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CULTURAL PRACTICES

and

RESULTS

for

CONCORD GRAPES

New York
1984

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Cultural Practices and Results for Concord Grapes, New York, 1984

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Introduction

In recent years, New York juice grape producers have experienced difficult economic circumstances. This is readily apparent when one considers that the average price paid to producers for juice grapes declined significantly from 1977 to 1985 (New York Agricultural Statistics, 1986). In 1985, the price for juice grapes averaged $116 per ton, down four percent from 1984 and 48 percent from an all time high price of $223 per ton received in 1977. At the same time, total production costs have continued to increase (New York Economic Handbook, 1987). Juice prices recovered to average $181 per ton for 1986.

Grape yields in the State averaged 4.0 tons per acre during this nine year period for all varieties. Yields varied from year to year but ranged from 2.5 tons in 1977 to 5.1 tons per acre in 1984. The New York Grape Farm Summary for 1983 for the Great Lakes Region provides data for 13 cooperating producers (Putnam, 1983). These growers had yields averaging 6.3 tons per acre for all varieties at an average value of $189 per ton. Grape receipts totaled $1,195 per bearing acre which exceeded cash production costs of $996 per acre but fell below total production costs of over $1,500 per acre on these farms (Appendix A, Table A1). For the State, yields averaged 4.7 tons per acre and the price for all varieties averaged $191 per ton. Thus, 1983 grape receipts for the State averaged less than $900 per acre - well below the cash production costs found on the Summary farms.

To address this problem, growers must exercise the most efficient management practices possible. Controlling production costs without sacrificing optimum yield requires the use of resources best adapted to grape production and appropriately applied cultural practices. Knowledge of effective cultural

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practices is necessary to evaluate their effect on grape yields and other aspects of grape production.

Objectives

The production of Concord grapes comprises approximately 70 percent of the total New York utilized grape production. Therefore, this study focused on Concords as a vital segment of the New York grape industry.

The purpose of this study was to evaluate the effects of cultural practices on yields and profitability of Concord grape production in the Great Lakes Region of New York. This paper summarizes the current practices used by Concord grape growers and attempts to relate those practices to yields and, therefore, profitability, in the production of Concord grapes in New York.

Procedures

As the major processor of Concord grapes in New York, National Grape Cooperative includes a large number of Concord grape growers. In January of 1985, questionnaires were mailed to about 500 member growers in cooperation with the Cooperative. The questionnaire was designed to obtain information for the 1984 crop production year. Responses from 120 growers were received with data complete enough to use in the summarization process.

Financial data for 1984 were not obtained from these growers. Yield was chosen as a generally reliable indication of potential enterprise profitability in the absence of economic data about input costs and product price. Yields were based on Cooperative records kept for each grower.

Appropriate factors from each record were tabulated to provide the number, average, and range for each factor. In addition, the data base was sorted by yield for 108 records that included production information. Also, sorts were made for growers who used only one of three training systems in their vineyards. These data were also tabulated to provide the number, average, and range for each factor in an effort to determine the extent and type of practices currently being used and to examine possible effects of these practices on yields.

Results

The study provided information for 120 grape enterprises for 1984. It included acreage of bearing and nonbearing grapes of Concord and all other varieties grouped together. Acreage and production by training system enabled calculation of yields for each system. Information about cultural practices included pruning, suckering, and shoot positioning as well as the use of daminozide (Alar™), fertilizer, and pesticides. Information about mechanical weed control, soil and leaf analysis, and harvesting practices were also obtained.

These data are presented in Table 1 to show the number, average, and range of the observations for each of the selected factors as they occurred on these 120 farms. The standard deviation for each factor is also given, where appropriate, as an indication of the variability.

Bearing Concords on survey farms totalled 2,707 acres and accounted for about 12 percent of the total New York acreage in 1984 (New York Agricultural Statistics, 1986). The surveyed farms were of typical size for New York. For the State, bearing vineyards averaged about 24 acres per farm including about 17 acres of bearing Concord grapes (New York Agricultural Statistics Service). Survey farms were about average in size with 25 acres per farm in all varieties of bearing grapes but had somewhat larger acreages of bearing Concords - averaging about 22 acres per farm.

Bearing Concord vineyards 10 years of age or older were present on all but one of the 120 farms. Acres of these bearing Concords totalled 2,507 acres and averaged about 21 acres per farm with two-thirds of the observations below the average acreage. Bearing Concord vineyards under 10 years of age totalled 200 acres on 30 farms and averaged 6.7 acres with over 70 percent having less than 10 acres each. Other varieties on 39 of these farms averaged nine acres of bearing grapes per farm.

Only 14 of the 120 farms had acreages planted to nonbearing grapes. Four farms averaged about five acres of Concords each; 10 farms averaged about seven acres of other nonbearing varieties per farm. Acreage varied greatly from farm to farm, but 11 observations had less than 10 acres of nonbearing grapes per farm.

Sixty percent of the growers used the Umbrella Kniffen training system in Concord vineyards averaging about 16 acres each. Vineyards were larger, averaging 19 acres each, for the 49 percent reporting the Hudson River Umbrella training system. Only 10 percent of the growers had Geneva Double Curtain trained vineyards which averaged about 22 acres per farm.

Yields of Concord grapes in 1984 varied widely from farm to farm. Average production was 6.2 tons per acre on the 110 farms reporting production. The Geneva Double Curtain vineyards averaged 7.7 tons per acre. The other two training systems averaged about six tons of Concord grapes per acre.

Hand pruning was the common practice on all the farms. Machine pruning was used on only nine of the farms and then on only part of the Concord acreage. Most of the machine pruning was followed by hand pruning. Nearly two-thirds of the farm operators were actively involved with pruning on a regular basis. Estimated cane weight per vine averaged 3.0 pounds for 87 farms reporting. Growers left an estimated average of 57 nodes per vine in the pruning process.

Removing suckers was a common practice reported by 92 growers. Thirteen growers used machine suckering on larger Concord acreages. About 31 percent of the growers positioned shoots after the pruning operation.

The use of daminozide to enhance yields was not a widespread practice in 1984. Only 10 percent of the growers used daminozide on all of their Concord grapes while over three-quarters of the growers used no daminozide at all.

Table 1. Selected Practices of Concord Grape Producers, 120 Farms, Great Lakes Area, New York, 1984.

Item	Number of Observations	Average	Range	Standard Deviation*
		acres per farm		
All Nonbearing Vineyards	4	4.9 ac	0.5-10.0	3.8
Concords	10	6.9 ac	0.7-22.0	5.8
Other varieties				
All Bearing Vineyards	30	6.7 ac	0.5-27.0	5.9
Concords < 10 years	119	21.1 ac	1.0-175.0	26
10 years & over	39	9.0 ac	0.5-42.0	11
Other varieties				
Concords Only:		acres per farm		
Training system -				
Hudson River Umbrella	59	19.2 ac	1.0-163.0	24
Umbrella Kniffen	72	15.7 ac	2.0-140.0	17
Geneva Double Curtain	12	21.7 ac	1.0-91.0	27
Other	5	4.2 ac	0.5-11.0	3.7
		tons per acre		
Yield -				
Overall	110	6.2 tons	2.0-10.9	1.5
By training system:				
Hudson River Umbrella	59	6.1 tons	2.0-10.8	1.6
Umbrella Kniffen	72	5.9 tons	2.0-9.2	1.4
Geneva Double Curtain	12	7.7 tons	5.2-15.0	2.5

- continued -

Table 1 continued

Item	Number of Observations	Average	Range	Standard Deviation*
Concords Only:				
Pruning practices -		acres per farm		
Method - Hand	120	20.7 ac	1.0-140.0	24
Machine	9	23.2 ac	2.0-84.0	24
Estimated cane weight/vine	87	3.0 lb	1.0-10.0	1.2
Estimate nodes left/vine	105	57 no	25-100	15
Suckering -				
By - Hand	92	19.4 ac	1.0-140.0	24
Chemicals	13	37.7 ac	3.0-175.0	45
Shoot positioning	37	18.8 ac	0.5-115.0	26
Fertilizer**		pounds per acre		
Nitrogen	112	85 lb	15-200	30
Potassium	51	168 lb	30-384	77
Spray applications for:		times per season		
Weeds	103	1.2	1-2	0.4
Insects	116	2.4	1-7	0.8
Disease	115	2.8	1-8	1.1
Cultivations	97	2.1	1-3	0.7
Mowings	80	1.7	1-3	0.8
		acres per farm		
Cover crops planted	12	14.8 ac	2.5-49.0	14
Harvesting practices:				
Own harvester	28	48.8 ac	3-175	43
Custom harvester	93	14.0 ac	1-63	12
Custom rates:		dollars per ton		
Without hauling	23	$32/ton	26-50	5
With hauling	72	$37/ton	26-55	8
Hauling distance (one way)	107	39 mi	1-200 mi	47

*Standard deviation- range above and below the average that would include about two-thirds of the observations for a normal distribution.

**After the 1983 harvest and before the 1984 harvest.

Fertilizer use on bearing Concords was reported for applications between the 1983 and 1984 harvests. Nitrogen, applied by 112 growers, averaged 85 pounds per acre. Potassium, applied by 51 growers, averaged 168 pounds per acre. No potassium applications were reported by 24 growers. The rest of the growers applied potassium most recently between one and 10 years before the 1984 harvest. Potassium is often only needed once in three to six years.

Pesticide control included both chemical and mechanical methods. Weeds were controlled by an average of 1.2 spray applications for growers who used chemicals. Those who cultivated or mowed averaged about two operations per season. All but four growers sprayed for insects which averaged 2.4 times in 1984. Disease sprays averaged 2.8 times for the season for 115 reporting growers. Cover crops were planted in 1984 by only 10 percent of the growers who planted an average of about 15 acres per farm.

Most growers had Concord acreages too small to justify owning a mechanical harvester. Seventy-seven percent of the growers hired their crop custom harvested. These growers averaged 14 acres per farm. The 23 percent of the growers who had their own harvester harvested an average of about 49 acres of their own Concord grapes.

Custom rates, including hauling, averaged $37 per ton - about $5 per ton more than when hauling was excluded. Hauling distance averaged 39 miles one way.

In addition to the above description of various cultural practices for the responding 120 farms, information is provided in Table 2 for 110 farms which reported production data and were sorted by yield into high, middle, and low third groups. Differences in cultural practices between the three yield level groups shown in Table 2 may have some or no relationship to yield and, therefore, profitability.

It would appear from these data that training system influences yield. Concord grapes grown with the Geneva Double Curtain (GDC) system on 12 farms had

the highest average yield of the three systems shown. The GDC yield at 7.7 tons per acre was 26 percent higher than the 6.1 ton yield produced on the Hudson River Umbrella (HRU) system and 31 percent higher than the Umbrella Kniffen yield. This relationship also occurred in the high third yield level group but not for the three GDC systems in the middle third group.

The influence of pruning practices on yield did not seem to be so clear cut. However, the high yield group averaged more nodes left per vine and less regular personal involvement by the operator in the pruning operation. This group had the largest size bearing acreage which diluted the operator's direct involvement with pruning with no apparent detrimental effect on yields. Shoot positioning and hand suckering seemed to enhance yield whereas chemical suckering did not.

The use of daminozide appeared to improve yield. More growers in the high yield group used daminozide on some or all of their Concord acreage. Fertilizer, lime, and pesticide control practices depend on individual farm needs and these results show no general effect on yield levels. Also, from these data, the use of cover crops did not appear to influence yields.

Soil and leaf analysis are commonly recommended every third year to help determine good management practices. Table 2 shows that 24 percent of 107 respondents used soil analysis and 21 percent of 101 respondents used leaf analysis in 1984. Because of the three year analysis cycle recommended, this level of the practice in one year would suggest a high degree of use. Also, while potassium requirements increase with higher yields, annual applications of potassium are generally not necessary to meet the needs of the vines. Greater use of potassium and soil and leaf analysis by the high yield group would seem to indicate that these growers are using these and other good management practices to encourage high yields.

Table 2. Selected Cultural Practices of Concord Grape Producers, Three Yield Level Groups, 110 Farms, Great Lakes Area, New York, 1984.

Item	All Farms	Yield Level Group: High Third	Middle Third	Low Third
Number of farms	110	37	36	37
Yield, tons per acre	6.2	7.4	5.9	4.5
Bearing acres per farm	28.4	33.7	28.1	22.6
		number of observations		
Training system -				
Hudson River Umbrella	59	22	19	18
Umbrella Kniffen	72	24	26	22
Geneva Double Curtain	12	9	3	0
		tons per acre		
Yield by training system -				
Hudson River Umbrella	6.1	7.2	6.2	4.5
Umbrella Kniffen	5.9	6.9	5.8	4.4
Geneva Double Curtain	7.7	9.1	5.5	--
Pruning practices -				
Est. cane weight/vine, lbs. (farms)	3.0 (82)	2.8 (31)	3.3 (26)	2.9 (25)
Est. nodes left/vine, no. (farms)	57 (97)	64 (32)	58 (34)	50 (31)
Operator regularly involved, % of farms	63	54	61	73
Suckering - hand, %	76	84	69	76
chemicals, %	12	5	14	16
Shoot positioning, %	31	38	33	22
		percent of farms		
Use of daminozide, % of farms -				
None used	77	59	80	92
Used on some acres	13	25	11	3
Used on all acres	10	16	9	6
		pounds per acre		
Fertilizer used -				
Nitrogen (farms)	86 (104)	83 (36)	96 (35)	78 (33)
Potassium (farms)	173 (45)	191 (21)	162 (11)	155 (13)
pH level	5.6 (61)	5.6 (24)	5.6 (22)	5.7 (15)
		times per season		
Spray applications for -				
Weeds	1.2	1.2	1.1	1.2
Insects	2.4	2.6	2.3	2.3
Disease	2.8	2.9	2.7	2.7
Cultivations	2.1	2.2	2.0	2.0
Mowings	1.7	1.4	1.7	1.9
		acres per farm		
Cover crop planted (farms)	15.6 (11)	20.2 (3)	12.4 (7)	25.0 (1)
		percent of farms		
Analysis taken in 1984				
Soil (farms)	24 (107)	30 (36)	29 (35)	14 (36)
Leaf (farms)	21 (101)	24 (34)	22 (32)	14 (35)

One practice that seems to have a positive effect on yields is the choice of training system. This is especially true when the yield limiting factor is canopy shading rather than soil or other site characteristics. In this situation, the Geneva Double Curtain (GDC) training system has proven to be beneficial for achieving higher yields. Table 2 shows a yield difference favoring the GDC system of 1.8 tons per acre over the Umbrella Kniffen (UK) training system and 1.6 tons per acre over the Hudson River Umbrella (HRU) system.

Data from the survey show that recent training system conversions were predominantly from the UK to the HRU training system. Table 2 shows HRU vineyards averaged 0.2 tons of grapes more per acre than UK vineyards. However, the most common reason for the conversion was "to reduce costs". About 10 percent of the total bearing acreage in the study was converted within the previous five years.

As shown by the study, larger yield increases can be expected by use of the GDC system. Although costs to convert to the GDC system are significant, the decision is worthy of consideration.

Work done by Markin in 1980 addressed the feasibility of converting from the UK to the GDC training system. That study indicated that such a conversion was most economically feasible for growers exercising better than average management practices on vineyards with favorable site characteristics.

Using Markin's approach and updating the conversion costs developed in his data, Table 3 summarizes the results when prices and yield levels vary. The yield increase of 2.6 tons per acre represents the response to good management and site characteristics found by Markin. The lower yield increase of 1.8 tons per acre after the conversion represents the yield difference found in the current study of Concord grape cultural practices between UK and GDC training systems.

Table 3. Summary of Results of Converting Concord Grape Training Systems from Umbrella Kniffen to Geneva Double Curtain, Sensitivity Analysis for Changes in Price and Yield, Two Models, New York State, 1986.

Model	Grape Price/Ton	Average Yield Increase	20 Year Net Present Value	Annual Equivalent Cash Flow	Recapture Period
	$	tons/acre	$/acre	$/acre	years
Model 1 - Trellis completely replaced					
	145	2.6	(195)	(17)	>20
		1.8	(1,152)	(100)	>20
	180	2.6	768	67	14
		1.8	(499)	(43)	>20
	215	2.6	(1,731)	151	10
		1.8	154	13	19
Model 2 - No posts replaced; bottom wire reused					
	145	2.6	726	63	11
		1.8	(230)	(20)	>20
	180	2.6	1,689	147	8
		1.8	423	37	14
	215	2.6	2,652	231	6
		1.8	1,076	94	10

The table shows the results obtained for three price levels centered around $180 per ton - close to the average juice price of $181 per ton for 1986 in New York (New York Agricultural Statistics, 1986). Results for two conversion extremes are also presented. In Model 1, the trellis is completely replaced; in Model 2 the posts and bottom wire of the UK system are reused. Appendix A includes tables in which the conversion costs are updated from 1980 to 1986. Using $180 per ton as the juice price, Appendices B and C illustrate the calculations for average yield increases of 2.6 and 1.8 tons per acre respectively.

Table 3 shows the net present value of the conversion over the 20 year planning period along with the annual increase to cash flow per acre and the time required to recapture the cost of the conversion. The data indicate

conversion to GDC is not feasible for average GDC yield expectations with complete trellis replacement (Model 1) except for those with the higher long term price expectations. Growers using the best management practices on vineyards with good site characteristics could justify converting to GDC at current or higher juice price expectations. When conversion requires less than full replacement of the existing trellis, conversion costs decrease and conversion becomes more economically feasible.

Many of the cultural practices used by Concord grape growers are influenced by the grower's perception of need. Regardless of perceptions, the needs of the plant must be met to achieve optimum yield levels. These data would appear to support the use of the Hudson River training system, proper pruning and pest control practices, daminozide, and soil and leaf analysis to meet nutrition and other vineyard needs in efforts to improve Concord grape yields. The use of the Geneva Double Curtain system was also associated with higher yields. However, site and vineyard suitability (soil, vine vigor, etc.) and greater management demands are important considerations regarding the use of this training system. In addition, the added cost of establishing or converting to the Geneva Double Curtain system should be carefully considered in relation to added returns.

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APPENDIX A.

Table A1. Calculation of Change in Grape Production Costs* New York, 1980 & 83 to 1986

Cost Item	Weight % of expenses	Index of Prices Paid 1977 = 100 1980	1983	1986	1980-86 % Chg	1986 Wgtd % chg	1983-86 % Chg	1986 Wgtd % chg
CASH EXPENSES:						CHANGES		
Fuel	4	177	205	178	0.6	0.02	-13.2	-0.53
Fert	6	143	139	128	-10.5	-0.63	-7.9	-0.47
Mach	15	131	172	185	41.2	6.18	7.6	1.13
Chem	4	102	125	127	24.5	0.98	1.6	0.06
Interest	12	138	145	143	3.6	0.43	-1.4	-0.17
Wages	39	132	151	181	37.1	14.48	19.9	7.75
Taxes	6	127	152	181	42.5	2.55	19.1	1.14
Supplies	5	128	138	136	6.3	0.31	-1.4	-0.07
Other	9	129	147	153	18.6	1.67	4.1	0.37
% Change in Cash Operating Expenses						26.0		9.2
NON-CASH EXPENSES:								
Deprec								
Mach	17	131	172	185	41.2	7.01	7.6	1.28
Bldg	12	128	138	136	6.3	0.75	-1.4	-0.17
Labor	42	132	151	181	37.1	15.59	19.9	8.34
Eqty Int	29	138	145	143	3.6	1.05	-1.4	-0.40
% Change in Non-Cash Expenses						24.4		9.1

CHANGE IN PRODUCTION COSTS PER BEARING ACRE:	1983 $	% Chg	1986 $
Cash Operating Expenses per acre	996	9.2	1,088
Non-Cash Expenses per acre**	579	9.1	631
Total Production Costs per acre	1,575		1,719

* Adapted from 1983 Grape Farm Summary, AE Ext 85-4, and Annual NY Economic Handbooks including AE Ext 86-35, Cornell University

** Includes operator's labor and management

Table A2. Conversion From UK to GDC Training Systems
Change in Conversion Costs, NYS, 1980 - 1986

Model 1. Trellis completely replaced

Cost Item	1980* Cost/ac	% Chg	1986 Cost/ac
	$		$
Labor	354	37.1	485
Material	1,689	6.3	1,795
Total Cost	2,043		2,280

* Markin, 1980

Model 2. No posts replaced; bottom wire re-used

Cost Item	1980* Cost/ac	% Chg	1986 Cost/ac
	$		$
Labor	247	37.1	339
Material	820	6.3	871
Total Cost	1,067		1,210

* Markin, 1980

Table A3. Conversion From UK to GDC Training Systems
Summary of Additional Annual Costs, Years 2-5
1980 & 1986

Model 1. Trellis completely replaced

Cost Item	1980* Cost/ac	% chg	1986 Cost/ac
	$		$
Pruning time saved	(25.50)	37.1	(34.97)
Trellis maint saved	(25.20)	6.3	(26.78)
Operator labor	43.55	37.1	59.72
Fertilizer	12.55	-10.5	11.23
Supplies	3.75	6.3	3.98
	9.15		13.19

* Markin, 1980

Model 2. No posts replaced; bottom wire re-used

Cost Item	1980* Cost/ac	% chg	1986 Cost/ac
	$		$
Pruning time saved	(25.50)	37.1	(34.97)
Operator labor	56.95	37.1	78.09
Fertilizer	12.55	-10.5	11.23
Supplies	3.75	6.3	3.98
	47.75		58.34

* Markin, 1980

APPENDIX B.

ASSUMPTIONS - GRAPE TRAINING SYSTEM CONVERSION - UK TO GDC - HIGH YIELD

Analysis year	1986	
Price	180 /tn	Avg Juice Price
Cost	37 /tn	Avg Harvest & Haul Cost
Yield increases after conversion	-1.0 tn/ac - Yr 1	Avg yield incr over 20 yrs = 2.59 tn/ac
	1.5 tn/ac - Yr 2	
	2.2 tn/ac - Yr 3	
	2.6 tn/ac - Yr 4	
	2.9 tn/ac - Yr 5	
	2.9 tn/ac - Yr 6-20	
Add'l GDC costs for years 6-20	58 /ac	- annual labor for cordon renewal
	45 /ac	- annual labor & maint when old trellis is completely replaced

Table B1. Conversion From UK to GDC Training Systems
Expected Annual Marginal Net Return Per Acre
1986

Model 1. Trellis completely replaced

Year	Added Yield tn/ac	Net Price $/tn	Incr Income $/yr	Incr Costs $/yr	Marginal Net Returns $/yr
2	1.5	143	215	13	201
3	2.2	143	315	13	301
4	2.6	143	372	13	359
5	2.9	143	415	13	402
6-20	2.9	143	415		
	Normal cost incr			13	
	Renewal pruning labor*			58	
	Trellis maintenance*			45	299

* Begins in year 6

Model 2. No posts replaced; bottom wire re-used

Year	Added Yield tn/ac	Net Price $/tn	Incr Income $	Incr Costs $	Marginal Net Returns $
2	1.5	143	215	58	156
3	2.2	143	315	58	256
4	2.6	143	372	58	313
5	2.9	143	415	58	356
6-20	2.9	143	415		
	Normal cost incr			58	
	Renewal pruning labor*			58	298

* Begins in year 6

Table B2. Conversion From UK to GDC Training Systems
Net Present Value Calculation, Per Acre Basis
1986

Model 1. Trellis completely replaced

Year	Item	Amount	6% factor	Cash Flow PV
		$	$	$
0	Conversion costs	(2,280)	1.0000	(2,280)
1	Lost yield	(143)	0.9434	(135)
2	Marginal net returns	201	0.8900	179
3	Marginal net returns	301	0.8396	253
4	Marginal net returns	359	0.7921	284
5	Marginal net returns	402	0.7473	300
6-20	Marginal net returns	299	7.2576	2,166
			NPV =	768
	20 year 6 % factor = 11.4699		AECF =	67
	Recapture period =			14 years

Model 2. No posts replaced; bottom wire re-used

Year	Item	Amount	6% factor	Cash Flow PV
		$	$	$
0	Conversion costs	(1,210)	1.0000	(1,210)
1	Lost yield	(143)	0.9434	(135)
2	Marginal net returns	156	0.8900	139
3	Marginal net returns	256	0.8396	215
4	Marginal net returns	313	0.7921	248
5	Marginal net returns	356	0.7473	266
6-20	Marginal net returns	298	7.2576	2,165
			NPV =	1,689
	20 year 6 % factor = 11.4699		AECF =	147
	Recapture period =			8 years

APPENDIX C.

ASSUMPTIONS - GRAPE TRAINING SYSTEM CONVERSION - UK TO GDC - HIGH YIELD

Analysis year 1986

Price 180 /tn Avg Juice Price
Cost 37 /tn Avg Harvest & Haul Cost

Yield increases after conversion
-1.2 tn/ac - Yr 1
0.7 tn/ac - Yr 2
1.2 tn/ac - Yr 3
1.7 tn/ac - Yr 4
2.1 tn/ac - Yr 5
2.1 tn/ac - Yr 6-20

Avg yield incr over 20 yrs = 1.80 tn/ac

Add'l GDC costs for years 6-20
58 /ac - annual labor for cordon renewal
45 /ac - annual labor & maint when old trellis is completely replaced

Table C1. Conversion From UK to GDC Training Systems
Expected Annual Marginal Net Return Per Acre
1986

Model 1. Trellis completely replaced

Year	Added Yield tn/ac	Net Price $/tn	Incr Income $/yr	Incr Costs $/yr	Marginal Net Returns $/yr
2	0.7	143	100	13	87
3	1.2	143	172	13	158
4	1.7	143	243	13	230
5	2.1	143	300	13	287
6-20	2.1	143	300		
	Normal cost incr			13	
	Renewal pruning labor*			58	
	Trellis maintenance*			45	184

* Begins in year 6

Model 2. No posts replaced; bottom wire re-used

Year	Added Yield tn/ac	Net Price $/tn	Incr Income $	Incr Costs $	Marginal Net Returns $
2	0.7	143	100	58	42
3	1.2	143	172	58	113
4	1.7	143	243	58	185
5	2.1	143	300	58	242
6-20	2.1	143	300		
	Normal cost incr			58	
	Renewal pruning labor*			58	184

* Begins in year 6

Table C2. Conversion From UK to GDC Training Systems
Net Present Value Calculation, Per Acre Basis
1986

Model 1. Trellis completely replaced

Year	Item	Amount	6% factor	Cash Flow PV
		$	$	$
0	Conversion costs	(2,280)	1.0000	(2,280)
1	Lost yield	(172)	0.9434	(162)
2	Marginal net returns	87	0.8900	77
3	Marginal net returns	158	0.8396	133
4	Marginal net returns	230	0.7921	182
5	Marginal net returns	287	0.7473	215
6-20	Marginal net returns	184	7.2576	1,336
			NPV =	(499)
	20 year 6 % factor =	11.4699	AECF =	(43)
	Recapture period =		over 20 years	

Model 2. No posts replaced; bottom wire re-used

Year	Item	Amount	6% factor	Cash Flow PV
		$	$	$
0	Conversion costs	(1,210)	1.0000	(1,210)
1	Lost yield	(172)	0.9434	(162)
2	Marginal net returns	42	0.8900	37
3	Marginal net returns	113	0.8396	95
4	Marginal net returns	185	0.7921	146
5	Marginal net returns	242	0.7473	181
6-20	Marginal net returns	184	7.2576	1,335
			NPV =	423
	20 year 6 % factor =	11.4699	AECF =	37
	Recapture period =		14 years	