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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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A COMPARATIVE ANALYSIS OF TRACTOR CONTRACT OPERATIONS IN NUEVA ECIJA, PHILIPPINES, 1972 and 1980

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ABSTRACT

Changes in tractor contract operations in Nueva Ecija between 1972 and 1980 were analyzed. Benefit-cost ratios were calculated for two-wheel and four-wheel tractors. The areas serviced for both tractor types were parameterized to determine the level of operation required to break-even. Results showed that, at current contract rates and with current utilization patterns, two-wheel tractor ownership from a purely profit-oriented viewpoint, is not viable. All two-wheel tractor owners were farmers with a main concern to prepare their own lands. Hence, there were many non-pecuniary interests not included in the benefit-cost analysis. No significant difference were noted between the 1972 and 1980 operations. The benefit-cost ratios for four-wheel tractors decreased from 1.24 in 1972 to 0.89 in 1979-80 but remained constant at approximately 0.66 for two-wheel tractors.

INTRODUCTION

Major changes have taken place recently in farming practices in the Philippines. These have been encouraged by the development of irrigation facilities, the adoption of modern high yielding varieties and the proper use of chemicals. Land preparation has also shifted from traditional to mechanized methods. The main reasons are timeliness of operation, better quality of land preparation and weed control, less drudgery, lower tillage costs and lack of carabaos, aggravated by the prevalence of carabao rustling.

The degree of mechanization in the country was intensified specifically by the special financing program of the government through the Central Bank: International Bank for Rural Development (CB:IBRD) Farm Mechanization Credit Program. Ownership both of two-wheel and four-wheel tractors increased tremendously due to the availability of loans for capital investments. The introduction of locally manufactured power tillers also contributed much to tractor ownership. Tractors were purchased not only for own farm operations but also for custom work.

Orcino and Duff (1973) reported a study of four-wheel tractor owners in Central Luzon conducted in 1972. Among the objectives were to determine the pattern of tractor ownership and use and to assess the level of profitability of the machine when used for subcontract work. Some of the results from this study are compared with the present findings to investigate the trends and changes that have taken place since 1972.

OBJECTIVES

The current study was conducted:

1. to identify and analyze the changes in ownership and use patterns of two and four-wheel tractors between 1972 and 1980;

2. to evaluate arrangements used by contractors to secure work, and changes which have occurred in the privision of contract services;

3. to examine the financial arrangements available for the purchase of tractors and their uses;

4. to evaluate changes in the profitability of the two and four-wheel tractor contract market since 1972, and the reasons for such changes; and

5. to assess the need for and the adequacy of repair services, maintenance, operator's training and spare parts availability, objectively, and from the owner's viewpoint.

THE SURVEY DESIGN AND METHODOLOGY

Data Collection

Information for the study was derived from two sets of surveys. The first set, which was gathered in 1972 (Orcino and Duff, 1973), covered four-wheel tractors only. More recent data were collected, from March to April 1980, through personal interviews with tractor owners from thirteen municipalities in Nueva Ecija. A pre-coded questionnaire was used. In order to select the survey respondents, a list of tractor owners was obtained from machine dealers, village officials and rural banks located in the province. The list was stratified into two and four-wheel tractor owners. Seventy-five (75) respondents were drawn from the four-wheel category and 50 from the two-wheel category.

Data Analysis

The data from the survey were compared with the results of the 1972 survey to determine the changes that have occurred between these years. Benefit-cost ratios were computed for two-wheel and four-wheel tractors purchased in 1972 and 1980. Whenever possible, data from the current study were used. However, some information was taken from the Orcino and Duff study. The area serviced, for both tractor types, was parameterized to determine the levels of operation required to break-even.

THE STUDY AREA

The province of Nueva Ecija, in Central Luzon, is one of the country's main rice growing areas. The province is relatively well mechanized. Four-wheel tractors were introduced into Nueva Ecija as early as 1942 and the use of two-wheel tractors started in the 1960's. Its municipalities are characterized by a mixture of irrigated, rainfed and some upland areas. The development of irrigation facilities started in the 1950's, but still more than 1/5 of the area devoted to rice remains unirrigated. Modern rice varieties predominate in almost all municipalities. The average annual rice yield from irrigated areas has increased from 2138 kgs/ha in 1973 to 3960 kgs/ha in 1979 (Figure 1).

The average yield from rainfed areas has remained constant. The total area planted to rice, (irrigated and rainfed) showed a decline from 1975 to 1977 but increased slightly thereafter (Figure 2). This was mainly due to the conversion of non-irrigated rice lands to production of other crops such as sugarcane, vegetables and corn since 1973.

In 1976, 23.2% of the 40,478 tractor units in the country - 18.7% of the four-wheel tractors, 26% of the two-wheel tractors, and 14.5% of the crawler tractors were located in Central Luzon.[1] This represented the highest number in any region in the Philippines.

RESULTS

Tractor Ownership Characteristics.

Tractor owner profile. Some general characteristics of the tractor owners interviewed in 1980 and 1972 are shown in Table 1. In 1980, all of the two-wheel tractor owners were farmers. The average farm size was 3.1 hectares and they had been farming for an average of 25 years. Of the 50 two-wheel tractor owners, 24 were leaseholders, 18 were amortizing owners, one was a farm-owner and 7 were under a combination of the different tenure status. The rice cropping intensity for the group was 196%.

Of the 75 four-wheel tractor owners, 68 were farmers, 3 were non-farming custom operators, and 4 were landlords. The landlords hired operators to manage their tractors while they practiced their own professions. The farmers who owned four-wheel tractors had, on average, been farming for 23 years and cultivated 9.1 hectares of land. Of the 68 tractor owning farmers, 34 owned their farms, 11 were lessess, 9 were amortizing owners, 4 were share-tenants, and 10 were under a combination of tenure status. The rice cropping intensity was 170%. This was because many of the four-wheel tractors were operated in non-irrigated areas where only one rice crop was grown per year. Corn, vegetables and other crops were grown during the remainder of the year.

In 1972, of the 142 tractor owners interviewed, 125 were farmers, 10 were custom service operators, and 7 were landlords. Of the tractor-owner-farmers, 123 were farm owners, one was a lessee and 1 was a share tenant. The average farm size was 28.0 hectares and the rice cropping intensity was 141%.

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[1]Data Source: Bureau of Agricultural Economics (BAEcon).

Tractor operator characteristics. Selected characteristics of the tractor operators are shown in Table 2. The majority of the four-wheel tractor operators were hired (72%). The rest were operated either by the owner themselves, by family members, or by a combination of hired, family, and owner. Ninety-one percent of the two-wheel and 88% of the four-wheel tractor owners reported no difficulty in getting operators from within the area.

Though most of these operators were already knowledgeable in machine operation, 21% of the operators for the two-wheel and 17% for the four-wheel tractors had to have further training on tractor operation. They received their training either from the dealer mechanics, from tractor owners, from other operators or through self-training. The advantages of formal training of tractor operators were reported as less incidence of breakdown and better maintenance knowhow, better quality of work, greater speed of operation, and better trouble shooting ability.

Tractor operators were paid at different rates depending on the extent of responsibilities given to them. These differences also depended on the owner's discretion, and sometimes on the kind of training undergone by the operator. No similar information was gathered in the 1972 study.

Tractor Characteristics

Tractor description. The 142 four-wheel tractor units surveyed in 1972 had an average of 62.5 horsepower, a little lower than the 1980 average of 68.0 hp (Table 3).[2] The average age of the machines was 4.4 years in 1972 and 6.7 years in 1980. In the case of the two-wheel tractors, the average horsepower was 8.9 and the average age was 3.0 years. All the four-wheel tractors surveyed both in 1972 and in 1980 were powered with diesel engines while 85% of the two-wheel tractors were gasoline powered.

Tractor Use Pattern

A comparison of tractor use by season and by location, as well as the changes in utilization between 1972 and 1980 are shown in Table 4 and Figure 3. Two-wheel tractors during the 1980 survey were used for an average of 137 hours (17 days) during the wet season and 121 hours (15 days) during the dry season or a total of 258 hours (32 days in a year). Forty-two percent of the total time was spent on harrowing, 38% on plowing and 19% on rotavating.

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[2] No statistical test was done to see if the difference was significant.

The four-wheel tractors were used for an average of 432 hours (54 days) during the wet season and 414 hours (52 days) during the dry season. The operation most commonly carried out with a four-wheel tractor was rotavating, using 65% of the time, followed by plowing, which utilized 19% of the total time. Minor operations carried out included threshing (8%), harrowing (5%), transporting, (3%) and providing power for water pumps. One striking feature, which is not apparent in Table 4 and Figure 3, is that the use for threshing is restricted to a few tractors which were all extensively used, i.e. working for as long as 15 hours per day during the harvest season.

In 1972, large tractors were utilized for an average of 175 days per year (1396 hours) which is about 65% more than in 1980. Rotavation was the main operation of the tractors, accounting for 38% of the total time used. Plowing and harrowing combined occupied 29% of the total time, while threshing and puddling (also called ara-wheeling) shares were 13% and 20%, respectively. The major contributors to the reduced utilization are the elimination of tractor powered puddling, the reduction of use for threshing by two-thirds and a 50% reduction in use for plowing and harrowing.

Farmers utilized two-wheel tractors more on own farms (66%), unlike the four-wheel tractors which were used only for an average of 17% on the owner's farm (Figure 4). This pattern of utilization of four-wheel tractors is similar to that observed in 1972 when only 20% of the total time was spent for own farm and 80% was for other farms.

Tractor Custom Services

In addition to being used on their own farms, 83% of the four-wheel and 36% of the two-wheel tractors were used for custom servicing. Custom services were provided both within and outside the village of residence. The average distance travelled within the village was 1.1 kms and 1.3 kms for two and four-wheel tractors, respectively. For four-wheel tractors which serve farms in other municipalities, the average distance travelled was 6 kms.

The maximum distance serviced by the operators averaged to 2.4 kms for two-wheel tractors and 47.4 kms for the four-wheel tractors, compared to 80 kms for four-wheel tractor operations in 1972. This reduction in the area serviced could well be due to the increased number of tractors both within the areas and in surrounding areas.

Four of the two-wheel tractor owners and 35 of the four-wheel tractor owners noted a decrease in area serviced (Table 5). Most also noted a decrease in the number of customers due to eventual acquisition

of tractors by their former customers and/or shift to carabao use because of increased fuel and oil costs. Only 4 of the two-wheel tractor owners and 9 out of the four-wheel tractor owners reported an increase in the area serviced.

Thirteen of the two-wheel and 29 of the four-wheel tractor owners could still service a wider area than they were presently servicing. The reasons given were that their tractors were still capable of more work and that there were still many potential customers within and outside the area. Those who answered negatively, i.e., tractors are no longer capable of servicing more than the present area, cited the following as their reasons: frequent breakdown of machine due to old age and fear of overusing their machines because of costly spare parts. Other reasons mentioned were competition with other tractors within and outside the area; high cost of fuel and oil; difficulty in collecting fees from customers; lack of time and men to do the extra work; and low machine capacity.

Fifty-six percent of the four-wheel tractor owners and 18% of the two-wheel tractor owners planned to continue their custom work, while 19% and 8%, respectively, planned to stop. Both two-wheel and four-wheel tractor owners signified they would continue custom operations as long as their machines were capable.

The majority of owners of both tractor types who responded reported a fixed service fee, while a few of the four-wheel tractor owners reported having negotiated the tractor service fee. Similarly, the service fee in 1972 was based generally on a fixed amount prevailing in the area, although a few tractor owners and customers negotiated the rate.

Fixing the contract service fee in both years involved several factors. Agents were sometimes employed by both the contractors and the farmer-customers. Fees were sometimes arranged by these agents, be they the contractor's or the farmer's agents. Prevailing rates in the area were also considered. In some cases, discounts averaging ₱10/ha for two-wheel and ₱33/ha for four-wheel tractors played an important role in service fee arrangements.

Some respondents reported having collected the service fee before or immediately after the operations is carried out to ensure getting paid. However, due to competition, some operators had to adjust their service rates in order to gain customers. Deferred payments and payments in kind (e.g. paddy) were also accepted.

Custom rates were affected by the location of the customer's farm. Operators charged more per hectare to compensate for the additional transport and other incidental expenses incurred for servicing distant farms. The additional charge averaged ₱20/ha for two-wheel tractors and ₱31/ha for four-wheel tractors.

Changes in contract rates. Contract rates for two-wheel tractors were on both a per hectare and a per day basis. For the four-wheel tractors, however, arrangements were all on a per hectare basis. In both cases, fuel was provided either by the tractor owner or by the customer. Table 6 shows the trend in two-wheel tractor service rates from 1972 to 1980. Using a two-wheel tractor with fuel provided by the tractor owner, the service rate increased from ₱100/ha to ₱275/ha for rotavation; ₱65/ha to ₱206/ha for plowing and ₱210/ha to ₱319/ha for harrowing.[3]

The rate for four-wheel tractor services with fuel provided by the tractor owners was ₱110/ha in 1972, rising to ₱225/ha in 1980, an increase of 104%. Aside from plowing, rotavation was the other major operation carried out by the four-wheel tractors with rate amounting to ₱158/ha in 1973 to ₱297/ha in 1980.

In 1974, the rate for harrowing was ₱230/ha, increasing to ₱380/ha in 1980.

Tractor Breakdown, Repair and Maintenance.

Problems in ownership, operation and maintenance of tractor. There were a number of problems associated with the ownership, operation and maintenance of tractors, as reported by 44% of the two-wheel and 75% of the four-wheel tractor owners (Table 7). The most frequent problems reported by two-wheel tractor owners were costly fuel and oil/shortage of diesel fuel (55%), followed by the cost of spare parts (19%), and frequency of breakdowns which delayed work schedules and required costly repair expenses (16%). Four-wheel tractor owners reported the same problems, with frequencies of 27% and 22%, respectively. The large difference in the number of people quoting expensive fuel and oil as a problem is probably due to the fact that two-wheel tractor owners use the machine predominantly on their own farms, whereas four-wheel tractor owners provide more custom services. The latter group should be better able to pass on increased fuel prices.

Tractor breakdowns. Minor repairs were done by the operator while major ones were done in the repair shops. There were cases when tractor was left in the field and repaired only when cash was available. The availability of locally made spare parts was not a problem according to 74% of the two-wheel and 73% of the four-wheel tractor owners. Local dealers usually had stocks and some even had mechanics available to repair the machine. These machine dealers were on average only 12.2 kms away from the two-wheel tractor owner's residence and 38.3 kms away from the four-wheel tractor owner's residence.

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[3] For harrowing, the values quoted are from the years 1977 and 1980 due to the absence of data for the years prior to 1977.

Of all the components, the lubrication system of the two-wheel and the power transmission of the four-wheel tractors broke down most frequently. However, it was the power transmission of the two-wheel and the engine of the four-wheel tractors which most frequently required spare parts.

These failures rendered the two-wheel tractors inoperable for an average of four days per breakdown, the downtime ranging from 1 to 30 days and an average of 30 days for four-wheel tractors with downtimes ranging from 1 to 90 days.

Some owners had resorted to limiting their tractors to lighter activities, such as threshing, power source for pumps and transporting, in order to reduce these failures. Others had reduced the number of customers served.

Credit and Financial Arrangement.

Tractor financing and credit. Twenty-eight percent of the two-wheel tractors were purchased in cash and 72% were obtained on installment (Table 8). Fifty percent of the respondents utilized personal funds to purchase[4] and only 14% borrowed money. The rest used a combination of own and borrowed money. The majority of the four-wheel tractors were paid by installment (87%) and only 13% were paid in cash. Fifty-four percent of those who paid in cash obtained their funds from a combination of borrowed and own personal money, 19% used borrowed money, and 27% used own funds.

Different forms of collateral were used to obtain the loans from the different banking institutions. Eighty-three percent of the borrowers for the two-wheel tractors used their Certificates of Land Transfer (CLT) and 17% used their farm land titles. Among the four-wheel tractor owners, 50% used their land titles, 19% used house and lot titles and 10% used their CLT's. Another 10% used a combination of farm and house and lot titles. Two percent borrowed under the group liability plan of the Ministry of Agrarian Reform.[5]

Table 9 shows that both two-wheel and four-wheel tractor owners borrrowed their initial capital investment from different sources such as the Development Bank of the Philippines-Agricultural Credit Administration (DBP-ACA), rural banks, dealers, commercial banks, and relatives. The amounts borrowed ranged from ₱1,000 to ₱18,000 (US$135 to $2,432), on the average, for the two-wheel tractors and from ₱1,000 to ₱145,000 ($135 to

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[4]Several of those purchasing in cash had short term credit from dealers, etc.

[5]This is a program of the government which allows the farmers to acquire machine on a group liability plan.

$19,545), on the average, for the four-wheel tractors. These loans had an average repayment periods of 1 to 15 years for both tractor types. It took between 2 to 42 days for the owners to obtain their loans for four-wheel tractor purchase and 2 to 20 days for loans for the two-wheel tractor purchase.

Sixty percent of the two-wheel and 64% of the four-wheel tractor owners reported problems in repaying their borrowed capital (Table 10). The main problems mentioned included: yield and/or crop failure; the amount of the installment being too big for them to meet; and that the tractors were not generating enough income. Personal financial problems, which they considered more urgent than meeting their bank obligations, also prevented them from repaying their loans on time. The frequencies with which these problems were reported are consistent with the utilil-ization of the two types of tractor.

Benefit-Cost Analysis

The information summarized in the tables was used, in conjunction with some supplementary information, to derive benefit-cost ratios for tractor contract operations. In their earlier study, Orcino and Duff estimated a benefit-cost ratio of 1.94 for all four-wheel tractors in 1972. The average age of these tractors was 4.4 years. In the following calculations, the benefit-cost ratios of two-wheel and four-wheel tractors purchased new in 1972 and 1980 are compared. For the computation of the benefit-cost ratios of tractors, only those units doing solely land preparation operations were considered. Those carrying out other activities, such as threshing, pumping, and transporting, were excluded since they tend to distort the analysis. The computations and results are shown in Table 10.

The values used were derived as follows: Capital investment was the average investment for tractors purchased new during that year. These were obtained from the survey data. Tax and insurance, including municipal tax, insurance premiums and registration fees, were computed as 2% of the capital investment. Annual depreciation was computed using the straight line method, that is:

$$\text{Annual depreciation} = \frac{\text{Initial cost minus salvage value}}{\text{Estimated useful life}}$$

For the purposes of these calculations the salvage value was assumed to be 10% of the initial capital investment, and the estimated useful lives were taken as 8 years for a two-wheel tractor and 20 years for a four-wheel tractor. Interest on capital invested in the tractor was charged at 12% per annum.

Variable costs per hour were computed from the survey data. The values for gasoline used were those reported for two-wheel tractors as this is the predominant source of motive power with an average consumption estimated at 1.50 liters per hour at a cost of ₱0.59/1 in 1972 and ₱4.79/1 in 1980, diesel fuel is the most important fuel for four-wheel tractors, with a consumption of 4.08 liters per hour, on the average, costed at ₱0.30/1 in 1972 and ₱2.85/1 in 1980. Oil and grease were also calculated based on consumption rates obtained from the survey; the former costed at ₱4.50/1 in 1972 and ₱11.30/1 in 1980, while the latter was at ₱3.00/kg in 1972 and ₱9.00/kg in 1980.

Repair and maintenance costs of 4% per annum for the two-wheel tractors and 5.5% for the four-wheel tractors were taken from the 1980 survey.

Labor costs in 1980 were taken as an average of 20% of the total revenue of the tractors derived from doing land preparation operations. This is the prevailing arrangement in the area with rates ranging from 10% to 35% of the gross contract service fee. Labor is usually composed of two drivers and sometimes helpers. In 1972, the labor fee was on a per day basis with an average of 2 drivers per tractor at the rate of ₱8.75 (US$1.18) per day per person plus 5 helpers per tractor at the rate of ₱6.50 (US$0.88) per day per person.

Total costs are estimated as total fixed costs per annum plus total variable costs per hour multiplied by the annual utilization in hours.

Total revenue was derived as the sum of the annual utilization in hours multiplied by the custom charge per hour. Since there was no annual utilization figures for the two-wheel tractors in 1972, Orcino and Duff having only studied four-wheel tractors, it was assumed that the utilization of two-wheel tractors had declined by the same amount as four-wheel tractors.

The estimated benefit-cost ratios indicated a decline in the average profitability of four-wheel tractors from 1.24 in 1972 to 0.89 in 1979-80. This indicates that although almost every increase in the operating costs was matched by an increase in the tractor service fee (Table 6), the profitability level still tended to decrease because of significant decline in the level of utilization. There is also the effect of the level of capital investment on the profitability.

On average, tractor custom-service is no longer profitable with the current utilization pattern and the current custom service rate. A consequent increase in the service fee is necessary if operators are to stay in business. Information gathered, however, already showed a number of tractor owners charging customers as high as ₱450 per hectare for rotavation and eventually, others may follow.

Ownership of two-wheel tractors does not appear to be financially viable. However, this is not totally unexpected since all of the two-wheel tractor owners were farmers whose main concern was presumably to prepare their own lands. In these circumstances, there are doubtless many non-pecuniary interests and these were not included in the benefit-cost analysis.

The annual utilization rates were parameterized to look further into the profitability of two and four-wheel tractors. Different utilization levels were assumed while the variable and fixed costs data were taken from the survey. The results are shown in Figures 4 to 7. Since these indicate the revenue (benefits) per hectare and the total costs per hectare, the benefit-cost ratio for any level of utilization can be directly computed. Results show that the two-wheel tractor would require 1602 hours or 91 hectares of land preparation use per annum to break-even and the four-wheel tractor would need 227 hectares or 1067 hours of land preparation.

In the case of the two-wheel tractor, which only had an average utilization of 258 hours or 32 hectares of land preparation use per annum, it would probably be impossible to increase the tractor utilization to this extent, given the physical capacity of the machines, their operators and the number of potential clients.

CONCLUSION

The results suggest that ownership of a two-wheel tractor is not financially profitable. However, there are many other benefits derived by the owners which were not quantified in this study. All the two-wheel tractor owners were farmers and they used their tractors mainly on their own farms, thus, the low level of utilization which was way below the break-even point.

On the other hand, the four-wheel tractor business, which was a reasonably profitable enterprise in 1972 with a benefit-cost ratio of 1.24 had declined in 1980 to a ratio of 0.89. The reduced level of utilization was one of the major contributors to this decline.

Contract rates per hectare increased steadily to catch up with the increases in the operating costs. Costly spare parts and frequent breakdowns had also posed a limitation in the extent of machine use. This had even caused some tractor owners to limit their tractor operation to threshing activities which were less taxing to the machine.

The study indicated that the tractor business is barely profitable at its present contract rates and pattern of utilization. This presents tractor owners with two alternatives if they are to stay in business. One would be to increase the present level of utilization of their tractors and the other would be to increase the contract rates.

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Table 1. General characteristics, tractor owners in Nueva Ecija, Philippines, 1972 and 1980.

Item	1972 4-wheel tractor	1980 2-wheel tractor	1980 4-wheel tractor
Farmer	125	50	68
Owner operator	(123)	(1)	(34)
Lessee	(1)	(24)	(11)
Amortizing owner	-	(18)	(9)
Share tenant	(1)	-	(4)
Combinations	-	(7)	(10)
Custom service operator	10	-	3
Landlord	7	-	4
Total	142	50	75
Average years in farming	-	25	23
Average farm size (ha)	28.0	3.1	9.1
Percent rice cropping intensity	141	196	170

Table 2. Characteristics of tractor operators, 125 respondents, Nueva Ecija, Philippines, 1980.

Item	TYPE OF TRACTOR 2-wheel (n = 50)	4-wheel (n = 75)
1.0 Machine Operators	% reporting	
1.1 self	32	11
1.2 family members	28	11
1.3 hired operator	26	72
1.4 combinations of the above	14	6
Total	100	100
2.0 Operators easily obtained in the area		
2.1 yes	91	88
2.2 no	9	12
3.0 Operators knowledgeable in tractor operation		
3.1 yes	79	83
3.2 no	21	17
4.0 Who trains the operator		
4.1 dealer mechanic	17	71
4.2 tractor owner	50	-
4.3 other tractor operators	33	-
4.4 self-trained	-	29
5.0 Formal training in tractor use and maintenance by tractor operators		
5.1 those with formal training	21	48
5.2 those without formal training	79	52
6.0 Differences in efficiency between tractor operators with and without formal training		
6.1.1 percent reporting difference	71	49
6.1.2 percent reporting no difference	29	51
6.2.0 Differences:		
6.2.1 Better quality of work	27	29
6.2.2 Greater speed of operation	29	16
6.2.3 Better maintenance know-how	6	14
6.2.4 Better trouble shooting ability	15	10
6.2.5 Less incidence of breakdowns	23	31

Table 3. Comparative tractor characteristics, Nueva Ecija, Philippines, 1972 and 1980.

Item	1972 4-wheel tractor	1980 4-wheel tractor	1980 2-wheel tractor
	n = 142	n = 75	n = 50
Average age (years)	4.4	6.7	3.0
Average horsepower (hp)	62.5	68.0	8.9
Fuel type (no.)		No. reporting	
Diesel	142	86*	7.0
Gasoline	-	-	43.0

*Total number of 4-wheel tractor units owned by 75 respondents.

Table 4. Comparative tractor utilization pattern for 1972 and 1980 by season, Nueva Ecija, Philippines.

Item	1972 4-wheel tractor (n = 142)	1980 2-wheel tractor (n = 50)	1980 4-wheel tractor (n = 73)
	Tractor use by location and season		
Wet season (hrs)	672	137	432
Own farm	169 (25)*	89 (65)	75 (17)
Off-farm	503 (75)	48 (35)	357 (83)
Dry season	724	121	414
Own farm	113 (16)	78 (64)	68 (16)
Off-farm	611 (84)	43 (36)	346 (84)
Total	1396	258	846
	Percent utilization by operation		
Operations			
Plowing	-	38	19
Harrowing	-	42	5
Plowing/harrowing	29	-	-
Rotavating	38	19	65
Cultivating	-	1	-
Ara-wheeling	20	-	-
Transporting/pump	-	-	3
Threshing	13	-	8
Total	100	100	100

*Figures in parentheses are percent values.

Table 5. Perception on the area being serviced, 125 tractor owners, Nueva Ecija, Philippines, 1980.

Item	Tractor type	
	2-wheel	4-wheel
1.0 Changes regarding area being serviced	No. reporting[a/]	
1.1 Increased	4	9
1.2 Decreased	4	35
1.3 The same	4	9
Total	12	53
2.0 Can service more farmers/area than presently serviced:		
those who reported YES	13	29
those who reported NO	22	37
Total	35	66
3.0 Reasons for YES		
3.1 The tractor can still perform well	8	18
3.2 The tractor has much available time for other farms	1	4
3.3 There are many customers within and outside the area	1	2
Total	10	24
4.0 Reasons for NO		
4.1 Competitions with tractors within and outside the area	5	16
4.2 Frequent breakdowns of the machine, old machine,	4	18
4.3 High cost of fuel and oil	-	3
4.4 Difficult to collect fees	-	2
4.5 Lack of time, physically difficult, insufficient machine capacity	7	1
4.6 For own farm use only	7	1
Total	23	41

a/ Not all respondents mentioned a reason.

Table 6. Contract rates[a] for tractor custom services by tractor type and operation from 1972 to 1980, 125 tractor owners, Nueva Ecija, Philippines, 1980.

Year	Item	TRACTOR TYPE					
		2-wheel				4-wheel[b]	
		Per ha		Per day		Per ha	
		(₱)	($)	(₱)	($)	(₱)	($)
1972	Plowing	65	8.78	-	-	110 (5)[c]	14.86
	Harrowing[d]	-	13.51	-	-	-	-
	Rotavating	100 (2)	-	-	-	-	-
1973	Plowing	-	-	-	-	116 (5)	15.68
	Harrowing	-	-	-	-	-	-
	Rotavating	115 (2)	15.54	-	-	158 (14)	21.35
1974	Plowing	-	-	-	-	131 (8)	17.70
	Harrowing	-	-	-	-	230 (2)	31.08
	Rotavating	117 (3)	15.81	-	-	173 (20)	23.38
1975	Plowing	-	-	-	-	137 (10)	18.51
	Harrowing	-	-	-	-	230 (2)	31.08
	Rotavating	128 (4)	17.30	-	-	178 (32)	24.05
1976	Plowing	-	-	-	-	137 (17)	18.51
	Harrowing	-	-	60 (1)	8.11	250 (2)	33.78
	Rotavating	188 (8)	25.40	-	-	187 (44)	25.27
1977	Plowing	128 (4)	17.30	62 (4)	8.38	160 (21)	21.62
	Harrowing	210 (4)	28.38	62 (4)	8.38	267 (3)	36.08
	Rotavating	219 (10)	29.59	-	-	213 (49)	28.78
1978	Plowing	150 (4)	20.27	65 (5)	8.78	183 (21)	24.73
	Harrowing	242 (5)	32.70	65 (5)	8.78	275 (4)	37.16
	Rotavating	233 (11)	31.49	-	-	238 (55)	32.16
1979	Plowing	153 (5)	20.68	74 (5)	10.00	215 (23)	29.05
	Harrowing	304 (7)	41.08	71 (7)	9.59	332 (5)	44.86
	Rotavating	266 (13)	35.94	-	-	275 (63)	37.16
1980	Plowing	206 (8)	27.84	74 (5)	10.27	225 (25)	30.40
	Harrowing	319 (11)	43.11	74 (5)	10.00	380 (8)	51.35
	Rotavating	275 (13)	37.16	-	-	297 (66)	40.14)

[a] Fuel expenses paid by tractor owners.

[b] There was no per day contract rate arrangement for four-wheel tractors

[c] Figures in parentheses are number of respondents reporting.

[d] Three passes for harrowing per hectare.

Table 7. Problems in ownership, operation and maintenance of tractors, 125 owners, Nueva Ecija, Philippines, 1980.

Item	Tractor type		
	2-wheel n = 50	4-wheel n = 75	All
No. reporting	22 (44%)	57 (76%)	79
	% reporting		
1. Costly fuel and oil/shortage of diesel fuel	55	27	34
2. Expensive spare parts	19	24	22
3. Frequent breakdowns which delay work/engine not reliable/ costly repair expenses	16	22	21
4. Difficult to manage operators and helpers	7	7	7
5. Unavailability of spare parts	3	8	7
6. Difficult to collect fees from customers	-	6	4
7. Lack of custom work due to competition	-	4	3
8. Difficult to meet schedule	-	2	2
Total	100	100	100

Table 8. Source of financing for tractor and type of collateral used for tractor loans by 125 respondents, Nueva Ecija, Philippines, 1980.

ITEM	TRACTOR TYPE		
	2-wheel n = 50	4-wheel n = 75	All n = 125
1.0 Manner of Payment of tractors		% reporting[a]	
1.1 Cash	28	21	24
1.2 Installments	72	79	76
2.0 Source of financing for tractors			
2.1 Personal	50	27	36
2.2 Borrowed	14	19	17
2.3 Personal & borrowed	36	54	47
3.0 Type of collateral used			
3.1 Farm land title	17	59	46
3.2 Certificate of land transfer	83	10	32
3.3 House and lot title	--	19	14
3.4 Group liability under the Ministry of Agrarian Reform	-	2	1
3.5 Combinations of 1 & 3	-	10	7
Total	100	100	100

[a] Some respondents owned more than one tractor.

Table 9. Loan characteristics, 2 and 4-wheel tractor owners, Nueva Ecija, Philippines, 1980.

Source	Days to acquire (no.)	Amount borrowed		Amount of installment		Amount of down payment	
		Average values					
		(₱)	($)[b]	(₱)	($)	(₱)	($)
1.0 Two-wheel tractor:							
1.1 DBP/ACA (10)[a]	20	14,190	1,917	1,316	177	1,280	173
1.2 RB/IBRD (7)	15	13,857	1,872	1,333	180	2,000	270
1.3 Dealer (5)	12	8,180	1,105	1,750	236	3,875	523
1.4 Commercial banks	7	18,000	2,432	1,500	202	2,000	270
1.5 Relatives (1)	2	1,000	135	-	-	-	-
2.0 Four-wheel tractor:							
2.1 RB/IBRD (39)	44	122,833	16,579	21,619	2,921	16,300	2,202
2.2 Dealers (8)	26	113,750	15,371	20,800	2,810	23,750	3,209
2.3 Commercial banks (3)	10	56,533	7,679	7,433	1,004	29,000	3,918
2.4 DBP/ACA (2)	15	145,000	19,594	5,500	743	42,000	5,625
2.5 Relatives (1)	2	1,000	135	-	-	-	-

a/ Figures in parentheses correspond to number reporting.

b/ Exchange rate used: ₱7.40 = 1US $

Table 10. Problems in repaying borrowed capital, 125 respondents, Nueva Ecija, Philippines, 1980.

Item	Tractor type		
	2-wheel	4-wheel	All
Percent reporting problems	60	64	63
Percent reporting no problems	40	36	37
Problems	% reporting		
1. Personal and financial problems	10	11	11
2. Tractor does not generate enough income	16	36	29
3. Low yield/crop failure	42	17	25
4. Too burdensome to pay the installments	32	36	35
Total	100	100	100

Table 11. Benefit-cost analysis of two and four-wheel tractors, 1972 and 1980, Nueva Ecija, Philippines.

Item	TRACTOR-TYPE			
	Two-wheel		Four-wheel	
	1972	1980	1972	1980*
CAPITAL INVESTMENT	₱ 8,000.00	₱ 13,000.00	₱ 82,834.00	₱ 192,250.00
Fixed cost/year **				
Tax & insurance	160.00	260.00	1,657.00	3,845.00
Depreciation	960.00	1,462.00	3,728.00	8,651.00
Int. on cap. inv.	528.00	858.00	5,467.00	12,688.00
Total fixed cost	₱ 1,588.00	₱ 2,580.00	₱ 10,852.00	₱ 25,184.00
Variable cost/hour				
Fuel & lubricants				
Diesel fuel/gasoline	0.89	7.19	1.22	11.64
Oil	0.23	0.59	0.10	0.24
Grease	-	-	0.04	0.11
Repair & maintenance	0.75	2.02	3.26	13.09
Labor	0.85	2.85	6.27	12.17
Total variable cost	2.72	12.65	10.89	37.25
TOTAL COST	₱ 2,755.74	₱ 5,843.70	₱ 26,054.44	₱ 55,282.00
TOTAL REVENUE	₱ 1,828.12	₱ 3,679.43	₱ 32,165.00	₱ 49,168.00
B/C	0.66	0.63	1.24	0.89

Notes:

Contract rates (₱/ha)				
(land preparation)	75	251	83	286
Threshing	-	-	3%	
Annual utilization (hrs)	429	258	1,396	808
Total				
Land preparation	-	-	1,214	-
Threshing	-	-	182	-

*Four-wheel tractors considered were only those units doing solely land preparation.

** Exchange rate used: ₱7.40 = 1 US$

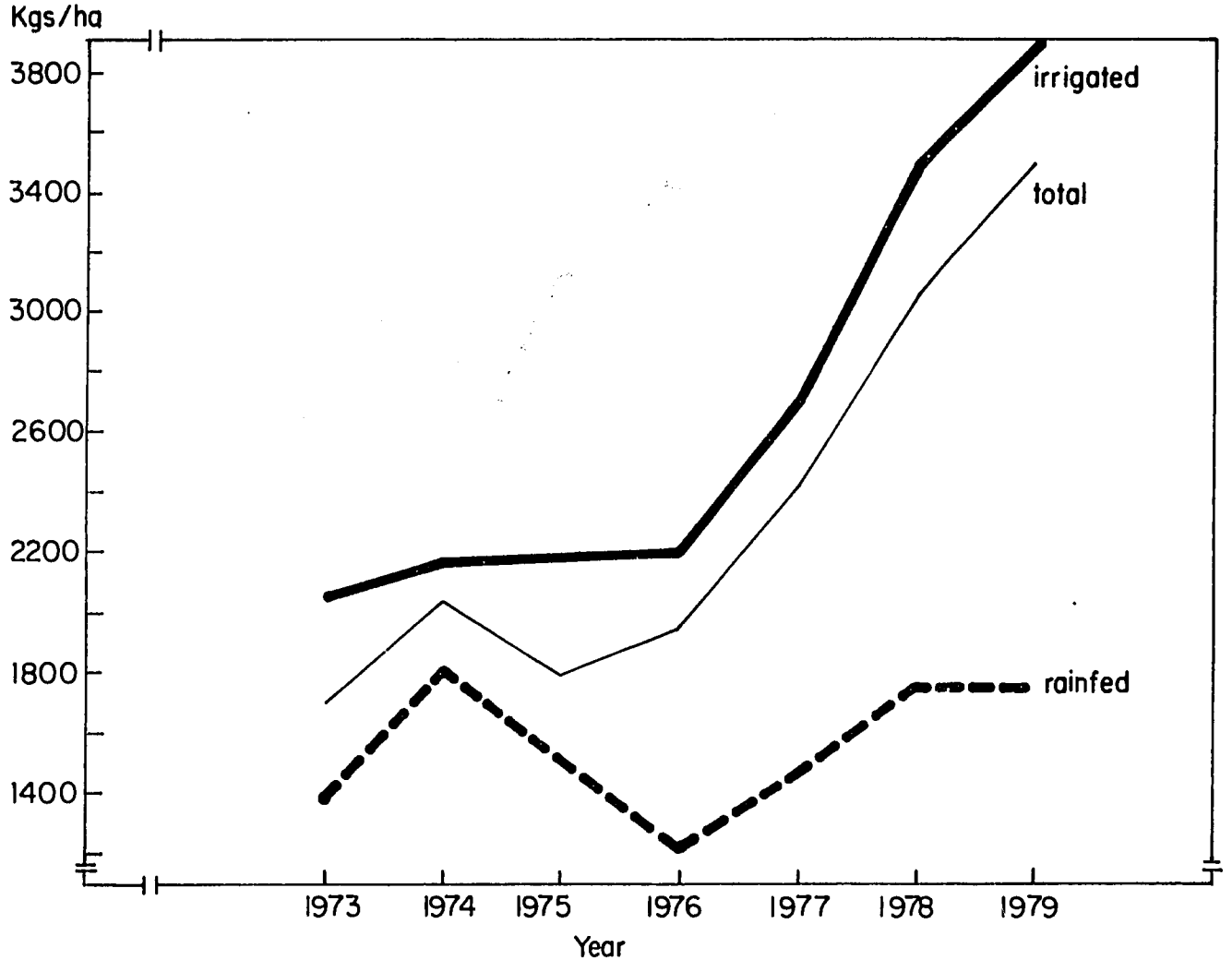

Fig 1 Rice yield per hectare (kgs/ha) from 1973-'79, Nueva Ecija, Philippines, 1980. (Source: BAECON)

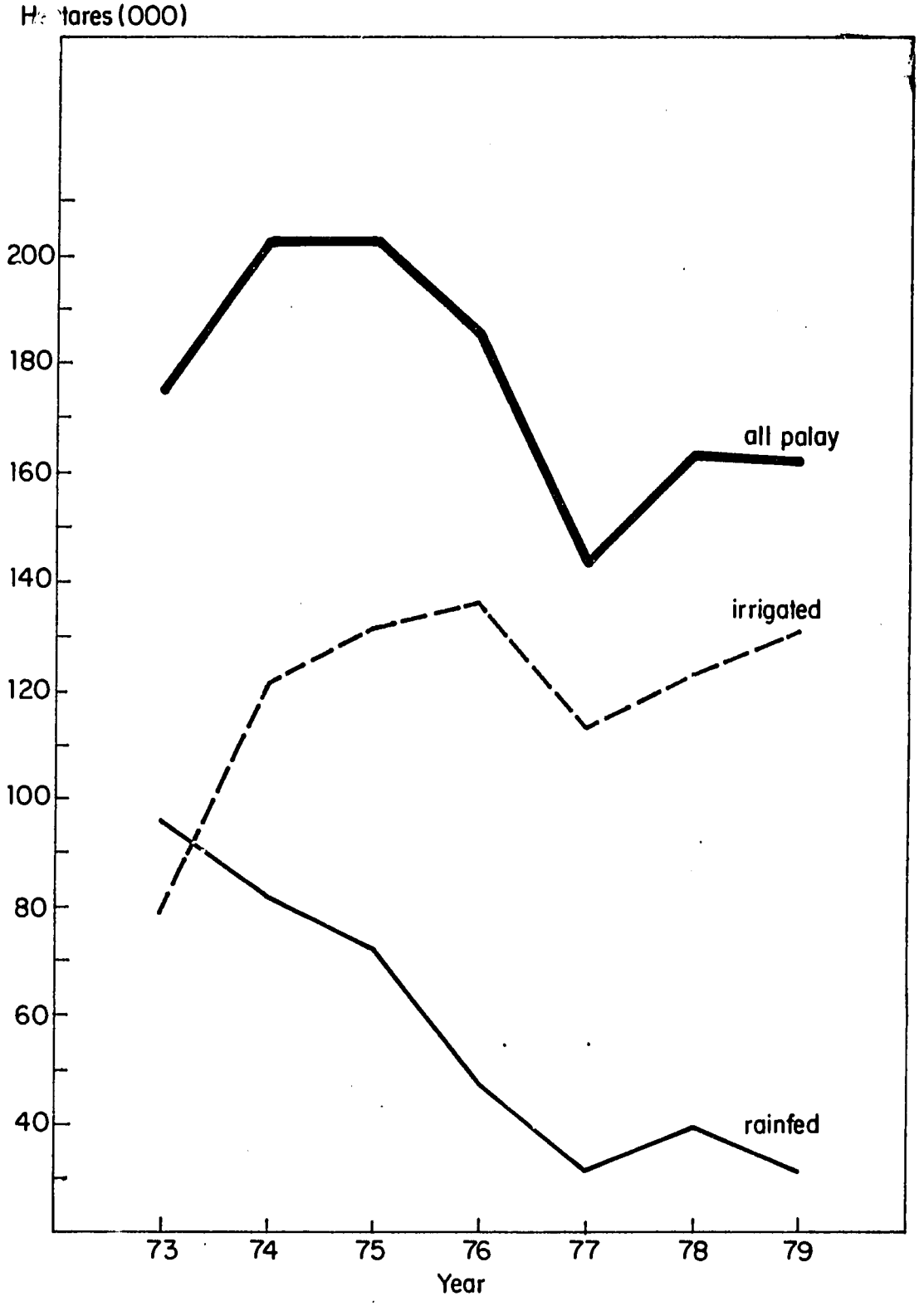

Fig. 2 -Area planted to rice from 1973-'79, Nueva Ecija, Philippines.
(Source: BAECON)

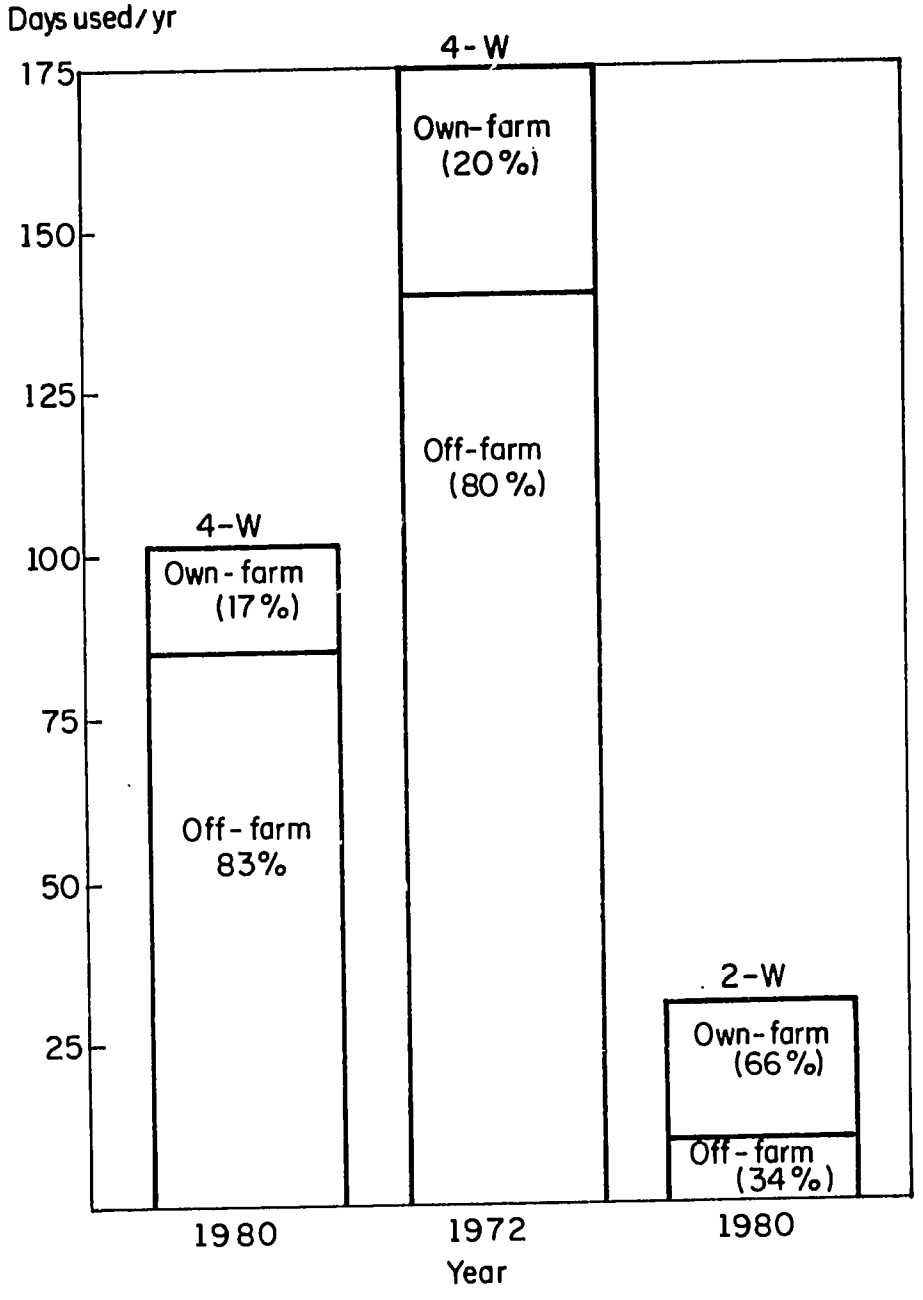

Fig.3 Comparative tractor use patterns by location and tractor type, 1972 and 1980, Nueva Ecija, Philippines.

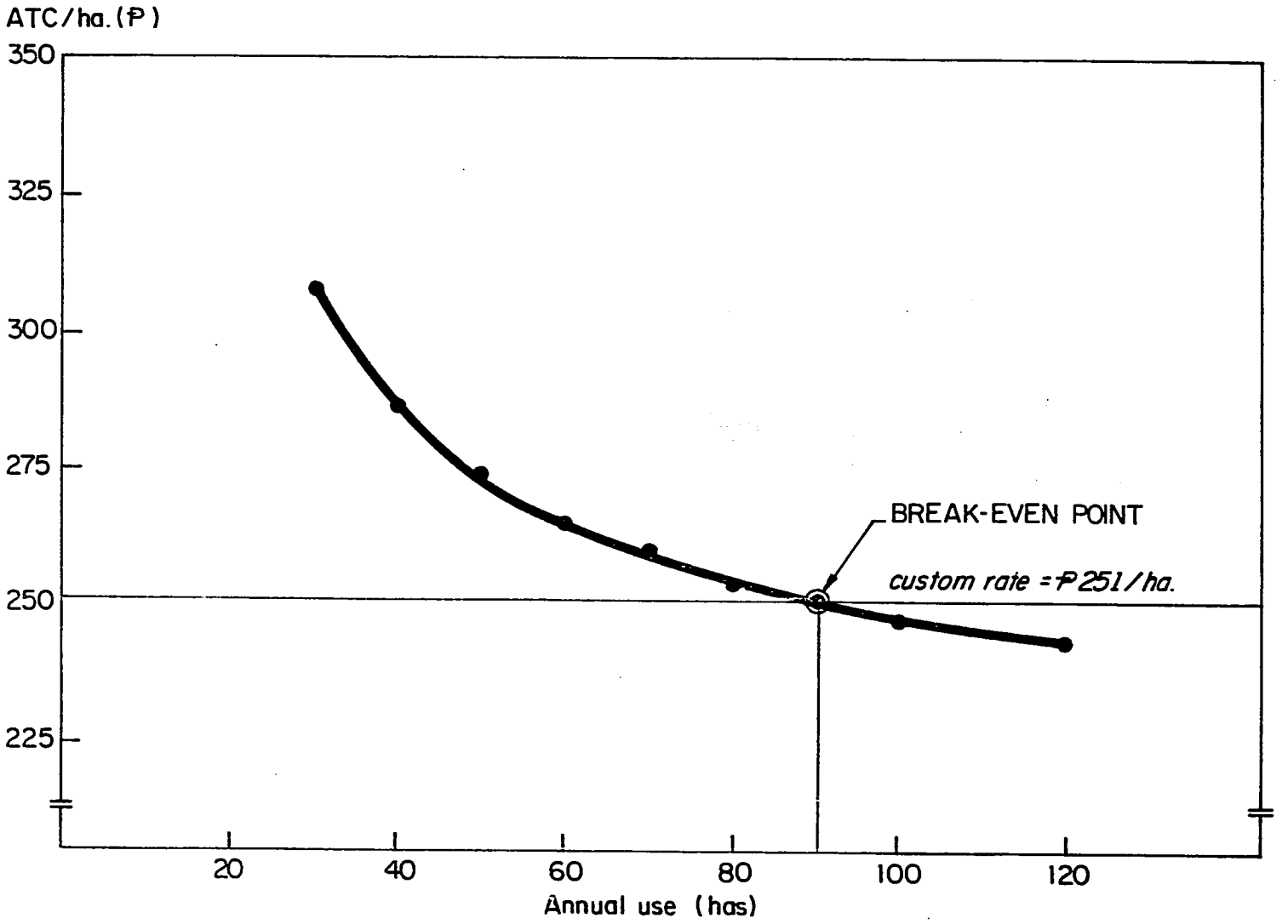

Fig.4 Cost per hectare by area served, 2-wheel tractors, Nueva Ecija, Philippines, 1980.

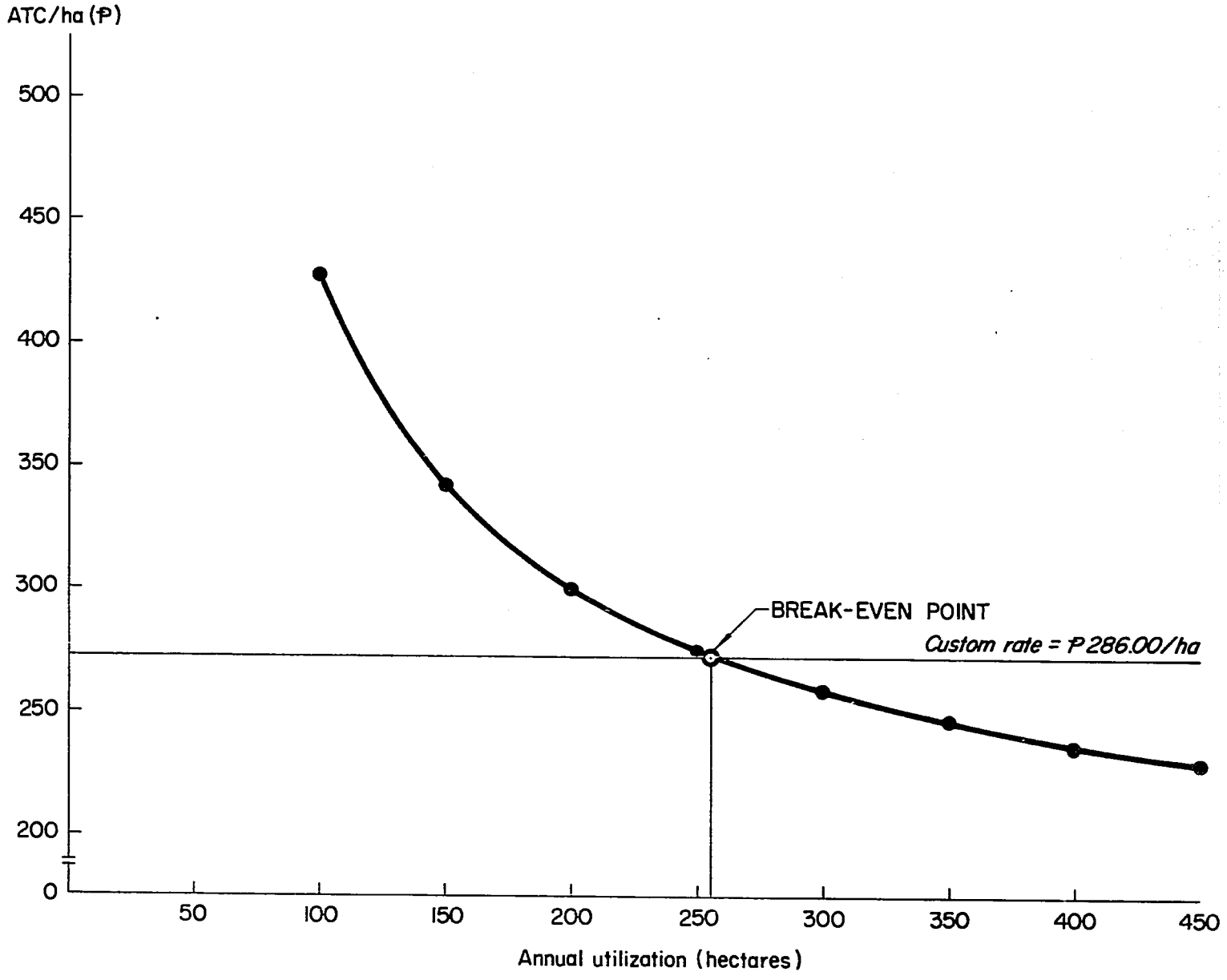

Figure 5. Cost per hectare by area serviced, four-wheel tractors, Nueva Ecija, Philippines, 1980.

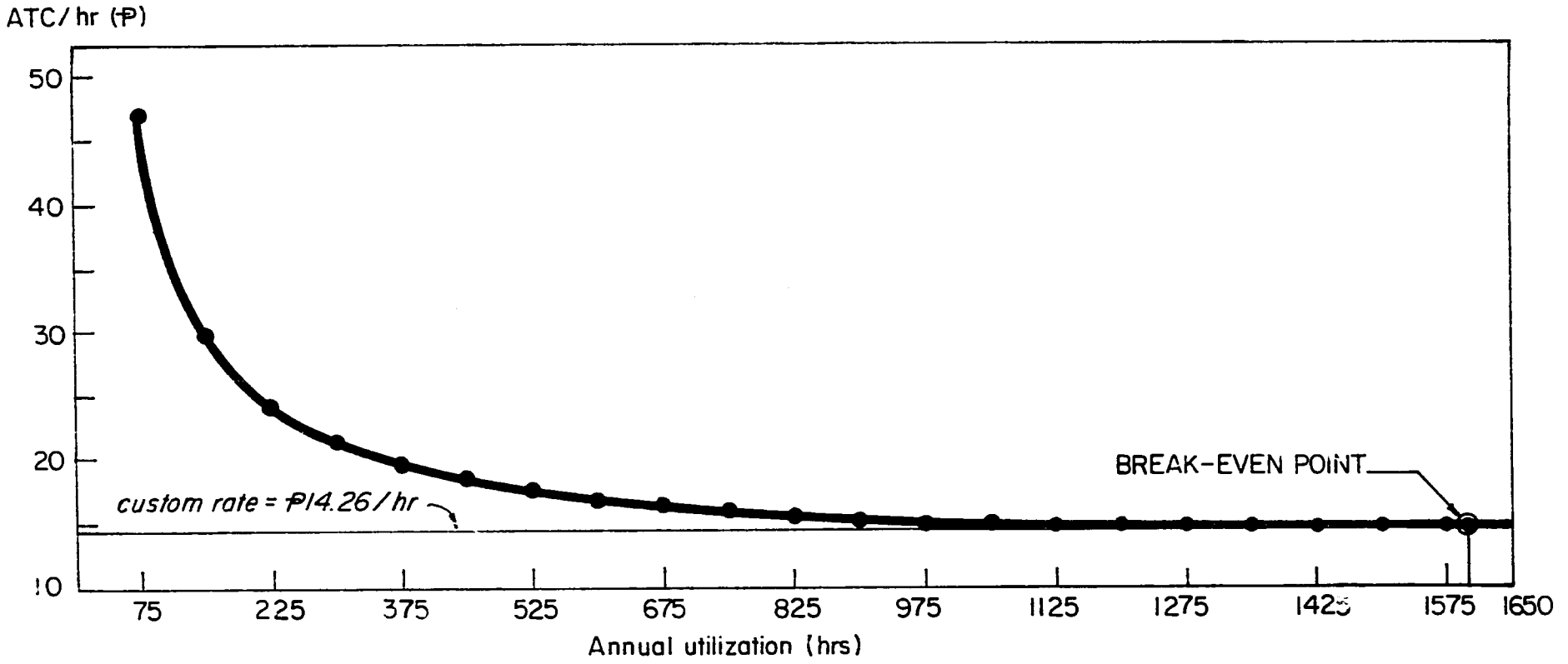

Fig. 6 Two-wheel tractor cost per hour, Nueva Ecija, Philippines, 1980.

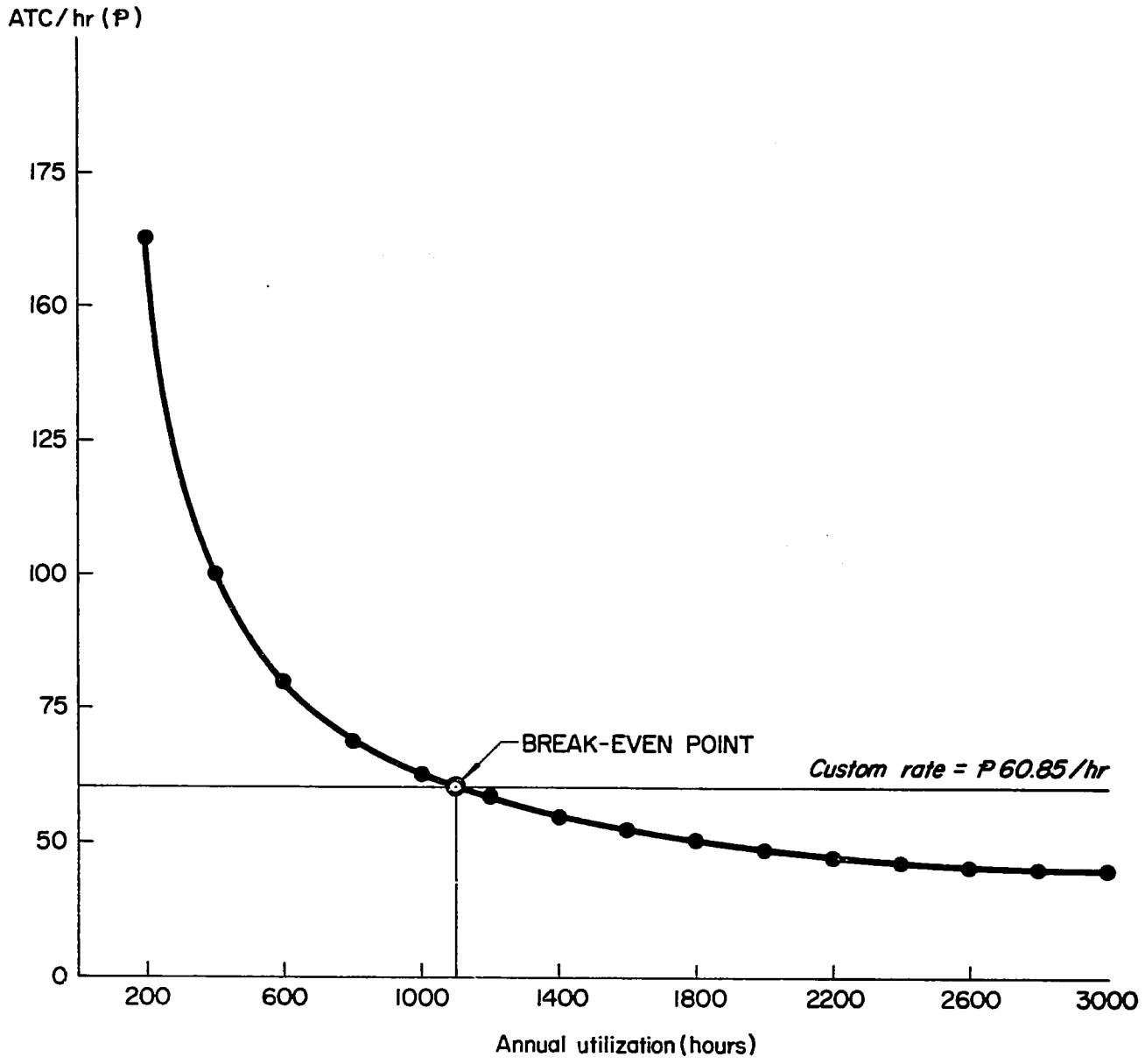

Figure 7. Cost per hour by different levels of utilization, four-wheel tractors, Nueva Ecija, Philippines, 1980.

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