ECONOMIC IMPLICATIONS OF TECHNOLOGICAL CHANGE ON THE PHILIPPINE SUGAR INDUSTRY: A CASE STUDY OF SOME FARMS IN THE VICTORIAS MILL DISTRICT

BY

LEODEGARIO M. ILAG[1]

In the previous issue of this journal,[2] Poblador showed the socio-economic implications of the effects of the government regulation on the sugar industry. He attempted to show how some aspects of the control of sugar industry are mainly responsible for the relatively high cost of sugar production in the Philippines. Specifically, he attempted to show how the present method of allocating domestic and export sugar quotas among the various planters and millers results in higher factor costs both in the farming and milling stages of production.

He attributed the over-all "inefficiency" of the Philippine sugar industry to the unequal costs at the margin resulting from the arbitrary allocation of domestic and foreign sugar quotas among planters and millers, lack of initiative on the part of sugar producers in reducing costs due to the relatively high incomes they realize from the sale of sugar.

The two policy measures Poblador enumerated as avenues through which the situation may possibly be improved are: to abandon the present method of allocating sugar production and allow instead the development of an organized sugar quota market where buying and selling of quotas especially export sugar quotas, can take place unhampered by any government restrictions; and repeal Republic Act No. 809 and allow sugar centrals and sugarcane planters to bargain among themselves as to the manner of payment for milling services.

Poblador dealt with the effects of the external factors on the sugar industry as a whole. However, in spite of these factors limiting

[1] The author wishes to acknowledge the helpful suggestions from Dr. V. W. Ruttan, Agricultural Economist, International Rice Research Institute.

[2] This journal, N. S. Poblador, "The Philippine Sugar Industry: A Case Study in Government Control." Vol. I, No. 2, pp. 1-20.

efficiency, there have been gains in productivity among sugar districts and among farms within the district. The purpose of this article is to explore some of the economic and technical factors accounting for the productivity gains among the farms within the mill district. This article will single out some findings on a particular sugar district, the Victorias Milling Company, Inc. that has made rapid progress under the present institutional arrangement. It attempts to describe the district as a sugar cane producing unit with emphasis on how the productivity of the farms in the district has been improved, describe the comparative costs and returns of some farms for two crop years, point out some technical factors related with the productivity of some sugar cane farms ,and discuss the implications of adopting a set of recommended farm practices. This may serve as a guideline in making certain adjustments which may redirect the course of the sugar industry. It must be recalled that sugar was the premier dollar earner of the country in 1961 and 1962 and ranked third in 1963.[1]

THE VICTORIAS MILLING DISTRICT AS A SUGARCANE PRODUCING UNIT

Geographical Location — The Victorias Milling District is located in the northern part of Negros Occidental province. It is comprised of the municipalities of Victorias, Manapla, Cadiz, and part of Saravia, with an approximate area of 38,000 hectares. It is bounded on the north by the Visayas Sea, on the east by the Himogaran River, on the south by a volcanic chain, on the southwest and west by the Malogo River.[2]

Climate — Based upon the distribution and amount of yearly precipitation, the Victorias Mill Disrtict belongs to the fourth type of climate.[3] It is characterized by no dry season and no very pronounced maximum rain period. However, the intensity of rainfall during the different months of the year and the yearly total rainfall vary with the different stations located in different places in the district. The planting of sugarcane in the district throughout the year is possible with this type of climate.

Area and Production — In 1961-62, the Victorias Mill District produced 2,858,644 piculs of sugar, roughly 12 per cent of the total sugar output of the Philippines. The area on which such production was obtained was 22,376.63 hectares, roughly about 10 per cent of the total area planted to sugarcane in the Philippines (table 1).

[1] Central Bank Annual Report of 1961, 1962 and 1963.
[2] Locsin, C. L. and F. T. Tabayoyong. Soils of the Victorias Milling District. Page 14. The Victorias Milling Co., Inc. 1953. 88 pp.
[3] Locsin, C. L. Ibid. Page 13.

Table I. *Proportion of area in sugarcane and sugar production in the Victorias Mill District in relation to the Philippines, by selected years,* 1933-34 *to* 1961-62.

YEAR	VICTORIAS		PHILIPPINES		PER CENT	
	Area (Hectares)	Production (piculs)	Area (Hectares)	Production (piculs)	Area (Hectares)	Production (piculs)
1932-33	*	1,838,530	*	20,230,567	*	3
1933-34	22,198	2,216,080	283,269	22,638,444	8	10
1934-35	12,788	998,591**	209,550	9,970,199	6	10
1935-36	15,601	1,528,618	251,615	14,087,670	6	11
1936-37	16,398	1,591,510	257,064	16,032,818	6	10
1937-38	16,304	1,518,257	227,944	15,126,107	7	10
1938-39	*	1,457,201	*	14,107,177	*	10
1939-40	*	1,505,995	*	15,383,417	*	10
1940-41	*	1,794,301	*	16,453,379	*	11
1941-42	*	556,419***	*	*	*	*
1942-43	*	*	*	*	*	*
1943-44	*	*	*	*	*	*
1944-45	*	*	*	*	*	*
1945-46	*	*	*	*	*	*
1946-47	*	107,475	*	1,213,046	*	9
1947-48	8,855	687,088	71,575	5,710,073	12	12
1948-49	14,836	1,243,240	116,994	10,461,211	13	12
1949-50	16,697	1,315,801	129,118	9,936,192	13	13
1950-51	18,952	1,558,142	154,607	13,413,485	12	12
1951-52	20,164	1,594,917	188,503	15,438,523	11	10
1952-53	21,591	1,926,493	209,265	16,263,408	10	12
1953-54	20,031	2,068,338	220,596	20,571,669	9	10
1954-55	19,865	1,661,927	218,443	19,669,862	9	8
1955-56	18,715	1,811,178	188,015	17,478,534	10	10
1956-57	18,578	1,617,323	178,006	16,393,379	10	10
1957-58	20,306	2,362,259	183,700	19,762,245	11	12
1958-59	20,007	2,343,626	195,691	21,688,962	10	11
1959-60	22,171	2,617,722	204,122	21,927,828	11	12
1960-61	22,875	2,410,596	208,751	20,817,964	11	12
1961-62	22,377	2,858,644	220,336	23,212.401	10	12

SOURCES: Annual Reports, Victorias Mill District
A Handbook of the Sugar and Other Industries in the Philippines, August, 1961.

*No data gathered

**The first crop limitation

***Partial production only due to the war. Estimated unmilled canes of Victorias 376,246 piculs and Manapla 1,194,599 piculs, would have made a total crop of 1,751,000 piculs for 1941-42.

NOTE: One short ton was converted to 14.34 piculs for the Philippine figures on production.

The area and production of the district as well as that of the Philippines have increased through the years. Noticeable decreases in production were apparent in 1934-35 when the first crop limitation was set and in 1941-42 when the war broke out.

The proportion of the area devoted to sugar in the district ranged from 6-13 per cent of the national sugarcane area. The proportion of the district's production, however, ranged from 8-13 per cent of the national sugar production.

As the total production and area varied, the yield per hectare of the district likewise varied. Table 2 and figure 2 show that the productivity of the farms in the district was better than the average farm in the Philippines for the last five years,[1] in which, the general average for the district has not gone down the 100th picul mark to the hectare. Lacson and Escober[2] reported that the annual sugar yield per hectare of the Victorias Milling District for the last 25 years showed an upward trend with an annual rate of increase of .90 picul sugar per hectare and 0.67 ton cane per hectare.

THE RESEARCH DEPARTMENT

Much of the credit for the rise in yield per hectare of the farms in the district goes to the research department. With its objective of finding out the best practice adaptable in the district, the department has unearthed considerable agricultural knowledge on sugarcane farming. Lacson and Escober (1962) attributed the increase in yields in the district to the emphasis the research department gave to variety, fertilizer experiments, and in intensive program of liming the district's acid soils in 1950-55.

Table 2. *Production rate in piculs sugar per hectare, Victorias Mill District and the Philippines,* 1933-34—1941-42; 1946-47—1961-62

YEAR	PICULS SUGAR PER HECTARE	
	Victorias	Philippines
1933-34	99.94	79.92
1934-35	78.08	47.58
1935-36	97.98	55.99
1936-37	97.05	62.37
1937-38	93.12	66.36
1938-39	91.25	—

[1] The average yield of Victorias of 105 piculs per hectar in 1963 was lower than the Philippines of 110. This was due largely to drought in the district.

[2] Manuel V. Lacson, and T. R. Escober, "Yield Trends in the Victorias Milling District," VM Co., Inc. Experiment Station Release No. 38. 1962.

YEAR	PICULS SUGAR PER HECTARE	
	Victorias	*Philippines*
1939-40	92.50	—
1940-41	100.73	—
1941-42	99.17	—
1946-47	67.07	—
1947-48	77.59	79.79
1948-49	83.80	89.37
1949-50	78.80	73.39
1950-51	82.22	86.62
1951-52	79.10	81.92
1952-53	89.23	77.72
1953-54	103.96	93.27
1954-55	83.66	90.07
1955-56	96.78	92.96
1956-57	87.06	92.12
1957-58	116.34	107.62
1958-59	117.14	110.86
1959-60	118.07	107.42
1960-61	105.38	99.82
1961-62	127.56	105.35

SOURCE: A Handbook of the Sugar and Other Industries in the Philippines. Page 173.
(From Philippine Sugar Association of the Philippines.)

The role being played by the research department can be gleaned from the number of studies it has conducted. From 1957-58 until 1961-62, 180 experiments were conducted on fertilizer; 102 on variety; 68 on variety and fertilizers; 38 on liming and organic matter; and 24 on others.[1] The results of these experiments are put across to the planters through an extension bulletin, the Victorias Milling Co., Inc. Experiment Station Bulletin, which at times is supplemented by technical releases.

Fertilization — While the rise in productivity of the farms in the district can be attributed to the interplay of numerous factors, Lacson and Escober (1962) pointed out fertilization as the major factor. It was reported that before the extension work with the planters was started, only 19 per cent of the fertilizers used were of the recommended types. In three years, the figure rose to 71 per cent and for

[1] Data furnished by Mr. F. T. Tabayoyong, Former Director of Research, Victorias Milling Company.

the crop year 1961-62, 89 per cent of the fertilizers were of the recommended types. The shift to the use of the recommended fertilizer is reflected in the average fertilization rates. In 1956-57, the average N-P_2O_5—K_2O fertilization rate to a hectare was 62-54-50 kilograms. Three years later, 1959-60, it was 91-89-107. In 1961-62, it was 99-109-121. The per cent increase in N-P_2O_5—K_2O application for 1959-60 over that for 1956-57 was 47-65-115. For 1961-62, it was 60-102-142 per cent. Although, these rates of fertilization in the district were below the general recommendation of the research department, the relationship of fertilization with the productivity of the farms is apparent, as can be gleaned from Table 3.

Table 3. *Fertilization rates and yield per hectare, three selected years, Victorias Mill District, Philippines.*

CROP YEAR	FERTILIZATION RATE (Kilograms)			Average piculs per hectare
	Nitrogen	Phosporous (P_2O_5)	Potassium (K_2O)	
1956-57	62	54	50	87.06
1959-60	91	89	107	118.07
1961-62	99	109	121	127.56

SOURCE: Lacson, M. V. and T. R. Escober, "Yield Trends in the Victorias Milling District." Victorias Milling Co., Inc. Experiment Station Release No. 38. Page 6.

Varieties grown — Another factor that should not be discounted is the variety grown. The rise and fall of sugarcane varieties grown in the district can be gathered from Table 4 and Figure 3. For the past 21 years excluding the war years, five varieties gained popularity. From 1934-35 to 1935-36, Badila was grown most extensively. However, from 1936-37 to 1942-43 and 1950-51 to 1952-53 crop years, POJ 2883 was the district's most outstanding variety. POJ 2878 took the lead from 1948-49 to 1949-50 crop years. Then from 1952-53 to 1956-57, the leading variety was $H_{37-1933}$. It declined in popularity because of its susceptibility to the leaf scorch disease of sugarcane. In 1957, a campaign was launched for its replacement. The lead was taken over by POJ_{3016} from then until the present. However, there are varieties that have been out-yielding POJ_{3016} and they have been recommended for wider commercial planting. They are: CO_{440}, CO_{449}, and NCO_{310}.[1]

[1] Tabayoyong and Basila (1959). Review of variety and fertilization tes harvested during the 1957-58 crop year. VMCo., Inc. Experimental Station Release No. 26.

Table 4. *Per cent area planted to eleven outstanding sugarcane varieties by year, Victorias Mill District, Philippines, 1934-35 to 1961-62.*

YEAR	POJ 2878	POJ 2883	POJ 3016	Alunan	Badila	DI-52	H37 1933	CP29 116	H44 3098	CO440	CO449	Others	TOTAL
1934-35	29.57	20.15	—	—	36.93	3.43	—	—	—	—	—	9.92	100
1935-36	30.17	27.91	—	—	31.09	2.57	—	—	—	—	—	8.26	100
1936-37	25.98	37.88	—	2.30	24.16	1.31	—	—	—	—	—	8.37	100
1937-38	19.05	51.02	—	4.96	17.40	.83	—	—	—	—	—	6.74	100
1938-39	14.53	61.00	—	6.28	11.54	.58	—	—	—	—	—	6.07	100
1939-40	8.72	73.18	—	7.92	8.02	.65	—	—	—	—	—	1.51	100
1940-41	2.89	82.51	—	9.06	3.93	.54	—	—	—	—	—	1.07	100
1941-42	2.62	82.35	—	11.47	2.41	.26	—	—	—	—	—	0.89	100
1942-43	.79	70.05	—	26.83	1.35	.35	—	—	—	—	—	0.63	100
1943-44°	—	—	—	—	—	—	—	—	—	—	—	—	—
1944-45°	—	—	—	—	—	—	—	—	—	—	—	—	—
1945-46°	—	—	—	—	—	—	—	—	—	—	—	—	—
1946-47°	—	—	—	—	—	—	—	—	—	—	—	—	—
1947-48°	—	—	—	—	—	—	—	—	—	—	—	—	—
1948-49	75.55	11.70	—	4.55	.32	—	—	—	—	—	—	7.88	100
1949-50	47.21	11.70	—	14.52	.12	.25	.11	—	—	—	—	4.44	100
1950-51	36.05	38.34	.08	16.08	.09	.04	2.29	—	—	—	—	7.03	100
1951-52	23.65	36.91	1.23	18.16	—	—	8.73	—	—	—	—	11.32	100
1952-53	12.54	32.53	3.19	18.75	—	—	18.68	.32	—	—	—	13.99	100
1953-54	6.37	26.14	8.10	18.22	—	—	32.17	.55	—	—	—	8.22	100
1954-55	2.84	19.75	15.41	11.97	—	—	40.95	1.82	.66	—	—	6.60	100
1955-56	1.04	10.15	22.28	6.43	—	—	44.00	3.19	1.65	—	—	11.26	100
1956-57	.45	7.49	32.94	4.45	—	—	43.27	5.44	3.21	—	—	2.75	100
1957-58	.21	4.45	41.45	1.93	—	—	36.04	7.64	4.10	.50	.15	3.53	100
1958-59	.14	2.60	48.35	.97	—	—	29.25	9.56	3.96	2.00	.56	3.53	100
1959-60	—	1.63	54.20	.85	—	—	26.60	6.89	3.09	3.64	.90	2.20	100
1960-61	—	.98	55.05	.75	—	—	22.86	9.40	1.74	6.32	.97	1.93	100
1961-62	—	.53	54.47	.47	—	—	21.40	8.84	1.17	9.83	.91	2.14	100

°From 1943-44 to 1947-48, no data were gathered.

Liming. The need for liming in the district has been recognized as early as 1953 when a detailed soil survey was undertaken in the district. Of the 29,802 hectares of agricultural land surveyed during the period, 63 per cent are of an acidity level of 4.6-5 pH and 32 per cent, 5-5 pH.[1] It was inferred that 99 per cent of the Victorias-Manapla soils should benefit by liming. Hence, simultaneous with the work on cane variety selection, an attempt to improve the conditions of the soil was done. It was found out that growth failure of cane in certain fields was commonly associated with soils having reaction below pH 4.5. Soil acidity becomes a limiting factor and one just cannot grow sugarcane profitably even with the best variety and the best fertilizers.[2]

Results of the field experiments on liming since 1950 have indicated that liming is necessary for maximum yields in the strongly acidic soils of the district. However, it was only when the cost of lime went down about ₱20 per metric ton in 1950 to ₱5.50 per ton delivered to the planter's farm since 1958 that the planters readily responded to liming at the rate recommended by the research department. During the 1958-59 crop year alone, 153 farms or haciendas of the district used a total of 10,547 metric tons of agricultural lime which is about four times bigger than the total used in 1955-56 crop year, and more than twice the total used in 1956-57.

Extension activities of the research department. The research department also undertakes extension services. From 1957-58 to 1961-62, about 5,568 soil samples were analyzed.[3] These samples came from 444 haciendas. Four haciendas were reported to have had their soil analyzed 14 times from 1950-1963.

Distribution of cane points is another extension service performed by the research department. From 1957-58 to 1961-62 a total of about 5,098,000 cane points of various varieties were distributed to the planters of the district. These varieties recommended for commercial planting have been experimented on for a number of years.

Another extension service performed by the research department is the personal consultation of the planter with the technician on possible farm improvements. Usually, it is the agronomist of the department who goes to the field, observes the field conditions, and interviews the farm operator. Before he leaves the farm, the recommendations are handed to the farmer.

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[1] C. L. Locsin and F. T. Tabayoyong, "Soils of the Victorias Milling District," VMCo., Inc. 1953. p. 48.

[2] Summary of Experimental Work on Sugarcane, 1957-59. Experiment Station Release No. 34. Victorias Milling Co., Inc.

[3] Soil recommendations are also prepared. Data were furnished by the Research Department, Victorias Milling Co., Inc.

The productivity gains among the farms over a period of time can be gauged more objectively through a comparison of the costs and returns of the farm business during the period. Data gathered from some farmers in the Victorias Mill District for two crop years, 1957-58 and 1961-62, are presented in this article.

The average per hectare costs, cash and non-cash of ₱2,537 in 1961-62 yielded the farm operator ₱647 per hectare return above all costs. This return is about three times as much as the report of Caintic, *et al*[1] of ₱197 in 1957-58 crop year. The higher returns resulted partly from the unexpected and temporary price rise and partly to the higher productivity of the farms in 1961-62 (Table 5). The farm productivity rose by about 11 per cent and the price of sugar rose by about 75 per cent.

Productivity gains during the period were attributed partly to the changes in farming practices among the farms. Positive changes in farm practices were noted for liming, land preparation, planting, replanting, fertilization, weeding, cultivation, after-harvest operations, and the method of transporting the canes to the railroad siding.[2]

Table 5. *Farm receipts and expenses, some sugarcane farms Victorias Mill District, Philippines,* 1957-58 *and* 1961-62 *crop years.*

ITEM	1961-62	1957-58
Receipts:	*per hectare*	
Picul sugar	122	110
Value in pesos	3184	1642
Expenses (in pesos)		
Cash		
Salary to permanent laborer	185	34
Salary to hired casual labor	442	250
Supplies	194	186
Repairs and maintenance	108	41
Interest on operating expenses[1]	56	48
Land tax[2]	9	9
Total cash cost	994	568
Milling		
Value of share for milling[3]	1146	596

[1] Caintic, C. U. *et al.* "Management Practices, Costs and Returns of Sugarcane Farms in the Victorias Milling District." Technical Bulletin 10. 1962. U.P. College of Agriculture, College, Laguna. Page 48.

[2] For an exhaustive analysis of these changes, see L. M. Ilag, "Farm Management Analysis of Some Sugar Cane Farms, Victorias Mill District, Philippines, 1961-62." M.S. Thesis. U.P. College of Agriculture. 1964 (Mimeographed).

ITEM	1961-62	1957-58
Non-cash		
Value of operator's labor	—	39
Value of unpaid family labor	—	1
Net decrease in inventory	—	33
Charge for the use of land[4]	336	190
Interest on average inventory[1]	61	21
Total non-cash cost	397	284
Total cost	2537	1448
Return above cash and milling cost	1044	481
Return above all cost	647	197
	per picul	
Gross Return	26.17	14.93
Cash and milling cost	17.58	10.58
Net returns above cash and milling cost	8.59	4.35
Total cost (cash, miling and non cash)	20.85	13.16
	5.32	1.77
Per cent increase in price per picul	75	
Per cent increase in total cost per picul	58	

[1] At 6 per cent
[2] At 1 per cent of assessed value
[3] At 36 per cent
[4] At 7 per cent of assumed market value.

The differences in farm expenses between the two crop years were most pronounced in the salary of permanent labor, the salary of hired casual labor, and repair and maintenance.

The increase in expenses in 1961-62 for the permanent labor was due to the increase in the number of permanent laborers hired. There were also indications of increase in salary. The increase in salary partly explained also the rise of expenses for casual labor. Also, the increase in productivity gave rise to increased harvesting expenses.

The increase in the milling charge, reflected in the value of the milling share value in 1961-62 was a result of the increase in both the productivity of the farm and the higher price of sugar since the milling share is fixed at 36 per cent of the gross volume of sugar.

SOME TECHNICAL FACTORS RELATED WITH THE PRODUCTIVITY OF SOME SUGARCANE FARMS

The technical factors related with the productivity of a sugarcane farm need to be spelled out in an effort to reduce the cost of producing a picul sugar so as to generate the maximum net productivity out of a given combination of farm resources.[1] Specially, in a mill district where the range in productivity among the sample farms is rather wide, (60-175 piculs of sugar per hectare), there is a pressing need for the identification of these factors. However, only those factors within the control of the operator, that can be quantitatively related with farm productivity, are enumerated in this article.

Liming. The farms that were limed had a higher yield than those that were not limed. A statistically significant difference at (5 per cent level) of about 26 piculs to a hectare was noted. (Appendix Table 1.)

Use of tractor. Those farms using tractor tended to have higher average yield per hectare than those farms using carabao. There was a statistically significant difference (.5 per cent level) in yield of about 28 piculs to a hectare between the two groups of farms. (Appendix Table 2.)

Subsoiling. The farms that used tractor when grouped into subsoiling and non-subsoiling indicated that those farms that employed subsoiling had a higher yield per hectare than those farms that did not subsoil. A difference of 15 piculs was noted, significant at 5 per cent level. (Appendix Table 3.)

Size of farm. A simple correlation test shows that about 14 per cent of the variation in the productivity of the farms can be explained by the variation in the size of farm. When a regression equation was fitted, it was noted that for every additional hectare above the average area harvested, it was accompanied by a positive change in farm productivity of about .1726 piculs per hectare or about 12 kilograms of sugar. This increase in farm productivity which accompanied the increase in the size of farm has been generally admitted as a function of a more efficient utilization of the other farm resources in larger farms. However, some small farms yield higher than many large farms. This is largely explained by some small farms sharing the resources of the bigger farms especially on the use of tractor and other heavy farm equipment.

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[1] When the Laurel-Langley agreement terminates in 1974, we may export sugar to the United States only if we can afford to pay the United States full duty which is about ₱3.50 per picul based on the exchange rate of ₱4.00 to $1.00. Source: Editorial, "Where Are We Going " Sugar News, Vol. 39 No. 9, pp. 528.

Amount of nitrogen applied to a hectare. The variation in nitrogen application to a hectare among the farms studied can explain about 19 per cent of the variation in farm productivity. This was approximated from the correlation coefficient between the two factors of .4373, significant at 1 per cent level. When a simple quadratic equation was computed to describe the relationship, it was noted that without nitrogen application, the yield to a hectare will be about 33 piculs. However, for every kilogram of nitrogen applied to a hectare there was an increase of about 1.81 piculs of sugar per hectare.

Rate of phosporous application to a hectare. About 15 per cent of the variation in the productivity of the farms can be explained by the rate of phosporous application. This was calculated from the simple correlation coefficient between the two factors of .3866, significant at 2 per cent level. Within the range of the data observed, an increase in the rate of phosporous application was accompanied by a constant increase in farm productivity. Every kilogram of phosporous added to a hectare was accompanied by an increase in farm productivity of about .2904 piculs per hectare. The point of diminishing marginal productivity was not yet reached as far as the data in this study are concerned.

Rate of potassium application. As in the case of phosporous application, about 15 per cent of the variation in the productivity of the farms can be explained by the variation in the rate of potassium application to a hectare of the sugarcane farm. An increase of one kilogram of potassium to a hectare of the sugarcane farm was accompanied by an increase in farm productivity of about .1640 piculs a hectare.

Number of days employed in fertilizing. At first glance, this factor may sound a duplication of the previous factors, the three major fertilizer elements. However, by singling out this factor, the method of fertilizer application or the intensity in the use of man-power in fertilizing is considered as well as the amount of fertilizer applied.

It is interesting to note that the number of days expended on fertilizing had the highest marginal productivity among the factors considered in the paper. Every unit change in man-day expended on fertilizing was accompanied by an increase of about 3 piculs of sugar to a hectare. This brings home the point that there are important precautions in fertilizer application that ought to be borne in mind. For example, it is not enough that the fertilizer is spread on the field or placed near the base of the plants. What counts is the effective utilization of the fertilizer elements applied. Digging holes and cover-

ing the holes after fertilizing is employed in some farms to insure full utilization of the fertilizer for the plants.

THE IMPACT OF ADOPTING SOME OF THE RECOMMENDED FARM PRACTICES ON THE COSTS AND RETURNS

The preceding discussion was confined to the physical relationship between farm productivity and some cultural practices. Obviously, this physical relationship would be rendered more meaningful if costs and returns are analyzed in the light of approximating the combined effect of a set of recommended farm practices on the income of the farm. To this end, the farms were grouped into two: those farms adopting all the selected practices and those farms not adopting all the selected practices. The selected farm practices considered were liming, subsoiling, land preparation, and fertilization. The seven farms that were lined, subsoiled, tractor was used in land preparation and were fertilized formed the first group. The five farms that were not limed, not subsoiled, carabao was used in land preparation, but were fertilized formed the second group.

It is revealing to note that the farms that employed all the selected cultural practices yielded about 36 piculs per hectare more than those farms that did not employ all the selected farm practices. This is presumably the combined effect of the sorted factors under the *ceteris parribus* condition.

The costs and returns in the two groups of farm proved most revealing. Table 6 shows that adopting all the selected cultural practices entailed more cost per hectare than those farms not adopting all the selected cultural practices. However, the difference in cost was more than compensated by the increase in productivity (returns) which we have assumed in this paper to be the combined effect of the different farm practices employed on the farms, specifically those sorted factors in the analysis. The farms that adopted all the selected farm practices had an average total cost of ₱2623 per hectare, ₱541 more than those farms that did not adopt all the selected farm practices. However, the former group of farms had a lower cost of production per picul of sugar produced, ₱1.46 less than the cost of production of the second group. The return above all cost in the first group of farms was higher by ₱401.00 per hectare or ₱1.46 per picul of sugar. With this analysis, the question, "Does high yield pay?", is partly answered. Moreover, the impact of technology on the costs and returns was roughly gauged.

Table 6. *Comparative costs and returns of some sugarcane farms employing all the selected farm practices and some of the farms not employing all the selected farm practices, Victorias Mill District, Philippines,* 1961-62.

ITEM	Farms employing all the selected farm practices	Farms not employing all the selected farm practices
Number of farms reporting	7	5
	per hectare	
Receipts:		
Picul sugar	137	101
Value in pesos	3585	2643
Expenses (in pesos)		
Cash		
Salary to permanent labor	212	157
Salary to hired casual labor	442	401
Supplies	206	150
Repairs and maintenance	19	14
Interest on operating expenses	53	44
Land tax	9	9
Total Cash Cost	941	775
Milling		
Value of share for milling	1291	952
Non-cash		
Charge for the use of land	336	336
Interest on average inventory	55	19
Total non-cash cost	391	355
Total cost	2623	2082
Return above cash and milling cost	1353	916
Return above all cost	962	561
	per picul	
Gross returns (in pesos)	26.17	26.17
Cash and milling cost	16.29	17.10
Net returns above cash and milling cost	9.88	9.07
Total cost (cash, milling and non-cash)	19.15	20.61
Net return above total cost	7.02	5.56
Per cent increase in total cost per hectare	26	
Per cent increase in net return above total cost per hectare	71	

CONCLUSIONS AND IMPLICATIONS

The Victorias Mill District exemplifies a sugar central that has achieved a considerable amount of productivity gains despite the present insti-

tutional arrangement of government control on the industry. Its contribution of 12 per cent to the national output of sugar was rather high, considering that there were 26 sugar centrals that milled sugar in 1961-62.

It appears that these productivity gains have resulted primarily from a continuous search for more efficient techniques of farm production, especially along the line of soil and varietal improvements financed by the Victorial Milling Company, Inc. This has occurred inspite of the institutional factors mentioned by Poblador which reduce initiative for such investment in research and development designed to achieve productivity gains.

It was shown that the general level of fertilization and liming in the district has increased and the search for more promising sugarcane varieties is in progress. That these changes in farm improvement are accompanied by an increasing productivity of the farms in the district clearly indicates that farmers are willing to make farm adjustments as long as higher net returns would be generated by the changes. Inspite of the progress already realized, farm productivity appears to remain a problem of the district, there being a wide range in productivity among the farms. While many of the farmers in the district have begun to realize the value of liming, higher rate of fertilization, continuous search for more productive sugarcane varieties, and other cultural practices, a number of farm operators still show that they resist farm innovations. There are farmers who contend that their farming experiences are more reliable than the research results of the research department. On the other hand, there are farmers who could not avail themselves of the recommended farm practices because of some financial and technical problems. Some of the farmers operate small farms that seem not to warrant the purchase of heavy farm equipment. Some of the farmers are not members of the farmers' cooperative through which farm supplies can be bought at a lower price. Other farmers appeared shy to call up the research department for consultation whenever some technical problems crop up.

The procedure followed in the research department of visiting individual farms is one effective means of narrowing the gap between the research results and the farm management practices. It seemed that the technicians can attend to the farm problems more effectively in this manner. However, it appears that with this process, the technicians can attend to a limited number of farms in a day. Alternative courses of action should therefore be mapped out to overcome this limitation. Holding of fields days is one alternative where farmers can be gathered at a time. It provides an occasion when farmers can exchange ideas with the researchers and among themselves regarding

their farm experience. It is also an occasion when the farmers can clarify specific pointers on what has been published on the extension bulletin. However, as already mentioned, there are other alternatives. With the experiences of the technical men in the research department, they can single out an extension method that will effectively and meaningfully work out in the district. Any internal adjustment within the district aimed at increasing the farm productivity prepares the sugar producers to face squarely any eventuality that endangers the sugar industry.

The seemingly threatening problem of the sugar industry is the probable outcome of the termination of the Laurel-Langley agreement at midnight of July 3, 1974. When the premium to the Philippine sugar in the U.S. market will be removed, the Philippines may either compete in the world market or continue selling sugar in the U.S. market. Any increase in the transportation cost and/or payment of full tariff duty in the U.S. market may consequently mean a decrease in the price of sugar in the country. The possibility of experiencing much lower prices might have been the reason why some farmers have already started to diversify their farms. Some are in livestock. One has already gone into the meat processing industry.

During 1961-62 when the study was being conducted, the price of sugar in the Victorias Mill District averaged ₱26 per picul. Following the sharp rise in price during 1963, the price of sugar has fallen slightly below the 1961-62 price level (approximately ₱24 per picul in recent months). If the price of sugar remains in this range, the Philippine sugar industry may remain in a relatively prosperous position. Expiration of the Laurel-Langley agreement would mean the payment of full tariff duty of about ₱3.50 per picul of Philippine sugar in the U.S. market. This may eventually reduce the price per picul of sugar in the country. Under the 1961-62 condition, net returns above total costs were approximately ₱7.00. If continued technological progress can prevent costs from rising above the 1961-62 levels, sugarcane production will remain an economically profitable enterprise.

APPENDIX

Table 1. *Relationship between liming and the yield per hectare, 84 sugarcane farms, Victorias Mill District, Philippines, 1961-62.*

ITEM	FARMS REPORTING number	AVERAGE YIELD PER HECTARE piculs sugar
Liming farms	67	127
Non-liming farms	19	101

Table 2. *Relationship between the system of land preparation and yield per hectare, 84 sugarcane farms, Victorias Mill District, 1961-62.*

ITEM	FARMS REPORTING number	AVERAGE YIELD PER HECTARE piculs sugar
Using tractor	67	127
Using Carabao	17	99

Table 3. *Relationship between subsoiling and yield per hectare, 67 sugarcane farms, Victorias Mill District, Philippines, 1961-62.*

ITEM	FARMS REPORTING number	AVERAGE YIELD PER HECTARE piculs sugar
Subsoiling	18	138
Not subsoiling	49	123