CGPRT No. 21

Potato in Indonesia: Prospects for Medium Altitude Production

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The CGPRT Centre

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Since 1982 LEHRI has been actively engaged in research on medium altitude potato and in 1988 the Agency for Agricultural Research and Development (AARD) requested the CGPRT Centre to conduct a study to identify the implications of expanded production of potato in medium altitude areas. Scientists of the above institutions conducted an integrated study covering production development, marketing, price development, consumption and export development with the assistance of CGPRT Centre staff. The International Potato Centre (CIP) supported the study financially. Support from the Directorate of Farm management and the Directorate of Horticulture is gratefully acknowledged.

The report, the result of collaboration between all the above institutions, presents a useful series of data and analyses which are needed for further research planning as well as development activities.

J.W. Taco Bottema

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Summary and Recommendations

The situation of potato in Indonesia is characterized by an increase in national consumption, which is especially significant in the higher income classes, and by rapidly increasing exports. The resulting demand appears to be strong and, taking into account the increased consumption of especially the urban higher income classes, a steady increase in national demand may be assumed in the coming five years. Consumption in rural areas is growing less rapidly but has experienced stable growth in the period 1981-1984. It should be noted that the most rapidly growing sectors of demand, the potato processing industry, export, and urban consumption, all require high-quality potato.

On the production side it is clear that although a steady long-term trend of increasing national production is visible, severe fluctuations still take place both between years and between seasons within a year. This is due largely to the cultivation of potato in relatively few highland areas. Lately though, production is spreading out to more highland areas in Central Java and North Sumatra. Only highland potato production supplies the major urban consumption centres and the processing industries, while North Sumatra supplies the export market.

Potato is mainly being produced in highland areas in West Java, Central Java, East Java, West Sumatra and North Sumatra. Production is capital-intensive and is based on smallholder systems of around 0.3 ha, using family labour. There are indications that production in highland areas is initially relatively high (10-15 t/ha) but decreases after several years. Factors leading to reduced yields in highland areas are the use of degenerated and infested seed, occurrence of pest and disease complexes and decreasing soil fertility. Erosion has been frequently noticed in highland areas. Moreover, although for a family-run farm, potato is usually a profitable crop, the exceptionally low prices that occurred frequently in the period 1983-1984 put many farmers into financial difficulty, which led to reduced capital investment and lower yields in many areas.

An efficient regional and inter-regional marketing network connects the major highland production areas with the major consumption centres. Although some minor price disparities do exist, it can be stated that price integration of major production and consumption centres is very good. Analysis of the marketing margins shows quite a high proportion, 80-89%, of the wholesale price accruing to the farmer, which in combination with the good price integration, leads to the conclusion that market integration is very good.

At present, medium altitude potato does not play a significant role in the national market. It is essentially a crop fitting into a complicated pattern of competing crops: chilli, cabbage, bean, watermelon, tomato and many others. The system, as practised by spontaneous growers, is based on low inputs (often based on residual effects of fertilizer applications to earlier crops) and low outputs of 4 to 6 t/ha. Areas planted to potato are seldom larger than 1000 sq m. Quality and quantity make medium altitude potato (m.a.), based on present practices, unattractive for anything other than local trading.

It was observed that m.a. potato occupies a specific niche in m.a cropping systems, based on low input and low output practices. Seeds are obtained from nearby highland

areas. The position of potato in m.a. cropping systems is clearly reflected in its place in the market: it supplies only nearby small markets and sometimes slightly larger markets when local markets are saturated.

Real prices of potato decreased steadily from 1980 to 1987. Price fluctuations occurred as the result of fluctuations in production but are decreasing as a result of the improved inter-regional market integration and perhaps also because production is spreading to more areas. Off-season prices are consistently Rp 50 to 70 per kg higher than production peak prices. This difference may not provide sufficient incentive for off-season production of m.a. potato.

Average seasonal price differences in Central Java are around Rp 55, for the quality class AB (i.e. 6-20 tubers/kg). M.a. potato tuber size yield trials indicate that at present only a very insignificant proportion of m.a. production could fall in this class, and that the major proportion may fall in classes C and D (20-30 tubers/kg and 30-40 tubers/kg). Prices fetched by these qualities may be 40-50% lower than the prices of the AB class. This means that the actual off-season benefit is reduced by 40-50% as well. The marketing costs consisting of packing, handling, transport and taxes are estimated at Rp 48/kg from Central Java to Jakarta and Rp 30/kg for Semarang. These extra costs absorb more than the remaining off-season benefit, which may be no more than Rp 30. M.a. potato is therefore likely to supply only those markets where actual prices are sufficiently high to absorb the extra marketing costs.

Production costs of highland potato are increasing in nominal terms, because of the increasing costs of stable manure, labour and the reduced subsidies on fertilizers and chemicals.

There are indications that in major highland production centres, production cannot be sustained over longer periods because of reduced soil fertility and the financial vulnerability of the smallholder systems which often results in inadequate investment capacity. While on the one hand this lack of sustainability has resulted in area diversification as new highland areas have been taken into production, it also points to a longer term decline of the overall highland production capacity. Since the upbeat market of quality potato is being supplied solely by highland areas, supply problems may occur after the decline in production of the newly-opened highland area. This may happen because in some newly-opened highland areas production takes place in an essentially non-sustainable manner.

It might be argued that the process of opening fresh highland areas can continue for some time since the Dieng case proves how quickly and efficiently this can be done. However, while this development seems to be occurring again in North Sumatra, caution is necessary to control erosion. Failure to do so could very well cause national production to decline.

In conclusion it can be observed that highland production and m.a. production respectively supplies different markets through separate marketing systems.

The highland production system is characterized by:

- (relatively) high input-high output,
- production is highly concentrated in a few areas,
- production occurs year-round,
- large quantities are produced, and
- relatively high quality potato of large size is produced.

The marketing system connecting highland production areas with consumption centres is based specifically on these characteristics. Traders are usually specialized.

Production of m.a. potato has entirely different characteristics:

- production is based on low input-low output,
- production takes place in scattered areas,
- small quantities are produced, and
- quality is low because the small tuber size is not suitable for the higher quality markets.

The marketing system connecting m.a. potato with consumers is localized and traders handle a wide variety of commodities.

It is evident that under low input conditions, m.a. potato is only partly linked with highland potato and that the marketing system handling m.a. potato is completely different from the highland trade system. Both systems are highly efficient and provide good margins to the growers. Integration of the two systems occurs only in two ways: assembly prices and wholesale prices of highland potato set the stage for price formation of m.a. potato, while seed is bought from nearby highland areas. Other than these connections, no relation exists between the two systems.

With regard to future developments two scenarios can be distinguished. The major issue is whether national production can be sustained to satisfy growing and stable demand from highland areas.

In the case of expanded and stable production from highland areas several developments are likely to occur.

Nominal prices are likely to go up in view of the increased cost of production. Since the marketing system is focused on the connection between major production and consumption centres, the present place of m.a. potato in the local market will remain undisturbed. In other words, if the present development of demand for highland potato continues, m.a. potato will remain a valid option as a complementary crop in m.a. cropping systems. Present crops are subject to rising costs of production as well, so it is unlikely that the position of potato in relation to crops will be affected heavily by the increasing production costs.

If the production of highland areas is not sustained and is not able to meet national demand, a different situation arises. Price fluctuations as induced by production fluctuations may assume a more severe character because of a reinforcement effect caused by growing demand. Prices may rise considerably in relation to other crops and the position of m.a. potato may become important nationally. Price developments may induce m.a. growers to invest more in potato, while the national marketing system may expand to include m.a. production areas and smaller highland production areas.

It is emphasized that the above scenarios do not describe two exclusive situations. In reality certain combinations of developments may occur.

Conclusions

1. The introduction of improved technology for m.a. potato in existing m.a. farming systems is likely to encounter serious problems, because it is unlikely that one minor component of a farming system can make the transition from low input-low output to a high input-high output technology regardless of the other components of the system.

The position of m.a. potato ought to be evaluated by taking into account horticultural crops in similar positions.

Based on present m.a. potato cultivation practices, and also the indications from research results, most m.a. produce is likely to fall in the lower quality grades, which will substantially reduce its position in relation to competing m.a. crops.

2. Although demand and prices are conducive to expanded potato production, based on present technology, it seems highly unlikely that within the coming five to ten years m.a. potato will contribute significantly to national production. It can, however, play an important role in supplying local markets and contribute to rural and urban diets outside the major consumption centres.

3. It appears most unlikely that expansion of m.a. potato production will affect national prices because m.a. producers have a wide range of production options available. They will base their choice of commodity on existing prices, and if these are not favourable in comparison to prices for other commodities, producers will not opt for m.a. potato. In other words, highland potato determines the price nationally, while interplay with prices for other m.a. crops determines the attraction of m.a. potato for the grower, and subsequently, production.

4. Present price developments applying to most horticultural commodities, including potato, show a downward trend in real price. This is most satisfactory and healthy because it is consumer friendly, while it strengthens in the long run the competitiveness of Indonesia's horticultural sector for export. The Government's policy of putting emphasis on price information and market information and non-intervention in price formation is wise because it stimulates broad sector development. The resulting market integration benefits both producers and consumers.

Recommendations

Medium altitude potato

1. Conduct research on the quality of m.a. potato because quality is the important factor which determines crop profit through linkage and incorporation in the existing marketing system, connecting highland potato to consumption centres. Through continued research, there may be opportunities to select varieties which would yield, under appropriate conditions, potato of sufficient quality.

2. Investigate the potential linkage of m.a. potato with the national marketing system. Two conditions should be looked into: the possibility of inducing production of m.a. potato in adequate quantity and quality, which basically entails the introduction of a high input-high output system.

3. The marketing of, and real consumer preferences and attitudes towards m.a. potato, should be established. Based on present results, it can be argued that m.a. potato could substitute for highland potato of Grades C and D (20-30 tubers/kg and 30-40 tubers/kg). In looking at the actual market proportion of these grades a guideline could be found to assess the market size. At present the proportion varies during the year and is likely to range between 20 to 40% of total production. It is suggested that potato traders be sought to actively co-operate in the research.

4. When market proportions of the various grades have been established, a survey should be conducted with the objective of establishing and quantifying implicit prices for the major quality characteristics. Such a survey could be limited to highland potato. Samples should be taken at all market levels. These samples should then be graded carefully; matching quality characteristics to specific prices. The survey should be conducted every season in order to gain insight into seasonal price fluctuations of low grade potato as well. The following quality characteristics should be taken into consideration:
   (i) moisture content,
   (ii) tuber size (number of tubers per kg),
   (iii) tuber shape (oval, round, irregular),
   (iv) cleanliness of tuber,
   (v) quality of tuber (eyes, rotten spots, etc.), and
   (vi) damaged tuber.

   This tentative list should be complemented with other quality characteristics in consultation with major users and traders. It is recommended that North Sumatra be included in the survey because of the significance of North Sumatra in potato export. The results of such a survey would give a quantitative indication of the value to be gained by post-harvest activities and grading, as well as storage of various grades.

5. With regard to the potential of m.a. potato, it is evident that high output production technology does not conform to farmers' practices in the majority of m.a. environments. It is therefore suggested to consider as a socio-economic component of production-related research, the establishment of the location-specific comparative advantage of potato in relation to competing crops. This way, upper and lower boundaries of costs of production of m.a. potato techniques can be established.

6. Identify relatively concentrated areas in which m.a. potato is grown. Depending on the desirability and the technical feasibility to integrate m.a. production with highland production, two different situations may be considered. One could select m.a. areas close to major highland areas to benefit from the highland marketing system. In this situation it is likely that m.a. potato will fall in the lower quality class and that it will fetch relatively lower prices than m.a. potato in more isolated areas. This could cause reduced incentives for growers because of reduced attraction of potato in relation to other m.a. crops. On the other hand, growers could benefit from input supply by traders.

   One could also avoid the issue of market integration and focus on relatively concentrated areas in isolation from major highland areas. These m.a. areas would supply nearby small towns and growers would enjoy relatively favourable margins which would improve the position of potato in relation to competing m.a. crops.

General

7. Assess sustainability of production in major highland areas as soon as possible, in order to gain insight into the possibility of fulfilling national demand, especially the growing market of quality potato for processing and export.

8. It appears that in the past two decades, research on potato has concentrated on the island of Java. Initially research has focused on the major highland production areas of West Java, while in the course of the 1980s research has included other production areas in East and Central Java, including areas at medium altitude. Assuming that the phase of variety selection of m.a. potato is nearing completion and that basic agronomic and pest management practices have been established, the yield potential of m.a. potato needs to be established for specific locations. It seems logical to allocate more resources to the adoption of on-farm research in selected areas on Java. The objective of such a programme could include the testing and viability of sustained m.a. potato production under variable conditions.

9. In view of the importance of North Sumatra and the developments in potato production in the area of Kerinci, it is suggested to formulate area-specific research programmes to expand productivity in Sumatra, especially in highland potato. In the case of the Kerinci area two things have been shown: 1) the willingness of farmers and traders to initiate production in suitable areas, and 2) yield levels in the Kerinci area are too low to justify investment and production. In North Sumatra an entirely different situation occurs in the export-driven potato production. In North Sumatra research should cover the integration of the present production system and its linkage with the export market.

1

Introduction

Since 1968 production of potato has increased considerably from 70,000 to 420,000 t in 1987. Viewed over the long-term, production and demand are steadily rising although serious fluctuations in production occur. Potato is a crop with several qualities which could make it an important option, especially for small farmers in upland Indonesia. The crop growth period is rather short, approximately 60 days, which facilitates fitting the crop into existing *palawija* and vegetable-based cropping systems. Moreover, the yield of potato per unit area is rather high. On the other hand, the production costs of potato are rather high; pest management and fertilizers are important components of the production costs. Although the costs of production are rather high, production still increases to satisfy the domestic demand.

Although potato has traditionally been a highland crop in Indonesia (Figure 1.4), there appears to be scope for expansion of production to medium altitude (m.a.) areas because of the recent availability of varieties suited to altitudes between 300 and 800 m above sea level. The production of new varieties with appropriate technology would expand the range of options of small, m.a. farmers and contribute to increased farm income.

M.a. potato offers, in terms of area expansion, an important option in broadening area diversification of potato as a commodity. M.a. potato also offers an interesting possibility for crop diversification in upland areas and a way to expand production of potato for the domestic and export markets.

It has been argued that the area of arable land in highland zones is limited and that in view of the rapidly rising demand and production, new options in production need to be considered and researched. Increased area diversification could diminish seasonal production fluctuations which would contribute to better price stability, while the impact of production-reducing factors in individual areas would generate less pronounced effects.

In Indonesia a vast area of arable m.a. land is potentially fit for cultivation of newly-developed m.a. or "hot" potato. Compared to the rather limited area of arable land at higher altitudes, the m.a. upland area offers great potential. Several matters need to be considered. Aside from basic issues such as yield potential and crop performance, which have been addressed to by the Central Research Institute for Horticulture (CRIH) and the Lembang Horticultural Research Institute (LEHRI) and International Potato Centre (CIP), potato would compete for land and inputs with a vast range of totally different secondary food crops and horticultural crops.

At the same time m.a. potato would compete with highland potato for market segments and shares which means that m.a. potato would have to link into the price, marketing and grading system connecting highland production centres with urban consumer centres.

Based on the above considerations the basic research question leading to the report was formulated as "what are the implications of expanded potato production in m.a. areas for prices and what is the potential for m.a. potato in general".

In this brief report a review of m.a. potato research will be given, followed by chapters covering potato production, price developments, marketing, consumption, and exports. A case study is included covering spontaneous production of m.a. potato which provides some insights into the structure of crop competition. Finally a small case study covering North Sumatra is presented.

Each chapter is preceded by a summary in which the most important facts and conclusions are presented.

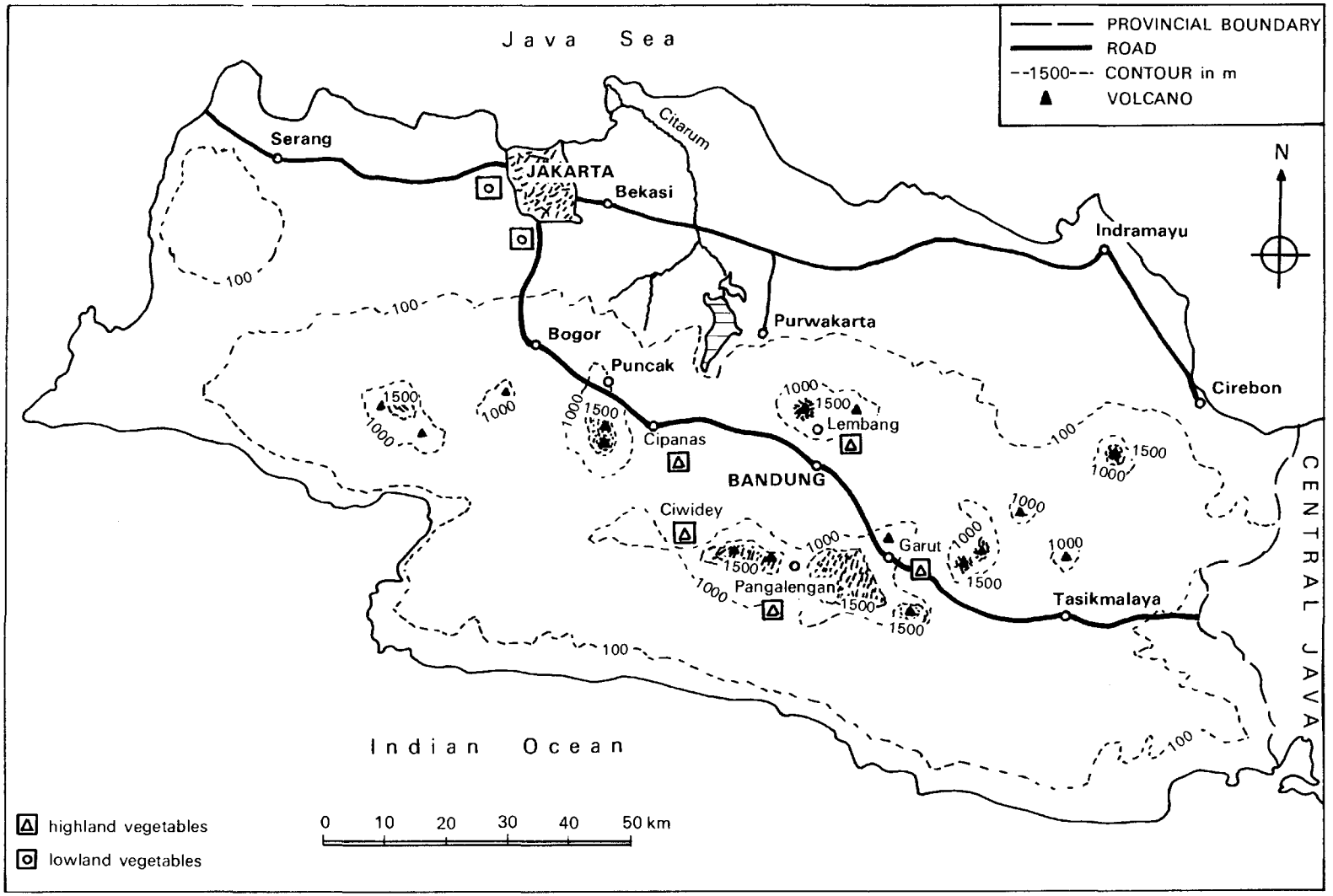

Figure 1.1 Potato production area in West Java.

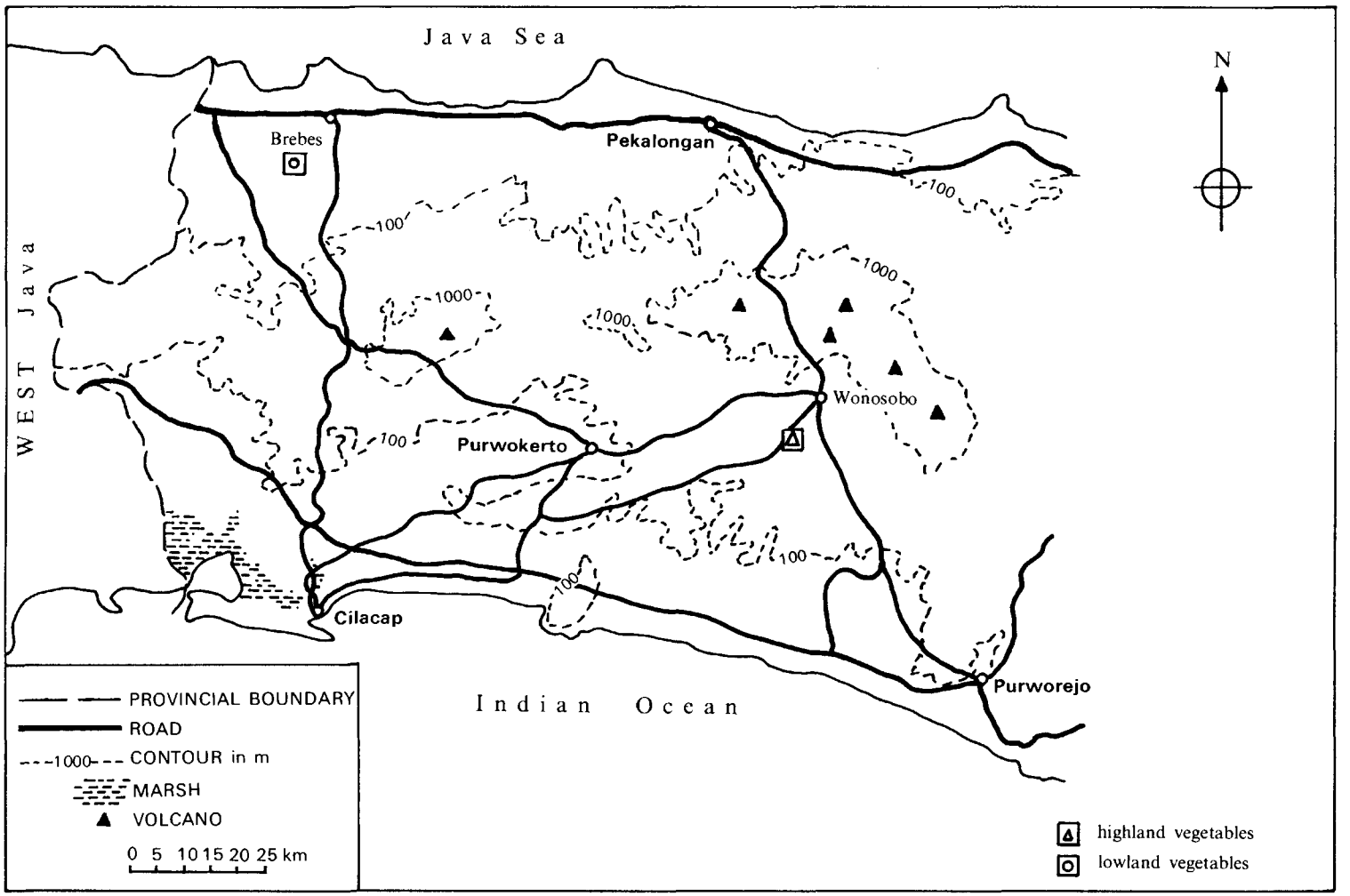

Figure 1.2 Potato production area in Central Java.

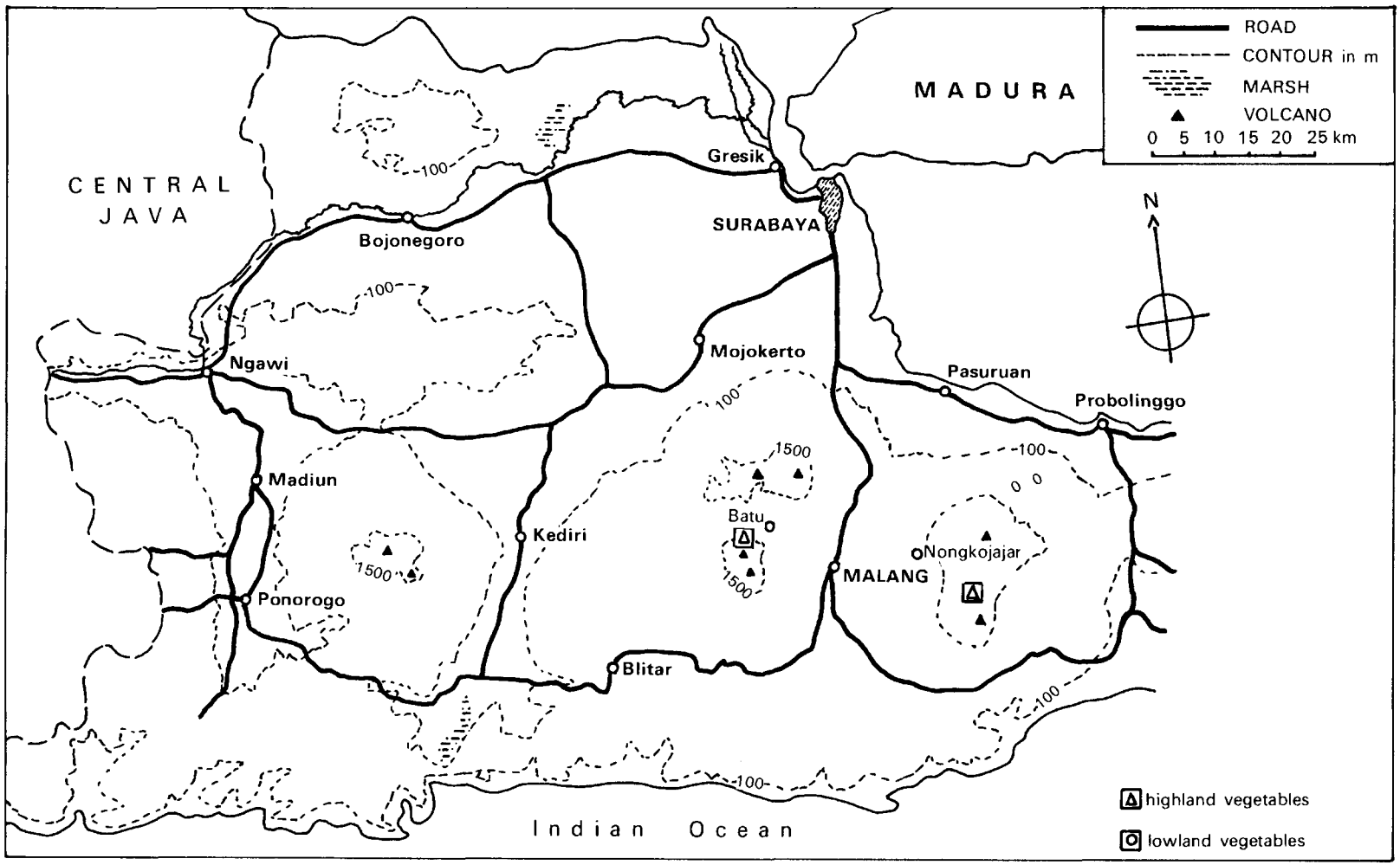

Figure 1.3 Potato production area in East Java.

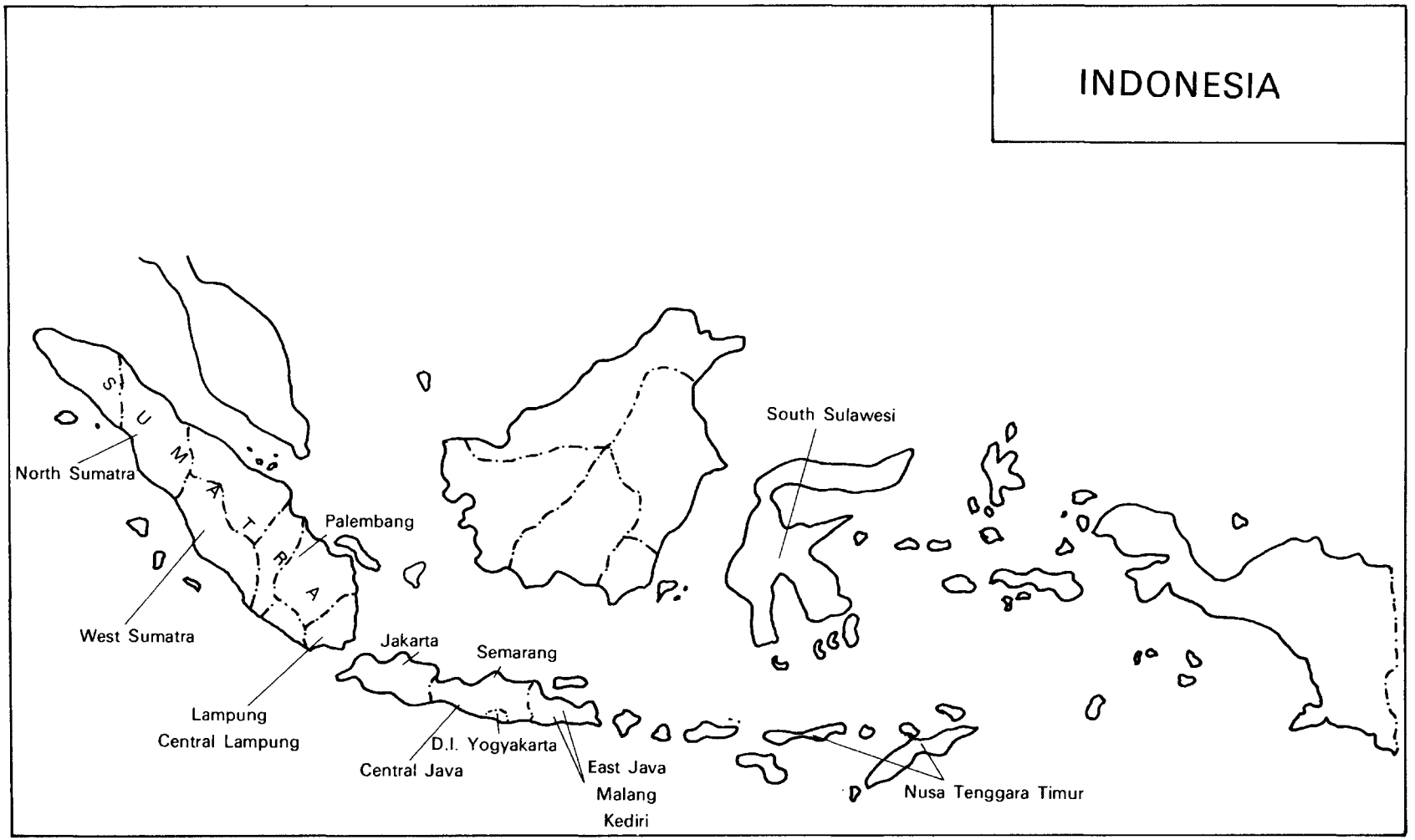

Figure 1.4 Map of Indonesia.

2

Research on Medium Altitude Potato in Indonesia

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Summary

Although this review of research on m.a. potato in Indonesia is not complete because of the omission of important issues such as pest and disease control, seed production and storage, several intermediate conclusions can be formulated. On the basis of recommended and improved varieties, such as Cipanas, Cosima, LT-2, and DTO-33, yield potential is promising. This has tentatively been confirmed in one location by on-farm research and in a small adoption programme. The results of the variety trials show high variability both in the course of time as well as in different locations. At this point it is not yet appropriate to speak of proven yield potential in different areas. In one adoption programme farmers achieved yields of 8-16 t/ha. However, some variety trials showed results of around 5 t/ha, whereas others conducted in the early phase of Southeast Asian Programme for Potato Research and Development (SAPPRAD) showed results which were much higher, around 25 t/ha.

With the introduction of new varieties a rather capital intensive way of production has to be introduced as well, which is essentially different from existing practices in m.a. potato and competing crops. The general stage of development of improved m.a. potato in Indonesia appears to be in transition from the establishment of yield potential through variety tests to a phase of on-farm research. Of vital importance is tuber size of m.a. potato, in order to identify its place in the market.

Research on medium altitude potato

In tropical areas potato is generally grown at higher elevation than other major food crops. Variability in soil and climate are reasons for variable yields. The often isolated location of highland areas has caused public and private investments to lag behind investments in accessible, lowland areas. Since the second World War, potato has become increasingly important in lowland and m.a. areas. High-yielding and early-maturing varieties have been developed and come into use. At present important lowland potato areas are located in the Indo-Gangetic plain (Bangladesh, Pakistan, India), Egypt, the Red River delta in Vietnam, southern China, Cuba and the Peruvian coast. (Horton 1987, pp. 123-124).

Horton (1987) indicates that in general, seed production is a problem in lowland areas because of institutional and technical reasons, while potato storage is difficult as well. However, in symbiosis with nearby highland areas, successful seed production programmes have been developed, such as in the 1960s in Mexico. In India, an effective lowland seed production system was developed, reducing costs of seed, which was originally transported from hilly areas. Seed is generally the most important

component in the cost of production of lowland potato, also because seeding rates are relatively high. Ingenious storing techniques have further contributed to the growing popularity of potato in the above mentioned areas. Potato processing using lowland potato has not developed significantly.

In Indonesia, an interesting situation occurs in Java because of the relatively well-developed road network connecting highland potato growing areas and the m.a. areas to urban centres. In Indonesia, potato which elsewhere has been classified as lowland potato, shows potentially good prospects in m.a. areas from 300 to 800 m. It must be indicated that the terms lowland and m.a. potato should not be taken literally but that they refer to areas with more or less appropriate temperatures for the newly-developed varieties referred to earlier as lowland potato.

Since the 1970s a substantial number of studies have been implemented in Indonesia. By and large, research focused almost exclusively on highland potato until 1980. In 1980 the Third International Symposium on Potato Production for the Southeast Asian and the Pacific regions took place in Bandung, Indonesia, sponsored jointly by AARD/the Ministry of Agriculture and CIP. In 1982 a workshop on the Agronomy of Potato was organized inventorizing the state-of-the-art of potato research, (Lokakarya Agronomi Kentang, SAPPRAD. Lembang, 22-24 December 1982). In the same year, a research thrust on m.a. potato was initiated.

Many studies have been done on m.a. potato in the framework of SAPPRAD by national staff of LEHRI and CRIH. The SAPPRAD project, funded by the Australian Government, is implemented with assistance from CIP.

Research on m.a. potato has taken place since 1982 and has covered a wide range of issues all dealing with various aspects of production. Within the regional project, Indonesia's thrust is directed towards agronomy, while other participating countries are focusing research on breeding, seed, storage, utilization, and seed production.

This means that a full review of m.a. potato research would have to be regional. This section will be limited to a brief review of the main agronomic findings because these are directly relevant to estimations of costs of production and benefit-cost ratios of m.a. potato. Other issues such as seed production, storage and utilization are of course equally important in an integrated commodity system. Since m.a. potato has not yet developed commercially, these issues will not be reviewed here. In our discussion we will look at agronomic practices, case studies and yield performances of several varieties.

I wish to emphasize that research on m.a. and highland potato has covered primarily the major traditional production centres located in West Java, and to a limited extent production areas in Central and East Java. A substantial number of variety tests have been conducted, which reflect the rather early stage of development of m.a. potato in Indonesia.

General agronomic practices

At medium altitude the recommended planting areas such as periodically flooded soils after rice, well-drained soils or sandy soils under weed-free crops such as sugarcane, have a low incidence of bacterial wilt. The best planting time in Java was found to be the beginning of the dry season (May-July), or when the minimum temperature is not higher than 20°C. Preferred varieties are: DTO-33, Cosima, LT-2, and Cipanas. Mulching is recommended to lower soil temperature, fertilizers are

applied at planting at 150-200 kg N/ha, 120-180 kg P_2O_5/ha, 100 kg K_2O/ha or 1000 kg NPK/ha (15-15-15) and cattle manure at 20 t/ha, goat manure at 15 t/ha, or chicken manure at 10 t/ha. Plants are harvested in 80 days (Kusumo et al. 1987).

Variety tests

Variety tests executed in 1982 and 1983 show experimental yields ranging between 20 and 45 t/ha. In 1982 variety tests showed yields ranging from 15 to 30 t/ha (App. Tables 2.1 and 2.2). In 1984 at the same location the yield varied from 6 to 24 t/ha (App. Table 2.3). In general it seems that Cipanas came out as the preferred variety because of good taste and consumer preference.

In 1985 yield performance was tested at different altitudes in farm fields (Asandhi 1987). As can be seen from Table 2.1 yields were rather low. It is assumed that the late planting time (September) was the main cause. It was concluded that individual varieties have different reactions to variations in altitude and temperature. Cipanas was concluded to be a fitting variety for altitudes over 500 m, while at lower altitudes, DTO-28, Cosima, TD 84-166 and Aquilla, are more fitting.

Table 2.1 The average yield of five varieties of potato grown at different locations, 1985.

Variety	Yield (t/ha)			
	Kepanjen 300 m	Gondanglegi 400 m	Lawang 500 m	Dau 600 m
Aquilla	5.05 bc	5.51 bc	5.85 cd	11.56 i
Cipanas	4.07 ab	4.11 ab	3.67 a	13.00 j
Cosima	5.31 bc	5.09 bc	5.20 bc	8.88 g
DTO-28	6.86 de	7.42 f	7.29 ef	8.99 g
TD 84-166	5.53 c	8.45 f	5.59 c	10.32 h

Source: Asandhi, A. A. et al. 1987. Yield performance of five varieties of potato at different altitudes.
Note: Means followed by the same letter are not significantly different according to DMRT at 5% level.

Kusumo and Subijanto (1987) conducted multi-location trials on the same varieties in the period May-October 1986. Yields were considerably higher than the 1985 trials, ranging between 10 and 20 t/ha (Table 2.2). The difference with the results of 1985 may be explained by the difference in planting time. In East Java planting was done in July, while in Central Java planting was done in June and July.

On-farm variety trials conducted in East and Central Java in 1985, indicate a similar variation in yield, while no conclusive evidence concerning the optimum planting period can be identified (App. Tables 2.6, 2.7).

The results of intercropping shallot with potato (App. Tables 2.8 and 2.9) are fairly homogeneous, with potato yields ranging from 8 to 22 t/ha in Central Java and from 13 to 23 t/ha in East Java. The variations in the yields of shallot are so vast that the analysis of the exercise should take into account more information.

Results of the Indonesian variety trials can be compared with elevation trials performed in Western Samoa (Broz 1987). In a variety trial executed at three different altitudes, Broz found yields ranging from 7 to 33 t at 100 m, from 5 to 32 t at 350 m and from 8 to 30 t at 800 m. Promising cultivars were Red Pontiac, Sequoia, B71-420.2., LT-1, LT-4, Serrana, and Cosima. The variability in variety trials was rather larger in Western Samoa than in Indonesia. It is clear, however, that altitude by itself does not influence yield of m.a. potato.

Table 2.2 Yield (t/ha) of 4 varieties at 8 locations in 1986.

Varieties	East Java				Central Java				Average
	Gondang-legi 400 m	Blitar 400 m	Lawang 500 m	Turen 500 m	Mage-lang 400 m	Karang-anyar 400 m	Tegal 400 m	Yogya 500 m	
Cipanas	19.31 a	14.22 b	20.45 b	11.67 b	24.67 b	12.59 b	13.03 b	15.56 a	16.44
Aquilla	10.91 b	7.65 c	19.76 b	12.93 b	23.18 b	26.59 a	12.23 bc	16.36 a	16.20
DTO-28	20.87 a	27.43 a	27.26 a	23.37 a	31.02 a	15.90 b	16.93 a	18.46 a	22.65
LT-2	18.19 a	17.80 b	25.71 b	16.52 b	19.21 c	4.61 c	10.37 c	17.76 a	16.27
Average	17.32	16.78	23.30	16.12	24.52	14.92	13.14	17.04	17.89
CV 6%	16.75	8.56	13.04	18.08	13.36	17.48	9.76	26.08	
LSD 5%	5.79	2.87	6.07	5.82	6.53	5.21	2.56	13.94	
1%	8.78	4.34	9.19	8.82	9.90	7.90	3.88	28.30	

Source: Kusumo, S. and Subiyanto. 1987.

It seems that the yield variability of varieties selected for the trials is rather too large. The vital issue of planting time may need further confirmation. At present the reported optimal planting time of June-July offers an opportunity to profit from the price peak occurring in the period June-August, for highland potato.

As a general conclusion it can be stated that m.a. potato shows promising yield potential of somewhere between 10 and 20 t/ha. It can also be concluded from the rather high variability of yield results, that factors such as planting time, early or late rains and local factors are significant in determining yield potential.

Tuber size and quality

It is of vital importance to establish more clearly the proportions of the various quality grades of the selected varieties. Class A (3-10 tubers/kg) fetches a high price, while class C (20-30 tubers/kg) fetches 40% less.

Widjajanto (App. Table 2.4) reported that an average of 36% of large tubers, 37% of medium tubers and 26% of small tubers was obtained. Of the selected varieties 44% of DTO-33 consisted of large tubers. These results may not be a good indication because the trial suffered from late blight stress. It is not clear whether the classes of large, medium and small size tuber conform to the commercial grading system.

The results of the trial presented in App. Tables 2.4 and 2.6 are clearer: the average tuber weight is 51 g, which places the average in class C. It should be further researched to determine whether the recommended varieties of DTO-33, Cosima, LT-2 and Cipanas produce tubers of sufficient size or whether performance can be improved. Cipanas produced tubers of 26 to 32 g and Cosima did slightly better with 41 to 44 g. Commercially Cipanas would fall in the lowest grade, while Cosima would just make class C. However, it is the proportion which is important, and data are not sufficient to draw conclusions on this very important issue.

On-farm research

In a case study conducted in the area of Magelang, Basuki (1987) found yields of 16 t/ha for Cipanas, 14 t/ha for Aquilla, 23 t/ha DTO-28, and 10 t/ha for DTO-33. These results were achieved by farmers participating in an adoption programme. The

altitude of the area is approximately 400 m. Non-participant farmers achieved yields averaging 3 t/ha using a local variety, possibly, degenerated Eigenheimer. Basuki found net returns per ha based on the above yields, of Rp 1.7 million for Cipanas, Rp 1.2 million for Aquilla, Rp 0.8 million for DTO-28, and Rp 0.5 million for DTO-33. Non-participant farmers apparently lost Rp 0.3 million. It should be indicated that in the calculation, costs of labour were calculated to be cash costs. However, in the situation of small farmers, labour is supplied by household members, so in reality households get a positive return for their labour. For detailed structures of the costs of production (App. Tables 2.10, 2.11, 2.12, and 2.13). Note that Basuki's report of high costs of production of non-adopters, is actually based on the national recommendation package.

A sensitivity analysis, based on the costs of production using the recommended practices (App. Table 2.15) in which yield varies from 4 to 16 t and prices from Rp 100 to Rp 400, indicates that at the most likely price levels of Rp 150 to Rp 250 (quality level: 20-30 tubers/kg), yields of 8 t generate a positive household income at a price level of Rp 150. Prices of Rp 250 require yields of over 5 t to generate a positive household income. However, the magnitude of cash inputs is such that at those yield levels farmers may not be willing to risk their scarce capital.

While a sensitivity analysis based on high inputs in m.a. potato is a hypothetical exercise, comparison with a sensitivity analysis of highland potato clearly indicates that highland potato production is financially a better proposition primarily because of the larger proportion of higher grade potato produced.

The difference in input required between traditional m.a. potato growers and the participants is striking. From an economic and farm management point of view we are dealing with a totally new crop in discussing the potential of newly developed m.a. varieties in relation to farmers' established practices. The costs of production of recommended varieties in m.a. areas are similar to the costs of production of highland potato.

Highland potato

In 1979, Moll (1980) estimated small-scale potato production yield to be approximately 11 t/ha at a value of Rp 1.2 million (1979: Rp 625 = US$ 1; for comparison 1988: Rp 1,700 = US$ 1). Total costs of production were estimated at Rp 0.89 million leaving a gross margin of Rp 0.3 million (App. Table 2.13). The average farm size in highland conditions was approximately 5000 m^2 with the majority of farms between 0.25 and 0.5 ha.

Soemarsono (1983) conducted excellent on-farm research in 1980-1981 in the area of Batu near Malang, East Java. The results indicate that when using high inputs under well-managed conditions, the yield of highland potato fluctuates considerably in time and that net returns are very sensitive to both prices and yield (Table 2.3 and App. Table 2.15).

Extremely important are the significant differences in price between the various grades of produce.

As shown in Table 2.4, approximately 50% of the tubers are classified as large, while 35% of the tubers are of medium size, 15% of the tubers are small.

M.a. potato production usually falls in the class C-B, which fetched prices 30 to 70% lower than assembly prices for highland potato in 1980/1981.

Table 2.3 Highland production trials, 1980-1981, Batu, Malang. Variety Ketela, area 0.1 ha.

Variety Ketela, area 0.1 ha Planting time	Oct. 1980	Nov. 1980	Dec. 1980	Jan. 1981	Feb. 1981	Mar. 1981	Apr. 1981	May 1981
Production cost (Rp)	195,000	181,000	183,000	194,000	196,000	180,000	185,000	177,000
Yield (kg)	1,326	1,047	1,619	1,250	1,843	2,015	1,448	1,465
Price (Rp):								
A	140	160	180	175	250	285	200	195
B	110	115	145	120	200	230	130	150
C	100	85	65	40	150	140	80	75
Gross return (Rp)	161,000	134,000	257,000	158,000	401,000	493,000	228,000	216,000
Net return (Rp)	-34,000	-47,000	74,000	-36,000	205,000	313,000	43,000	39,000

Source: Soemarsono, S. 1983.

Table 2.4 Highland production trials, 1980-1981, Batu, Malang. Proportion of qualities. Variety Ketela, area 0.1 ha.

Quality	Month																Average (%)
	Oct.	%	Nov.	%	Dec.	%	Jan.	%	Feb.	%	Mar.	%	Apr.	%	May	%	
Large	616	46	454	43	864	53	423	34	986	53	1,093	54	781	54	549	37	48
Medium	506	38	389	37	524	32	549	44	558	30	590	29	425	29	536	37	34
Small	173	13	173	17	199	12	232	19	234	13	273	14	157	11	345	24	15
Damaged	32	2	32	3	33	2	46	4	65	4	59	3	85	6	35	2	3
	1,326		1,047		1,619		1,250		1,843		2,015		1,448		1,465		

Source: Soemarsono, S. 1983.

Soemarsono's findings indicate that during the production peak, (February-March 1981) the proportion of large-sized tubers was high at over 50%, while the proportion was lower than 50% in the non-peak months. These proportions are of vital significance in calculating farm profit.

3

Production

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Summary

Production of potato in Indonesia increased rapidly in the period 1968 to 1987 from 70,000 t/year to 420,000 t/year. Substantial fluctuations occurred in the years 1970, 1975 and 1976 and 1982. In 1982 production was 170,000 t and in the years 1983 to 1987 production more than doubled.

Traditionally, West Java has been the major production centre for highland potato. In 1981 the proportion of national production from West Java decreased from over 60% to slightly less than 50% to remain constant at that level. The proportion of national production from Sumatra increased from 15% to about 23% in the period 1980-1982 because of significant production increases in the province of West Sumatra. However, West Sumatra production declined sharply in the years 1983 and onwards causing the proportion from Sumatra to decrease to 15% in 1984. In 1986 the proportion from Sumatra reached 20% of the total national production, because of continued production increases in the province of North Sumatra. The proportion of national production from Central Java showed an increase from approximately 7% in 1980 to 18% in 1985 because of the rapidly expanding production of the Dieng Plateau. East Java slowly increased its proportion from 4% in 1980 to 10% in 1985. As viewed over the period 1980 to 1985, a tendency towards area diversification is shown, while West Java remains the main producer of potato.

Yields of highland potato range from 12 to 14 t in the major production centres. Net returns are highly sensitive to yields and prices. Yield of m.a. potato in traditional circumstances is estimated at 2 to 4 t. Detailed analysis of cost of production indicates that on the basis of average yield in highland areas, farm profits are negative in periods of low prices. However, in situations where household members supply farm labour, as is the case in the small-scale production systems, the household derives a positive return.

Brief history and production systems

According to Heyne (1950), the first reports about potato on Java date from 1750-1775. Of the originally imported varieties only "Kentang Jawa" survives, its origin is unknown.

Potato has been cultivated commercially in Indonesia since around 1920. Initially cultivation took place in a few selected highland areas in West and East Java. It spread in the course of time to other highland areas and was adopted as a complementary vegetable in rural and urban diets.

In 1918 substantial areas were planted with potato in East Java (2800 ha) and in Central Java (1700 ha). Production in West Java was less important at 600 ha. From 1920 onwards the total area under potato in Java ranged from 8,300 to 10,000 ha. Production was equally distributed over West, Central and East Java. Heyne mentions that in a few areas potato was cultivated at 500 m altitude. Two yields per year were reported in highlands.

At present, potato is grown mainly in highland areas and in a few m.a. areas. One can distinguish two basically different systems, with different technologies and in which potato has two different roles.

The most important system is the highland cultivation system in which vast amounts of inputs are used. It is characterized by heavy application of fertilizers: 20-36 t of chicken manure, 500-1000 kg of TSP and Urea, and pesticides such as Vonzodeb (50-70 kg are used per cultivation per ha). This system is labour intensive and requires 400 man-days/ cultivation/ha, and yields 12 to 16 t per harvest. Seed quantities range from 600 to 1000 kg/ha. This production technology is employed by smallholders with average holdings of 0.3 ha, and is applied in two essentially different production systems. In highland environments potato is cultivated as a virtual monocrop with up to four yields per year, sometimes in rotation with cabbage (Dieng Plateau, some areas in Pangalengan) (App. Table 3.2). Potato is also cultivated in a more diverse highland production system where other horticultural crops such as tomato, cabbage, and onions are of equal importance. This production system is prevalent in scattered and relatively isolated highland areas and sometimes in areas where potato has previously been cultivated intensively. Because of the high costs, farmers are not always able to maintain soil fertility and productivity, and consequently they diversify to other crops. It appears that this diversified production system is less capital-intensive than the monocropping system. These two systems produce purely commercial crops for the major consumption centres.

In m.a. areas potato has been grown since the second World War, primarily as a result of farmers' initiatives to broaden their crop range for food. In this system, which produces only for the local market, a low input - low output technology is employed by the growers. Potato here is typically a "catch" crop which can be fitted into rice or maize-based cropping systems. Potato competes with sweet potato, tomato, beans, chilli, watermelon and various other crops in an intricate cropping pattern which may span two years. Nationally this production is of little importance.

National production

Potato in Indonesia is a horticultural commodity. It is traditionally used as an additional vegetable in soups and has lately developed to include french fries. National research and development responsibility for potato is located at the Directorate of Horticulture and in CRIH and LEHRI. Potato in Indonesia can be considered as a true horticultural crop, which is produced mainly in several concentrated highland areas. Potato ranks sixth among the major horticultural commodities (Figure 3.1). Figure 3.1 indicates a fairly steady expansion in harvested areas of onion, cucumber, cabbage, tomato and potato. The behaviour of chilli is rather erratic. The harvested area has increased with a very big jump from 1983 to 1984. Even allowing for imprecise data, it is confirmed by the price data on chilli, that major production and price fluctuations occur. It should be noted that of the six major commodities only

onion, cabbage and potato are grown almost exclusively in highland areas, while production of chilli, cucumber and tomato mainly takes place at medium altitude as well as in lowland. The development of the three highland horticultural commodities confirms a steady expansion in highland area for horticultural commodities.

Figure 3.2 indicates that production of potato has expanded rapidly from 1968 to the present. Around 70% is produced in Java while Sumatra produces 20% of the total production. These two islands, especially Java, play an important role in the potato industry.

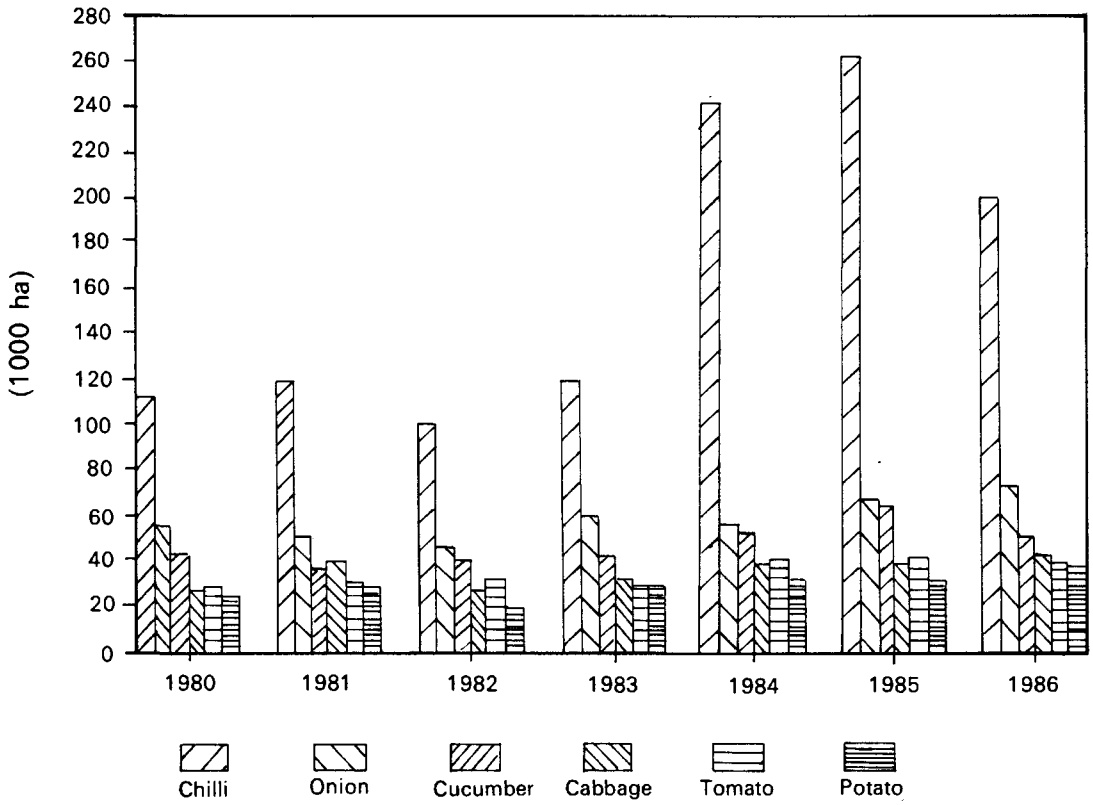

Figure 3.1 Estimated harvested area of six main commodities, 1980-1986.

Note: Estimated area of chilli, cucumber and tomato in 1980, 1981 and 1982 are approximates based on yearly production figures divided by the average yield over the period 1983, 1984, 1985 and 1986.

Nationally, potato production fluctuates quite considerably as shown in Figure 3.2. In recent years, the lowest production was 185,000 t in 1982 and the highest was 470,000 t in 1986.

Because of the large proportion of the national output produced in Java, production shifts as took place in 1981 and 1982 on Java, made themselves felt nationally. It is generally assumed that the low production figure in 1982 was caused by a drought which hit Java in that year and which affected all commodities including rice.

To have a better understanding of the recent development of potato production, we must analyse production data, simultaneously with price series data. At this point a brief analysis may suffice.

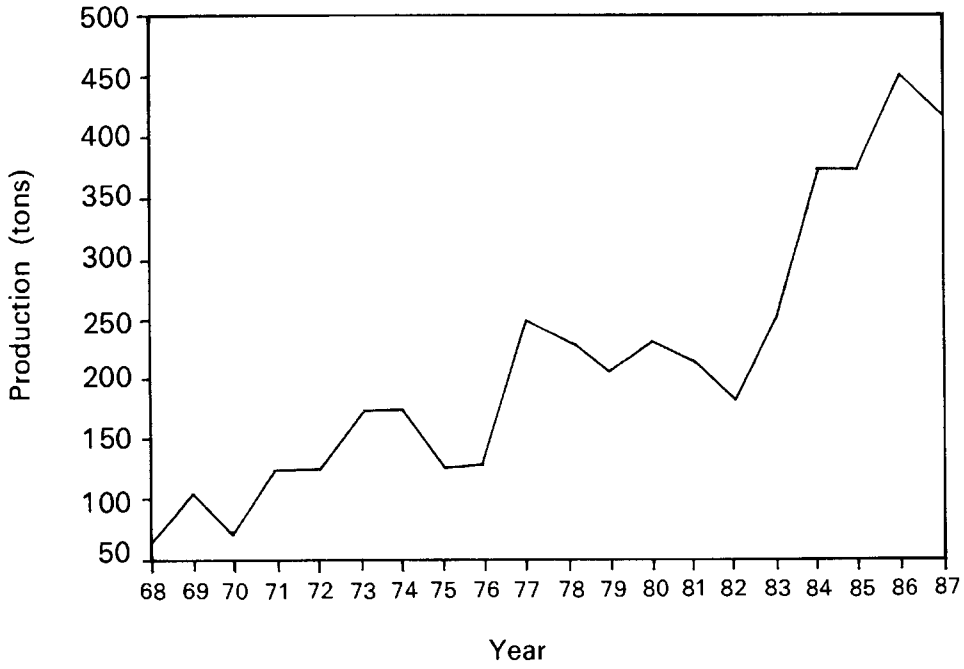

Figure 3.2 Potato production fluctuations, 1968-1987.
Source: Central Bureau of Statistics.

In 1982 Indonesia experienced a long drought and the rainy season began late in November/December. Farmers usually plant potato in October/November and harvest in December/January (usually the time of the lowest price). In December/January 1983 farmers had a bad harvest (late rains) and consequently the price remained quite high. Because of low supply the potato price reached Rp 444/kg in Jakarta in August 1983, the highest price in the last eight years. Generally speaking, this story applies to almost all commodities in Indonesia in 1983. In the case of potato, farmers apparently thought that the potato price in 1984 would remain as high as in 1983. They extended their potato areas. At the same time, Dieng Plateau began to play a more important role in potato production. The result was that the potato price dropped in 1985 to only Rp 282/kg in Jakarta at the usual time of the highest yearly prices in June.

Consequently, in 1985 production came down to the level of 1980. The period 1980-1985 clearly indicated the keenness of producers to profit from high prices, and the impact of production-induced fluctuations on price and production in Indonesia. It would appear, however, that such heavy production-induced fluctuations are not likely to affect national output by so much again because of the continuing area diversification of production.

Area development

The total annual area planted with potato from 1980 to 1985 fluctuated, from nearly 21,000 ha in 1982 to 33,000 ha in 1984. The average of the yearly national harvested area is 27,000 ha.

Lately two Sumatran provinces have emerged as major producers, West Sumatra and North Sumatra, while in Java the province of Central Java has increased its contribution to national production (Table 3.1 and Figure 3.3).

Table 3.1 Potato production, harvested area and yield, Indonesia, 1980-1985.

REGIONS	Items[1]	Years						Average
		1980	1981	1982	1983	1984	1985	
North Sumatra	P (tons)	23664	24950	27381	30082	31311	33491	28465
	A (ha)	1904	1951	2156	2343	2454	2434	2207
	Y (t/ha)	12.43	12.79	12.70	12.84	12.84	15.36	13.16
West Sumatra	P (tons)	11685	15496	10213	14006	20179	20439	15336
	A (ha)	1091	1845	1248	1352	1876	1334	1593
	Y (t/ha)	10.71	84.00	8.18	10.36	10.36	15.36	23.16
Jambi	P (tons)	1805	13676	4696	1881	2110	2210	4396
	A (ha)	420	3425	1347	459	498	521	1112
	Y (t/ha)	4.30	3.99	3.49	4.10	4.24	4.24	3.95
Bengkulu	P (tons)	1084	9830	6432	6161	4334	2546	3590
	A (ha)	172	156	1164	1115	930	974	752
	Y (t/ha)	6.30	6.30	5.53	5.53	4.66	2.61	4.77
Other Sumatra	P (tons)	9314	9694	3987		7912	4412	6373
	A (ha)	664	2155	625		957	669	828
	Y (t/ha)	14.03	4.50	6.38		8.27	6.60	7.70
SUMATRA	Total P (tons)	47552	64799	52709	55847	66046	62007	58161
	Total A (ha)	4251	9532	6540	5361	6715	5729	6355
	Y* (t/ha)	11.19	6.80	8.06	10.42	9.84	10.82	9.15
West Java	P (tons)	141139	94318	74315	111562	175112	132674	87856
	A (ha)	9685	8029	6760	9898	11432	10245	9373
	Y (t/ha)	14.57	11.49	10.98	11.27	15.32	12.95	9.37
Central Java	P (tons)	16325	12340	16002	44214	75444	44215	34757
	A (ha)	2632	2504	2000	4862	6391	4456	3808
	Y (t/ha)	6.20	4.93	8.00	9.09	11.80	9.92	9.13
East Java	P (tons)	11448	7242	8840	19045	41029	24588	18699
	A (ha)	5261	3221	2951	6211	4824	5539	4668
	Y (t/ha)	2.18	2.25	3.00	3.07	8.51	4.44	4.01
Other Java	P (tons)	94	253	84	213	508	668	303
	A (ha)	37	70	33	77	133	134	81
	Y (t/ha)	2.54	3.61	2.55	3.77	3.82	4.99	3.76
JAVA	Total P (tons)	169006	114153	99241	175034	292093	202145	141615
	Total A (ha)	17615	14004	11752	21048	22780	20374	17979
	Y* (t/ha)	9.59	8.15	8.44	8.32	12.82	9.32	7.90
SULAWESI	Total P (tons)	16785	13425	11293	16321	9159	14454	13573
	Total A (ha)	9179	2346	2130	2714	2587	2454	3568
	Y* (t/ha)	1.83	5.72	5.30	6.01	3.54	5.89	3.80
OTHER INDONESIA	Total P (tons)	3042	3017	1558	2784	4248	4658	3218
	Total A (ha)	605	722	574	1182	948	803	806
	Y* (t/ha)	5.03	4.18	2.71	2.36	4.48	5.80	3.99
INDONESIA	Total P (tons)	236385	195394	164801	249986	371546	283264	216566
	Total A (ha)	24450	26604	20996	30305	33030	29360	28658
	Y* (t/ha)	9.67	7.34	7.85	8.25	11.25	9.65	7.56

Source: Directorate General for Food Crops, 1986.

[1]P: Production; A: Area harvested; Y: Yield; Y^*: $\frac{\text{Total P}}{\text{Total A}}$

Note: In some years and provinces there are significant differences between CBS and the above data. In particular the categories "Other Sumatra" and "Other Java" are considered to be unreliable.

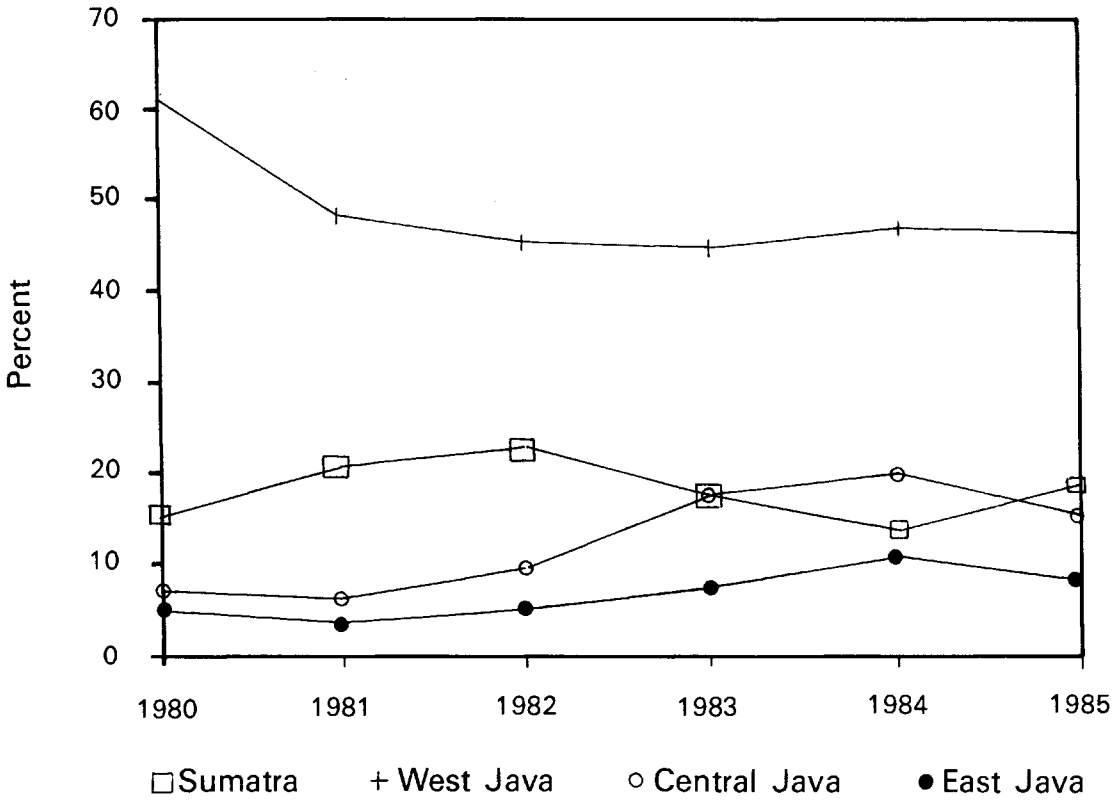

Figure 3.3 Proportional contribution of regional production to national production, 1980-1985.

The development of harvested areas in the regions shows that Sumatra, especially the provinces of Jambi and West Sumatra, significantly increased its contribution to the national area harvested since 1981 (Table 3.1). The total area cultivated with potato in Sumatra was 4,251 ha in 1980 and doubled to 9,532 ha in the next year.

The huge increase in potato production in Jambi and West Sumatra in the period of 1980 to 1981 took place mainly because the accessibility of these two provinces increased significantly. After completion of the trans-Sumatra highway in 1980, these two provinces gained good access to other provinces in Sumatra and to Java, and to the most important consumption centres. In the Kerinci mountains around Sungaipenuh in Jambi, about 3,500 ha of land was planted to potato in 1981. It meant an increase of 750% in the harvested area in Jambi compared with the 1980 situation of 420 ha. The farmers apparently thought they could expect high incomes from potato cultivation. However, probably because of low yields of 3 to 4 t/ha, farmers lost interest. Since this large increase in potato production in 1981, production dropped sharply to pre-1981 levels.

From 1982 to 1983 Central Java doubled its area planted with potato. Central Java increased its area from 2,000 ha in 1982 to 4,862 ha in 1983. At the same time East Java increased its area from 2,951 to 6,211 ha. The increase in the East Java harvested area is due mainly to the development of Sumber Brantas and its surrounding area north of Batu, a traditional potato production area in East Java. After this rapid expansion the area fell to 5,539 ha in 1985.

From 1983 to 1984 the potato area in Central Java developed at the same pace as the year before (in 1984 the harvested area in Central Java was 6,391 ha). This consistent expansion of the potato area in Central Java (more than 200% increase in two years) is unparalleled in the history of Indonesian potato production. The Dieng Plateau area of Central Java is one of the emerging potato production centres of the last four years. Table 3.2 shows the expansion of the Wonosobo area, which covers part of the Dieng Plateau.

Table 3.2 Area development in Wonosobo, Central Java (Dieng area, partly). **(ha)**

Commodity	Area harvested						
	1980	1981	1982	1983	1984	1985[1]	1986[1]
1. Potato	643	923	852	1,401	961	1,143	1,493
2. French bean	855	428	446	827	1,342	-	-
3. Garlic	221	245	154	273	870	766	1,433
4. Cabbage	875	736	726	1,023	1,013	784	1,815
5. Chilli	519	561	266	430	1,422	-	-
6. Shallot	276	232	241	285	372	431	299
7. Mustard greens	410	342	361	416	579	357	353
8. Tomato	132	34	14	64	112	-	-

Source: Dinas Pertanian Kab. Wonosobo, 1986.
[1]CBS, 1987.

Pigeonpea (*kacang gude*), tobacco, maize and a local variety of potato have been grown on the Dieng Plateau for a long time. A new variety of potato seed (Granola) and more intensive cultural techniques were introduced by West Java potato traders in 1980. At that time some of the West Java traders realized that the potato supply from Pangalengan and other areas in West Java was not sufficient to meet the increase in demand. Investment was needed to expand their sources, because they realized that the potato yield in Pangalengan had begun to decrease, while the eruption of Mount Galunggung (April 1982) made quite a large farm area in West Java, especially in Garut and Pangalengan where vegetables and potatoes were cultivated, unsuitable for production for several months.

The West Java potato traders and the local farmers co-operated in potato production. The traders provided quality seed and advice in cultural technique to the farmers and channelled the farmers' produce. They managed to establish Dieng as a major potato production centre in two years.

Since 1983, the main crop of the Dieng Plateau has been potato and Dieng has become one of the important potato production centres in Indonesia. Dieng sends its produce mainly to Central and West Java consumption centres. Sometimes, Dieng traders receive orders from the inter-island traders, so that Dieng assembly traders have organized shipments to Kalimantan. They also export through agents in Semarang, to Singapore or Malaysia. At present, besides potato as the main crop, farmers also cultivate cabbage, garlic, asparagus and mushrooms as shown in Table 3.2. The last two crops are produced by farmers in co-operation with PT Mantrust. PT Mantrust provides credit for farmers and handles the asparagus and mushrooms for further processing and marketing (mainly for export).

Since 1983, the area under potato in North Sumatra has expanded rapidly, mainly because of the rapid extension of potato cultivation in the Karo regency. Since 90% of

potato exported to Penang and Singapore originates in North Sumatra, area and production development in North Sumatra is basically export-driven development. This is contrary to the case of Jambi, where after an initial rapid expansion, production declined. In North Sumatra the necessary pre-conditions for commercialization and production expansion seem to be present. It has been reported that further expansion of highland areas for horticultural commodities is still possible (Table 3.3).

Table 3.3 Area development in Tanah Karo. **(ha)**

Commodity	Area harvested						
	1980	1981	1982	1983	1984	1985	1986
1. Potato	-	516	506	1,127	792	-	1,366
2. French bean	-	184	302	373	233	-	412
3. Garlic	-	83	65	207	102	-	244
4. Cabbage	-	539	479	1,120	801	-	1,360
5. Chilli	-	716	936	606	686	-	1,354
6. Shallot	-	84	142	107	115	-	357
7. Mustard greens	-	341	289	393	216	-	316
8. Tomato	-	411	436	592	408	-	620

Source: Dinas Pertanian Kab. Karo, 1987.

Because of the increased area diversification, the magnitude of the fluctuation in national production is assumed to have decreased. Statistical proof cannot yet be given. Although in 1980, 61% of the national production came from one agricultural zone (West Java highlands), in 1985, 45% was produced by West Java, with an equal quantity being produced in four different areas: Central Java, North Sumatra, East Java and West Sumatra. With the present spatial structure of production, a local drought is certainly less likely to affect national production as dramatically as in 1982-1983.

Yield development

The average land productivity of potato is low and fluctuates year by year. The national yield between 1980 and 1985 varied from 7,345 t/ha in 1981 to 11,249 t in 1984 (Table 3.1). The average yield for this period was 8.9 t compared with 20-30 t under appropriate application of agricultural practices (Asandhi 1987).

The highest and most stable yields are obtained in North Sumatra and West Java. Yields in North Sumatra are stable (12.43 t in 1980 to 15.36 t in 1984), with an average of 13.16 t. The West Java yield fluctuates more than the North Sumatra yield, the lowest being 11.05 t (1982) and the highest, 15.32 t (1984). The average yield for West Java is 12.44 t. The average yield in West Sumatra province is 10.56 t, making West Sumatra the third highest yielding region in Indonesia.

It seems not unlikely that yields have been under-reported in the recent past. In some areas in East Java potato has been a cash crop as of old, whereas the yields quoted seem too low. Several years ago, large quantities of potato sales may have escaped registration because traders often pick up the crop directly from the farmers' fields. The yield for the rest of Indonesia is very low. The average yield in the other regions is less than 6 t (Table 3.1). The yield in Central Java has been increasing since 1982 when the Dieng Plateau came into real production.

In Figure 3.4 yield developments of the main production areas are depicted.

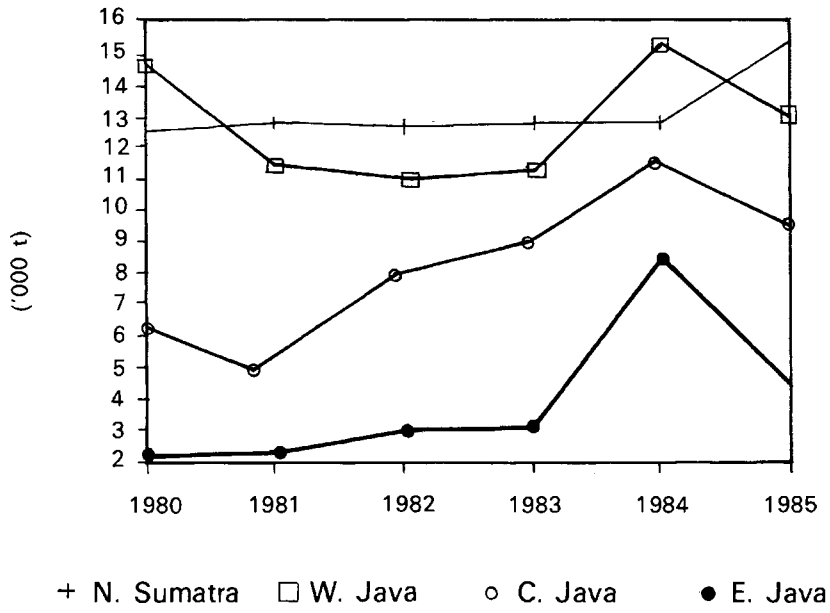

Figure 3.4 Yield development of four major production areas, 1980-1985.

Annual average yields seem to have become more stable with an upward trend. This can be regarded as a clear indication of the increasing commercialization of potato cultivation in the major highland potato areas. It is especially interesting to note the good performance of Sumatra in yield development.

Production costs and profitability

Regarding production costs and profitability, existing data sets do not yet cover a large variety of situations and levels of farm technology. To be able to differentiate between potato production in highland and m.a. areas, primary data were collected in an m.a. potato area, Magelang. Because comparative data are available regarding highland potato production we will first discuss highland costs of production and profitability.

In Table 3.4, four different highland locations are reflected. The fact that the figures regarding the village of Ngablak are based on only four respondents should not discourage their use. The data were generated in in-depth interviews in the presence of experienced key-informants, and it soon became clear that there was very little variation in technology and cost of production between growers in the same district.

There appears to be little variation in input between the four locations. It is clear that highland potato growers are commercial growers and are not afraid of investment. Some variations exist in labour input and the use of stable manure. Yields reach levels of 12 to 16 t and are at slight variance with the West Java and Central Java yields. The locations in West Java do not reach the provincial averages in their respective years, while the locations in Central Java yielded considerably higher than the provincial average.

Table 3.4 Highland input-output relationships of potato per hectare.

Inputs	West Java		Central Java	
	Ciwidey n = 35[a]	Sukabumi n = 38[b]	Dieng n = 26[c]	Ngablak n = 4[d]
1. Seed (kg)	1013	800	1218	1006
2. Stable manure (t)	20.3	8.1	36.6	36.6
3. Fertilizer (kg)				
TSP	494	-	-	446
Urea	565	-	-	534
Total	1059	864	1147	980
4. Labour (man-days)				
Family	63	91	-	160
Hired	250	361	-	114
Total	313	452	424	274
5. Pesticide (kg Vondozeb)	102	67	70	55
Yield (t/ha)	12.1	11.4	16.4	12.5

Sources: [a]Adiyoga 1984, [b]Adiyoga and Ameriana 1985, [c]Koesmawardani 1983, [d]Primary data CGPRT 1987.

Highland potato growing is a capital intensive farm business. Purchase of seed and pesticides, and costs of labour make up substantial investments (Table 3.5).

Assuming that the physical relationship between input and output of potato production is constant in the period 1983-1987, using four sets of data (Table 3.4), the estimation of gross margin and profit from potato production yielding 13 t/ha, is shown in Table 3.5.

Table 3.5 Gross margin and profit of highland potato production, 1987.

Item	Quantity (unit)	Price (Rp/unit)	Value (Rp '000)
Yield	13	-	-
Price	-	180	-
Gross output	-	-	2340.00
Costs:			
Seed (kg)	986	700	690.20
Stable manure (t)	20.5	10000	205.00
Fertilizer (kg TSP + Urea)	1006	130	130.78
Pesticide (kg Vondozeb)	79	6200	489.80
Gross margin			+ 824.22
Other costs:			
Total labour (Man-days)	390	1500	585.00
Land rent (4 months)			200.00
Capital interest (5% per 4 months)			115.00
Profit			− 75.78

Notes: Input prices 1987 (Input prices data from Balithot Lembang and other sources, in 1987), selling in January-March 1987 (Output price is monthly average of assembly price in centre of production in West Java from January to March 1987).

Table 3.5 shows a negative profit for highland potato taking into account land rent and capital interest. Calculations were based on a yield of 13 t and Rp 180/kg.

The negative profit should serve as an indication of the sensitivity to yield and price.

The profitability of potato production is very sensitive to yield and output price. As indicated earlier in Table 3.3, the yields of potato in the regions in Indonesia normally range from 3 to 15 t/ha.

It can be inferred from Table 3.6 assuming a 13 t yield, that even at the lowest price the household still generates a modest income, while a commercial farm would make a loss. It is clear that commercial potato farming at present yield levels does not make a profit the year round. This is confirmed by the findings of Soemarsono, as reported in Chapter 2. Much depends on the proportion of grade A production.

Table 3.6 Sensitivity of gross margin to price and yield of highland potato.

Price	Yield							
	6	8	10	12	14	16	18	20
150	-0.97	-0.67	-0.37	-0.07	0.23	0.53	0.83	1.13
200	-0.67	-0.27	0.13	0.53	0.93	1.33	1.73	2.13
250	-0.37	0.13	0.63	1.13	1.63	2.13	2.63	3.13
300	-0.07	0.53	1.13	1.73	2.33	2.93	3.53	4.13
350	0.23	0.93	1.63	2.33	3.03	3.73	4.43	5.13
400	0.53	1.33	2.13	2.93	3.73	4.53	5.33	6.13

Notes: Production cost as in Table 3.8 = Rp 1.87 million.
Hired labour as 65% of total labour cost.
Prices reflect both different prices for the different grades as well as seasonal fluctuations.

Table 3.7 shows the approximate gross margin and profit for potato in m.a. areas and highland environments. Cultivating m.a. potato is less capital intensive than highland potato. Yields are also considerably lower at approximately 4 t.

Production systems yielding around 4 t of potato per ha in a sustainable manner do exist. They occur in m.a. areas where potato is one of the many crops after rice or maize. M.a. potato as a monocrop does not exist, which may explain why it has not enjoyed much recognition. Inputs in low-yielding potato production are low relative to highland systems, and are used in small quantities.

The budget analysis above shows two extreme conditions. The first condition includes all possible costs in calculating the profit. Labour required on the farm is treated as though it were all hired, while a rental value of land and capital interest is charged. A large or a commercial farm may use this analysis, but it is not appropriate for a smallholder.[1] The second condition assumes that the land, labour and capital requirements of the farm are supplied by farmers. In this case, the profitability of potato is measured by the gross margin.

At the price of Rp 180/kg, which is the lowest in the season, a positive gross margin will still be obtained even for the low-yielding m.a. potato. But at this price, a commercial farm will make a loss even with a high yield. If the price increases to Rp 275/kg, a yield of 13 t/ha will make a high profit (Table 3.7).

[1] A survey conducted in Garut showed that of 57 potato grower respondents, 90% were small farmers (< 0.3 ha), of which 86% had their own land and on average about 35% of the total labour requirement was family labour (Adiyoga 1984).

If only 35% "free" family labour is available, then the gross margin for the 13 t crop will decrease to Rp 443,970/ha while for a 4 t crop it becomes Rp 158,250/ha. So, even if farmers have to pay hired labour (about 65% of total labour), the gross margin is still positive.

Table 3.7 Gross margin and profit of medium altitude and highland potato production with different yields and prices, 1987.

Item	Medium altitude	Highland	
	A[a]	B[b]	C
Yield (t/ha)	4	9	13
Price (Rp/kg)	180	180	180
Gross output (Rp '000)	720.00	1620.00	2340.00
Costs (Rp '000):			
Seed (kg)	140.00	540.00	690.00
Stable manure	100.00	150.00	205.00
Fertilizer	52.00	130.00	130.78
Pesticide	26.00	310.00	489.80
Gross margin (Rp '000)	+ 402.00	+ 490.00	+ 824.22
Other costs (Rp '000):			
Total labour	375.00	450.00	585.00
Land rent (4 months)	200.00	200.00	200.00
Capital interest (5% per 4 months)	44.65	89.00	115.00
Profit (Rp '000)	− 217.65	− 249.00	− 75.78
Profit (Price = Rp 275/kg)	+ 217.65	+ 606.00	+ 1159.22)

[a]Estimated from primary data on m.a. potato from Magelang, 1987.
[b]Estimated from Sinaga (1985).

The positive gross margin indicates that in Indonesian smallholder agriculture, production of potato at medium as well as high altitudes, is a valid option. It cannot be concluded from these data that potato production is an attractive option, because comparison with the gross margins of competing crops would be necessary. At a national level, such a comparison does not yield significant conclusions because environmental and technological variations determine true comparative profitability.

It should be noted that in highland areas, farmers in horticulture have been long used to hefty investments, which is not the case in m.a. environments where the relatively large investment in potato production reduces the attraction for growers.

Trend of production costs

In order to show the trend of costs and margins, a certain production technology should be chosen as a basis of analysis. Assuming that the production technology is technically constant, then the level of costs and margins depend only on the prices of inputs and outputs.

Among several inputs used for potato cultivation, the development of the seed price is difficult to follow, apparently because the price of seed depends on quality.

From several data collected at different times and locations, no trend in seed price can be found. So in this analysis, the price of seed is assumed to be stable, while for other inputs (stable manure, fertilizer, pesticide and labour) price trends are reflected. It is realized that in reality, prices of the various qualities of seed fluctuate a lot and may indirectly influence output. Farmers are known to buy seed more in accordance with their financial capacity than with a view to achieving high yields.

Using production technology as in Table 3.5 with 35% free family labour available; with output price data from the Directorate of Horticulture and input prices from Lembang (Table 3.5), the trends of costs and margins of potato production from 1983-1987 are shown in Table 3.8.

Table 3.8 Costs and margins of potato production per hectare, 1983-1987.

Item	1983	1984	1985	1986	1987
Yield (t/ha)	13	13	13	13	13
Price (Rp/kg)	269	193	197	240	230
Gross output (Rp '000)	3497.00	2509.00	2561.00	3120.00	2990.00
Variable costs (Rp '000):					
Seed (986 kg)	690.20	690.20	690.20	690.20	690.20
Stable manure (20.5 t)	164.00	164.00	184.50	184.50	205.00
TSP + Urea (1006 kg)	90.54	110.66	120.72	120.72	130.78
Pesticide (79 kg Vondozeb)	316.00	316.00	316.00	454.25	489.80
Hired labour (65% of total = 234 man-days)	210.60	210.60	234.00	234.00	351.00
Total variable costs	1471.34	1471.46	1545.42	1683.67	1866.78
Gross margin	2025.66	1017.54	1015.58	1436.33	1123.22

The prices of stable manure, fertilizer, pesticide and labour increased from 1983 to 1987. The price of seed remained constant. The costs of potato production increased from 1984 to 1987 on an average of 9% per year. The highest margin was achieved in 1983, and decreased sharply in 1984. This was because the price of potato decreased from Rp 269/kg in 1983 to Rp 193/kg in 1984. From 1984 to 1985, the margin was relatively stable. The margin increased by 40% to Rp 1,436,330 in 1986, and decreased to Rp 1,123,220 in 1987.

Considering that the Indonesian government increased the price of fertilizer from Rp 125/kg to Rp 135/kg in 1987 and has reduced subsidies for pesticides from 75% to 55% since 8 October 1987, it can be predicted that the costs of potato production will still increase. If the price of potato remains relatively stable, the profitability of potato will decrease in the following years. However, the reduced subsidies will also affect other crops, but particularly potato is greatly affected because of the relatively intensive use of fertilizers and chemicals.

We may conclude that although potato production seems feasible in a smallholder setting, there are no strong signs of spontaneous expansion because of the increasing costs of production. Especially in the case of potato, improved technology will be the key factor in development because of the sensitivity to yields and prices.

Conclusions

Potato is cultivated intensively and almost exclusively in highland areas, and until 1980 was concentrated in West Java. In the period 1980-1986, national production expanded to areas in North and West Sumatra, as well as Central and East Java with the effect of stabilizing national production. The major production areas have the highest and the most stable provincial annual yields. Yields in the major production areas are rather low. They range from 10 to 12 t on the average, but an increase in average annual yield is visible. Costs of production are increasing, but potato is a valid option for cropping in highland as well as in medium altitude small farms operating with family labour.

4

Price Development

H. Siregar, Directorate of Horticulture

Summary

In the period 1982-1983 a substantial fluctuation in price was induced by a dry spell, which took place in 1982. The highest prices usually occur in the months of May, June and July, while the lowest prices usually occur in the months of December, January and February. Differences between average seasonal highest and lowest nominal assembly prices range between Rp 50 and 100. There was a slight downward trend in the price differences in the period 1983-1987. Price integration of assembly prices between major production centres and wholesale prices between major consumption centres was quite good, indicated by correlations of between 90 and 95%. Assembly and wholesale prices tracked quite well, suggesting good price linkage between production and consumption centres. Assuming for practical reasons, a monthly inflation rate of 1%, wholesale as well as assembly real prices of potato showed a downward trend in the period 1980-1987. The good price correlation and the fact that real prices are decreasing, suggest that there is good market integration from producer to wholesale trader. However a conclusion regarding market integration has to take into account information included in the chapter on marketing and utilization.

Approach

In Indonesia no true national market in a literal sense exists. Price formation of potato is the result of interplay between supply from the various production centres in the highlands, and the urban consumption centres on the coast. In this section, producer prices or assembly prices in the main production areas are compared with wholesale prices in the main consumption centres. Specific attention is devoted to fluctuations of nominal prices through time, price integration between production centres and consumption centres, and trends in real prices. Since registered prices, relate only to specific highland production areas and specific consumption centres, it should be kept in mind that prices as indicated do not apply directly to potato from m.a. areas.

Potato prices collected and analysed for this study are assembly prices and wholesale prices. Definitions for those price levels are stated below.

Assembly prices

The assembly price is the farmers' selling price to the assembly traders at the production centres. Prices are collected daily (except holidays) by the market authorities by monitoring three to five transactions between traders and farmers or interviewing three to five farmers who sell their potato on trading days.

Wholesale prices

The wholesale price is the wholesale selling price to the sub-wholesaler/retailer at the "central market" in each consumption centre. These prices are also collected daily in the same manner as the assembly prices by the market authorities.

Source of price data

Assembly and wholesale prices are collected from various markets and disseminated to farmers and traders in the programme of the Vegetables Market Information Service. This service is conducted by the Directorate of Food Crops Economics in co-operation with the German Agency for Technical Co-operation (GTZ) (Project code ATA 85/86).

Table 4.1 Start of price data collection in Java.

Province	Area of data collection	Start of data collection
DKI Jakarta	Jakarta Metropolitan Wholesale market (W)	January 1980
West Java	Bandung (W)	May 1983
	Pangalengan (A)	January 1980
	Garut (A)	April 1983
	Ciwidey (A)	May 1983
Central Java	Semarang (W)	January 1981
	Surakarta (W)	May 1983
	Sumberan/Dieng (A)	January 1981
DI Yogyakarta	Yogyakarta (W)	January 1981
East Java	Surabaya (W)	April 1980
	Pujon Mantung (A)	May 1981
	Batu (A)	May 1982

Note: (W): Wholesale prices in consumption centres.
(A): Assembly prices in production centres.

Along with the step by step approach as employed by the project, data collection in the various areas started at different times (Table 4.1).

The assembly and wholesale daily prices of potato for all those areas were collected (until August 1987) and processed into average monthly or weekly prices for further processing and analysis in this study. Based on the purpose of the present study, several analytical tools were used:

1. Graphs of monthly price developments.

2. Variation of monthly price series.

3. Correlation of price developments between the production and consumption centres and among the consumption centres.

4. Since the inflation rate was quite significant, the nominal prices had to be deflated to obtain the real prices in order to achieve a clear picture of price developments.

Since the average yearly inflation rate for food prices for the years 1979-1986 was 12.32% (see App. Table 4.1), this study assumed that the average inflation rate during the time frame (January 1980 to August 1987) was 1% per month. The graphics and correlation of real prices development were also made on this basis.

Price fluctuation and disparity between production and consumption areas

In 1982 an extended dry period had a negative effect on production in Java which caused exceptionally high prices in mid-1982. Potato production in 1983 is assumed to have been affected as well because of corrective overplanting. Later in 1983 even higher prices were recorded after prices reached a low in the beginning of 1983.

Jakarta and West Java

Figures 4.1 (a, b and c) outline the price development for Jakarta, the main consumption centre in Indonesia, and Pangalengan, Ciwidey, and Garut in West Java, its main suppliers of potato.

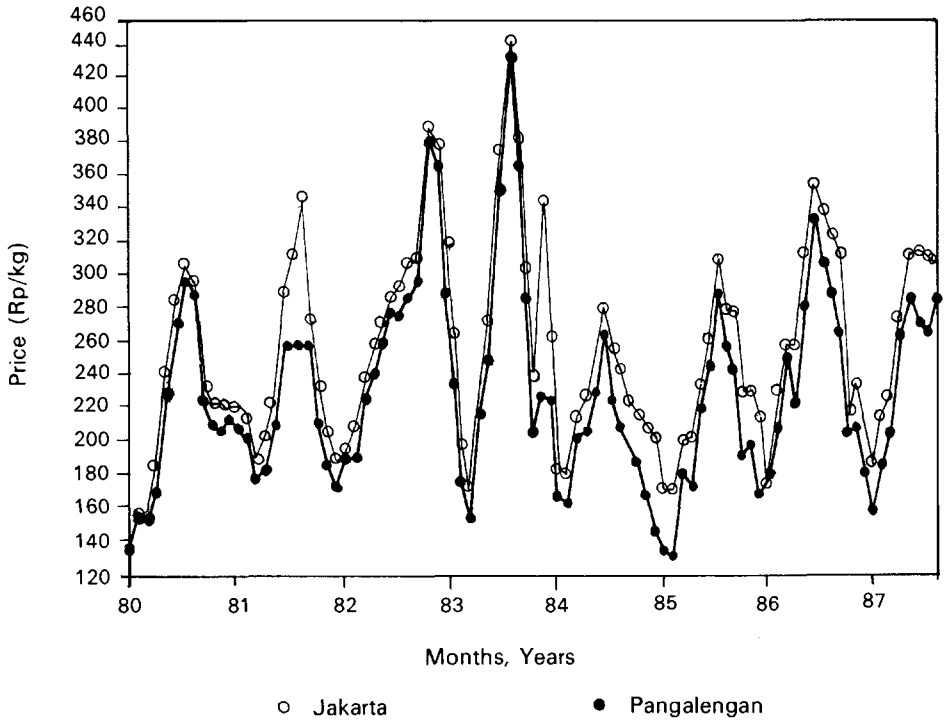

Figure 4.1a Monthly wholesale and assembly prices (nominal) for potato, Jakarta and Pangalengan.

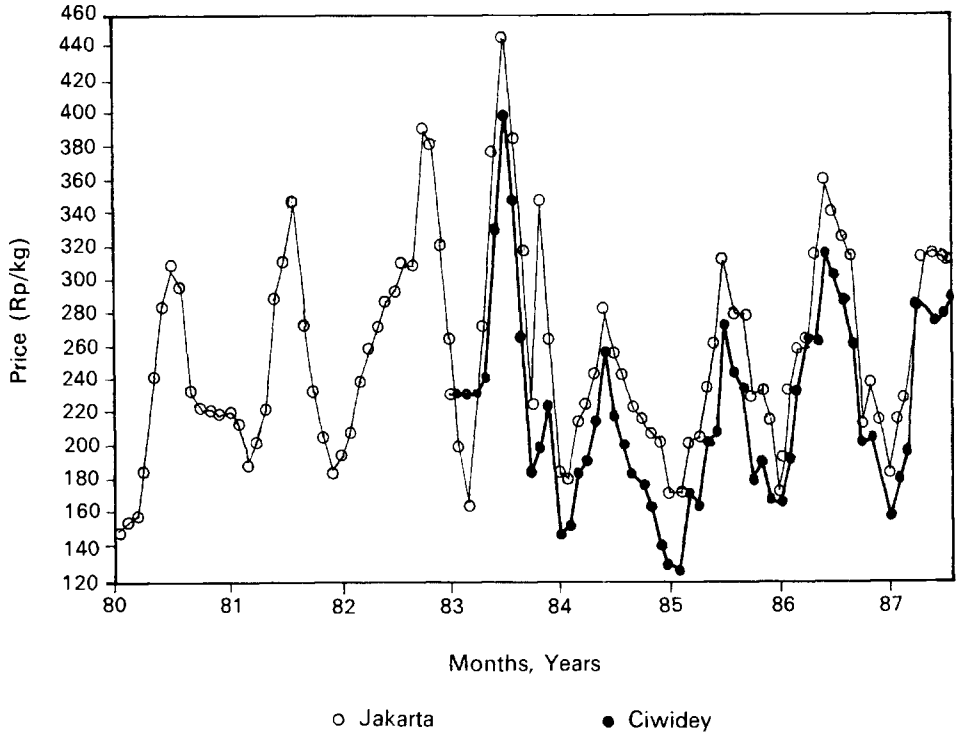

Figure 4.1b Monthly wholesale and assembly prices (nominal) for potato, Jakarta and Ciwidey.

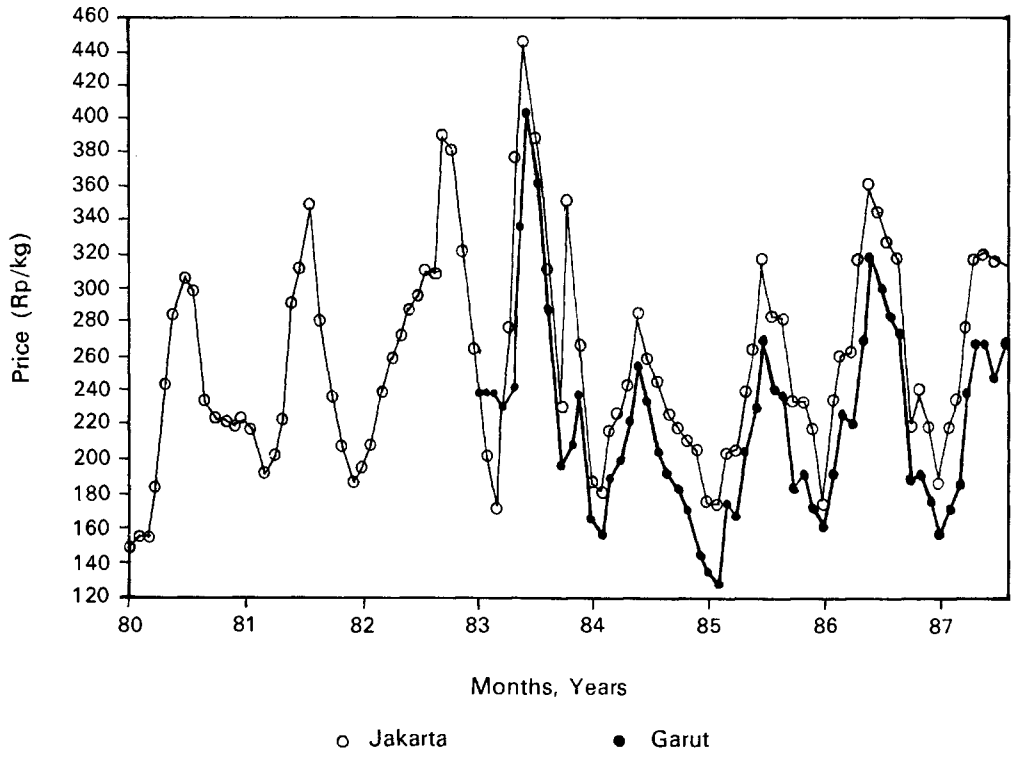

Figure 4.1c Monthly wholesale and assembly prices (nominal) for potato, Jakarta and Garut.

The Jakarta wholesale prices usually reach the highest level in the middle of the year. However, in 1982 the highest price was reached in October and November (Rp 390 and Rp 383 per kg). The highest monthly prices in 1980 and 1981 were reached in July (Rp 305/kg) and in August (Rp 347/kg) respectively. The highest potato prices in 1983, 1984, 1985, 1986 and 1987 were recorded in July (Rp 444/kg), June (Rp 282/kg), July (Rp 312/kg), June (Rp 358/kg) and June (Rp 319/kg) respectively.

Excluding 1982 and 1983 yearly average prices, the Jakarta yearly average for potato is rather stable. The range of yearly price differences is between Rp 222/kg in 1980 to Rp 242/kg in 1981 (less than 10% variation).

The Jakarta wholesale price usually reaches the lowest level in January or February. In 1981 the lowest price occurred in December. The lowest prices in 1980 until 1987 ranged from Rp 148/kg (January 1980) to Rp 201/kg (February 1983).

The differences between the highest prices and the lowest prices increased during 1980 to 1983 and decreased in the period 1984 to 1987. This indicates that the price fluctuations in the period 1980-1983 were higher compared with the 1984-1987 period.

Further information about price fluctuation is given in App. Table 4.1. A brief analysis of development of seasonal price differences is given in the section on price trends.

The production shortage and subsequent overplanting in 1982 and 1983 is reflected in Table 4.2 with price differences of Rp 194 and Rp 243 in 1982 and 1983 respectively.

Table 4.2 Yearly wholesale prices (nominal); highest and lowest prices for potato in Jakarta, 1980-1987.

Year	Average price (Rp/kg)	Highest price		Lowest price		Difference (Rp)
		Month	Rp/kg	Month	Rp/kg	
1980	222	July	305	January	148	157
1981	242	August	347	December	188	159
1982	290	October	390	January	196	194
1983	285	July	444	February	201	243
1984	224	June	282	February	182	100
1985	234	July	312	February	173	139
1986	271	June	358	January	173	185
1987	272	June	319	January	189	130

Bandung, the nearest big city to Jakarta (distance: 180 km), is the main consumption centre in West Java. The Bandung wholesale price development is similar to the Jakarta price development. Wholesale price fluctuations are given in Table 4.3.

Table 4.3 Yearly wholesale prices (nominal), highest and lowest prices for potato in Bandung, 1983-1987.

Year	Average price (Rp/kg)	Highest price		Lowest price		Difference (Rp)
		Month	Rp/kg	Month	Rp/kg	
1983[a]	319	July	451	October	229	222
1984	222	June	292	February	180	112
1985	234	July	311	February	173	138
1986	272	June	359	March	176	183
1987[b]	275	May/Aug.	320	January	186	134

[a] May to December.
[b] January to August.

The Bandung price levels are slightly higher than Jakarta. From trader interviews we know that the Bandung wholesalers handle smaller quantities compared to their colleagues in Jakarta. This increases their overhead slightly.

Traders in Ciroyom (central wholesale market for Bandung) usually buy potato and many other types of vegetables (carrot, chilli, celery, leek, cabbage, etc.) in a small truck (less than 2 t). Their colleagues in Jakarta usually pay their sellers after they have sold the potato, (± one week consignment); the Bandung wholesaler almost always pays in cash. It means that the Bandung traders have higher costs (transport cost and interest) than the Jakarta traders.

Pangalengan, Garut and Ciwidey are among the most important potato production centres in Indonesia. The assembly price of potato fluctuates in the same manner as the Jakarta wholesale price. The price developments of all production centres are in the same direction with very low price disparities (Figures 4.1a, b, and c).

From the available information, we can indicate the relationship between the price developments in West Java production centres and the price developments in Jakarta.

Jakarta wholesale prices and assembly prices of West Java production centres have the same behaviour. The assembly prices and the wholesale prices go up simultaneously and price disparities are relatively small. The assembly prices decrease earlier than the wholesale prices and the disparities are greater than when the price increases.

Substantial price differences seldom survive for more than one month because there is ample competition between traders. The price information service has had an integrating effect in this regard. Fluctuations in production are almost simultaneously reflected in wholesale prices. The price differences between the production centres and Jakarta ranged from Rp 3/kg to Rp 50/kg with an average of Rp 20/kg. The price differences have become slightly greater in recent years. This is due mainly to the increase in transport costs (especially fuel costs). Normally the Garut assembly prices are lower than the other West Java production centres prices. This is due mainly to the distances/transport cost difference. Jakarta-Garut distance is greater than the distance of Pangalengan-Jakarta or Ciwidey-Jakarta.

Central Java

The price movements in Semarang, the biggest consumption centre in Central Java and Sumberan, the nearest production centre, are similar to the situation in West Java. In some instances the Sumberan price increased slightly, while the Semarang price was still decreasing (in September-October 1981 the Sumberan price increased from Rp 149 to Rp 154 but the Semarang price decreased from Rp 189 to Rp 185). The Semarang-Sumberan price disparities are greater compared with Jakarta-West Java price disparities. Complete price developments of Semarang wholesale price and Sumberan assembly price are outlined in Figure 4.2 (a, b).

The slightly larger price disparities in Central Java compared with those in West Java reflect the less advanced communications and infrastructure in Central Java. Also, options for assembly traders to select different consumption areas are more limited because of greater distances.

Price development in Surabaya and its production centres (Pujon Mantung and Batu) is quite interesting. The Surabaya prices correlate more with the prices in Pujon Mantung than with the prices in Batu. This was demonstrated clearly in September-December 1982: the Surabaya and Pujon Mantung price increased while the Batu price decreased.

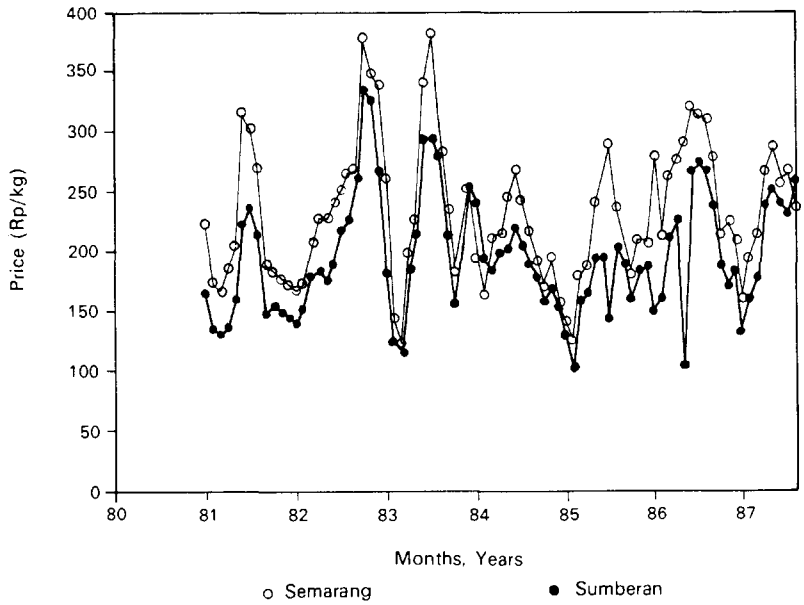

Figure 4.2a Monthly wholesale and assembly prices for potato, Semarang and Sumberan.

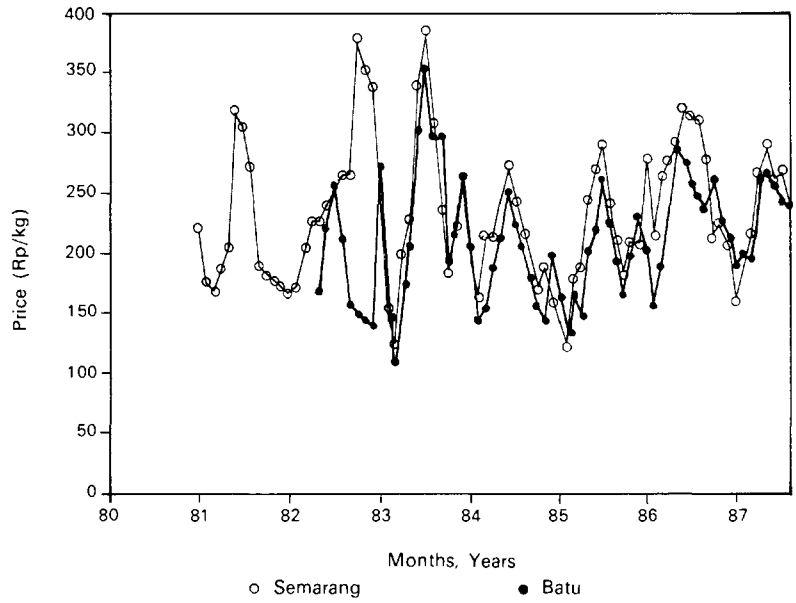

Figure 4.2b Monthly wholesale and assembly prices for potato, Semarang and Batu.

Price integration

Jakarta, Semarang, and Surabaya

The distance between Jakarta and Surabaya is about 900 km and Semarang is halfway between. The price in Jakarta is usually higher than the Surabaya and Semarang prices, but sometimes the Surabaya prices are higher than the Jakarta prices.

Despite this, the three biggest cities in Java have the same direction and trend in price development (Figure 4.3a and b).

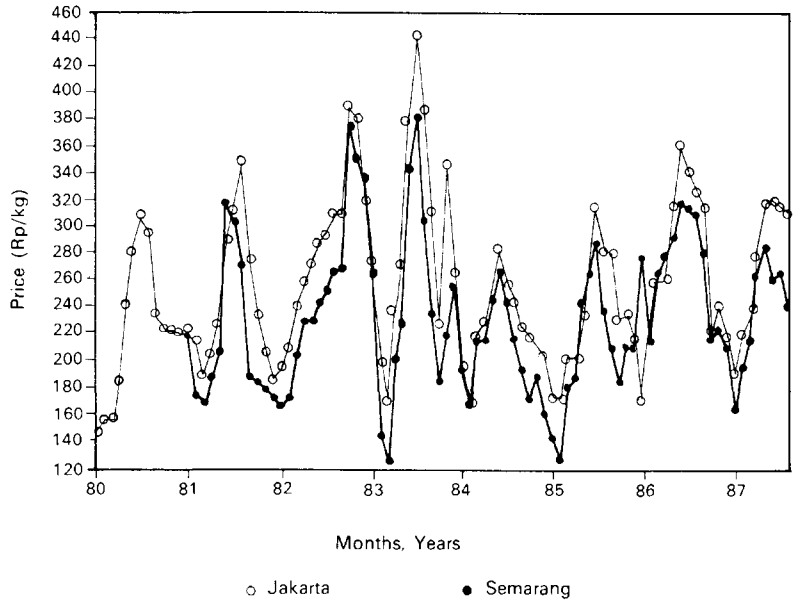

Figure 4.3a Monthly wholesale prices for potato, Jakarta and Semarang.

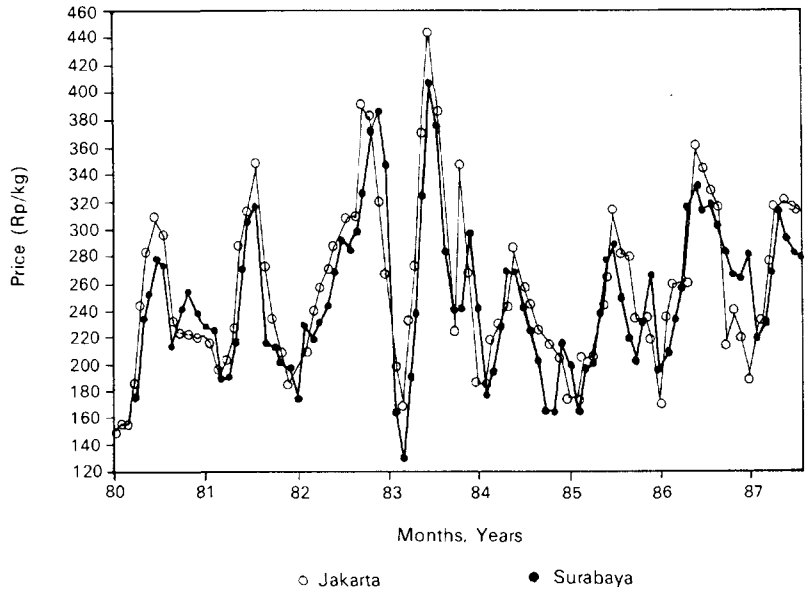

Figure 4.3b Monthly wholesale prices for potato, Jakarta and Surabaya.

Price correlation

Correlation of price developments between two places or markets is a statistical parameter used to measure the degree of market integration. The correlation value ranges from − 100% (via 0%) to + 100%. Correlations of + 100% are an indication of perfect market integration, which means that the markets correlated are actually one and the same market. In the seventies many markets in Java functioned more or less independently, each consisting of several production areas and one major consumption area, usually urban conglomerations. In the last ten years developments have taken place at a rapid pace in Java, and market integration has improved. Regarding the outer islands developments have not been as fast; large disparities with Java still exist for many commodities and goods.

The nominal price development correlation values between six consumption centres, Jakarta, Bandung, Semarang, Yogyakarta, Solo and Surabaya (Table 4.4) are positive and on the average, high. From the 15 price correlation values between those cities, three are very high (> 90%):

Jakarta-Bandung (96%)
Yogyakarta-Semarang (91%)
Solo-Semarang (91%)

Table 4.4 The correlation of price developments between the consumption centres; real and nominal prices (until August 1987).

Real	Jakarta	Bandung	Semarang	Yogyakarta	Solo	Surabaya
Jakarta		52	80	80	52	89
Bandung	0.9741		52	52	52	52
Semarang	0.9258	0.9287		80	52	80
Yogyakarta	0.9429	0.9230	0.9521		80	80
Solo	0.9145	0.9123	0.9292	0.9097		52
Surabaya	0.9208	0.9381	0.9261	0.9384	0.8859	

Nominal	Jakarta	Bandung	Semarang	Yogyakarta	Solo	Surabaya
Jakarta		52	80	80	52	89
Bandung	0.9587		52	52	52	52
Semarang	0.8879	0.8922		80	52	80
Yogyakarta	0.8989	0.8721	0.9109		80	80
Solo	0.8762	0.8788	0.9115	0.8720		52
Surabaya	0.8618	0.8936	0.8797	0.8760	0.8499	

Note: 1. The upper area of the diagonal are the sample number (average monthly prices).
2. Real prices are deflated from nominal price by 1% per month.

The price correlation value between Jakarta and Bandung is 96% which means that the price developments in Jakarta were similar to the price developments in Bandung. This is an indication that potato for Jakarta and Bandung comes from the same production areas, and that those production areas have equal opportunity to supply both cities.

The Yogyakarta and Solo price developments are closely related to the Semarang prices (more then 91% correlation values), but Solo and Yogyakarta price developments are less close (correlation value of 87%). This situation may indicate that Semarang, the biggest consumption centre in Central Java, induces price developments in the other cities. The lowest price correlation value is between Surabaya and Solo (85%).

The price development correlation values between three main consumption centres and six main production centres are relatively high (Table 4.5). Between each of the West Java production centres (Pangalengan, Garut and Ciwidey) and Jakarta, the largest price correlation value of 97% was found. The second largest price correlation for West Java production centres relates to Semarang (more than 91%). The price correlations between Surabaya and Pangalengan and between Surabaya and Pujon Mantung (East Java) are also quite high (more than 90%).

Table 4.5 Price correlation values between major consumption centres (Jakarta, Semarang and Surabaya) and six main production centres (Pangalengan, Garut, Ciwidey, Sumberan, Pujon Mantung, and Batu).

Production Centres	Nominal			Real		
	Jakarta	Semarang	Surabaya	Jakarta	Semarang	Surabaya
Pangalengan	90	78	78	90	78	78
	0.977	0.9107	0.9080	0.9908	0.9371	0.8858
Garut	54	54	54	54	54	54
	0.9732	0.9132	0.8527	0.9832	0.9511	0.9090
Ciwidey	53	53	53	53	53	53
	0.9718	0.9284	0.8661	0.9756	0.9510	0.9044
Sumberan	78	78	78	78	78	78
	0.8024	0.8379	0.7681	0.8677	0.8985	0.8505
Pujon Mantung	75	75	75	75	75	75
	0.8072	0.8748	0.9228	0.8647	0.9116	0.9479
Batu	63	63	63	63	63	63
	0.5967	0.5892	0.6717	0.6692	0.6319	0.7067

Note: 1. The numbers in the first row are the numbers in the samples (average monthly prices).
2. Real price is deflated from nominal price by 1% per month.

The other price correlation values between production centres (excluding Batu) and three major consumption centres (Jakarta, Semarang and Surabaya) are still rather high ($> 80\%$). The Batu production centre has the best trade relation with Surabaya (67%). The relative isolation of the area is reflected in the rather low correlation values.

For a clearer picture of the relation between consumption centres and production centres, ranking is given in Table 4.6.

Table 4.6 Ranking of Jakarta, Semarang and Surabaya to a particular production centre (based on its correlation value).

Rank	Jakarta	Semarang	Surabaya
1	Pangalengan	Ciwidey	Pujon Mantung
2	Garut	Garut	Pangalengan
3	Ciwidey	Pangalengan	Ciwidey
4	Pujon Mantung	Pujon Mantung	Garut
5	Sumberan	Sumberan	Sumberan
6	Batu	Batu	Batu

The relatively high correlation values between those cities are a reflection of very good inter-regional trade on Java. Major highland production centres are able to supply any consumption centre when the price difference between those regions is big enough to cover the marketing cost. When a production centre has excess supply and the local price is low, the inter-regional traders have a chance to supply the other consumption centres as well as their own regular consumption centres.

Present marketing mechanisms reduce inter-regional price disparities and price fluctuations on Java. Smaller price fluctuations enable farmers to properly plan their potato production and ensure their income. In the long run this situation enables farmers to invest more in the farm, resulting in better production and better quality potato.

Price trends

Real prices

Some important price trends can be observed in the development of nominal price. Price fluctuations have become smaller in recent years (since 1984) compared to the previous years (1980-1983). Yearly average potato prices look stable.

To get a clearer picture of wholesale price trends, we need to analyse potato prices in real price terms. From the real prices (deflated nominal prices by 1% per month from August 1987) and also the nominal price we can draw some tentative conclusions. Real price fluctuations are becoming smaller in recent years (since 1984) compared to the previous years. The real price level has decreased. The average monthly real prices in 1980-1983 exceeded Rp 400/kg and they decreased to about Rp 300/kg in 1984-1987, as shown in Figure 4.4 a and b.

It should be remarked that a slight downward distortion may be caused by the assumption of a 1% per month deflation rate (non-cumulative). However, the issue actually involves how much the decrease is, because it is evident that real prices are going down. Estimations of inflation vary widely and the CBS indicates highly variable monthly figures.

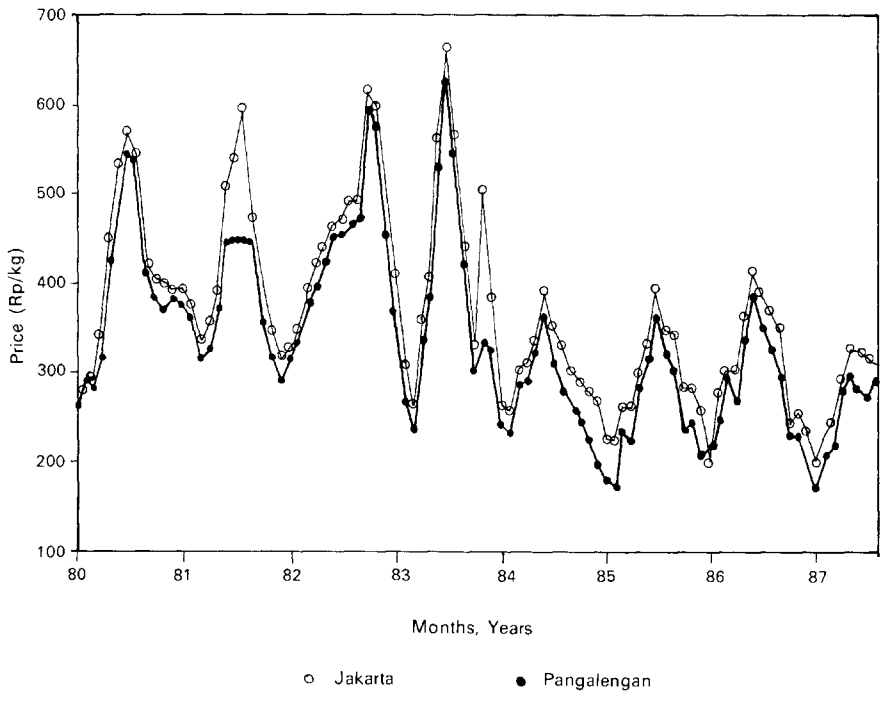

Figure 4.4a Monthly real wholesale and assembly prices for potato, Jakarta and Pangalengan.

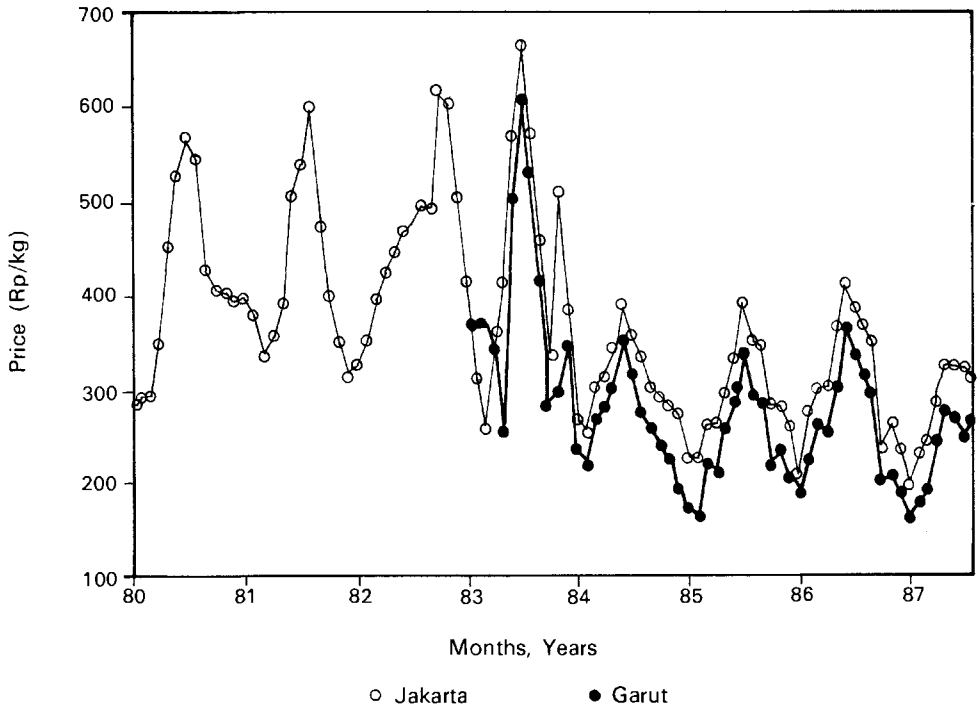

Figure 4.4b Monthly real wholesale and assembly prices for potato, Jakarta and Garut.

It may be noted that the decrease in real prices is consistent with the good price integration found in an earlier section of this chapter, and the generally increasing demand and the increasing production in various production areas. Quite simple competition between producers seems to bring about reduction in real prices.

Trends in seasonal fluctuations of assembly prices

Assembly prices are farm gate prices, or in the case of potato the "in the ground" price. They are the major indicator for an assessment of the feasibility of profitable off-season production in m.a. areas. In principle the optimal growing period of m.a. potato is June-July. Generally during that time of year, prices of highland potato are at a high level because of lower production in the highland areas (see Chapter 5).

Both low and high average seasonal assembly prices were calculated for the areas of Ciwidey, Garut and Pangalengan in West Java, and Sumberan in Central Java, and Pujon Mantung and Batu in East Java based on time series data from 1983 to 1987. Although the data series comprises only five years, and no meaningful statistical analysis can be applied, it seems justifiable to conclude that although there are variations between assembly prices, and behaviour in the production centres (Table 4.7) a slight downward trend of the average difference is noticeable (Figure 4.5).

It should be clear that the average nominal difference which reached Rp 56.50 in 1987, is not meaningful to judge feasibility in specific areas. However, it seems reasonable to expect that in the coming years, under normal conditions, nominal differences will be between Rp 50 and 100/kg, and that they are likely to be close to Rp 50/kg.

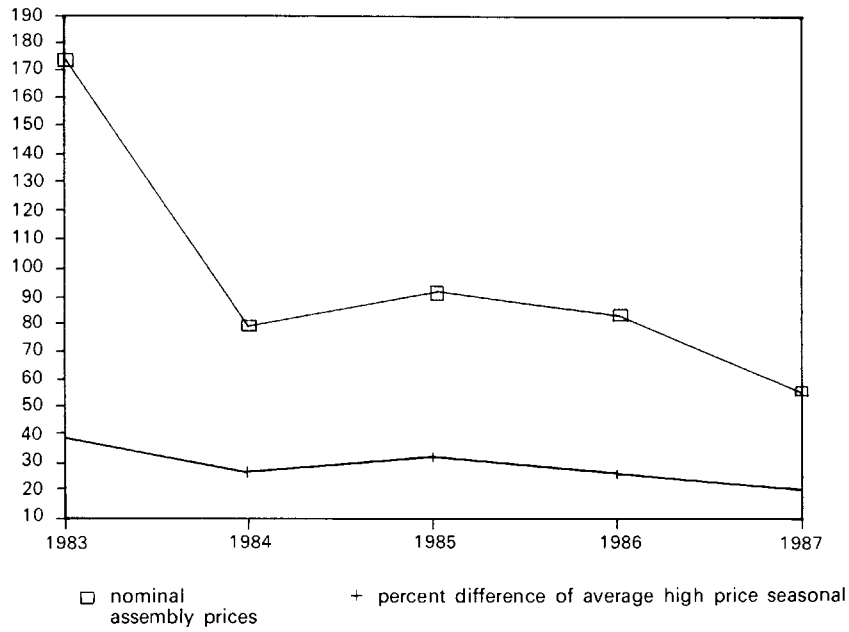

Figure 4.5 Nominal and percent (of high seasonal) difference between high and low seasonal assembly prices.
Note: Prices are nominal assembly prices based on compound grade AB (30-20 tubers/kg) or AB super (6-10 tubers/kg). Prices and percentages are unweighted means of six areas: Ciwidey, Garut, Pangalengan, Sumberan, Pujon Mantung and Batu.

Table 4.7 Percentage (of high seasonal average) difference between high seasonal average and low seasonal average assembly prices.

	1983		1984		1985		1986		1987	
	D	%	D	%	D	%	D	%	D	%
Ciwidey	175	35.35	84	27.18	99	33.90	97	28.96	81	28.13
Garut	163	32.60	83	26.52	100	34.01	103	31.31	70	26.42
Pangalengan	224	42.50	87	27.02	119	36.96	113	32.10	69	24.13
Sumberan	158	40.10	68	23.45	46	20.35	44	17.05	47	20.09
Pujon Mantung	155	39.64	72	26.09	98	35.51	70	24.39	49	20.94
Batu	175	39.59	86	27.30	87	30.42	73	24.09	23	8.98
Average	175	38.30	80	26.26	91.50	31.86	83.33	26.32	56.50	21.45

Note: D: Nominal assembly price difference.

Having established this, it is essential to note that these prices relate to a compound grade of AB highland potato, with 3 to 20 or 6 to 10 tubers per kg. While noting that traders' grading systems do vary slightly, it should be clear that more information is necessary for a general impression regarding the potential of m.a. potato. Prices of lower grades, in which m.a. produce seems likely to be classified, are 25 to 40% lower. This means that the issue of seasonality of prices is overshadowed by the more important issue of the quality and size of m.a. potato. Since at this point, hardly any m.a. produce is marketed to major consumption centres, no firm conclusion can be drawn. But it should be clear that the average seasonal price difference of the AB does not automatically benefit m.a. produce.

Price behaviour

Examples of results of the seasonal average of prices in selected production and consumption centres are provided in Figures 4.6 and 4.7 respectively. Considering data during the last five years, one may say there is a tendency for prices to be higher during the second season compared to the first and the third seasons. This price behaviour occurs both in production and consumption centres. It is easily understood that when prices in production centres increase, prices in consumption centres should also increase, and vice versa.

Price behaviour usually also reflects the cultivation pattern usually applied by farmers. Most highland farmers, as supported by environmental conditions, have the tendency to produce more potato during the first and the third seasons. Obviously, these two seasons are supported by adequate rainfall so that land can be irrigated. Production during the second season usually drops creating a relative shortage in supply, and market prices increase accordingly. This phenomenon seems to occur continuously even though the magnitude of price fluctuations may vary from one season to another.

Since fluctuations of both assembly prices and wholesale prices seem substantial, around Rp 70 to Rp 80/kg in assembly prices in West Java in 1987 and approximately Rp 50/kg in Central Java, some scope may exist, if technologically feasible, for off-season planting. Actual prices of the appropriate grades should be reckoned with, in order to establish the benefits.

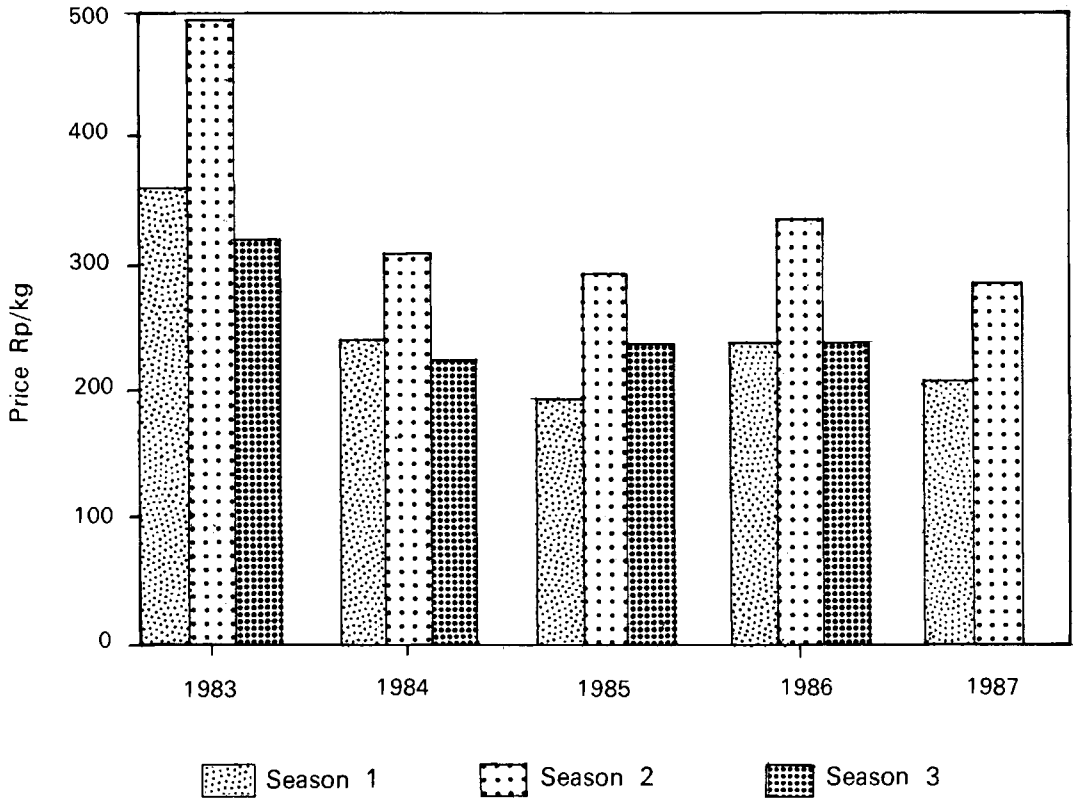

Figure 4.6 Average seasonal assembly prices of potato in Ciwidey, 1983-1987.

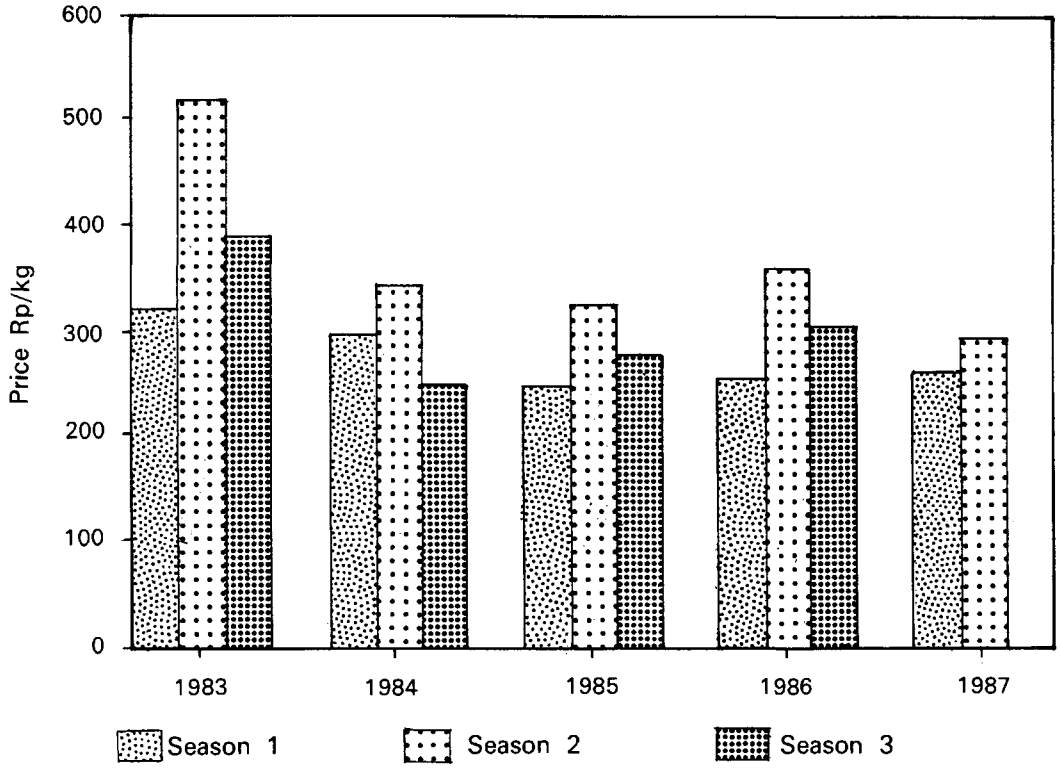

Figure 4.7 Average seasonal wholesale prices of potato in Jakarta, 1983-1987.

5

Marketing and Utilization

H. Siregar, Directorate of Horticulture

Summary

The marketing component covers only the system involving assembly traders and not the retail system. In general, farmers sell potato in the ground to assembly traders. Farmers receive between 75 and 90% of the wholesale selling price. This margin is very high and shows, in conjunction with good price integration, that potato market integration in general in Indonesia is very good. Assembly traders take a profit of around 3% of their selling price and wholesale traders take a profit of around 4% of their selling price, which seem rather low. This may be explained in part by the fact that most big assembly traders are major potato growers themselves.

There is a daily broadcasted price information programme on the radio, supplying farmers with wholesale and assembly prices (App. Note A). This market information programme has had a very good affect on farmers' margins in horticultural commodities. Storing appears to be exclusively done by big traders/growers in highland areas either in the ground or in warehouses. Assembly traders use a grading system taking into account tuber size, and the proportion of damaged tuber. Assembly and wholesale prices refer to a compound grade of 6-10 or 3-20 tubers per kg. (AB) Grading is fairly standard but differences do exist (App. Note B).

The new and rapidly growing processing industries have their own requirements which include more quality criteria such as water content, shape, cleanliness and even specific varieties. These criteria are induced by their processing equipment, primarily for the production of french fries. A case study indicates that on the basis of prices of imported french fries, commercial farmers have to produce at least 20 t/ha of good quality tubers. This appears to be difficult to achieve. Although private sector attempts are still continuing, serious problems are being experienced, such as the availability of disease-free seed and production problems caused by nematodes.

Approach

In the section on marketing and utilization a rather selective approach was employed, which resembles the structure of Chapter 3 on price development.

Marketing analysis is focused on the outflow from the major highland production areas and inflow into Jakarta. The marketing chain from producer to wholesale market is analysed. The component from the wholesale market to the retailer and consumers has been left out of the study because the focus of the study is on wholesale price formation as relevant to development of m.a. potato.

In this section, the marketing structure from the major highland areas will be discussed because of its relevance to m.a. potato. Moreover, a case study is given regarding recent developments in potato utilization and processing.

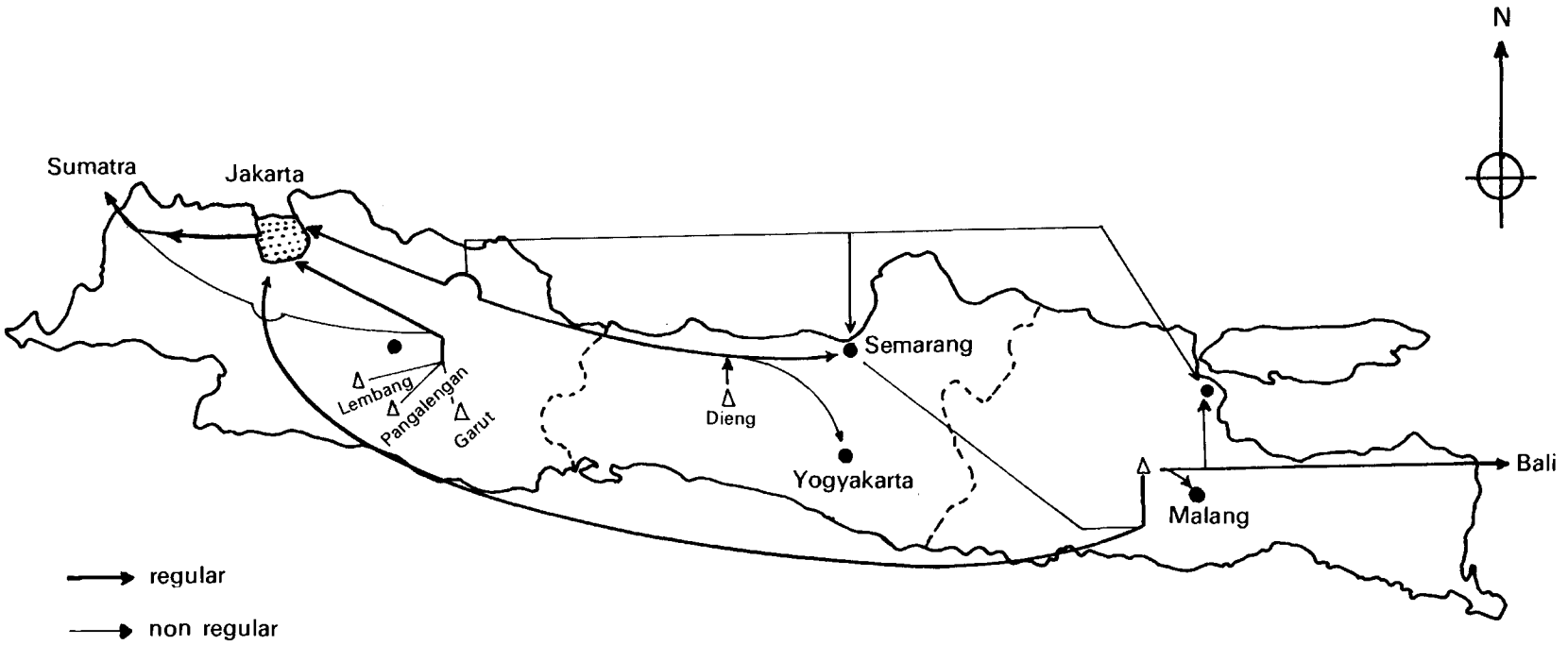

Figure 5.1 The main flow of potato from Java production centres to consumption centres.

For highland potato from the major production areas, and for m.a. potato as well as for isolated scattered highland potato, different marketing systems exist. Regarding m.a. and isolated highland areas, production and consumption appear to be very localized, resembling the situation for many horticultural commodities a decade ago. M.a. and isolated highland potato supply only nearby markets in which the price of potato from the major highland production areas is relatively high. In other words, assembly prices and wholesale prices of the major highland areas determine the margins and profitability for m.a. and highland potato from isolated areas. Chapter 8 presents a case study which covers m.a. production as well as marketing in order to provide an integrated picture.

Major production area outflows

Figure 5.1 shows major flows in Java.

Each important consumption centre in Java traditionally has its own production centres, usually located in the same province. For instance, Jakarta, the capital of Indonesia and the most populated city (about 7 million inhabitants), is normally supplied with potato from the three West Java production centres. Jakarta is easily accessible from those production centres (approximately 200-350 km) within 5-7 hours by truck. The geographical situation in Java as it relates to the potato production and consumption centres is depicted in Figures 1.1, 1.2 and 1.3.

Jakarta is supplied mainly by the Pangalengan, Ciwidey and Garut production areas. Jakarta is also supplied regularly from Central Java (Wonosobo/Sumberan) and East Java (Pujon Mantung and Batu) production centres.

Sumatra production centres (Jambi, West Sumatra and North Sumatra) sometimes supply Jakarta with potato. Sumatran production centres usually supply Jakarta and surrounding areas between May and July when the Jakarta price is at its highest. In May to July the Sumatran price is usually low and it reaches its peak in September to November. The price difference in May to July between Jakarta and West Sumatra or North Sumatran production centres can reach up to Rp 150-200/kg, sufficient to cover the transportation and other marketing cost.

Ciwidey production centre

Ciwidey is one of the important production centres in Java which has a unique market. The assembly traders in the area are not interested in supplying the wholesalers in the Central Market, Pasar Induk Kramat Jati (PIKJ), Jakarta, since the wholesalers in Jakarta bargain the price to a relatively low level and the payments are often postponed (consignment). At present, traders, big retailers and small wholesale traders come to the market to purchase on a cash basis. These big retailer/small wholesale traders come to Ciwidey because this area is able to supply a large variety of vegetables. This is especially attractive to big retailers who cut down on costs by this arrangement. This configuration is unique in the sense that traders would rather face competition in buying than in selling, and this situation almost approaches the auction.

The estimation of the average potato outflow from Ciwidey is about 70 t/day (March, April, September, October and November), and about 80 t/day at the highest level (December, January and February) and around 50 t/day at the lowest level. The relation between the estimated outflow of potato and assembly price developments of Ciwidey are outlined in Table 5.1.

According to the survey, the estimated total outflow of potato from Ciwidey in 1987 is around 25,000 t (average daily outflow estimated at 70 t/day) or about 20% of the total West Java production in 1985.

Table 5.1 The relation between estimated outflow of potato and monthly assembly prices in Ciwidey.

Year	Month and price (Rp/kg)												
	1	2	3	4	5	6	7	8	9	10	11	12	Ave.
1983	233				243	332	402	350	267	186	200	226	271
1984	150	153	186	193	217	259	221	203	186	180	166	142	188
1985	130	125	174	168	204	209	276	244	236	184	191	171	192
1986	167	195	236	266	266	318	305	290	268	205	206	188	239
1987	160	182	197	286	286	278	280	291					228
Price level	Low (Average)			Fair (Average)			High			Fair		Low	
Outflow (t/day)	80			70			50			70		80	

Source: Directorate General for Food Crop Economics. Yearbook 1987.

Pangalengan production centre

Pangalengan is the biggest production centre in Indonesia. According to the survey results, the average potato outflow from this area is estimated at 100 t/day (March, April, May, September, October and November), while the low level is estimated at 70 t/day. The highest level is estimated at 125 t/day. The relation between the estimated outflow of potato and monthly assembly price in Pangalengan is outlined in Table 5.2.

The total outflow of Pangalengan in 1987 is estimated at 40,000 t or about 30% of the West Java production in 1985.

Table 5.2 The relation between estimated outflow of potato and monthly assembly prices in Pangalengan.

Year	Month and price (Rp/kg)												
	1	2	3	4	5	6	7	8	9	10	11	12	Ave.
1980	135	154	151	168	225	262	297	289	226	210	205	214	211
1981	209	203	178	184	212	259			260	212	188	174	208
1982	192	192	230	243	262	281	282	292	297	384	368	291	277
1983	238	176	156	220	254	355	431	370	294	206	233	229	263
1984	169	164	205	209	233	269	227	209	198	188	170	149	199
1985	135	132	183	177	224	250	294	260	246	193	201	171	206
1986	182	212	256	228	294	339	312	295	270	209	211	183	249
1987	160	190	208	269	287	276	270	294					244
Price level	Low			Fair			High			Fair		Low	
Outflow (t/day)	125			100			70			100		125	

Source: Directorate General for Food Crop Economics. Yearbook 1987.

The Ciwidey and Pangalengan contribution to West Java potato production is estimated at 50%[1]. The remaining part is produced by Garut and other production areas (Kuningan, Majalengka, Sukabumi, Cianjur, etc.).

[1] Based on the 1985 production.

Dieng Plateau, Central Java

The Dieng Plateau in Central Java is an important supplier for Jakarta and West Java. Central Java and East Java supply Jakarta and its surroundings in larger quantities in June and July (at maximum prices) and in December to February (at minimum prices). In June and July, and in December to February the price disparities between Jakarta and Central Java or East Java are usually at the highest level Rp 40-60/kg. As the price differences in this study are calculated from average monthly prices, the daily price difference could be higher than stated above at certain dates.

The Dieng Plateau, which is the main vegetable supplier in Central Java, is dominated by potato. According to the information of the biggest farmers/traders in the area, about 90% of the agricultural land of the area is cultivated with vegetables, 30% of which is planted with cabbage and 70% with potato.

The average outflow of this area is 90 t/day in April, May, August, September, October and November. The highest daily outflow is 150 t in December to March, and the lowest outflow of 50-60 t/day takes place between June and July. Table 5.3 outlines the relation between supply (outflow) and the assembly price.

The total outflow of the Dieng area in 1987 is estimated at 30,000 t or around 70% of the Central Java production in 1985. The remaining 30% is produced in the smaller areas of Ngablak, Magelang, Jimbaran, and several others.

Table 5.3 Relation between estimated daily outflow and monthly prices in Dieng.

Year	Month and Price (Rp/kg)												
	1	2	3	4	5	6	7	8	9	10	11	12	Ave.
1981	164	135	132	136	159	221	236	214	149	154	149	145	166
1982	142	154	179	183	177	192	218	226	262	335	328	269	222
1983	185	125	118	187	214	295		282	214	157	203	253	203
1984	241	194	185	199	202	219	206	191	181	160	169	157	192
1985	131	104	157	165	194		147	201	189	161	183	187	174
1986	150	162	211	225	107	266	273	265	238	190	174	181	204
1987	134	161	177	240	252	239	233	263					212
Price level	Low			Fair		High			Fair			Low	
Outflow (t/day)	150			90		50 to 60			90			150	

Source: Directorate General for Food Crop Economics. Yearbook 1987.

Several conclusions regarding outflow and major production areas may be drawn on the basis of this information. It is evident that production of potato occurs mainly in relatively few highland areas which are highly specialized in potato cultivation. Seasonality of production is similar among these areas; outflows are high and prices are low in October through March, while outflows decrease to 30-70% in June, July, and August, causing increases in assembly prices of 50-100%. This seasonality in price formation is confirmed by the average seasonal assembly prices for major production areas as presented in Chapter 3. In periods of high prices in Jakarta, price disparities are sufficient as far as Sumatra and Central Java to Jakarta. Even in periods of low potato prices in Jakarta, the margin is sufficient to allow a flow of potato from Central Java. The high degree of area specialization has had significant consequences for the

structure of trade and the effectiveness of the marketing system as will be seen in later sections.

Inflow to the Central Market, Jakarta

Since Jakarta is the largest urban centre and the biggest market for potato, inflow to Jakarta was estimated. Traders were interviewed while a road check was employed to check at the Central Market in Jakarta. All horticultural commodities actually have to go through the Central Market before they continue to retailers. Lately traders have often circumvented the Central Market to go directly to the retailers, thereby saving costs.

According to a 24-hour road check survey on 11 and 12 July 1987, the quantity of potato entering PIKJ, the main wholesale market for Jakarta, amounted to 72.5 t in 24 hours. The quantity originated from:

West Java:	42.4 t	(58%)	Central Java:	24.2 t	(33%)
Pangalengan:	19.6 t	(27%),	Wonosobo:	15.6 t	(21.5%),
Garut:	18.3 t	(25%),	Magelang:	8.6 t	(11.8%),
Ciwidey:	4.5 t	(6%),			
East Java:	5.9 t	(8.2%)			
Batu areas:	5.9 t	(8%).			

The vehicles used for shipments to PIKJ were five large trucks and four medium-sized trucks. The five large trucks came from Pangalengan (two trucks), Garut (two trucks) and Wonosobo (one truck). The four medium trucks came from Ciwidey, Wonosobo, Magelang and Batu (one truck from each area).

According to traders interviewed in PIKJ (two traders), 75% of the potato for Jakarta passes through PIKJ; the rest are delivered directly to retail markets or supermarkets. The total quantity, including PIKJ and direct deliveries equalled 96.5 t of potato per day supplied to the 7.5 million people of Jakarta. Comparing this to the situation in September 1978, when PIKJ absorbed 99% of the total inflow of potato (54.7 t) to Jakarta (Abu Haerah et al. 1982), some conclusions can be drawn.

The daily total inflow of potato to Jakarta has increased by about 41.8 t (76%) in nine years. The role of PIKJ as the "only gate" for vegetables and fruits to enter Jakarta has decreased proportionally by about 24.2% (from 99% in 1978 to 75% in 1987) in nine years. According to traders interviewed, this is mainly due to the relatively high handling cost for vegetables in PIKJ compared with direct delivery of vegetables to retail markets.

If a commodity enters Jakarta via PIKJ, some extra costs are incurred for: Tickets for Bapengkar (loading and unloading labour organizations): Rp 1,000 per truck (Rp 2/kg); Unloading: Rp 2/kg; Parking fee: Rp 200/hour/truck, normally Rp 400 (since 2 hours is needed before the truck is unloaded) or Rp 0.8/kg; Loading onto small truck: Rp 2/kg; Transport cost for small truck from PIKJ to retail market: Rp 10,000 per 2 t (average of Rp 5/kg); Extra loss because of loading and transport damage.

The total extra cost is about Rp 12/kg and about five to six hours of time.

These problems are by no means specific to potato; in the case of less bulky commodities, already 60% is finding its way directly to retailers.

The role of big traders

This section explores practices of marketing potato based on information obtained from traders. Traders were interviewed at West Java production centres: Pangalengan and Ciwidey and at major consumption centres: PIKJ Jakarta. Traders were also interviewed in the Dieng area in Central Java. There is evidence that the potato traders are a true rural-based class of traders, which is a very encouraging sign, as seen from the perspective of rural development.

Identity of the interviewed traders

The traders selected for interviews belong to the group of the biggest traders in their "economic area". The traders in production centres (assembly traders) are also active in farming potato and other vegetables. As farmers, the traders belong to the large potato farmers: they operate 2-6 ha of planting area per month. They produce about 20-60 t of potato per month. Another component of their trading activities is supplying farmers with inputs (chicken manure, pesticide, farm tools, vegetable seed, etc.), transport and credit. One of the traders in Ciwidey also buys and sells goat leather.

The farming of potato takes place on the traders own land. Sometimes he also leases land. The traders run their potato production business as a fully-owned business (all production costs being his expenses) or on a share basis (sharing the production cost and product). They apply various production sharing systems according to their relation with the farmers (1:1, 1:2, 1:3, etc. according to the balance of their production cost/resources contribution). One of the respondents operates about 50 ha of farmland which is cultivated mainly with potato.

More in-depth information on traders' activities shows that the majority of the assembly traders have developed trade from their own production. An interesting aspect is that they now tend to become production area-based wholesale traders, with links to various consumption centre-based wholesale traders-cum-distributors. This latter component of the marketing chain has not been researched and deserves further study in order to assess total market efficiency.

Trading activities

In trading potato and other vegetables, traders have a decisive role in potato marketing in their area and are even able to influence the local and wholesale market. The share of the respondents in the total area outflow is very significant: 25-50% of the total area outflow. For instance, a trader interviewed in Ciwidey conducts delivery of 80-150 t of potato per week to eight different locations in West Java (Cikampek, Karawang, Bekasi, Purwakarta, Tangerang, Serang) and the southern part of Sumatra (Tanjung Karang and Metro). It should be kept in mind that they do not just handle potato, but nearly all types of vegetables grown in the area.

The assembly traders use three main buying methods:

Tebasan system (standing crop transaction)

The farmers and the trader (buyer) negotiate the value of potato before they harvest. Harvesting costs and other costs are the expenses of the buyer (the pure *tebasan* system).

Agent system

The assembly traders receive assistance from agents (on the basis of commission) in buying potato from the farmer's house or farmer's storage house. The assembly traders decide their buying price and give a commission to the agent between Rp 5-10/kg depending on the market situation.

Direct buying system

Many assembly traders buy potato directly at their kiosk/shop/warehouse from the farmers or from the field assembly traders.

The payment system is negotiable between the assembly traders (as buyers) and the sellers. The payment system ranges from cash and carry, advance payment, postponed payment and combinations of these three. Each of the payment systems has positive or negative consequences, both on the buyers and sellers. But in general, the real price received by the seller or paid by the buyers is of the same value, whatever paying system they may select for the transactions.

All the assembly traders interviewed have their own vehicles to transport their commodities from the farms to their warehouse/shop or to the buyer's location. The assembly traders usually have 2 to 10 trucks. The vehicles are not solely for their own trading activities but are also rented to other traders.

The tasks performed by the assembly traders range from harvesting, to loading/unloading, sorting, grading, cleaning, weighing, packing, transporting, and storage and financing. The assembly traders also normally act as inter-regional traders and some of the assembly traders also have branches or partners in the consumption centre markets.

Not a single trader applies modern management practices to run his business. He just practises a traditional management system. There is no formal book-keeping, no proper documentation of transactions. Traders trust each other based on their experiences. For instance, a wholesaler in a consumption centre was easily supplied with 10 t of potato after he sent a message through the truck driver for the order, without any prior price negotiation. This trading practice, of course, can only be used by traders who have had a long (more than five years) and good relationship. In fact, the traders take quite a big marketing risk, because sometimes the daily price fluctuates sharply.

They also use various terms of payment in their selling transaction to customers which resemble the agent and the direct buying system.

Pangalengan is the biggest potato production centre in Java, mainly supplying the large markets in West Java and Central Java. Sometimes traders reach Surabaya and other cities in East Java or even the southern part of Sumatra and Kalimantan (especially West Kalimantan and South Kalimantan). But Jakarta is the most important market for Pangalengan because big quantities are regularly taken.

Ciwidey has for the last four years been actively entered by small traders/non-specialized traders who wish to get various vegetables in one trip. The buyers generally come from the smaller cities and act as small wholesalers or large retailers selling directly to the retailer or consumer. To avoid disappointing their customers, the Ciwidey traders also buy certain vegetables from Lembang when Ciwidey is not able to supply them.

Marketing channels and marketing costs

It is important to distinguish marketing chains and marketing costs for particular commodities in particular regions. The marketing cost of a particular commodity is closely related to the effectiveness of the marketing system. Marketing cost itself is one of the quantitative indicators of the degree of marketing efficiency. An efficient potato marketing system enables farmers to get a reasonable income and in turn encourages farmers to invest more (in quality or quantity) inputs (tools, chemical, manure, seed, etc.) which in turn results in better production.

In view of these considerations, the Indonesian Government has launched actions and policies aimed at improving the marketing of agricultural commodities. One of the government actions which has had a positive impact on marketing efficiency is the Market Information Service Project for Vegetables, including potato (App. Note A). In this programme prices are accounted daily, increasing integration of wholesale prices with assembly prices.

Marketing channels

The main consumption centre for West Java production centres (Garut, Pangalengan and Ciwidey) and Central Java production centres (Dieng Plateau) is Jakarta. Though the distance between these production areas and Jakarta is relatively short (200 to 400 km over good roads) marketing channels are long. Produce has to pass through the hands of four to six intermediaries on their way from producer to consumer. Potato has to be weighed, packed, loaded and unloaded and transported between weighing scales, trucks and traders stalls quite a number of times. All these activities involve costs.

The marketing channels of potato from the production areas to consumption centres vary, depending on the distance of a consumption centre from the production centre and the demand quantity (as a reflection of population and income per capita of the population) of the consumption centre.

When the distance between production centre and consumption centre is large, trading is not efficient if the commodity is traded in small quantities because transport costs increase per unit traded. This situation makes larger traders more competitive and explains their dominant role in marketing compared to small traders. For example, the trade between Dieng and Jakarta is dominated by larger traders, but between Pangalengan/Ciwidey and Bandung relatively more small traders are active. For a big city like Jakarta where the demand is big, the larger trader can play a relatively more important role.

Although the marketing channels may vary from case to case, they can be generalized as outlined in Figure 5.2.

Marketing cost

The margins between farmers' selling prices and wholesalers' selling prices cover the costs for harvesting, cleaning, grading, packing, transport from the field to the roadside, to a collecting point, market or store, weighing, loading and unloading. They also include the fixed costs for the daily kiosk ticket, sanitation, electricity and other fees. Gross profit in this case, is the margin between the selling price minus the cost items stated, and the buying price. This gross profit should be deducted along with personnel costs and interest on capital to arrive at a net profit.

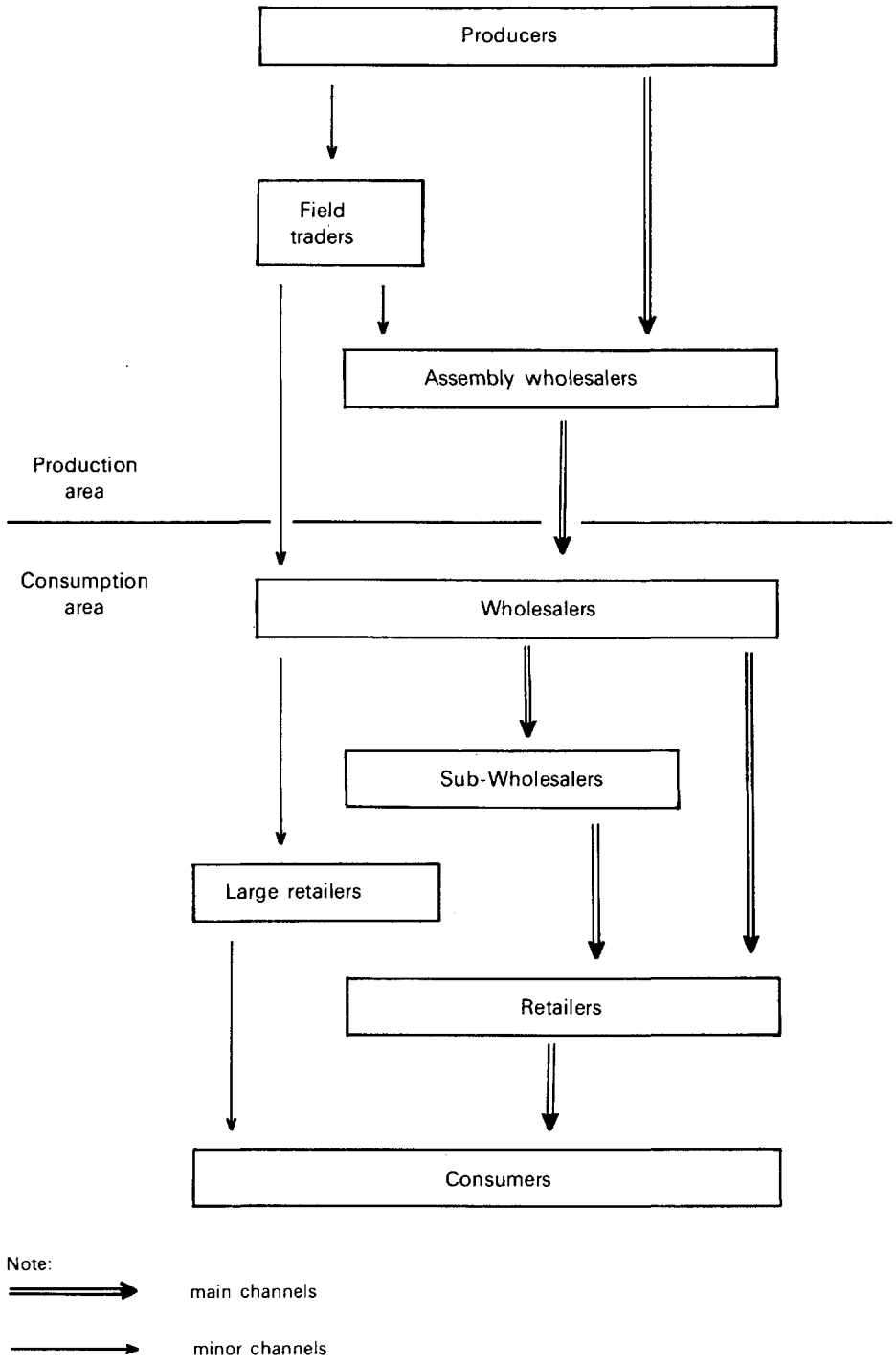

Figure 5.2 The main marketing channels of potato in Java.

Almost all farmers sell their potato as standing crops to the assembly traders. The farmers' share (from the wholesaler selling price) in West Java is higher than the share of their colleagues in Central Java. There are two reasons why West Java farmers get more than the Central Java farmers. West Java production areas are closer to Jakarta. The transportation cost from Pangalengan to Jakarta is between Rp 6/kg and Rp 7/kg while from Dieng it is about Rp 30/kg. Moreover, the selling price of West Java potato appears to be Rp 10/kg higher than the selling price of Dieng potato in the Jakarta central market because of quality reasons (Tables 5.4 and 5.5).

Harvesting, sorting, packing, weighing, carrying to road side, loading and transport costs are the expenses of assembly traders. The absolute figure of these cost items is nearly the same for Ciwidey and Dieng, Rp 5/kg and Rp 7/kg respectively. For packing, plastic sacks are used which cost Rp 200/sack. Each plastic sack can be filled with 50 kg of potato.

Transport cost from production to consumption centres is normally the expense of assembly traders. The transport cost from Pangalengan to PIKJ Jakarta is relatively low, Rp 7/kg for a distance of about 220 km or around Rp 33.5/t/km. The transport cost includes the expenses of tickets for Bapengkar (loading/unloading labour organization) Rp 1,000/truck, and a parking fee of Rp 200 per hour. Normally two hours are needed before the truck is unloaded.

Table 5.4 Marketing costs of potato from farm level in Dieng to wholesale level in Semarang and Jakarta, September 1987.

Price level and cost items	Destination			
	Semarang		Jakarta	
	(Rp/kg)	(%)	(Rp/kg)	(%)
1. Assembly traders buying price (standing crops prices)	240	82.8	240	78.7
2. Harvesting, sorting, packing, weighing, carrying to roadside and loading	7	2.4	7	2.3
3. Packing materials	4	1.4	4	1.3
4. Transport cost from Dieng	12	4.1	30	9.8
5. Assembly trader gross profit	7	2.4	7	2.3
6. Wholesale buying price	270	93.1	288	94.4
7. Unloading and weighing	2	0.7	2	0.65
8. Sorting	2	0.7	2	0.65
9. Daily kiosk ticket, sanitation, electricity and other fees	4	1.4	5	1.6
10. Wholesale gross profit	12	4.1	8	2.6
11. Wholesale selling price	290	100.00	305	100.00

Notes:
2. Harvesting = Rp 2.5/kg.
   Sorting, packing and others = Rp 4.5/kg.
3. Packing materials (plastic sack) = Rp 200/50kg = Rp 4/kg.
5. Transport cost: to Semarang: Rp 60,000/5 tons = Rp 12/kg
   to Jakarta: Rp 150,000/5 tons = Rp 30/kg.

Table 5.5 Marketing costs of potato from farm level in Pangalengan and Ciwidey to wholesale market at PIKJ, Jakarta, July 1987.

Price level and cost items	Origins			
	Pangalengan		Ciwidey	
	(Rp/kg)	(%)	(Rp/kg)	(%)
1. Assembly traders buying price (standing crops prices)	270	87.1	280	88.9
2. Harvesting, sorting, packing, weighing, carrying into roadside and loading	6	1.9	5	1.6
3. Packing materials	4	1.3	4	1.3
4. Loading onto trucks	1	0.3	1	0.3
5. Transport cost to Jakarta	7	2.3	6.5	2.1
6. Assembly trader gross profit	5	1.6	4.5	1.4
7. Wholesale buying price	293	94.5	301	95.6
8. Unloading and weighing	2	0.6	2	0.65
9. Sorting	2	0.6	2	0.65
10. Daily kiosk ticket, sanitation, electricity and other fees	5	1.7	5	1.6
11. Wholesaler gross profit	8	2.6	5	1.6
12. Wholesaler selling price	310	100.00	315	100.00

Notes:
2. Harvesting = Rp 2/kg.
Sorting, packing and others = Rp 4/kg (Pangalengan) and Rp 3/kg (Ciwidey).
3. Packing materials (plastic sack) = Rp 200/50kg = Rp 4/kg.
5. Transport cost to Jakarta by 15 ton trucks from
Pangalengan: Rp 110,000/truck = Rp 7.3/kg --> Rp 7/kg
Ciwidey: Rp 100,000/truck = Rp 6.6/kg --> Rp 6.5/kg.

The longer distance from Dieng to Jakarta is clearly reflected in the comparatively lower margin paid to the farmers in Dieng (Table 5.6).

Table 5.6 Marketing margins (in percentage) of major production area to wholesale level in Jakarta.

	Dieng	Ciwidey	Pangalengan
1. Assembly price	78.7	88.9	87.1
2. Wholesale buying price	94.4	95.6	94.5
3. Wholesale selling price	100.00	100.00	100.00

The magnitude of the margins indicates that the marketing system is highly efficient from producer to wholesale level. Regarding retail prices, another 25% is usually added which means that potato is quite efficiently marketed in comparison with other, more perishable horticultural commodities.

Storage facilities

Since the high fluctuations in 1982 and 1983, traders and farmers are especially interested in price development of potato. Since they realize that the potato price fluctuates and in order to reduce losses and increase profit, they tend to store their commodity when the potato price is low to keep it until the price increases.

Besides avoiding losses when the prices are low, the farmers also store their potato in order to have planting materials for the next planting. They have two alternatives in storing potato, delaying the harvest or storing it in a warehouse. When prices are good, potato harvesting is done when the potato reaches 70 to 90 days, but when the prices are bad, harvest can be delayed up to 200 days.

A large farmer in Dieng is able to store 200 t of potato. He stores potato seed in wooden crates. He also applies insecticide (Monitor), about 1.5 l for 30 t of potato every two weeks. The physical losses of potato are about 20% in five months.

The assembly traders also store potato. They are able to store potato in quantities of about 50 to 500 t. Normally they store the potato for about one month. The losses are approximately 5% per month. The storage handling cost (excluding warehouse rent) is about Rp 5 to Rp 8/kg/month.[1]

In conclusion it appears that storage is at present almost exclusively done in the higher areas by farmers as well as traders. Wholesale storage does not seem to have developed as yet. The good inter-regional trade system makes wholesale market storage for longer periods superfluous. Traders prefer to keep the potato as close as possible to their buying points to keep their options open.

Utilization and processing

During the last four years, the big Indonesian cities (Jakarta, Surabaya, Bandung, Semarang, Medan, etc.) have been invaded by American-style, fastfood restaurants (e.g. Kentucky Fried Chicken). This development does not stop at big cities, fast food restaurants are also being opened in the smaller cities (Malang, Bogor, etc.). They have introduced french fries to Indonesian consumers. Since 1983, supermarkets began selling imported frozen potato (french fries) to their customers. During the last ten years supermarkets have grown rapidly in Indonesian cities.[2] Snack foods which are traditionally important in Indonesia are expanding in availability and variety.

Recently, several potato processing industries have started operations. They have capacities ranging from 20 to 40 t of potato per day. A low estimation of total demand of fresh potato for the potato industry would be around 12,000 t per year. If the total Java potato production is 200,000 t (in 1985), the industry absorbs about 6% of the total Java production.

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[1] 1 man-day is needed to sort about 1 ton of potato. The cost is about Rp 1,250 to Rp 2,000/man-day.

[2] In the last ten years 10 shopping centres and 55 supermarkets have opened in central Jakarta (Editor, No. 5, 26 September 1987, p. 70).

A supermarket manager informed us that the main customers of frozen french fries are not foreigners but Indonesians. Foreigners are not interested in consuming frozen potato since the commodity packs do not give any information about the expiry dates.

Indonesia has a traditional method for processing potato into chips. The traditional potato chips are made by:

slicing;
dipping slices into a solution of 10 gram calcium carbonate in 1 liter of water for a night (about 20 hours);
washing slices;
blanching slices in salt solution (1 g of natrium chloride (NaCl) in 1 liter of water);
sun drying;
frying;
packing in a plastic bag.

These traditional potato chips are made by home industries in the cities around potato production centres (Bandung, Garut, Malang). Normally, they get their supply of fresh potato directly from the assembly traders in production centres. The supply not only comes from the nearest production centres but also from further away if the nearest production centre cannot compete in quality or price. At present, according to local assembly traders, Dieng also regularly supplies potato to a potato chip home industry located at Garut. One of the respondents claimed to have regularly supplied the potato chip industry in Garut with 10 t of potato (Granola) per week. The potato industry has particular criteria for fresh potato:

skin:	firm, no damage, not broken and not too many eyes, shallow eyes and free of soil
tuber:	big, healthy, yellowish meat
tuber shape:	oval-long oval, regular
maturity:	at least 100 days after planting, 20% dry matter

The buying price of the industry in Garut at the end of September 1987 was Rp 290/kg (28-09-87) to Rp 295/kg (29-09-87). The direct relation between the Dieng traders and the potato industry in West Java has been in existence for one year.

For the last two years, other types of processed potato chips have been produced as well and they are becoming more common to Indonesian consumers. In previous years all of the potato chips were imported (e.g. "Pringle"). Today, at least five potato chip industries are supplying potato chips in different quality classes. The lowest quality potato chips retail price is Rp 150-Rp 200/pack (20 g net). These low-quality potato chips focus on the lower income groups as their target market.

Processing: A case study

To give an impression of how the potato processing industries have recently influenced the production of Indonesian potato, a typical case is given.

PT S (a limited liability company) began to run a business in potato processing in

mid-1987. PT S has a franchise to produce potato products under the "Z" trade mark from a Swiss company.

PT S produces potato chips and frozen french fries. The product is regarded as high-quality and has met the "Z" standard. For instance, vegetable oil[1] is used for frying. No artificial constituent, food additive or other chemicals are used. At present PT S produces three kinds of potato chip: natural, chicken and paprika. The variety of flavours can be extended into 20 types in the future.

At present the factory has the capacity to process 1,000 kg/hour of fresh potato for potato chips, and 650 kg/hour of fresh potato for french fries.

250 kg of potato chips are processed from 1 t of fresh potato and 250 kg of french fries processed from 650 kg of fresh potato. The factory capacity in absorbing fresh potato equals 13,200 kg per day.

In September 1987, during a marketing trial PT S already absorbed 5 to 10 t/day of fresh potato. They plan to absorb 25 t/day as of January 1988 and to expand to 40 t/day in July 1988.

For procurement of fresh potato, PT S has already signed a contract with another private enterprise, PT T, as supplier for the factory. PT T is responsible for supplying the factory regularly (every two days) with a certain volume.

PT T is planning to produce potato through co-operation with farmers, who have experience in growing potato. They decided to produce potato in the Pangalengan, Ciwidey, Garut and Dieng areas. Production cost for potato is estimated at about Rp 4.2 to 5 million/ha, and the yield would be 20 to 30 t/ha. The factory has certain quality criteria. Among those criteria are:

Variety:	Diamond (origin: Holland) or Ilam Hardy (origin: New Zealand)
Tubers:	size: medium-large shape: oval-long oval, regular eyes: little and fairly shallow eyes clear: no excess soil healthy: without any infection
Maturity:	110-115 days after planting (about 80% water content)

The agreement between the factory and supplier of fresh potato contains "a cost plus contract" regarding pricing potato. The production cost of PT T is Rp 4.2 to 5 million/ha. The PT T yield of potato ranges between 20 and 30 t. Based on the quality requirement of the factory, PT T is able to sell about 70% of their production to the factory. Ten percent of the production is for planting material and the remaining 20% is considered as low-quality potato which is sold through the traditional market.

PT T is a newcomer to the potato production business and it faces many problems to organize (in co-operation with the farmers) production of potato which meet the factory requirements (quantity, quality, schedule and price). According to our investigation, PT T at the end of September 1987 bought two lots of potato from assembly traders in the Dieng area. In fact they were not able to meet the factory quality and quantity requirements from their own production.

[1] Vegetable oil price is nearly 300% of the ordinary cooking oil price, bean oil price is Rp 2,000/kg while the other is Rp 700/kg.

Due to the inappropriate quality of potato supply and neglect in potato stock management by PT S, the factory faces some problems. Among these problems are the additional work needed to remove the eyes (because the machine is not able to remove too-deep eyes), and checking whether the tuber is healthy, and the removal of fried chips which are "browning". As a result, an increase in waste (about 20%) is being experienced while these factors also cause a decrease in factory capacity of approximately 25%.

The factory managers informed us that their main target market are medium and high income level consumers for potato chips and high income level consumers for french fries.

The factory price of potato chips is be Rp 150/pack of 20 g and Rp 2,000/kg for french fries. The retail price of potato chips (lower quality from other factories) is Rp 150-200/pack of 20 g and the retail price of imported french fries (frozen) from New Zealand for 7 kg original pack on 17 September 1987 in a supermarket is Rp 4,850 (US$ 3). A 0.5 kg pack (repacked by supermarket) is Rp 1,450 (Rp 2,900/kg). The c.i.f. price of french fries (made in USA) is US$ 1.11 (Rp 1,830) per kg. With an import duty of 30% and a sales tax of 10% the french fries cost up to Rp 2,562/kg (profit is not yet accounted).

Obviously the firm aims to sell at a price range similar to imported produce. This seems to be well within the possibilities for the low-quantity packed produce, such as the 20 g packs and 0.5 kg french fries packs. It is not certain that they will manage to compete successfully with imported produce regarding the larger family packs.

More worrying seems to be the increased factory losses in waste and capacity related to the inadequate supply of potato. It seems of vital importance to these firms that better technology and seeds are used otherwise the concept does not appear to be viable.

6

Imports and Exports

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Summary

Exports of potato, primarily from North Sumatra to Penang rose sharply from approximately 7,000 t in 1983 to 26,000 t in 1987. At present the market share of Indonesian produce in Penang is quite substantial, while in Singapore it is only 4%. Nominal c.i.f. Penang prices dropped to Rp 600 in 1987 from Rp 700 in 1986. Indonesian foreign trade of potato is becoming important and contributes to demand.

Imports of potato or potato products are rather small, potato seed being the major component, while the import of french fries is rapidly increasing, although the volume is still very small at 177 t in 1986.

Imports

Indonesian imports consist of 5 CCCN categories:

Potato seed	(CCCN: 07 01 110)
Other potato	(CCCN: 07 01 190)
Potato flour and meal in packs of 20 kg or more	(CCCN: 11 05 110)
Other flour and meal	(CCCN: 11 05 190)
Potato flakes	(CCCN: 11 05 200)

Exports consist only of the category "other potato". The term of "other potato" in this paper can be interpreted as "fresh potato for consumption", and in future will be referred to as fresh potato. The category "potato flakes" also can be interpreted as frozen french fries.

"Potato seed" is the most important category of imported potato both in terms of value and volume. The yearly volume of potato seed imported in the period of 1981 to 1986 is stable at a level of 500 t/year. In 1983 and 1984 the imports almost doubled compared to the other years, perhaps in the expectation of continuing high prices, as induced by the high prices of 1983.

Since Indonesia is not yet able to produce planting materials in a commercial way, import of potato seed is necessary to sustain potato production of the country.[1] The main seed exporting countries to Indonesia are the Netherlands, Germany and Australia.

[1]The Indonesian Horticulture Research Institute is already able to produce potato planting materials by tissue culture technique and other quick propagation techniques.

The category of imports which is less important is "fresh potato". Fresh potato imports from 1981 to 1985 fluctuated between 400 and 1,600 t per year, and decreased in 1986 to only 66 t.

The imports of processed potato increased in the period 1981 to 1986 (Table 6.1). Potato flour and meal imports increased from 35 t in 1981 to 285 t in 1985, an increase of about 700% in four years. Imports of french fries (flakes) also increased from 5 t in 1981 to 177 t in 1986. Detailed data on potato imports can be seen in Tables 6.1 and 6.2.

Table 6.1 Volume of potato imports to Indonesia (t), 1981-1986.

CCCN	Type of potato	1981	1982	1983	1984	1985	1986
0701110	Potato seeds	545	565	957	1,096	209	442
0701190	Other potato	417	1,600	856	625	603	66
1105110 and 1105190	Potato flour and meal	35	61	104	187	285	122
1105200	Potato flakes	5	3	1	20	79	177

Source: Central Bureau of Statistics, Indonesia.

Table 6.2 Value of potato imports to Indonesia, 1981-1986 (US$ '000, c.i.f.).

CCCN	Type of potato	1981	1982	1983	1984	1985	1986
0701110	Potato seeds	310	297	435	482	92	246
0701190	Other potato	271	301	432	425	524	62
1105110 and 1105190	Potato flour and meal	68	28	39	167	122	150
1105200	Potato flakes	17	8	5	11	42	306
	Potato	666	634	911	1,075	760	764

Source: Central Bureau of Statistics, Indonesia.

Exports

Indonesia's recorded export volume was quite stable and low in the period 1981 to 1983, at around 100 to 300 t/year. From 1984 to 1986 it increased significantly to 12,295 t in 1984 and increased further to 19,288 t in 1985 and 21,872 t in 1986. Further detailed export data are outlined in Table 6.3.

Table 6.3 Volume and value of potato exports from Indonesia, 1981-1986.

CCCN	Type of potato	1981	1982	1983	1984	1985	1986
0701190	Other potato						
	Volume (t)	285	150	1,892	12,295	19,288	21,872
	Value (US$ '000, f.o.b.)	38	17	205	1,356	2,022	2,176

Source: Central Bureau of Statistics, Indonesia.

The main export destinations of Indonesian fresh potato are Singapore and Malaysia (Penang). The export to Penang in 1986 was 12,955 t or about 60% of the

total potato exported. The export to Penang in 1987 (January to September) was 11,072 t or about 1,230 t per month, compared to the export in 1986 (January to September) of about 9,777 t or about 1,080 t per month. In August, prices recovered slightly to US$ 600.

There seems to be some fluctuation in monthly potato exports to Penang (Figure 6.2). Penang prices fluctuate independently from the monthly export volumes (Figure 6.1). Prices were stable at 680 to 700 Malaysian dollars (M$) in 1986, but experienced a sharp drop in the period March to May 1987, to M$ 550/t.

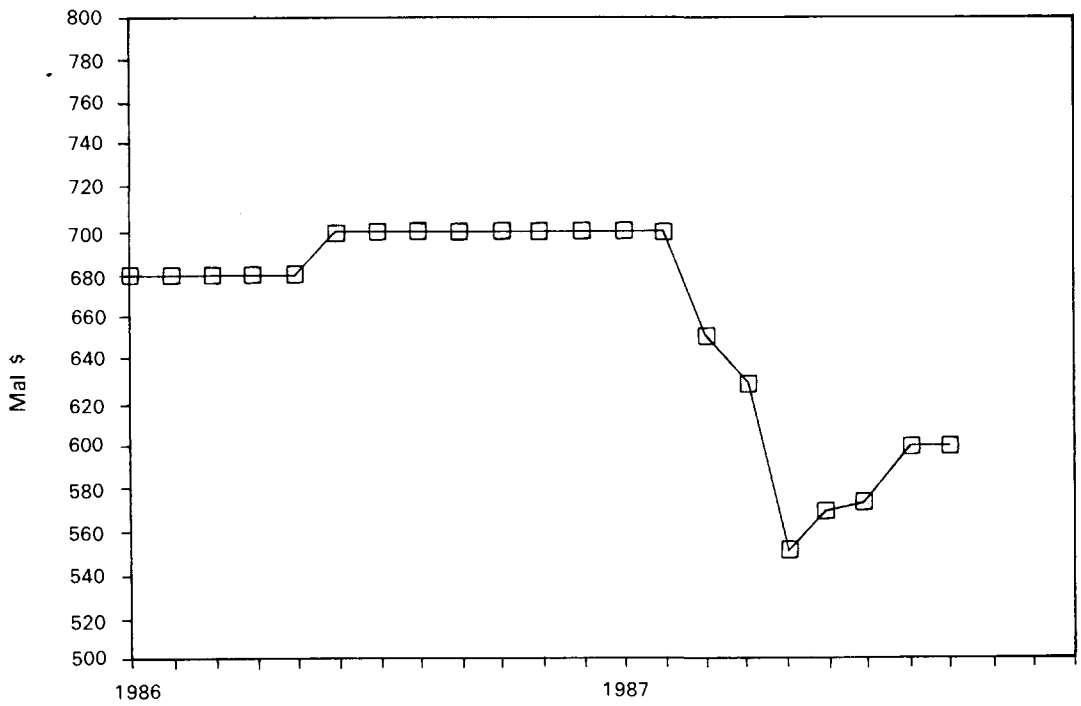

Figure 6.1 Monthly price of potato (Penang, c.i.f.), 1986-1987.

The total value of vegetable (potato, cabbage, Chinese cabbage, carrot, ginger and tomato) exports to Penang from January 1986 to September 1987 was M$ 30,033,022. The value of potato exports was M$ 15,849,782 which equals about 50% of the total vegetable exports. The value of cabbage export was M$ 8,960,334 and contributed about 30% to the total vegetable exports. Indonesian vegetable exports to Penang (January 1986 to September 1987) are outlined in App. Table 6.1. App. Table 6.2 depicts price developments of potato and cabbage.

The sharp increase in exports of horticultural commodities and especially potato, is a very positive sign for the potato industry in Indonesia. It may help link the Indonesian potato production system to international markets and contribute to creating competitive potato production.

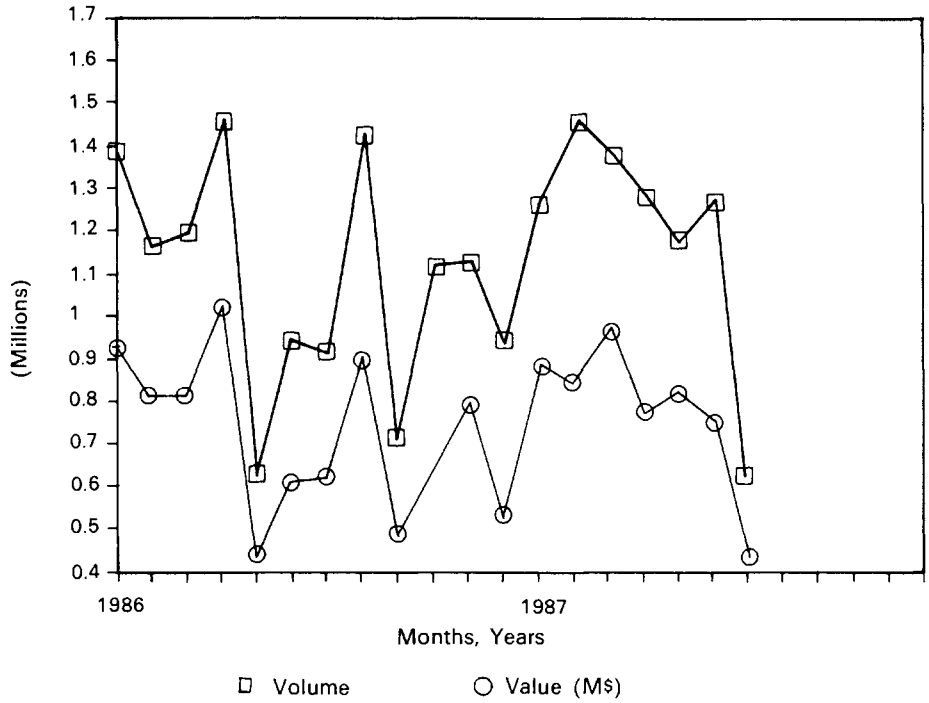

Figure 6.2 Monthly volume and value of potato exports to Penang, 1986-1987.

1 M$ = Rp 620 - August 1987
= Rp 660 Spot prices

7

Consumption

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Summary

Potato in Indonesia is consumed as a vegetable in a large variety of dishes and recently has become popular as french fries or as potato chips. National consumption data show that in higher income classes more potato is consumed, while consumption on Java in urban areas is significantly higher than consumption outside Java. Per capita consumption in Indonesia has increased from 0.5 kg in 1968 to approximately 2 kg in 1985. A consumption prediction, assuming linearity in consumption growth, predicts potato consumption to be around 440,000 t in 1999. Another approach using price elasticities leads to a prediction of around 410,000 t in 1999.

Approach

The analysis of consumption aspects is based on two secondary data sets: the National Socio-Economic Survey (SUSENAS) which is conducted by the Central Bureau of Statistics (BPS) every three years. SUSENAS data from 1981 and 1984 will be used to discuss patterns of consumption of potato and other commodities. Results from earlier SUSENAS surveys will be used along with other data to obtain a longer term perspective. The second data source is Food Balance Sheets also published by BPS.

The 1981 SUSENAS survey data were collected in four rounds. SUSENAS 1984 included only one round of data collection. The 1981 SUSENAS data are usually considered by analysts to be of better quality due to the year-round coverage of the consumption.

In the SUSENAS data the unit of observation is the household. Data are collected from all provinces and regencies (*kabupaten*). Random sampling is used to select subdistricts, villages and households. In 1984 the sample included more than 50,000 households. Consumption and expenditure on specific commodities are measured on the basis of one week, total expenditure is measured on a monthly basis.

The use of household expenditure data for the measurement of potato consumption presents a number of problems:

1. While household expenditure data on consumption of the major crops such as rice, maize and cassava are usually reliable, this is not the case for crops that are consumed in small quantities such as potato.

2. Annual per capita consumption of commodities is obtained through multiplying weekly consumption by the number of weeks. If there are seasonal differences in the consumption of crops this distorts the picture.

3. SUSENAS data measure household consumption only. In countries such as Indonesia where consumption of food at markets, food stalls and restaurants is very important to all income classes of the population, this causes an underestimation of total consumption. This trend is reinforced by the fact that Indonesia is now at a stage of development where food consumption outside the household will increase. Fastest consumption growth is occurring in restaurants and fast food outlets.

4. The household expenditure survey ignores different qualities of crops. An increase in the expenditure on a certain commodity can mean the purchase of a larger quantity, a higher quality or a combination of the two. This makes it difficult to assess pure quantity effects in relation to incomes and prices. In the case of potato in Indonesia there are five different qualities.

5. Potato in Indonesia is a vegetable crop. In many dishes it can easily be substituted by another vegetable. Consumption patterns therefore are less fixed than for many other crops.

Forms of potato consumption

Potato in Indonesia is consumed in a fairly large variety of dishes and soups as one of several vegetables. Increasingly, especially in urban areas, potato is consumed in different forms such as french fries or as processed products such as potato chips. Potato used for processing is either imported or the highest quality domestic production.

Consumption patterns

Introduction

The consumption of potato in Indonesia differs according to region, location and income class. Table 7.1 summarizes the basic pattern for 1981 and 1984 for a number of categories. This table shows clearly that:

1. Potato consumption is significantly higher in Java than outside Java.

2. Potato consumption in urban areas both in Java and outside Java, is much higher than consumption in rural areas.

3. Consumption of potato increases rapidly with income, with the highest income groups consuming more than three times the amount of potato that the lowest income class consumes.

4. According to the SUSENAS data, potato consumption almost doubled between 1981 and 1984. This is consistent with information on consumption from the Food Balance Sheets for potato (Table 7.5) and indicative of the sharp fluctuations around the trendline (Figure 7.1).

Table 7.1 Potato consumption in Indonesia, 1981-1984 (kg/capita/yr).

	Expenditure class[1]	1981	
		Urban	Rural
Java	I	0.69	0.31
	II	0.89	0.32
	III	1.23	0.41
	IV	1.95	0.68
Outside Java	I	0.35	0.39
	II	0.66	0.29
	III	0.84	0.40
	IV	1.46	0.96
Indonesia	I	0.51	0.35
	II	0.76	0.31
	III	0.98	0.41
	IV	1.64	0.87
		1984	
		Urban	Rural
Java	I	0.37	0.52
	II	0.67	0.42
	III	1.31	0.72
	IV	3.58	1.50
Outside Java	I	0.33	0.06
	II	0.60	0.12
	III	1.24	0.59
	IV	2.82	1.61
Indonesia	I	0.35	0.25
	II	0.62	0.26
	III	1.27	0.64
	IV	3.13	1.58

Source: CBS, SUSENAS 1981, 1984.
[1]Expenditure classes (Rp '000/capita/year):

		1981	1984
Urban	I	<88	<130
	II	88-117.99	130-172.99
	III	118-176	173-260
	IV	>176	>260
Rural	I	<51	<79
	II	51- 67.99	79-104.99
	III	68-102	105-157
	IV	>102	>157

Table 7.2 compares household consumption of potato in Indonesia with the consumption of rice and cassava as two of the staple foods, and with cabbage, bean and tomato as some of the more important vegetables crops.

Consumption of rice, as the major staple crop, is highest of all commodities. It is interesting to note that for the lowest income category, rice consumption in urban areas is higher than in rural areas, while for the highest income category, rural rice consumption is higher than urban rice consumption. This partly reflects differences in

income distribution and partly the fact that rural low income groups consume more non-rice staples such as cassava and maize compared to the urban poor. On the other hand, the urban rich have a more diversified consumption pattern than the rural rich and the importance of rice is rapidly declining among urban rich consumers. As for potato, the consumption in urban areas is consistently higher than in rural areas for both high and low income groups. This is similar to the patterns of tomato, cabbage and bean. Cassava consumption, according to the SUSENAS data, declines consistently with rising incomes, although different cassava products such as dried cassava chips (*gaplek*), fresh roots and *krupuk* (fried cassava chips) behave in quite a different manner.

Table 7.2 Consumption of selected crops in Indonesia, urban and rural areas, 1981 and 1984.

Expenditure class[1]	Commodity											
	Rice		Cassava		Potato		Cabbage		Bean		Tomato	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
					1981 Urban							
I	85.57	19851	3.59	215	0.51	137	1.13	153	2.14	347	7.64	262
II	77.52	18206	3.45	195	0.76	199	1.22	171	2.40	399	10.34	360
III	76.71	18675	2.74	175	0.98	283	1.56	242	2.79	514	12.79	476
IV	78.21	19869	2.56	185	1.64	487	1.78	308	3.29	660	17.96	703
					1981 Rural							
I	66.48	14108	18.21	792	0.35	74	0.96	93	2.23	283	3.54	101
II	73.49	15589	14.96	640	0.31	74	1.10	115	2.82	364	4.35	133
III	82.14	17875	13.71	624	0.41	98	1.29	141	2.96	398	5.49	167
IV	89.13	20121	10.64	541	0.87	213	1.55	213	3.56	535	9.80	340
					1984 Urban							
I	88.77	28890	10.61	936	0.35	101	1.29	187	2.53	531	5.23	244
II	99.04	33194	8.41	776	0.62	193	1.56	287	3.27	770	9.93	441
III	103.95	35936	9.21	911	1.27	436	1.97	390	4.01	1026	12.75	605
IV	110.00	39758	7.58	779	3.13	1206	3.17	751	5.61	1589	19.88	1031
					1984 Rural							
I	54.45	17101	25.32	1594	0.25	44	0.69	77	2.21	351	1.78	77
II	82.23	26076	26.46	1682	0.26	51	1.04	137	3.72	602	3.30	134
III	103.27	33816	25.82	1741	0.64	158	1.34	206	4.60	822	5.50	243
IV	125.74	43033	22.19	1831	1.58	486	2.44	468	6.45	1345	10.06	505

Source: SUSENAS 1981 and 1984.
[1]Expenditure class: see note Table 7.1
Q: Quantity (kg/capita/year)
V: Value (Rp)

Participation rates

Participation rates provide information on consumption from a somewhat different perspective, showing the percentage of the population that has actually consumed a certain commodity during the period covered by the SUSENAS survey. Table 7.3 presents participation rates for selected urban areas and for urban and rural Indonesia, Java and outside Java. The table shows that, as expected, close to 100% of the population consume rice. The number of households consuming potato is the lowest of all commodities listed and ranges from close to zero in rural areas outside Java to 37%

for the highest income groups in Jakarta. The number of households, consuming other horticultural crops is considerably higher. The table confirms the trend of decreasing cassava consumption with higher incomes. Comparing potato consumption in the different urban markets it can be concluded that the patterns are quite similar, with the exception of the highest income group where consumption of potato is much more common in Jakarta than in Yogyakarta and Surabaya. An explanation for this could be that consumption patterns in Jakarta have become more westernized than in the other cities, at least among the highest income groups.

Table 7.3 Participation rates of selected crops consumed in urban and rural areas, 1984.

Locations by expenditure class		Rice	Cassava	Potato	Cabbage	Bean	Tomato
Indonesia	I	.98	.39	.05	.17	.46	.24
		(.77)	(.47)	(.02)	(.08)	(.27)	(.09)
	II	.99	.36	.10	.22	.56	.38
		(.90)	(.48)	(.02)	(.12)	(.42)	(.12)
	III	.99	.38	.17	.25	.64	.41
		(.94)	(.48)	(.06)	(.15)	(.50)	(.17)
	IV	.96	.29	.30	.32	.72	.48
		(.97)	(.44)	(.12)	(.21)	(.09)	(.25)
Java	I	.96	.41	.05	.24	.53	.20
		(.74)	(.44)	(.03)	(.15)	(.36)	(.03)
	II	.98	.37	.10	.27	.58	.39
		(.88)	(.47)	(.03)	(.17)	(.48)	(.07)
	III	.99	.37	.18	.26	.63	.46
		(.93)	(.47)	(.05)	(.19)	(.54)	(.10)
	IV	.94	.27	.32	.29	.68	.52
		(.97)	(.43)	(.09)	(.24)	(.62)	(.20)
Outside Java	I	.99	.38	.04	.10	.38	.29
		(.80)	(.50)	(.007)	(.03)	(.19)	(.13)
	II	.99	.36	.09	.17	.55	.37
		(.91)	(.50)	(.01)	(.07)	(.36)	(.17)
	III	.99	.38	.16	.25	.65	.37
		(.95)	(.48)	(.06)	(.11)	(.47)	(.21)
	IV	.98	.30	.28	.35	.74	.45
		(.97)	(.45)	(.14)	(.19)	(.59)	(.27)
Jakarta	I	1	.33	.04	.04	.25	.29
	II	1	.21	.11	.09	.33	.44
	III	.99	.24	.20	.12	.37	.48
	IV	.95	.19	.37	.17	.59	.55
Yogyakarta	I	.99	.42	.01	.51	.72	.21
	II	1	.41	.13	.48	.91	.52
	III	.97	.40	.20	.50	.92	.41
	IV	.77	.21	.24	.41	.76	.42
Surabaya	I	1	-	-	.33	1	.33
	II	1	.37	.12	.20	.84	.41
	III	1	.39	.10	.25	.80	.47
	IV	.93	.29	.20	.29	.73	.45

Source: SUSENAS 1984.

Note: Figures in parentheses represent participation rates for rural areas. Expenditure class, see Table 7.1.

Demand parameters

Expenditure and price elasticities of demand provide additional information on how consumption of potato is affected by the price of the crop and incomes of the consumers.

Price elasticities for a number of urban markets were estimated for 1981 and 1984 using the model presented in equation 7.1. The results are presented in Table 7.4. The figures may not necessarily be divided by the population of the urban locations selected since the sample size of the survey has been randomized to represent the respective population.

$$LN\ Q = LN\ a + b\ LN\ I + c\ LN\ P \qquad (7.1.)$$

where:

Q = quantity of potato consumed
I = expenditure (Rp/capita/year)
P = price of potato (Rp/kg)

Table 7.4 Own-price elasticities of potato for selected urban markets, 1981 and 1984.

	1981	1984
Jakarta	-0.58***	-0.66***
Surabaya	-1.34***	-0.61
Semarang	-0.80**	-1.05
Bandung	-0.37	-1.17***
Urban outside Java	-0.46***	-0.42***

** 95% level of significance
*** 99% level of significance

Although the differences between the locations and years are considerable it can be concluded that consumption of potato is rather elastic. The average would probably be in the area of -0.6 to -0.8. It should be noted that the price elasticities outside Java are considerably lower than on Java. Consumption of potato in Java is probably more sensitive to price because of better market integration and the availability of a wider variety of substitutes.

The relationship between per capita household potato consumption and total expenditure (or income) was estimated by using a semilog functional form applied to aggregate SUSENAS household survey data. Expenditure figures from the 1981 SUSENAS survey were inflated to measure the effect of real expenditure variation from the pooled 1981-1984 cross section data. For inflating real and nominal "total expenditure on consumption", figures from the national accounts were compared.

Because of differences in the number of observations in each expenditure group, weighted ordinary least squares were used for estimation. Equation (7.2.) shows the estimation equation and (7.3.) gives the estimation results. The income parameter is highly significant and leads to an income elasticity estimate of 0.69 (equation 7.4.). This places potato in the category of relatively luxury food products comparable to, for example, processed soybean foods such as *tempe*.

$$\frac{Xi}{SQRT\ N_i} = \frac{Ao}{SQRT\ N_i} + A_1 * \frac{LN\ (EXP_i)}{SQRT\ N_i} + A_2 * \frac{Dt}{SQRT\ N_i} + e \quad (7.2.)$$

X_i = consumption in each household expenditure class i (per capita per year)
N_i = number of observations in each expenditure class
EXP_i = expenditure in group i (Rp/capita/year)
D_t = time dummy 1981 = 0, 1984 = 1
e = error term

$$X_i = -9.31 + 0.879*LN(EXP_i) - 0.526*D_t \quad (7.3.)$$
(3.40) (0.287) (0.248)
2.74** 3.06** 2.12**

$R^2 = 0.26$ ** significant at 95% level

$$E_{x,y} = \frac{d_x}{d_{EXP}} \cdot \frac{EXP_s}{X_s} = \frac{A_1}{X_s} = 0.69 \quad (7.4.)$$

$E_{x,y}$ = income elasticity of demand
X_s = sample mean of per capita consumption
E_XP_s = sample mean of household expenditure

$$X_{pt} = X_{1984} + E_{x,y} * \frac{d_{yi}}{y_i} \quad (7.5.)$$

X_{pt} = projected per capita consumption in year t where t = 1985 1999

Again, it should be stressed that these data do not reflect prices and quantities adequately since different qualities with different prices are lumped together. The results have to be used with caution.

Consumption trends and projections

In this section an attempt will be made to forecast potato consumption for the period 1985-1999, using two different data sets.

Table 7.5 presents Food Balance Sheet data for potato for the period 1968 to 1985. The availability as food for human consumption is obtained by adjusting production data for imports and exports and for seed use and waste. A trend line was fitted through the consumption data using simple linear regression (equation 7.6.):

$$Y = 12.49\ X - 796.9 \qquad R^2 = 0.76 \quad (7.6.)$$
(38.3) (1.7)

The actual data and the expected values of the trend line are presented in columns (2) and (3) respectively of Table 7.6. Actuals and the trendline are also shown in Figure 7.1. Although fluctuations around the trendline are quite sharp, it explains 76% of the

variation and provides a good summary of longer term trends. The trend implies a consumption growth of 9.9% per year in the period 1968-1985 and 3.6% per year for the period 1985-1999. Reduction of the growth rate is due to the linearity of the trendline which gives high growth rates at a low base and lower rates when starting from a higher base. Assuming linearity in consumption growth, potato consumption in 1999 in Indonesia is predicted to be around 440,000 t.

Table 7.5 Indonesia: Domestic supply and consumption of potato, 1968-1985.

Year	Production	Imports	Supply available for domestic utilization and export	Exports	Domestic supply	Domestic utilization			Consumption (kg/capita/yr)
						Seed	Waste	Food	
1968	65	-	65	-	65	10	3	52	0.47
1969	104	-	104	-	104	11	5	88	0.77
1970	70	-	70	-	70	9	4	57	0.49
1971	123	-	123	1	122	11	6	105	0.90
1972	124	-	124	3	121	12	6	103	0.85
1973	173	-	173	4	169	17	8	144	1.16
1974	178	-	178	5	173	15	9	149	1.17
1975	124	-	124	5	119	12	6	101	0.77
1976	121	-	127	7	120	12	6	102	0.76
1977	248	-	248	8	240	16	12	212	1.56
1978	233	-	233	2	231	19	23	189	1.35
1979	204	-	204	1	203	15	20	168	1.17
1980	230	-	230	-	230	-	23	207	1.42
1981	217	1	218	-	218	19	11	188	1.26
1982	180	2	182	-	182	16	9	157	1.03
1983	250	2	252	2	250	21	25	204	1.30
1984	372	2	374	12	362	23	18	321	2.01
1985	373	1	374	19	355	23	18	314	1.92

Source: CBS, Food Balance Sheets, various issues.

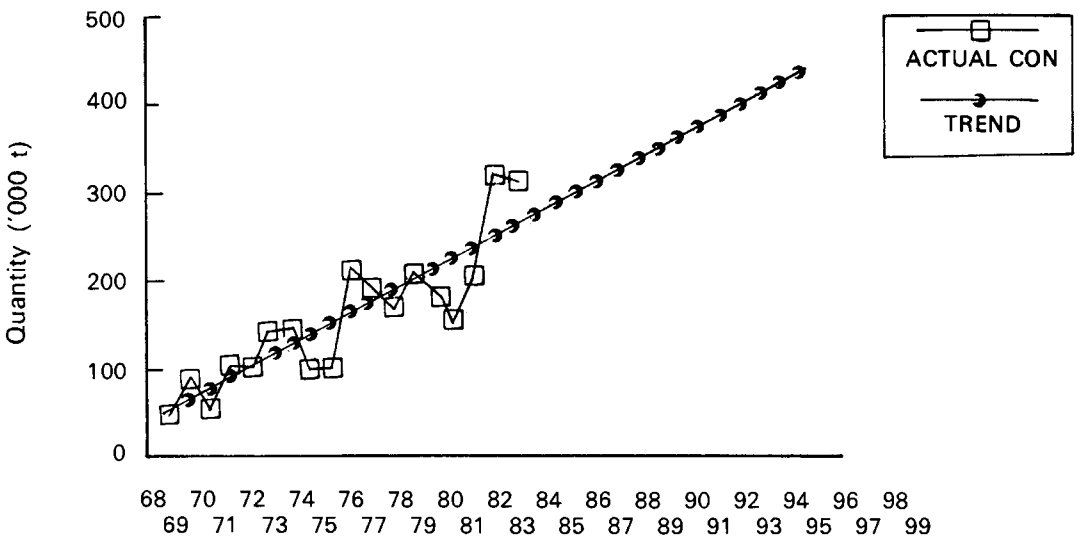

Figure 7.1 Projected consumption of potato.

An alternative approach is to use demand parameter data from the SUSENAS survey to forecast consumption. Equation 7.5 projects per capita consumption, applying the income elasticity figure to a 1984 base. The income elasticity value of 0.69 was used to forecast per capita household potato consumption until the year 1999. It is assumed that expenditures covered by the SUSENAS surveys increase proportionally with the expenditure figures from the national statistics.

A 2% growth in annual real per capita income is assumed to result in a 1.4% annual increase in per capita potato consumption. Since population increases by 2.1% per year, an annual increase of 3.5% is expected. This is very close to the 3.6% increase obtained from the trendline. Table 7.6 column (4) gives the projected per capita potato consumption calculated from equation 7.5. By multiplying per capita projected consumption with the projected population (column (5)), total projected household consumption is obtained. This information is shown in column (6) of Table 7.6 and in Figure 7.2. Estimated household consumption in 1999 is 296,000 t.

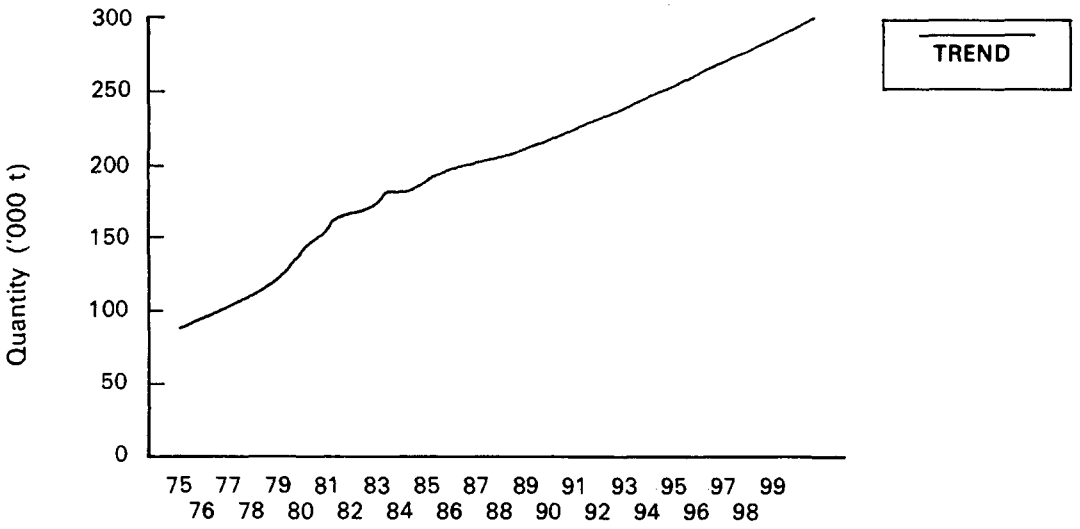

Figure 7.2 Projected potato consumption based on SUSENAS, 1981-1984.

Comparing the 1985 Food Balance Sheet figures App. Tables 7.1 and 7.2, which give the total consumption, with the 1985 household consumption data, non-household consumption is estimated to be around 70,000 t. Figure 7.3 combines the information of Figures 7.1 and 7.2.

Applying the 3.5% growth rate to non-household consumption, this figure will increase from 70,000 to 113,000 t between 1985 and 1999. This leads to an estimated total consumption of 296,000 + 113,000 = 409,000 t. This estimate is very close to the 440,000 t estimate which was the result of applying a trend to the balance sheet figures. The difference between the estimates may be due partly to a lower income growth expected during the 1990s compared to the fast expansion of national per capita income observed during the 1970s.

Table 7.6 Potato consumption in Indonesia, actuals and two projections.

Year	Actual consumption	Trend consumption projection	Per capita consumption SUSENAS projection	Population projection	Household consumption projection
(1)	(2)	(3)	(4)	(5)	(6)
1968	52	52.7			
1969	88	65.2			
1970	57	77.7			
1971	105	90.2			
1972	103	102.7			
1973	144	115.2			
1974	149	127.7			
1975	101	140.2	0.68	131	89.6
1976	102	152.7	0.72	134	97.0
1977	212	165.2	0.77	137	105.1
1978	189	177.7	0.81	140	113.1
1979	168	190.2	0.90	143	128.4
1980	207	202.7	0.98	147	143.5
1981	188	215.2	1.07	150	161.2
1982	157	227.7	1.10	153	167.8
1983	204	240.2	1.15	157	180.1
1984	321	252.7	1.16	160	185.7
1985	314	265.1	1.17	164	192.6
1986		277.6	1.19	167	198.5
1987		290.1	1.20	171	205.6
1988		302.6	1.22	174	211.6
1989		315.1	1.23	178	218.9
1990		327.6	1.24	182	226.3
1991		340.1	1.26	185	232.6
1992		352.6	1.27	189	240.2
1993		365.1	1.28	193	248.0
1994		377.6	1.30	197	255.8
1995		390.1	1.31	201	263.8
1996		402.6	1.33	205	271.9
1997		415.1	1.34	209	280.0
1998		427.6	1.35	213	288.3
1999		440.1	1.37	217	296.7

(2) Actual consumption data based on Food Balance Sheets (availability for human consumption).

(3) Trend projection of consumption Food Balance Sheet data ('000 t).

(4) Per capita consumption based on SUSENAS 1981-1984 data (1984 base).

(5) Actual and estimated population of Indonesia in millions, CBS estimates.

(6) Projected household potato consumption based on demand parameters derived from pooled 1981-1984 SUSENAS consumption data.

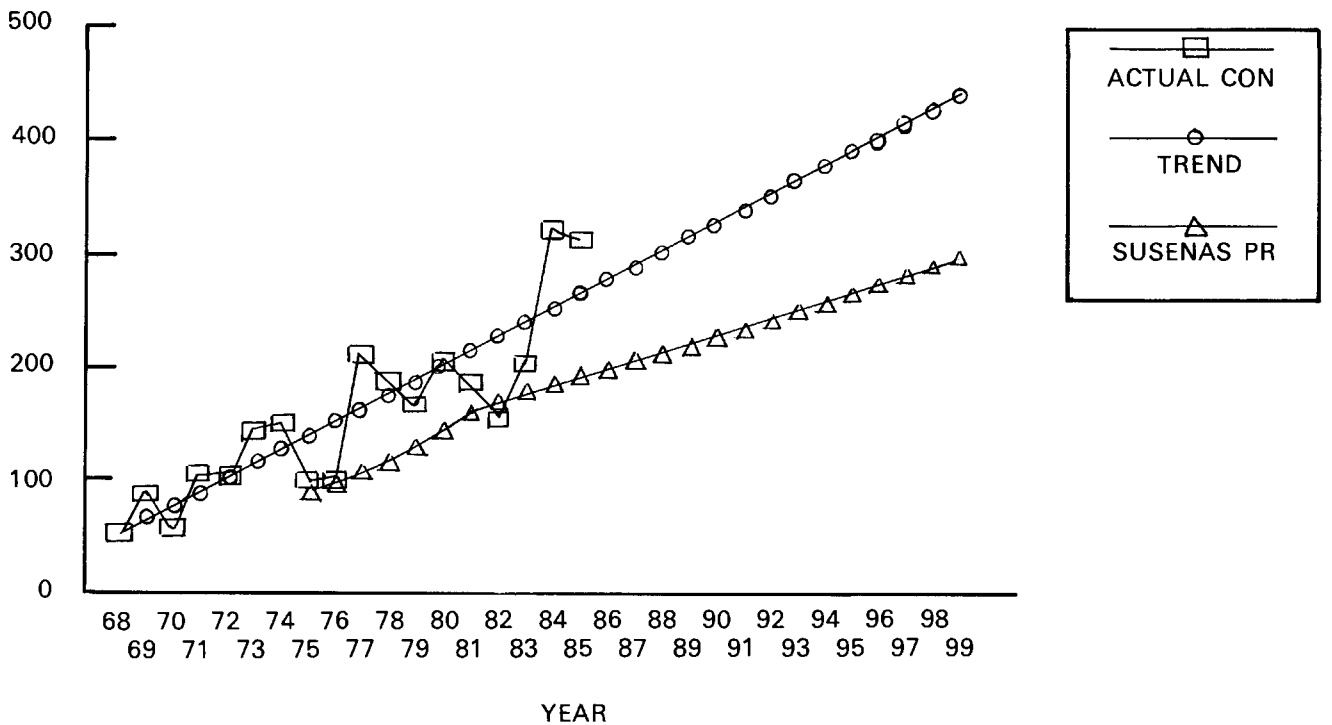

Figure 7.3 Two projections combined based on Figures 7.1 and 7.2.

8

Medium Altitude Potato in Magelang Regency: A Case Study

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Summary

A case study conducted in the area of Magelang clearly indicates that spontaneous m.a. growers employ a low input-low output production system. Yields of improved varieties were rather low at approximately 4 t/ha. Seed quality was reported to be low. These results do not indicate the fitness of the variety in the agronomic environment but do, in our view, indicate difficulties experienced by early adopters in the transition from a low input-low output system to a high input-high output system. These difficulties concern primarily the availability of capital for the necessary inputs and they support the view of the team that although difficulties and technology modifications will take place, use of appropriate m.a. varieties is bound to take place if proper seeds are available. Sweet potato was found to be more popular than white potato. Extensive local knowledge and nomenclature regarding sweet potato were encountered (App. Table 8.1).

Approach

In the regency of Magelang, potato has been grown for a considerable time both in highland and at medium altitude. In order to gain insight into the structure of production and marketing of m.a. potato, a case study was conducted in the area of Magelang. The Magelang regency was selected for several reasons. The most important is the fact that m.a. potato has been cultivated in the district since the second World War. Hence, farmers and traders have managed to create a production and trading system which has been sustained over a period of more than 40 years. In view of the absence of m.a. varieties, this achievement is exceptional. Another reason for selecting the Magelang area was the scale of production. Other areas visited during the reconnaissance trip showed very limited production of m.a. potato.

The area around Malang, East Java, should be mentioned. On the basis that m.a. potato is usually grown near a centre of highland production, one would expect some spontaneous m.a. potato growing between Batu and Malang. Many farmers in that area reported to have produced m.a. potato over a long period, but most, if not all farmers abandoned potato as a cash crop because of the more substantial income derived from cultivation of chilli pepper. The main factor causing decreasing yield of m.a. potato was reported to be a lack of viable seed.

Another area in which m.a. potato was reported to be cultivated, is the area of Karanganyar, Central Java (Figure 8.1). However, because of time limitations during the reconnaissance trip and the more promising prospects of the area around Magelang, the reconnaissance part focused its attention on Magelang. In the area around Bandung and Pangalengan virtually no m.a. potato is grown, probably because of a long tradition of vegetable cultivation at medium altitudes. In the area south of Cianjur, some m.a. potato is cultivated.

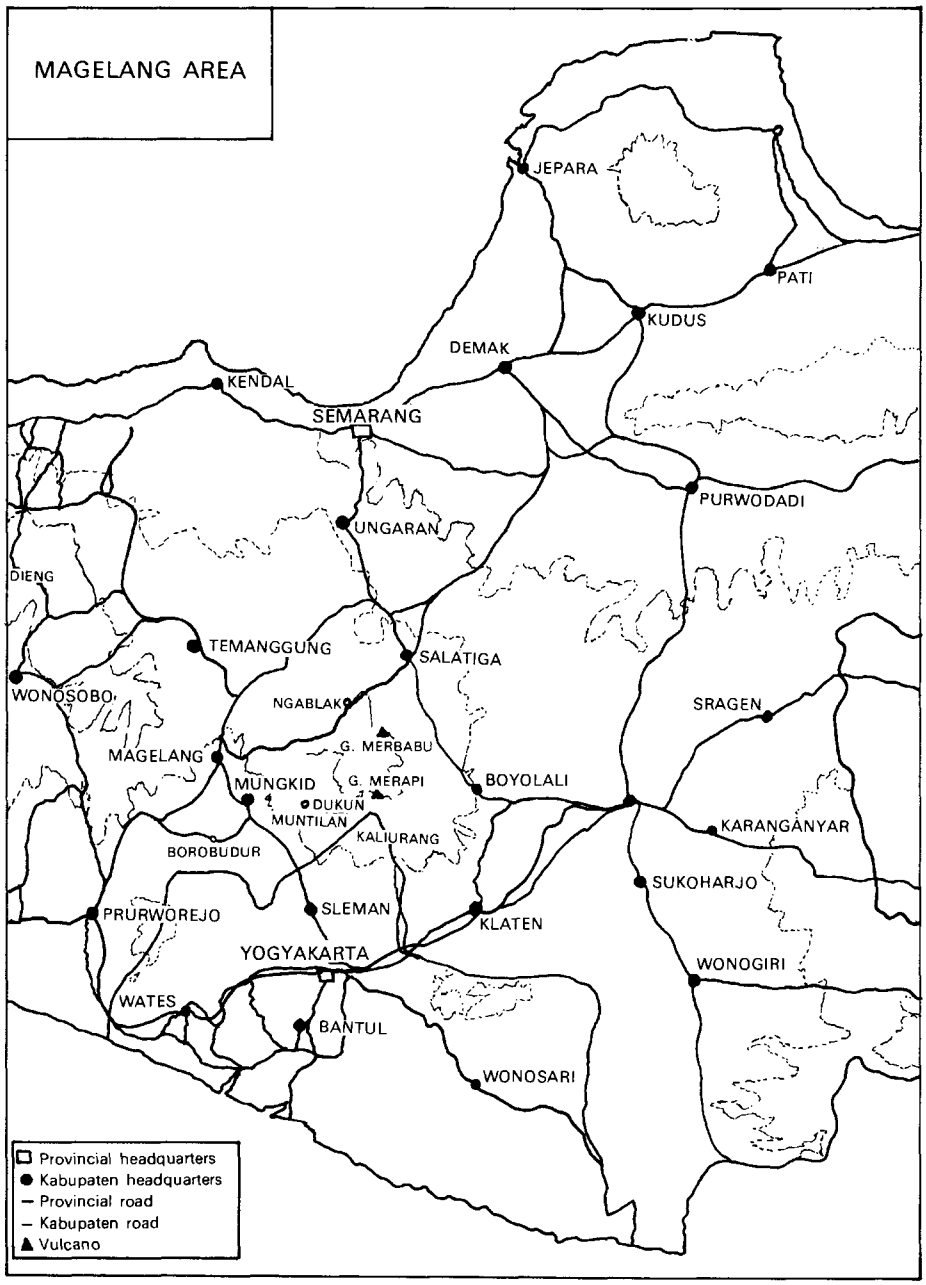


Figure 8.1 Map of Magelang area, Central Java.

Recent history of medium altitude potato in Magelang

In the area of Magelang, several villages on the slope of Mount Merapi have cultivated potato since the second World War. During the war, the villages of Srumbung and Dukun were supplied with potato seed to increase production of food for home consumption. At this time a substantial part of the rice production was confiscated by the Japanese occupying forces which increased the need of the villages to expand production of non-rice commodities. Several types of bean and cabbage and also potato were included in the production system together with increased cultivation of maize and cassava. Before the war the village economy could be characterized as a subsistence economy with emerging sales of tobacco. A local variety (Kretek*) of rice with a growth period of five months, was planted in October and harvested in February-March, leaving a period of five months for cultivating maize, sweet potato and sometimes tobacco as a cash crop. The stress put on the village economy during the war resulted in the intensification of the second planting period, running from March to September. Little is known about the varieties introduced, but it is certain that the major potato variety, described as "*varietas* Landbouw" was the Dutch variety "Eigenheimer". According to villagers this variety survives until today although in a degenerated form. Production of these seeds takes place in higher altitude.

The process of change and intensification which started during the war continued in the period after. Two additional developments proved to be highly significant for shaping the production system into its present form.

Outside traders came to visit the village, first on foot and later by bicycle, to purchase vegetables and rice for the purpose of selling it in nearby urban centres (Yogyakarta, Magelang). This commercialization of subsistence cropping took a long time to develop into a stable trading system. Although the need for food in urban centres was great and prices were high, there were long periods of upheaval and insecurity between 1945 and 1965. It would appear, from the village perspective, that the trade system developed intermittently from purely local trading in difficult periods, to more direct rural urban trading in quieter periods.

The second development was the introduction of fertilizer which was used mainly to increase the production of rice. The increased production of rice enabled the farmers in the period from 1955 onwards, to use the second planting period for cash cropping tobacco, which yielded excellent prices relative to food crops. In the early 1960s farmers started to apply manure for the production of vegetables, including potato and sweet potato, which became increasingly important as cash crops. In 1965, short duration varieties of rice became available and the use of fertilizer became generally adopted. In this period farmers derived their income, in order of importance, from tobacco, rice and vegetables. From the early 1970s, (under the New Order Government), facilitated by the stable and secure situation, the process of commercialization and intensification of production assumed a rapid pace. High-yielding varieties of coconut trees were introduced which further increased food security for the village population, enabling farmers to concentrate more on cash cropping. Farmers got used to the application of fertilizer, resulting in significant increases in yield of rice. In 1980, the price of tobacco went down considerably

*Kretek (onomatopee = krêtêk) refers to the sound of hulling the grain.

resulting in a completely new basis for village cash crops. Vegetables, especially bean and sweet potato became the major source of cash income, while the rice surplus also increased, resulting in an increased importance of rice as a source of cash. *Palawija* crops, such as maize, are still planted with the dual purpose of direct food supply as well as for cash. Tobacco, for thirty years the main vehicle of village development, is today of minor importance.

At present, the cropping system prevalent in the villages of Dukun and Srumbung show a vast change, in comparison with the cropping systems before the second World War. Two systems can now be identified. In the first system, farmers plant their first rice crop in October-November, and the second rice crop in February-March, which is then followed by a third combination of crops: tomato, chilli, and tobacco. Depending on adverse weather conditions and cultivation of crops with longer growing periods, one rice crop may drop out every two years. This system depends on the availability of *sawah* and water. Tobacco is increasingly being intercropped with bean, chilli and groundnut which points to the second, more popular cropping system. In the second cropping system farmers plant their rice crop in October and plant an intricate mixture of vegetables and *palawija* crops from February onward. In this second planting period a large number of crops are interplanted: maize, leafy vegetables, cabbage, *petai, loncang* (eggplant), bean, *semangka* (watermelon), tomato, chilli, sweet potato and potato.

On the basis of our observations, it would not be right to adhere to the classical structure of three cropping periods. In the case of Srumbung and Dukun, the shorter duration of the first (rice) crop has been conducive to intensification of the second cropping period. Areas planted to individual crops are small, planting and harvest time of the various crops are well sequenced, while maintaining maximum flexibility with regard to crop options. This way risks are minimized.

The importance of m.a. potato in this environment is limited. Farmers will base their decisions to plant on expectations regarding price. As a result, a large number of crops are competing with each other. M.a. potato is, with present technology, an option of minor importance from the farmers' point of view.

Socio-economic aspects: an overview

Location and size of the areas

The Magelang regency consisting of 21 districts, is located in Central Java around 80 km north of Yogyakarta. The population is engaged mainly in agriculture as farmers and on-farm labourers (53% or 343,000 out of 652,000 in 1985). Almost 37% of the area is used for rice cropping (irrigated and non-irrigated), while another 63% is cultivated with secondary crops (dryland) (Table 8.1).

The two districts where the survey was conducted, Dukun and Srumbung, are located 17 and 21 km from Magelang, the capital of the regency. The size of the two areas are 53.4 and 53.2 km^2 with average elevations of 578 and 501 m, respectively. Dukun and Srumbung districts are adjacent to one another. The Ngablak district is located 37 km to the northeast from Magelang. It is 43.8 km^2 in area and located at 1,378 m, the highest in the Magelang regency; it provides potato seed to adjacent areas.

Table 8.1 Land utilization, Magelang regency, 1985.

Land type	Area (ha)
I. Wetland (*sawah*):	40,076
1. Irrigated	29,814
2. Non-irrigated	10,262
II. Dryland:	68,497
1. Land for building	17,377
2. Dryland for secondary crops	38,289
3. Grassland	2
4. Ponds	91
5. Trees	2
6. State-owned forest	7,873
7. Estates (State- and Private-owned)	164
8. Others	4,699
Total	108,573

Source: Magelang in Figures 1985, Statistics Office, Magelang, 1986.

Population

The total population of Magelang regency was reported to be 967,369 in 1985. This figure consists of 207,600 households. Dukun, Srumbung, and Ngablak districts contain 8,600, 8,500, and 7,600 households. The sex ratio in these districts does not appear to be extremely high although the number of females is consistently high in each of the three districts. Table 8.2 shows the population of the research areas.

The average number of household members is five, and ranges from zero to seven excluding parents. The population density in each of the three districts is around 700 per km^2.

Table 8.2 Population in Dukun, Srumbung and Ngablak, 1985.

District/ Regency	No. of house-holds	Population		Sex ratio	Total
		Male	Female		
Dukun	8514 (4.10)	18308	19447	0.94	37755
Srumbung	8691 (4.19)	18071	19138	0.94	37209
Ngablak	7661 (3.69)	16425	17607	0.93	34032
Magelang regency	207600	474795	492574	0.96	967369

Source: Magelang in Figures 1985. Statistics Office, Magelang, 1986.
Note: Figures in parentheses are percentages.

Farm survey

Research focused on two districts, namely Dukun and Srumbung. Both are located at elevations of around 500 m. The two areas were also the location of an m.a. potato trial. This project is part of a regional project being conducted by SAPPRAD in co-operation with LEHRI.

A number of farmers were deliberately chosen as respondents because they participated in the trial. Twenty respondents were interviewed in each district making up a total of 40 respondents in the two districts. Information given by the extension workers have also benefitted the research. Selection of the research location and the respondents was also based on discussion with the Agriculture Office of Magelang regency and information given by the extension workers.

The Ngablak district was also visited for additional information since this area is known as the production centre of highland potato in Magelang regency.

Structured questionnaires were only used in the first two districts since the socio-economic study would only apply to farmers in m.a. areas.

Respondents were divided into three groups, participants in the m.a. potato trial, spontaneous m.a. potato growers, and those who prior to participation in the m.a. trial had already gained experience in potato growing.

The total number of households interviewed was 40, in which 11 respondents (27%) were participants, 14 (35%) spontaneous, and 15 (38%) participants and spontaneous farmers.

Respondent characteristics

Most of the respondents (25) have more than four dependents, and 26 respondents are between 31 and 50 years old. This means that family planning as advocated by the government is not practised by the respondents. Meanwhile, most of the respondents are categorized as active labour force (Table 8.3).

The farmers' reasons for participating in the SAPPRAD project are interesting. The project offers a dual opportunity. First, farmers receive recommended seeds and inputs free of charge which reduces their production costs. Furthermore, the residual effect left by fertilizer application in such intensive farming benefits the farmer's next commodity, paddy. The question then remains whether the farmers would continue to adopt the technology when the project terminates. This would be a difficult task for the extension workers, because it would appear that the high level of inputs would not be easily realized by these small farmers.

Education

Most of the farmers or people working in agriculture or in agricultural-based industries lack formal education. Most attended SD (a six-year elementary school), but many failed to attend class year round. Most farmers stated that economic conditions made them drop out of formal education. They had to help their parents on the land or with small-scale industries.

Occupation

The types of occupation are presented in Table 8.4. Besides farming (34), including activities in animal husbandry and fisheries, most of the respondents are also working as traders (29 respondents), particularly in farm-products trading. This is a common second occupation and it is interesting to note that almost all of the respondents are involved in such activity. Perhaps the agricultural situation in these areas offers good opportunities for small-scale trading. Also, extensive small-scale trading is usually a sign of (seasonal) lack of work.

Table 8.3 Household characteristics of the respondents in Magelang, 1987.

Farmers	No. of respondents	Total (No. of household members; incl. head of household)	No. of dependants				Age (years)		
			In-house (One roof)		Outside				
			<=4	>4	<=4	>4	>30	31-50	>50
1. Participant	11 (27)	85	3 (20)	7 (28)	5 (36)	1 (100)	5 (83)	6 (24)	-
2. Spontaneous	14 (35)	87	5 (33)	9 (36)	3 (21)		- 10 (38)	4 (50)	
3. Participant + Spontaneous	15 (38)	91	7 (47)	9 (36)	6 (43)		1 (17)	10 (38)	4 (50)
Total	40 (100)	263	15 (100)	25 (100)	14 (100)	1 (100)	6 (100)	26 (100)	8 (100)

Table 8.4 Type of occupation of the respondents in Magelang, 1987.

Farmers	Type of occupation					
	First*			Second**		
	1	2	3	1	2	3
1. Participant	11 (32)	-	-	8 (28)	1 (25)	-
2. Spontaneous	12 (35)	2 (50)	-	9 (31)	3 (75)	-
3. Participant + Spontaneous	11 (32)	2 (50)	2 (100)	12 (41)	-	1 (100)
Total	34 (99)	4 (100)	2 (100)	29 (100)	4 (100)	1 (100)

* Code: 1 Farming (incl. animal husbandry and inland fisheries)
2 Teaching
3 Others: military officer (ABRI) or *penjaga sekolah*.

** Code: 1 Trading (on-farm and off-farm products)
2 Local government official (*carik*, *bayan*, etc.)
3 Others: carpenter.

Table 8.5 Total land being employed by the respondents in Magelang, 1987.

Farmers	Owned	Rented	Shared	Others*
	(ha)			
1. Participant	6.50	0.58	-	-
2. Spontaneous	12.01	0.63	-	0.30
3. Participant + Spontaneous	10.86	-	0.15	0.80

**bengkok, warisan*

Land-use

Like other farmers in Indonesia, farmers in the three districts are engaged in growing many commodities. They are not specialized in certain commodities.

Two types of land may be described as follows: wetland (*sawah*) is used particularly for irrigated paddy. Sometimes, this field is also available for certain secondary crops. This practice is employed during the dry season in areas when and where the water supply is not sufficient for irrigation. Dryland (*tegal*) is used mainly for secondary crops and perennials or estate crops. Secondary crops are food crops excluding rice and are usually called *palawija.*

Description of land ownership is provided in Table 8.5. Most of the farmers are working on their own land, but some of them are also working seasonally or on annually rented land.

Land owned by the farmers is small. This is typical for Java. The total area owned by the 40 respondents is only 29.37 ha with an additional area of 1.46 ha rented and shared land. Local government officials, *carik* or *bayan*, have village land for their use. This land is called *tanah desa* (village land). The land is a legal reward for their services. The area of land of each official varies according to their service and position. There are four respondents in this category and the total land they have is 1.10 ha. This land would be returned to the local government at the end of their services.

Productivity is the main objective in a small farm like this so all respondents were very interested in the adoption of new technologies. They welcomed ways and means that would increase their production. This was indicated by all respondents during the interviews. They raised many technical questions.

Expenditure

The major source of income comes from products sold by the farmers. Total income varies from year to year depending on seasonal commodity prices. In general nominal prices in 1987 were higher than in previous years. Real prices, however, were lower than in previous years. This was due to the rapid growth of inflation of the national currency. Two devaluations stipulated by the government (1983 and 1986) have affected the returns of the farmers. On the other hand, revenues from most commodities were not all affected proportionally by national inflation.

Some figures on expenditure of the farmers are shown in Table 8.6. It provides a rough picture of income and expenditure of the three groups observed in the area.

Detailed items may not be represented completely by the classes listed. Expenditure was usually higher than the income reported when interview techniques were used.

This is common in collecting data on income and expenditure using structured questionnaire sheets. Here, cross-check techniques have been used by considering the respective sources of income. Although efforts have been made to collect all figures appearing on the revenue items, it seems that the data are not reliable.

It should be noted that rice, cooking oil, sugar, coffee, tea, kerosene, soap, and cigarettes are included in daily consumption. Furthermore, taxes on landholdings, TV, and motorcycles are added in the taxes item. Retribution consists of funds collected by the local government for village improvement, religious and traditional/customary activities during the year. Expenditure for traditional family ceremonies and financial support for family members is included under "others".

Table 8.6 Household expenditure of potato farmers in Magelang, 1986. **Rp '000**

Items	Participant	Spontaneous	Participant+ Spontaneous
1. Daily consumption	8,838	12,465.6	13,169.4
2. Education and health	5,197	1,992.5	4,299.8
3. Clothes	1,468	1,048	1,240
4. Taxes	227.9	289.45	309.5
5. Retribution	1,249	1,484.8	1,323
6. Transport and recreation	1,716	2,621.5	2,947
7. Electricity	-	-	258
8. Others	1,175	947	1,522
Total	19,870.9	20,848.85	25,068.7
N	11	14	15
Average			

There are no significant differences between the three groups in expenditure, which indicates that potato cultivation is not limited to specific socio-economic groups in Magelang.

Area planted

The area planted by commodity is presented in Table 8.7. The large range of crops grown and the consequent small area per crop is shown in Table 8.7. The area cultivated with potato was much larger in the group of spontaneous potato growers. This indicates that potato is a commodity the farmers usually grow.

It is interesting to note that sweet potato is also familiar to farmers. Information on this indicates that the commodity is not grown in a fixed pattern.

Of the commodities listed in the table, rice receives first priority of all households, as it is a staple, and production is being improved by the farmers themselves: *swadaya masyarakat* (commutity self help).

Corn and chilli are considered as other important potential commodities.

Production of the main commodities during the last harvest season are listed in Table 8.8. These figures were obtained based on information reported by all 40 respondents.

Table 8.7 Area planted in Magelang, 1987.

Area planted (ha)	Participant (ha)	Spontaneous (ha)	Participant + Spontaneous (ha)
1. Paddy	2.55	4.90	5.20
2. Chilli	1.30	0.67	0.92
3. Tomato	0.78	0.97	0.50
4. Tomato + Chilli	-	0.10	0.35
5. Potato	0.85	2.23	1.20
6. Sweet potato	0.05	2.20	0.60
7. Yard-long bean	0.05	-	0.05
8. French bean	0.35	0.20	0.32
9. Cabbage	0.10	-	-
10. Chinese cabbage	-	-	0.025
11. Cucumber	-	0.10	-
12. Mustard greens	-	0.05	0.20
13. Corn	0.82	1.20	0.67
14. Peanut	-	-	0.05
15. Cassava	-	0.28	0.10
16. Tobacco	-	-	1.20
17. Tobacco + Chilli	0.30	-	0.30
18. Salak (*Salacca edulis*)	-	0.22	0.20
19. Melon	-	-	0.50
20. Grass	-	-	0.20
Total	7.30	12.66	12.18
N	11	14	15

Table 8.8 Area and production of selected commodities (the last harvest season) by category in Magelang, 1987.

Commodity	Participant		Spontaneous		Participant + Spontaneous	
	Area planted (ha)	Production (kg)	Area planted (ha)	Production (kg)	Area planted (ha)	Production (kg)
Paddy	2.65	9,685	5.0	17,610	3.90	11,205
Potato	0.75	2,815	2.1	13,160	1.95	7,516
Chilli	0.75	5,500	0.42	1,100	0.575	2,430
Tobacco	0.30	365	-	470	-	160
Tomato	0.40	4,450	0.47	1,000	0.65	8,715
Melon	-	-	-	-	-	500
French bean	0.45	2,900	-	900	0.10	600
Corn	0.52	1,300	1.20	880	0.32	1,500
Cassava	-	1,200	-	2,335	-	5,000
Cabbage	-	-	-	17,000	-	-
Fish	-	-	-	700,000	-	-
Sweet potato	0.05	-	1.50	18,800	0.40	6,700
Yard-long bean	-	-	-	-	0.10	125

Paddy has its own characteristics. Farmers grow paddy to secure food for all household members. This is easily understood since rice is a staple food for the majority of the people.

An issue that should be considered in this m.a. area is that potato, chilli, tomato, vegetables, and selected *palawija* crops are all competing crops among the commodities

usually grown by the farmers. At this moment, chilli and tomato are very popular with farmers since these two commodities fetched very attractive prices during the last two harvests. Farmers are therefore trying to cultivate more chilli and tomato during the following season. The prices were stable at the usual production peak even though production from these areas was quite high. This supports the finding of good local market integration because it may be assumed that production in Magelang complements production from other regencies and areas.

Based on the figures, progress in potato production as shown by the participants does not really indicate its potential to many other spontaneous farmers. Productivity shown by the participants was very low (around 3,758 kg/ha) compared to that of the spontaneous m.a. potato growers who reached around 6,262 kg/ha. This is almost 60% higher than participant productivity. The group of participants who had previous experience also yielded low, 3,750 kg/ha. An explanation may be found in late arrivals both of inputs and dubious quality of planting material provided.

It is also important to note that the nominal market price of potato has been almost constant. This means a decrease in real price. Hence, productivity development and price development are not conducive to increases in potato production.

The question could be raised why farmers cultivate potato. One reason is that farmers can usually sell their production as the market absorbs it. This is proven because farmers have continuously grown potato over a long time. The short growing period of 60-70 days benefits farmers since they can grow potato between fixed crops.

Seed supply

Seeds are normally purchased from the local market, Talun, located in the Dukun district, and are always available during the planting season. Quality is generally low and often degenerated varieties are sold. The seeds farmers usually use are low-quality varieties compared with those introduced by LEHRI, the SAPPRAD's project counterpart in Indonesia. Various high-quality seed varieties introduced by the project in Dukun are Cipanas, Aquilla, DTO-28, and DTO-33. Of these varieties, according to farm-experiment results (Asandhi et âl. 1987), DTO-33 was very promising (24.037 t/ha). Nonetheless, data obtained in the field do not yet confirm this potential.

The source of seeds was identified as Dieng, the highland area where potato has developed as an expansion of West Java's highland production centres. This area, which is located in the Wonosobo regency, is adjacent to the Magelang regency and is only 60 km away. Therefore, accessibility to the area is not a problem for the majority of farmers.

The survey findings confirm that m.a. potato cultivation is usually dependent on seed from nearby highland production areas. Usually second class and relatively degenerated seeds find their way to the m.a. cultivator. This seed is then planted in unsuitable environments as all varieties are more suitable to highland conditions. M.a. growers are aware of this and periodically have attempted to improve production by purchasing better quality seed. In these attempts they were advised by traders who play a key role in potato cultivation.

Nevertheless production of m.a. potato is sustained on a low-input basis. Since potato is intrinsically a "catch" crop in m.a. areas, farmers do not like, and in most cases cannot afford to spend much money on inputs. Cheap seed fits in well with the role of potato in m.a. farming systems.

Marketing and transport

Accessibility to the area is quite good because of the good road network. Road conditions and frequency of vehicles are no problem to farmers. Moreover, the distance to the local markets to which they transport their commodities from the farmers' houses or fields are very small (from 500 m to 1 km). Transport costs are therefore low; the average is Rp 2/kg from the farmers' houses or fields to the local markets.

Several commodities in the area were sold from the farmers' houses or fields. Tobacco and melon are included in this selling activity.

Two types of marketing arrangements apply. The first type consists of an after-harvest direct selling system. Here, farmers harvest the commodities and sell them from their houses, fields, or in the market. The latter are places where the price of commodities is bargained with the traders.

A second type is when farmers sell their commodities before harvest time. This system is called *tebasan*. Farmers stated various reasons for using this system. Most said that they needed cash for daily consumption, and capital for the next planting season. They also reported that through this system, farmers would not have to pay labour, transport costs, and material for packaging. However, they face risks if, for instance, the amount of production and price they agreed on did not meet expectations or prices were lower compared to going prices. In fact, based on their experiences, *tebasan* can be profitable to both farmers and traders because of the security it gives to both parties.

Out of 20 respondents (Table 8.9), 12 respondents employ the *tebasan* system. The last column (other reasons) indicates there are many other reasons why farmers select the *tebasan* system. No costs of harvesting need to be paid by farmers and there is no need to look for labour to be hired. Farmers themselves would receive money directly or as a down payment (usually 25 to 50% of the total amount agreed) which would be submitted one or two days before harvesting time. In research conducted on cassava in East Java, the results indicated that there was no difference between the direct and the *tebasan* systems the farmers applied (Pasaribu 1985). In many cases the *tebasan* system would be more profitable for farmers when labour is scarce in certain locations. This type of marketing arrangement has been widely applied in Java. *Tebasan* itself means to split commodities in parts, which indicates the involvement of two parties.

Table 8.9 Tebasan marketing system in Magelang, 1987.

Type	No. of respondents who sell in the field	No. of respondents with *tebasan* system	Reasons why respondents choose *tebasan* system		
			More profitable	Need money in cash	Others
Participant	3	1	-	1	1
Spontaneous	8	8	1	3	5
Participant + Spontaneous	9	3	1	-	2
Total	20	12	2	4	8

Potato development

Historically, farmers in Magelang, Central Java, have been planting potato for many years. Potato is mostly planted in the highland and some cultivation takes place in m.a. areas. The altitude of Magelang ranges from 235 to 1,826 m with Latosol and Regosol soils (App. Table 8.2).

Compared to other vegetables, such as cabbage, Chinese cabbage, bean and chilli, the area of potato is rather limited (Table 8.11). The reason for this may be that the climate of m.a. villages in the Magelang area is not suitable for potato. Potato usually grows well at altitudes of over 800 m, while other vegetables can be grown in both highland and m.a. areas.

In the period 1982-1986, production of potato fluctuated annually. In 1982 the production of potato was 3,217.90 t, and decreased to 2,077.35 t in 1983. As the potato area increased, production of potato in 1984 also increased to 4,361 t. In 1985, although the potato acreage decreased, the production of potato still increased, because the yield of potato increased. It may have been that in this year many farmers used the high-yielding potato variety, Granola. In 1986 production of potato decreased to 4,625.10 t from 6,733.60 t in 1985, because both the acreage and yield decreased (Table 8.10).

Table 8.10 Harvested area, production and yield of potato in Magelang, 1982-1986.

Year	Area harvested (ha)	Production (t)	Yield (t/ha)
1982	722	3,217.90	4,456
1983	419	2,077.35	4,957
1984	1,031	4,361.00	4.229
1985	978	6,733.60	6,885
1986	863	4,625.10	5,359

Source: Dinas Pertanian Tanaman Pangan DT II Kabupaten Magelang.

In order to gain insight into planting and harvesting fluctuations Figure 8.2 is presented.

It follows from Figure 8.3 that the data for 1982 are unreliable. For the years 1983 onwards, however, the data appear reasonable, with a slightly larger area planted than harvested. Looking at Figure 8.2 no recurrent pattern can be seen. It should be noted that the production figures are based on production from highland areas together with production from m.a. areas. The decrease in production after the peak in 1985 may be explained partly as the result of the higher prices of competing crops such as tomato and chilli, and partly as the result of decreasing seed viability and quality occurring after the introduction of new seeds which took place in the 1984/1985 season.

In the highlands, potato is planted at the beginning of the rainy season (October), at the end of the rainy season (March) and in the dry season (July). In these areas, potato is intercropped with other vegetables such as cabbage, Chinese cabbage, garlic, carrot or with other crops such as corn and tobacco.

In m.a. areas, potato is planted after paddy harvesting (May-July). Competing crops are chilli, tomato, cabbage, snap bean, watermelon and corn.

Usually there are three peaks of planting in October, March and July, and three peaks of harvesting July, May/June, and September.

Table 8.11 Production and harvested area of several crops in Magelang, 1982-1986.

Crops	1982		1983		1984		1985		1986	
	HA[a]	Prod[b]	HA	Prod.	HA	Prod.	HA	Prod.	HA	Prod.
1. Cabbage	2360	29786.70	2145	30743.20	3078	58535.46	2607	34086.64	3031	40151.60
2. Chinese cabbage	766	5146.40	528	1355.30	1201	12171.20	1301	10305.00	1351	15350.80
3. Bean	2333	1688.86	2401	1815.74	2390	2703.07	2583	2657.46	1752	2135.50
4. Pepper/ chilli	1111	1740.74	1514	1575.67	2372	2325.37	1825	1667.34	2306	3708.47
5. Tomato	701	2228.68	776	1988.07	707	1708.88	860	2629.60	744	2227.79
6. Snap bean	878	1106.40	634	1324.10	1347	4378.00	1302	2699.31	1428	4574.30
7. Potato	722	3217.90	419	2077.35	1031	4361.00	978	6733.60	863	4625.10

Source: Dinas Pertanian DT II Kabupaten Magelang (S.P. II).
[a] HA = Harvested Acreage (in ha)
[b] Prod = Production (in t).

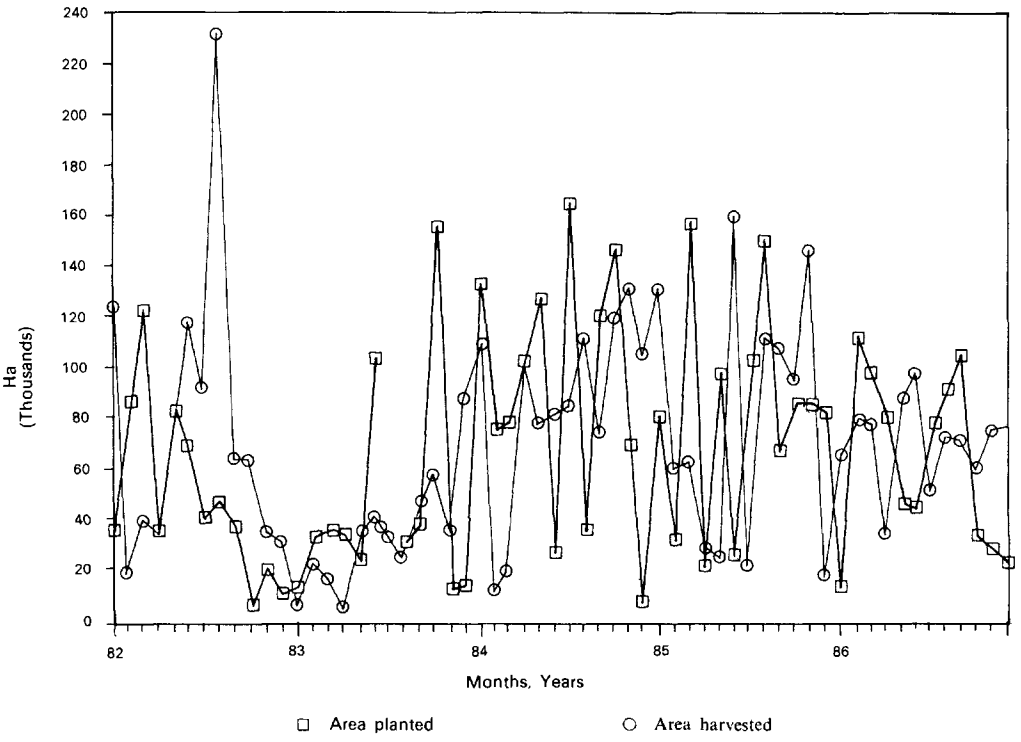


Figure 8.2 Monthly fluctuations of planted area and harvested area of potato, Magelang, 1982-1986.
Source: Dinas Pertanian Magelang

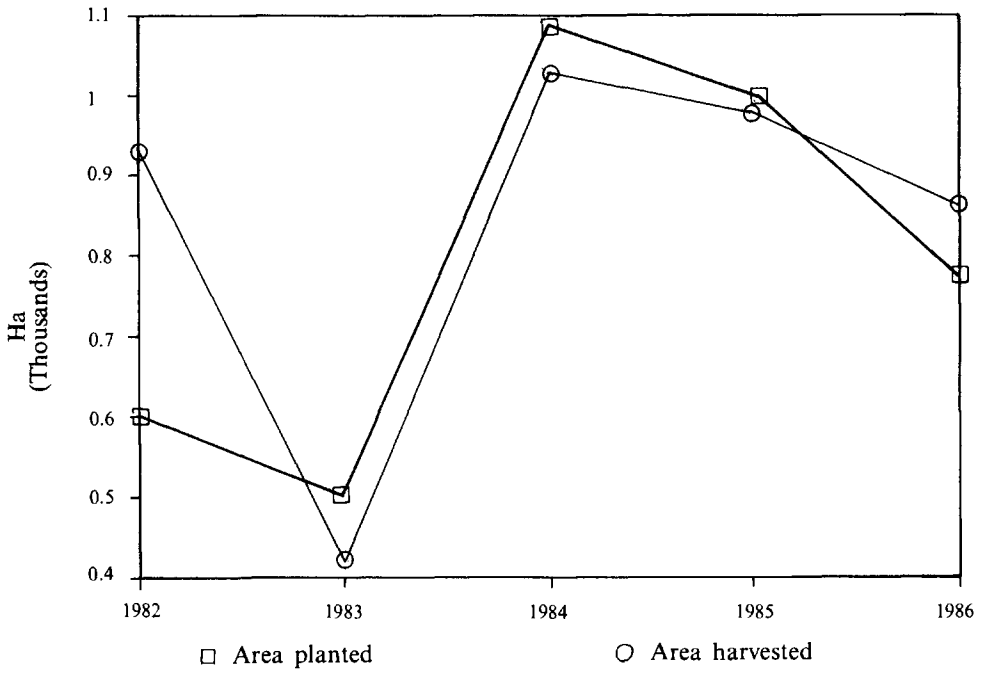


Figure 8.3 Total annual planted area and harvested area of potato, Magelang, 1982-1986.

Costs, gross margin and profit

The variety in technology and environment of potato production can be characterized by three situations. At medium altitudes potato production takes place with local and improved varieties, while in highland areas improved varieties are used more often.

It must be remarked that one often encounters degenerated varieties which do not yield very well. Several varieties were planted in m.a. areas, local varieties such as Marini, Kapur and Talun, and the improved variety of Cipanas. The latter is a new variety which was introduced by LEHRI in 1985. In the highlands, the Granola variety was selected for analysis. The budget analysis of potato production in Magelang is shown in Table 8.12.

The gross margin of m.a. potato, planted in June 1987 and sold in September 1987, was Rp 125,800/ha for the local varieties and Rp 826,650/ha for Cipanas. The gross margin of highland potato, planted in October/November 1986 and sold in May 1987, was Rp 1,588,500/ha. If "free" family labour were available, the margin of both m.a. potato and highland potato will increase.

Most farmers usually plant potato on their own land and use their own capital. If the land and capital interest are charged, the local variety will make a loss. But in practice farmers will not pay charges on their own land or capital while family labour is free. So it can be concluded that both m.a. and highland potato production is profitable from a family run, smallholder perspective. It should of course be taken into account that plots are small so that the substantial investments per hectare are in reality not a good indicator for capital investment by the m.a. smallholder.

Position of medium altitude potato in cropping systems

Paddy is the base crop in the existing cropping system. Usually paddy is planted in October/November and harvested in January/February. After paddy harvesting, farmers may grow tomato or chilli because these commodities fetch a high price in the harvesting season. Tomato is a typical 100 to 120 days crop, while chilli, as an annual crop, is 130 to 330 days. After this sequence farmers will revert back to paddy.

After paddy harvesting, instead of growing tomato or chilli, farmers may grow paddy again. Then the harvest is in May/June. In order to go back to paddy in the following season (October/November), farmers have some alternative crops. These are potato (65 to 70 days), snap bean (90 days), corn (100 to 115 days), watermelon (90 days), and others.

The reason farmers grow potato in the cropping system is that potato is a short duration crop of 65 to 70 days. When potato is about 30 days old, farmers usually prepare planting material for the paddy crop. By the time potato is harvested, the seed of paddy will be ready to plant. In other words, by planting potato, farmers are able to fix the time to plant paddy.

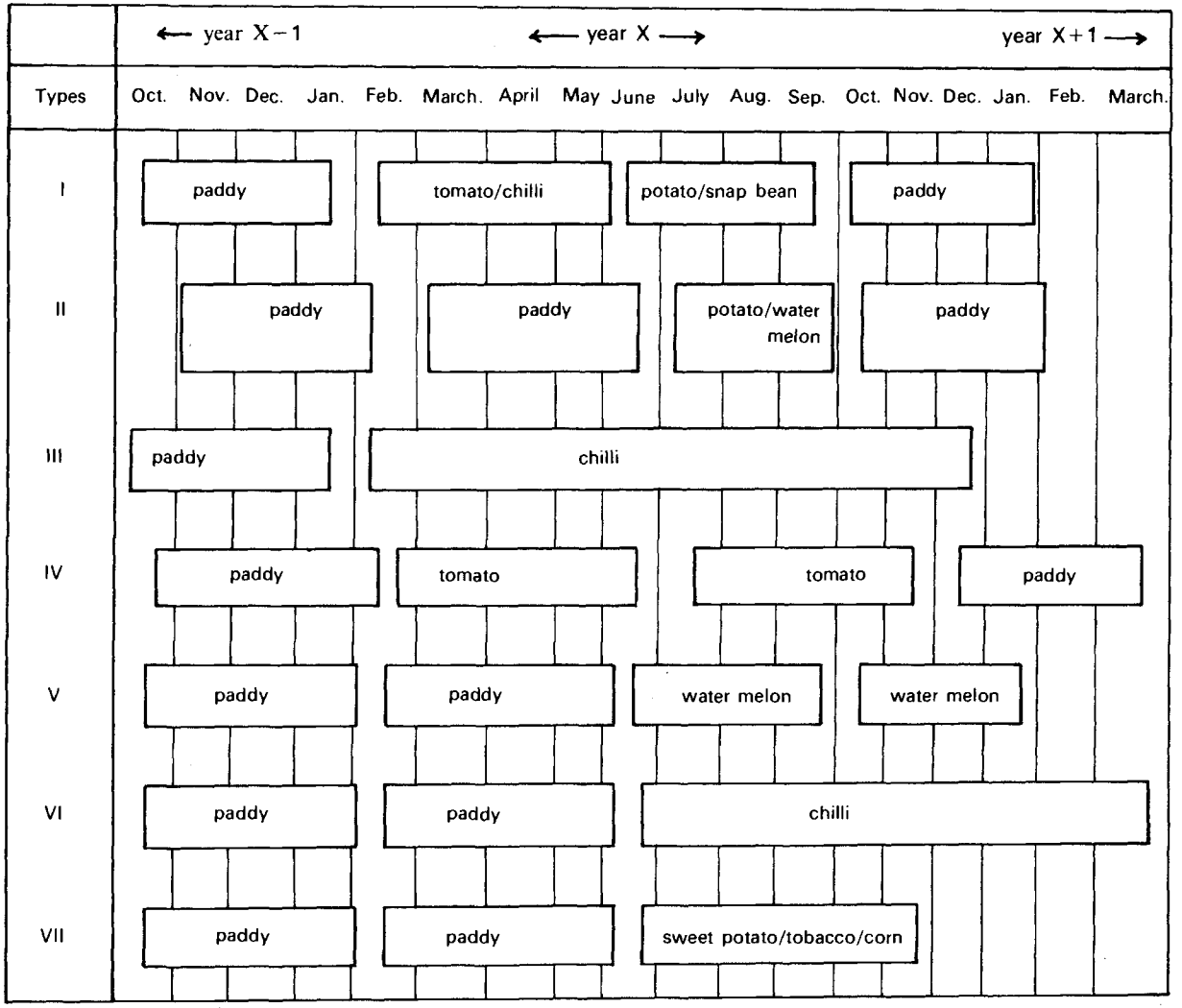
Because several crops can be grown simultaneously, and because each farmer makes his own decision in choosing the commodity and planting time, cropping systems in Desa Dukun vary among farmers and places. The resulting cropping calendar is extremely complicated in Dukun.

However, several types of cropping systems can still be indicated as shown in Figure 8.4.

Table 8.12 Costs, gross margin and profit of potato production per hectare in Magelang, 1987.

Item	Medium altitude						Highland		
	Local			Cipanas			Granola		
	Unit	Rp/unit	Value (Rp '000)	Unit	Rp/unit	Value (Rp '000)	Unit	Rp/unit	Value (Rp '000)
Yield (t/ha)	3.7	-	-	9.4	-	-	12.5	-	-
Farm gate price (Rp/kg)	-	225	-	-	242	-	-	275	-
Gross output	-	-	832.50	-	-	2274.80	-	-	3437.50
Variable costs:									
Seed (kg)	375	347	130.10	1045	525	548.60	1006	600	603.60
Stable manure (t)	10	10000	100.00	14	10000	140.00	36.6	10000	366.00
TSP + Urea (kg)	412.5	125	51.60	1144	125	143.00	980	130	127.40
Labour:									
Hired (man-days)	89	1500	133.50	77	1500	115.50	114	1500	171.00
Family (man-days)	177	1500	265.50	214.5	1500	312.75	160	1500	240.00
Pesticide (kg Sevin)	8.7	3000	26.00	59.7	3000	179.30	113.7	3000	341.00
Total variable costs			706.70			1448.15		1849.00	
Gross margin			125.80			826.65			1588.50
Margin including family labour			391.30			1148.40		1828.50	
Other charges:									
Land rent			225.00			225.00			150.00
Capital interest	46.60			83.65			99.95		
Total cost of production	978.30			1756.80			2098.95		
Profit			- 145.80			518.00			1338.55

Source: Primary data analysis, CGPRT 1987, Magelang.



Source: Primary data analysis

Figure 8.4 The cropping system in Desa Dukun, Magelang; altitude 450-500 m.

Comparative costs, gross margin and profit

In Desa Dukun, farmers usually plant potato on their own land or in a sharing arrangement with the land owner. Farmers are willing to rent land to plant potato, and for commercial commodities such as watermelon, chilli and tomato, some farmers are willing to rent land.

In order to compare a farm where the land is owned with other farms where the land is rented, all costs are taken into consideration. The budget analysis in Table 8.13 gives both variable costs and total costs of production. The variable costs consist of the cost of seed, stable manure, fertilizer, pesticide, total labour (family and hired labour) and other materials. The total costs of production consist of variable costs plus land rent which is calculated according to the duration of the crops, and capital interest (20% per year).

From Table 8.13, it is clear that the profit of the local potato variety is very low (-Rp 145,780/ha) compared with the competing crops, while Cipanas yields a higher return than the local variety. More information is given in App. Tables 8.2 and 8.3.

But even though the profit of local potato varieties is very low, farmers in Desa Dukun still grow them. There are several reasons for this.

Farmers do not charge interest on their own land or on their own capital while costs for family labour are part of the household income. From a household point of view potato is profitable, because the gross margin is positive Rp 391,300/ha (Table 8.12) .

The growing period is short, about 65-70 days. This means the farmers are able to earn some money quicker than with other commodities. Potato is easy to fit in before reverting to paddy.

Potato is treated by farmers as an alternative crop. Usually farmers do not plant their land only with potato. Besides planting potato, in a small part of their land, farmers plant other crops. In this way, farmers manage their financial flow regularly during a year, while they reduce market price risks though diversification.

Regarding the Cipanas variety, it can be seen from Table 8.13 that the yields achieved by farmers are low, only 9.40 t/ha, while the potential is about 17 t/ha. The seed used by farmers is of low quality. Some seed apparently was rotten, while during the growth period, about 11% of the potato was destroyed by pests.

Ngablak: adjacent highland area

Potato in Kabupaten Magelang is produced in the Dukun and Srumbung area at medium altitude and the Ngablak area (highland 800 - 1000 m). The m.a. area only produces potato for the local market and local consumption. More important is potato produced in Ngablak.

Although the Ngablak production area is relatively close to many cities (Semarang, Salatiga, Magelang, Boyolali, Temanggung, Solo, etc.) and has a good access road, potato and other highland vegetables are only marketed at small cities/districts close to the area. The main reason for this situation is that the quantity of potato production in the area is relatively small and the quality of potato is relatively low[1]. Moreover, the area is quite close to the Dieng production centre with which it cannot compete in terms of quantity, quality and regularity of supply.

[1]Compared with other highland potato production centres, e.g., Dieng Plateau.

Table 8.13 Costs, gross margin and profit of several crops in Desa Dukun, Magelang, per ha, in 1987.

Crops	Yield (t/ha)	Price (Rp/kg)	Gross output (Rp '000)	Variable costs (Rp '000)	Gross margin (Rp '000)	Total costs of production (Rp '000)	Profit (Rp '000)	Growing period (months/days)
1. Watermelon	12.50	400	5000.00	1482.28	3517.72	1792.64	3207.36	3 months
2. Chilli:								
a. Long chilli (ex Taiwan)	12.25	445	5451.25	1853.75	3597.50	2534.12	2917.13	5 months
b. local var.	11.70	600	7020.00	1084.50	5935.50	2381.40	4638.60	12 months
3. Tomato:								
a. Kingkong var.	18	300	5400.00	1266.50	4133.50	1888.15	3511.85	5 months
b. Super 375 var.	15	450	6750.00	1547.50	5202.50	2197.25	4552.75	5 months
c. Intan var.	8.40	250	2100.00	936.50	1163.50	1525.15	574.85	5 months
4. Snap bean	10	130	1300.00	687.00	613.00	1051.15	248.85	3 months
5. Corn	3.50	250	875.00	557.50	317.50	913.24	-38.24	3 months
6. Sweet potato	12.00	50	600.00	460.00	140.00	1001.00	-401.00	5 months
7. Potato:								
a. Local var.	3.70	225	832.50	706.70	165.80	978.28	-145.78	65-70 days
b. Cipanas var.	9.40	242	2274.80	1448.15	826.65	1756.80	518.00	65-70 days

Source: Primary data, CGPRT 1987, Magelang.

The main crops of the Ngablak area are tobacco and maize. Potato, cabbage and other highland vegetables are less important. The Ngablak assembly market is active about two days in five (*wage* and *pahing* according to the Javanese calendar)[2]. On market days, traders come to the market, and buy potato and other vegetables from this area and sell it directly to the retailers or consumers in Salatiga, Ngampel and other cities (Figure 8.5). The traders are active every day in different assembly markets buying many types of vegetable according to the Javanese market days in the villages.

The farmers sell their produce to the village assembly traders where they sell for cash about 50 to 100 kg of potato, or directly to the Ngablak market if the amount of potato for sale is bigger. The potato varieties grown in this area are mainly Ketela and Granola. Each trader buys about 50 to 200 kg of potato per market day or roughly about 100 to 400 kg per week.

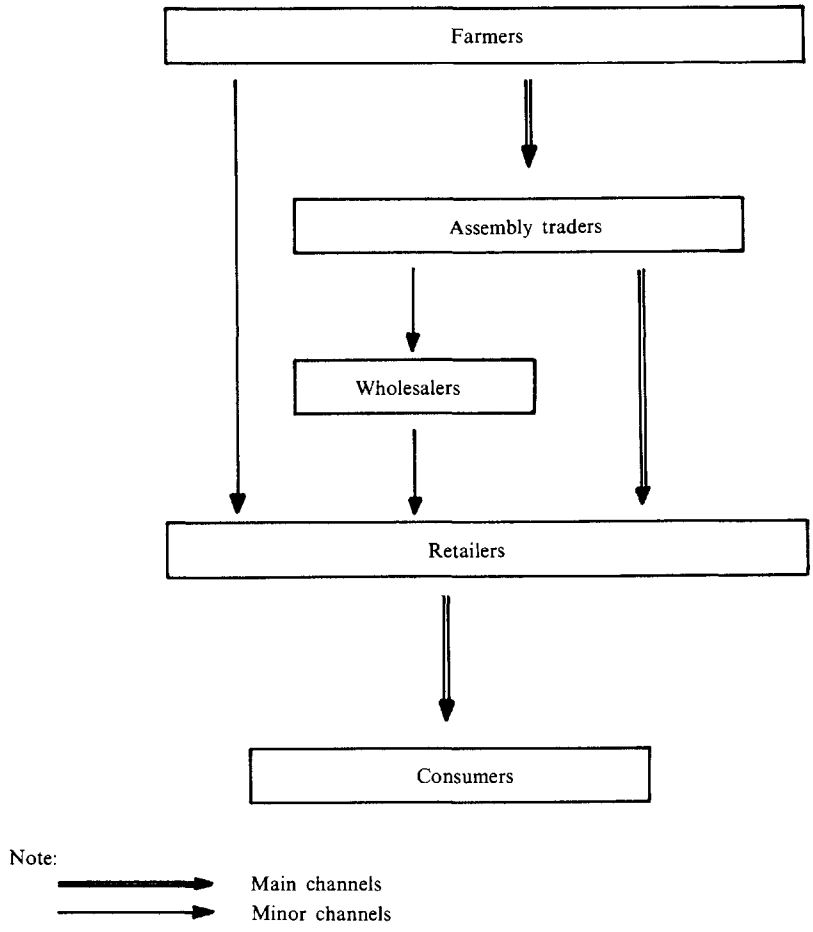


Figure 8.5 The main marketing channels of Ngablak potato to the consumption areas in Salatiga or Ngampel, September 1987.

[2]Further information about Javanese calendar is given in App. Table 8.4.

According to the traders, the total outflow from this market is about 3 to 5 t per market day (6 to 10 t per week) or about 300 to 600 t per year. If we estimate that some 30% is not channelled on the market day or not through the market, the total potato outflow from the Ngablak area is about 400 to 800 t a year, including potato seed.

There are about 8 to 10 potato seed traders active in the market. They collect the mature and healthy potato directly from the farmers. They treat potato seed by storing it above the kitchen fireplace for about a week or more. Normally they sell the potato one to three months after purchase. The seed quality is relatively low compared to the seed from Dieng. The Ngablak seed costs about Rp 400/kg, while the Dieng seed fetches about Rp 500 to 600/kg.

Since the marketing channels are relatively short, the farmer's share is quite large, about 75% of the retail price (Table 8.14). The transport cost from the Ngablak assembly market to the retail market (Salatiga or Ngampel) is about Rp 500/100 kg of potato. The gross profit of retailers is Rp 25/kg.

Table 8.14 Marketing costs of potato from Ngablak to Ngampel, September 1987.

Price level and cost items	Rp/kg	%
1. Potato standing crops price	260	75.4
2. Harvesting and transportation to farmer's house	15	4.3
3. Transport to Ngablak assembly market	5	1.5
4. Weighing and other cost	5	1.4
5. Farmer's selling price to assembly traders	285	82.6
6. Assembly traders cost for packing, weighing, market tax	9	2.6
7. Assembly trader's gross profit	11	3.2
8. Assembly trader's selling price to retailers	305	88.4
9. Transport (Ngablak to Ngampel)	5	1.4
10. Packing, packing materials, and weighing	6	1.7
11. Market tax and other fees	4	1.3
12. Gross profit of retailers	25	7.2
13. Retailers selling price to consumers	345	100

The price development data of the Magelang regency are available only for the Ngablak assembly prices from 1984 to 1987. Compared to the neighbouring production areas such as Dieng, the Ngablak assembly prices look higher. The monthly averages of Ngablak assembly prices were about Rp 20 to 50/kg higher than the Dieng assembly prices. This difference in prices with the Dieng or Pangalengan production areas is mainly because of differences in marketing practices. The marketing channels of Ngablak potato are shorter. The retailers of Ngablak potato are supplied directly by

farmers or assembly traders, while in the other areas potato has to be channelled through three to four more intermediaries (field traders, wholesalers, sub-wholesalers and retailers). Since Ngablak potatoes are marketed only to nearby small cities, the transportation costs (and also other marketing costs) are lower compared with potato originating from other production centres which are more distant and which have to be channelled through the big cities before they reach those small cities supplied by Ngablak. Those factors enable the trader to buy potato from the farmers for a higher price (Figure 8.6).

The potato price development in Ngablak, has a similar pattern to other areas, for example, Dieng assembly prices or Semarang wholesale prices. High prices are reached in May to August and November to February which are considered as periods of low prices for potato. Medium prices are usually reached in March/April, September/October.

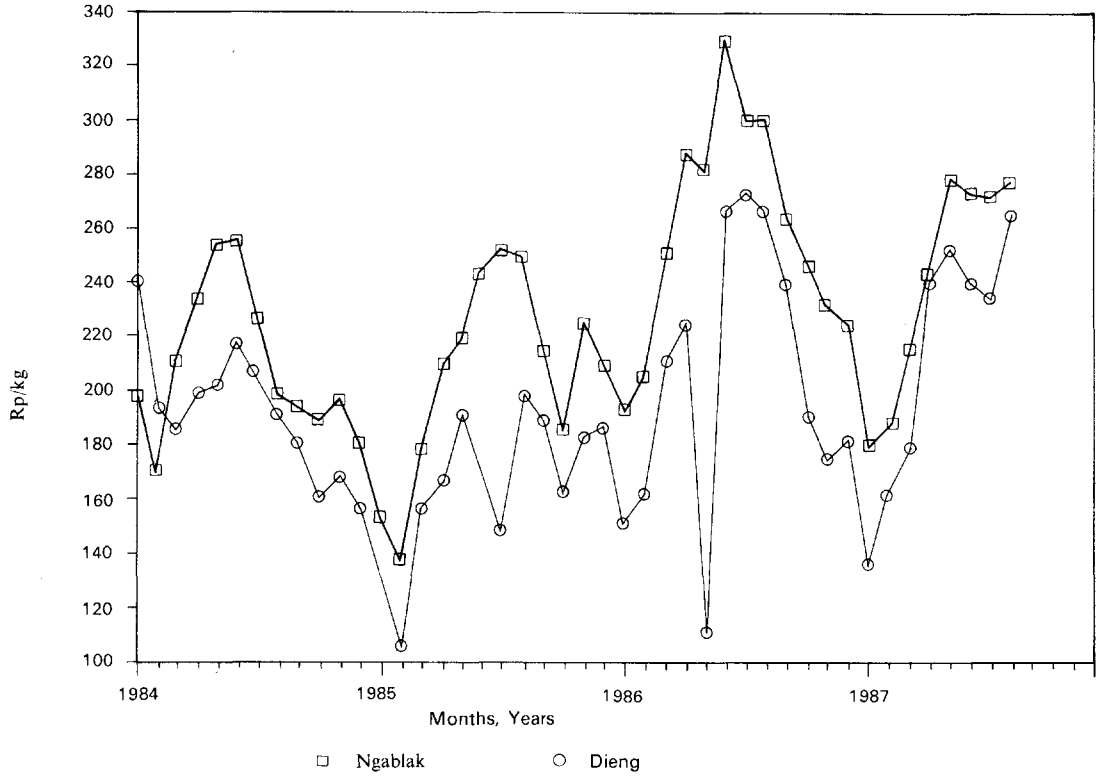


Figure 8.6 Monthly average of Ngablak and Dieng assembly prices.

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North Sumatra: Export-Based Potato Production

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Background and summary

In the period before the interruption of the friendship between Malaysia and Indonesia in the early 1960s, North Sumatra horticultural produce had a market share in Singapore of ± 40%. Relative to other horticultural production centres in Indonesia, North Sumatran farmers enjoyed a good income during the export boom. The favourable location of the Belawan harbour and Polonia airport at very short distances from the major market of Singapore was highly conducive to horticultural development linked to exports.

During the period of confrontation, exports dropped drastically to nought. The consequences for the farmers and their lifestyle were grave. After the political relations improved, the market slowly opened up again for produce from North Sumatra. However, during the absence of North Sumatra produce on the market, other horticultural producers such as the People's Republic of China, the Republic of China and Thailand acquired strong positions. It proved to be extremely difficult to regain the lost market share in Singapore. In response the Indonesian government stimulated a broader approach covering the Penang market and including a wider range of horticultural commodities, with more attention to packing, transport and quality control.

Present exports from North Sumatra

In the period 1983 to 1987, exports of potato from North Sumatra to Malaysia and Singapore increased at a great rate. In 1983, exports totalled 7,300 t and reached 26,000 t in 1987, as indicated in Table 9.1. In 1987 the market share of North Sumatran produce in the Singapore market was approximately 4%, while the market share in Penang was considerably higher.

The proportion channelled through government-sponsored organizations such as Pusat Koperasi Unit Desa (PUSKUD) has remained very small compared with total exports. In the years 1983 to 1987, PUSKUD exports of potato increased from 300 to 3000 t, while exports of FES (Friedrich Eberhard Stiftung), a private foundation, are still very much in the early stages of development at 200 t. These facts indicate the paramount importance of the private sector in export development. It has been indicated by officials from North Sumatra's agricultural office that PUSKUD's marketing methods need further improvement especially in cleaning and packing. PUSKUD packs the tuber in baskets without sophisphicated grading while cleaning is poor. In contrast, the FES applies an export-oriented grading system and modern packing techniques as well as cold storage. Potato exported by FES fetches a higher

price than the produce exported by PUSKUD. Private traders have commenced improved grading and packing to a limited degree. The transition from traditional and relative low cost marketing and packing techniques must be closely connected with the grading, cleaning and packing techniques as practised by the assembly traders in buying potato from the producers, if the total system is to be efficient and cost effective.

Marketing problems

The black soil found in Karo is very suitable for potato but it has created some loss in revenue because it sticks to the tubers. Tuber colour and cleanliness affect value-added which could be generated through post-harvest activities such as cleaning.

Several buying patterns exist. Tubers are harvested directly from the field by the traders and are delivered to respective warehouses. Tubers are also sold on "*karung*-basis", in bags made of jute or plastic. With this traditional packing method the tubers are not sorted according to grades.

Sorting is at present not a popular activity among farmers. They prefer to sell production at once without investing more time in sorting. However, there seem to be opportunities for increased production because bigger tubers fetch higher prices. It is quite clear that the North Sumatran marketing system is in a stage of transition, towards integration of the local marketing, buying and packaging system, with the requirements of the export market.

Production development

The harvested area has expanded rapidly in the region of Karo from 665 ha in 1983/1984 to 1035 ha in 1985/1986 (Table 9.2). The area harvested in the area of Simalungun has remained constant at approximately 1000 ha. Productivity in the area of Karo shows a downward trend from 18.5 t (1983/1984) to 13.5 t (1985/1986). Productivity in the area of Simalungun has remained around 13 t in this period.

These figures might confirm the general observation regarding highland production, of initially high yields in newly-opened production areas, and it confirms that the process of opening new highland areas for horticultural production still continues in North Sumatra.

Dairi is likely to show sizeable area expansion in the future, according to local officials. Soil erosion is reported to take place in all potato production areas.

It has been reported that farmers are still engaged in traditional patterns of cultivation, in which farmers carefully look at one another in order to identify successful crops and cropping patterns. As a consequence, over-production based on over-optimistic expectation of prices takes place relatively often. In this regard, potato producers have to be made aware that they primarily produce for the export market with its own price mechanism. At present extension workers and government officials are establishing a programme to streamline the production method as well as planting time. It needs to be appreciated that in the short period of 1983 until the present, production has expanded rapidly, and that on the basis of the export demand, production systems and marketing practices are undergoing rapid change. Potato seems to enjoy a comparative advantage in North Sumatra (App. Table 9.1) although that may well prove to be temporary.

Prospects

In the context of the study, the possibility of expanding cultivation to m.a. areas would not be strongly recommended given the existing conditions. It is important to note that a large area of highland is reported to be available in North Sumatra for horticultural crops. These areas might never have been investigated but, according to the local Food Crops officials, Aceh Province, and the Regencies of Simalungun, Dairi, North Tapanuli, and South Tapanuli, are among the potential areas for highland potato. Incentives to cultivate potato in m.a. areas in these regions are not sufficient for both farmers and the local policy makers.

It would appear, that because of the direct export market connections and further potential, that location-specific research covering varieties and cultural practices would have a more direct pay-off than research into m.a. potato. However, m.a. potato might have some potential for the local market. This would require specific follow-up as outlined in the summary and recommendations.

Table 9.1 Export of potato to Malaysia and Singapore from North Sumatra, 1983-1987 **Volume in t**
Value in US$ '000

Year	Malaysia		Singapore		Total	
	Volume	Value	Volume	Value	Volume	Value
1983	3,808	438	3,515	403	7,323	841
1984	9,783	1,107	7,085	801	16,868	1,908
1985	10,229	1,086	7,408	787	17,637	1,873
1986	14,735	1,488	6,620	668	21,355	2,156
1987	23,090	2,593	2,964	325	26,054	2,918
Total	61,645	6,658	27,592	2,984	79,237	9,696

Source: PUSKUD Harapan, Medan, North Sumatra, 1988.

Table 9.2 Harvested area, productivity, and production of potato by regency in North Sumatra, 1983/1984-1985/1986.

Regency	1983/1984			1984/1985			1985/1986		
	Harvested area (ha)	Productivity (t/ha)	Production (t)	Harvested area (ha)	Productivity (t/ha)	Production (t)	Harvested area (ha)	Productivity (t/ha)	Production (t)
1. Medan	-	-	-	-	-	-	-	-	-
2. Langkat	-	-	-	-	-	-	-	-	-
3. Deli Serdang	-	-	-	-	-	-	-	-	-
4. Simalungan	1,064	13,880	14,768	1,010	14,646	12,410	951	12,784	12,158
5. Karo	665	18,553	12,338	792	14,599	11,563	1,035	13,410	13,879
6. Asahan	-	-	-	-	-	-	-	-	-
7. Labuhan Batu	-	-	-	-	-	-	-	-	-
8. North Tapanuli	441	6,893	3,040	360	11,058	3,981	277	12,472	3,455
9. Central Tapanuli	-	-	-	-	-	-	-	-	-
10. South Tapanuli	130	5,092	662	128	11,071	1,500	76	10,934	830
11. N i a s	-	-	-	-	-	-	-	-	-
12. Dairi	22	6,909	152	42	24,904	1,046	57	13,000	741
Total	2,322	13,333	30,960	2,340	13,461	30,500	2,396	12,996	31,063

Source: North Sumatra Food Crops Office, Annual Report, Medan, issues: 1984, 1985, 1986.

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Appendix

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Chapter 2

Table 2.1 Cultivar evaluation at Jambegede (335 m).

Variety	Yield t/ha planted on	
	1 June '82	15 June '82
Ketela	22.0	26.5
Cipanas	25.0	20.5
Desiree	34.5	25.0
Spunta	29.0	28.5
77-052-39	37.5	35.5
1282-19	44.5	29.0

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.

Table 2.2 Variety testing at Jambegede (335 m) RBD, 3 reps, single row beds, Spacing 80 X 25 cm^2, Fertilizer: 120 kg, 180 kg P_2O_5, 100 kg, 20 t manure/ha. (Scientist: Ir. Dasi. 1982.)

Variety	t/ha	Clone	t/ha
Desiree	23.90	77-045-88	26.35
Spunta	24.75	77-045-175	21.20
Red Pontiac	20.50	77-045-39	28.95
Kennebec	21.20	77-045-166	22.85
Aquilla	15.10	1284-12	23.95
LT-1	26.40	1284-17	25.20
DTO-28	29.90	25081-159	29.70

Source: as 2.1.

Table 2.3 Response of cultivars to the "hot" growing conditions of Jambegede from 30 May to 27 August 1984.

Variety	Total yield (t/ha)	Average tuber (g)	Tubers/ plant (no.)	Plants harvest-ed (%)	Market-able yield (%)	Rotten tubers[a] (g/plant)	Specific gravity
DTO-28	23.6	69	6.1	94	99	11	1057
R. Pontiac	22.8	93	4.6	91	99	120	1052
Katadhin	19.8	83	4.4	88	99	85	1054
Spunta	16.3	48	6.1	91	99	5	1069
Red la Soda	13.3	41	6.0	81	99	101	1071
Aquilla	12.8	37	6.6	81	97	48	1068
Cosima	11.9	44	4.9	84	99	61	1080
AVRDC 1284-19	8.7	32	5.5	41	95	40	1074
Cipanas	6.2	32	3.5	88	97	110	1062
77-052-39	6.1	61	2.3	81	97	77	1070
Grand mean	14.2	54	5.0	82	98	66	1066
CV (%)	16.6	37	24.1	15	2	52	1730
LSD (5%)	5.3	NS	NS	NS	NS	NS	NS
LSD (1%)	7.6	NS	NS	NS	NS	NS	NS

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.

[a] Not included in total tuber yield.

Rotting was due primarily to bacterial wilt.

Table 2.4 Response of 8 heat tolerant cultivars to highland conditions with severe late blight stress, grown at Sumber Brantas, East Java from January to March 1984 (Widjajanto, 1984).

Cultivar	Yield (t/ha)	Tuber size			Plant harvested (%)
		Large (%)	Medium (%)	Small (%)	
Radosa	18.0	33	47	19	15
R. Pontiac	16.0	40	30	30	43
B71-240.2	14.8	40	40	30	58
LT-2	11.5	32	47	21	55
DTO-33	9.9	44	35	21	80
DTO-2	8.9	56	30	14	10
N565.1	8.2	15	38	47	60
AVRDC 1282-15	7.0	40	32	28	48
Grand mean	11.8	36	37	26	46
CV (%)	45	47	36	36	34
LSD (5%)	NS	NS	NS	14	23
LSD (1%)	NS	NS	NS	19	32

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.

Table 2.5 Response of 16 cultivars to the "hot" growing conditions of Jambegede from 30 May to 27 August 1984.

Variety	Yield (t/ha)	Average tuber wt (g)	Tubers/ plant (no.)	Plants harvested (%)	Marketable yield (%)	Specific gravity
Desiree	25.0	57	7.9	93	96	1053
Spunta	22.3	53	8.1	78	95	1053
Katadhin	22.3	73	5.7	53	97	1055
R. Pontiac	22.1	66	6.0	97	97	1051
25-081-159	21.2	48	7.9	93	96	1055
77-045-175	21.1	62	6.2	85	97	1084
1284-12	20.6	64	6.2	82	95	1075
Red la Soda	19.2	59	5.9	83	96	1053
77-052-39	18.3	47	7	82	96	1074
LT-1	18.2	46	7.2	84	96	1059
DTO-28	15.4	60	4.7	71	97	1049
1282-19	15.1	40	6.8	61	94	1061
Kennebec	13.5	53	4.6	91	96	1053
Cipanas	13.3	26	9.1	83	91	1055
Aquilla	12.5	27	8.7	81	88	1075
Cosima	10.9	41	4.7	93	92	1054
Grand mean	18.2	51	6.7	78	95	
CV (%)	15.7	15	21.6	12	19	
LSD (5%)	4.8	13	2.4	16	3	
LSD (1%)	6.4	18	3.2	22	4	

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.

Table 2.6 On-farm varietal yield trials, East Java, 1985.

Variety	Yield (t/ha)			
	Gondanglegi (350 m)	Kepanjen (325 m)	Dau (600 m)	Ketawang[a] (320 m)
DTO-28	15.38	21.97	13.8	6.7
DTO-33	15.09	27.71	19.9	7.1
Cosima	8.90	5.87	12.3	5.3
Cipanas	8.28	18.63	12.3	6.5

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.
[a] No irrigation.

Table 2.7 Yield (t/ha) of m.a. varieties in Central Java.

Location (200 m^2 each)	I. Dry season July-Oct. 1985		II. Wet season Oct.-Dec. 1985			Average
	DTO-28	Cipanas	DTO-28	Cipanas	Cosima	
Tegal (480 m)	10.2	11.2	13.0	10.5	14.5	11.9
Magelang (462 m)	17.2	22.2	12.1	14.9	14.4	16.2
Yogyakarta (473 m)	16.1	15.1	8.2	16.8	9.2	13.1
	14.5	16.2	11.1	14.1	12.7	
	15.3			12.6		

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.

Table 2.8 Yields (t/ha) of potato and shallot at four locations, Central Java, 1986.

Yield	Magelang		Solo		Tegal		Yogyakarta	
	Potato	Shallot	Potato	Shallot	Potato	Shallot	Potato	Shallot
A	17.12 a	-	21.83	-	7.80 a	-	10.25 a	-
B	18.62 a	1.42 a	20.33 a	17.81 b	11.05 a	10.42 a	9.55 a	-
C	18.53 a	1.45 a	20.07 a	18.78 b	8.45 a	11.81 a	8.48 a	-
D	18.53 a	2.27 a	22.75 a	12.53 a	8.10 a	12.08 a	8.46 a	-
E	-	-	-	-	-	-	-	-
F	-	10.25 b	-	23.4 c	-	11.64 a	-	-
	18.20		21.25		8.85		9.19	
CV %	11.38	28.92	13.14	7.49	36.25	11.20		
LSD								
5%	4.14	2.22	5.57	2.71	5.57	2.57		
1%	6.27	3.37	8.44	4.11	8.44	3.90		

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.

Table 2.9 Yields (t/ha) of potato and shallot at four locations, East Java, 1986.

Yield	Gondanglegi		Blitar		Lawang		Turen	
	Potato	Shallot	Potato	Shallot	Potato	Shallot	Potato	Shallot
A	14.17 a	-	17.40 a	-	19.57 b	-	14.92 a	-
B	18.92 a	1.94 a	14.40 a	2.01 a	23.88 b	0.71 a	15.50 ab	-
C	13.83 a	5.83 ab	16.93	3.38 a	14.43 a	1.11 a	16.25 ab	-
D	15.42 a	8.75 b	14.53 a	8.96 b	21.78 b	1.01 a	17.83 b	-
E	20.75 a	7.78 b	17.43	3.57 a	15.64 ab	2.32 b	16.50 ab	-
F	-	19.44 c	-	7.10 b	-	4.07 c	-	
	16.62		16.14		19.06		16.20	
CV %	23.95	26.77	14.23	33.58	12.52	12.85	7.79	
LSD								
5%	7.49	4.41	4.32	3.16	4.49	0.48	2.38	
1%	10.89	6.42	6.29	4.60	6.54	0.69	3.46	

Source: Kusumo, S. et al. eds. 1987. Five years of SAPPRAD in Indonesia.

Table 2.10 Production costs of lowland potato farm per hectare, Desa Dukun, Magelang.

Cost	Participant farmer Recommended variety[a]		Non-participant farmer Local variety		Adopter farmer Cipanas variety	
	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)
Variable cost						
Seed (kg)	1,000	500,000	437.5	168,750	1,430	617,002
Fertilizer:						
Urea (kg)	325	37,092	383.3	43,749	665	83,125
TSP (kg)	265	30,601	350	40,417	425	53,125
KCl (kg)	165	20,625				
Stable manure	1,145.8	206,250	1,201.4	216,250	1,600	288,000
Pesticide:						
insecticide/ nematicide (l/kg)	18	27,000	6.2	8,680	12	18,000
fungicide (kg)	12	54,000			24	108,000
Labour:						
land preparation (HOK)[b]	166.2	166,200	169	169,000	869	259,000
planting (HOK)	78.7	78,700	86	86,000	135	135,000
maintenance (HOK)	128.2	128,200	150.9	150,900	153.5	153,500
harvesting (HOK)	80.7	80,700	72.2	72,200	138.5	138,500
Opportunity cost:						
Land hiring		375,000		375,000		375,000
Capital interest (5%)		85,218		66,547		111,413
Total cost (Rp '000)		1,789,586		1,397,493		2,339,665

Source: Basuki, R.S. 1987. A case study in Desa Merdikorejo, Sleman, and Desa Dukun, Magelang, Central Java. *In* Asandhi, A.A. 1987. Report on transfer of technology.

[a] Variety Cipanas, Aquilla, DTO-28, DTO-33.

[b] 1 HOK = 8 man-hours/day.

Table 2.11 Production costs of lowland potato farm per hectare, in Desa Merdikorejo, Sleman.

Cost	Participant farmer Recommended variety[a]		Non-participant farmer Local variety	
	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)
Variable cost	1,000	500,000	355.9	144,257
Seed (kg)				
Fertilizer:				
Urea (kg)	325	37,820	289.4	33,675
TSP (kg)	265	30,674	210.6	24,380
KCl (kg)	165	20,600		
Stable manure	280.2	152,000	280.2	152,083
Pesticide:				
insecticide/				
nematicide (l/kg)	10.8	13,500	14	17,500
fungicide (kg)	4	18,000		
Labour:				
land preparation (HOK)[b]	180	180,000	186.7	186,700
planting (HOK)	95	95,000	82	82,000
maintenance (HOK)	208.7	208,700	117.7	117,700
harvesting (HOK)	102	102,000	54.9	54,900
Opportunity cost:				
Land hiring	1	81,250	1	81,250
Capital interest (5%)		71,983		44,722
Total cost (Rp '000)		1,511,000	1	939,167

Source: Basuki, R.S. 1987. A case study in Desa Merdikorejo, Sleman, and Desa Dukun, Magelang, Central Java. *In* Asandhi, A.A. et. al. 1987.

[a] Variety Cipanas, Aquilla, DTO-28, DTO-33.

[b] 1 HOK = 8 man-hours/day.

Table 2.12 Net returns of lowland potato farm per hectare, in Desa Dukun, Magelang.

Budget cost	Participant farmer								Non-participant farmer		Adopter farmer	
	Recommended variety											
	Cipanas		Aquilla		DTO-28		DTO-33		Local variety		Cipanas	
	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)	Quantity	Value (Rp '000)
Yield (t/ha)	10,719		11,637		17,019		24,037		4,363		11,700	
Gross receipt (Rp)		2,575,240		2,795,789		2,044,322		5,774,586		1,048,211		2,810,925
Total cost (Rp)		1,789,586		1,789,586		1,789,586		1,789,586		1,397,492		2,339,665
Net return (Rp)		785,654		1,006,203		254,736		3,985,000		349,282		471,270

Source: Basuki, R.S. 1987. A case study in Desa Merdikorejo, Sleman, and Desa Dukun, Magelang, Central Java. *In* Asandhi, A.A. et. al. 1987.

Table 2.13 Average input-output data per hectare for potato, Pangalengan, West Java, 1979.

Yield and output	Amount (t)	Price (Rp)	Value[a] (Rp)
Main product	10.29	106.5	1,095,200
By-product, seed potato	1.01	134.8	136,400
Total, potato	11.20		1,231,600
Variable	**Amount (t)**	**Price (Rp)**	**Costs[a] (Rp)**
Seed potato	1.38	237.0	325,900
Organic fertilizer	22.79	3.4	77,400
Mineral fertilizer	1.41	65.0	105,500
Pesticides			242,300
Temporary hired labour (days)	0.20	857.0	89,100
Interest			54,200
Total variable costs			894,400
Overhead costs			
Land rent			45,000
Family labour (days)	6.16		p.m
Total overhead costs			45,000
Economics			**Value[a] (Rp)**
Value of production			1,231,600
Gross margin			337,200
Net earnings			292,200
Net earnings per month			84,300
Production cost per kilogram			83

Source: Moll, H.A.J. 1980. Potato production on small farms in Pangalengan, West Java. *In* Potato production in the Humid tropics.

[a]Value and costs are rounded to the nearest Rp 100 except for the production costs/kg. Number of observations = 132. US$1 = Rp 625.

Table 2.14 Sensitivity of gross margin of m.a. potato to price and yield.

Price	Yield										
	4.0	4.5	5.0	5.5	6.0	7.0	8.0	10.0	12.0	14.0	16.0
100	-1.39	-1.34	-1.29	-1.24	-1.19	-1.09	-0.99	-0.79	-0.59	-0.39	-0.19
125	-1.29	-1.23	-1.17	-1.10	-1.04	-0.92	-0.79	-0.54	-0.29	-0.04	0.21
150	-1.19	-1.12	-1.04	-0.97	-0.89	-0.74	-0.59	-0.29	0.01	0.31	0.61
175	-1.09	-1.00	-0.92	-0.83	-0.74	-0.57	-0.39	-0.04	0.31	0.66	1.01
200	-0.99	-0.89	-0.79	-0.69	-0.59	-0.39	-0.19	0.21	0.61	1.01	1.41
250	-0.79	-0.67	-0.54	-0.42	-0.29	-0.04	0.21	0.71	1.21	1.71	2.21
300	-0.59	-0.44	-0.29	-0.14	0.01	0.31	0.61	1.21	1.81	2.41	3.01
350	-0.39	-0.22	-0.04	0.14	0.31	0.66	1.01	1.71	2.41	3.11	3.81
400	-0.19	0.01	0.21	0.41	0.61	1.01	1.41	2.21	3.01	3.81	4.61

Notes: Cost of production from: Five years of SAPPRAD in Indonesia.
Cost of production, total = Rp 1.79 million.
Cost is assumed for all labour to be hired: Rp ± 0.55 million/ha.
Opportunity costs (land rent + interest) are estimated at Rp 0.34 million.
For small farm situation labour costs will add to household income.
The price variation is meant to reflect the prices of the various grades, as well as seasonal fluctuations.

Table 2.15 Highland production trials, 1980-1981, Batu, Malang. Variety Ketela, area 0.1 ha.

	October		November		December		January	
Value and Volume of production:	Value	Volume	Value	Volume	Value	Volume	Value	Volume
Potato size:								
a. Large	140	615.62	160	454.17	180	863.9	175	423.71
b. Medium	110	505.71	115	388.52	145	523.54	120	548.88
c. Small	100	173.3	85	172.88	120	198.73	70	231.99
d. Damaged	50	31.89	60	31.82	65	33.22	40	46.28
Sub-total	160,739.40	1,326.52	133,951.00	1,047.39	257,422.20	1,619.39	158,105.35	1,250.86
Cost of production:								
a. Land rent	5,000.00		5,000.00		5,000.00		5,000.00	
b. Seed	87,750.00		81,000.00		80,100.00		80,000.00	
c. Fertilizer	15,569.00		15,569.00		15,569.00		15,569.00	
d. Insecticide	42,239.40		38,044.00		39,506.60		43,455.10	
e. Labour	45,025.54		41,831.50		43,174.00		50,229.54	
Sub-total	195,583.94		181,444.50		183,349.60		194,253.64	
Income:	(34,844.54)		(47,493.50)		74,072.60		(36,148.29)	

Table 2.15 (*Continued*)

	February		March		April		May	
Value and Volume of production:	Value	Volume	Value	Volume	Value	Volume	Value	Volume
Potato size:								
a. Large	250	986.15	285	1092.62	200	781.20	195	548.70
b. Medium	200	557.88	230	590.38	130	425.46	150	536.33
c. Small	150	233.98	140	272.92	80	156.92	75	345.27
d. Damaged	120	65.03	130	59.3	50	84.64	90	34.75
Sub-total	401,014.10	1,843.04	493,101.90	2,015.22	228,335.40	1,448.22	216,468.75	1,465.05
Cost of production:								
a. Land rent	5,000.00		5,000.00		5,000.00		5,000.00	
b. Seed	85,000.00		80,300.00		84,600.00		90,000.00	
c. Fertilizer	15,569.00		15,569.00		15,569.00		15,569.00	
d. Insecticide	45,727.10		38,731.50		36,043.50		25,282.30	
e. Labour	44,999.50		40,563.00		44,267.50		42,452.00	
Sub-total	196,-295.60		180,163.50		185,480.00		178,303.30	
Income:	204,718.50		312,938.40		42,855.40		38,165.45	

Source: Soemarsono, 1983.

Chapter 3

Table 3.1 Area and production development of major horticultural commodities.

Commodity	1980		1981		1982	
	Area harvested (ha)	Production (t)	Area harvested (ha)	Production (t)	Area harvested (ha)	Production (t)
1. Chilli	111,800[2]	207,551[2]	120,000	211,618[2]	100,000	175,092
2. Onion	53,949	217,723	51,403	176,031	47,249	159,379
3. Cucumber	42,500[2]	174,572[2]	37,000	152,228[2]	42,000	172,760
4. Cabbage	27,373	323,022	40,086	349,013	28,920	317,118
5. Tomato	28,500[2]	100,643[2]	31,000	108,764[2]	34,000	119,393
6. Potato	24,450	230,377	30,278	216,713	20,996	164,801
7. Mustard greens	18,561	103,985	20,555	123,552	20,135	112,635
8. French beans	-	48,333	-	49,722	-	53,718
9. Shallot	19,213	76,312	19,073	79,405	19,226	70,765
10. Garlic	-	-	5,847	17,366	4,748	13,891
11. Carrot	4,544	42,835	5,470	54,859	5,743	49,787
12. Radish	5,138	30,096	4,382	24,617	3,220	17,036

Source: Ministry of Agriculture
[1] Preliminary figures
[2] Estimated area harvested

Table 3.1 (*Continued*)

Commodity	1983		1984		1985		1986[1]	
	Area harvested (ha)	Production (t)	Area harvested (ha)	Production (t)	Area harvested (ha)	Production (t)	Area harvested (ha)	Production (t)
1. Chilli	120,388	295,760	243,246	313,685	264,321	341,564	201,604	386,674
2. Onion	61,143	283,819	57,467	295,079	68,263	361,058	74,109	365,176
3. Cucumber	44,040	182,398	54,059	220,177	65,361	239,948	51,334	280,747
4. Cabbage	33,168	391,346	39,999	584,057	39,713	665,445	44,711	594,855
5. Tomato	30,175	88,909	41,823	138,108	43,276	160,018	40,400	164,958
6. Potato	30,305	249,986	33,030	371,546	32,350	372,825	38,432	404,938
7. Mustard green	24,142	134,804	23,864	153,009	25,243	189,430	29,301	233,472
8. French beans	19,236	66,558	27,678	83,275	29,733	89,740	28,390	101,473
9. Shallot	20,848	71,638	23,712	107,752	25,904	144,867	27,484	170,204
10. Garlic	5,065	18,275	9,084	47,521	12,308	61,143	16,712	91,899
11. Carrot	5,504	53,057	6,811	54,199	7,182	71,317	10,827	96,847
12. Radish	4,020	21,240	3,464	21,687	3,195	22,332	3,806	29,540

Table 3.2 Area development in West Java. Bandung (Pangalengan area)

Commodity	Area harvested (ha)						
	1980	1981	1982	1983	1984	1985	1986
1. Potato	4,335	-	3,594	5,001	5,976	5,489	4,943
2. Onion	1,877	-	2,295	2,440	2,862	4,492	4,059
3. Garlic	587	-	315	314	371	484	520
4. Cabbage	4,115	-	3,914	4,293	5,538	5,096	4,752
5. Carrot	500	-	422	531	824	755	718
6. Shallot	1,863	-	1,590	1,743	2,038	2,490	2,443
7. Mustard greens	2,041	-	1,809	2,261	2,119	1,913	2,087
8. Radish	471	-	363	602	509	660	535

Source: CBS
Note: Including municipality.

Chapter 4

Table 4.1 Inflation rate in Indonesia[1], 1979-1986.

Groups	Year								Average
	1979	1980	1981	1982	1983	1984	1985	1986	
General	21.77	15.97	7.09	9.69	11.46	8.76	4.31	8.83	10.98
1. Food	22.37	16.25	7.99	7.29	10.04	6.32	2.05	13.59	12.31
2. Housing	17.04	18.28	7.74	14.33	12.91	12.80	7.03	4.58	11.84
3. Cloth	29.67	12.70	3.81	3.39	4.31	3.00	3.32	9.47	8.71
4. Others	18.38	14.62	5.92	11.79	16.29	10.84	5.22	5.77	11.10

Source: Central Bureau of Statistics, Indonesia (1987).
[1] Aggregate of 17 big cities.

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Chapter 5

Note A. Market Information Service in brief.

The Market Information Service (MIS) provides daily price information for farmers and traders. The MIS covers vegetable and secondary food crop prices of the 8 provinces: North Sumatra, DKI Jakarta, West Java, Central Java, DI Yogyakarta, East Java, and North Sumatra, and South Sulawesi.

MIS collects the price of transactions for vegetables in production areas (assembly prices) and in consumption centres (wholesale prices). The prices are collected for certain qualities at the peak of market turnover by qualified data collectors. Each commodity price is quoted from five transactions (minimum of three transactions). These data are sent to the Provincial office of MIS. The Provincial office managers of MIS check the data and pass them on to local radio stations and newspapers as well as to the MIS central office in Jakarta by telephone. The data operator in Jakarta receives the data from the MIS Provincial offices, checks and transfers them to the Price Broadcasting Forum and in the evening they are sent to Radio of the Republic Indonesia (RRI). RRI broadcasts the price information at 8:05 p.m. to the whole country.

The MIS system provides adequate market information for producers, traders and customers involved in the marketing of vegetables. This information service can contribute to agricultural development in the following ways:

1. Improve the bargaining position of the farmers (weaker elements of the marketing system) and help them to get a fair share of the consumer price.

2. Stimulate competition between traders dealing in vegetables, thereby contributing to the technical and allocative efficiency of the marketing system for vegetables.

3. Information promotes the continuous and smooth adaptation of the supply to the development of the demand.

Note B. Potato quality

Variety, size, maturity and health condition of potato tubers are indicators which determine the price which consumers are willing to pay for potato. The Java market and also farmers, prefer the Granola variety which has been produced for the last six years.

The production areas offer "young" (immature) and "old" (mature) potato. "Young" potato is harvested 10 to 20 days before "old" potato (105-125 days after planting) and is normally sold at 5 to 10% below mature potato.

Although farmers, especially those who store potato for some time, grade according to size, grading is mainly done by assembly traders. They sort out the small ones which they intend to use as seed. The following five grades could be identified:

A about 3 - 10 tubers/kg
B about 10 - 20 tubers/kg

C about 20 - 30 tubers/kg
D about 30 - 40 tubers/kg
E about 40 and more tubers/kg

Normally A, B and C are not sold separately by the farmers/assembly traders. They are offered mainly as grade ABC (fewer than 20 tubers/kg) and grade AB (fewer than 10 tubers/kg). The definition of ABC or AB or other grades appears to vary with the season. Therefore, the traders agree only on a price after they have checked a sample of the lots offered or when the supplier has a long-standing relationship and a good reputation.

To have an idea about the relation between grade and price, an example is given from the Dieng production area in September 1987.

Grade	No. of tubers/kg	Price (Rp/kg)
A	3 - 5	300
AB super	6 - 10	260
ABC	10 - 15	240
C	20 - 25	170
Other	40 - 50	100

Chapter 6

Table 6.1 Value of Indonesian vegetable exports to Penang, (January 1986 - September 1987)

Monthly period		Potato (M$)	%	Cabbage (M$)	%	Chinese cabbage (M$)	%	Carrot (M$)	%	Ginger (M$)	%	Tomato (M$)	%	Total value (M$)
86	J	930529.00	54	682950.10	39	15619.50	1	21915.30	1	70404.50	4	16461.00	1	1737978.45
	F	815551.20	45	763190.50	42	33701.40	2	10985.20	1	177849.50	10		0	1801367.92
	M	423160.60	33	593795.50	46	13235.90	1	25167.40	2	239780.00	19		0	1295220.88
	A	621103.20	47	502265.80	38	12700.80	1	11667.30	1	159899.30	12		0	1307724.17
	M	480052.80	39	505933.80	41	44096.40	4	17184.80	1	193420.00	16	650.30	0	1241438.04
	J	792036.00	51	434894.90	28	48933.50	3	7335.00	0	260850.00	17	13746.50	1	1557895.01
	J	889357.00	48	582583.70	31	6479.20	0	3358.80	0	369440.00	20	4462.50	0	1855780.95
	A	970627.00	59	289754.90	18	8008.00	0		0	363760.00	22		0	1632227.61
	S	825454.00	52	342309.20	21		0		0	434720.00	27		0	1602556.07
	O	443154.60	30	634155.60	44	712.50	0		0	376080.00	26		0	1454176.83
	N	646149.00	49	459669.00	35	6032.00	0		0	212969.00	16	6816.00	1	1331734.48
	D	1135372.00	62	546645.00	30	2853.60	0	9339.00	1	130010.00	7	7108.00	0	1831427.21
Total		8972546.40	48	6338148.00	34	192372.80	1	106952.80	1	2989182.30	16	49244.30	0	18649527.62
average		747712.20	48	528179.00	34	16031.07	1	8912.73	1	249098.53	16	4103.69	0	1554127.30
87	J	813855.00	59	421398.00	31	8700.00	1	8280.00	1	116400.00	9		0	1368724.49
	F	1028982.50	69	319584.00	21	15689.00	1	12918.00	1	111340.00	7	6854.25	0	1495467.29
	M	616105.80	59	191396.00	18	421.20	0	5623.80	1	229121.00	22	1605.00	0	1044372.64
	A	901353.60	78	98945.00	9		0	2191.75	0	153900.00	13	903.50	0	1157393.76
	M	615558.00	58	199986.00	19	640.00	0	2177.50	0	232027.20	22	3770.00	0	1054258.33
	J	523468.10	47	342779.60	31	10800.00	1	1788.80	0	225802.50	20	4050.80	0	1108789.43
	J	840124.50	54	421175.00	27	26779.20	2	6127.50	0	239006.40	15	17872.30	1	1551183.74
	A	773370.00	66	219280.50	19		0	225600	0	151491.60	13	28401.75	2	1174897.42
	S	764424.00	53	407841.85	29	2976.00	0	4244.50	0	228888.00	16	21900.00	2	1430372.81
Total		6877241.50	60	2622385.95	23	66005.40	1	45607.85	0	1687976.70	15	85357.60	1	11385459.91
average		764137.94	60	291376.22	23	7333.93	1	5067.54	0	187552.97	15	9484.18	1	1265051.10
Total (86/87)		15849787.90	53	8960533.95	30	258378.20	1	152560.65	1	4677159.00	16	134601.90	0	30034987.53
average		754751.80	53	426692.09	30	12303.72	1	7164.79	1	222721.86	16	6409.61	0	1430237.50

Table 6.2 Average price of potato and cabbage in Penang, 1975-1977 and 1986-1987. **(M$/kg)**

Year	Price	
	Potato	Cabbage
1975	0.39	0.26
1976	0.45	0.21
1977	0.52	0.32
1986	0.59	0.69
1987 *	0.52	0.62

* per September 1987.

Chapter 7

Table 7.1 Availability of potato for domestic consumption, 1968-1985 ('000 t).

Year	Production (1)	Waste (2)	Seed (3)	Export (4)	Import (5)	Availability for consumption (6)
1968	65	3	10	-	-	52
1969	104	5	11	-	-	88
1970	70	4	9	-	-	57
1971	123	6	11	1	-	105
1972	124	6	12	3	-	103
1973	173	8	17	4	-	144
1974	178	9	15	5	-	149
1975	124	6	12	5	-	101
1976	126.69	5.99	12.46	6.98	0.07	101.33
1977	248.23	12.03	15.59	7.61	-	213
1978	233	23	19	2	-	189
1979	204	20	15	1	-	168
1980	230	23	-	-	-	207
1981	217	11	19	-	1	188
1982	180	9	16	-	2	157
1983	250	25	21	2	2	204
1984	372	18	23	12	2	321
1985	373	18	23	19	1	314

Source: CBS Food Balance Sheets (various issues). Jakarta.

Table 7.2 Consumption of potato per capita, 1968-1985.

Year	Consumption			Mid-year population ('000)
	kg/year	g/day	cal/day	
1968	0.47	1.29	1	111,171
1969	0.77	2.11	1	113,629
1970	0.49	1.34	1	116,175
1971	0.9	2.4	2	118,809
1972	0.85	2.33	2	121,632
1973	1.16	3.18	2	124,601
1974	1.17	3.21	2	127,586
1975	0.77	2.12	1	130,597
1976	0.76	2.08	1	133,650
1977	1.56	4.27	3	136,766
1978	1.35	3.70	3	139,960
1979	1.17	3.20	2	143,246
1980	1.42	3.89	3	146,201
1981	1.26	3.45	2	149,677
1982	1.03	2.82	2	152,988
1983	1.30	3.56	3	156,372
1984	2.01	5.51	4	159,831
1985	1.92	5.26	4	163,367

Source: CBS Food Balance Sheets (various issues). Jakarta.

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Chapter 8

Table 8.1 Varieties of sweet potato, as reported by an experienced farmer in Dukun, Magelang.

Name	Description
1. Asin	: dirty red
2. Nyonyak nginang	: white skin, red tuber
3. Kemba	: red skin, dirty white tuber
4. Walik angin	: white skin, white tuber
5. Prol	: white skin, white tuber (round)
6. Malotok	: white skin, white tuber
7. Bandung	: white skin, long tuber
8. Sumbawa	: red skin, white tuber
9. Jenawi	: red skin, red tuber (oval)
10. Manggisan	: red skin, red tuber (round)
11. Mlenting	: red skin, red tuber (long)
12. Gatotkaca	: red skin, white tuber
13. Darowati	: pinky skin, white tuber
14. Sangit	: dirty yellow skin, white tuber
15. Cakar ayam	: red skin, white tuber
16. Krentol	: white skin, white tuber (round)
17. P.B.	: red skin, red tuber
18. Mentik urang	: red skin, red tuber

Table 8.2 The cost of production and proftability of several crops, per 1000 m^2, in Dukun, Magelang, in 1987.

ITEM	Watermelon			Long chilli			Tomato (King Kong)		
	unit	price Rp/unit	value	unit	price Rp/unit	value	unit	price Rp/unit	value
I. Cost of Production									
a. Labour operations:									
Land preparing (HOK)	6.2	1200	7750	6.72	1250	8400	14.4	1500	21600
Planting + Fertilizing	5.	1250	6950	7.72	1250	9650	2.8	1500	4200
Maintenance (HOK)	12.7	1250	15900	7.48	1250	9350	16.4	1500	24600
Harvesting (HOK)	10	1250	12500	22	1000	22000	18	1000	18000
Transportation	-	-	-			7650			
b. Materials:									
Seed	2	1300	26000	10		7000	5		7000
Stable manure (t)	1	10000	10000	1	20000	20000	1	5500	5500
Urea (kg)	135	125	16875	-	-	-	45	125	5625
TSP (kg)	70	125	8750	32	125	4000	15	125	1875
KCl (kg)	5	150	750	48.5	150	7275	5	150	750
ZA (kg)	-	-	-	100	150	15000	-	-	-
Foliar fertilizer (bottle)	3.4	2000	6800	-	-	-	5.5	1000	5500
Stick (unit)	-	-	-	-	-	-	250	25	6250
Ties (kg)	-	-	-	-	-	-	1.5	3000	4500
Bags	-	-	-	16	250	4000			
Fungicide (kg)	4.86	7000	34000	4.75	7000	33300	1.5	7500	11250
Insecticide	4	3000	12000	9.4	4000	37750	2	5000	10000
c. Other charges:									
Land charges (Rp)									
Interest									
II. Yield (kg/1000 m^2)	1250			1225			1800		
Price (Rp/kg)		400			445			300	
Gross profit (Rp)			500000			545125			540000
Total Cost (Rp)			191275			240125			176350
Profit			308725			304750			363650

Table 8.2 (*Continued*).

ITEM	Tomato (Super-375)			Tomato (Intan)			Pepper (Local Var.)			Snap bean		
	unit	price Rp/unit	value	unit	price Rp/unit	value	unit	price Rp/unit	value	unit	price Rp/unit	value
I. Cost of Production												
a. Labour operations:												
Land preparing (HOK)	17.33	1500	26000	15.5	1500	23250	15.5	1500	23250	7.33	1500	11000
Planting + Fertilizing	3.3	1500	5000							3.4	1500	5100
Maintenance (HOK)	19.33	1500	29000	7.5	1500	11250	28	1500	42000	2.66	1500	4000
Harvesting (HOK)	15	1000	15000	10	1000	10000				6.66	1500	10000
Transportation												1500
b. Materials:												
Seed	5		8000	10		6000	10		4000	3	2000	6000
Stable manure (t)	1	20000	20000	1	12000	12000	1	12000	12000	1	7000	7000
Urea (kg)	75	125	9375	30	125	3750	16	125	2000	40	125	5000
TSP (kg)	15	125	1875	30	125	3750	16	125	2000	15	125	1875
KCl (kg)	17	150	2550	10	150	1500	8	150	1200	7.5	150	1125
ZA (kg)	40	150	6000	-	-	-	-	-	-	-	-	-
Foliar fertilizer (bottle)	-	-	-	3	500	1500	24	500	12000	0.5	2500	1250
Stick (unit)	250	25	6250	250	25	6250	-	-	-	300	25	7500
Ties (kg)	6	1200	7200	2	1200	2400	-	-	-	-	-	-
Bags										4	250	1000
Fungicide (kg)	1.5	7000	10500	1	7000	7000	-	-	-	-	-	-
Insecticide	1.6	5000	8000	1	5000	5000	2	5000	10000	1.27	5000	6350
c. Other charges:												
Land charges (Rp)												
Interest												
II. Yield (kg/1000 m^2	1500			840			1170			900		
Price (Rp/kg)		450			250			600			160	
Gross profit (Rp)			675000			210000			702000			144000
Total Cost (Rp)			199750			138650			198450			101700
Profit			475250			71350			503550			42300

Table 8.3 The cost of production and profitability of potato per ha, in Magelang, 1983-1986.

Year	Cost of production (Rp)	Profitability			
		Yield (t/ha)	Price (Rp/kg)	Gross-output (Rp)	Profit (Rp)
1. Oct.-March '83/'84	784,500	10.7	90	963,000	178,500
2. April-Sep. '84	988,000	10.7	140	1,498,000	510,000
3. Oct.-March '84/'85	939,200	10.7	140	1,498,000	558,800
4. April-Sep. '85	1,095,000	10.7	140	1,498,000	403,000
5. Oct.-March '85/'86	n.a	n.a	n.a	n.a	n.a
6. April-Sept. '86	1,118,500	9.7	275	266,750	851,750
7. Oct.-March '86/'87	1,131,500	9.7	275	266,750	864,750

Source: Dinas Pertanian DT II Kabupaten Magelang.

Table 8.4 The Javanese calendar.

Pasaran: *Pon*, *Wage*, *Kliwon*, *Legi* and *Pahing* (5 days)

Selapanan: 7 (calendar days) x *Pasaran* = 35 days
e.g. Between Sunday-*Pahing* to the next Sunday-*Pahing* = 35 days

Windu: 81 x *Selapanan*

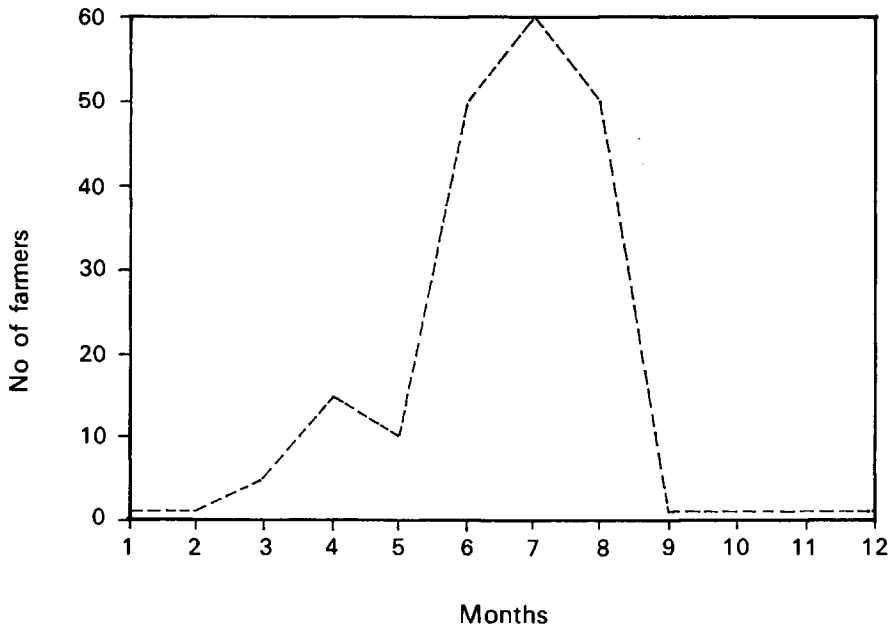

Figure 8.1 Estimated planting frequency of sweet potato, Dukun, Magelang.

Chapter 9

Table 9.1 Farmers' profit from potato compared with other selected crops in North Sumatra (estimated in 1987). (Rp '000)

Selected crops	Production cost	Total production (t/ha)	Revenue	Profit
Potato	2,000	20	4,600	2,600
Cabbage	1,750	25	3,426	1,675
Tomato	3,000	8	2,610.72	- 389.28
Chinese cabbage	1,000	20	1,896.4	896
Carrot	600	10	1,742.6	1,142.6
Ginger	2,500	20	10,800	8,300

Source: North Sumatra Regional Office of Trade, Medan, 1988.

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Glossary

Acronym

AARD	Agency for Agricultural Research and Development
CAER	Centre for Agro-Economic Research
CBS (or BPS)	Central Bureau of Statistics (Biro Pusat Statistik)
CCCN	Import/Export code GOI
CGPRT	Coarse Grains, Pulses, Roots and Tuber Crops
CIP	International Potato Centre (Peru)
CRIH	Central Research Institute of Horticulture
FES	Friedrick Eberhard Stiftung
GOI	Government of Indonesia
LEHRI (or Balithot Lembang)	Lembang Horticultural Research Institute (or Balai Penelitian Hortikultura Lembang)
PIKJ	Pasar Induk Kramat Jati (Kramat Jati Central Market)
PUSKUD	Pusat Koperasi Unit Desa (Central Rural Co-operative Unit)
SAPPRAD	Southeast Asian Programme for Potato Research and Development
SUSENAS	Survei Sosial-Ekonomi Nasional (National Socio-Economic Survey)

Abbreviation

Rp	Rupiah (Indonesian currency). Rp 1600 = US$ 1

Indonesian Terms

Bayan	Village level official
Bengkok	The land made available for the use of the village head

Carik	Secretary of the village administration
"Catch" crop	Short duration secondary or tertiary crop using residual fertilizer of previous crop
Desa	Village
Gaplek	Chopped and dried cassava
HOK	Hari Orang Kerja (Man-days) (1 HOK = 8 man-hours/day)
Kabupaten	Regency
Kacang gude	Local bean (*Cayanus cayan*)/pigeonpea
"Karung-basis"	Sold by (jute) bag; not weighed
Kecamatan	District
Krupuk	Prawn or fish cracker
Loncang	Eggplant
Palawija	Upland crops such as soybean, corn and cassava
Penjaga sekolah	School guard
Petsai	Chinese cabbage
Sawah	Paddy field (lowland)
Semangka	Watermelon
Swadaya Masyarakat	Self-effort of society
Tanah desa	Village land
Tebasan	A system where farmers sell their commodities before harvest time
Tegal	Upland (homeyard)
Tempe	Fermented soybean (cake)
Varietas	Variety
Warisan	Inheritance

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