



Department of Primary Industry

AN ECONOMIC SURVEY  
OF SMALLHOLDER  
COFFEE PRODUCERS - 1976

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## 2. INTRODUCTION

- 2.1 Coffee is the dominant cash earner for the 1.2 million national population in the Highlands. Production has grown rapidly from a level of 33 tonnes in 1950 to 43,000 tonnes in 1975-76. Unlike the other major agricultural export crops, coffee production is based on production by smallholders.
- 2.2 Very high prices in 1975-76 pushed the value of exports to a record K53 million. Even higher prices are being offered for the 1976-77 coffee season with prospects for good prices for a further two years. Department of Primary Industry projections Reference (18) see coffee firmly establishing itself as the major agricultural export crop with the majority of production being smallholder.
- 2.3 So reliant are rural highlanders on coffee production for cash earning that the nature of the commodity vitally affects the social life of the highlander particularly as is subject to violent price swings. Further, coffee is creating a cash cropping model with which most other alternative cash earning activities are compared. Reliance on a single cash earner puts producers in a vulnerable position when prices, fluctuate and physical restrictions imposed.
- 2.4 The survey carried during the coffee season of 1976 examined economic aspects of smallholder production. In particular the labour and cash inputs required for production were examined. Only limited examinations of inputs into smallholder coffee production have previously been carried out. In addition size of holdings, amounts of new plantings and the condition of holdings was assessed. In these latter aspects the survey supplements material collected by Wilson and Evans (17) on tree and grower numbers and by G. Dick (8) on aspects of smallholder husbandry. In addition the response of smallholders to change in price is examined.

### 3. OUTLINE OF COFFEE INDUSTRY IN PAPUA NEW GUINEA<sup>1</sup>

- 3.1 The major producers of coffee are nationals with smallholdings of 400-600 coffee trees added to their subsistence gardens. In 1973 there were 205,000 such smallholders, most of whom live in the Highlands area with some in a few coastal areas. In the 3 established Highlands Provinces (Eastern Highlands, Chimbu and Western Highlands) some 42% of electors are coffee growers. In these provinces coffee is the dominant cash earner for the national population. Production of such smallholders was estimated at 29,905 tonnes in 1975/76 or 70% of the total coffee crop, see Table (i).
- 3.2 In the Highlands, coffee was first grown by expatriates employing workers from neighbouring areas. In these areas agricultural officers promoted coffee amongst the villagers. By the late 1950's estates were increasing significantly in number and size, but most were still in the early stages of development. The village people responded to the example of estate development and field advice, and confidently planted coffee in new areas as well as expanding established areas. By 1961/62 smallholder production was approximately 1600 tonnes from a level in 1954/55 of about 20 tonnes.
- 3.3 With the entry in 1962, of the International Coffee Agreement, to which Papua New Guinea was committed through Australia, the encouragement of coffee was ceased. No further land was alienated for estates and government promotion of smallholder plantings stopped. This broad policy was continued through to 1973 when international coffee quotas were suspended. The policy throughout the period disadvantaged latecomers to coffee, such as the Southern Highlands, (who had virtually no coffee planted in 1962), West Sepik and Madang.

1. This section gives a very brief outline of the coffee industry in P.N.G. For further details see Munnall and Densley "Coffee" (Ref.13) which summarizes major events or Cartledge "History of the Coffee Industry in Papua New Guinea "(5) which gives a full account of events.



- 3.4 Smallholder plantings continued during the period of restraint, but at a reduced rate. In the 8 years to 1974/75 the rate of increase in production was 11% p.a. Low coffee prices during the late 1960's early 70's contributed to the slower growth in production. During the years of especially low prices much cherry ~~was~~ not harvested from trees and some parchment coffee was stored in expectation of higher prices. Three times smallholder production fell below that of the previous year.
- 3.5 Since 1973 the Government's policy has been to increase coffee plantings in developing areas with few or no economic alternatives. Out of a Papua New Guinea planting target of 9,000 hectares, the Southern Highlands was allocated an area of 2,000 hectares. Presently the Department of Primary Industry is giving coffee production national priority second only to food production. In the established coffee areas priority is being given to maximize any quota that Papua New Guinea may need to negotiate under its obligations as an exporting member of the International Coffee Organization.
- 3.6 Smallholder production has responded to higher prices of the past 2 years and surveys indicates a high level of new plantings. This and the expected good outlook for coffee prices have led DPI to tentatively project coffee production to increase to 52,000 tonnes in 1979/80. Such an increase would firmly establish coffee as Papua New Guinea's major agricultural export crop.
- 3.7 The Papua New Guinea Coffee Industry Board exercises control over exports and internal marketing. It is made up of grower's representatives and a government representative. The Board is also responsible for promotion of P.N.G. coffee. The Board obtains its funds for operation from a levy imposed on coffee exports. The levy is also used to build up a stabilization fund.
- 3.8 The plantation sector presently accounts for 30% of production. Highlands groups wish to participate in this sector of the industry and have made commercial purchases of some 20 plantations representing about one quarter of plantation production.

- 3.9 Most coffee sold by smallholders has been processed to the dry parchment stage and is purchased where access to processing facilities is cheap. Since 1974 only Papua New Guineans have been permitted to buy coffee on the roadside. It is estimated that during peak periods over 400 buyers operate in the Highlands. In general a good service is provided by such buyers while Department of Primary Industry operates as a buyer of last resort in remote areas.
- 3.10 There are 81 processing facilities which process coffee from parchment to green bean. Such processing facilities are often linked to plantations and play an important role in financing purchases by roadside buyers. Localization of such facilities is also taking place and two thirds of the coffee processed in 1975/76 was in facilities with at least part local equity.



#### 4. SURVEY METHOD

- 4.1 The survey was carried out during a 6 week period in April and May 1976. During the period coffee harvesting was well underway in the Chimbu and the Western Highlands Provinces, but only in the early stages in the Eastern Highlands. Thirteen (13) villages were selected from these 3 major coffee producing Provinces mentioned above. The location of the villages is shown in the attached Map. Appendix 1 tables the surveyed villages, their surrounding area and distinguishes whether the village was in the flush harvesting time at the time of the survey or not. Throughout the report villages are referred to by their surrounding area to assist identification.
- 4.2 The villages were selected to include a wide spread of villages:-  
Factors used in selection of village includes:-
- (a) being close to an urban centre
  - (b) having poor road access to major markets
  - (c) long experience in producing coffee
  - (d) relatively recent introduction to coffee
  - (e) availability of land to extend plantings.
- 4.3 Hence the sample of villages was widespread throughout the major coffee producing provinces with the aim of identifying as large a number of factors affecting smallholder production as possible. Hence large variances are apparent in the data, and it attempted to analyse reasons for the variation.
- 4.4 Information was gathered by final year students from Vudal Agricultural College. Students worked in pairs with one student being assigned to his home village - the spread of villages fitting the criteria above. A student was placed in his own village to increase co-operation between growers and interviewers. Further it alleviated many language and accommodation problems and enabled a check on answers that students felt doubtful of.
- 4.5 Within each village so selected, each student selected four (4) coffee growers alphabetically from the Roll of electors for that village. Hence in all 104 growers were studied.

- 4.6 Students stayed in their assigned village for 11 days. Their initial task was to select their 4 growers, and then visit each of their coffee gardens counting the number of trees including new plantings and assessing the condition of the gardens. The students then interviewed each of his growers regarding some personal details, stockholdings of coffee and cash costs incurred in production of coffee. The students also informed growers of the Department of Primary Industry's programme to maximize coffee production in the immediate future with a view to maximizing any quota that may need to be negotiated under the International Coffee Agreement.
- 4.7 The remainder of the stay involved observing as much work as possible that went into his growers' gardens. The majority of observations were of harvesting with observations of pulping, washing/drying and weeding. Each observation included the type of labour employed, hours of work and the amount of work performed. Observations were also made of coffee sales, in particular type of sale (cherry/parchment, roadside/factory) size of sale lot and waiting time at point of sale.
- 4.8 Observations of annual production and income were not possible in the short period and as all sales are for cash, no records are available.

## 5. GROWER CHARACTERISTICS

- 5.1 Growers were questioned about their age, family size, formal education and coffee plantation experience. The majority of growers (57%) were in the 31-45 years age group with 85% of growers being between 26 and 50 years. Growers under 25 years formed only 7% of the sample. (Table 1) Similar results were obtained from Wilson and Evans (17) except that they found only 2%-3% of growers in the same provinces were under 25 years.
- 5.2 Table 2 shows there is no apparent differences in the number of mature trees planted by each age group, however it appears the number of immature trees (both under 12 months, and 12-36 months) were higher in the younger age groups.
- 5.3 Of the 104 growers interviewed only 19 had either formal education or coffee plantation experience. Such growers were mainly in young age groups, Table 3. 12 growers had formal education, 9 of which were under 30 years. 10 growers had experience on a coffee plantation of which 5 were under 35 years. The length of experience at the coffee plantation was under 6 months in 7 cases and only 2 growers had both formal education and coffee plantation experience.
- 5.4 As detailed later the management performance of growers with plantation experience was below the average, but above that for similarly aged growers.
- 5.5 Overall then the coffee smallholder is a middle aged man with no formal education and heavily reliant on Department of Primary Industry's extension workers and older similarly taught coffee producers for his knowledge of coffee management.
- 5.6 The low number of young coffee growers must be viewed with concern, the proportion of young growers is far below that for the general population. The figures in Table 2 that younger growers tended to have more immature trees may reflect that they have been more responsive to the high prices of 1975 and 1976 or that they are actively trying to force their way into coffee production as an income earning venture. Later it appears that younger grower's management is well below average. This may be a reflection of problems in land ownership and the freedom of such growers to earn and spend their income.



## 6. TREE NUMBERS

- 6.1 Interviewers counted all the trees the selected growers owned or part owned. Trees were divided into those planted during the past year, those 12-36 months old and mature trees. Questions were also asked regarding dead and non-bearing trees, however response to this was poor and such trees have been omitted from further analysis.
- 6.2 As the growers surveyed were not a random sample the results for tree numbers have no statistical significance and are presented only as a guide for the surveyed provinces. The results are compared with a previous sample survey, Evans and Wilson (17) and a further sample survey (Reference 7) carried out by field officers in 1976. The latter survey was considered preliminary before widespread adoption of the technique is used for other crops.
- 6.3 Details of tree numbers are shown in Table 4. The average tree numbers for the 3 Provinces was 530 trees of which 450 were mature and 80 (16%) of the total, immature. Of the 80 immature trees 30 were planted in the last 12 months.
- 6.4 Holdings in the Western Highlands averaged 630 trees while those in the Eastern Highlands averaged 420 trees. In the Chimbu Province the average of the 3 villages gives an average similar to the 3 Provinces average. However, in one of these villages an extraordinarily high number of mature trees were found per grower for the area. If this village is excluded the Chimbu average is 390 trees or 75% of the overall average.
- 6.5 Chart 1 shows the size of holdings for the 3 Provinces. Over half the growers had between 200 and 500 mature trees with only 6% of growers having more than 1,000 mature trees. The largest and smallest holdings found in the survey were both at Bena (1) village. These holdings were 1,426 and 135 trees respectively. A holding at Lufa had only 20 mature trees but a considerable number of immature trees.
- 6.6 The number of immature trees was high throughout the 3 Provinces, being 16% of total tree numbers. Of the growers surveyed 50% had plantings less than 12 months old, and 75% had plantings 12-36 months old.

- 6.7 The Eastern Highlands had the highest percentage of immature plantings at 18% of total plantings with 7% being planted in the last year. The Western Highlands had 17% immature (7% and 10%) while the Chimbu had a low level of plantings immature - 11% with a particularly low 3% being planted in the last year.
- 6.8 These immature plantings are well above that found by Evans and Wilson for 1973. Their immature percentages were 5.0%, 7.0% and 2.7% for the respective provinces. The immature percentage found in the 1976 Perennial Crops Sample Survey (7) is shown in Table 6. These also show a high immature percentage. Surprisingly a very high percentage of immature trees (18%) was found in Chimbu.
- 6.9 The results regarding mature tree numbers closely match those found in 1973 by Evans and Wilson in the Eastern Highlands and Chimbu. The result in the Western Highlands is some 100 mature trees below that of Evans and Wilson. However, figures found in the pilot survey of 1975 (1) support figures nearer those found in this survey rather than Evans and Wilson. Field Officer reports do not support the far bigger garden size in the Western Highlands Province suggested by Evans and Wilson (15), although the Perennial Crops Sample Survey (7) also suggests a larger garden size in the Western Highlands.
- 6.10 With the high number of immature trees found it must be questioned why the number of mature trees per grower has not increased between the 1973 and 1976 surveys. One explanation would be that tree numbers are declining due to senile and dead trees at the same rate as new plantings. However the Perennial Crops Sample Survey shows only a low percentage of senile trees and Dick's survey in the Western Highlands (Ref 8) found only 19 of the 274 interviewed growers admitted having abandoned gardens. Further smallholder production in the established Provinces continues to increase. Future survey techniques will need to be strengthened to isolate trees which have died.
- 6.11 Hence it must be concluded that the very strong prices since July 1975 have significantly stimulated new coffee plantings. However in the Chimbu Province where immature plantings are typically below that of other highlands areas, new plantings in the surveyed villages in the Chimbu were very small and below replacement levels.

- 6.12 The surveyed new plantings tally with large amounts of coffee seed distributed by Department of Primary Industry during 1975 -76 and which has strengthened since June 1976. These figures are shown in Table 5. Again Chimbu is very low compared to other provinces.
- 6.13 Looking at specific villages it is noticeable that two villages adjacent to urban centres, while having large holdings have a low percentage of trees - 2.2% and 6.2% respectively. In the Goroka case land shortage is not contributing to low new plantings, It may be that alternative sources of income are more readily available, lessening dependence on coffee production for income.
- 6.14 Nebilyer and Lufa had high levels of new planting, both within the previous twelve months and up to 3 years. Both are relatively new areas to coffee, with some very small plots of mature coffee, however new plantings are such that their average holding is well above average of other villages surveyed in their Provinces. A grower at Nebilyer recorded the highest new planting in the 12 months previous to the survey of 290 trees.

## 7. CONDITION OF THE GARDENS

- 7.1 Coffee is a hardy tree which will still bear, though at lower levels, with only sparse and sporadic maintenance being carried out on it. As such it fits in well as a highlands smallholder crop. Dick (8) discusses the management practices in the Hagen area and argues that there is a need for more intensive management by smallholders. This survey examined growers holdings in respect to 4 important management aspects which have a large effect on the holding's yield. These four aspects were fencing, shading, pruning and weeding. These four factors are considered to indicate the degree of attention trees are being given and with the aid of an index combining the 4 aspects together, the management performance of different classes of growers and villages is compared.
- 7.2 Table 7 shows that 15% of growers had all their gardens fenced, less than a third had carried out any sort of pruning and regular weeding was carried out by 37% of growers with a further 37% carrying out intermittent weeding. Shade was considered inadequate in 28% of gardens while considered excessive in 13%.
- 7.3 Of the four management factors adequate shade must be considered most fundamental, for unless adequate shade is maintained trees will soon cease bearing. Clearly growers see little need for intense management for new plantings are seen as the method of increasing production rather than intensified management. It gives the further advantage to the smallholder that he is able to take advantage of high prices by a full harvesting of cherries, when prices fall however he can harvest only as required by his income needs. This would not be true for growers in land short areas are unable to increase the size of their gardens.
- 7.4 Pruning is the least carried out and least understood practice. Dick (8) in 1976 found only 3% of gardens in the Hagen area were pruned. Of the 32 growers this survey found with pruned plots, less than a third were using the recommended multiple stem system. Cutting off tops and single stem pruning were the popular 'system'. The pilot survey of 1975 (Ref 1) found a poor grower knowledge of pruning. As stated later, the lack of pruning not only decreases the yields but greatly slows pickers picking cherries from very high branches and contributes greatly to non harvesting of cherry especially when prices are at lower levels.



- 7.5 The framing of questions regarding pruning make detailed analysis difficult. Nevertheless, over 70% of holdings were said to need pruning and a stricter interpretation would push the percentage much higher. In the Chimbu Villages the number of holdings which required pruning was well above the average at 88%.
- 7.6 The widespread lack of fencing leads to widespread pig foraging of plots and damage to the coffee tree's root system. Dick measured this and found 43% of gardens were damaged by pigs. However, some growers allow pigs in the garden while working in the belief that the pigs pull out weeds and benefit the garden. Hide in Sina Sina (Ref 12) also notes that growers felt that pigs in the coffee gardens benefited the soil.
- 7.7 At the time of the survey in 1976 there was a confident expectation that prices would remain very high for at least a further two seasons, and there was a noticeable clearing up of gardens. (Fleckenstein 1975 (Ref 10) also noted this for the Eastern Highlands Province in 1972/73 after 1971/72). In particular many new fences being put up around coffee gardens, in many cases with pig wire with strands of barbed wire.
- 7.8 The two close to town villages had no fenced coffee whatsoever, and this probably reflects control of pigs needed by outside bodies i.e. town council. The newer planted areas also had only a few gardens fenced, reflecting that fencing does not occur during the initial planting stages, when trees are most vulnerable.
- 7.9 Shading was noticeably deficient at Chuave (2) and Watabung where it was also reported that the wood was needed for firewood. Often where shading was classified as satisfactory, it was patchy around the edges of the plots, often where new coffee was planted.
- 7.10 Other problems found but not enumerated in the survey were close spacing of trees, hindering access for maintenance and harvesting; and plantings on poor soils or in poorly drained areas.

- 7.11 Nine growers responded that they had used fertilizer at some stage on their holdings. 6 responses came from Bena (2) where a D.P.I. patrol in 1974 had distributed fertilizer. No regular usage since the patrol was found however. The 3 remaining growers had purchased fertilizer from a plantation or retail outlets. One such grower had 6 months working experience on a coffee plantation.
- 7.12 P.S.S. in Hagen has noted a large jump in sales of fertilizer to smallholders during the 1976 flush and is expecting a further boost during 1977. It is not D.P.I. policy to encourage smallholder usage of fertilizer and it is unlikely whether such applications would be beneficial under the smallholder's low level of Management. Were the cutting of shade to result such actions would be disastrous, for it is unlikely (and unreasonable) that smallholders would maintain sufficient fertilizer applications in times of low prices.
- 7.13 Table 8 shows that the major source of new planting material is a grower's own garden. This includes seed for expansion and volunteer seedlings likely to achieve maturity. Only 29% of growers said new plantings came from D.P.I. and a further 20% noted other sources such as missions or village and headmen's nurseries.
- 7.14 Management Index  
A "Management Index Score" has been compiled by combining grower performance of fencing, shading, weeding and pruning. The actual weightings are shown in Appendix 2. The aim is to compare the scores of different types of growers rather than make further comments on the absolute level of management. Therefore a score of 100 is given to the average score for all growers.
- 7.15 The variation between villages is great with Baiyer River averaging 209 and Chuave (2) 56. The Baiyer River village had a large mission input into coffee growing. The second lowest scoring village Bena (1) was at a rather high altitude for coffee production and much smallholder attention had turned to vegetable production. The variation within each village was smaller than that between villages.

- 7.16 Table 9 shows the average management score for each village and the management score of the largest grower in each village. In 9 of the 13 villages his score is higher than the village average and averaged over the 13 villages the largest grower's score is 28% above the village average. A similar point is shown in Table 10 where the management score is divided by different classes of growers. It shows that growers with holdings over 1000 mature trees averaged 146 while those with under 200 mature trees averaged 85.
- 7.17 Younger growers, especially those under 25 years score below the average for all growers. This is despite the fact that Dick (8) found that in many aspects of crop husbandry in his sample group growers up to the age of 29 had a better knowledge than growers over 45 years. The reasons for younger growers not apparently applying their knowledge could be that alternative activities attract younger growers away from the village life and coffee production or that such growers do not have the same control over income from their coffee holdings as older growers.
- 7.18 As noted previously growers with formal education and/or plantation experience were generally young. Growers with plantation experience are 15% below the average for all growers but this is not as far below the average as the under 25 years age group. Growers with formal education were some 7% above the average for all growers despite being biased with younger growers.
- 7.19 The high management performance of larger growers cannot be ignored. Setting aside unique village factors one would expect larger growers therefore to gain higher yields from their coffee holdings. As examined later much of the labour used is hired and the ability to mobilize labour is of utmost importance. It seems unlikely that larger growers are taking labour that should be used on smaller holdings for the harvesting requirements on block of say 450 mature trees is small at 33 man days and even the requirements for 1000 mature trees would be no more than 75 man days.

7.20 It could be concluded that the extension effort would be more efficient if it was aimed specifically at large holders. Given that management techniques and enthusiasm seem to be village based it could be argued that the benefit would flow down to other village growers. Against this must be weighed the desirability of marking out larger holders, particularly as coffee production is very much an individual or family cash earning activity. In the survey the top 10% of growers owned 21% of the mature trees. The disparity would be a good deal less within each village. As the need for more intense husbandry will increase with a growing population, the question of providing the best extension service will become more vital. The above is only one aspect of the problem.

## 8. PROCESSING EQUIPMENT

- 8.1 Coffee sold by smallholders is generally parchment coffee<sup>1</sup>. To obtain parchment coffee from the cherry picked off the trees requires the following stages. The cherry's skin is removed normally by a hand powered pulper costing about K175. Department of Primary Industry has developed a cheaper model made basically of wood for K15. The skin may be removed by hand, but this is a very slow process (see 10.15). The bean is then fermented to remove a layer of mucilage and then sundried to the storable parchment stage. Fermenting should be carried out in a wooden container, and this is normally constructed by the grower. Hollowed out logs, bamboo and plastic buckets are acceptable alternatives, however metal containers give coffee a tainted flavour.
- 8.2 The advantages of parchment are that it is a storable product, so that it need not be marketed immediately and can be accumulated into large amounts so that large batches of income can be received. Where access to a coffee factory is cheap, cherry has the advantage of providing a quick cash return after a day's harvesting. A grower can utilize both methods of selling.
- 8.3 Pulpers (Table 11)  
All growers surveyed had access to a coffee pulper. Over 70% of growers claimed part ownership in a pulper with the average spread of ownership being 7 growers. 9 cases of individual ownership were claimed, 6 of these were at Baiyer River. While factors in each village vitally affected the number of pulpers owned in the village generally the ownership of pulpers became more individualized the larger the holding.
- 8.4 At Wurup Village only 2 of the 8 growers had a share in a pulper. Again it is suggested that local reasons eg. council, general enthusiasm were paramount.
- 8.5 Of the pulpers surveyed 35% were over 5 years old and 9% had been purchased in the last 12 months. The condition of the pulpers was generally assessed to be good or fair with only 3 pulpers being considered in poor condition. However, in many cases pulpers were poorly adjusted resulting in many nipped beans and much unprofitable time spend attempting to adjust the pulpers, see 10.13.

1, There is no precise data on the breakup of smallholder coffee, however 60-70% parchment would seem a fair guess.



- 8.6 As explained later, growers normally pulped in the evening after a day's picking. Little joining together of lots of cherry for pulping was observed, nor excessive storage in the cherry form apparent.
- 8.7 Growers who did not have a share in the ownership of a pulper generally hired their use. Hiring could be on a daily or annual rate or an amount per bucket or rice bag pulped. A wide range in the charges reflects the availability of pulpers in different villages. The boom in prices has inflated the hire rates.
- 8.8 Various charges reported were, an annual charge ranging from K2 - K10, a daily charge of 20 toea, a price per rice bag of 20 toea around Goroka, 80 toea/bag at Henganofi to K2 per bag at Kindeng. Rates at Kindeng when prices were lower were quoted at 50 toea/bag. Clearly such arrangements could be extremely profitable to the owner of a pulper.
- 8.9 Eleven surveyed growers stated they had made cash contributions for the purchase of pulpers in the 12 months previous to the survey. In addition one grower from the Baiyer River village individually purchased a pulper. The average amount of the contribution was K8.90, or about one-twentieth the normal retail price for a Bentall Baby Pulper of K175. Only 10% of growers were listed as making contributions, and considering the spread of ownership averages about 7 growers there would appear to be an understatement of expenditure on pulpers (The above figures suggest a pulper life of 30 years).
- 8.10 An estimate of the depreciation that must be charged by a grower for his share in a pulper can be gained from 8.3 and 8.5. The annual depreciation on a one-seventh share in a pulper costing K175 and lasting five years is K5 p.a.
- 8.11 Fermenting Vessels - As shown in Table 12 all but 3 growers had at least part ownership in fermenting vessels. 81% of growers used only wooden containers with 4% using metal containers only. 13% of growers stated they used both wooden and metal vessels. 2 growers used plastic buckets.

- 8.12 Growers using incorrect fermenting practices were limited to 3 villages. In Lufa, a fairly newly developed area, saucepans and dishes were the main fermenting vessels. This was picked up in the 1975 Pilot Study (1) and the didiman had visited the village to rectify the problem, clearly without success. In Bena (1) and Wurup the use of both wooden and metal vessels was apparent. Both these villages had a low percentage of growers claiming ownership of pulpers and as mentioned in 7.15, Bena (1) growers did not regard coffee as their major source of cash income. It appears that many different problems of management move in tandem.
- 8.13 The majority (79%) of growers own their fermenting box individually, and where ownership was shared it was normally between only 2-3 people. The condition of boxes was assessed and 95% of the boxes were considered in good or fair condition.
- 8.14 Drying Materials - As found in the pilot survey of 1975, a large range of materials were used for drying coffee. These are shown in Table 13. The most popular in almost equal usage were plastic sheeting, rice or copra bags and woven bush matting.
- 8.15 In Lufa where sundrying is not always available it was noted that coffee was sometime hung on the house roof and dried. Damage in quality from smoke would occur from such practices.
- Stocks
- 8.16 55% of growers were holding dried stocks at the time of the survey, however all such holdings were small. The survey was carried out at the beginning of the coffee season and it shows that stocks were not carried forward from the 1975 season to 1976, indicating that growers were satisfied with prices paid in 1975 and were not stocking up in the expectation of higher prices as was evident between the 1971-1972 and 1972-1973 seasons. See Evans and Wilson (17) and Fleckenstein(10).
- 8.17 Stocks were generally stored individually by growers, generally in his house (Table 14) as the most convenient and secure place. 63% of respondents said storage was off the ground normally on the bed but in some cases on leaves or a concrete slab. 11 growers said they stored coffee in a special storage shed. 7 of these came from Chuave (2) and Hagen villages.

## 9. CASH COSTS OF PRODUCTION

- 9.1 Smallholder coffee producers normally incur a small cash cost for the purchase of tools such as spades, knives, ~~saws~~, and bags, buckets, sheets of plastic and other items. The average amount spent on such items by growers actually incurring the expense was K6 per year. In addition growers may hire labour to assist them in the garden. Where this was incurred the cost averaged K18-40 per year.
- 9.2 It should be noted that data recorded in this section relies on grower recall rather than observation. Hence the amounts stated must be treated with a good deal of caution. It was supposed in 8.9 that expenditure on pulpers was underestimated and it is thought that a similar under-estimation may occur in the estimates below.
- 9.3 81% of growers surveyed had incurred expenses related to coffee in the past year while 65% incurred expenses for coffee production purposes only.
- 9.4 The most common purchase (Table 15) is that of bags (rice bags and copra bags) for storing and selling the crop. The average cost to each grower incurring is K1-70 per year for an average purchase of 4 rice bags or 3 copra bags. Rice bags are relatively cheap, with a ready supply at about 20 toea each from trade store owners who have bought bags of rice to be sold in small units. Copra bags are more expensive being about 60toea for new bags and 30-40 toea for used bags. Flour bags, fertilizer bags and other bags were also used. Bags e.g. rice bags can also be obtained by buying a bag of rice and where no cost can be attributed to the bag.
- 9.5 The next popular purchase (40 growers) was for tools such as spades, bush knives or pruning saws. In only one case did the grower state the purchase was for his coffee plot only. The average cost of such purchases was K4-70. Clearly the whole cost cannot be charged to coffee production because the tools are used in the subsistence gardens and other village activities. Further there is a relatively low incidence of regular maintenance in the coffee garden, (see Section 7).
- 9.6 Plastic was purchased by almost 40% of the growers at an average cost of K3-40 per grower. Over two thirds of the growers buying said the plastic was for the purpose of coffee drying only.

- 9.7 The other major material item was for buckets. The average cost per buying grower was K2.10 and in all but 2 of the 20 cases it was stated that the buckets were used for purposes other than coffee. Blankets for drying coffee, a small amount of fertilizer and oil for a pulper were other reported expenses.
- 9.8 Paid labour was reported to be used by one third of the interviewed growers. This is probably an under-estimate for interviewers put insufficient stress on the question in at least 2 villages. When labour was incurred the average cost was K18.40, clearly the largest cash cost. Table 16 shows that growers with a large number of children were in less need of hiring labour than others, particularly growers with no children.
- 9.9 The rate paid by growers for labour varies greatly hence it is difficult to estimate the usage of hired labour as against family labour. Two reported rates were K1.00 per day (below the rural minimum wage) and 6.5 toea per kilo of cherry harvested, which would give an average earning of K2.00 per day. Plantations at the time of the survey were paying 4 - 5 toea per kilo of cherry harvested. Children when employed for harvesting were often allowed to sell some of the harvested crop in lieu of direct payment. Other payments in kind e.g. food were also frequently made.
- 9.10 Looking at the management index (Table 17), it appears that growers who scored well in the management index are more likely to hire labour than other growers. In addition a greater proportion of growers who scored well in the management index actually incurred cash costs during the year. This can be explained in part by the tendency of larger growers to have a higher management index score.
- 9.11 For the purposes of budgeting for the average cash requirements of growers, consideration must be given to items lasting more than one season, and therefore not purchased by all growers in a 12 month period. Also some of the cost for tools etc. used in other than coffee production should be apportioned. This is shown in Table 19 for four stratified groups of growers. It shows the smallholder with around 450 mature trees could expect to spend K3.55 on material items for his coffee production. If he needed to hire labour he would need to pay a further K16.00. As the size of grower increases so the cash costs would increase.

- 9.12 Table 18 shows the cash costs per trees, for the growers incurring the cash expenses. While the absolute level of cash costs increase with increasing tree numbers, the costs per mature tree for the smaller growers are almost double those for average sized growers.
- 9.13 Clearly a multitude of factors will affect each individual grower's spending. Hiring of labour is the largest single expense, but the size of the grower's family has an important effect on the amount of labour required to be hired by a grower. Growers can make economics in purchases of materials and by careful usage can extend their life. Nevertheless growers with better management appear more likely to incur cash expenses than other growers. However, Table 10 also showed that larger growers tended to have a higher management score than other growers - they also had a higher incidence of cash cost than average.
- 9.14 The low level of cash costs as a percentage of sales revenue removes much of the need to trim expenditure of material items. By far the largest capital item is the pulper. By sharing ownership it does not appear to be a severely limiting constraint, and the use of D.P.I. designed pulpers at K15 each drastically reduce this cost.

## 10. LABOUR INPUTS

- 10.1 Labour inputs are studied in the smallholder situation to indicate a smallholder's cost of production and his income received for a unit of labour input (e.g. one day's work)<sup>1</sup>. These can then be compared with costs and returns from other crops or proposed enterprises and also wage earning opportunities. Further coffee's labour requirement can be compared with other village requirements indicating the level of plantings a smallholder can adequately maintain without encroaching on other, particularly subsistence, requirements; or before hiring labour is required.
- 10.2 The inputs were collected by interviewer observation of work on their selected growers' coffee gardens. The aim was to maximize the number of observations of labour inputs (particularly harvesting). Hence where estimates are made below of annual inputs into coffee, they are gained by bringing together the labour required for each task necessary in coffee production and adjusted to the average sized plot found by Wilson & Evans (17) of 0.19 hectares producing 215 kilogrammes of parchment per year.
- 10.3 Some wide coefficients of variation were found in the data collected. These are indicated in Tables 20, 21 and 23. While some of this may be interviewer error, most would reflect the vastly different circumstances under which smallholder coffee is produced in different locations throughout the highlands. Some of the reasons include the distance of coffee gardens from the house; the location of the pulper used in relation to the garden, place of storage, and water supply; and the use of casual labour. In the case of pulpers the requirement to frequently adjust pulpers in some cases was apparent. Variations were generally larger in the non flush period where the individual factors were relatively more important to the work performed than in the flush.

## HARVESTING

- 10.4 Harvesting comprises two thirds of the labour input into mature coffee. Observations of harvesting were obtained in all but 1 of the 13 surveyed villages and the results of rates of harvesting hours worked per picking and weight picked per picking are shown in Table 20 and Charts 2 & 3.

1. Throughout the paper a man day is of 8 hours length. This aids comparison with a day's pay in wage employment.



- 10.5 The hours worked per picking averaged nearly 5 hours with no significant variation between flush and non flush periods. Chart 3 shows the distribution of hours worked at each picking. A two peaked distribution is shown, the first peak is where the average time worked is 2-5 hours (44% of observations) allowing work on food gardens or other activities to be carried out in the other part of the day. 27% of the observations showed more than 6 hours work being spent on harvesting virtually excluding any other work on that day.
- 10.6 Of the harvesting work observed, men did about 35% (in Chimbu the percentage was a good deal higher) females about 50% and children 15%; see Table 25. During the flush harvesting period these percentages differed in that some of the picking done by children out of the flush was performed by women.
- 10.7 The weight picked per picking (which may involved more than one picker) averaged 42 kg of cherry, with the figures for the flush villages being three times that observed for non flush villages.
- 10.8 The average rate of picking for all observations was 37 kg of cherry per man day.
- 10.9 A marked difference arose for the rate of harvesting during the flush period is double that at other times (45kg/day and 22kg/day respectively) The difference significant at the 95% level of confidence. A fairly large standard error is shown and the range of harvesting rates is shown in Chart 2. Reasons for the wide difference between the flush and non flush periods are clearly that during the flush much more cherry is on each tree and less time is spent walking between trees. This factor is particularly important in most small-holder coffee which has been planted close together and allowed to grow tall and bushy. Here access to small amounts of cherry during the off season is particularly difficult making the returns to harvesting in the off season half those of the flush. This undoubtedly contributes to much non harvesting of the crop particularly at the beginning and end of the season. 2
2. See Appendix 4 on Price Responsiveness where it is argued that harvesting responses to price during the flush are more important than those outside the flush period.

- 10.10 Harvesting rates reported for a number of plantations over whole seasons are 50 kg of cherry per day or about 25% above the smallholder rate, assuming that 75% of a smallholder's crop is harvested during the flush period (Appendix 4). The flush rate of smallholders is similar to that of school labour picking on plantations.

#### PULPING

- 10.11 Pulping was carried out in almost all cases by a hand operated Bentall machine. The time taken at each pulping averaged about 2 hours, with the time taken in flush villages being slightly (not significantly at the 95% level of confidence) longer than in non flush villages (see Table 21 and Chart 5). Only 2 observations (both in non flush villages) showed pulping to take longer than 4 hours.
- 10.12 The amount pulped at each pulping differed significantly between flush and non flush villages and corresponded well to the amounts of cherry harvested per picking. In most observed cases the day's harvest was pulped on the same day. Hence the rate of pulping in flush villages was almost double that of non flush villages. This would imply there is quite a deal of time spent in correctly adjusting the pulper and ensuring that water is available.
- 10.13 The rate of pulping varied enormously from 1-145 kilograms of cherry pulped per hour. The variation is shown in Chart 4. The major reasons for the variation is the siting of the pulper in relation to a water supply a many inexperienced adjustments sometimes being required. Water should be freely used when pulping cherry but in many cases this involved a long haul and in many such cases was ignored. In many cases resultant damage made many of the adjustments necessary.
- 10.14 Most of the pulping (65%) is done by men with the remainder being equally shared between women and children. The difference between flush and non flush villages was not marked although children appeared to do a less proportion of the work during the flush.
- 10.15 Where a pulping machine is not available the coffee cherry skin is removed by squeezing the cherry between the fingers. Such hand pulping was observed in 3 cases - all in the Lufa village. As shown in Table 21 the average time spent pulping was 4 hours at an unbearably slow rate of under 1 kg of cherry pulped per man hour worked.

## OTHER PROCESSING

- 10.16 Other processing required for production of coffee parchment are the fermenting and washing of the coffee followed by sun drying and sorting of dried coffee. The input compared to that of harvesting is minor but an important factor in the quality of parchment produced. Of the 19 observations of washing and drying of coffee (Table 22) the average time spent at each washing was 1.3 hours with an average rate equivalent to 8 kg of dry parchment per man hour. Again wide variations were found in the observations. The availability of water is again an important factor. While the coffee is being taken from the house to be laid out in the sun, some person needs to be about to turn the coffee to ensure even drying, be ready to take coffee inside if rain threatens and to prevent theft. The time spent watching over coffee is not considered a labour input in Table 24 below.
- 10.17 In the Eastern Highlands and Chimbu Provinces males did over 70% of the man hours recorded for washing and drying. In the Western Highlands the percentage for men was 20% with a higher involvement of children. During the flush period the percentage of work done by children and males increases while that done by women decreases.
- 10.18 As noted in Section 7 above, inputs into maintenance work such as weeding or pruning are small. During the survey 24 observations of weeding were made, (Table 22) The average time spent weeding was 3.8 hours with an average rate of 20 man days per hectare at the planting density recorded in Wilson & Evans (17).
- 10.19 Most of the weeding observations were in non flush villages with about three quarters of such work being done by men. Weeding observations during flush periods were almost exclusively of men working.
- 10.20 No observations of pruning work were made during the survey.
- 10.21 Despite the large number of new plantings reported only a couple of observations in relation to new planting were recorded. In many cases new plantings are adjacent to existing plots hence requiring only small inputs for clearing, holing and planting and dispensing with new shade establishment.

MARKETING (Table 23)

- 10.22 23 sales of cherry coffee and 33 sales of parchment from selected growers were observed during the survey period. Cherry sales were observed from growers in 3 villages (Bena (2), Kama and Wurup). All have good access to coffee factories. The size of the sales ranged from 8-61 kilograms with an average of 25 kilograms.<sup>3</sup> In Bena (2) and Wurup the size of sales corresponded closely to the amounts harvested at each picking. In Kama however where the amounts harvested at each picking was high, due to a large number of workers working co-operatively together, the average sale was about two thirds of that picked. It may be assumed the remainder was held for further processing into parchment.
- 10.23 The average time taken between arriving at the selling point with cherry coffee and making a sale (this normally includes refusals of offers from other buyers) was 1.1 hours. In addition to this time must be added the time spent walking from the house to the selling point and back. This may be very small where villages are adjacent to road access but could involve some hours walk.
- 10.24 33 sales of parchment were observed, 30 of these were roadside sales and 3, all from the Hagen village, were factory door sales. The average weight of sale was 16.5 kilograms of parchment with a range from 4 to 50 kilograms. 23 of the observed sales came from villages classified as being in the flush. The average lot size of such villages differed only slightly from that of non flush villages. The time taken before a sale was made averaged 1.6 hours for the flush villages and 2.8 hours for non flush villages. This difference is significant at the 95% level of confidence. This would reflect the tendency of roadside buyers to concentrate on flush areas. (Since the survey there has been a marked increase in the number of coffee buying vehicles and hence non flush areas are less likely to be disadvantaged). (Anderson Ref: 2)
3. In a survey of coffee prices in the Western Highlands in June 1977 (2) the average weight of cherry lots offered for sale was 10 kg., the average parchment lot size was 11 kg. In the pilot survey of Eastern Highlands and Chimbu in 1975 (Anderson(1)) a much larger sale size was reported. This was probably due to growers overestimating their sale size.

- 10.25 The Bureau of Statistics Survey of Village Conditions in 1975 (ref.4) examined the transport of cash crops for sale. This excluded roadside sales. For the Eastern Highlands, Chimbu and Western Highlands Provinces 24% - 32% of villages were reported as transporting coffee to a factory for sale with average travelling times varying from 2.5 hours to 4.8 hours. The maximum to minimum range was 16 hours to 0.1 hours.
- 10.26 Estimates from this survey would suggest that a grower producing 215 kilograms of parchment p.a. with an average sales size of 15-17 kilogrammes (about 1 full rice bag), will be selling coffee about 15 times per year, each sale requiring 1 - 2 hours. His annual input therefore is about 3 man days. For remote areas carrying times could easily be four times the above, coupled with prices 10 -20t/kg below well served areas. The grower can offset some of these effects by selling in large lots and/or selling at the factory door.
- 10.27 The time waited at a selling point to sell cherry was less than for parchment. This reflects that cherry is only sold in good access areas and when growers want a quick cash return. Also growers will test various buyers prices for their parchment more than for cherry, for their lot of parchment is normally higher value than a lot of cherry and prices offered for parchment tend to vary by a greater amount.
- 10.28 At present there is very fierce competition between roadside coffee buyers in most areas of the Highlands where road access is good. The growers appreciate their strength as a group and gain from the prices received. The growers also gain in terms of freedom of operation. With many roadside buyers, growers can sell their coffee at a time which suits them, also they can choose whether to sell in large lots (to earn significant amounts at each sale) or small lots (where the cash is earned quickly) or in either cherry and/or parchment. If a grower needs to sell his coffee in large lots to protect his income he loses that freedom.

### SOME PREVIOUS ESTIMATES

- 10.29 The survey results regarding labour inputs are compared to some other estimates used by the Department of Primary Industry and other published data. Some figures have been based on field officer estimates, records kept by research stations and commercial plantations and most recently records of the Southern Highlands Development Authority in establishing coffee blocks of 30 - 50 hectares using labour intensive methods. Some university work has also been done.
- 10.30 The harvesting rates previously used by D.P.I. (P. Emmerly (9), D.P.I. Field Manual (6) have generally been lower than found in the survey, although the most recent budgets (Arthur 1975 (3) Trainor 1975 (16) match fairly closely those found in the survey. Unpublished data collected by Fleckenstein in the Goroka area during a flush period corresponds to that collected here. Observations by Hide (12) differ in many respects. He has very low amounts of coffee cherry being picked per person per day viz 7.1 kilograms in flush periods and 6.4 kilograms for a whole season. He also comments that "rarely is a whole day spent harvesting". He notes that of his harvesting observations 63% were of women.
- 10.31 Pulping and processing observations are somewhat quicker than previous estimates, including those by Hide. This may be due to under-estimates by enumerators of activities related to processing. It may also under-estimate the inefficiencies of processing small lots.
- 10.32 Estimates of maintenance on mature coffee vary widely. Pritchard (14) has studied labour inputs into weeding coffee under various types of shade for labour intensive and herbicide applications. For coffee under casuarina shade (and closely spaced as is most smallholder coffee) he found an annual input of 50 man days per hectare was required. This survey estimates a full round of weeding is equivalent to 20 man days/hectare. Hide estimates annual maintenance of 5 man days/hectare. The Department of Primary Industry Field Manual (6) suggests annual maintenance at maturity of 50 man days per hectare .

- 10.33 Table 24 shows the estimated total input at maturity for the smallholder block producing 215 kilogrammes of parchment per year. In general the input of 52 man days per year at maturity is less than found in other sources due to the higher harvesting rate. Harvesting takes almost two-thirds of the total labour input. Processing takes about 20% of the input with the remainder evenly divided between marketing and maintenance.
- 10.34 It is assumed that 75% of a smallholder's production comes from a flush period of four months. While each area of production will differ, the assumption is broadly supported by the distribution throughout the year of smallholder coffee processed by registered facilities. Hence 31 man days are required by the average sized grower during the flush period. Were the grower to rely solely on his own labour he would need to work on his coffee garden nearly 2 days per week during this period and one day a fortnight at other times. As is noted above the grower is assisted by his wife, children and in some cases hired labour. The labour available to each grower depends on many factors, however a requirement of 31 days in a four month period would not appear excessive or disruptive. Over half the surveyed growers had under 400 mature trees, and it would appear that labour availability is not limiting the present small size of holdings.
- 10.35 Where holdings are substantially above the 400 mature trees a grower tends to hire labour. Table 16 showed that larger growers paid out more in hiring labour than others and Table 15 showed that growers with few children had a higher incidence of hiring labour. The use of outside labour is higher than previously suggested by Hide (12) in his study in the Sina Sina. He noted that non house hold labour participated in only 5% of the harvesting days.
- 10.36 In the Chimbu where it may be argued that returns to labour in the subsistence sector are declining due to 1 and shortages it appears that participation of men in the coffee gardens (55% of man days observed) is a good deal higher than in the Western or Eastern Highlands (38% and 35% respectively). A breakup of activities in the coffee garden by sex is given in Table 25.



## 11. INPUTS AND RETURNS FROM SMALLHOLDER COFFEE

- 11.1 Using the labour and cash inputs found in the survey a budget is worked in Table 26 for a grower producing 215 kg of parchment per year from a mature garden. Table 27 also shows inputs during the development period of the garden, discounting returns at 9% p.a. This gives a weight to labour and cash put into the garden before production starts.
- 11.2 At maturity, using the assumed roadside parchment price of 65toea/kg the grower would earn a net income of K130, with returns to a day's labour at maturity of K2.50. While the level of income is small due to small plot sizes, the returns to labour compare well with other cash cropping enterprises or wage employment. Sackett (15) estimated a Net Income of K420 for a sample of copra producers in 1972-73 and Godyn (11) estimated a net income of K310 p.a. to smallholder cocoa producers in Bougainville in 1973.
- 11.3 Viewing the smallholder coffee planting as a project lasting 15 years and discounting inputs and returns at 9% p.a. a Discounted Net Return of K1.60 per man day is shown at a roadside parchment price of 65t/kg.
- 11.4 The returns are very sensitive to price change, whether because of remoteness the grower is offered a lower roadside price, or because of market fluctuations. For example if the grower of Table 26 lives in a remote area where 10t/kg is deducted from the normal roadside price by buyers and the grower's marketing input is doubled, his annual net income would decline to K110 and his returns to labour at maturity drop almost 25% to K1.89 per man day. The grower may well, of course, adapt to his circumstances by building up large lots, combining his coffee with other growers, sell at the factory door, etc.
- 11.5 Chart 6 shows the sensitivity of returns to price changes (without changing any other assumptions e.g. reducing cash costs). Plotted on the chart are indicative roadside prices for the 1972 to 1976 flush seasons (May - August), based on reported factory door prices. Also shown is a forecast price for 1979 - 1981 Department of Primary Industry (18).

- 11.6 The chart shows the huge boom in prices in 1976 and 1977. Using 1976 prices the grower earned a net income of K205 and had a return to labour of nearly K4.00 per day. (The grower selling his coffee at June 1977 prices was gaining a return to labour of over K7.00 per day).
- 11.7 At more normal prices a net income ranging from K63 in 1972 to K93 in 1974 is shown (in dollars or Kina current at that time). The respective returns to labour at maturity are K1.30/day and K1.80/day. Hence the prices ruling in the early 1970's brought net incomes below K100 at current prices with returns approximating the rural wage. Fluctuations in price during that period could still increase or decrease incomes by 50% over a two year period.

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Table (i)

PAPUA NEW GUINEA COFFEE PRODUCTION  
COFFEE YEAR 1975/76 (OCT-SEPT)

Tonnes Green Bean

| <u>Province</u>    | <u>Plantation</u> | <u>Smallholder</u> | <u>Total</u>  |
|--------------------|-------------------|--------------------|---------------|
| Western Highlands  | 6,641             | 8,956              | 15,597        |
| Eastern Highlands  | 5,671             | 7,817              | 13,488        |
| Chimbu             | -                 | 6,736              | 6,736         |
| Morobe             | 734               | 2,586              | 3,320         |
| East Sepik         | -                 | 1,308              | 1,308         |
| Enga               | -                 | 1,119              | 1,119         |
| Northern           | 14                | 493                | 534           |
| Madang             | -                 | 311                | 311           |
| West Sepik         | -                 | 221                | 221           |
| Southern Highlands | 41                | 234                | 275           |
| Milne Bay          | -                 | 88                 | 88            |
| Other              | -                 | 36                 | 36            |
| <b>TOTAL:</b>      | <b>13,128</b>     | <b>29,905</b>      | <b>43,033</b> |

Percentage of total 30.5% 69.5%

Source P.N.G. Coffee Industry Board

Table 1

AGE OF SURVEYED COFFEE GROWERS - BY PROVINCE

| <u>Age in<br/>Years</u> | <u>W.H.P.</u> |       | <u>Chimbu</u> |       | <u>E.H.P.</u>   |       | <u>Total</u> |       |
|-------------------------|---------------|-------|---------------|-------|-----------------|-------|--------------|-------|
|                         | No            | %     | No            | %     | No.             | %     | No.          | %     |
| 1 - 25                  | 4             | 12.5  | 2             | 8.3   | 1               | 2.1   | 7            | 6.8   |
| 26 - 34                 | 7             | 21.9  | 6             | 25.0  | 10              | 21.3  | 23           | 22.3  |
| 35 - 44                 | 9             | 28.1  | 9             | 37.5  | 23              | 48.9  | 41           | 39.8  |
| 45 +                    | 12            | 37.5  | 7             | 29.2  | 13              | 27.7  | 32           | 31.1  |
| All growers             | 32            | 100.0 | 24            | 100.0 | 47 <sup>1</sup> | 100.0 | 103          | 100.0 |

Note 1: The age of one grower was not recorded

Table 2

SIZE OF GROWER'S HOLDINGS

| <u>Age Group</u><br><u>In Years</u> | <u>Average No. of Trees per Grower</u> |                                      |                                     |                     |
|-------------------------------------|----------------------------------------|--------------------------------------|-------------------------------------|---------------------|
|                                     | <u>No of</u><br><u>Growers</u>         | <u>Trees</u><br><u>&lt;12 months</u> | <u>Trees</u><br><u>12-36 months</u> | <u>Mature Trees</u> |
| 1 - 20                              | 2                                      | 343                                  | 124                                 | 412                 |
| 21 - 25                             | 5                                      | 22                                   | 50                                  | 312                 |
| 26 - 30                             | 16                                     | 56                                   | 53                                  | 398                 |
| 31 - 35                             | 13                                     | 14                                   | 33                                  | 390                 |
| 36 - 40                             | 28                                     | 29                                   | 48                                  | 411                 |
| 41 - 45                             | 18                                     | 7                                    | 41                                  | 544                 |
| 46 - 50                             | 13                                     | 34                                   | 81                                  | 424                 |
| 51 - 55                             | 2                                      | 28                                   | 60                                  | 432                 |
| 56 - 60                             | 4                                      | 0                                    | 19                                  | 453                 |
| Over 60                             | 3                                      | 0                                    | 41                                  | 491                 |

Table 3

FORMAL EDUCATION AND PLANTATION EXPERIENCE - BY AGE GROUP

| <u>Age Group</u> | <u>Total No.</u> | <u>No. with formal</u><br><u>Education</u> | <u>No. with</u><br><u>Coffee Pltn.</u><br><u>Experience</u> | <u>No. with</u><br><u>-Both</u> |
|------------------|------------------|--------------------------------------------|-------------------------------------------------------------|---------------------------------|
| 1 - 20           | 2                | 2                                          | 0                                                           | -                               |
| 21 - 25          | 5                | 2                                          | 1                                                           | -                               |
| 26 - 30          | 16               | 5                                          | 3                                                           | 1                               |
| 31 - 35          | 13               | 1                                          | 1                                                           | -                               |
| 36 - 40          | 28               | 2                                          | 3                                                           | 1                               |
| 41 - 45          | 18               | 0                                          | 0                                                           | -                               |
| 46 - 50          | 13               | 0                                          | 0                                                           | -                               |
| 51 - 55          | 2                | 0                                          | 0                                                           | -                               |
| 56 - 60          | 4                | 0                                          | 1                                                           | -                               |
| over 60          | 3                | 0                                          | 1                                                           | -                               |
|                  |                  | <u>12</u>                                  | <u>10</u>                                                   |                                 |

Table 4

AVERAGE NUMBER OF COFFEE TREES PER GROWER - BY VILLAGE AND PROVINCE WEIGHTED AVERAGE

| <u>Village</u>                          | <u>Trees</u><br><u>12 Months</u> | <u>Trees</u><br><u>12-36Months</u> | <u>Mature</u><br><u>Trees</u> | <u>total</u> |
|-----------------------------------------|----------------------------------|------------------------------------|-------------------------------|--------------|
| Henganofi                               | 20                               | 31                                 | 392                           | 443          |
| Bena (1)                                | 5                                | 30                                 | 385                           | 420          |
| Bena (2)                                | 36                               | 33                                 | 358                           | 427          |
| Lufa                                    | 88                               | 127                                | 239                           | 454          |
| Kama                                    | -                                | 9                                  | 401                           | 410          |
| Watabung                                | 37                               | 42                                 | 286                           | 365          |
| EASTERN HIGHLANDS                       | 31(7%)                           | 45(11%)                            | 344(82)                       | 420          |
| Elimbari                                | 2                                | 42                                 | 332                           | 376          |
| Chuave (1)                              | 17                               | 59                                 | 752                           | 828          |
| Chuave (2)                              | 22                               | 23                                 | 367                           | 412          |
| CHIMBU PROVINCE                         | 14(3%)                           | 41(8%)                             | 484(90%)                      | 539          |
| Excluding Chuave (1)                    | 12(3%)                           | 33(8%)                             | 350(89%)                      | 394          |
| Nobilyer                                | 137                              | 73                                 | 454                           | 664          |
| Wurup                                   | 12                               | 107                                | 444                           | 563          |
| Hagen                                   | 14                               | 24                                 | 574                           | 612          |
| Baiyer River                            | 23                               | 50                                 | 616                           | 689          |
| WESTERN HIGHLANDS                       | 47(7%)                           | 64(10%)                            | 522(82%)                      | 633          |
| AVERAGE OF ABOVE PROVINCES <sup>1</sup> | 32(6%)                           | 51(10%)                            | 452(84%)                      | 535          |

1. Weighted according to smallholder production, in 1975/76

|        |              |             |
|--------|--------------|-------------|
| W.H.P. | 149,273 bags | 0.38        |
| CHIMBU | 112,263      | 0.29        |
| E.H.P. | 130,291      | 0.33        |
|        |              | <u>1.00</u> |



Table 5

SEED DISTRIBUTION JULY - JUNE 1975 - 76 EX-AIYURA

kg

|            | <u>Arusha</u> | <u>Bourbon</u> | <u>Total</u> |
|------------|---------------|----------------|--------------|
| E.H.P.     | 586           | 71             | 657          |
| CHIMBU     | 11            | -              | 11           |
| W.H.P.     | 83            | 66             | 149          |
| S.H.P.     | 429           | 395            | 824          |
| ENGA       | 195           | 250            | 445          |
| MADANG     | 40            | 45             | 85           |
| WEST SEPIK | 130           | -              | 130          |
| TOTAL:     | 1,474         | 827            | 2,301        |

TABLE 6

PRENNIAL CROPS SAMPLE SURVEY - 1976

|        | <u>Selected Data</u>                    |               |                |                  | <u>Av.area/<br/>Grower<br/>ha</u> | <u>Prodn/<br/>Grower<br/>Green Bean</u> |
|--------|-----------------------------------------|---------------|----------------|------------------|-----------------------------------|-----------------------------------------|
|        | <u>Percentage of total area Planted</u> |               |                |                  |                                   |                                         |
|        | <u>Immature</u>                         | <u>Senile</u> | <u>Bearing</u> | <u>New Plnt.</u> |                                   |                                         |
| W.H.P. | 13                                      | 3             | 79             | 5                | 0.17                              | 200 kg                                  |
| CHIMBU | 18 <sup>1</sup>                         | 4             | 75             | 4                | 0.11                              | 167 kg                                  |
| E.H.P. | 14                                      | 4             | 74             | 8                | 0.11 <sup>2</sup>                 | 74 kg <sup>2</sup>                      |

1. Immature Plantings would appear to be overstated
2. Area of production per grower appears to be understated, possibly due to high grower numbers assumed.

Table 7

CONDITION OF GARDENS

No. of respondents

|                | <u>No Gardens Fenced</u>   | <u>Some Gardens Fenced</u> | <u>All Gardens Fenced</u> |
|----------------|----------------------------|----------------------------|---------------------------|
| <u>Fencing</u> | 55 (53%)                   | 33 (32%)                   | 16 (15%)                  |
|                | <u>Insufficient Shade</u>  | <u>Excessive Shade</u>     | <u>Adequate Shade</u>     |
| <u>Shading</u> | 29 (28%)                   | 13 (13%)                   | 62 (60%)                  |
|                | <u>No Apparent Weeding</u> | <u>Irregular Weeding</u>   | <u>Regular Weeding</u>    |
| <u>Weeding</u> | 28 (27%)                   | 38 (37%)                   | 38 (37%)                  |
|                | <u>No Apparent Pruning</u> | <u>Pruning Required</u>    | <u>Pruning Carried</u>    |
| <u>Pruning</u> | 48 (46%)                   | 24 (23%)                   | 32 (31%)                  |

Table 8

SOURCES OF NEW PLANTING MATERIAL

|                       | <u>No. Responses</u> | <u>% of Total Responses</u> |
|-----------------------|----------------------|-----------------------------|
| D.P.I. Distribution   | 32                   | 29%                         |
| Grower's own Material | 50                   | 45%                         |
| Other Material        | 29                   | 26%                         |
| Total Responses*      | <u>111</u>           |                             |

\* Some growers used more than one source.

Table 9

MANAGEMENT INDEX SCORE - BY VILLAGE

Average of all Growers and Largest Grower

Average Score for all growers = 100

| <u>Village</u>    | <u>Average of all Growers</u> | <u>Largest Grower</u> |
|-------------------|-------------------------------|-----------------------|
| Henganofi         | 112                           | 128                   |
| Bena (1)          | 67                            | 128                   |
| Bena (2)          | 69                            | 21                    |
| Lufa              | 109                           | 107                   |
| Kama              | 115                           | 128                   |
| Watabung          | <u>75</u>                     | <u>192</u>            |
| EASTERN HIGHLANDS | 91                            | 117                   |
| Elimbari          | 80                            | 107                   |
| Chuave (1)        | 107                           | 149                   |
| Chuave (2)        | <u>56</u>                     | <u>43</u>             |
| CHIMBU            | 81                            | 100                   |
| Nebilyer          | 93                            | 149                   |
| Wurup             | 139                           | 213                   |
| Hagen             | 72                            | 43                    |
| Baiyer River      | <u>208</u>                    | <u>256</u>            |
| WESTERN HIGHLANDS | 128                           | 165                   |
| Total of above    | 100                           | 128                   |

Table 10

MANAGEMENT INDEX SCORE BY CLASSES OF GROWER

(a) Formal Education

| <u>Grower with Fromal Education</u> | <u>Growers with no Formal Education</u> |
|-------------------------------------|-----------------------------------------|
| 107                                 | 99                                      |

(b) Age of Grower

| <u>1 - 25 yrs</u> | <u>26 - 34 yrs</u> | <u>35 - 44 yrs</u> | <u>45 yrs +</u> |
|-------------------|--------------------|--------------------|-----------------|
| 79                | 92                 | 107                | 105             |

(c) Coffee Plantation Experience

| <u>Growers with Plantation Experience</u> | <u>Growers with no Plantation Exp.</u> |
|-------------------------------------------|----------------------------------------|
| 85                                        | 102                                    |

(d) Numbers of Mature Trees

| <u>1 - 200</u> | <u>201 - 500</u> | <u>501 - 1000</u> | <u>1001 +</u> |
|----------------|------------------|-------------------|---------------|
| 85             | 91               | 119               | 146           |

(e) Number of Children

| <u>0</u> | <u>1 - 2</u> | <u>3 - 4</u> | <u>5 - 6</u> | <u>7+</u> |
|----------|--------------|--------------|--------------|-----------|
| 100      | 111          | 95           | 131          | 99        |

ble 11

FFEE PULPERS - OWNERSHIP, AGE AND CONDITION

(a) Spread of Ownership

|           | <u>Individual</u> | <u>2-5 Owner</u> | <u>6-10 Owner</u> | <u>10+Ownership</u> | <u>No Pulp.</u> | <u>Total</u> |
|-----------|-------------------|------------------|-------------------|---------------------|-----------------|--------------|
| Responses | 9                 | 17               | 28                | 22                  | 23              | 99           |

(b) Conditions of Pulpers

|           | <u>Good</u> | <u>Fair</u> | <u>Poor</u> | <u>Total</u> |
|-----------|-------------|-------------|-------------|--------------|
| Responses | 40          | 32          | 3           | 75           |

(c) Age of Pulpers

|           | <u>Less than 1 yr.</u> | <u>1-5 yrs</u> | <u>6-10yrs</u> | <u>Over 10 yrs</u> | <u>Total</u> |
|-----------|------------------------|----------------|----------------|--------------------|--------------|
| Responses | 7                      | 42             | 14             | 12                 | 75           |

ble 12

FERMENTING VESSELS

age of different fermenting vessels and ownership and condition  
wooden fermenting boxes.

(a) Different Fermenting Vessels

|             | <u>Wooden Vessel only</u> | <u>Metal Vessel only</u> | <u>Both</u> | <u>Other</u> | <u>Total</u> |
|-------------|---------------------------|--------------------------|-------------|--------------|--------------|
| Respondents | 78                        | 4                        | 12          | 2            | 96           |

(b) Ownership of Fermenting Boxes

|             | <u>Individual Ownership</u> | <u>Shared Ownership</u> | <u>Total</u> |
|-------------|-----------------------------|-------------------------|--------------|
| Respondents | 54                          | 14                      | 68           |

(c) Condition of Fermenting Boxes

|             | <u>Good</u> | <u>Fair</u> | <u>Poor</u> | <u>Total</u> |
|-------------|-------------|-------------|-------------|--------------|
| Respondents | 2           | 33          | 4           | 69           |

Note: - Differing totals due to responses to some questions  
being unusable.

THE PURCHASERS - OWNERSHIP, AGE AND CONDITION

Table 13

**DRYING MATERIALS USED FOR COFFEE**

|                    | No. Responses |
|--------------------|---------------|
| Bush Matting       | 53            |
| Plastic Sheets     | 54            |
| Copra or Rice Bags | 57            |
| Blankets           | 42            |
| Other              | 2             |
| <b>Total</b>       | <b>208</b>    |

Table 14

**STORAGE PLACE FOR DRIED COFFEE**

|                                | No. Growers Responding |     |
|--------------------------------|------------------------|-----|
| Growers House - on the ground  | 17                     | 22% |
| Growers House - off the ground | 50                     | 63% |
| Special Storage House          | 11                     | 14% |
| Other                          | 1                      | 1%  |

are - differing totals due to responses to some questions

Table 15

ANNUAL CASH COSTS

No. of growers incurring, Average Cost, and dual usage.

| <u>Item</u>            | <u>No.Growers<br/>Incurring</u> | <u>No.Growers<br/>Using for dual<br/>Purpose</u> | <u>Average Cost for<br/>Growers incurring</u> |
|------------------------|---------------------------------|--------------------------------------------------|-----------------------------------------------|
| Bags                   | 64                              | "                                                | K1.70                                         |
| - rice bags            | 51 (Av. No. bags purchased 4.0) |                                                  |                                               |
| - copra bags           | 31 (Av. No. bags purchased 2.7) |                                                  |                                               |
| Spade/Saw              | 41                              | 40                                               | K4.70                                         |
| Plastic ..<br>Sheeting | 40                              | 12                                               | K3.40                                         |
| Bucket                 | 20                              | 18                                               | K2.10                                         |
| Blankets               | 2                               | 2                                                | K10.50                                        |
| Fertilizer             | 1                               | 0                                                | K2.00                                         |
| Oil for Pulper         | 1                               | 0                                                | K1.20                                         |
| <hr/>                  |                                 |                                                  |                                               |
| Total of above items   | 81                              | ..                                               | K5.95                                         |
| Labour                 | 34                              | 0                                                | K18.40                                        |
| <hr/>                  |                                 |                                                  |                                               |
| Total All<br>Items     | 84                              | ..                                               | K13.20                                        |

Table 16

FAMILY SIZE AND HIRING OF LABOUR

Family size by size of holding, and amount of hired labour.

| Children | Total No.<br>Growers | Av. Size Holding<br>(Mature Trees) | No. Growers<br>Hiring Labour<br>(% of total growers<br>in class) | Cost of Hired<br>Labour<br>Per incurring<br>grower |
|----------|----------------------|------------------------------------|------------------------------------------------------------------|----------------------------------------------------|
| 0        | 9                    | 266                                | 5 (56%)                                                          | K 2.80                                             |
| 1 - 2    | 29                   | 387                                | 10 (34%)                                                         | K21.30                                             |
| 3 - 4    | 39                   | 463                                | 13 (33%)                                                         | K23.35                                             |
| 5 - 6    | 16                   | 528                                | 5 (31%)                                                          | K14.20                                             |
| 7+       | 11                   | 425                                | 1 ( 9%)                                                          | K25.00                                             |

Table 17

MANAGEMENT INDEX BY NO. GROWERS INCURRING LABOUR -  
CASH COST, BY AMOUNT OF COST INCURRED

| Management<br>Rating | Total<br>No. Growers | No. Growers<br>Hiring<br>Labour | Av. Cost | No. Growers<br>Incurring<br>Cash Cost | Av. Total<br>Cash Cost<br>(for growers<br>incurring |
|----------------------|----------------------|---------------------------------|----------|---------------------------------------|-----------------------------------------------------|
| Below<br>Average     | 53                   | 15 (28%)                        | K10.43   | 40 (75%)                              | K 9.36                                              |
| Average              | 27                   | 7 (26%)                         | K21.43   | 23 (85%)                              | K11.97                                              |
| Above<br>Average     | 20                   | 11 (55%)                        | K15.91   | 19 (95%)                              | K13.60                                              |
| Very Good            | 4                    | 3 (75%)                         | K48.33   | 4 (100%)                              | K52.75                                              |



Table 18

CASH COSTS PER TREE  
FOR GROWERS INCURRING CASH EXPENSES

| Mature Trees | Av. of Class Interval | Av. Cash Costs Per Grower | Av. Cash Costs Per Mature Tree |
|--------------|-----------------------|---------------------------|--------------------------------|
| 1 - 200      | 138                   | K 8.24                    | 6.0 toea                       |
| 201 - 500    | 332                   | K10.95                    | 3.3 toea                       |
| 501 - 1000   | 638                   | K21.13                    | 3.3 toea                       |
| 1001+        | 1137                  | K23.60                    | 2.1 toea                       |
| All growers  | 452                   | K13.22                    | 2.9 toea                       |

Table 19

AVERAGE CASH COSTS FOR ALL GROWERS SURVEYED

|                               |        | No. Mature Trees |           |            |        |             |
|-------------------------------|--------|------------------|-----------|------------|--------|-------------|
|                               |        | 1 - 200          | 201 - 500 | 501 - 1000 | 1001+  | All Growers |
| Tools                         | K0.60  | K1.05            | K0.95     | K3.15      | K1.10  |             |
| Bags                          | K1.00  | K0.90            | K1.25     | K2.00      | K1.10  |             |
| Plastic                       | K0.60  | K1.35            | K1.55     | K2.15      | K1.35  |             |
| Material                      |        |                  |           |            |        |             |
| Cash Cost                     | K2.20  | K3.30            | K3.75     | K7.30      | K3.55  |             |
| (Growers using family labour) |        |                  |           |            |        |             |
| Labour                        | K14.85 | K15.00           | K25.50    | K55.00     | K18.90 |             |
| Cash Costs                    |        |                  |           |            |        |             |
| (Growers using hired labour - |        |                  |           |            |        |             |
|                               | K17.05 | K18.30           | K29.25    | K62.30     | K22.45 |             |

Note: Half of the Cost for Tools is allocated to Coffee Production.

TABLE 20  
HARVESTING - LABOUR INPUTS

|                                                                        | <u>All Observations</u>   |  |     | <u>Flush Villages</u>     | <u>Non Flush Villagers</u>     |
|------------------------------------------------------------------------|---------------------------|--|-----|---------------------------|--------------------------------|
| 1. <u>Rate of picking</u><br>(kg cherry picked per<br>man-hour worked) |                           |  |     |                           |                                |
| No. of observations                                                    | 168                       |  | man | 110                       | 58                             |
| Mean of observations                                                   | 4.6kg/man hr (36.8kg/day) |  |     | 5.6kg/man*hr (44.8kg/day) | 2.8*kg/man hr (22.4kg/man day) |
| Standard error                                                         | 3.0kg/man hr              |  |     | 3.1kg/man hr              | 2.7kg/man hr                   |
| Co-efficient of<br>variation (C.V.)                                    |                           |  |     | 5.2%                      | 12.7%                          |
| 2. <u>Hours worked per picking</u>                                     |                           |  |     |                           |                                |
| No. of observations                                                    | 180                       |  |     | 122                       | 58                             |
| Mean of observations                                                   | 4.8 hours                 |  |     | 5.2 hours                 | 4.6 hours                      |
| Standard error                                                         | 2.4 hours                 |  |     | 2.6 hours                 | 3.6 hours                      |
| C.V.                                                                   |                           |  |     | 4.5%                      | 10.2%                          |
| 3. <u>Weight of Picking</u><br>(kg cherry picked<br>per picking)       |                           |  |     |                           |                                |
| No. of observations                                                    | 168                       |  |     | 110                       | 58                             |
| Mean of observations                                                   | 41.5 kg                   |  |     | 51.9 kg                   | 17.3 kg*                       |
| Standard error                                                         | 57.3 kg                   |  |     | 63.2 kg                   | 17.0 kg                        |
| Co-efficient of<br>variation                                           |                           |  |     | 11.6%                     | 12.9%                          |

\* Significant difference at 95% level of confidence

TABLE 21  
LABOUR INPUTS - PULPING

|                                                    | <u>All Observations</u> | <u>Flush Villages</u>           | <u>Non Flush</u>                 |
|----------------------------------------------------|-------------------------|---------------------------------|----------------------------------|
| 1. <u>Hand Operated Bentall Pulpers</u>            |                         |                                 |                                  |
| A) Rate of Pulping (Kg cherry pulped per man hour) |                         |                                 |                                  |
| No. observations                                   | 69                      | 47                              | 22                               |
| Mean of Observations                               | 22.4 kg/man hour        | 26.4 kg/man hour*               | 13.7 kg/man hour*                |
| Standard error                                     | 25.2 kg                 | 21.8 kg                         | 30.0 kg                          |
| C.V.                                               |                         | 12.0%                           | 46.7%                            |
| b) Hours worked per pulping                        |                         |                                 |                                  |
| No. Observations                                   | 72                      | 47                              | 25                               |
| Mean Observations                                  | 2.1 hours               | 2.2 hours                       | 2.0 hours                        |
| Standard error                                     | 1.5 hours               | 1.6 hours                       | 1.4 hours                        |
| C.V.                                               |                         | 10.6%                           | 14.0%                            |
| c) Amount Pulped per pulping (Kg cherry)           |                         |                                 |                                  |
| No. observations                                   | 69                      | 47                              | 22                               |
| Mean observations                                  | 49.0 kg                 | 62.8 kg*                        | 19.3 kg*                         |
| Standard error                                     | 60 kg                   | 68.5 kg                         | 11.9 kg                          |
| C.V.                                               |                         | 15.9%                           | 13.1%                            |
| 2. <u>Hand Pulping</u>                             | <u>Rate of Pulping</u>  | <u>Hours worked per pulping</u> | <u>Amount pulped per pulping</u> |
| No. observations                                   | 3                       | 3                               | 3                                |
| Mean observations                                  | 0.8 kg/man hour         | 4.3 hours                       | 5.2 kg                           |
| Standard error                                     | 0.6 kg/man hour         | 0.8 hours                       | 2.4 kg                           |

\* Significant difference at 95% level of confidence

TABLE 22  
LABOUR INPUTS - OTHER ACTIVITIES

|                                                  | <u>No. Observations</u> | <u>Mean of Observations</u> | <u>Standard Error</u> |
|--------------------------------------------------|-------------------------|-----------------------------|-----------------------|
| <b>1. Weeding</b>                                |                         |                             |                       |
| a) Trees weeded around per man hour              | 23                      | 16 trees (20 man days/ha)   | 16 trees              |
| b) Hours worked per weeding                      | 24                      | 3.8 hours                   | 2.7 hours             |
| <b>2. <u>Washing/Drying Coffee</u></b>           |                         |                             |                       |
| a) Rate of washing (equiv. dry parchment Kg/hr)  | 16                      | 7.5 kg/hour                 | 5.9 kg                |
| b) Hours worked per washing/drying               | 19                      | 1.3 hours                   | 1.1 hours             |
| c) Amount washed per washing (Kg, dry parchment) | 16                      | 11.7 kg                     | 12.3 kg               |

TABLE 23

Observations of Sales-Cherry

|                      | <u>Time spent waiting</u> | <u>Weight per sale</u> |
|----------------------|---------------------------|------------------------|
| All observations     | 20                        | 23                     |
| Mean of observations | 1.1 hours                 | 24.5 kg                |
| Standard error       | 1.2 hours                 | 14.9 kg                |

Observations of Sales-Parchment

1. Weight per sale

|                      | <u>Flush villages</u> | <u>Non-flush Villages</u> |
|----------------------|-----------------------|---------------------------|
| No. of observations  | 23                    | 11                        |
| Mean of observations | 17.6 kg               | 15.0 kg                   |
| Standard error       | 14.3 kg               | 13.8 kg                   |
| C.V.                 | 16.9 %                | 27.7 %                    |

2. Time spent waiting

|                      | <u>Flush villages</u> | <u>Non-flush villages</u> |
|----------------------|-----------------------|---------------------------|
| No. of observations  | 23                    | 11                        |
| Mean of observations | 1.6 hours*            | 2.8 hours*                |
| Standard error       | 1.5 hours             | 1.8 hours                 |
| C.V.                 | 19.5 %                | 19.4 %                    |

\* Significant difference at 95% level of confidence

TABLE 24

Summary of Labour Inputs - at maturity

Smallholder Coffee Producer  
450 Mature trees  
0.19 hectares

Annual production 215 kg parchment. (Cherry equivalent 1190 kg)

1132 kg / ha  
Parchment

| <u>Labour Inputs</u> <i>Per ha</i>  | <u>Annual</u>      | <u>Flush period</u> <sup>1</sup> | <u>Non-flush period</u> <sup>1</sup> |
|-------------------------------------|--------------------|----------------------------------|--------------------------------------|
| Maintenance (Weeding) <sup>2</sup>  | 4 man days         | 1 man day                        | 3 man days                           |
| Harvesting <i>174</i>               | 33 man days        | 20 man days                      | 13 man days                          |
| Pulping <i>37</i>                   | 7 man days         | 4 man days                       | 3 man days                           |
| Washing/Drying <i>26</i>            | 5 man days         | 4 man days                       | 1 man day                            |
| Marketing <sup>2</sup> <i>16</i>    | 3 man days         | 2 man days                       | 1 man day                            |
| <b>TOTAL<sup>3</sup> <i>274</i></b> | <b>52 man days</b> | <b>31 man days</b>               | <b>21 man days</b>                   |

- Notes
1. Assumes that 75% of annual production is harvested, processed and marketed in a flush period assumed to be 4 months.
  2. All coffee sold as parchment
  3. Excludes any new plantings of coffee

TABLE 25

MAN-DAYS OBSERVED - DIVIDED BY SEX

|                          | <u>PERCENTAGES</u> |               |                 |
|--------------------------|--------------------|---------------|-----------------|
|                          | <u>Male</u>        | <u>Female</u> | <u>Children</u> |
| 1. <u>Harvesting</u>     |                    |               |                 |
| Flush                    | 38                 | 49            | 13              |
| Non Flush                | 40                 | 35            | 25              |
| All observations         | 38                 | 48            | 14              |
| 2. <u>Pulping</u>        |                    |               |                 |
| Flush                    | 65                 | 23            | 13              |
| Non Flush                | 58                 | 16            | 26              |
| All observations         | 63                 | 21            | 17              |
| 3. <u>Weeding</u>        |                    |               |                 |
| Flush                    | 92                 | 8             | 0               |
| Non Flush                | 59                 | 26            | 15              |
| All observations         | 65                 | 23            | 12              |
| 4. <u>Washing/Drying</u> |                    |               |                 |
| Flush                    | 54                 | 34            | 11              |
| Non Flush                | 41                 | 59            | 0               |
| All observations         | 50                 | 42            | 8               |
| 5. <u>TOTAL OF ABOVE</u> |                    |               |                 |
| Flush                    | 44                 | 44            | 12              |
| Non Flush                | 49                 | 34            | 17              |
| All observations         | 45                 | 42            | 13              |

X

TABLE 26

INPUTS AND RETURNS FOR SMALLHOLDER COFFEE  
AT MATURITY

ASSUMPTIONS

Grower with 0.19 ha, about 450 mature trees

Annual Production 215 kg parchment (cherry equivalent 1190 kg)  
(Source Wilson & Evans (17)).

Equivalent yield 1140 kg parchment/hectare

Labour Inputs based on Table 24

Cash Costs based on Table 19

Pulper depreciation based on 8.10

Establishment expenses not capitalized.

No labour inputs assumed for new plantings.

Roadside price used of 65 toea/kg, Based on 1979-81 forecast price

1. Costs

a) Labour Inputs

|                |            |
|----------------|------------|
| Maintenance    | 4 man days |
| Harvesting     | 33         |
| Pulping        | 7          |
| Washing/Drying | 5          |
| Marketing      | 3          |
|                | <hr/>      |
|                | 52         |

b) Cash Costs

|                  |       |
|------------------|-------|
| Tools            | K1.10 |
| Bags             | K1.10 |
| Drying Materials | K1.35 |

c) Depreciation of Pulper K5.00

2. Returns

|                                         |                  |
|-----------------------------------------|------------------|
| Production                              | 215 Kg parchment |
| Price                                   | 65 toea/kg       |
| Gross Income                            | <hr/> K139.75    |
| Less Cash Costs                         | 3.55             |
| Depreciation of Pulper                  | <hr/> 5.00       |
|                                         | <hr/> 8.55       |
| Net Income                              | K131.20          |
| Man days                                | 52               |
| Net Return per man-day<br>(at maturity) | K 2.50           |



TABLE 27

INPUTS AND RETURNS TO SMALLHOLDER COFFEE  
PLAINING LASTING 15 YEARS

|                                  | Yr 1          | 2      | 3      | 4          | 5       | 6            | 7 - 15  |
|----------------------------------|---------------|--------|--------|------------|---------|--------------|---------|
| Clearing & Drainage              | 76 m.d.       |        |        |            |         |              |         |
| Lining, Holing, Planting         | 28 m.d.       |        |        |            |         |              |         |
| Shade                            | 15 m.d.       |        |        |            |         |              |         |
| Nursery                          | 8 m.d.        |        |        |            |         |              |         |
| Pulper                           | -             | -      | -      | K25        |         |              |         |
| Maintenance                      | 10 m.d.       | 8 m.d. | 8 m.d. | 4 m.d.     | 4 m.d.  | 4 m.d.       | 4 m.d.  |
| Harvesting                       | -             | -      | -      | 11 m.d.    | 21 m.d. | 26 m.d.      | 22 m.d. |
| Processing & Drying              | -             | -      | -      | 3 m.d.     | 4 m.d.  | 10 m.d.      | 12 m.d. |
| Marketing                        | -             | -      | -      | 2 m.d.     | 2 m.d.  | 3 m.d.       | 3 m.d.  |
| Tools, Bags, Drying Mats         | K15           | -      | -      | K3.55      | K3.55   | K3.55        | K3.55   |
| TOTAL INPUTS <sup>K</sup>        | K15           | -      | -      | 28.55      | 3.55    | 3.55         | 3.55    |
| Man Days                         | 137 m.d.      | 8 m.d. | 8 m.d. | 20 m.d.    | 31 m.d. | 43 m.d.      | 52 m.d. |
| Produce Parchment                | -             | -      | -      | 70 kg      | 140 kg  | 180 kg       | 215 kg  |
| Gross Income (Price 65t/kg)      | -             | -      | -      | K45        | K91     | K117         | K140    |
| Discounted Net Return (@9% p.a.) | K1.60 per day |        |        |            |         |              |         |
|                                  | Gross Income  |        | Costs  | Net Income |         | Labour Input |         |
| Yr 1                             | -             |        | K15    | -K15       |         | 137 man days |         |
| 2                                | -             |        | -      | -          |         | 8 man days   |         |
| 3                                | -             |        | -      | -          |         | 8 man days   |         |
| 4                                | K 45          |        | K28.55 | K16.45     |         | 20 man days  |         |
| 5                                | 91            |        | 3.55   | 87.45      |         | 31 man days  |         |
| 6                                | 117           |        | 3.55   | 113.45     |         | 43 man days  |         |
| 7 - 15                           | 140           |        | 3.55   | 136.45     |         | 52 man days  |         |

Discounted. Net Flow @ 9% p.a.  
Discounted. Net Flow

610.10  
K1.60 per day  
385 man days

**ASSUMPTIONS**

As for Table 26

in addition;

|                            |                       |
|----------------------------|-----------------------|
| Clearing and Drainage      | 400 man days/ hectare |
| Lining Holing and Planting | 150 man days/ hectare |
| Shading                    | 80 man days/ hectare  |
| Nursery                    | 40 man days/ hectare  |

CHART 1 MATURE TREES PER GROWER  
BY Province

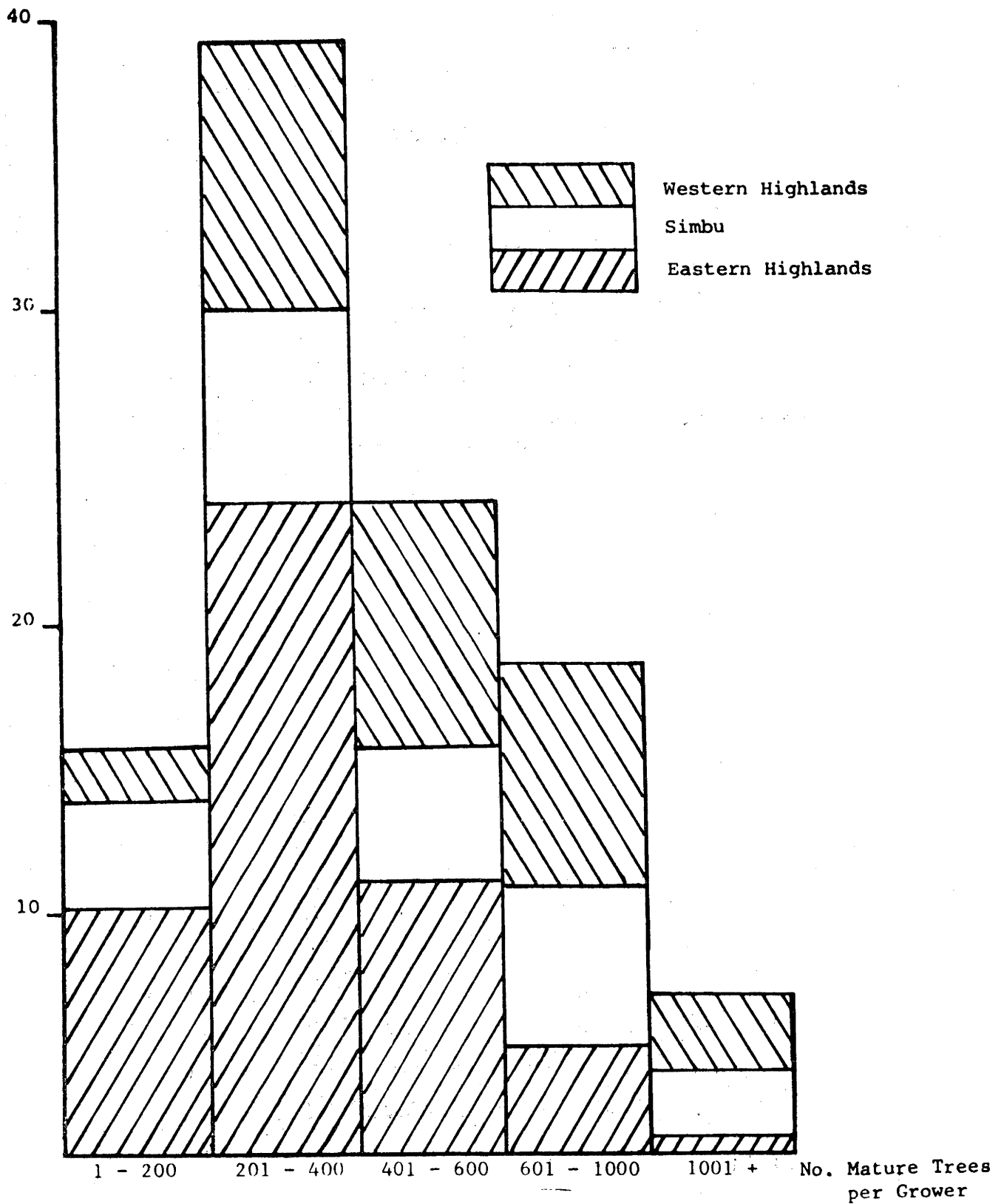


Chart 2      Rates of Harvesting

Kg cherry picked per man-day (8 hours)

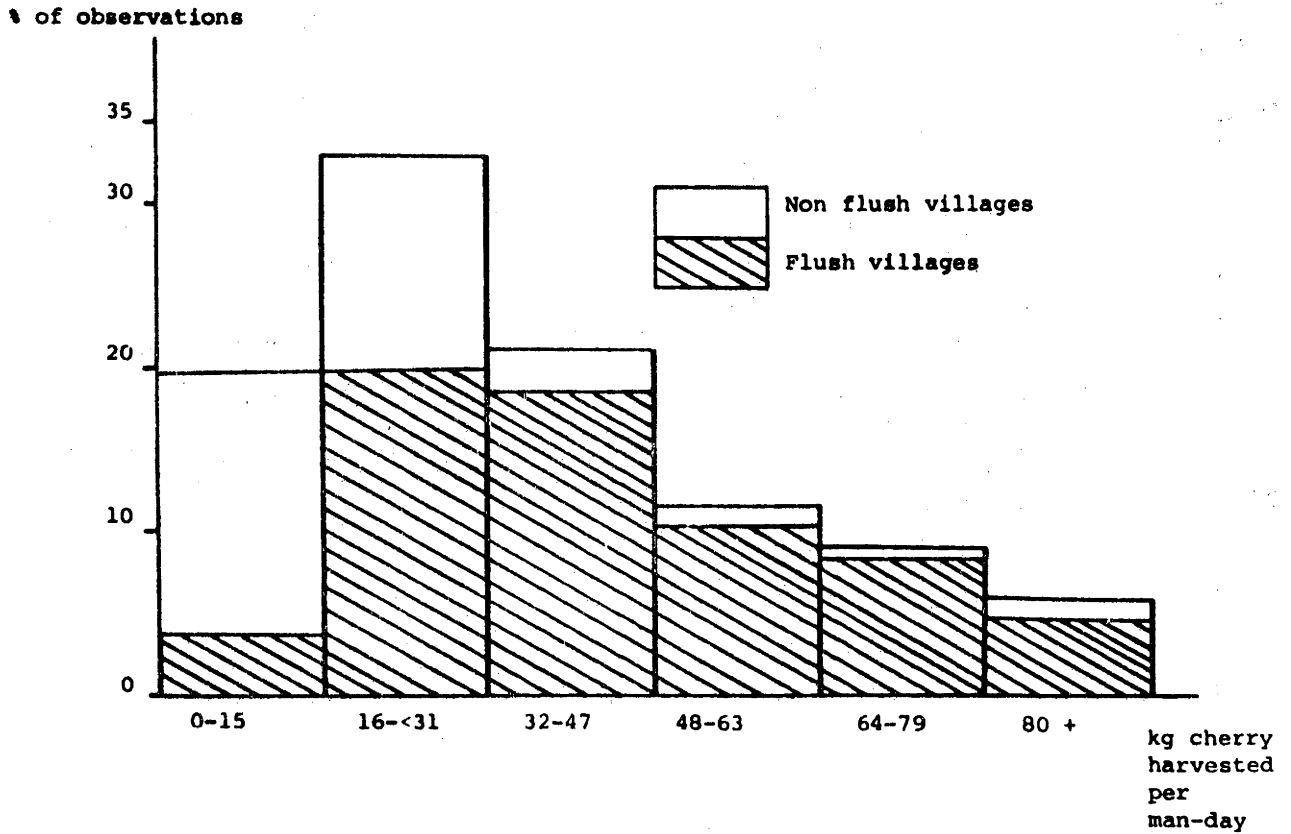


Chart 3      Hours Worked per Picking

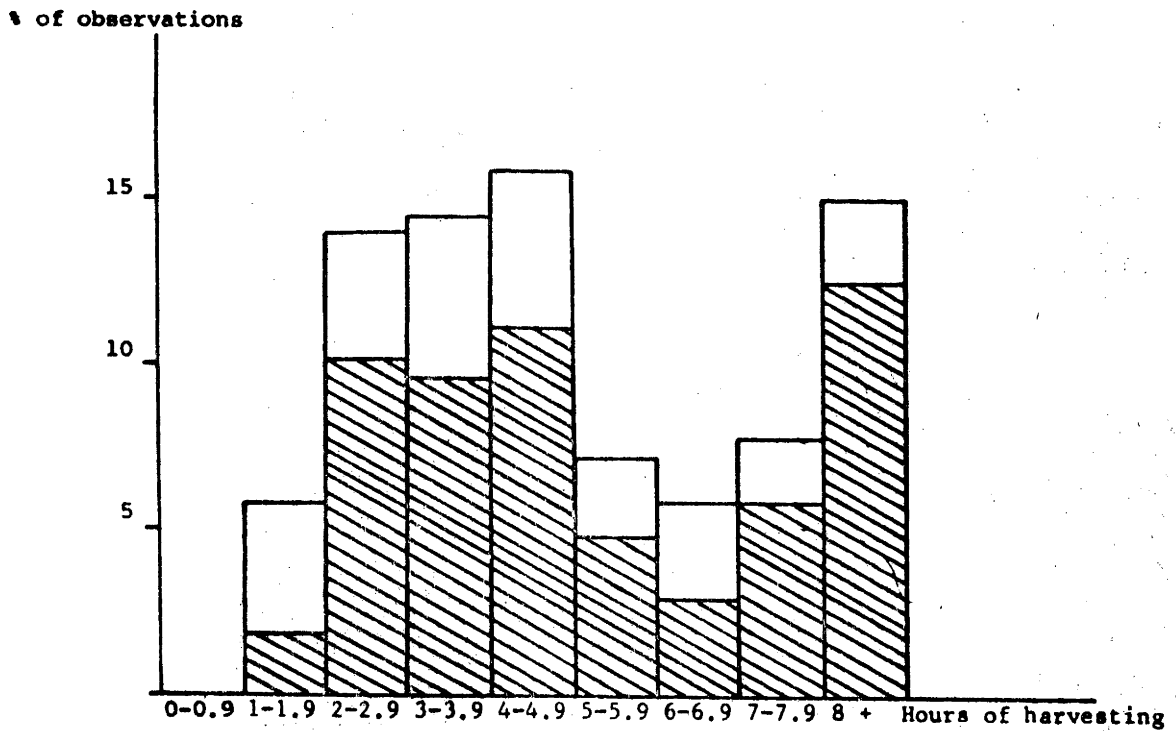
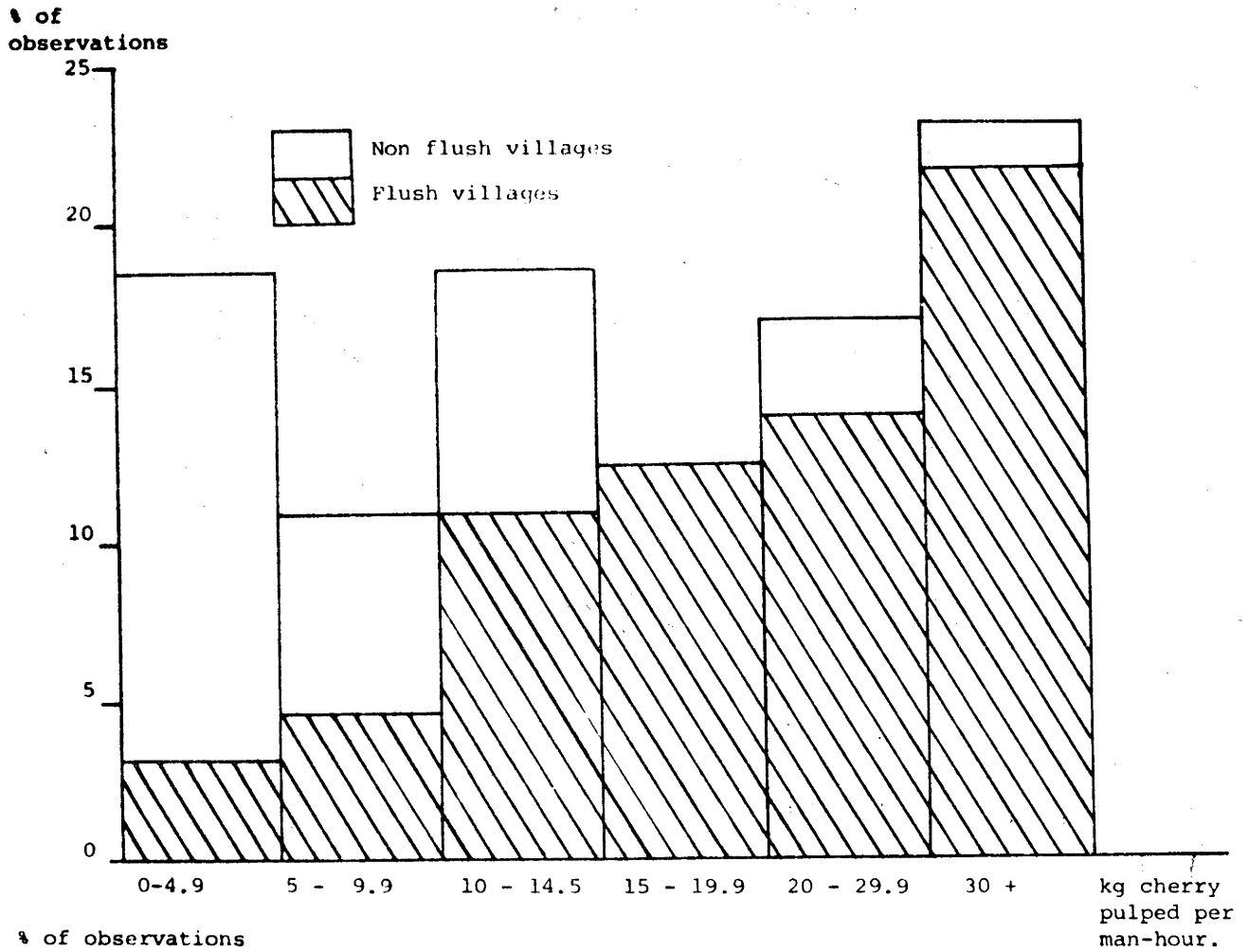


Chart 4     Rates of Pulping



% of observations

Chart 5     Hours worked per pulping

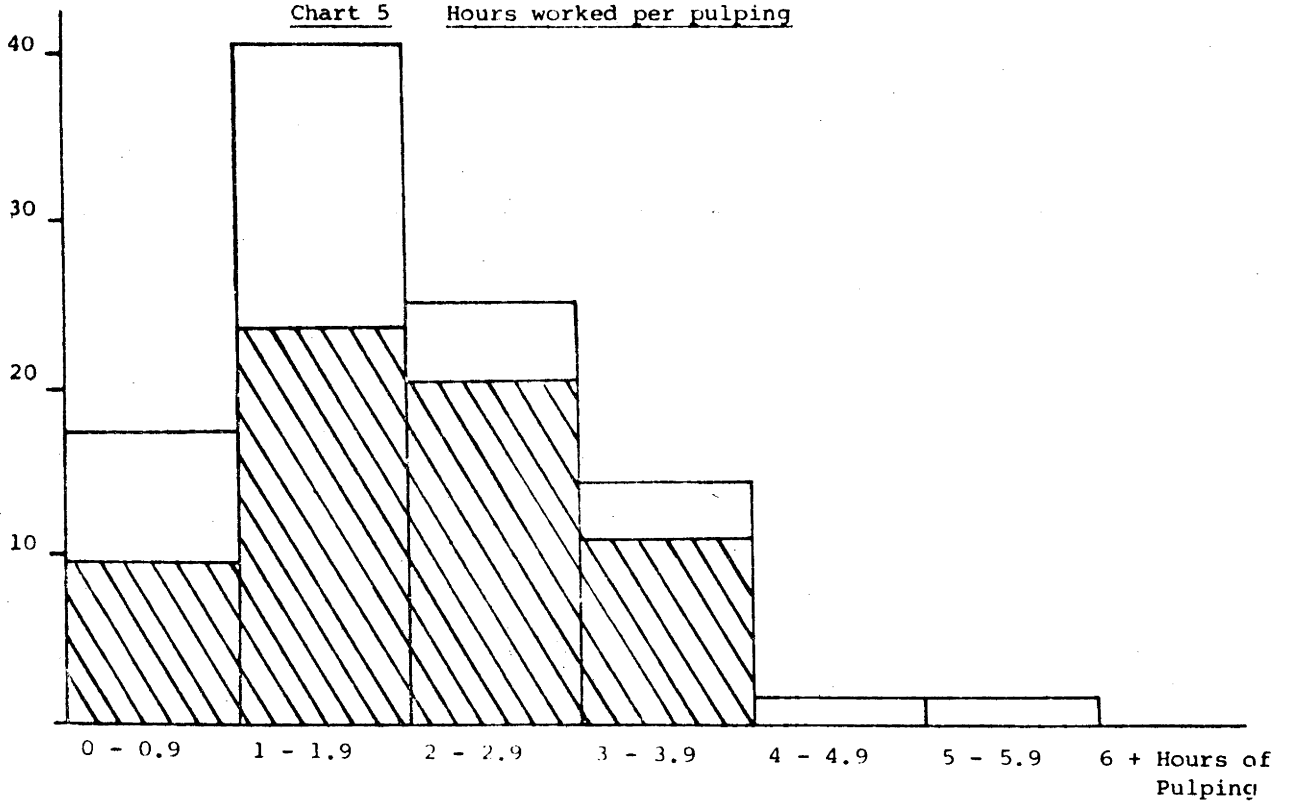
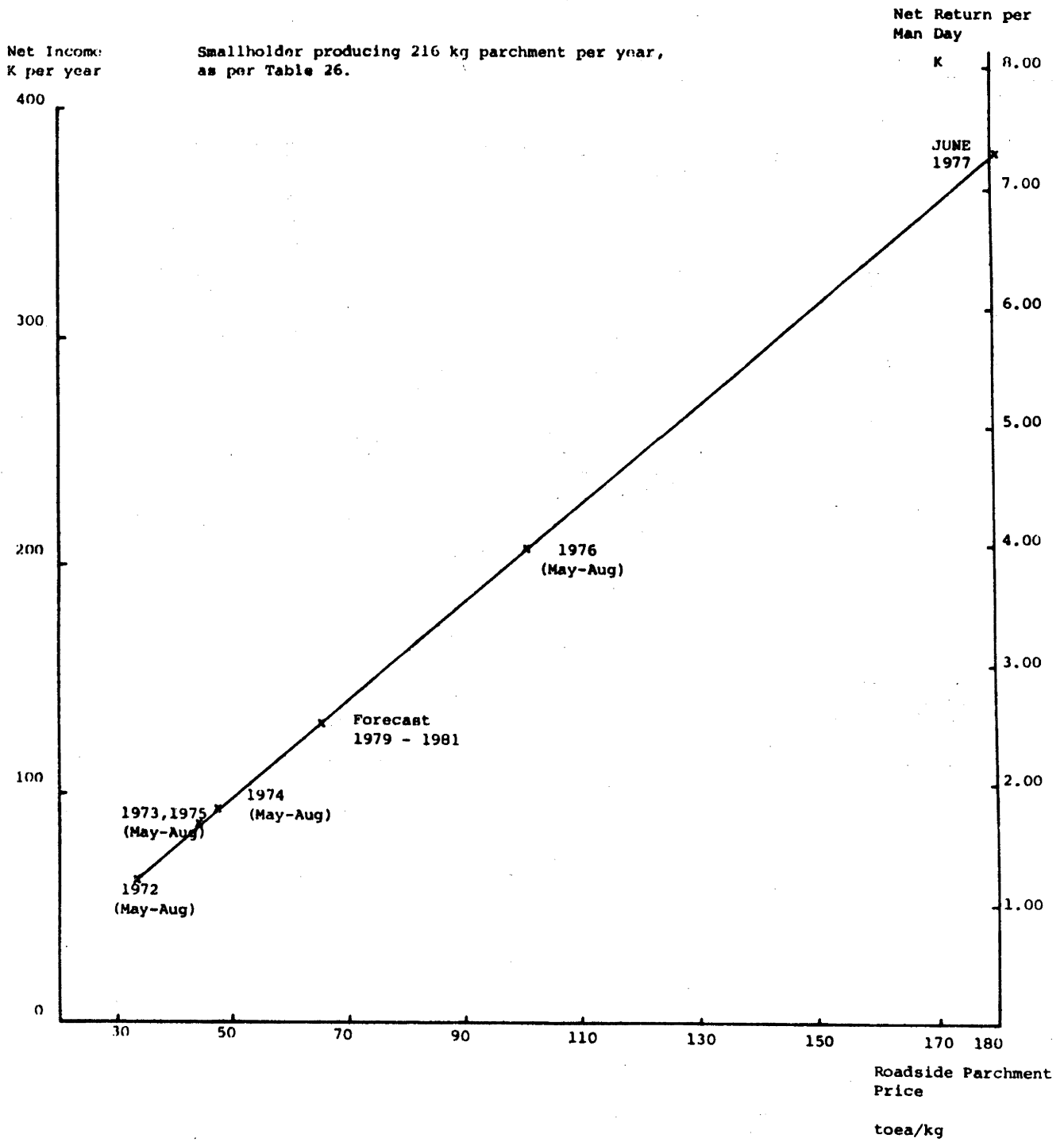
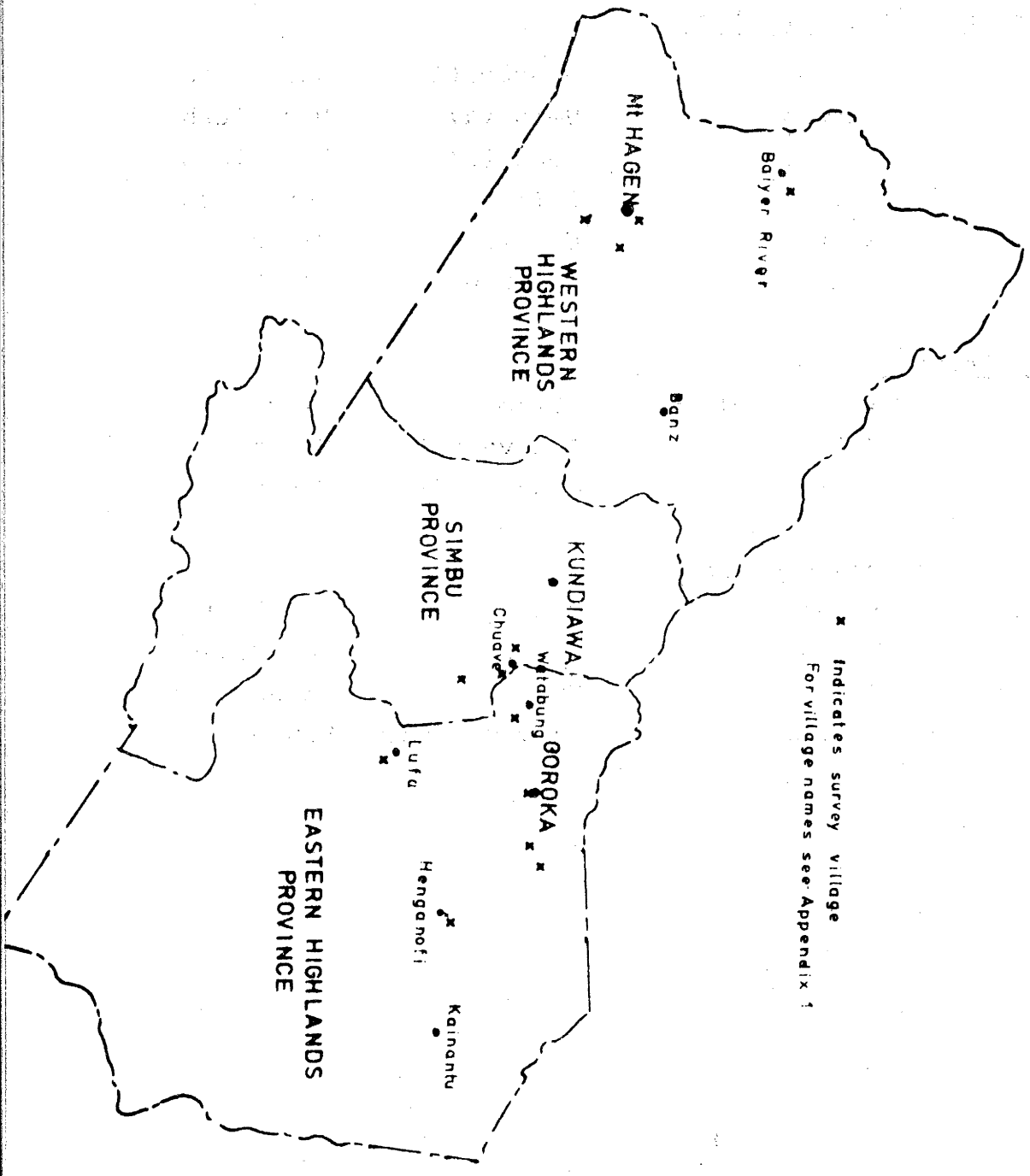


Chart 6

RETURNS TO SMALLHOLDER COFFEE PRODUCTION  
AT VARIOUS PRICES



# LOCATION OF SURVEY VILLAGES



Appendix 1

TABLE OF SURVEYED VILLAGES

| <u>Village Name</u>               | <u>Area Name</u> | <u>Flush/non Flush</u> |
|-----------------------------------|------------------|------------------------|
| <u>Eastern Highlands Province</u> |                  |                        |
| Abave                             | Henganofi        | Non Flush              |
| Matusa                            | Bena (1)         | Non Flush              |
| Kaiyufa                           | Bena (2)         | Non Flush              |
| Duto                              | Lufa             | Non Flush              |
| Kama                              | Goroka           | Flush                  |
| Imero                             | Watabung         | Flush                  |
| <u>Chimbu Province</u>            |                  |                        |
| Keu - Kamagam                     | Elimbari         | Flush                  |
| Mainomo                           | Chuave (1)       | Flush                  |
| Maimo                             | Chuave (2)       | Flush                  |
| <u>Western Highlands Province</u> |                  |                        |
| Keremol                           | Nebilyer         | Non Flush              |
| Kutbal                            | Wurup            | Non Flush              |
| Kuluamp                           | Hagen            | Flush                  |
| Kanane                            | Baiyer River     | Flush                  |



## Appendix 2

### COMPILATION OF MANAGEMENT INDEX

The responses to questions on fencing, shading, weeding and pruning, a management index is made up to compare the management performance of different groups of growers.

Clearly other factor should be included, but those 4 basic premises give a guide to the relative care of blocks by growers.

It is based on the following points system:

|                |                         |   |
|----------------|-------------------------|---|
| <u>Fencing</u> | Nil Fenced              | 0 |
|                | 1 - 50% Plots Fenced    | 1 |
|                | Over 50% Fenced         | 2 |
|                | All plots Fenced        | 3 |
| <u>Shading</u> | Adequate                | 3 |
|                | Excessive               | 1 |
|                | Inadequate              | 0 |
| <u>Weeding</u> | Regular                 | 3 |
|                | Intermittant            | 1 |
|                | Not Weeded              | 0 |
| <u>Pruning</u> | Pruning - Multiple Stem | 3 |
|                | - Multiple + Topping    | 1 |
|                | - Single Stem           | 1 |
|                | - Multiple +Single      | 2 |
|                | Other, No Pruning       | 0 |

Hence Highest Possible No. of points 12

The average points score for all growers was 4.69 and this is scored as 100 in the index.

APPENDIX 3

SMALLHOLDER COFFEE SURVEY

APRIL - JUNE 1976

Q U E S T I O N N A I R E

A. ABOUT THE GROWER

1. a) Name of Grower .....  
b) Approximate Age .....  
c) Number of children .....
2. Village .....  
Area .....
3. Name of Interviewer .....  
Is this your home village? .....
4. Did the grower attend shcool YES/NO  
If YES  
what was the highest level he attended .....
5. Has the grower ever worked on a coffee Plantation?  
YES/NO  
If YES  

| <u>Name of Plantation</u> | <u>Place</u> | <u>Period Worked</u> |
|---------------------------|--------------|----------------------|
| _____                     | _____        | _____                |
| _____                     | _____        | _____                |
| _____                     | _____        | _____                |
6. Find out the grower's three main sources of income  
apart from coffee  
(for example: Tobacco, Cattle, Vegetables,  
Piggery, Trade Store etc)  
1. (most important after coffee).....  
2. (next most important).....  
3. (third importance after coffee),.....

7. Is the main source of the grower's income coffee, or one of the activities mentioned above?

Coffee .....

Other (name it) .....

B. ABOUT THE GARDEN

8. How many separate plots of coffee does this grower own .....Plots.

9. COUNTING TREES IN EACH PLOT - Put your rough workings in the following spaces (or on the back of the last page).

---

PLOT 1

PLOT 2

PLOT 3

---

PLOT 4

PLOT 5

---

10. TOTAL FOR EACH PLOT

|                                                | <u>Plot 1</u> | <u>Plot 2</u> | <u>Plot 3</u> | <u>Plot 4</u> | <u>Plot 5</u> |
|------------------------------------------------|---------------|---------------|---------------|---------------|---------------|
| a) No. of trees planted in last 12 months      | .....         | .....         | .....         | .....         | .....         |
| b) No. of mature trees                         | .....         | .....         | .....         | .....         | .....         |
| c) No. of immature trees (12 months - 3 years) | .....         | .....         | .....         | .....         | .....         |
| d) No. of dead trees                           | .....         | .....         | .....         | .....         | .....         |
| e) Is the plot fenced<br>YES/NO                | .....         | .....         | .....         | .....         | .....         |

(Fill in a column for each plot the grower has, if he has more than 5 plots use the back of page 2)

For all the plots

11. Is the shading? a) insufficient .....(tick  
b) adequate .....  
c) excessive .....
12. Weeding a) garden regularly weeded .....  
b) recently weeded after long  
period .....  
c) not weeded for long period .....
13. Pruning a) No pruning done.....  
b) Pruning now needed.....  
c) Pruning done.....
14. Pruning System a) Nil  
Used b) Single stem .....  
c) Multiple stem .....  
d) Top cut off tree only .....

15. Ask the grower where he gets new seedlings from?

.....

16. Ask the grower if he has ever put fertilizer on his  
coffee? YES/NO  
If YES

what was the fertilizer called? .....

.....

17. Comment on the general condition of the garden. e.g.

height of weeds

amount of shade

height of trees

spacing of trees

yielding of coffee

.....

.....

.....

.....

.....

.....

.....

.....

C. GROWER'S PROCESSING EQUIPMENT

18. a) Does the grower own or own a share in a coffee Pulper?  
YES/NO

If YES,

b) how many other people share in the ownership of the pulper?.....

c) how many years (season) old is the pulper?  
.....(years)

d) what is the condition of the pulper?

GOOD .....

FAIR .....

POOR .....

19. a) What vessel does the grower ferment his coffee in?

.....

.....

If a FERMENTING BOX,

b) Has the grower own or own a share in it? YES/NO  
If YES

c) How many other people share in the ownership of the box .....

d) What is the size of the fermenting box?  
.....inches by .....inches.

e) What is the condition of the fermenting box?

GOOD .....

FAIR .....

POOR .....

20. WEIGH any stocks of coffee the grower has? .....kg

21. Are the stocks of coffee - very dry .....

- not very dry .....

- some dry, some not dry ....

22. Have the beans been sorted to pick out defective beans?  
YES/NO

23. Where are the stocks of coffee being held?

- in a special storage house.....

- in the house, on the ground .....

- in the house, off the ground .....

e.g. on wood slats

- other .....

24. What does the grower dry his coffee on?

Bush matting .....  
 Plastic Sheets .....  
 Copra or Rice bags .....  
 Blankets .....  
 Other .....  
 .....

25. Cash Expenses:

List any money the grower has spent in the last  
 12 months on:-

| <u>No.</u>                                             | <u>Total</u><br><u>K</u> | <u>Use for other</u><br><u>than coffee</u><br><u>YES/NO</u> | <u>Bought</u><br><u>New or used</u><br><u>YES/NO</u> |
|--------------------------------------------------------|--------------------------|-------------------------------------------------------------|------------------------------------------------------|
| Spades                                                 |                          |                                                             |                                                      |
| Pruning Saw                                            |                          |                                                             |                                                      |
| Buckets                                                |                          |                                                             |                                                      |
| Plastic (for<br>drying coffee)                         |                          |                                                             |                                                      |
| Rice Bags                                              |                          |                                                             |                                                      |
| Copra Bags                                             |                          |                                                             |                                                      |
| Other Bags                                             |                          |                                                             |                                                      |
| Any other cash expense - e.g. labour, fertilizer, etc. |                          |                                                             |                                                      |
| .....                                                  |                          |                                                             |                                                      |
| .....                                                  |                          |                                                             |                                                      |

### GROWER'S ACTIVITY

Each evening, record the main activities which took up the grower's time during the day. Note particularly work in the coffee garden or food garden or coffee sales.

Also include any money that was spent for the coffee garden.

| DATE | ACTIVITY | HOURS SPENT<br>ON ACTIVITY |
|------|----------|----------------------------|
|------|----------|----------------------------|

## OBSERVATIONS OF COFFEE WORK

[illegible]

# OBSERVATIONS OF COFFEE SALES

[illegible]



## Appendix 4

### SMALLHOLDER RESPONSE TO PRICE CHANGES

1. Smallholder coffee production has shown a steady upward trend from 10,600 tonnes in 1966/67 to 29,900 tonnes in 1975/76. This is a growth rate of about 12% p.a. Nevertheless during this period there have been 3 years when production has declined from that of the previous year - 1967/68, 1970/71 and 1973/74. Clearly then many short term factors affect the smallholder's production of coffee. This appendix gives a short examination of short term price and income fluctuations and their effect on production.

2. It is often stated that growers respond positively to prices while it is sometimes countered that growers harvest only enough coffee to achieve a desired income. Dick (8) states that production in Mount Hagen to ruling prices, showed a response to price and Fleckenstein (10) from observations in Goroka says that growers responded to higher prices in 1972/73 by cleaning their gardens and harvesting more cherries from their trees. 1976/77 data is not yet available, however it appears that extraordinarily high prices for that and the previous season were accompanied by a fall in smallholder production. It seems that one important factor was that very high income levels dampened the need for cash.

3. The short term production response can come from increased harvesting of cherries, this can come from a full harvesting of available cherries on trees during the flush period and/or a longer harvesting period. Response from the holding of stocks will also affect the marketed production from year to year production. The Papua New Guinea Coffee Industry Board in compiling their production figures do not take account of smallholder stockholdings as they are not normally considered significant. This survey found no significant stockholdings carried forward to the 1976 season, although Wilson & Evans (17) suggest a significant stockholding was carried into the 1972/73 coffee year.

The climate, while not thought to be a major cause of fluctuating production, also contributes in year to year fluctuations. Other responses such as improved (or poor) maintenance, particularly weeding and fencing, and new plantings take longer for their effects to show and then are subject to the ruling short term factors.

Production data from the Papua New Guinea Coffee Industry Board is used. Production is divided between plantations and smallholdings on the basis of information supplied by processors. The price series used is the Bank of Papua New Guinea Coffee Export Price Index. This is a monthly figure compiled since 1966/67. Both series are shown in Figure 1. In addition, the monthly processing returns of three processing factories were examined. These are required by the Coffee Industry Board and show the amount of smallholder coffee processed monthly since 1968/69. It is graphed out in Figure 2. The aim was to discover the seasonality of smallholder production over a number of years with different prices.

6. Smallholder coffee production from 1966/67 to 1975/76 shows a linear equation of best fit of

$$Y = 8430 + 2130 x$$

where  $Y$  = Annual smallholder coffee production in tonnes

$x$  = Number of years since 1966/67 coffee year

The  $r$  value for the equation is 0.96

The correlation between total smallholder production and prices shows a positive response, significant at the 5% level. The regression equation of smallholder production on the price index for the current year ( $x_2$ ) is

$$Y = 190.4x_2 - 1651$$

However the downturn in production sold in 1970/71 was accompanied by a rise in the Price Index. Further, production was static between 1972/73 and 1973/74 despite a slight price rise, and production rose the following year despite a small price fall.

7. Lagging prices one year does not improve the fit and this would further support the suggestion that no significant amounts of stocks are held and that production is much more dependent on prices current at the time of harvesting with little reference to prices of the previous year.

8. If stockholding is not a major cause of variation in production being marketed the major cause is to harvesting or non-harvesting of available cherry on trees. If this is the case it could be argued that prices during the flush harvesting period have more effect on production than an annual average price. (While the flush is not a fixed period and differs in timing and intensity between areas it is defined at the May-August period when most smallholder coffee is produced). However using the price index for May to August only showed a similar pattern to the average annual prices. It does not show the production drop in 1973/74 while prices were above those of the previous year.

9. The trend of prices over each year's flush period (May-August) is also examined. The hypothesis tested is that if prices decline during the flush period, irrespective of their absolute levels, sales will fall. It may also be a rough guide to growers' expectation of future prices. It is noted that during 1970/71 and 1973/74 prices fell during the defined flush period and production for the year in both cases fell despite the fact that prices were at a higher level than the previous year. In 1968/69 however prices fell during the flush period but a strong increase (55%) in sales was found. Production however had declined to 1967/68 and some stocks could have been disposed of in 1968/69.
10. Other analysis was carried out but did not prove statistically significant. These included a multiple correlation of smallholder production on the price index of the current and previous year. In an attempt to eliminate factors such as inflation of prices and "normal" expansion of coffee production by adding to gardens and planting new areas, modified indices of production and prices were used. Actual smallholder production was expressed as a percentage of production expected from the linear trend line found in paragraph 5. Prices were as in the other analysis deflated by a National Accounts deflator. For 1974/75 and 1975/76 where this indicator is not available the increase in the Consumer Price Index was used. No significant linear or other relationship was found at the 5% level.
11. The hypothesis of a significant positive relationship between price and production can still be accepted for many factors prevent the linear trend line being considered the expected production if prices remained constant in real terms. Possible causes are the coming into bearing of plantings stimulated by earlier prices, new plantings encouraged for general development and unrelated to short term price levels, the prices information received by growers and their expectations of future prices did not coincide with actual prices. Changes in the marketing structure could at times affect production reaching markets, the demand for cash and the changes in cash requirements (e.g. taxes, availability of road transport) could have an effect as could local social and ceremonial customs. Finally in some years climate and pests may play a role as could the prices and marketing opportunities for alternative cash crops e.g. tobacco, vegetables, although these are not thought to be major.

12. To look at the seasonality of smallholder production within a season, the processing returns of 3 factories were examined monthly over an eight year period. From the labour inputs found in the survey it is apparent that labour inputs are more productive in the flush period than out of it. It could therefore be thought that when prices are low, non-harvesting would occur in the non flush periods rather than the flush periods. To examine this the factories' 4 largest processing months were given as a percentage of the annual throughput. Clearly distortions could be expected because of seasonality, different modes of buying, machinery breakdown and many others. Nevertheless the factories showed some similarity in movements between the years. This is shown in figure 2.
13. The amount of smallholder production processed in the largest 4 months (generally May-August) varied from 50% to 84% of annual smallholder processings. The 3 factories showed a weak positive correlation with price (i.e. when prices were higher, the largest 4 months as a percentage of annual processings was higher) rather than the expected negative correlation. From that it may be supposed that prices during the flush period and the resultant decisions about harvesting are of primary importance and far more important than those outside the flush period.

#### CONCLUSION

14. It can be concluded that smallholder coffee production shows a positive response to the current price level. In addition it appears important whether prices are declining or rising during the flush period, probably indicating price expectations. The main short term response is the harvesting or non-harvesting of available cherry in the flush period. Many other factors are at play and are difficult to eliminate in the statistical analysis. The more important of these are the lag between new plantings and production, grower expectations of prices, the income requirements of growers (particularly at higher levels) and climatic effects.

Figure 1 Smallholder Production and Prices

Smallholder Production, Source Coffee Industry Board.  
Prices, Source Bank of Papua New Guinea

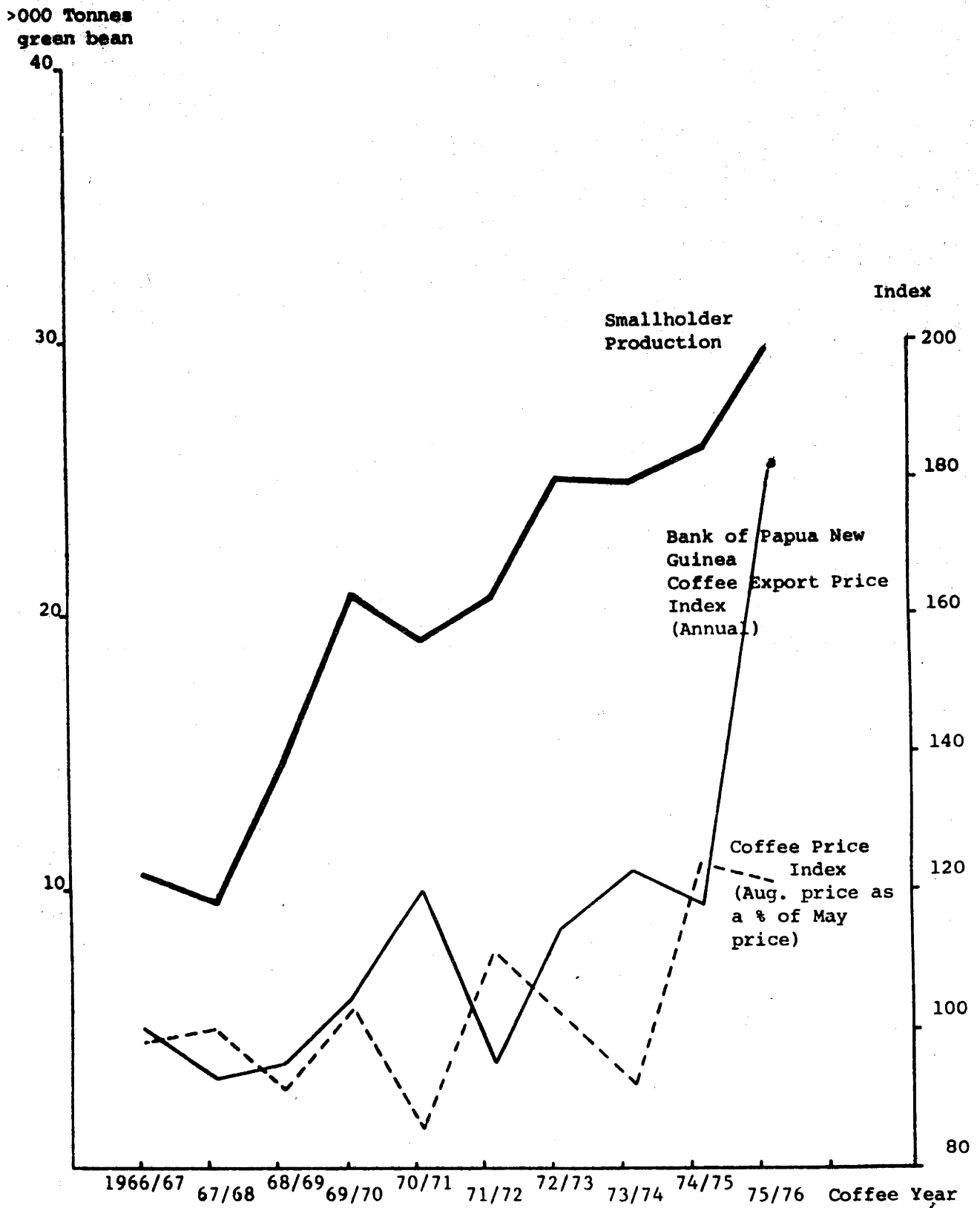


Figure 2

Seasonality of Smallholder Coffee Production 1968-9 to 1975-6

Percentage of Annual Smallholder Coffee processed in the four largest processing months — 3 selected factories.

