SWEET POTATO MARKETING IN THE PHILIPPINES

by

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INTRODUCTION

The sweet potato or camote (Ipomoea batatas) has been used in the Philippines as human food for many decades. Its economic value ranges from a substitute for rice and corn to a staple food in some areas of the country. The crop may also be used for animal feed, for starch production and for various other industrial purposes. The sweet potato thrives in many climates and in various types of soil in the Philippines.[1] There is a continuous supply of the crop the year around in many places in the country.

Of all root crops grown in the country, the sweet potato leads in importance. Of the 426,270 hectares planted to root crops in the Philippines in 1977, 52 percent was devoted to sweet potatoes. The total production of root crops in 1977 was 2.05 million tons of which 43 percent was sweet potatoes (Table 1). The hectarage planted to root crops and total production for the period 1967-1977 are presented in Table 2.

The sweet potato represents the most important vegetable consumed in the Philippines with an average rate of use that is more than double that of any other vegetable.[2] Based on the food and consumption survey for the 1970-1976 period, the nationwide per capita use of sweet potatoes averaged 10.73 kilograms annually.[3]

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[1] C. L. G. Santos. Sweet Potato Marketing in the Philippines, Special Studies Division, Ministry of Agriculture, 77-10 (March 1977), p. 1.

[2] Ibid.

[3] E. F. Aviguetero et al. Income and Food Consumption: Summary of 19 Economic Surveys, Special Studies Division, Ministry of Agriculture, 78-15 (June 1978), p. 43.

Various studies have been undertaken regarding the culture and utilization of sweet potatoes. A marketing study on this crop should therefore, provide insight into the problems and practices affecting its distribution. The objectives of this report are: (1) to review the present state of economic knowledge concerning production, utilization and marketing of sweet potatoes in the Philippines and (2) to propose and outline an economic study of some aspects of sweet potato marketing.

TABLE 1. Rootcrops Grown in the Philippines: Hectarage Planted and Production (in Metric Tons) for 1967-1977.

	1967		1968		1969	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Sweet Potato	135510	686761.4	131800	672395	134680	706274.1
Cassava	86520	528726.6	83880	481928.4	85690	487326.7
Gabi	22600	96265.2	23100	97267.7	22130	94179.1
Pao	3810	18215.3	3910	18374.3	3790	17779.8
Tugui	2700	10899.3	2720	10228.6	2580	9460.7
Ubi	4960	26702.3	4950	24994.2	4710	23087
Total	252100	1367570.1	250360	1305248.2	253580	1338107.4

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

	1970		1971		1972	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Sweet Potato	134620	731393.9	128310	656717.2	139400	651467.7
Cassava	82620	442222.6	81820	427054.1	82680	439697.4
Gabi	23550	91628.3	24420	90097.1	25520	86254.2
Pao	4270	17777.1	4260	16745.0	4140	17053.1
Tugui	2360	8828.1	2220	7879.7	2030	4469.5
Ubi	4940	24413.1	4950	22137.5	4710	18762.5
Total	252360	1316263.1	245980	1220810.6	258480	1217704.4

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 1 continued

	1973		1974		1975	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Sweet Potato	144280	647645.6	181000	806998	195730	986017.3
Cassava	87420	444710.3	96710	480015	119310	684506.9
Gabi	25110	91595.9	26340	84351	25970	92706.3
Pao	3450	13691.1	3380	14624	3920	19591.1
Tugui	1710	4188.1	1870	5174	1370	3453.9
Ubi	4360	18665.5	4610	19592	4910	20858.2
Total	266330	1220496.5	313910	1410754	351210	1807133.7

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

	1976		1977	
	Hectarage	Production	Hectarage	Production
Sweet Potato	208670	829453.7	221730	887748
Cassava	132690	794378.2	154270	987791
Gabi	36710	112431.4	36380	123552.7
Pao	3300	19471.5	4080	18224.8
Tugui	1230	4429.4	1130	4135.3
Ubi	6310	23754	8230	26621.2
Total	388910	1783918.2	426270	2048043

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

TABLE 2. Rootcrops: Hectarage Planted and Production (in Metric Tons) by Region for 1967-1977

	1967		1968		1969	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Philippines	252100	1367570.1	250360	1305248.2	253580	1338107.4
Ilocos	3520	30239.1	3210	29901.4	3090	29259.1
Cagayan Valley	26060	220344.5	25970	211075.2	25610	203127
Central Luzon	11890	75453.2	12360	76844.2	12440	77297.7
Southern Tagalog	13200	77536.9	11150	66499.2	10860	64398.5
Bicol	34900	183828.8	34320	176030.1	36370	216337.2
Western Visayas	23060	88973.5	23210	86942.4	22690	86898.3
Central Visayas	-	-	-	-	-	-
Eastern Visayas	77500	313995.6	77480	312195.8	77040	311144.1
N & E Mindanao	35260	186188.0	34560	151350.7	38180	161118.6
S & W Mindanao	26710	191010.5	28100	194409.2	27300	188526.9
Central Mindanao	-	-	-	-	-	-

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 2 continued

	1970		1971		1972	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Philippines	252360	1316263.1	245980	1220810.6	258480	1217704.4
Ilocos	13990	155514.9	13880	150620	9750	96431.1
Cagayan Valley	16750	130999.9	12140	73102.6	14670	100809.7
Central Luzon	10740	64839	7290	24512.3	8400	26732.3
Southern Tagalog	10490	65340.3	10940	66847.2	13950	74714.2
Bicol	35150	198090.6	38440	205709.7	44270	217385.2
Western Visayas	17660	86675.4	12459	63932.9	10840	49144.7
Central Visayas	-	-	-	-	43090	109309.2
Eastern Visayas	83760	289089.9	85750	295643.4	51120	202075.2
N & E Mindanao	40470	187373.6	41000	180495.4	37870	170078.7
S & W Mindanao	23350	138339.5	24090	159947.1	24520	171024.1
Central Mindanao	-	-	-	-	-	-

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 2 continued

	1973		1974		1975	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Philippines	266330	1220496.5	313910	1410754	351210	1807133.7
Ilocos	9620	97067.6	15690	108507	18540	121416.7
Cagayan Valley	15440	110378.1	7500	31233	8500	36494.8
Central Luzon	7850	26300.4	6310	24985	6670	29225.3
Southern Tagalog	13620	76745	15190	129456	17010	125988.8
Bicol	47860	220289.4	68160	334176	79160	508678.8
Western Visayas	9110	40126.4	9940	52157	11300	71011.6
Central Visayas	41990	101786	71320	133395	71510	199136.7
Eastern Visayas	50430	191194.7	70740	236643	79150	352037.2
N & E Mindanao	45700	176033.3	34740	255814	42580	243809.9
S & W Mindanao	24710	180575.6	14320	104388	16790	119333.9
Central Mindanao	-	-	-	-	-	-

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 2 continued

	1976		1977	
	Hectarage	Production	Hectarage	Production
Philippines	888910	1783918.2	426270	2048043
Ilocos	15340	107907.7	18270	130521
Cagayan Valley	9560	40437	11510	49581.2
Central Luzon	8340	27191.5	9960	32201.7
Southern Tagalog	20290	84141.7	20110	94706.6
Bicol	66640	503354.3	66790	515316.8
Western Visayas	15050	84708	19480	83214.8
Central Visayas	64400	168049.5	79090	195443.2
Eastern Visayas	97420	246667.5	92330	248625.9
N & E Mindanao	48000	156055	38810	134630.1
S & W Mindanao	37230	333489.9	61530	528775.8
Central Mindanao	6640	31643.1	8390	35027.9

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

CHAPTER I

TRENDS IN PRODUCTION

Total hectarage planted to sweet potatoes has varied erratically over the 1967-1977 period but has shown an overall upward trend. In 1967, the hectarage planted was 131,510. Hectarage rose a small amount in each of the succeeding two years with an average annual increase of one percent. In 1970 the hectarage decreased by .004 percent and in 1971 it was further reduced to 128,310--a 5 percent decline. However from 1972 to 1977 plantings experienced a continuous increase. Area planted in 1972 was 139,400 hectares. The area increased by 4 percent in 1973, 25 percent in 1974, and 8 percent in 1975. In 1976 area decreased slightly by 2 percent but again increased by 15 percent in the following year. Hectarage planted in 1977 was 221,730.

From Table 3 it can be observed that from the period 1967 to 1977 the largest area planted to sweet potatoes was in Eastern Visayas, constituting 23 percent of the total hectarage in 1977. The Ilocos Region and Southern and Western Mindanao Regions have shifted toward sweet potato production with increases in area planted from 2,020 and 7,250 hectares, respectively, in 1967 to 14,830 and 26,070 hectares in 1977. Cagayan Valley witnessed a decrease in hectarage planted to sweet potatoes from 23,280 in 1967 to 9,550 in 1977.

Yields of sweet potatoes for the period 1967 to 1977 also exhibit major year-to-year fluctuations, contributing further to annual variations in sweet potato production. In addition to the large annual

variations in yields, there has been an overall decline in the average yields per hectare over the period 1967 through 1977. The average yield in 1967 was 5.22 metric tons per hectare. Yields declined by 2 percent during the following year. In 1969, the average yield increased by 3 percent, and the next year by another 4 percent reaching the highest average so far attained. From 1971 to 1974 average yields continued to decrease. In 1975 the yields increased by 13 percent but decreased by 19 percent the next year. In 1977 the average yield went down to 4.0 metric tons per hectare. This declining behavior in yield is linked to technical problems such as lack of better quality planting materials, insecticides and rodenticides.[4] In addition, (1) bad weather, (2) marketing problems, and (3) lack of educational programs for sweet potato producers may have contributed to the declining trend.

Production of sweet potatoes in 1967 was 686,761.4 metric tons. Output declined by 2 percent in 1968 but increased in 1969 and 1970 by 5 percent and 4 percent, respectively. In 1971 production declined by 10 percent and by another one percent each year in 1972 and in 1973. In 1974 there was a 25 percent increase in production and a further increase of 22 percent in 1975. Production was 986,017.3 metric tons in 1975, which was the highest during the 11-year period under consideration. In 1976 production declined by 21 percent but partly recovered with a 14 percent increase in the following year.

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[4]Santos, p. 38.

Table 3 shows the production in each region for the period 1967 through 1977. From 1967 through 1969 Cagayan Valley produced more than any other region but its production has been decreasing since 1969. Bicol and Eastern Visayas had higher shares of national production from 1970 to 1977. Ilocos Region has had relatively rapid expansion and may have potential for future expansion of sweet potato production.

There has been no reported importation of sweet potatoes during the 1967-1977 period, according to the Central Bank statistical files. The Philippines depends on domestic production for its supply of sweet potatoes.

TABLE 3. Sweet Potato: Hectarage Planted and Production (in Metric Tons) by Region for 1967-1977

	1967		1968		1969	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Philippines	131510	686761.4	131800	672395	134680	706274.1
Ilocos	2020	20379.7	1970	20394.9	1980	20387.4
Cagayan Valley	23280	194547.3	23230	185450.5	23250	185000.4
Central Luzon	8270	58103.1	8610	59152.8	8700	59818
Southern Tagalog	5060	26077.5	4310	24645.7	4200	23635.6
Bicol	20260	101316.1	20010	96230.5	21220	130628.2
Western Visayas	8150	29624.1	8230	29598.8	8200	29856.5
Central Visayas	-	-	-	-	-	-
Eastern Visayas	40030	176916	42030	175643.6	42100	176056
N & E Mindanao	15190	44544.2	15180	40414.5	16780	40417.2
S & W Mindanao	7250	35253.4	8230	40863.7	8250	40472.9

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 3 continued

	1970		1971		1972	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Philippines	134620	731393.9	128310	656717.2	139400	651467.7
Ilocos	11430	124057.8	10900	117935.7	7660	81154
Cagayan Valley	14940	123033	10460	65999.6	11820	77306.7
Central Luzon	7530	52872.8	4150	14465.5	5330	16236.6
Southern Tagalog	4020	23333.1	4150	25365.1	5240	26015.3
Bicol	20160	123509.0	21500	135752.6	26880	144304.3
Western Visayas	6880	31898.1	4870	25403.0	4460	21590.6
Central Visayas	-	-	-	-	18120	43771.3
Eastern Visayas	44920	158924	45160	151013.5	30860	111479
N & E Mindanao	17730	56148.5	19860	71908.9	21280	75907.7
S & W Mindanao	7010	37617.6	7260	48871.3	7750	53702.2

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 3 continued

	1973		1974		1975	
	Hectarage	Production	Hectarage	Production	Hectarage	Production
Philippines	144280	647645.6	181000	806998	195730	986017.3
Ilocos	7640	82035.3	12050	91704	15360	105000.6
Cagayan Valley	13230	93334.5	6380	23246	6750	28484.7
Central Luzon	4870	15018.0	4520	16843	5230	21207.4
Southern Tagalog	4890	24871.3	7110	60804	7480	58583.6
Bicol	28250	145725.0	38590	181591	42600	252716.7
Western Visayas	4450	17025.2	5480	27113	5570	39042.7
Central Visayas	14660	31821.5	33260	54987	33320	81300.3
Eastern Visayas	32320	112944.9	45020	152699	46230	201007.4
N & E Mindanao	26960	78228.8	20640	141186	24780	136955.6
S & W Mindanao	5010	46641.1	7950	56825	8410	61718

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 3 continued

	1976		1977	
	Hectarage	Production	Hectarage	Production
Philippines	192270	781201.7	221730	887748
Ilocos	12030	81991.1	14830	106632.5
Cagayan Valley	7960	35384.0	9550	43689
Central Luzon	6850	31637.6	8210	25559.2
Southern Tagalog	8610	31338.4	8770	37835.8
Bicol	19390	121698.4	36140	265764
Western Visayas	6780	43016.8	8210	37721.6
Central Visayas	27850	76961.6	34270	70047.2
Eastern Visayas	54080	186233	50280	129618.7
N & E Mindanao	37710	106217.6	20610	62850.3
S & W Mindanao	11010	66723.2	26070	88308.2

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

CHAPTER II

TRENDS IN CONSUMPTION

Based on the results of the report on the 19 nationwide economic surveys of food consumption relative to income for the period 1970 to 1976, the average annual per capita consumption of sweet potatoes was 10.73 kilograms.[5] The consumption data are presented on the basis of annual per capita rates of use by income groups. For those consumers with an annual per capita income of less than ₱ 400 (lowest group) average consumption over the 6-year period was 13.5 kilograms. Average per capita consumption for the ₱ 400 - ₱ 799 income group (medium low) was 10.6 kilograms while that for the ₱ 800 - ₱ 1,400 income group (medium high) and for the ₱ 1,500 and over group (highest) averaged 9.9 and 8.9 kilograms, respectively. The average income elasticity of demand from the lowest to the medium low group was -.30. The average income elasticity for both the medium low to medium high and medium high to the highest income groups was -.11, while that for the lowest to the highest income group was -.24. The income elasticity of less than zero, indicating decreasing consumption as income increases, places sweet potatoes in the category of an inferior good to Philippine consumers.

Table 4 indicates regional differences in per capita consumption of sweet potatoes in the Philippines. Annual per capita consumption ranged from a high of 30.8 kilograms in Eastern Visayas to a low of 3.3

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[5] Aviguetero, p. 43.

TABLE 4. Sweet Potato: Annual Per Capita Consumption by Region, 11 Surveys, May-June 1974 - December 1976, Philippines

Region	Consumption (kilograms)	Income-Quantity Elasticity
Ilocos	5.1	0.00
Cagayan Valley	5.3	0.19
Central Luzon	4.9	0.59
Metro Manila	4.2	0.58
Southern Tagalog	3.3	0.40
Bicol	11.1	-0.06
Western Visayas	10.2	0.07
Central Visayas	15.1	-0.24
Eastern Visayas	30.8	-0.35
Western Mindanao	18.2	-0.27
Northern Mindanao	17.4	-0.01
Eastern Mindanao	10.4	-0.24
Central Mindanao	15.6	0.23
Philippines	10.6	-0.28

Source: E. F. Aviguetero et al. Income and Food Consumption Patterns for Major Foods, Special Studies Division, Ministry of Agriculture, 78-13 (May 1978), p. 17.

kilograms in Southern Tagalog. Regional differences in consumption may result in small part from differences in per capita incomes, but are largely determined by differences in tastes and preferences. The tabulations indicate that the rates of consumption are high in many areas in Visayas and Mindanao where sweet potatoes are used as a staple food or rice/corn substitute. Rates of consumption are rather low in many places in Luzon since rice is the major staple food and sweet potatoes supplement rice in the diet.

The trends in total utilization of sweet potatoes could not be determined at this point in time due to insufficient data. There are no statistics for the proportion of local production that goes into industrial use and that which has been wasted due to spoilage and handling from producer to consumer.

If data were available, total requirement could be estimated by the formula:

$$R^* = C^* + I^* + W^* + E^*$$

where: C^* = Human consumption requirements

I^* = Requirements for industrial use and livestock feeds

W^* = Allowance for wastage

E^* = Exports

Human consumption requirements can be computed by $C^* = aN^*$

where a = average per capita consumption

N^* = national population figure

Data on sweet potato exports are available from the Central Bank of the Philippines (see Table 5).

TABLE 5. Sweet Potato Exports, 1969-1977

Year	Quantity of Exports (Gross kilograms)	Importing Country	FOB $ (US Dollars)	FOB ₱ (Pesos)
1969	*			
1970	*			
1971	*			
1972	*			
1973	1,000	United Kingdom	180	1,220
1974	449,050	Hongkong	64,977	436,705
1975	10,400	Hongkong	2,230	16,324
1976	12,000	Hongkong	1,000	7,402
1977	150[1]	Guam	270	1,982

Source: Central Bank Statistic Data, Manila Philippines.

*no exports

[1]in net kilograms

CHAPTER III

TRENDS IN PRICES

As reflected in the retail price reports on the major agricultural crops of the Bureau of Agricultural Economics during the period 1969 to 1976, sweet potato prices registered an average annual increase of 14.71 percent.[6] (Refer to Table 6 for reported average annual sweet potato prices).

The Ilocos region witnessed the highest average retail price during the period (79 centavos per kilogram) while Bicol received the lowest average retail price per kilogram (46 centavos).

Sweet potato prices received by farmers registered an average annual increase of 15 percent from 1969 to 1976.[7] Prices declined only once--by 2 percent in 1976.

Ilocos and Central Luzon received the highest average farm price (36 centavos per kilogram) over the 8-year period. Southern and Western Mindanao growers received only 23 centavos per kilogram, which was the lowest annual average farm price over the period and only 64 percent of the Ilocos and Central Luzon farm prices.

The relatively high price received by farmers in the Ilocos Region

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[6]Using the wholesale price index in the Statistical Handbook of the Philippines published by the National Census and Statistics Office in 1976 it was noticed however that the real retail price of sweet potatoes had been decreasing from 36 centavos per kilogram in 1969 (1969 as base year) to 21 centavos per kilogram in 1976.

[7]Using the same wholesale price index the real farm price of sweet potatoes decreased from 16 centavos per kilogram in 1969 (1969 as base year) to 12 centavos per kilogram in 1976.

might have induced farmers to increase the area planted to sweet potatoes from 2,020 hectares in 1967 to 14,830 hectares in 1977. One would expect the farm prices of agricultural crops to be relatively high in Central Luzon compared to those in other regions since these provinces are near the major central market, which is Manila. Also, population increases have expanded the quantity demanded in Manila.

Santos noted in the consolidated report of Sweet Potato Marketing in the Philippines that sweet potato prices during 1974-1976 showed relatively little seasonal variation.[8] Representative seasonal price patterns are presented in Figures 1A and 1B. (The indices of seasonal variation and indices of irregularity of sweet potato retail and farm prices in Central Luzon were computed using the 13 months - moving average method).

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[8]Santos, p. 3.

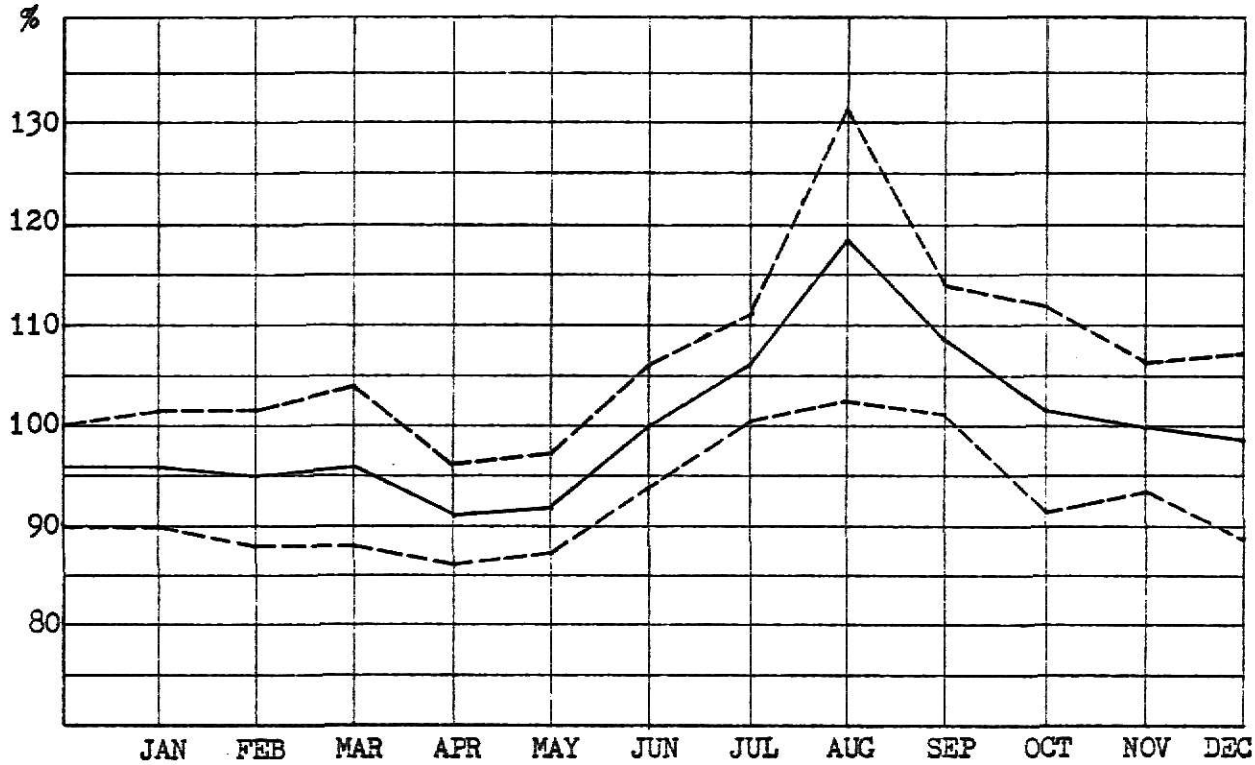

Fig. 1A. SWEET POTATO RETAIL PRICES IN CENTRAL LUZON
INDICES OF SEASONAL VARIATION AND IRREGULARITY
AUGUST 1969 - JUNE 1976

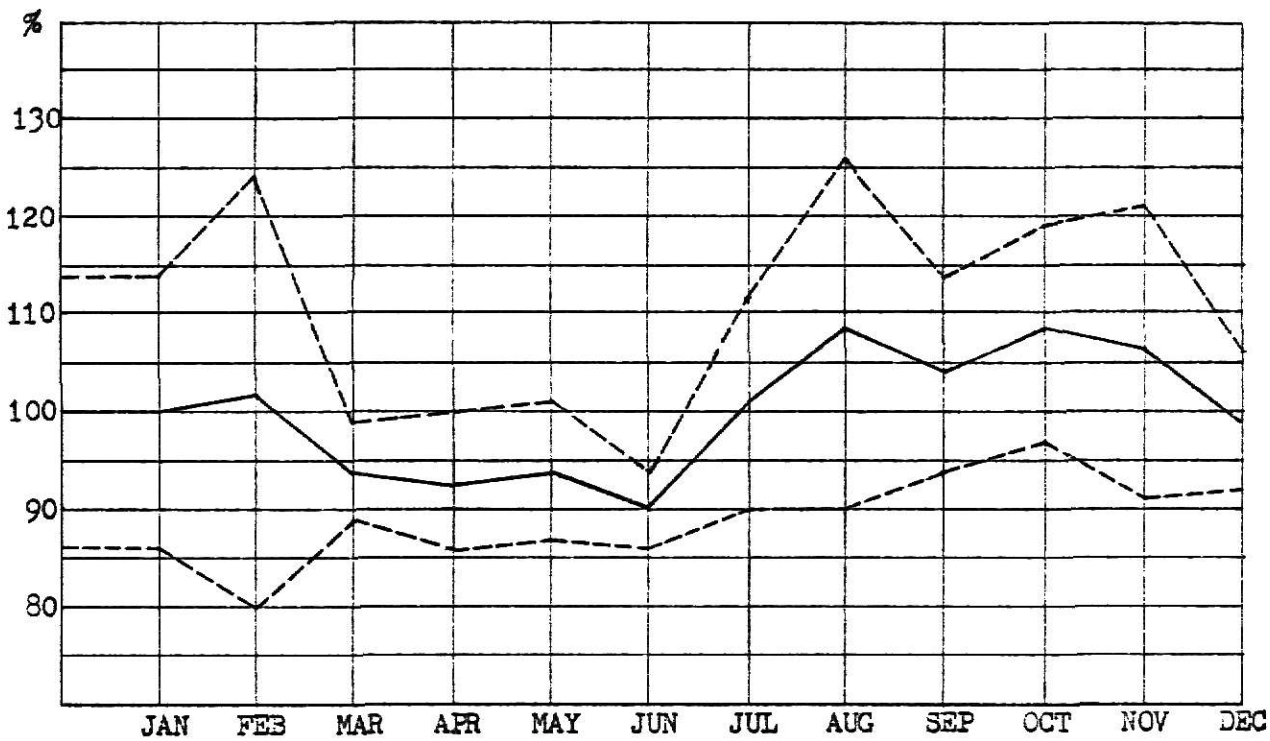

Fig. 1B. SWEET POTATO FARM PRICES IN CENTRAL LUZON
INDICES OF SEASONAL VARIATION AND IRREGULARITY
JULY 1970 - JUNE 1976

TABLE 6. Sweet Potato: Farm-Retail Price Spreads 1969-1976 (In Pesos/Kilogram)

	1969				1970			
	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)
Philippines	.36	.16	.20	44	.37	.19	.18	51
Ilocos	.39	.20	.19	51	.44	.28	.16	64
Cagayan Valley	.41	.22	.19	54	.37	.19	.18	51
Central Luzon	.36	.24	.12	67	.42	.27	.15	64
Southern Tagalog	.31	.17	.14	55	.35	.21	.14	60
Bicol	.22	.12	.10	55	.26	.15	.11	58
Western Visayas	.40	.14	.26	35	.39	.15	.24	38
Central Visayas	-	-	-	-	-	-	-	-
Eastern Visayas	.41	.13	.28	32	.36	.13	.23	36
N & E Mindanao	.34	.12	.22	35	.33	.15	.18	45
S & W Mindanao	.39	.11	.28	28	.40	.14	.26	35

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 6 Continued.

	1971				1972			
	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)
Philippines	.46	.24	.22	52	.52	.28	.24	54
Ilocos	.48	.26	.22	54	.63	.31	.32	49
Cagayan Valley	.45	.23	.22	51	.55	.30	.25	55
Central Luzon	.51	.25	.26	49	.55	.33	.22	60
Southern Tagalog	.50	.28	.22	56	.59	.31	.28	53
Bicol	.39	.26	.13	67	.43	.26	.17	60
Western Visayas	.47	.21	.26	45	.54	.28	.26	52
Central Visayas	-	-	-	-	-	-	-	-
Eastern Visayas	.47	.25	.22	53	.52	.30	.22	58
N & E Mindanao	.40	.23	.17	58	.45	.25	.20	56
S & W Mindanao	.47	.20	.27	43	.44	.21	.23	48

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 6 Continued.

	1973				1974			
	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)
Philippines	.63	.31	.32	49	.80	.41	.39	51
Ilocos	.82	.39	.43	48	1.09	.50	.59	46
Cagayan Valley	.60	.33	.27	55	.88	.44	.44	50
Central Luzon	.63	.34	.29	54	.84	.52	.32	62
Southern Tagalog	.59	.41	.18	69	.90	.46	.44	51
Bicol	.49	.33	.16	67	.66	.38	.28	58
Western Visayas	.74	.30	.44	41	.81	.46	.35	57
Central Visayas	-	.31	-	-	-	.38	-	-
Eastern Visayas	.67	.31	.36	46	.82	.40	.42	49
N & E Mindanao	.49	.28	.21	57	.51	.39	.12	76
S & W Mindanao	.60	.25	.35	42	.66	.29	.37	44

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

Table 6 Continued.

	1975				1976			
	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)	Retail Price	Farm Price	Farm-Retail Spread	Farmer's Share of Retail Price(%)
Philippines	.85	.42	.43	49	.93	.41	.52	44
Ilocos	1.11	.52	.59	47	1.37	.44	.93	32
Cagayan Valley	.94	.50	.44	53	.84	.43	.41	51
Central Luzon	.79	.47	.32	59	1.00	.43	.57	43
Southern Tagalog	.78	.46	.32	59	.98	.40	.58	41
Bicol	.78	.39	.39	50	.46	.38	.08	83
Western Visayas	.86	.42	.44	49	1.10	.43	.67	39
Central Visayas	-	-	-	-	1.05	.42	.63	40
Eastern Visayas	.91	.46	.45	51	.86	.43	.43	50
N & E Mindanao	.75	.39	.36	52	.84	.38	.46	45
S & W Mindanao	.69	.32	.37	46	.76	.35	.41	46

Source: Republic of the Philippines Ministry of Agriculture, Bureau of Ag. Economics.

CHAPTER IV

FARM-RETAIL PRICE SPREADS

Dahl and Hammond define marketing margin as the difference between farm price and retail price. Marketing margin refers only to the price difference and makes no statement about the quantity of the product marketed.[9] Marketing margin is also defined as the farm-retail price spread by the U.S. Department of Agriculture in reference to statistics that present the retail and farm price differences.

The farm-retail price spreads for sweet potatoes in the Philippines for the period 1969 to 1976 were determined by subtracting the average price received by farmers for sweet potatoes from the average retail price paid by the consumers for the same crop in the same year. Data for both prices were gathered from the Philippine Bureau of Agricultural Economics. Table 6 gives us the farm-retail price spreads of sweet potatoes in the Philippines from 1969 to 1976.

A number of difficulties are encountered in attempting to measure price spreads.[10] Several difficulties relate to determining the average retail price at which a particular product was sold in a given period. Variables such as quality, unit of sale, type of store, geographic location all cause variation in retail prices. Other problems include difficulty in obtaining accurate farm price data for individual products,

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[9] Dale Dahl and Jerome Hammond, Market and Price Analysis (New York: McGraw Hill Inc., 1977), p. 139.

[10] U.S., Department of Agriculture, Farm-Retail Spreads for Food Products, Misc. Pub. No. 741 (Washington, D.C.: Government Printing Office, 1957).

difficulty in obtaining precise data on spoilage and shrinkage of physical quantity as the product moves from farms to consumers, and difficulty in establishing the value of by-products when they must be considered. These limitations may affect the accuracy of the price spreads computed from prices in Table 6.

The national average farm-retail price spread for sweet potatoes in 1969 was 20 centavos per kilogram. In 1970 the spread decreased by 10 percent. However, from 1971 to 1976 it increased at an average rate of 19.5 percent per year. Farm-retail price spread in 1976 averaged 52 centavos per kilogram of sweet potatoes.

The farmer's share of the retail price was 44 percent in 1969. It increased to 51 percent in 1970, 52 percent in 1971, and 54 percent in 1972. It decreased, however, to 49 percent in 1973. In 1974 it went up to 51 percent but declined to 49 percent again the next year. In 1976, the farmer's share was down to 44 percent.

In 1976, the Ilocos Region had the highest average retail price and highest average farm price but the farmer's share of the retail price was the lowest (32 percent). The corresponding farm-retail price spread was 93 centavos per kilogram. The Bicol Region had the lowest average retail price, but Bicol farmers' share of the retail price was the highest at 83 percent. The farm-retail price spread in this region averaged only 8 centavos per kilogram.

There is a general preconception that wide margins mean high prices to consumers and low prices and incomes to producers and accordingly, the narrower the margin, the more efficient the market is. However,

this is not true in many cases. If each farmer peddled his produce from house to house, or if each consumer bought her goods by shopping from farm to farm, the prices paid by consumers and the prices received by farmers would be identical. The marketing margin would be zero. But this does not make the marketing system efficient since a great deal of time would be spent in the marketing process, and important marketing functions may not be performed effectively. The marketing margin represents charges for many different marketing services such as assembly of products from the farmers, storage, transportation, processing, wholesaling and retailing. Entrepreneurial returns or profit for those who provide marketing services must be included in the margin also. The efficiency of a market, therefore, cannot be measured simply by the width of the margins, either in percentage form or in absolute amounts.[11] Increasing profit levels often are construed to be an indication of market inefficiency. However, there are no absolute standards of "reasonableness" in profit levels.

Generally, the marketing process begins with the gathering or assembling of farm products from the farmers. Physical functions such as storage and transportation are performed by marketing agencies as are the facilitating functions of standardization, financing, risk bearing and market information.

After they leave the farm, most products are processed or prepared in some way for shipment or sale at retail. Generally, the more a

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[11] Geoffrey Shepherd, Gene Futrell, and J. Robert Strain. Marketing Farm Products, 5th ed. (Ames: Iowa State University Press, 1976) p. 232.

commodity is changed from the time it leaves the farm until it reaches the consumer, the greater the portion of the retail price represented by processing costs. For instance, costs are incurred when sweet potatoes are processed into starch. Likewise costs are incurred for the functions of wholesaling and retailing. Expenses such as taxes, depreciation, repairs, bad debts, interest and rent must be recovered, along with those for the obvious items such as labor, packaging, product waste, energy, etc., in the marketing margin for the product.

The farmer's share of the retail price often fluctuates over a period of time as observed in Table 6. This results from the changing farm-retail prices and the relatively inflexible nature of the marketing margin.

Several factors tend to explain why marketing charges do not move up and down with farm-retail prices. Changes in farm prices are usually the result of increases or decreases in product availability. When farmer's prices decline because of increase in supply, marketing costs are not directly affected because they are related to the physical product rather than the peso-value paid to farmers and to price trends as a whole. For example, it takes the same amount of space to transport sweet potatoes whether they are sold for 90 or 80 centavos per kilogram.

CHAPTER V

TIME, SPACE AND FORM CONSIDERATIONS

The main concern of this report is the problem of getting the commodity from producer to consumer at the lowest cost permitted by marketing conditions and available technology. Value is added in the marketing process through change in time, space and form of commodities delivered to consumers.

Marketing costs relating to each value-increasing physical function are costs of storage from one time period to another, costs of transportation from one place to another and costs of conversion from one form to another. These costs are the economic basis for the time, space and form differentials in prices that exist in the markets for farm products.[12]

An analysis is hereby presented with regard to time, space and form considerations which characterize the Philippine sweet potato market.

Time Considerations

For many farm commodities production and marketing are characterized by a high degree of seasonality. The period of harvest for crops in a single region encompasses periods of a few weeks to a few months at most. On the other hand, demands for farm products tend to be rather stable throughout the year. This means that the marketing

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[12] Ibid, p. 13.

system for farm products must store or hold much of the annual production and allocate it throughout the year. Two kinds of costs involved in this process reported by Dahl and Hammond are: 1) The direct costs of providing the physical facilities for storage; and 2) The costs that are due to the risk of price changes which occur while the product is in storage.[13] Other costs include inventory carrying costs, costs of maintaining product quality and costs of unavoidable product losses.

The time factor for sweet potato marketing is not as big a problem as with commodities requiring a highly specialized environment, however, extent of spoilage and loss during marketing is not really known and might be quite high. Storage facility costs are not high since sweet potatoes can be stored in ordinary room temperature. However, according to the "Philippine Recommends for Vegetables," to maintain the quality of sweet potatoes, storing should be maintained at 10°-13° and 80 percent to 90 percent relative humidity (RH). Injured or bruised surfaces should be allowed to heal by curing at 32°C and 95 percent to 97 percent RH for a few days. Properly cured roots will last for five to eight months.[14]

Sweet potatoes can be grown all year around in a wide variety of soils all over the country. Seasonal sweet potato prices have generally remained stable for the past years.[15] One possible way of reducing

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[13]Dahl, p. 186.

[14]Philippine Council for Agriculture and Resources Research, Philippine Recommends for Vegetables (Los Banos, Laguna, Phil., 1976), p. 102.

[15]Santos, p. 3.

marketing costs is programming production (i.e., staggering planting schedules) to meet a particular market demand in a specific period. Proper timing of planting, harvesting and marketing of sweet potatoes will lessen, if not minimize, the effects of seasonality and fluctuations of supply and prices. Manila, the major consuming center, gets its supply from different producing centers all year around to meet its demand, thereby reducing seasonal price fluctuations. The Tarlac-Pangasinan crop comes early in the year, the Cavite crop around mid-year and the Bataan crop late in the year.[16] (Figure 2A).

Space Considerations

Prices for sweet potatoes vary from region to region (Table 6). In 1976 the retail price per kilogram of sweet potatoes ranged from a low of 46 centavos in Bicol Region to a high of ₱ 1.37 in the Ilocos Region. Santos pointed out in the survey report that the price differences for the commodity reflect differences in location as well as other factors.[17]

The geographical flow of sweet potatoes is mostly intra-island rather than inter-island. (Figures 2A, 2B, and 2C). Potatoes produced in each of the three major islands are consumed and utilized in the respective islands (e.g., those produced in Luzon are also consumed in Luzon). Inter-island flow of sweet potatoes is nil. How far sweet potatoes can be reasonably transported by coastal ships or on land before product value disappears is not known.

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[16] Ibid, p. 33.

[17] Ibid, p. 3.

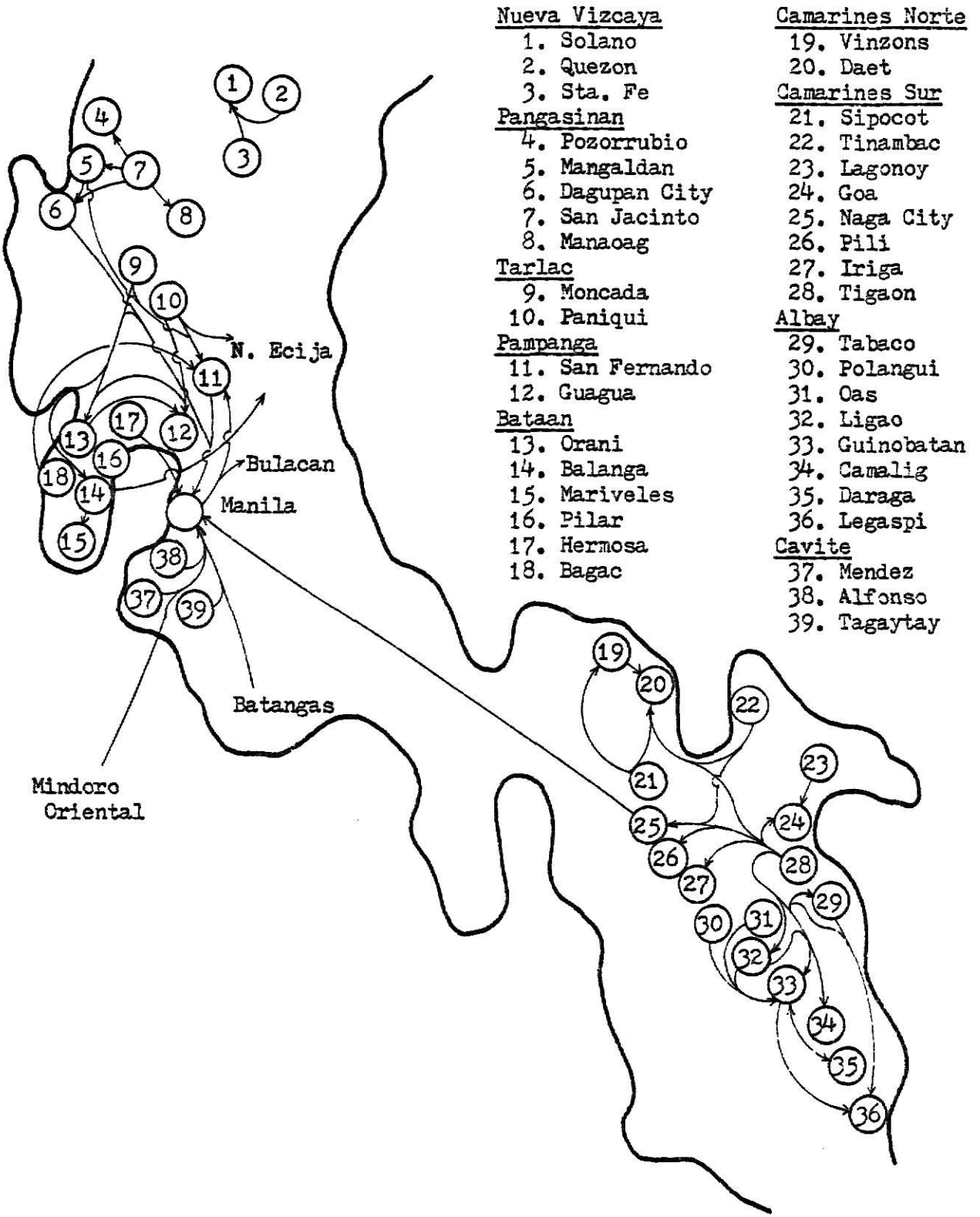


Fig. 2A. GEOGRAPHIC FLOW OF SWEET POTATOES ORIGINATING IN MAJOR PRODUCTION AREAS, LUZON, 1974-76

Source: C. L. G. Santos. Sweet Potato Marketing in the Philippines. Special Studies Division, Ministry of Agriculture, 77-10 (March 1977), p. 34.

Aklan
1. Kalibo
2. Altavas

Capiz
3. Sapian
4. Ivisan
5. Roxas City

Iloilo
6. Lemery
7. Passi
8. Iloilo City
9. Guimaras

Negros Occ.
10. Bacolod City
11. Talisay
12. Itinigaran
13. Cauayan
14. Isabela

Negros Or.
15. Bayawan
16. Sibulan
17. Dumaguete City

Cebu
18. Balamban
19. Toledo City
20. Cebu City

Bohol
21. Maribojoc
22. Tagbilaran City
23. Catigbi-an
24. Carmen

Leyte
25. Dulag
26. Alang-Alang
27. Tacloban City

Eastern Samar
28. Guiuan

Western Samar
29. Basey
30. Sta. Rita
31. Hinabangan
32. Wright
33. Jiabong
34. Catbalogan
35. Daram

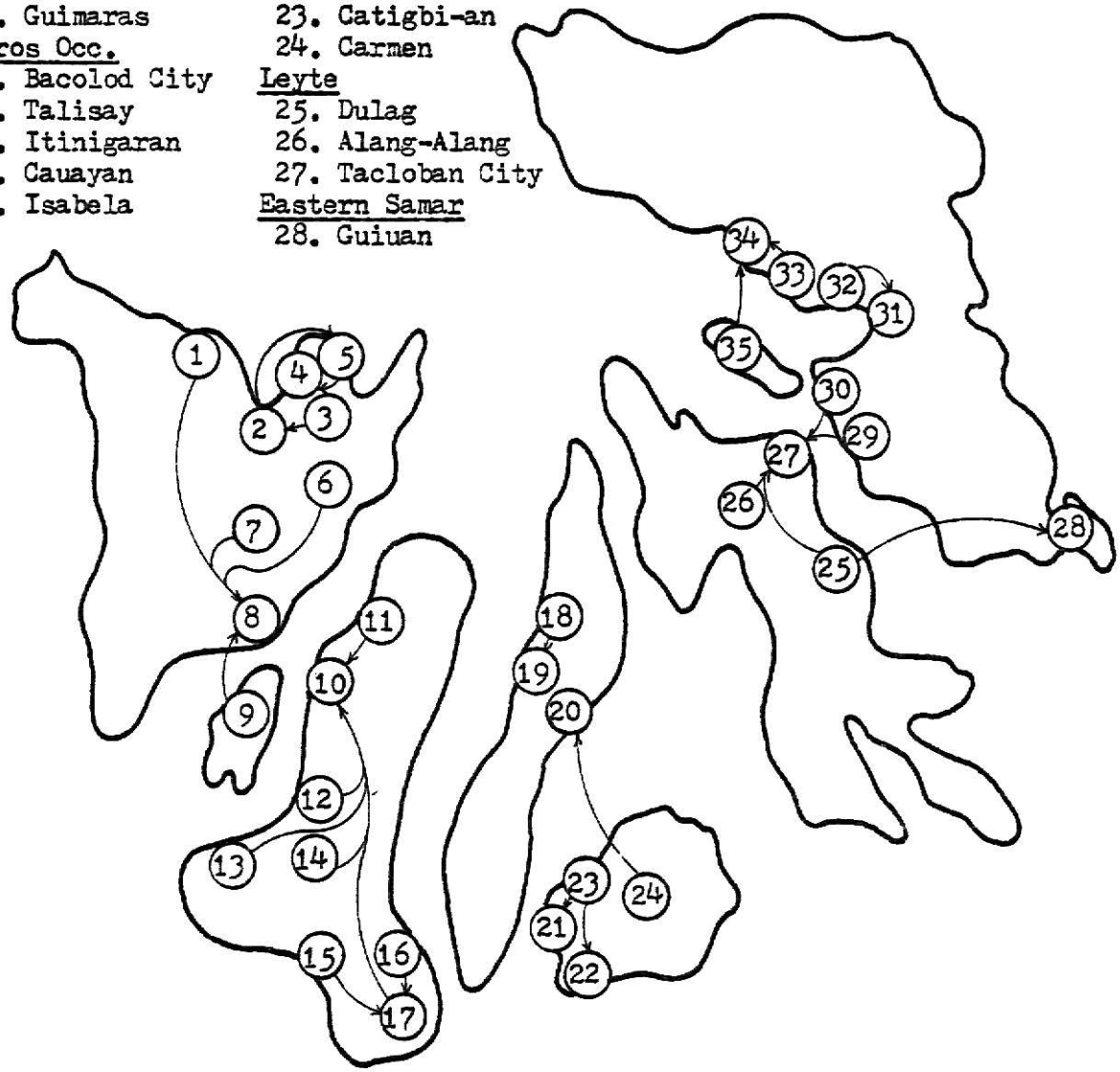
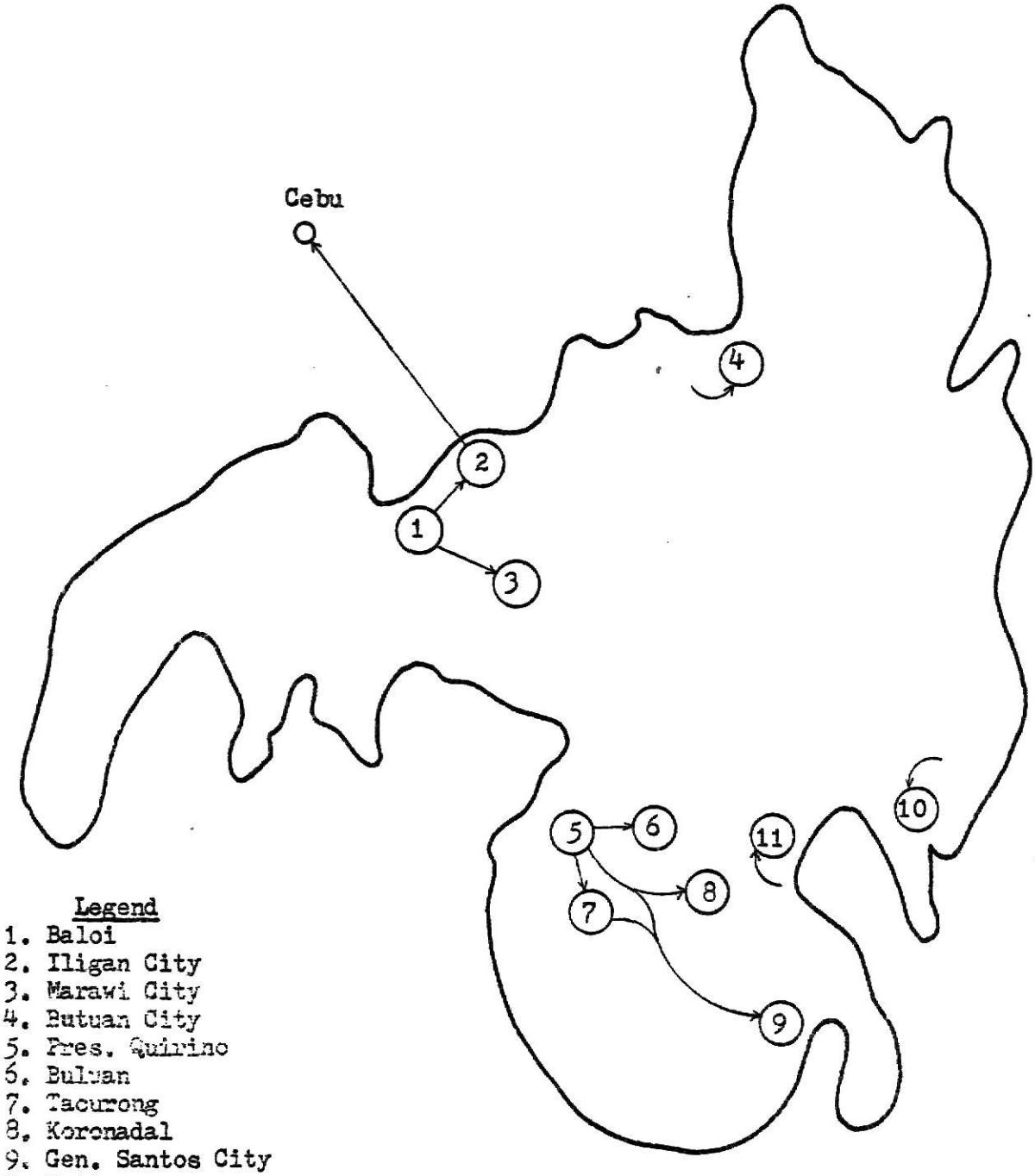


Fig. 2B. GEOGRAPHIC FLOW OF SWEET POTATOES ORIGINATING IN MAJOR PRODUCTION AREAS, VISAYAS, 1974-76

Source: C. L. G. Santos. Sweet Potato Marketing in the Philippines. Special Studies Division, Ministry of Agriculture, 77-10 (March 1977), p. 35



Legend

1. Baloi
2. Iligan City
3. Marawi City
4. Butuan City
5. Pres. Quirino
6. Buluan
7. Tacurong
8. Koronadal
9. Gen. Santos City
10. Mati
11. Davao City

Fig. 2C. GEOGRAPHIC FLOW OF SWEET POTATOES ORIGINATING IN MAJOR PRODUCTION AREAS, MINDANAO, 1974-76

Source: C. L. G. Santos. Sweet Potato Marketing in the Philippines, Special Studies Division, Ministry of Agriculture, 77-10 (March 1977), p. 36.

Prices of agricultural products vary geographically in relation to the transportation differential required to move commodities from one place to another. The means of transportation used depends upon the availability of the modes of transportation and the unit-distance rate for each mode.

One way by which intra-regional and interregional trade can be approximated and minimum cost transport patterns determined is through the use of the transportation model.

Form Considerations

The form in which sweet potatoes are marketed has a significant bearing on marketing costs. Measurable sources of price variation within the form dimension consisted of grade, type of container and product form.

Sweet potatoes are generally sorted by removing the diseased and badly bruised tubers before packaging them for market.[18] Grading is done by sorting the sweet potatoes into four size groups. Extra large called No. 1's; large called No. 2's; medium called No. 3's and small called No. 4's. Typically the price of No. 1's is more than double that for No. 4's. This should encourage farmers to produce the largest sweet potatoes possible and sort them by size. But without a uniform standard for each size category it is difficult to get uniform sizing among the various growers. To a grower who has no No. 1's, the No. 2's look big and are likely to be classed No. 1's. Likewise, when prices

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[18] Ibid, p. 13.

are high, the No. 2's are likely to be called No. 1's.[19]

After washing, the sweet potatoes are generally packed in "kaings"[20] or sacks for sale. The weight of the container varies depending on their sizes. Farmers seem to have little idea about the conversion of sacks or "kaings" of sweet potatoes into kilograms. The retailers sell sweet potatoes on a "tumpok" (a pile) basis. There is no set way of measuring the quantity contained in a "tumpok".[21]

Selling by sack affects the bargaining power of farmers due to buyer's concern regarding the contents. This results in less favorable prices to farmers. Consumers were also affected by buying on a "tumpok" basis since selection of good sweet potatoes in a "tumpok" was not permitted.

Standardization of sweet potatoes by size, color, texture of the outer covering and presence or absence of weevil damage would likely permit sale by description if implemented. Standardization of quality factors and weights would permit improved price reporting and, presumably, pricing efficiency in sweet potato markets.

Governments frequently play an important role in establishing uniform grade standards. Government participation has expected advantages as follows: (1) the government can more easily act as a disinterested third party in applying the grades; (2) grade proliferation may

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[19] L. B. Darrah and F. A. Tiongson, Agricultural Marketing in Philippines, (Los Banos, Laguna, Phil.: University of the Philippines College of Agriculture Textbook Board, 1969) p. 248.

[20] Kaing is a woven bamboo basket which is used as a container. It varies in size.

[21] Santos, p. 37.

be reduced; and (3) grade terminology is likely to be more uniform and less confusing.[22]

Another important factor which has a direct influence on marketing costs is the degree of processing. This involves change in the physical form of sweet potatoes in accordance with consumer demand. Table 7 gives us the forms by which sweet potatoes can be prepared for human consumption. Likewise, sweet potatoes can be utilized for feeds and starch production and other industrial purposes. A project presently supported by the National Food and Agriculture Council has shown that sweet potatoes can be utilized for making flour, snack foods (shoe-string and chips), wine and "nata".[23]

Some of the factors contributing to potential popularity of processed products to consumers are: (1) assurance of products with acceptable levels of quality, (2) convenience in storage, (3) ease of preparation of the processed products, and (4) avoidance of the high rates of spoilage frequently encountered with fresh market sweet potatoes.

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[22]Dahl, p. 213.

[23]National Food and Agriculture Council, Sweet Potato: Its Potentials for Food and Feeds in the Philippines (Quezon City: National Food and Agriculture Council, 1976), p. 4.

TABLE 7. Forms in which Sweet Potatoes can be Processed for Food

Manner of Preservation and Type of Product	Characterization
Canning:	
Sirup packs	Small whole roots, chunks or mixed types packed and processed in sugar sirups of varying concentrations.
Vacuum packs	Roots, as above, processed under vacuum without addition of sirups.
Solid packs	Mashed stock packed solidly in cans and heat processed.
Purees	Comminuted, strained, precooked stocks, usually unflavored, heat processed.
Baby foods	Specially prepared and blended heat-processed purees for infant and child feeding. Usually without additives.
Freezing:	
Strips, slices, dices, chunks	Variously prepared from peeled or unpeeled potatoes, frozen with or without sirups, and with or without cooking or baking.
Mashed, souffle	Stock prepared as for solid-pack canning, but preserved by freezing.
Purees	Pureed product preserved by freezing.
Dehydration:	
Strips, dices	Prepared pieces blanched, dehydrated with heat and vacuum with or without anti darkening treatments.
Flakes	Peeled, preheated stock, sliced, cooked, pureed, double-drum dried flaked, packaged in low-oxygen atmospheres.
Flours	Stock washed and dehydrated fresh or after cooking, ground and sifted.

Table 7 continued

Manner of Preservation and Type of Product	Characterization
"Alayam" and similar specialty products	Prepared prebaked roots pulped pureed, other additives incorporated, extruded onto trays baked in ovens. Used directly as cookies, snacks, or confections; or ground to give "Alamalt" flour for use in ice creams or other products.
Cooking in oil:	
Chips	Prepared raw slices of suitable thickness and shapes immersed in hot cooking oils, drained, salted as desired, packaged in low-oxygen atmospheres.

Source: U.S. Department of Agriculture, Agricultural Research Service, Sweet Potato Culture and Diseases, Agriculture Handbook No. 388 (June, 1971), p. 4.

CHAPTER VI

RESEARCH PROPOSAL

I. Purpose of the Study

The primary purpose of this research proposal is to provide economic information needed for getting sweet potatoes from the space, time and form that they enter the market to the space, time and form needed for providing to consumers maximum satisfaction at minimum marketing costs. A major objective is to establish a framework within which the various physical dimensions of marketing costs can be analyzed and the effect of unit cost changes on market flows determined for the purpose of minimizing costs and developing an effective and workable marketing program for sweet potatoes. It also aims to give information on the costs associated with each factor and provide alternative paths to minimize such costs in balancing supply and consumption.

II. Areas to be Studied

Central Luzon, Southern Tagalog and Bicol Regions are reported as major sweet potato suppliers for Luzon. (The geographical flow of sweet potatoes in Luzon is shown in Figure 2A). In 1977 production in metric tons was 25,559.2 in Central Luzon, 37,835.8 in Southern Tagalog and 265,764 in Bicol (Table 3). The major production centers reported were Tarlac, Pangasinan, Cavite, Bataan, Batangas, Oriental Mindoro and Camarines Sur. The Tarlac-Pangasinan crop comes early in the year, the Cavite-Batangas crop around mid-year and the Bataan crop late in the year. From each of these areas, sweet potatoes move into other Central Luzon

areas (e.g., Nueva Ecija, Pampanga and Bulacan) and to the Metropolitan Manila area which is the major destination. In Bicol, a major portion of the produce went to nearby markets within the area; in all other areas of Luzon, a relatively small amount was consumed within or near production areas.[24]

Production in Central Luzon and Bicol was reported to go 98 percent for human consumption and 2 percent for processing in 1974. In Southern Tagalog 100 percent of production was reported to go for human consumption.[25]

In 1976 retail prices per kilogram of sweet potatoes were a peso and 25 centavos in Metropolitan Manila, a peso in Central Luzon, 98 centavos in Southern Tagalog and 46 centavos in Bicol. Farmer's share of the retail price was 43 percent in Central Luzon, 41 percent in Southern Tagalog and 83 percent in Bicol (Table 6).

Central Luzon, Southern Tagalog and Bicol Regions offer opportunities to observe contrasts in marketing practices, planting and harvesting dates, existing processing activity and a major market that will permit study of various retail marketing techniques and analysis of demand responses over a major population with a broad range of income levels. The three regions have the variety of markets and marketing characteristics that makes them very suitable for a baseline study of sweet potato marketing

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[24] Santos, p. 33.

[25] M. V. Javier. Sweet Potato Marketing, Part I: Bicol, Special Studies Division, Ministry of Agriculture, 74-26 (Septermber 1974), p. 16; T. C. Pili. Part IV: Southern Luzon, 75-4 (February 1975), p. 16; I. P. Carlos. Part VI: Central Luzon, 75-7 (March 1975), p. 18.

in the Philippines.

III. Research Approach

A. Concept and Use of the Transportation Linear Programming

The transportation linear programming method will be used to find the minimum cost program for distributing sweet potatoes from several supply points (sources) to a number of demand points (destinations). The transportation problem may be stated generally as:

Minimize the objective function

$$Z = \sum_{i=1}^{m} \sum_{j=1}^{n} C_{ij} X_{ij}, \text{ for } i = 1,2,\ldots,m;\ j = 1,2,\ldots,n$$

subject to the constraints that

$$\sum_{i=1}^{m} X_{ij} = D_j, \quad \text{for } j = 1,2,\ldots,n$$

$$\sum_{i=1}^{n} X_{ij} = S_i, \quad \text{for } i = 1,2,\ldots,m$$

and

$$X_{ij} \geq 0 \quad \text{for all } i \text{ and } j$$

D_j and S_i are nonnegative integers that represent, respectively, the demand at the j^{th} destination and the supply at the i^{th} source. The model will allocate the surplus quantities from the multiple origin points among the deficit quantities at the multiple destination points so that requirements of all the destinations are satisfied at a minimum total cost for the system as a whole. The "User's Guide to Computerized System for Feasible Agribusiness Development"[26] will be used as reference

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[26] Richard Phillips et al. User's Guide to Computerized System for Feasible Agribusiness Development, 2 vols. (Manhattan, Kansas State University Food and Feed Grain Institute, Rev. ed., July 1977). Vol. 2, Sec. 12 1-56.

for structuring the problem and input data for computer analysis.

Initial empirical analysis will be limited to the study of the time and space dimensions of sweet potato marketing. The form dimension will eventually be included in the model when the development of an integrated least-cost marketing network is considered in the simulation. The time required for production, transport and utilization will be reflected in the model by considering the time dimension of both the quantities supplied and the quantities demanded and treating storage as an alternative to transport in the optimum solution. The model contains the recursive feature so that the volumes assigned to storage in the solution for the previous period are added to the supply of quantities available for distribution in the current period.

The computer package program which will be used to solve the recursive linear programming problem is also available at the Ministry of Agriculture Computing Center in the Philippines. The model as formulated deals simultaneously with the least-cost marketing pattern in time and space. Seperate solutions are obtained for each month during the marketing year. For a given month, the alternative destinations include (1) current consumption at the origin point, (2) current consumption at destination points, (3) storage at the origin point for later consumption there, storage at the origin or at the destination for later consumption at the destination point. The transfer cost for each of the links entered to the transportation model represents the least-cost method of transfer via that link, given the existing marketing system. The quantities available at each origin point in the period are allocated among the alternative destinations in time and space

so as to minimize total marketing costs for the commodity.[27]

The second month of the marketing year represents a new linear programming problem with new current volumes of demand at each location and new volumes of demand for storage to serve future requirements at these locations. The available supply quantities for the second month at each location are defined as the current quantities plus the accumulated quantities in storage from prior periods. The marketing costs for the links in the current month represent transportation costs, but those for the succeeding month are a combination of storage and transportation costs. This same process is repeated month by month in sequence through the marketing year.

B. Transportation Linear Programming Model - An Example

A hypothetical model is hereby presented to provide a working example of how computer analysis can be applied to the transportation linear programming approach that is being proposed. This example makes use of the master projection computer program developed at Kansas State University which is available at the Ministry of Agriculture Computing Center in the Philippines.

In the sample model, Camarines Sur, Bataan, Pangasinan, Tarlac, Cavite, Batangas, Metropolitan Manila, Nueva Ecija and Pampanga are considered as both supply and demand points. To facilitate analysis, a single shipping point is selected for each area as follows: Naga in Camarines Sur, Balanga in Bataan, San Carlos in Pangasinan, Tarlac in

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[27] Ibid., Vol. 1, Sec. 7-4.

Tarlac, Cavite in Cavite, Batangas in Batangas, Divisoria in Metropolitan Manila, Cabanatuan in Nueva Ecija and San Fernando in Pampanga. Since Metropolitan Manila is supposed to be just a destination point, a fictitious supply row is established to this area to convert an unbalanced transportation problem to the required balanced transformation format in order that the recursive feature will function properly. The supply quantities for the current month and the demand requirements for both the current and the succeeding month are considered in each of the month-by-month computer runs. March, which is assumed as the peak harvest month for sweet potatoes in Luzon, is designated as the first month of the marketing year.

The supply, demand, storage and transportation cost coefficients which are the input data needed for the computer run, are derived from several sources. The 1977 production data have been used as a guide in estimating quantities supplied. Arbitrary figures are assigned for each month in each of the producing provinces based on their respective reported peak harvest seasons. Since data are not available, October and November are designated as peak harvest months for sweet potatoes in Camarines Sur. Table 8 shows the calculated supply of sweet potatoes by month.

In the sample problem it is assumed that monthly per capita consumption is constant. Since provincial data are not available the reported annual regional average per capita consumption figures are used to determine the monthly averages.[28] The demand requirements are obtained

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[28]Avigueteto, p. 17.

TABLE 8. Calculated Supply of Sweet Potatoes by Origin by Month
(In Metric Tons)

Month	Supply Area Number and Location									
	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL
March	1247.1	153.4	3757.2	3399.4	283.8	170.3	0.0	384.7	409.9	9805.8
April	1247.1	102.2	1825.0	1651.1	378.4	227.0	0.0	346.2	369.0	6146.0
May	1247.1	51.1	644.1	582.8	567.5	340.5	0.0	307.7	328.0	4068.8
June	1247.1	102.2	429.4	388.5	1608.0	964.8	0.0	307.7	328.0	5375.7
July	1247.1	153.4	322.1	291.4	3310.6	1986.4	0.0	307.7	328.0	7946.7
August	1247.1	204.5	214.7	194.2	1608.0	964.8	0.0	307.7	328.0	5069.0
September	2494.2	306.7	107.3	97.1	567.5	340.5	0.0	307.7	328.0	4549.0
October	4988.3	869.0	214.7	194.2	378.4	227.0	0.0	307.7	328.0	7507.3
November	4988.3	1789.1	322.1	291.4	283.8	170.3	0.0	307.7	328.0	8480.7
December	2494.2	869.0	429.4	388.5	189.2	113.5	0.0	307.7	328.0	5119.5
January	1247.1	306.7	644.1	582.8	94.6	56.8	0.0	307.7	328.0	3567.8
February	1247.1	204.5	1824.9	1651.1	189.2	113.5	0.0	346.2	369.0	5945.5
ANNUAL TOTAL	24941.8	5111.8	10735.0	9712.5	9459.0	5675.4	0.0	3846.4	4099.9	73581.8

by multiplying the estimated 1977 population for each province by the regional monthly average per capita consumption (Table 9). The supply and demand quantities are in metric tons.

The distance from each supply point to each alternative demand point is obtained from a road map. A constant figure of 30 centavos is multiplied to the kilometer distance to determine transport cost per metric ton. An arbitrary ten pesos is added to transport cost to obtain the marketing cost (i.e., storage and transportation costs) per metric ton for the second month in each of the monthly runs (Table 10).

The reliability of the computer output depends on the accuracy of the input data used. Since accurate data were not available at the time the sample problem was solved by the computer, the results do not provide a representative picture of the marketing flow of sweet potatoes and that the whole process serves only as a working model.

The instruction for running the data in the computer system is in the "User's Guide to Computerized System for Feasible Agribusiness Development."[29] The optimum solutions for the sample problem are summarized in Table 11. In March, for example, Camarines Sur, Bataan and Pangasinan were able to satisfy their own requirements for the current month. Tarlac and Cavite imported from Pangasinan for their local consumption needs. Metropolitan Manila filled up its demand by importing from Pangasinan and Tarlac. Nueva Ecija and Pampanga utilized their supply and imported from Pangasinan to meet their requirements. Batangas utilized its own supply and ended deficit. The surplus were allocated

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[29]Phillips, Vol. 2, Sec. 12, 1-56.

TABLE 9. Calculated Monthly Demand by Destination for Sweet Potatoes (in Metric Tons)

Area Number and Location		Calculated Demand
21	Camarines Sur	1078.5
22	Bataan	108.5
23	Pangasinan	696.1
24	Tarlac	281.2
25	Cavite	175.9
26	Batangas	313.2
27	Metro Manila	2290.4
28	Nueva Ecija	427.4
29	Pampanga	455.5
TOTAL		5826.7

TABLE 10. Calculated Transport Cost (Pesos/Metric Ton)

DESTINATION / ORIGIN	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga
21 Camarines Sur	0	170.10	193.20	169.80	124.20	115.50	132.90	167.70	152.70
22 Bataan	170.10	0	45.00	32.70	14.10	70.20	37.20	38.40	17.40
23 Pangasinan	193.20	45.00	0	21.00	47.70	93.30	60.30	32.10	38.10
24 Tarlac	169.80	32.70	21.00	0	46.50	69.90	36.90	14.70	17.10
25 Cavite	124.20	14.10	47.70	46.50	0	33.60	9.60	44.40	29.40
26 Batangas	115.50	70.20	93.30	69.90	33.60	0	33.00	67.80	52.80
27 Metro Manila	132.90	37.20	60.30	36.90	9.60	33.00	0	34.5	25.50
28 Nueva Ecija	167.70	38.40	32.10	14.70	44.40	67.80	34.50	0	18.00
29 Pampanga	152.70	17.40	38.10	17.10	29.40	52.80	25.50	18.00	0

*Add ₱ 10/MT for storage costs when quantities are held for consumption the succeeding month.

TABLE 11. Summary of Optimal Shipping and Storage Patterns - An Example (in Metric Tons)

MARCH

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac			281.2							281.2
25 Cavite			175.9							175.9
26 Batangas						170.3				170.3
27 Metro Manila			416.0	1874.4						2290.4
28 Nueva Ecija			42.7					384.7		427.4
29 Pampanga			45.6						409.9	455.5
TOTAL CURRENT	1078.5	108.5	1657.5	1874.4		170.3		384.7	409.9	5683.8
121 Camarines Sur	168.6									168.6
122 Bataan		44.9	63.6							108.5
123 Pangasinan			696.1							696.1
124 Tarlac			281.2							281.2
125 Cavite			175.9							175.9
126 Batangas										
127 Metro Manila				1525.0	283.8					1808.8
128 Nueva Ecija			427.4							427.4
129 Pampanga			455.5							455.5
TOTAL STORED	168.6	44.9	2099.7	1525.0	283.8					4122.0
TOTAL SUPPLY	1247.1	153.4	3757.2	3399.4	283.8	170.3		384.7	409.9	9805.8

Table 11 continued.

APRIL

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac			281.2							281.2
25 Cavite			175.9							175.9
26 Batangas						227.0				227.0
27 Metro Manila			40.7	1932.3			317.4			2290.4
28 Nueva Ecija								427.4		427.4
29 Pampanga									455.5	455.5
TOTAL CURRENT	1078.5	108.5	1193.9	1932.3		227.0	317.4	427.4	455.5	5740.5
121 Camarines Sur	337.2									337.2
122 Bataan		102.2	6.3							108.5
123 Pangasinan			696.1							696.1
124 Tarlac			281.2							281.2
125 Cavite			175.9							175.9
126 Batangas										
127 Metro Manila					554.3		1491.4			2045.7
128 Nueva Ecija			81.2					346.2		427.4
129 Pampanga			86.5						369.0	455.5
TOTAL STORED	337.2	102.2	1327.2		554.3		1491.4	346.2	369.0	4527.5
TOTAL SUPPLY	1415.7	210.7	2521.1	1932.3	554.3	227.0	1808.8	773.6	824.5	10268.0

Table 11 continued.

MAY

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac				281.2						281.2
25 Cavite					175.9					175.9
26 Batangas						313.2				313.2
27 Metro Manila					244.7		2045.7			2290.4
28 Nueva Ecija								427.4		427.4
29 Pampanga				127.5					328.0	455.5
TOTAL CURRENT	1078.5	108.5	696.1	408.7	420.6	313.2	2045.7	427.4	328.0	5826.7
121 Camarines Sur	505.8									505.8
122 Bataan		51.1		2.4						53.5
123 Pangasinan			644.1	52.0						696.1
124 Tarlac				281.2						281.2
125 Cavite					175.9					175.9
126 Batangas						27.3				27.3
127 Metro Manila					146.9					146.9
128 Nueva Ecija				119.7				307.7		427.4
129 Pampanga									455.5	455.5
TOTAL STORED	505.8	51.1	644.1	455.3	322.8	27.3		307.7	455.5	2769.6
TOTAL SUPPLY	1584.3	159.6	1340.2	864.0	743.4	340.5	2045.7	735.1	783.5	8596.3

Table 11 continued.

JUNE

DESTINATION \ ORIGIN	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac				281.2						281.2
25 Cavite					175.9					175.9
26 Batangas						313.2				313.2
27 Metro Manila					1608.0	365.7	146.9			2120.6
28 Nueva Ecija				107.3				320.1		427.4
29 Pampanga									455.5	455.5
TOTAL CURRENT	1078.5	108.5	696.1	388.5	1783.9	678.9	146.9	320.1	455.5	5656.9
121 Camarines Sur	674.4									674.4
122 Bataan		47.2								47.2
123 Pangasinan			429.4							429.4
124 Tarlac				281.2						281.2
125 Cavite										
126 Batangas						313.2				313.2
127 Metro Manila										
128 Nueva Ecija								415.0		415.0
129 Pampanga									328.0	328.0
TOTAL STORED	674.4	47.2	429.4	281.2		313.2		415.0	328.0	2488.4
TOTAL SUPPLY	1752.9	155.7	1125.5	669.7	1783.9	992.1	146.9	735.1	783.5	8145.3

Table 11 continued.

JULY

DESTINATION \ ORIGIN	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac				281.2						281.2
25 Cavite					175.9					175.9
26 Batangas						313.2				313.2
27 Metro Manila					2290.4					2290.4
28 Nueva Ecija				10.2				417.2		427.4
29 Pampanga					34.8				420.7	455.5
TOTAL CURRENT	1078.5	108.5	696.1	291.4	2501.1	313.2		417.2	420.7	5826.7
121 Camarines Sur	843.0									843.0
122 Bataan		92.1			16.4					108.5
123 Pangasinan			55.4							55.4
124 Tarlac				281.2						281.2
125 Cavite					175.9					175.9
126 Batangas						313.2				313.2
127 Metro Manila					617.2	1673.2				2290.4
128 Nueva Ecija								305.5		305.5
129 Pampanga									235.3	235.3
TOTAL STORED	843.0	92.1	55.4	281.2	809.5	1986.4		305.5	235.3	4608.4
TOTAL SUPPLY	1921.5	200.6	751.5	572.6	3310.6	2299.6		722.7	656.0	10435.1

Table 11 continued.

AUGUST

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			270.1							270.1
24 Tarlac				281.2						281.2
25 Cavite					175.9					175.9
26 Batangas						313.2				313.2
27 Metro Manila							2290.4			2290.4
28 Nueva Ecija								427.4		427.4
29 Pampanga		96.0							359.5	455.5
TOTAL CURRENT	1078.5	204.5	270.1	281.2	175.9	313.2	2290.4	427.4	359.5	5400.7
121 Camarines Sur	1011.6									1011.6
122 Bataan		108.5								108.5
123 Pangasinan										
124 Tarlac				194.2						194.2
125 Cavite					175.9					175.9
126 Batangas						313.2				313.2
127 Metro Manila					1432.1	651.6				2083.7
128 Nueva Ecija								185.8		185.8
129 Pampanga									203.8	203.8
TOTAL STORED	1011.6	108.5		194.2	1608.0	964.8		185.8	203.8	4276.7
TOTAL SUPPLY	2090.1	313.0	270.1	475.4	1783.9	1278.0	2290.4	613.2	563.3	9677.4

Table 11 continued.

SEPTEMBER

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			107.3							107.3
24 Tarlac				281.2						281.2
25 Cavite					175.9					175.9
26 Batangas						313.2				313.2
27 Metro Manila	1348.8				391.6	27.3	522.7			2290.4
28 Nueva Ecija								427.4		427.4
29 Pampanga		198.2							257.3	455.5
TOTAL CURRENT	2427.3	306.7	107.3	281.2	567.5	340.5	522.7	427.4	257.3	5237.9
121 Camarines Sur	1078.5									1078.5
122 Bataan		108.5								108.5
123 Pangasinan										
124 Tarlac				10.1						10.1
125 Cavite					175.9					175.9
126 Batangas						313.2				313.2
127 Metro Manila							1561.0			1561.0
128 Nueva Ecija								66.1		66.1
129 Pampanga									274.5	274.5
TOTAL STORED	1078.5	108.5		10.1	175.9	313.2	1561.0	66.1	274.5	3587.8
TOTAL SUPPLY	3505.8	415.2	107.3	291.3	743.4	653.7	2083.7	493.5	531.8	8825.7

Table 11 continued.

OCTOBER

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			141.8		554.3					696.1
24 Tarlac		281.2								281.2
25 Cavite	175.9									175.9
26 Batangas						313.2				313.2
27 Metro Manila	1181.4						1109.0			2290.4
28 Nueva Ecija							24.6	373.8	29.0	427.4
29 Pampanga		337.5							118.0	455.5
TOTAL CURRENT	2435.8	727.2	141.8		554.3	313.2	1133.6	373.8	147.0	5826.7
121 Camarines Sur	1078.5									1078.5
122 Bataan		108.5								108.5
123 Pangasinan		64.9	72.9							137.8
124 Tarlac		76.9		204.3						281.2
125 Cavite	175.9									175.9
126 Batangas	86.2					227.0				313.2
127 Metro Manila	2290.4									2290.4
128 Nueva Ecija							427.4			427.4
129 Pampanga									455.5	455.5
TOTAL STORED	3631.0	250.3	72.9	204.3		227.0	427.4		455.5	5268.4
TOTAL SUPPLY	6066.8	977.5	214.7	204.3	554.3	540.2	1561.0	373.8	602.5	11095.1

Table 11 continued.

NOVEMBER

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan		226.0	459.9	10.2						696.1
24 Tarlac				281.2						281.2
25 Cavite		175.9								175.9
26 Batangas						313.2				313.2
27 Metro Manila		159.5					2130.9			2290.4
28 Nueva Ecija								427.4		427.4
29 Pampanga		247.2							208.3	455.5
TOTAL CURRENT	1078.5	917.1	459.9	291.4		313.2	2130.9	427.4	208.3	5826.7
121 Camarines Sur	1078.5									1078.5
122 Bataan		108.5								108.5
123 Pangasinan		696.1								696.1
124 Tarlac				281.2						281.2
125 Cavite		175.9								175.9
126 Batangas	142.9					170.3				313.2
127 Metro Manila	1671.2				459.7		159.5			2290.4
128 Nueva Ecija								307.7	119.7	427.4
129 Pampanga									455.5	455.5
TOTAL STORED	2892.6	980.5		281.2	459.7	170.3	159.5	307.7	575.2	5826.7
TOTAL SUPPLY	3971.1	1897.6	459.9	572.6	459.7	483.5	2290.4	735.1	783.5	11653.4

Table 11 continued.

DECEMBER

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac				281.2						281.2
25 Cavite		175.9								175.9
26 Batangas						313.2				313.2
27 Metro Manila		268.8					2021.6			2290.4
28 Nueva Ecija				107.3				320.1		427.4
29 Pampanga		139.9							315.6	455.5
TOTAL CURRENT	1078.5	693.1	696.1	388.5		313.2	2021.6	320.1	315.6	5826.7
121 Camarines Sur	1078.5									1078.5
122 Bataan		108.5								108.5
123 Pangasinan			429.4							429.4
124 Tarlac				281.2						281.2
125 Cavite		175.9								175.9
126 Batangas	199.7					113.5				313.2
127 Metro Manila	1216.0				365.1		268.8			1849.9
128 Nueva Ecija								415.0	12.4	427.4
129 Pampanga									455.5	455.5
TOTAL STORED	2494.2	284.4	429.4	281.2	365.1	113.5	268.8	415.0	467.9	5119.5
TOTAL SUPPLY	3572.7	977.5	1125.5	669.7	365.1	426.7	2290.4	735.1	783.5	10946.2

Table 11 continued.

JANUARY

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac				281.2						281.2
25 Cavite		175.9								175.9
26 Batangas	168.6					144.6				313.2
27 Metro Manila					270.5		1849.9			2120.4
28 Nueva Ecija				119.7				307.7		427.4
29 Pampanga				127.5					328.0	455.5
TOTAL CURRENT	1247.1	284.4	696.1	528.4	270.5	144.6	1849.9	307.7	328.0	5656.7
121 Camarines Sur	1078.5									1078.5
122 Bataan		108.5								108.5
123 Pangasinan			377.4	54.4						431.8
124 Tarlac				281.2						281.2
125 Cavite		22.3								22.3
126 Batangas						225.4				225.4
127 Metro Manila										
128 Nueva Ecija								427.4		427.4
129 Pampanga									455.5	455.5
TOTAL STORED	1078.5	130.8	377.4	335.6		225.4		427.4	455.5	3030.6
TOTAL SUPPLY	2325.6	415.2	1073.5	864.0	270.5	370.0	1849.9	735.1	783.5	8687.3

Table 11 continued.

FEBRUARY

ORIGIN / DESTINATION	21 Camarines Sur	22 Bataan	23 Pangasi-nan	24 Tarlac	25 Cavite	26 Batangas	27 Metro Manila	28 Nueva Ecija	29 Pampanga	TOTAL DEMAND
21 Camarines Sur	1078.5									1078.5
22 Bataan		108.5								108.5
23 Pangasinan			696.1							696.1
24 Tarlac			246.3	34.9						281.2
25 Cavite			175.9							175.9
26 Batangas	168.6					144.6				313.2
27 Metro Manila				1810.9	211.5					2022.4
28 Nueva Ecija								427.4		427.4
29 Pampanga									455.5	455.5
TOTAL CURRENT	1247.1	108.5	1118.3	1845.8	211.5	144.6		427.4	455.5	5558.7
121 Camarines Sur	1078.5									1078.5
122 Bataan		108.5								108.5
123 Pangasinan			696.1							696.1
124 Tarlac			281.2							281.2
125 Cavite		96.0	79.9							175.9
126 Batangas						194.3				194.3
127 Metro Manila										
128 Nueva Ecija			81.2					346.2		427.4
129 Pampanga				86.5					369.0	455.5
TOTAL STORED	1078.5	204.5	1138.4	86.5		194.3		346.2	369.0	3417.4
TOTAL SUPPLY	2325.6	313.0	2256.7	1932.3	211.5	338.9		773.6	824.5	8976.1

for the succeeding month. Camarines Sur and Bataan stored their own surplus for the next month. After satisfying its demand requirements for the succeeding month, Pangasinan shipped its surplus to Bataan, Tarlac, Cavite, Nueva Ecija, and Pampanga. Tarlac and Cavite shipped their surplus to Metropolitan Manila. Since the model has a recursive feature the surplus quantities assigned to storage in the solution for March were automatically carried over to the supply figures available for distribution in April.

Table 12 indicates the minimum monthly marketing costs incurred for transferring sweet potatoes from origins to destinations. These consist of transport costs for the transfer of the commodity during the current month, and a combination of storage and transport costs for allocation to the succeeding month. The monthly average cost figures are obtained by dividing the total costs incurred by the total supply quantities allocated for each month. It is observed that there are large variations in the monthly total cost and average cost figures but these should not be given undue importance. Reasons for the differences are: (1) Low costs are incurred during the months when a majority of the provinces become self-sufficient (e.g., May and June). If demand requirements are satisfied from each source, transfer costs would be zero. (2) Transport and storage costs would be lower for the current month if these costs have already been charged to the preceding month (e.g. October - November).

Table 13 shows the average monthly inventory by destination point and average utilization of warehouse space. The average monthly inventory is the quotient obtained by dividing the number of storage months (in this case, it is 12) into the sum of the quantities allocated for

TABLE 12. Summary of Minimum Costs - An Example

Month	Total Cost	Ave. Cost (₱/MT)
March	₱ 260,102.49	₱ 26.53
April	159,129.25	15.50
May	36,565.65	4.25
June	53,966.19	6.63
July	130,616.81	12.52
August	79,688.30	8.23
September	223,242.29	25.29
October	630,794.04	56.85
November	360,346.51	30.92
December	258,566.17	23.62
January	60,252.93	6.94
February	151,218.29	16.85

TABLE 13. Average Monthly Inventory by Destination Point and Average Utilization of Warehouse Space - An Example

Area No.	Location	Ave. Monthly Inventory (MT)	% Utilization
21	Camarines Sur	834.3	77
22	Bataan	98.8	91
23	Pangasinan	413.7	59
24	Tarlac	251.4	89
25	Cavite	148.4	84
26	Batangas	220.0	70
27	Metro Manila	1363.9	60
28	Nueva Ecija	366.0	86
29	Pampanga	390.5	86

storage to each destination during the marketing year as gathered from Table 11. Percentage utilization is the ratio of average monthly inventory to capacity. The capacity refers to the maximum quantity allocated for storage in any month during the marketing year. As indicated in Table 13, possible storage sites for sweet potatoes are Bataan and Tarlac with warehouse capacity in metric tons of 108.5 and 281.2 respectively and corresponding percentage utilization of 91 and 89.

C. Collection of Necessary Real Data

Input data needed for the study will be obtained from several sources. Data on shipment by origin will be gathered through interviews with major traders in each consuming center. Wholesale prices in each consuming center will be obtained from the Bureau of Agricultural Economics. Population and income data to be used in the analysis of demand for each consuming center will be gathered from the Bureau of Census and Statistics.

Data to be used in the analysis of supply will be gathered in coordination with the production technicians from the Bureau of Plant Industry/ Bureau of Agricultural Extension and the provincial statisticians from the Bureau of Agricultural Economics assigned in each producing area. Primary data on production need to be gathered since only regional data are available at the Bureau of Agricultural Economics and these data do not indicate provinces and areas of importance.

Data on costs of storage will be gathered through interviews with farmers, agricultural engineers and major traders in the areas to be studied. The commonly used method of economic analysis, fixed and variable cost analysis or simple budget analysis will be adopted to calculate the costs of storage based on normative operations and practices.

The costs of transporting sweet potatoes from producing areas to consuming centers will be obtained from a survey of shippers and brokers operating in the areas to be studied. Assuming that the trucking business is competitive and there is no backhauling transportation charges for shipping sweet potatoes from a given production area to a particular market depend on (1) the rate per kilometer and (2) the distance to market. To establish the relationship between transportation costs and distance, the general equation for transportation rates as a function of distance can be written:

$$Y = f(X)$$

where Y is the transportation costs in pesos per metric ton and X is the approximate one-way distance in kilometers between shipping point and destination. Regression technique will be considered to determine the appropriate form of the general equation. Unit costs of transportation between selected shipping points and consuming centers will be computed by using the estimating equation. If a difficulty arises in the collection of data, the economic engineering costing procedure may be adopted.

D. Research Methodology

The immediate objective of this research proposal is to describe and evaluate some characteristics of the sweet potato marketing system in the Philippines, primarily, to determine how the system's output is affected by changes either in the quantities supplied and demanded or in the unit cost changes. The first stage of the research is the construction of the transportation linear programming model which represents the relevant characteristics of the "real-world" system.

The second stage is concerned with the operation of the model. The operation phase involves a generation of synthetic output data (i.e., we systematically vary inputs to the model in order to determine how the resulting output characteristics are affected). The ultimate purpose, of course, is to infer from the data generated through operation of the model how the corresponding real-world system would function under similar circumstances.

IV. Potential Benefits

Essentially, the proposal is an attempt to develop a handy method of studying some physical characteristics of sweet potato marketing. However the approach is quite flexible. The method can be applied to the study of other agricultural commodities especially in determining the economic feasibility of physical improvements to the marketing system.

The transportation linear programming model, in itself, can be used for developing optimum inter-provincial flow patterns. If proposed improvements are projected in the model, the total benefits as well as the incidence of these benefits are determined by comparing the results of the linear programming solutions with and without the improvements.

In making the comparative runs through the transportation linear programming model with and without specific proposed improvements, the quantities of supply and quantities of demand normally are held constant while the least-cost marketing pattern is modified to reflect the proposed improvements. The optimum flow patterns may be quite different with and without the proposed improvements, even though by definition both must meet the total demand requirements during the projected period

for which the runs are made. The total marketing cost for the solution without the improvements minus the total marketing cost with the proposed improvements equals the savings (benefits) which can be attributed to the improvements. The two distribution patterns can be compared to see how the benefits (including possible negative benefits) are distributed among supply points and demand points over the whole set-up.

Proposed improvements in marketing channels and facilities will affect the best possible marketing flow pattern in either or both of two ways: (1) by reducing or eliminating capacity restrictions which force use of routes more costly than the least-cost routes, and (2) by reducing the unit costs for some of the marketing links in the flow so that the least-cost routes themselves become less expensive.

The transportation model used in the computer system for feasible agribusiness development does provide shadow prices. A comparison of the shadow prices included in the output from the linear programming solution for the different links will provide a good indication where reductions in marketing costs would be most beneficial to the system as a whole.[30]

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[30]Phillips, Vol. 1, Sec. 7-13.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Sweet potato is the most important vegetable consumed in the Philippines. It is used not only as food but as a material in the manufacture of alcohol, starch and other industrial products. Furthermore, on account of its high feeding value, sweet potato can be fed to farm animals.

A comparison of the average present day yields by weight of sweet potato, cassava, yellow corn and sorghum shows that on a yearly basis, sweet potato yields 110 percent more than cassava, 400 percent more than yellow corn and 387 percent more than sorghum. This is only considering the root yield of sweet potato. Furthermore, given more attention to cultural practices for this crop, the possible improvement for roots alone is estimated to be 500 percent.[31]

The nutritive value of sweet potatoes are high. They are good sources of energy-supplying sugars and other carbohydrates; of calcium, iron and other minerals; and of vitamins particularly of Vitamin A in the popular high carotene orange-flesh varieties and of Vitamin C.[32]

In nutritive value, sweet potatoes produce more protein, iron Vitamin A and Food Energy per hectare than each of the other three crops. Also, sweet potatoes can support more persons per day for their nutrient

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[31] N.F.A.C., p. 1.

[32] U.S. Department of Agriculture, Agricultural Research Service, Sweet Potato Culture and Diseases, Agriculture Handbook No. 388 (June 1971), p. 3.

and caloric requirements than either rice or corn which constitute the bulk of the Filipino diet.[33]

Its high nutritive values are not only of importance as human food but also as animal feed. Sweet potatoes can replace corn in broiler rations by as much as 50 percent and in swine rations as much as 100 percent without seriously affecting the digestability of the rations.[34]

Sweet potato can also be utilized for making flour, snack foods and wine. Sweet potato contains 14-25 percent starch, hence it is a good source of starch which proves quite suitable for use in certain adhesives, in bakery products and in laundry products.

Aside from its high yield potential, high nutrient value and versatility of use, it is also a crop that is easy and cheap to grow, sturdy during drought and typhoons and acceptable by the Filipino people. Considering all its attributes, sweet potato deserves more attention not only on the production aspects but also on the economics of marketing the commodity.

Whenever food prices increase, consumers want to know why. They ask how much of the food peso farmers are receiving and who gets the difference. Likewise, farmers look at prices in the retail markets and at the prices they are being paid for farm products and they want to know what becomes of the difference.

The main concern of this proposal is the marketing problem of

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[33] R. L. Villareal. Sweet Potato: Its Present and Potential Role in the Food Production of Developing Countries. Paper read at the Regional Technical Meeting on Root Crops held in Fiji on Nov. 24-29, 1975.

[34] N.F.A.C., p. 4.

getting the commodity from producers to consumers at the lowest cost permitted by marketing conditions and available technology. Value is added in the marketing process through changes in time, place and form of the commodity delivered to consumers.

Shepherd, Futrell and Strain, in their book, 'Marketing Farm Products'[35] noted that in a perfect market, the price differentials in time, place, and form would be equivalent to the corresponding differences in costs. Prices at any one time, therefore would be uniform over geographical areas, plus or minus the cost of getting supplies from surplus to deficit areas. Prices in a perfect market also would be uniform at any one point over periods of time, plus or minus the costs of storing from one period to another or the costs of producing at different times. And the prices for different grades of a commodity in a perfect market at any one point of time would be uniform plus or minus the costs of converting the commodity from one grade or form to another or plus the relative costs of producing the different grades.

The concept of the perfect market as a criterion for appraising market performance will be used to identify marketing problems. The recursive linear programming model can be used to evaluate effects on marketing costs of programmed production, alternative storage sites, changes in production location and changes in transportation. The effects of additional marketing functions, such as grading and processing on marketing costs and flow patterns can also be evaluated by the proposed model.

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[35]Shepherd, p. 24.

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SWEET POTATO MARKETING IN THE PHILIPPINES

by

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AN ABSTRACT OF A MASTER'S REPORT

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Sweet potato is the leading root crop in the Philippines. In 1977, of the 426,270 hectares planted to root crops in the Philippines 52 percent was devoted to sweet potatoes. It is also the most important vegetable consumed in the country with a per capita rate of use of 10.73 kilos annually, which is more than double that of any other vegetable.

The report has two objectives: first, to review the present state of economic knowledge concerning production, utilization and marketing of sweet potatoes in the Philippines and second, to propose an economic study of the cost aspects of the time and space dimensions of sweet potato marketing.

The main concern of the report is the problem of getting the sweet potatoes from producer to consumer at the lowest cost permitted by marketing conditions and available technology. Value is added in the marketing process through change in time, space and form of the commodity delivered to consumers.

Marketing costs relating to each value-increasing function are costs of storage from one time to another, costs of transportation from one place to another and costs of conversion from one form to another. These costs are the economic basis for the time, space and form differentials that exist in the sweet potato market.

In the proposal, Central Luzon, Southern Tagalog and Bicol Regions are designated as the areas to be studied. Initial empirical analysis will be limited to the study of the time and space dimensions of sweet potato marketing. The recursive linear programming method will be used to find the minimum cost program for distributing sweet potatoes from several supply points to a number of demand points. The master projection

computer program developed at Kansas State University which is available at the Ministry of Agriculture Computing Center in the Philippines will be used to solve the transportation linear programming problem.

The objective of the program is to identify the least-cost combination of storage and transportation costs connecting origins and destinations in time as well as space from the two basic alternatives: (1) store at the origin point and ship when demanded and (2) ship when supplied and store at destination point. The choice will depend upon relative storage costs at origin and destination compared to the difference in discounted present values of transportation costs if delayed after storage.

The supply, demand, storage and transportation cost coefficients are the input data needed for the computer run. A hypothetical model is included in the report to provide a working example of how computer analysis using the recursive linear programming approach is adopted to solve specific marketing problems associated with sweet potato marketing in the Philippines. Data requirements of the model will be developed in the Philippines if the project is approved.