. Bag in net sacks of marketable quantities and keep in dry, well ventilated area, or place in single layer on poultry netting that is suspended in a cold, dry area. Onions should be cleaned but not washed.	3	10%

[a] Adapted from Storing Vegetables and Fruits. 1970. Market Quality Research Division, Agricultural Research Service, Washington, D.C.
[b] Open-bin storage recommendations from Dearborn, (1977) and Kern (1978).
[c] Storage recommendations are from Dinkel, 1977.
[d] Assumes all vegetables are cleaned using no water with the exception of carrots which can be washed if dried thoroughly.

ling and storage conditions shown assume that the area has been properly cleaned by removing vegetables showing signs of decay, has adequate temperature regulation, ventilation, and moisture control, and that the vegetables have been handled in a manner which precludes spoilage-inducing damage (ARS, 1970). Operating costs include an annual repair cost of $100 per unit under miscellaneous repairs and a fuel cost of $20 per unit per month for four months. Details for greenhouse, irrigation system, fencing, and storage construction are given in Appendix B.

There is little information available for the Kuskokwim River area concerning use of mechanized tillage equipment. Information was drawn from other areas of Alaska and from areas in the conterminous 48 states in which smaller truck farms are the primary production units (Burlingame, 1970; Dhillon and Nickel, 1972; Hassinger, 1977a; Wise and Carlin, 1967; Wooding and Dinkel, 1978). Equipment lists vary little for farms up to 24 acres. The major pieces of tillage equipment recommended for the Aniak area are shown in Appendix A, by farm unit size. Equipment costs include both owner and operating costs.

Owner costs for buildings and equipment include: 1) investment cost calculated as shown (Dawson Alaska Insurance Co., 1978).

$$\text{Investment cost} = \frac{\text{New cost} + \text{salvage}}{2} (\text{Interest Rate})$$

with an interest rate of 7%* and a zero salvage value, and 2) insurance at $7.00 per $1,000 at new value. Depreciation was calculated over five years with zero salvage value using the straight line method. Repairs and maintenance are calculated at 5% of new cost.** Details of equipment specifications and costs are given in Appendix A.

It was assumed throughout the calculations that sound management practices will be followed which include: early spring tillage; preparation of a seed bed which is free of debris; proper weed and insect control using herbicides and insecticides applied to maintain a low weed or insect population; and a timely harvest beginning as early as mid-July for early cabbage, broccoli, and cauliflower and continuing into September. The production cost also includes a

*A rate of 6% is charged by the Alaska Agricultural Revolving Loan Fund but this may increase.

**Does not include labor or a parts inventory and is an average for all equipment. Estimates are from Fairbanks, Alaska, local dealers, 1977.

green-manure crop. The green-manure crop recommended is spring rye, oats, common buckwheat, or annual ryegrass. It is used in a three-year rotation with potatoes to reduce losses from disease caused by soil-borne organisms. The crop is turned under while still succulent and will improve the soil's friability and moisture-holding capacity (Lewis, Lewis, and Wooding, 1978).

All small equipment is considered to be replaced at the rate of one-fourth the stock per year. Included as small equipment are field and greenhouse hand tools, vegetable crates, and pots and flats. Miscellaneous crop-care items such as twine, pot stakes, vermiculite, plant-tie ribbon, and wire are assumed to be replaced annually. A complete listing showing number of units required for each farm size, the price per unit, and unit weight is given in Appendix A. Marketing supplies include only packaging. The type, quantity, and price per unit are shown in Table 4. Cleaning equipment for carrots and potatoes was not included. The storage methods recommended and the market demand do not indicate additional cleaning will be required. As the market expands, however, it may be desirable to include a cleaning facility for these crops.

Labor estimates for a medium-size vegetable production operation which is not family owned and operated are not available in Alaska. Therefore, the labor required was calculated by combining data from the Aniak garden project with that from family farms of comparable size in the conterminous 48 states (Burlingame, 1970; Dhillon and

Table 4: Marketing Supplies (Packaging) and Price Per Unit[a]

Crop	Packaging Type	2 Acres	6 Acres	12 Acres	24 Acres	Price Per Unit
Onions	3 lb. poly	653	1,633	2,613	5,553	$27 per 1,000
		$ 27	$ 54	$ 81	$ 162	
Cabbages	1 lb. poly[b]	1,699	6,533	14,374	28,750	$25 per 1,000
		$ 150	$ 175	$ 375	$ 725	
Carrots	1 lb. poly	5,893	15,714	49,178	90,356	$25 per 1,000
		$ 150	$ 400	$ 1,150	$ 2,275	
Potatoes[c]	100 lb.	66	232	465	919	$88 per 250
	burlap	$ 26	$ 88	$ 176	$ 352	
	20 lb. poly	166	581	1,162	2,297	$68 per 1,000
		$ 15	$ 25	$ 68	$ 136	
	10 lb. poly	332	1,162	2,324	4,494	$39 per 1,000
		$ 15	$ 39	$ 78	$ 195	

[a]Price and unit size source: Alaska Paper Company, 1978. Anchorage, Alaska.
[b]Assumes cabbages weigh approximately 3 lbs. per head.
[c]Assumes 1/2 are in 100 lb. sacks, 1/4 in 20 lb. sacks, and 1/4 in 10 lb. sacks.

Nickel, 1972; Hassinger, 1977; Wise and Carlin, 1967). On a family farm, a family member generally functions as the manager and marketing agent. Because the Kuskokwim River farms will not be family owned and operated, a grower-manager will fill this role, a major function of which will be to act as a marketing agent. Table 5 gives the details of time and wages for labor on the four farm units. Further details of the allocation of labor are shown in the cash-flow tables in Appendix C.

Seed varieties and seeding rates were obtained from local growers, Agricultural Experiment Station, Cooperative Extension Service, and Agricultural Research Service, as well as from the Aniak garden project (Dinkel and Epps, 1978; Dinkel and Ginzton, 1976; Epps, 1971; Hassinger, 1977; Washburn, 1978). The recommended varieties, rate of seeding, and seeding method are shown in Table 6. The amount of seed required for the acreage allotted to each crop within the farm unit and the price per unit are shown in Table 7.

Fertilization rates and methods of application will vary by crop (Burlingame, 1970; Dinkel and Ginzton, 1976; Loynachan, Laughlin, and Wooding, 1978). Three major categories of fertilizer application are used for the field crops. It was assumed irrigation would be available. Greenhouse and field fertilizers are those typically used in the interior of Alaska. Although recommendations have been made which would seem specific, it should be realized that soils will vary and the rates shown may require alteration for each farm location. Soils may also require applications of lime and/or phosphate. Before planting, preferably during the preceding fall, soil samples should be taken and lime requirements estimated (C.E.S., 1977; Epps, 1973; Swan, 1978). Table 8 shows the fertilizers and recommended application rates and methods. The total fertilizer requirements and prices per unit are given in Table 9. The prices quoted include air freight. If barge rates are used, the cost of fertilizer would be reduced by 30-35%.

Herbicides will be required for weed control. Recommendations vary dependent on the crop and the type of weed to be controlled. It is anticipated that lambs quarter will present the greatest need for control by use of an herbicide. Table 10 lists the recommended herbicides for the Aniak area, the method and the rate of application (Swan, 1978; Turner et al., 1971). The insect problem may not be severe if levels are initially kept under control (Epps, 1973). Root maggots will probably be a problem however, even on new lands. Good sanitation and cultural practices should eliminate or keep in check undesirable populations. Table 11 contains recommendations

Table 5: Labor Requirements and Wage Rates

Labor Category	2 Acres		6 Acres		12 Acres		24 Acres	
	Time	Wage per hour	Time	Wage per hour	Time	Wage per hour	Time	Wage per hour
Grower Manager	—		1 person 12 months	[a]	1 person 12 months	[a]	1 person 12 months	[a]
Marketing Agent	1 person 9 months	[b]	—	—	—	—	—	—
Field Boss	1 person 7 months	$7.00	1 person 7 months	$7.00	1 person 7 months	$7.00	1 person 7 months	$7.00
Field Labor, full-time	2 persons 4 months	$5.00	3 persons 4 months	$5.00	3 persons 4 months	$5.00	3 persons 4 months	$5.00
Field Labor, part-time	—	—	1 person 2 months	$4.00	3 persons 2 months	$4.00	5 persons 2 months	$4.00
Greenhouse Labor	—	—	—	—	1 person 7 months	$5.00	1 person 7 months	$7.00

[a] A salary of $1500 per month is paid for 12 months.
[b] A fee of $200 per month is paid for 9 months.

Table 6: Seed Varieties and Planting Recommendations

Crop	Varieties	Spacing, Depth of Planting, Plant and Seed Requirements
Potatoes	Kennebec Bake King Green Mountain Alaska Red	Row width: 36 inches Seed piece or seed eye spacing within rows: 8 inches Depth of planting: 3-5 inches Seed pieces or seed eyes per acre: 21,780 Average weight per seed piece: 1.75 ounces Seed potatoes required per acre: 2,395 pounds Seed piece or seed eye spacing within rows: 8 inches[a]
Cabbage	Early Marull (early) Golden Acre (early) Earliana (early) Tastie (mid-season) Blue Chip (mid-season) Hybrid 15 (mid-season)	Row width: 36 inches Plant spacing within rows: 12 inches Transplants per acre: 14,520 3,000 seeds per ounce 10 ounces of seed per acre
Broccoli	Green Duke Gem Improved Green Comet Southern Comet Green Comet Waltham 29	Row width: 36 inches Plant spacing within rows: 15 inches Transplants per acre: 11,616 3,000 seeds per ounce 8 ounces of seed per acre

Cauliflower	Super Snowball Snow Crown Super Junior Snowball Whitehorse Snowmound	Row width: 36 inches Plant spacing within rows: 15 inches Transplants per acre: 11,616 3,000 seeds per ounce 8 ounces of seed per acre
Carrots	Spartan Bonus Nantes Special Long Spartan Sweet Royal Chantenay	Row width: 15 inches Depth of planting: 1/4–1/2 inch Seed per acre: 3 pounds Thin to 2-3 inches between plants (if necessary). Carrots can be planted in 5 foot strips, spaced 4 foot apart to facilitate application of herbicides by tractor.
Onions	Yellow Sets	Row width: 18 inches Depth of planting: 2 inches. Set spacing within rows: 3 inches. Sets required per acre: 116,160
Turnips	Tokyo Market (Tokyo Cross) Petrowski	Row width: 18 inches Depth of planting: 1/2–3/4 inch Seed per acre: 3 pounds Thin to 4-6 inches between plants (if necessary)
Rutabagas	York Improved American Purple Top	Row width: 24 inches Depth to planting: 1/2–3/4 inch Seed per acre: 2 pounds Thin to 6-8 inches between plants (if necessary)

[a]Spacing of potatoes will vary by management method and variety. Kennebecs which do not set an excessive amount of potatoes could be spaced as closely as 6 inches in 36-inch rows while Bake King or Green Mountain would probably require 10-12 inch spacing in rows 38-40 inches apart (Logsdon, 1979).

Table 7: Seed Requirements[a] and Prices

Crop	2 Acres	6 Acres	12 Acres	24 Acres	Price Per Unit[b]		Rate of Seeding[c]
Potatoes: Seed	1,437 lbs	5,030 lbs	10,059 lbs	19,879 lbs	–		2,395 lbs per acre
Eyes	6,000	21,000	42,000	83,000	$31.65 per 1,000		10,000 eyes per acre[d]
Cabbage	1 oz.	1/4 lb	1/2 lb	3/4 lb	1/2 oz	$1.05	5 oz per acre
					1 oz	$1.90	
Broccoli	1 oz.	1/2 lb	1/2 lb	3/4 lb	1/2 oz	$3.25	4 oz per acre
					1/4 lb	$32.00	
Cauliflower	1/2 oz.	2 oz.	1/4 lb	1/2 lb	1/4 oz	$1.05	4 oz per acre
					1 oz	$3.50	
					1/4 lb	$10.00	
Carrots	2 lbs	3 lbs	7 lbs	15 lbs	1 lb	$8.00	3 lb per acre
Onions (seeds)	2 lbs	4 lbs	6 lbs	13 lbs	1 lb	$1.00	73 lb per acre[e]
Turnips	1/4 lb.	1/4 lb	1/2 lb	3/4 lb	1/4 lb	$7.00	7 oz per acre
Rutabaga	1/2 lb	1/2 lb	1/2 lb	1/4 lb	1/2 lb	$3.50	12 oz per acre
Green Manure Oats	60 lbs	210 lbs	420 lbs	830 lbs	1 bu	$10.00	100 lbs per acre
Tomatoes	1 pkt.	1 pkt.	2 pkt.	3 pkt.	1 pkt.	$.50	3 seeds per plant

[a] The amount of seeds required is for the acreage allotted to each particular crop in a garden unit. For example, the 2-acre garden contains .6 acres of potatoes requiring 1,437 lbs. of seed at the rate of 2,395 lbs. per acre. The amounts required are based on packaging quantities, not on fractions of the per-acre rate. For example, if 1-1/2 lbs. are required, a 2-lb. unit may be allocated.

[b] 1978 prices for seeds were obtained from: Stokes Seeds Inc., 737 Main Street, Buffalo, N. Y.; Burpee Seed Company, Warminister, PA.; Anne's Greenhouse, Sheep Creek Road, Fairbanks, AK.

[c] Seeding rates were obtained from: Henry Field Seed and Nursery Company, Shenandoah, Iowa; Agway, Inc., Seed Division, Box 1333, Syracuse, New York. Direct field seeding rates were taken from grower recommendations. In the case of transplants, seeding rates were used which would give 1-1/2 times the seedlings required (assumeing that losses will occur during production and transplanting).

[d] The seeding rate of 10,000 eyes per acre was used in Aniak in 1977. This seed rate was used rather than the rate suggested in Table 6, as was the 1977 price. Yields quoted are based on these results. Seed eyes could be used the first year and potatoes for seed stored for the second year crop. If seed cannot be stored, certified seed can be obtained in Alaska at approximately $.36 per lb. f.o.b. Aniak for a cost of $865 per acre. Caution is advised to exercise care to bring in virus-free seed and to retain seed for the following year on a very selective basis.

[e] The onion seeding rate shown is for sets grown from seed in the field and stored over winter. Onions grown from sets would require approximately 900 lbs. per acre at a price of approximately $1,000 per acre f.o.b. Aniak.

Table 8: Fertilizers and Recommended Application Rates and Methods

Crop	Fertilizers
Potatoes[a]	1,250 pounds per acre of 10-20-20 mixed fertilizer (specify that potassium in the 10-20-20 is supplied as sulphate of potash). Fertilizer is banded 2 inches to each side and slightly below the seed piece with a planter having a fertilizer attachment or when planting by hand.
Cabbage	1,000 pounds per acre of 10-20-20 mixed fertilizer (specify that potassium in the 10-20-20 is supplied as sulphate of potash) broadcast in spring and incorporated into the soil during seed bed preparation. 90 pounds per acre of urea (45-0-0) applied as a side dressing 4-5 weeks after transplanting. To avoid leaf burning, immediately follow side dressing with irrigation.
Broccoli	Same as for Cabbage.
Cauliflower	Same as for Cabbage.
Carrots	900 pounds per acre of 10-20-20 mixed fertilizer (specify that potassium in the 10-20-20 is supplied as sulphate of potash) broadcast in the spring and incorporated into the soil during seed bed preparation.
Onions	Same as for Carrots.
Turnips	Same as for Carrots.
Rutabagas	Same as for Carrots.

[a]An alternative to banding fertilizer is to broadcast prior to planting. Broadcast fertilizer remaining between the rows is then rolled onto the hill during hilling. Furthermore, the amount of fertilizer applied in this manner could be increased up to twice the amount used when banding with no damage to the crop (Logsdon, 1979).

Table 9: Fertilizer Requirements[a] and Prices

Crop	2 Acres	6 Acres	12 Acres	24 Acres	Price Per Unit[b]	Rate of Application
Potatoes[c]						
10-20-20 w/K as sulphate of potash	750 lbs	2,625 lbs	5,250 lbs	10,375 lbs	$ 17.30 per 50 lb	1,250 lbs/A
Cauliflower, Broccoli, Cabbage						
10-20-20 w/K as sulphate of potash	550 lbs	2,100 lbs	3,500 lbs	7,000 lbs	$ 17.30 per 50 lb	1,000 lbs/A
45-0-0 (Urea)	50 lbs	189 lbs	315 lbs	630 lbs	$480.00 per ton	90 lbs/A
Carrots, Turnips, Rutabagas, Onions						
10-20-20 w/K as sulphate of potash	585 lbs	1,620 lbs	3,870 lbs	7,830 lbs	$ 17.30 per 50 lb	900 lbs/A
Green Manure						
45-0-0 (Urea)	50 lbs	210 lbs	420 lbs	830 lbs	$480.00 per ton	100 lbs/A
Seedlings[d]						
10-52-17	3 lbs	9 lbs	18 lbs	36 lbs	$ 3.98 per 3 lb.	
Tomatoes[e]						
10-52-17	7 lbs	24 lbs	48 lbs	96 lbs	$ 46.83 per 45 lb	10-3/4 lb/100 ft^2
0-46-0	2 lbs	7 lbs	14 lbs	28 lbs	$ 17.90 per 50 lb	3 lb/100 ft^2
$MgSO_4$	¼ lb	½ lb	1 lb	2 lb	$ 3.25 per 5 lb	¼ lb/100 ft^2

[a]The amount of fertilizer required is for the acreage allotted to each particular crop in a garden unit. The amounts required are based on packaging quantities.
[b]1978 prices were obtained from E. C. Geiger, Harleysville, Pennsylvania, and Alaska Mill and Feed Company, Inc., Anchorage, Alaska.
[c]Fertilizer rates assume good management practices are used. The rate applied is to approximate a 20-ton-per-acre yield. The crop will require more intensive care than if a lower rate were applied.
[d]Seedling fertilizer requirements were obtained from C.E.A., 1977; and Epps, 1971. The amounts were estimated using a rate of approximately 1/2 oz. per 1 gallon water.
[e]Fertilization rates used are from C.E.S., 1977.

Table 10: Herbicide Rates and Methods of Application

Crop	Herbicide	Method of Application	Rate of Application
Potatoes	SENCOR (metribuzin) (cole crops are sensitive)	Pre- and early post-emergence, broadcast or banded.	.5-1 lb/A in 10-40 gal. water. Avg. half life: 40-50 days.
	PREMERGE[a]	Preemergence, with conventional sprayer.	7.5 qts/A in 50/100 gal. water.[a]
Cabbage Broccoli Cauliflower Turnips Rutabagas	DACTHAL (dimethyl tetrachloroterephthalate)	Preemergence, to weeds, with conventional sprayer.	4-10 lb/A in 25-50 gal. water. Avg. half life: 100 days.[b]
Carrots Onions	LOROX (linuron)	Pre- or postemergence, sprayed on soil without surfactant controls. Emerged grasses to 2 in., broadleaf weeds to 6 in.	.5-3 lbs/A in sufficient water to cover area. Phytotoxic concentrations disappear in 4 months.[c]
Carrots Onions	TENORAN (chloroxuron) (cole crops may be sensitive)	After weed emergence and before 2 in. high with conventional sprayer.	6-8 lbs/A in 25-40 gal. water. Breaks down in sandy-loam at 35% loss in 8 weeks.[d]
Cabbage Broccoli Cauliflower	CDEC	Preemergence, soil surface with ground sprayer. Apply to transplants prior to weed emergence.	2-6 lbs/A in 25-40 gal. water. Persists generally 3-6 weeks.[e]

[a]The 7.5 qts/A rate in 50-100 gal. of water is used in the Matanuska Valley. A rate of approximately 9 qts/A applied at 40 gal./A has been recommended for the interior of Alaska. 9 qts/A is recommended for application just as plants begin to emerge to give weed-free conditions until cultivation and hilling. (Wooding, 1978). In 1977, 2 gal./2,000 ft^2 was applied at Aniak.

[b]Application rates in the Matanuska Valley at 16 lb/A have been used successfully.

[c]An application rate of 4 lbs/A is recommended and used for onions in the Matanuska Valley. A single weeding before application is recommended.

[d]Rate used in Matanuska Valley.

[e]TREFLAN (trifluralin) is a commonly used herbicide for all cole crops. However, its effectiveness was not considered as good as the herbicides listed.

Table reference except where noted: Dearborn, 1977.

Table 11: Insecticide Rates and Methods of Application

Crop and Insect	Insecticide	Method of Application	Rate of Application
APHIDS[a]	Diazinon AG-500 (EC)	Spray at first sign of insects. Repeat as necessary to maintain control.	
Broccoli			1/2-1 pt./A at 7-10 day intervals within 5-7 days of harvest.
Cauliflower			
Cabbage			1 pt./A to within 10 days of harvest.
Carrots			
Tomatoes			1/2 pt./A.
CUTWORMS	Diazinon AG-500 (EC)	Broadcast just prior to planting. Work into soil 3-4 in.	2-4 qts./A.[b] 1 replanting treatment only.
Broccoli		Side dress after planting with directional nozzle.	
Cauliflower			
Cabbage			
ROOT MAGGOTS	Diazinon AG-500 (EC)	Broadcast as for cutworms.	As for cutworms. 1/4 to 1/2 pt. in 50 gal. of water.
Broccoli		Transplant water 1/2 to 1 cupful per plant with drop nozzle.	
Cauliflower			
Cabbage		Spray with drop nozzle to plant soil root area.	1 pt./A at 10-day intervals. 4-5 applications per season.

[a] Malathion and Kelthane are also recommended for control of greenhouse aphids and mites, respectively.
[b] The 2-4 qt./A rate is for the total season and should be applied at 10-day intervals.
Table reference: (Washburn, 1978).

from the Agricultural Experiment Station at Fairbanks and Agricultural Research Service at Palmer. Costs of herbicides and insecticides are variable. For example, Premerge and Diazinon are approximately $30 per gallon f.o.b. Aniak. However, on new lands there should not be a weed problem for several years if good cultivation practices are followed. There will, however, be a root maggot problem for the cole crops. A cost of $5 per acre for insecticides and herbicides should be adequate on new lands for the first several years. However, this could increase to as much as $50 per acre for previously cropped lands or for lands on which good cultivation methods are not used.

PRODUCTION COSTS

All budgets and the yearly cash flow statements (Appendix C) were prepared considering the production inputs discussed in the preceding paragraphs. Even though one tractor and some tillage implements are already available in the Aniak area and more are on order, these were included in the capital costs in order to provide a better indication of the total investment for all farm units.

Five major categories have been included as capital investments. These are: major implements, small implements, buildings, fencing,

Table 12: Capital Investment Cost

	2 Acres	6 Acres	12 Acres	24 Acres
Major implements				
Tractor unit	$ 3,580.64	$ 5,000.00	$ 5,000.00	$ 9,971.00
Tillage	3,397.21	6,618.39	6,618.39	9,714.72
Planting	976.00	3,676.28	3,676.28	5,340.20
Harvest	400.00	400.00	2,740.00	2,740.00
	$ 8,353.85	$15,694.67	$18,034.67	$27,765.92
Small implements				
Field	$ 478.23	$ 547.87	$ 670.56	$ 1,038.66
Greenhouse	851.12	1,599.33	1,636.11	2,036.91
	$ 1,329.35	$ 2,097.20	$ 2,306.67	$ 3,075.57
Buildings				
Greenhouse	$ 1,400.68	$ 2,830.70	$ 4,285.03	$ 8,188.85
Machine storage	1,336.16	1,336.16	1,807.97	1,807.97
Vegetable storage	5,014.26	10,028.50	15,042.78	20,057.04
	$ 7,759.10	$14,195.36	$21,135.78	$30,053.86
Fencing	$ 1,147.36	$ 1,872.68	$ 2,949.48	$ 3,497.82
Irrigation	$ 888.51	$ 2,065.12	$ 4,130.24	$ 8,260.48
TOTAL	$19,478.17	$35,925.03	$48,556.84	$72,653.65

and irrigation. All costs shown are for new equipment. Prices are f.o.b. Aniak. Table 12 details the capital cost for each farm unit. Start-up costs, shown in Table 13, are those which will be incurred during the first year of operation before production can begin. Details are given in Appendix A.

The annual budgets for a typical year of operation are given in Tables 14 through 17 for each farm unit. The costs are broken down into two major categories: owner costs which would be incurred whether the farm were in production or not, and operating costs which are incurred only if the farms are operating. Each of the categories include both production and marketing costs. It should be noted that a land lease cost has been included under owner cost. Land in Aniak is currently leased at a charge of $100 per year for 6 acres. This charge will not continue when Kuskokwim Native Association land is used.

Table 13: Start-Up Costs (excluding capital costs)

	2 Acres	6 Acres	12 Acres	24 Acres
Field				
Seed[a]	$ 308.62	$ 881.03	$ 1,708.31	$ 3,404.33
Fertilizer[b]	700.41	2,329.24	4,727.83	9,091.93
Herbicides	10.00	30.00	60.00	120.00
Fuel	100.00	300.00	600.00	1,200.00
Oil	37.50	75.00	150.00	300.00
Annual supplies	126.46	489.91	836.09	1,576.91
Small tools & equipment[c]	1,813.00	677.04	889.48	2,510.64
Repair parts	100.00	150.00	200.00	300.00
	$2,195.99	$4,932.22	$ 9,171.19	$18,503.81
Greenhouse				
Seeds	$ 10.80	$ 75.75	$ 81.75	$ 129.17
Fertilizer	4.46	13.38	26.76	54.03
Annual supplies & equipment	59.97	311.96	359.05	702.51
Small tools[c]	655.48	1,603.00	3,059.12	$6,948.52
	$ 728.71	$2,004.09	$ 3,526.68	$ 6,948.52
Marketing				
Materials	$ 283.40	$ 855.50	$ 1,927.00	$ 3,816.00
TOTAL	$3,208.10	$7,791.81	$14,624.87	$29,268.33

[a]The seed cost assumes potato eyes will be shipped in the first year. In succeeding years, it should be possible to use potato seed produced in the Kuskokwim area.
[b]Fertilizer costs include air freight rates at $.16 per pound, Anchorage to Aniak. The cost could be cut at least 30-35% if barge transportation is used.
[c]The total inventory of small tools is purchased at start-up.

Table 14: Annual Costs—2 Acres

Operating costs			
Production costs			
Seedling production	$ 1,097.10		
Equipment	669.72		
Labor[a]	19,823.50		
Seed, fertilizer[a]	1,009.03		
Herbicide, insecticide	10.00		
Small tools[b]	203.25		
Annual supplies[a]	126.46		
Miscellaneous repairs	100.00		
Total Production Costs		$23,039.06	
Marketing costs			
Labor	$ 1,800.00		
Materials	283.40		
Storage	180.00		
Total Marketing Costs		$ 2,263.40	
Total Operating Costs			$25,302.46
Owner costs			
Production costs			
Depreciation[c]	$ 4,241.31		
Equipment	486.24		
Buildings	113.64		
Land lease	30.00		
Irrigation	37.32		
Total Production Costs		$ 4,980.51	
Marketing costs			
Depreciation[c]	$ 1,002.85		
Buildings	210.60		
Total Marketing Costs		$ 1,213.45	
Total Owner Costs			$ 6,121.96
TOTAL All Costs			$31,424.42

[a]Excludes seedling production.
[b]¼ replaced annually.
[c]Depreciation is a non-cash cost.

Table 15: Annual Costs—6 Acres

Operating costs			
Production costs			
Seedling production	$ 2,521.84		
Equipment	675.0		
Labor[a]	34,920.00		
Seed, fertilizer[a]	3,210.27		
Herbicide, insecticide	30.00		
Small tools[b]	358.86		
Annual supplies	489.91		
Miscellaneous repairs	150.00		
Total Production Costs		$42,355.88	
Marketing costs			
Labor	$ 9,750.00		
Materials	855.50		
Storage	360.00		
Total Marketing Costs		$10,965.50	
Total Operating Costs			$53,321.38
Owner costs			
Production costs			
Depreciation[c]	$ 5,318.81		
Equipment	820.41		
Buildings	172.38		
Land lease	99.99		
Irrigation	86.70		
Total Production Costs		$ 6,498.29	
Marketing costs			
Depreciation[c]	$ 2,005.70		
Buildings	421.17		
Total Marketing Costs		$ 2,426.87	
Total Owner Costs			$ 8,925.16
TOTAL All Costs			$62,246.54

[a]Excludes seedling production .
[b]¼ replaced annually.
[c]Depreciation is a non-cash cost.

Table 16: Annual Costs—12 Acres

Operating costs			
Production costs			
Seedling production	$ 5,747.34		
Equipment	2,336.33		
Labor[a]	44,696.50		
Seed, fertilizer[a]	6,436.14		
Herbicide, insecticide	60.00		
Small tools[b]	601.57		
Annual supplies	836.09		
Miscellaneous repairs	200.00		
Total Production Costs		$60,913.97	
Marketing costs			
Labor	$11,250.00		
Materials	1,927.00		
Storage	540.00		
Total Marketing Costs		$13,717.00	
Total Operating Costs			$74,640.97
Owner costs			
Production costs			
Depreciation[c]	$ 7,812.70		
Equipment	1,146.84		
Buildings	249.36		
Land lease	200.01		
Irrigation	173.40		
Total Production Costs		$ 9,582.31	
Marketing costs			
Depreciation[c]	$ 3,008.55		
Buildings	631.77		
Total Marketing Costs		$ 3,640.32	
Total Owner Costs			$13,222.63
TOTAL All Costs			$87,853.60

[a] Excludes seedling production.
[b] ¼ replaced annually.
[c] Depreciation is a non-cash cost.

Table 17: Annual Costs—24 Acres

Operating costs			
Production costs			
Seedling production	$ 6,916.28		
Equipment	4,100.00		
Labor[a]	44,880.50		
Seed, fertilizer[a]	12,496.26		
Herbicide, insecticide	120.00		
Small tools[b]	813.85		
Annual supplies	1,576.91		
Miscellaneous repairs	300.00		
Total Production Costs		$64,287.52	
Marketing costs			
Labor	$11,250.00		
Materials	3,816.00		
Storage	720.00		
Total Marketing Costs		$15,786.00	
Total Operating Costs			$ 86,989.80
Owner costs			
Production costs			
Depreciation[c]	$12,029.08		
Equipment	1,830.66		
Buildings	408.12		
Land lease	400.02		
Irrigation	346.80		
Total Production Costs		$15,014.68	
Marketing costs			
Depreciation[c]	$ 8,022.80		
Buildings	842.37		
Total Marketing Costs		$ 8,865.17	
Total Owner Costs			$ 23,879.85
TOTAL All Costs			$110,869.65

[a]Excludes seedling production.
[b]¼ replaced annually.
[c]Depreciation is a non-cash cost.

CHAPTER IV

SIZE AND EXTENT OF THE MARKET

To determine the size and extent of the market in the Kuskokwim River area, production capability and market potential were considered. There are limitations in both categories. General factors that limit production capability are climate, manpower availability, land availability, transportation, investment capital, and management expertise. The market potential of the Kuskokwim River basin area, from Stony River to Bethel, is limited by population and accessibility. On the other hand, the area has sufficient population to generate a demand for a vegetable production unit larger than that currently located in Aniak.

MARKET STRUCTURE

The marketing area has been divided into three distinct units due to the difference in anticipated market share, geographic location, transportation, and population. These units will be referred to as the *Aniak area, Bethel area,* and *Red Devil area*. The composition of each of these units is shown in Table 18.

The natural separation of the population into up-river and down-river areas indicates that product distribution would be best facilitated if production and storage were located in the Aniak area to service the Aniak and Bethel areas, and in the Red Devil area for up-river distribution. From these locations, 80% of both the Aniak and Red Devil area markets could be captured. This is not the case in the Bethel area, which is split into two distinct marketing units: 1) the city of Bethel and 2) the outlying communities and villages. The city of Bethel has three main stores serving approximately 60% of the population. An estimated goal is to capture 50% of this market. Access to the outlying communities and villages requires transfer of goods in Bethel. A high rate of loss could be incurred during transfer particularly during the winter months. Therefore, it is suggested that

Table 18: Marketing Area Populations, Stores, and Runways

	Population[a]	Major Stores	Runway
Aniak Area			
Crooked Creek	136	1	yes
Napamute	10	0	no
Chuathbaluk	137	1	no
Aniak	323	2	yes
Kalskag (upper)	153	1	yes
Kalskag (lower)	227	1	yes
TOTAL	986	6	4
Bethel Area			
Tuluksak	137	0	yes
Akiak	187	1	yes
Akiachak	365	1	yes
Kwethluk	450	0	yes
Bethel	3,500	3	yes
Nunapitchuk	608	1	yes
Kasigluk	209	0	no
Napakiak	296	1	yes
Napaskiak	not available	0	no
Oscarville	not available	0	no
TOTAL	5,752+	7	7
Red Devil Area			
Stony River	100	1	yes
Sleetmute	132	1	yes
Red Devil	40	1	yes
TOTAL	272	3	3

[a]Approximate, Orth, 1971.

no attempt be made to meet more than 35% of the market demand in the outlying areas. The two marketing units within the Bethel area represent a potential market for 44% of the produce from Aniak. Total market estimates indicate the gardens in the Aniak and Red Devil areas would supply approximately 50% of the vegetable market in the Kuskokwim River basin. The size of each market area and the market goals are shown in Table 19.

Table 19: Size and Extent of Market by Area

	Population (est.)	Market Goal (% of product)
Aniak Area	986	80
Bethel Area	5,833	44
Red Devil Area	272	80

Tables 20a and 20b show the supply for all areas for each farm size indicated. It should be noted that to generate the maximum market supply two units are used, 24 acres in Aniak and 2 acres in Red Devil.

PRODUCT PREFERENCES OF CONSUMERS

Since consumption patterns and consumer demand within the Kuskokwim River region may be somewhat unique, demand patterns as related to other areas prove to be of little value. Therefore, a survey of stores in the Aniak and Bethel areas, discussions with the Aniak garden project manager, residents of the three areas, and information from the Cooperative Extension Service in Bethel were used to determine preference patterns. These preference patterns are shown in Table 21.

The consumer ranking of vegetables by preference is not the same as the amount of each crop produced. For example, cabbage is preferred by consumers over carrots, but more carrots were produced. The rank of products purchased also differs from those preferred. Some products are either not available in area stores or are of such poor quality that they are not purchased. Table 22 illustrates the total consumption of each vegetable type in number of pounds consumed.

Market Outlets

There is no wholesale outlet for produce in the Kuskokwim River region. All produce is shipped from either Anchorage or Seattle. It is suggested that the produce from the Aniak and Red Devil areas be marketed at wholesale only. Operating either as or through a wholesale distribution outlet, the farm manager could establish and maintain an orderly flow of product, more easily forecast future demand, and minimize handling of the produce. Retail outlets could be serviced not only through standing orders but on an immediate demand basis.

There may be only one exception to sales only to retailers. In some cases, damaged produce or harvest from experimental crops could be cleared by selling direct to the consumer. However, retail outlets should be given the option to accept this type of product at a lower cost before such disposal is made.

Table 20a: Percentages of Market and Pounds Supplied in Each Market Area for Each Farm Unit(s)[a]

Product	Red Devil (%)	Red Devil (lbs.)	Aniak (%)	Aniak (lbs.)	Bethel (%)	Bethel (lbs.)
			2-Acre Farm (Red Devil)			
Potatoes	80	11,040	5	2,264		
Carrots	80	5,520	2	373		
Cabbage	80	5,096				
Onions	20	1,960				
Turnips	80	1,975				
Rutabagas	80	1,882				
Broccoli	73	3,763				
Cauliflower	80	1,697				
			6-Acre Farm (Aniak)			
Potatoes	48	6,654	80	39,840		
Carrots			80	15,714		
Cabbage			80	19,600		
Onions			13	4,900		
Turnips			80	7,410		
Rutabagas			80	6,273		
Broccoli			80	15,054		
Cauliflower			76	5,654		
			12-Acre Farm (Aniak)			
Potatoes	80	11,040	80	39,840	14	41,688
Carrots	80	5,520	80	15,714	17	23,944
Cabbage	80	5,096	80	19,600	13	18,428
Onions			21	7,840		
Turnips	80	1,975	80	7,410	15	7,904
Rutabagas	80	1,882	80	6,273	14	7,528
Broccoli	80	4,124	71	13,439	–	–
Cauliflower	80	1,697	80	5,976	15	6,463
			24-Acre Farm (Aniak)			
Potatoes	80	11,040	80	39,840	45	132,882
Carrots	80	5,520	80	15,714	48	69,122
Cabbage	80	5,096	80	19,600	46	61,548
Onions			47	16,660		
Turnips	80	1,975	80	7,410	43	22,725
Rutabagas	80	1,882	80	6,273	50	26,350
Broccoli	80	4,124	80	15,054	15	15,947
Cauliflower	80	1,697	80	5,976	47	20,599

[a]Shipping and handling losses are not included in pounds supplied.

Table 20b: Percentage of Market and Pounds Supplied in Each Market Area for the 12 Plus 2 and 24 Plus 2 Acre Units[a]

Product	Red Devil[b]		Aniak[b]		Bethel[b]		Bethel[c]	
	(%)	(lbs.)	(%)	(lbs.)	(%)	(lbs.)	(%)	(lbs.)
	12 Acres (Aniak)[a] + 2 Acres (Red Devil)[b]							
Potatoes	80	11,040	80	39,840	14	41,688	19	55,392
Carrots	80	5,520	80	15,714	17	23,944	21	29,837
Cabbage	80	5,096	80	19,600	13	18,428	17	23,524
Onions	20	1,960[d]	21	7,840				
Turnips	80	1,975	80	7,410	15	7,904	19	9,879
Rutabagas	80	1,882	80	6,273	14	7,528	18	9,411
Broccoli	52	2,680	80	15,054			3	3,592
Cauliflower	80	1,697	80	5,976	15	6,463	19	8,160
	24 Acres (Aniak)[a] + 2 Acres (Red Devil)[b]							
Potatoes	80	11,040	80	39,840	45	132,882	49	146,166
Carrots	80	5,520	80	15,714	48	69,122	53	75,015
Cabbage	80	5,096	80	19,600	46	61,548	49	66,584
Onions	20	1,960[d]	47	16,660				
Turnips	80	1,975	80	7,410	43	22,725	47	24,700
Rutabagas	80	1,882	80	6,273	50	26,350	53	28,232
Broccoli	80	4,124	80	15,054	15	15,947	18	19,710
Cauliflower	80	1,697	80	5,976	47	20,599	51	22,296

[a] Shipping and handling losses are not included in pounds supplied.
[b] Indicates production from single unit only.
[c] Indicates production from large and small units.
[d] When 2-acre unit is in production, onions are supplied to Red Devil only at market share indicated.

Table 21: Vegetable Products Listed by Consumer Preference[a]

Product	Rank by Products Purchased	Rank by Consumers Preference	Rank by Poundage Produced
Potatoes	1	1	1
Cabbage	4	2	3
Broccoli	5	3	4
Carrots	3	4	2
Onions	2	5	8
Turnips	6	6	6
Rutabagas	—[b]	7	5
Cauliflower	7	8	7

[a] Barker, 1978.
[b] Not available in local stores.

Table 22: 1977 Consumption by Area and Product (lbs)[a]

Area	Potatoes	Carrots	Cabbage	Onions	Turnips	Rutabagas	Broccoli	Cauliflower
Aniak	49,800	24,900	22,410	35,690	9,130	9,130	18,592	7,470
Bethel	291,400	145,650	131,085	208,765	52,915	52,915	108,752	43,695
Red Devil	13,800	6,900	6,210	9,890	2,530	2,530	5,152	2,070
TOTAL	355,000	177,450	159,705	254,345	64,575	64,575	132,496	53,235

[a]Consumption information obtained from the following sources: Swanson's, Native Store, Alaska Commercial, Bethel, Alaska; Kosko's and Alaska Commercial, Aniak, Alaska. Consumption for the Red Devil Area was estimated using population figures.

CHAPTER V

TRANSPORTATION

The mode of transportation used in delivering the produce from the point of production or storage into the hands of the retail outlets will be an important influencing factor not only in scheduling but also in the determination of type of storage crops marketed during the winter months. Aircraft are the main source of transportation in the area. This mode of transportation is the most economically desirable, in terms of expediency, price, and dependability. However, the limitations as well as the benefits of air transport must be realized. The factors to consider in air transportation are temperature, scheduling and area location, load capacity, and transportation cost.

There are very few villages that are not accessible by air. Some of these areas require double handling of the product in transfer from larger to smaller aircraft. This increases the possibility of damage as well as cost. To minimize damage as much as possible, retail outlets must be made aware of delivery schedules and any deviation which may occur. Carriers as well must be aware of the perishability of the product.

Capacity of the different types of prop-type aircraft used within the Kuskokwim valley area varies from 1,000 to 1,400 pounds. Freight is generally carried on a space-available basis. An understanding with the carrier concerning acceptable poundage and packaging must be reached in order to schedule regular deliveries.

Land transportation is available during the winter months from the closer outlying communities and may substitute for air deliveries to a limited extent. This may eliminate some of the handling problems associated with air transportation and provide savings which, hopefully, will be passed on to the consumer. However, if produce is not protected, freezing may induce spoilage and greater damage than transport by air freight.

Because there is a risk of damage to the produce whether it is shipped by air or overland, there must be a clear policy concerning

responsibility for damage. Traditionally, in wholesale operations, when the produce leaves the wholesale outlet it is the responsibility of the purchaser. The wholesaler, however, should accept responsibility if the packaging is found faulty. All freight costs will be paid by the retail outlets and eventually passed on to the consumer. Applicable freight rates are shown in Table 23. The main purpose for calculating these rates is to aid the retailer in establishing a pricing policy and indicate to the producer a possible forward price.

Table 23: Freight Rates Charged by Wien Air Alaska[a]

From	To	Rate/Pound
Aniak	Stony River	$.11
Aniak	Sleetmute	$.10
Aniak[b]	Red Devil	$.07
Aniak	Crooked Creek	$.08
Aniak	Kalskag	$.07
Aniak	Tuluksak	$.14
Aniak	Akiak	$.14
Aniak	Bethel	$.07
Aniak	Nunapitchuk	$.14
Aniak	Napakiak	$.14
Aniak	Napaiskak	$.14
Red Devil[b]	Sleetmute	$.08-.10
Red Devil[b]	Stony River	$.08-.10

[a]Minimum freight rate is $10.50 for Wien Air Alaska and its subcontractors.
[b]Flights from Aniak to Red Devil are scheduled three times a week with additional flights when necessary. Freight rates from Red Devil to Sleetmute and Stony River are estimates received from Wien subcontractors.

CHAPTER VI

PRICING POLICY

The continued operation of any business is dependent upon a return which covers the costs of production. If returns fall below operating cost for several consecutive years and predictions for future years do not indicate a change, the business will, by necessity, shut down. On the other hand, if the returns do exceed operating cost, the excess will be applied to owner cost. If returns cover both owner and operating cost, the business will break even. It is only when returns exceed operating and owner cost that a return on investment will be realized.

With these points in mind, several questions must be considered when establishing a market price:

- Is it possible to establish and receive a market price which will generate a positive cash flow and provide a reasonable return on investment?
- If a return on investment cannot be realized, can the revenue received cover operating costs?
- Can a price be established which will, at least, cover operating cost and stimulate demand for the product to such an extent that the target market share will be realized?
- Can pricing policy be structured in such a way that a savings to the consumer can be realized?

Considering these questions, suggested wholesale prices plus transportation were established for each vegetable crop (Table 24).

The operating cost per pound of produce is reduced as the size of farms increases. The 24-acre farm was used to establish a product cost. The Bethel area, with its large population, several retail outlets with established pricing policies, and an additional transportation cost for produce shipped to these retail outlets was selected for use in establishing wholesale prices for the Kuskokwim River area farms. The Bethel area was also used to suggest prices for retail outlets which will be selling produce from the Kuskokwim River area farms.

Table 24: Pricing Strategy

Product	1 Operating Cost	2[a] Anchorage Wholesale + Transportation @ $.14/lb.	3[b] Present Bethel Retail Selling Price	4[c] Current Bethel Retail Margin (4=3-2)	5 Aniak Price + Transportation @ $.07/lb.	6 Possible Future Retail Price (6=5+4)	7[d] Possible Savings To Bethel (7=3-6)
Potatoes	$.133	$.27	$ .37	$ .10	$.22	$ .32	$.05
Carrots	$.201	$.42	$ .69	$ .27	$.32	$ .59	$.10
Cabbage	$.103	$.39	$ .55	$ .16	$.32	$ .48	$.07
Onions	$.399	$.30	$ .55	$ .25	$.32	$ .57	$.02
Turnips	$.164	$.40	$ .65	$ .25	$.32	$ .57	$.08
Rutabagas	$.136	$.43	$ .65	$ .22	$.32	$ .54	$.11
Broccoli	$.280	$.54	$1.89	$1.35	$.47	$1.82	$.07
Cauliflower	$.219	$.64	$1.79	$1.15	$.57	$1.72	$.07
Tomatoes	$.936	$.83	$1.89	$1.06	$.95[e]		

[a] Wholesale prices and transportation as of March, 1978.
[b] Retail selling price observed in Bethel in January, 1978, Swanson's, Native Store, and Alaska Commercial average.
[c] Determined by local retailer as mark-ups over operating costs.
[d] Local Aniak consumers will have a possible advantage in retail price of approximately $.07/lb.
[e] No transportation included since production capacity will supply only neighboring markets.

Table 25: Cost of Production of Vegetable Crops ($/lb)

Product	2 Acres			6 Acres			12 Acres			24 Acres		
	Operating Cost[a]	Owner Cost	Total Cost	Operating Cost	Owner Cost	Total Cost	Operating Cost	Owner Cost	Total Cost	Operating Cost	Owner Cost	Total Cost
Potatoes	.498	.139	.637	.346	.067	.413	.243	.050	.293	.133	.044	.177
Carrots	.713	.155	.868	.495	.075	.570	.348	.056	.404	.201	.049	.250
Cabbage	.334	.078	.412	.232	.038	.270	.163	.028	.191	.103	.025	.128
Onions	1.302	.312	1.614	.905	.152	1.057	.636	.112	.748	.399	.099	.498
Turnips	.490	.124	.614	.340	.060	.400	.239	.045	.284	.164	.039	.203
Rutabagas	.384	.098	.482	.267	.047	.314	.188	.035	.223	.136	.031	.167
Broccoli	1.135	.244	1.379	.789	.119	.908	.555	.088	.643	.280	.078	.357
Cauliflower	.861	.217	1.078	.598	.105	.703	.420	.078	.498	.219	.191	.410
Tomatoes[b]			1.830			1.460			1.170			.936

[a]Operating cost includes both production and marketing.
[b]Cost of tomatoes was determined using actual production, operating, and marketing costs and owner costs for 1/2 the greenhouse structure and equipment.

ESTABLISHING PRODUCT COSTS

Costs for producing each of the field vegetable types were determined by assuming all inputs would be similar except fertilizers, seeds, market packaging, storage, and labor associated with non automated procedures. The costs of these various inputs were added to the remaining base cost to obtain an operating cost of production for each vegetable type. This cost was then added to the owner cost to obtain a total production cost shown in Table 25. It was assumed that the same percentage of owner cost would be assigned to all vegetable types.

It should be noted that depreciation, a noncash cost, makes up approximately 85% of the owner cost. An average investment cost which assumes a five-year loan at 7% interest for equipment and building purchases makes up approximately 14% of owner costs. If purchases are made without assuming a loan, this cost would be eliminated. The owner cash cost remaining would be the land lease which was charged at the rate of $16.67 per acre ($100 per 6 acres). Therefore, if noncash costs (depreciation) are not considered and no loans are assumed, the owner cost would be approximately 1% of that shown in Table 25.

Suggested Wholesale Prices

Wholesale prices for Kuskokwim River produce were established using 1977 average Anchorage wholesale prices as baseline data. Anchorage wholesale prices and suggested prices f.o.b. Aniak are shown in Table 26. If the production costs are assumed to be cash

Table 26: Anchorage Wholesale Prices and Suggested Wholesale Prices F.O.B. Aniak ($/lb)

Product	Aniak	Anchorage
Potatoes	$.15	$.13
Carrots	$.25	$.28
Cabbage	$.25	$.25
Onions	$.25	$.16
Turnips	$.25	$.26
Rutabagas	$.25	$.29
Broccoli	$.40	$.40
Cauliflower	$.50	$.50
Tomatoes	$.95	$.69

Table 27: Expected Gross Sales and Returns for a 24-Acre Farm

Product	Suggested Selling Price ($)	Marketable Produce (lbs.)	Expected Gross Sales ($)
Potatoes	$.15	183,763	$ 27,564
Carrots	$.25	90,356	22,589
Cabbage	$.25	86,244	21,561
Onions	$.25	16,660	4,166
Turnips	$.25	32,110	8,027
Rutabagas	$.25	34,505	8,626
Broccoli	$.40	35,125	14,050
Cauliflower	$.50	28,272	14,136
			$120,719
Tomatoes	$.95	2,646	2,514
			$123,233
Less operating cost			86,988
Return			$ 36,245

costs only and purchases of equipment and buildings do not necessitate loans, the suggested Aniak prices result in a 14% return on investment. Table 27 shows the return which could be expected from a 24-acre farm using the suggested wholesale prices f.o.b. Aniak.

It is of interest to determine if the suggested Aniak wholesale price would result in a savings to the consumer. To make this determination, it was assumed that the Bethel merchants who would be handling Kuskokwim River produce would maintain the mark-ups over wholesale cost plus freight which are now being used for Anchorage produce. Table 24 illustrates Bethel retail prices, retail margins, suggested future retail prices and possible savings to consumers.

CHANGES IN EXPECTED REVENUES

There are two major changes which could alter the expected gross revenue. The onion crop may be eliminated, and a 2-acre farm in the Red Devil area could be producing vegetables at the same time a 24-acre farm in the Aniak area were in production.

Onion production costs are high because of the small acreage allotted to production of this crop. If, due to storage and product maturity limitations, onion production does not prove feasible, it is suggested that the area allotted for onion production be switched to broccoli. This would increase the return by approximately $5,274 for a total of $41,519.

Table 28: Red Devil Area Suggested Wholesale Prices and Expected Returns for 2 Acres, 24 Acres, and 2 Plus 24 Acres

Product	Suggested Wholesale Price[a] ($/lb)	Marketable Produce (lb)	Expected Returns
Potatoes	.23	13,284	$ 3,055
Carrots	.33	5,893	1,945
Cabbage	.33	5,096	1,682
Onions	.33	1,960	647
Turnips	.33	1,975	652
Rutabagas	.33	1,882	621
Broccoli	.48	3,763	1,806
Cauliflower	.58	1,697	948
Total Sales for 2 Acres			$11,356
Production Cost for 2 Acres			25,302
Returns for 2 Acres			($13,946)
Returns for 24 Acres			36,245
Returns for 2 plus 24 Acres			$22,299

[a]Suggested wholesale price is the Aniak wholesale price plus freight at $.08 per pound.

If the 2-acre farm in the Red Devil area is operated in conjunction with the 24-acre farm in the Aniak area and vegetables are sold in the Red Devil area at Aniak wholesale price plus transportation ($.08 per pound), the gross revenue for the combined operation will be reduced (see Table 28). As indicated in Table 25, production costs on the 2-acre plot exceed the anticipated wholesale price received in Aniak for all vegetable types.

Although the returns from a combined operation are lower than those from the 24-acre unit, there is justification for the 2-acre farm in the Red Devil area. Transportation services to this up-river community are such that high losses of produce may be sustained in shipment from Aniak. This physical limitation is considered adequate reason for producing and storing vegetables in Red Devil. If the 2-acre farm is regarded as the beginning phase of a development of larger acreage in the Red Devil area, this would also provide a justification for sustaining lower returns to the combined operation during the development years.

CHAPTER VII

FINAL THOUGHTS AND SUGGESTED DEVELOPMENT APPROACH

This evaluation of the agricultural development of the middle Kuskokwim River valley has been concerned with field production of vegetable crops on medium-sized truck farms. The objective of the study was to provide as many answers as possible to questions concerning cost of producing vegetables; location and size of farms; location, type, and size of storage facilities; products preferred by consumers; size and extent of the market; transportation of produce; and pricing and marketing policy. The final question: Will the market price established be such that a reasonable market share can be captured and a positive cash flow and reasonable return on investment be realized?

The following answers are derived from an analysis of data collected in the Kuskokwim area, from other regions of Alaska applicable to the Kuskokwim valley, and from the conterminous 48 states which apply to farm size, labor availability, and production practices.

FINAL THOUGHTS

As can be seen from Table 29, the costs of production decrease as farm size and automation level increase. Using this information, crop production information, 1977 population distribution in the Kuskokwim River valley, and schedules and routes of air carriers, the most favorable locations for vegetable farms were termed to be in the Aniak and the Red Devil areas. The Aniak farm could be expanded to 24 acres while the Red Devil area farm would best be limited to 2 acres. The Red Devil area farm should be regarded as the beginning of a vegetable production development program for the upper Kuskokwim River region. Therefore, the lower returns realized by operating the 2- and 24-acre farms will be sustained only over the development period.

Table 29: Cost of Producing Crops ($/lb)

Crop	2 Acres	6 Acres	12 Acres	24 Acres
Potatoes	.50	.35	.24	.13
Carrots	.71	.50	.35	.20
Cabbage	.33	.23	.16	.10
Onions	1.30	.91	.64	.40
Turnips	.49	.34	.24	.16
Rutabagas	.38	.27	.19	.14
Broccoli	1.14	.79	.56	.28
Cauliflower	.86	.60	.42	.22
Tomatoes	1.83	1.46	1.17	.94

Storage facilities will be needed for potatoes, carrots, cabbage, onions, rutabagas, and turnips. Because much of the Kuskokwim area is on a flood plain, above-ground storage is recommended. Storage would be in the form of 20 x 20-foot module units, each with a capacity of 50 tons. The storage units should be located at the sites of vegetable production with a 200-ton (4-unit) capacity at Aniak and a 50-ton (1-unit) capacity in the Red Devil area.

The marketing area for the Kuskokwim region extends along the Kuskokwim River from Stony River to Bethel and surrounding communities. Geographic location, population distribution, and transportation routes serve to divide the area into three distinct marketing units: the Aniak area, the Bethel area, and the Red Devil area. It was assumed that Kuskokwim River produce sold through retail outlets would capture only a part of the market in each area. The Bethel area could be supplied at a rate of 44% by weight of the produce now imported. Both the Aniak and Red Devil areas, on the other hand, could be supplied up to 80% by weight. Some vegetable varieties which cannot be produced in these two areas would still be imported.

Consumers in the Kuskokwim region showed distinct product preferences, which however, varied from those actually purchased. The lack of good-quality produce of various types in local markets was given as the major reason for this discrepancy. With a reasonable size truck farm in the area, the available produce should come closer to satisfying the demands of the consumer in terms of preference as well as quality.

Aircraft are the main source of transportation in the Kuskokwim basin. All but five villages have airstrips accessible by either regularly scheduled commercial air service or by small, private carriers operating on a demand basis. Because of existing scheduled service, air trans-

port is most appropriate for delivery of produce. In addition, losses due to spoilage or damage would undoubtedly be less than if some other form of carrier were used.

Production from the Aniak and Red Devil farms can be most effectively handled through a wholesale outlet. Local truck farms could provide a steady flow of high-quality, selected products to area retailers through 8 months of the year. A transportation cost advantage could be realized through purchases from a local wholesaler. The 24-acre truck farm can be used to supply retailers at wholesale prices comparable to Anchorage wholesale price. Production costs for the 24-acre farm, suggested prices f.o.b. Aniak, and 1977 Anchorage wholesale prices are shown in Table 30.

If retail stores maintain their present mark-up over Anchorage wholesale prices plus freight when pricing Kuskokwim River produce, consumers should realize a slight benefit in lower market price. Therefore, a reasonable market share should be attained by Kuskokwim River producers. At the wholesale prices suggested, a return to investment of approximately 14% can be anticipated. Assuming that a schedule of closing of accounts receivable from produce marketed is maintained, farms and the wholesale outlet should operate with a positive cash flow.

The assumption is made that the goal when entering the vegetable-production industry is to attain the largest appropriate production area as rapidly as possible. It is cautioned that a grower-manager, new to the area, will need time to gain experience, that new lands must be brought into production, and that there will be a period during which soil conditions will not be stable. Expansion of production should not be so rapid that quality of the produce is sacrificed or that the marketing system and marketing experience is over-extended.

SUGGESTED DEVELOPMENT APPROACH

It has been shown by the estimates made in this report that production and marketing of vegetable crops is economically feasible in the Kuskokwim River basin. Although other industries unrelated to agriculture may also be feasible, this discussion will be limited to those alternatives which are within the agricultural category.

Development of the agricultural potential of the Kuskokwim region would have a large impact on land use and on the current lifestyle of area residents. Because land use and lifestyle are very important factors in planning development alternatives, those alternatives

Table 30: Suggested Wholesale Price

Crop	Production Cost 2 Acres Red Devil	Production Cost 24 Acres Aniak	Wholesale Price F.O.B. Aniak	Wholesale Price F.O.B. Red Devil	Wholesale Price F.O.B. Anchorage
Potatoes	$ .50	$.13	$.15	$ .23	$.13
Carrots	$ .71	$.20	$.25	$ .33	$.28
Cabbage	$ .33	$.10	$.25	$ .33	$.25
Onions	$1.30	$.40	$.25	$ .33	$.16
Turnips	$ .49	$.16	$.25	$ .33	$.26
Rutabagas	$ .38	$.14	$.25	$ .33	$.29
Broccoli	$1.14	$.28	$.40	$ .48	$.40
Cauliflower	$ .86	$.22	$.50	$ .58	$.50
Tomatoes	$1.83	$.94	$.95	$1.83	$.69

having the greatest impact on these factors must be carefully evaluated. The agricultural alternatives considered here are large-scale vegetable production, controlled-environment crop production, grain and forage production, and livestock enterprises.

Large-Scale Vegetable Production

The 24-acre production area detailed in this report is a diversified operation which is centrally located and relies on existing transportation corridors. Expansion into larger areas would imply the use of truck farms which specialize in one or two crops. There would be a need for a more complex agribusiness infrastructure including equipment service centers, storage facilities, a wholesale marketing agency, and a labor pool. The crops produced would be directed toward specific markets, a large portion of which would be outside the Kuskokwim River basin. Therefore, except for high value, perishable vegetable products, modes of transport other than air freight would have to be utilized.

Based on these premises, a large-scale vegetable production operation would require the development of service centers in urban areas with farming operations in close proximity. In the Kuskokwim area, these would in all probability be located in Bethel and Aniak with farming development up-river from Aniak. Entry to markets outside the Kuskokwim area for specific vegetable crops would be necessary. Immediate market expansion would most likely be to Holy Cross and St. Mary's which would present a diversified market. However, the Seward Peninsula, the McGrath-Galena area, and the Anchorage area would be possible outlets for field lettuce, broccoli, cauliflower, and potatoes. Additional transportation corridors including surface routes would have to be utilized. Potatoes in large quantities should be transported by surface carriers. Broccoli and cauliflower, although higher-value crops, could also be carried by surface transportation. Lettuce, a high-value, perishable crop could be transported on existing air carriers.

Controlled-Environment Crop Production

The controlled-environment crop-production industry includes greenhouses ranging from simple polyethylene-covered frame houses to heated and supplementally lighted houses. Also included are totally controlled environments using no sunlight and controlled air

quality. Produced in these environments are generally high-value crops such as salad vegetables, flowers, and bedding plants. The infrastructure requirements for the industry include scheduled transportation services for perishable products, storage facilities emphasizing controlled cooling, and provision of power at rates comparable to or less than average rates in Alaskan urban communities. Off-peak lighting would be a potential where rates are substantially higher than feasible for operation around the clock.

The greenhouses discussed in this report are primarily used for seedling production. A tomato crop is recommended for production to utilize the available greenhouse space after the bedding plant season and to provide a high-quality product to local buyers. The facilities are not of a size which would allow production of tomatoes at a cost low enough to provide a positive margin over operating cost. It has been shown, however, that facilities approaching an acre in size can operate with a positive return over total cost of production of a tomato crop (Lewis and Thomas, 1977). The market in the Kuskokwim River basin could support an operation of this size producing largely tomatoes, with a minimal crop mix of cucumbers and peppers. The facility suggested for use is a double-wall, polyethylene-covered wood- or tubular steel-frame structure. Heating would have to be provided to extend the growing season to five to eight months. In addition, cooling facilities which could maintain temperatures near 50°F would be necessary for crop storage (Dinkel, 1978). In combination with the greenhouse, field lettuce could be grown. This crop would utilize the same storage and transportation facilities. The existing air-freight service is considered adequate for the system outlined.

If expansion beyond a one-acre, greenhouse-field lettuce operation is considered, the infrastructure requirements would include the development of service centers which would be similar to and located in the same areas as those for the large-scale truck farms. Markets outside the area would be necessary for salad crops. These would undoubtedly differ little from those for large-scale truck farms. A heavy emphasis on regular transportation schedules for perishable products is an important requirement as is available power at commercial rates if any form of lighting is to be used in production of the crops.

Grain and Forage Production

Historically, grain and forage production have been considered either as large-scale units producing in an area large enough to make processing, storage, and marketing of the product an economically feasible operation (Lewis and Wooding, 1978; Thomas and Carney, 1978) or, smaller units producing grain and forage for a livestock industry which is located with a reasonable proximity to this feed base (Burton, 1971). In terms of land availability, either type of production is conceivable in the Kuskokwim River drainage. However, before such development can begin, the required support services must be considered.

Projections have been made for utilizing land blocks up to 2.3 million acres in the Yukon-Porcupine region (Lewis, Thomas, and Wooding, 1978). The product is intended largely for export to the Pacific Rim countries. The Yukon-Porcupine report summarizes the necessary support services, including: a road system connecting producers to country and terminal elevators, grain elevators, and dryers for processing and storage; power service for farmsteads; service support for machinery sales and service; and a transport system to bring the processed grain to tidewater.

The Kuskokwim region, with a deepwater port at Bethel could provide ready access to tidewater. Not as much land is available as in the Yukon-Porcupine flats. However, it is estimated that 50,000 acres in dryland grain production is a sufficient land mass to produce marketable quantities of grain for export once a marketing system is in place (Lewis and Wooding, 1978). Although markets are available for Alaskan grain, it is doubtful that market prices balanced against production and transportation costs will attract investors to remote areas which do not have existing transportation corridors to tidewater ports (Thomas and Carney, 1978).

Grains and forage produced for local consumption as feed or as food may be a viable enterprise for the Kuskokwim basin. Production costs for grains on 200 and 800 acres in remote areas have been calculated and the operations would seem viable when the costs are compared to prices of imported feed (Lewis, Thomas, and Wooding, 1978). The Stony River area of the upper Kuskokwim could provide up to 10,000 acres which could be used for small-grain and forage production. The Kuskokwim River provides a natural transport system to all points including Bethel. Markets for the grain and

forage would certainly include any livestock producers. However, the market for food barley should not be ignored.

Before a venture of this type is considered, it must be realized that grain-drying and holding facilities will be needed; barley-pearling, rolling, or grinding equipment will be required for the food barley market; and forage-handling equipment and storage should be available. With these realizations, the grain and forage production industry may be a viable venture for consideration in the near future.

Livestock Enterprises

No attempt has been made to evaluate thoroughly the potential for livestock production in the Kuskokwim basin. Burton (1971) discusses livestock production in southwestern Alaska and presents 1967 cost data. However, this information applies only to Kodiak, Kenai, and the Aleutian chain. More relevant, perhaps, is the interest shown by the Kuskokwim Native Association for development of the Stony River area as an area for livestock production. Historical information indicates that hogs were the most successful as a meat animal in the area. Cattle were raised, but overwintering was a problem. In recent years, a community of homesteaders has also been successful with small numbers of poultry. There is an indication that a heavier reliance on imported meat products will be a trend in the future. Therefore, a local source of these products would be an advantage to area residents both in price and fresh quality.

Although there is no quantitative data available concerning animal-carrying capacity of the range in the Stony River area, animal production (hogs, cattle, sheep and goats) using this range in combination with locally produced grains and forage may be a success. Indications are that a major factor in the success of a meat production venture would be the availability of a good quality feed during the winter months. This could be provided if adequate drying and storage facilities are available.

The question of processing for a meat industry will not be addressed here except to mention that economies of scale do not indicate the viability of a full-scale processing plant in the near future. However, the sale of live animals would be within state of Alaska meat-processing requirements, and a custom-exempt slaughter facility in which purchaser owned animals are slaughtered without inspection

could be used. The minimal facilities used require Division of Agriculture approval and products must be labeled "not for sale."

Indications are that agriculture will play a major role in the development scenario of the Kuskokwim River valley. If development takes place in an haphazard manner, the impact may not be positive. The considerations for the future presented here certainly do not encompass the entire spectrum of possible enterprises. On the other hand, a diversified agribusiness economy can be begun with orderly development of the four enterprises discussed.

A suggested sequence of events might be to begin with a controlled-environment crop production center consisting of a one-acre greenhouse area complementing the medium-size truck farm outlined in this study. A natural second step would then be expansion to large-scale, specialty truck farms and the opening of new market areas. Livestock and grain could be developed conjunctively, but on a small scale to evaluate the quality of production as well as to build management expertise. As agricultural production increases, transportation corridors may expand and diversify, opening the door to large-scale grain production or further expansion of vegetable and larger crop and livestock enterprises.

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APPENDIX A

EQUIPMENT REQUIREMENTS AND ANNUAL OWNER COSTS

Table A.1: Large Equipment Requirements

	2 Acres	6 Acres	12 Acres	24 Acres	Price fob Aniak	Weight (lbs)	Replacement Frequency[a]
Tractor Unit	15 HP-4WD				$3,580.64	1,179	10 years
		25-30 HP	25-30 HP		5,000.00	2,000	10 years
				47-50 HP	9,971.00	4,200	10 years
Moldboard Plow	1 bottom				265.00	400	12 years
		2 bottom	2 bottom		395.00	600	12 years
				3 bottom	1,128.00	800	12 years
Meeker Harrow	4 foot				453.00	275	15 years[b]
		5 foot	5 foot		502.64	200	15 years[b]
				6 foot	535.60	325	15 years[b]
Disk Harrow	5 ft tandom	5 ft tandom	5 ft tandom		659.44	360	10 years
				7 ft gang	1,547.88	970	10 years
Cultipacker	6 foot	6 foot	6 foot		622.17	592	15 years
				8 foot	792.17	743	15 years
Planter w/fertilizer & herbicide attachment		2 row	2 row		1,308.00	250	8-14 years
				4 row	2,616.00	500	8-14 years
Planter w/fertilizer applicator	1 row				193.55	200	8-14 years
Spring Shank Cultivator w/shovels, S-shanks	5 foot	5 foot	5 foot		290.00	200	12 years
Tool Bar				8 foot	312.41	276	12 years
Spikes, Shovels, Shanks				6 each	216.00	100	8 years
Spin Spreader	5 bushel				194.85	150	8 years
		8.3 bushel	8.3 bushel		485.28	169	8 years
				11.3 bushel	841.20	270	8 years

Sprayer, PTO, 2 wheel		20' boom	20' boom	20' boom	1,546.66	500	10 years
Wagon		4T	4T	4T	737.00	200	12 years
Rototiller	32 inch				1,107.60	485	12 years
		40 inch	40 inch		1,865.48	628	12 years
				50 inch	2,899.00	1,000	12 years
Transplanter	1 row				587.60	400	15 years[c]
		2 row	2 row	2 row	1,883.00	800	15 years[c]
Potato Digger	1 row	1 row			400.00	500	12 years
			2 row	2 row	2,740.00	1,500	12 years[d/e]

[a]Equipment replacement frequency from 1960-1979 averages from summaries of various experiment station studies. There is some indication from interior Alaska producers that equipment may be replaced at more frequent intervals. Reference: James, Sydney, G. and
[b]Everett Stoneberg. 1974. Farm accounting and business analysis. Iowa State University Press, Ames, pp. 20-21.
[c]Manufacturers estimate. 1978. W. W. Manufacturing Company, 60 Rosenhayn Avenue, Bridgeton, New Jersey.
[d]Manufacturers estimate. 1978. A. H. Hummert Seed Company, 2746 Chauteau Avenue, St. Louis, Missouri.
[e]Manufacturers estimate. 1978. Lockwood Corporation, Box 160, Gering, Nebraska.
The two row potato digger is scheduled for beginning production by Lockwood Corporation in the summer of 1978.

Table A.2: Small Equipment, Tools and Annual Supplies

	2 Acres	6 Acres	12 Acres	24 Acres	Price ea.[a]	Weight[b]
FIELD EQUIPMENT & SUPPLIES						
Small Equipment						
Water-light Meter	1	1	1	1	24.26	2
pH Meter	1	1	1	1	18.25	2
Soil Test Kit	1	1	1	1	47.32	2
4 gal. Sprayer	2	–	–	–	42.22	12
Wheelbarrow	2	2	3	4	79.94	65
Converti-Truck	2	4	6	8	72.04	46
Small Tools (replaced 1/4 per year)						
Spade	3	–	–	–	33.47	7
Transplanting Spade	3	2	2	2	17.91	7
Scoop Shovel	2	4	4	4	20.94	5
Shovel	2	2	2	2	18.80	5
Planting Bar	2	–	–	–	15.10	8
Five Prong Cultivator	2	4	4	4	12.90	3
Spading Fork	3	–	–	–	14.30	5
Scoop Fork	2	–	–	–	32.66	7
Nurseryman's Hoe	2	4	4	4	9.12	3
Convex Hoe	2	4	4	4	9.39	2
Wood Grading Rake	2	–	–	–	7.39	3
Straight Head Rake	2	–	–	–	11.66	4
Cape Cod Weeder	3	–	–	–	2.94	1
Weed Hook	2	–	–	–	5.41	2
12 qt. Sprinkling Can	3	–	–	–	11.07	4
Wooden Crates	10	30	60	80	12.64	4
Vegetable Crates	10	30	60	80	12.64	4
Utility Cans–20 gal.	2	3	6	8	26.78	5
Propagating Knife	3	6	8	8	8.08	1
Annual Supplies						
10 lb. Ball Twine	1	4	4	8	17.56	10
Packing Boxes	40	120	240	480	1.88	1/2
Pot Stakes–12"	2–500 ct	4–500 ct	4–500 ct	6–500 ct	22.53	5
Marking Pencils	2–12 ct	2–12 ct	2–12 ct	3–12 ct	6.64	1
Plant Tie Ribbon	1–300 ft	3–300 ft	6–300 ft	12–300 ft	1.55	1

GREENHOUSE EQUIPMENT & SUPPLIES

Small Equipment						
12 qt. Sprinkling Can	2	3	3	3	11.87	4
Utility Cans—20 gal.	2	3	3	6	26.78	5
4 gal. Sprayer	2	3	3	3	42.22	12
4½ ft^3 Utility Cart	1	2	2	4	84.88	70
Max-min Thermometer	2	4	6	12	17.44	1
Soil Thermometer	2	4	6	12	8.51	1
4 $yd.^3$ Soil Sterilizer	1	1	1	1	552.60	150
Small Tools (replaced 1/4 per year)						
5" x 8" Containers	12—100 ct	35—100 ct	70—100 ct	140—100 ct	28.81	28
Flats	2—100 ct	5—100 ct	12—100 ct	24—100 ct	44.21	40
Hose Nozzles	2	3	3	3	11.30	2
5" Plastic Pots	2—25 ct	2—25 ct	6—25 ct	12—25 ct	12.62	2
5 gal. Pots	2—20 ct	4—20 ct	8—20 ct	15—20 ct	16.01	14
Florist Trowel	2	3	3	6	6.44	1
Narrow Trowel	2	3	3	6	2.08	1
Hand Cultivator	3	4	4	8	2.85	1
Asparagus Knife	2	3	3	6	3.90	1
Weed Hook	2	3	3	6	5.25	1
Annual Supplies						
Pot Stakes—6"	2—100 ct	4—100 ct	8—100 ct	16—100 ct	13.44	1
Marking Pencils	1—12 ct	1—12 ct	1—12 ct	1—12 cut	6.64	1
Propagating Knife	2	4	4	4	8.08	1
Vermiculite	6 2-½ ft^3	20 2-½ ft^3	40 2-½ ft^3	80 2-½ ft^3	6.95	5
Plant Tie Ribbon	1	1	2	4	1.55	1
Wire—18 yd. roll	1	1	1	1	13.44	12
10 lb. Ball Twine	1	1	2	4	17.56	10
Packing Boxes	10	30	60	120	1.88	1/2

[a]F.o.B. Aniak; [b]in pounds.

APPENDIX B

DETAILS AND MATERIALS LISTS FOR ALL BUILDINGS, IRRIGATION SYSTEM, AND FENCING

BUILDINGS

Three types of structure are included in the truck farming enterprise. For each, lumber was assumed to be available from local sources in commercial cut lengths and sizes. Labor used for construction was capitalized and charged at $7.00 per hour.

Greenhouses

The greenhouses are primarily used for seedling production. The space required for seedlings was used to determine the house size. Two basic units have been used, a 10' x 12' house and a 12' x 20' house. The seedlings are grown on removable shelves, three high at the sides, back and center of the houses. The tomato crop is grown in pots in the available space after the shelves are removed. The houses are wood frame with a double wall, 6 mil polyethylene covering which is replaced every year. The tomato crop is irrigated and fertilized with a Gewa injector through a Chapin spaghetti tube system.* Seedlings are cared for with the Gewa and hand sprayers. Greenhouse space, materials required and prices are shown in Table B.1

Machine Storage

Table B.2 shows the materials list and prices for the machinery storage. Storage for machinery and equipment will be necessary during the winter months. There is no necessity for heating or flooring. The structure is wood frame with galvanized sheet metal covering. No insulation is used.

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*E.C. Geiger, Box 285, Harley, Pennsylvania, 1977 Catalogue, pp. 14-21, 76.

Table B.1: Greenhouse Sizes, Materials List and Materials Price[a]

	2 Acres		6 Acres		12 Acres		24 Acres	
	House Size							
	1-10'x12'		1-10'x12', 1-12'x20' or 3-10'x12'		3-12'x20'		6-12'x20'	
2"x4" Lumber	1,132'	$ 402.99	3,049'	$1,085.44	5,751'	$2,047.36	11,502'	$4,094.71
2"x2" Lumber	44'	11.00	104'	28.48	210'	33.00	240'	66.00
Hardware	angles, nails louvred door poly, tacks & tape	104.64		164.10		194.05		388.09
Bench Fabric[b]	200'	150.87	300'	440.32	300'	454.72	400'	909.43
Polycovering[c]	12'x100'	31.18	12'x200'	62.36	20'x500'	155.90	20'x900'	280.62
Labor[d]	2 man wks.	700.00	3 man wks.	1,050.00	4 man wks.	1,400.00	7 man wks.	2,450.00
TOTAL		$1,400.68		$2,830.70		$4,285.03		$8,188.85

[a] Greenhouse designs were adapted from: Reichhold, Reinforced Plastics Division. 1977. Make it easy. P.O. Box 81110, Cleveland, Ohio; Epps, Alan C. and Axel R. Carlson. 1973. Greenhouses in Alaska. Cooperative Extension Service, University of Alaska, Fairbanks, Publication No. 51.

[b] Bench fabric for covering of seedling benches is 1"x1", 14 gauge wire.

[c] Polycovering for initial construction is included in the capital cost. In succeeding years it is considered an expense.

[d] Labor includes installation of the irrigation-fertilization system.

Table B.2: Machinery Storage Materials List and Materials Price

Supplies	2 & 6 Acres (12'x20')		12 & 24 Acres (24'x20')	
2"x4" Lumber	916'	$ 326.10	926'	$ 329.66
4"x6" Cribbing	64'	45.57	88'	62.66
Galvanized Sheet	28 sheets	389.76	33 sheets	475.20
Hardware	misc.	31.75		40.28
Roofing	20'	17.98	20'	26.17
Labor	1½ man weeks	525.00	2½ man weeks	875.00
TOTAL		$1,336.16		$1,807.97

Vegetable Storage*

Because most of the Kuskokwim River area is a flood plain, aboveground storage for potatoes, carrots, cabbage, turnips, rutabagas and onions is necessary. A storage building 20' x 20' in size will store 50 ton of vegetables, the approximate tonnage available from a 2-acre area. The 20' x 20' modules can be added as the fields are expanded to reach a 200-ton (four unit) capacity for the 24 acre farm. It is necessary to maintain temperatures between 32°F and 38°F in the storage units. Therefore, minimal heating will be required. To minimize heat loss, the roof, walls and floor contain 6 inches of insulation. Bins are provided for vegetable storage to hold the produce away from the walls and floors. Ventilation is provided in the floors and roof to maintain continuous air circulation. With these additions, required temperatures can be maintained with no more than 5,000 to 10,000 BTU heating capacity. The materials list and prices for the vegetable storage units for each farm size are given in Table B.3.

IRRIGATION

A minimal irrigation system has been provided. The system uses river water pumped to the field location through polyvinyl-chloride (PVC) flexible pipe. Pumps have been provided with appropriate screens for river water sediment. Water is supplied to the field through a PVC mainline and Chapin twin-wall, drip-irrigation hose feeders.**

*Preliminary design, materials list and labor estimates: Axel R. Carlson, Agricultural Engineer, Cooperative Extension Service, University of Alaska, Fairbanks, Alaska.

**A. H. Hummert Seed Company, St. Louis, Missouri, 1978 catalogue, pp. 72, 90-93.

APPENDIX B

Table B.3: Vegetable Storage Units Materials List and Materials Price

Supplies	50T, 20'x20' Unit	
Lumber		$2,246.36
2"x4"	1,168'	
2"x6"	300'	
1"x8"	1,200'	
2"x2"	2,400'	
8"x8"	80'	
Insulation[a]	1,340'–54 rolls	1,098.00
Vapor Barrier	20'100'–6 mil	64.30
Roofing	20 2'x12' galvanized	185.00
Hardware	miscellaneous	300.00
Labor	4 man weeks	1,120.00
TOTAL		$5,014.26

[a]Commercial insulation can be replaced with sawdust available from local lumber mills. This will reduce cost by $1,098.00.

The system is designed to apply a uniform water supply adjacent to the plants at soil level. The feeder tubes and pumps can either be left in the field or removed during winter months. Supplies, particularly pump requirements will vary with the proximity of the field to a water source. Estimates of supplies and prices are shown in Table B.4.

FENCING

Fencing has been provided for all field units. It is anticipated that some degree of control will be needed for animals in the area. All fencing is welded wire, 2" x 4" mesh, 6' height. Fence posts are 4" x 4", wood from local suppliers, creosoted for protection. Gates are 20' width to allow easy access with equipment. Supplies needed and price lists are given in Table B.5.

Table B.4: Materials and Prices for Fencing

Supplies	2 Acres		6 Acres		12 Acres		24 Acres	
Fencing	1,254'	$ 382.20	2,090'	$ 709.02	3,344'	$1,145.34	4,598'	$1,527.12
8' Posts	118	336.06	209	595.23	336	956.93	460	1,310.00
20' Posts	2	82.59	2	82.59	3	123.88	4	427.20
Creosote	6 gal.	34.01	11 gal.	60.84	18 gal.	98.33	24 gal.	133.50
Equipment	misc. hardware	50.00		75.00		100.00		100.00
Labor	¾ man weeks	262.50	1 man weeks	357.00	1½ man weeks	525.00	2 man weeks	800.00
TOTAL		$1,147.36		$1,872.68		$2,949.48		$3,497.92

Table B.5: Materials and Prices for Irrigation Systems

Supplies	2 Acres		6 Acres		12 Acres		24 Acres	
Pump	1-3 Hp	$150.00	1-5 Hp	$ 250.00	2-5 Hp	$ 500.00	4-5 Hp	$1,000.00
Mainline–PVC	250'	286.01	400'	457.62	800'	915.24	1,600'	1,830.48
Twinwall Hose	10,000'	427.50	30,000'	1,282.50	60,000'	2,565.00	120,000'	5,130.00
Supplies	misc.	25.00		75.00		150.00		300.00
TOTAL		$888.51		$2,065.12		$4,130.24		$8,260.48

APPENDIX C

CASH FLOW—ALL UNITS

Table C.1a: Cash Flow—2 Acres, Production*

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
PRODUCTION													
OPERATING COST													
Seedling Production													
Seeds	11		11										
Fertilizer	4		4										
Small tools[a]	164		164										
Annual supplies	58		58										
Labor[b]	860			215	430	215							
Equipment													
Fuel and oil	138			69			69						
Repairs & maint.[c]	532			100							432		
Planting, Crop Care													
Labor[b]: field	13,352			280	1,204	1,634	5,117	5,117					
greenhouse	1,075						215	215	215	215	215		
Seeds	309		309										
Fertilizer	700		700										
Herbicide	10		10										
Small tools[a]	93			93									
Annual supplies	51		16	35									
Harvest													
Small tools	63					63							
Labor[b]	5,397								2,559	1,634	1,204		
Annual supplies	76					76							
Miscellaneous													
Small tools[a]	47			47									
Repair parts	100									100			
Total	23,040	–	1,272	839	1,634	1,988	5,401	5,332	2,774	1,949	1,851	–	–
OWNER COST													
Equipment													
Field	432			144			144			144			
Greenhouse	54			18			18			18			
Buildings													
Field	57			19			19			19			
Greenhouse	57			19			19			19			
Land Lease	30			10			10			10			
Irrigation	36			12			12			12			
Total	666			222			222			222			
TOTAL PROD. COST	23,706	–	1,272	1,061	1,634	1,988	5,623	5,332	2,774	2,171	1,851	–	–

Table C.1b: Cash Flow—2 Acres, Production

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
MARKETING													
OPERATING COST													
Labor[d]	1,800	200	200	200				200	200	200	200	200	200
Materials	283							283					
Storage													
Fuel	80	20	20									20	20
Repairs	100				50				50				
Total	2,263	220	220	200	50	–	–	483	250	200	200	220	220
OWNER COST													
Buildings	210			70			70			70			
Total	210			70			70			70			
TOTAL MARK. COST	2,473	220	220	270	50	–	70	483	250	270	200	220	220
TOTAL COSTS	26,179	220	1,492	1,331	1,684	1,988	5,693	5,815	3,024	2,441	2,051	220	220

[a]
[b]Small tool cost is 1/4 the total cost.
[c]Full-time labor @ $5.00/hr. for 4 months; field boss @ $7.00/hr. for 7 months.
[d]Includes parts used, grease and oil only.
Marketing agent.

*All entries for all cash-flow tables have been rounded to the nearest dollar. Therefore slight differences in totals on Tables 14 through 17 may have occurred.

Table C.2a: Cash Flow—6 Acres, Production*

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
PRODUCTION													
OPERATING COST													
Seedling Production													
Seeds	76		76										
Fertilizer	13		13										
Small tools[a]	401		401										
Annual supplies	312		312										
Labor[b]	1,720			430	860	430							
Equipment													
Fuel and oil	376		188				188						
Repairs & maint.[c]	300		300										
Planting, Crop Care													
Labor[b]: field	27,859			1,500	2,704	2,064	8,896	6,942	3,415	1,134	1,204		
greenhouse	2,150						430	430	430	430	430		
Seeds	881		881										
Fertilizer	2,329		2,329										
Herbicide	30		30										
Small tools[a]	85			85									
Annual supplies	208		31	177									
Harvest													
Small tools[a]	190					190							
Labor[b]	4,911								2,629	2,282			
Annual supplies	282					282							
Miscellaneous													
Small tools	84			84									
Repairs	150									150			
Total	42,357	–	4,561	2,276	3,564	2,966	9,514	7,372	6,474	3,996	1,634	–	–
OWNER COST													
Equipment													
Field	759			253			253			253			
Greenhouse	63			21			21			21			
Buildings													
Field	57			19			19			19			
Greenhouse	117			39			39			39			
Land Lease	99			33			33			33			
Irrigation	87			29			29			29			
Total	1,182	–	–	394	–	–	394	–	–	394	–	–	–
TOTAL PROD. COST	43,539	–	4,561	2,670	3,564	2,966	9,908	7,372	6,474	4,390	1,634	–	–

Table C.2b: Cash Flow—6 Acres, Production

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
MARKETING													
OPERATING COST													
Labor[d]	9,750	1,500	1,500					750	750	750	1,500	1,500	1,500
Materials	856							856					
Storage													
Fuel	160	40	40									40	40
Repairs	200				100				100				
Total	10,966	1,540	1,540	–	100	–	–	1,606	850	750	1,500	1,540	1,540
OWNER COST													
Buildings	420			140			140			140			
Total	422			140			140			140			
TOTAL MARK. COST	11,386	1,540	1,540	140	100	–	140	1,606	850	890	1,500	1,540	1,540
TOTAL COSTS	54,925	1,540	6,101	2,810	3,664	2,996	10,048	8,978	7,324	5,280	3,134	1,540	1,540

[a] Small tool cost is 1/4 the total cost.
[b] Full-time labor @ $5.00/hr. for 4 months; field boss @ $7.00/hr. for 7 months; part-time labor @ $4.00/hr. for 2 months during planting and harvest; grower-manager @ $1,500/month for 12 months.
[c] Includes parts used, grease and oil only.
[d] Time allocated from grower-manager.

*All entries for all cash-flow tables have been rounded to the nearest dollar. Therefore slight differences in totals on Tables 14 through 17 may have occurred.

Table C.3a: Cash Flow—12 Acres, Production*

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
PRODUCTION													
OPERATING COST													
Seedling Production													
Seeds	82		82										
Fertilizer	27		27										
Small tools[a]	765		765										
Annual supplies	359		359										
Labor[b]	4,515			1,505	1,505	1,505							
Equipment													
Fuel and oil[c]	750		375				375						
Repairs & maint.	1,586		500								1,086		
Planting, Crop Care													
Labor[b]: field	3,589			1,505	2,704	8,294	9,257	5,115	5,115	1,204	2,704		
greenhouse	2,580						645	645	645	645			
Seeds	1,708		1,708										
Fertilizer	4,728		4,728										
Herbicide	60		60										
Small tools[a]	101			101									
Annual supplies	272		78	194									
Harvest													
Small tools[a]	379				379								
Labor[b]	6,220								3,938	2,282			
Annual supplies	564				564								
Miscellaneous													
Small tools[a]	121			121									
Repair parts	200									200			
Total	60,915	–	8,682	3,426	5,152	9,799	10,277	5,760	9,698	4,331	3,740	–	–
OWNER COST													
Equipment													
Field	1,068			356			356			356			
Greenhouse	78			26			26			26			
Buildings													
Field	75			25			25			25			
Greenhouse	174			58			58			58			
Land Lease	201			67			67			67			
Irrigation	174			58			58			58			
Total	1,770	–	–	590	–	–	590	–	–	590	–	–	–
TOTAL PROD. COST	62,685	–	8,682	4,016	5,152	9,799	10,867	5,760	9,698	4,921	3,790	–	–

Table C.3b: Cash Flow—12 Acres, Production

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
MARKETING													
OPERATING COST													
Labor[d]	11,250	1,500	1,500				750	750	750	1,500	1,500	1,500	1,500
Materials	1,927						1,927						
Storage													
Fuel	240	60	60									60	60
Repairs	300				150				150				
Total	13,717	1,560	1,560	–	150	–	750	2,677	900	1,500	1,500	1,560	1,560
OWNER COST													
Buildings	633			211			211			211			
Total	633	–	–	211	–	–	211	–	–	211	–	–	–
TOTAL MARK. COST	14,350	1,560	1,560	211	150	–	961	2,677	900	1,711	1,500	1,560	1,560
TOTAL COSTS	77,035	1,560	10,242	4,227	5,302	9,799	11,828	8,437	10,598	6,632	5,290	1,560	1,560

[a]Small tool cost is 1/4 the total cost.
[b]Full-time labor @ $5.00/hr. for 4 months; field boss @ $7.00/hr. for 7 months; part-time labor @ $4.00/hr. for 6 months during planting and harvest; grower-manager @ $1,500/month for 12 months, and greenhouse labor for $5.00/hr. for 7 months.
[c]Includes parts used, grease and oil only.
[d]Time allocated from grower-manager.

*All entries for all cash-flow tables have been rounded to the nearest dollar. Therefore slight differences in totals on Tables 14 through 17 may have occurred.

Table C.4a: Cash Flow—24 Acres, Production*

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
PRODUCTION													
OPERATING COST													
Seedling Production													
Seeds	129		129										
Fertilizer	54		54										
Small tools[a]	1,516		1,516										
Annual supplies	703		703										
Labor[b]	4,515			1,505	1,505	1,505							
Equipment													
Fuel and oil[c]	1,500		750				750						
Repairs & maint.	2,600		850								1,750		
Planting, Crop Care													
Labor[b]: field	33,421			1,505	2,704	8,294	8,882	5,115	5,115	602	1,204		
greenhouse	2,580						645	645	645	645			
Seeds	3,404		3,404										
Fertilizer	9,092		9,092										
Herbicide	120		120										
Small tools[a]	122			122									
Annual supplies	449		140	309									
Harvest													
Small tools[a]	506					506							
Labor[b]	8,880								5,268	3,612			
Annual supplies	1,128					1,128							
Miscellaneous													
Small tools	186			186									
Repair parts	300									300			
Total	71,205	–	16,758	3,627	4,209	11,433	10,277	5,760	11,028	5,159	2,954	–	–
OWNER COST													
Equipment													
Field	1,629			543			543			543			
Greenhouse	201			67			67			67			
Buildings													
Field	75			25			25			25			
Greenhouse	333			111			111			111			
Land Lease	399			133			133			133			
Irrigation	348			116			116			116			
Total	2,985	–	–	995	–	–	995	–	–	995	–	–	–
TOTAL PROD. COST	74,190	–	16,758	4,622	4,204	11,433	11,272	5,760	11,028	6,154	2,954	–	–

Table C-4b: Cash Flow—24 Acres, Production

	TOTAL	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
MARKETING													
OPERATING COST													
Labor[d]	11,250	1,500	1,500				750	750	750	1,500	1,500	1,500	1,500
Materials	3,816							3,816					
Storage													
Fuel	320	80	80									80	80
Repairs	400								200				
Total	15,786	1,580	1,580	–	200	–	750	4,566	950	1,500	1,500	1,580	1,580
OWNER COST													
Buildings	843			281			281			281			
Total	843	–	–	281	–	–	281	–	–	281			
TOTAL MARK. COST	16,629	1,580	1,580	281	200	–	1,031	4,566	950	1,781	1,500	1,580	1,580
TOTAL COSTS	90,819	1,580	18,338	4,903	4,409	11,433	12,303	10,326	11,978	7,935	4,454	1,580	1,580

[a]Small tool cost is 1/4 the total cost.
[b]Full-time labor @ $5.00/hr. for 4 months; field boss @ $7.00/hr. for 7 months; part-time labor @ $5.00/hr. for 10 months during planting and harvest; grower-manager @ $1,500/month for 12 months.
[c]Includes parts used, grease and oil only.
[d]Time allocated from grower-manager.

*All entries for all cash-flow tables have been rounded to the nearest dollar. Therefore slight differences in totals on Tables 14 through 17 may have occurred.