SOCIO-ECONOMIC FACTORS AFFECTING THE INCOME AND PRODUCTIVITY OF PINEAPPLE FARMERS IN SAMARAHAN, SARAWAK

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CROP PRODUCTION PROGRAMME
SCHOOL OF SUSTAINABLE AGRICULTURE
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NURUL AZZAH BINTI ZAINAL

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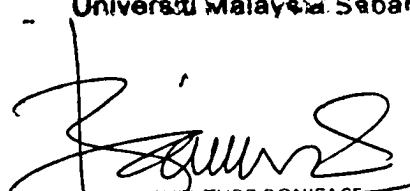BR09110022
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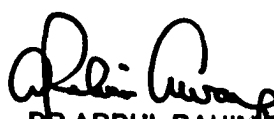
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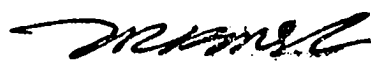2. Dr. Bonaventure Boniface
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ABSTRACT

Locally recognized as *nanas*, pineapple is one of the well-known tropical fruits besides banana, mango and papaya. This unique fruit is being cultivated extensively in many parts of the world including Malaysia and commonly consumed fresh or in processed form. Due to its high demand worldwide, pineapple cultivation must be efficient in order to have high quality as well as continuous and sufficient supply. In Malaysia, this matter has been of high concern by the Ministry of Agriculture (MOA), Malaysian Pineapple Industry Board (MPIB) and other related agencies. These agencies had been implementing various development activities to uplift the pineapple industry in the country. These included in activities to help the small-scale pineapple farmers in improving their income level. This study was conducted to determine the socio-economic factors affecting the income and productivity of pineapple farmers in Samarahan, Sarawak. The survey commenced from July to August 2012 with total of 55 respondents using structured questionnaire as the research instrument. SPSS Software version 20 was used to analyse data collected. Binomial logistic regression analysis indicated that only land size was statistically significant to the monthly income of pineapple farmers (B=.492, p<.05). In the meantime, the factor analysis and Mann-Whitney U Test revealed that perceptions of pineapple farmers with monthly income of below RM 830 and above RM 830 had no significant differences regarding the factors affecting their productivity namely inputs and awareness factor (Z=-.589, p=.556) and farm background factors (Z=-.288, p=.773). Land size affected the income of pineapple farmers in Samarahan, Sarawak. On productivity, the pineapple farmers agreed that inputs and awareness factor and also farm background factors influenced their productivity. Overall, these findings suggested that the pineapple farmers played important roles and with the assistance of the relevant agencies, they would be able to contribute in enhancing the pineapple industry in Sarawak and in Malaysia on the whole.

FAKTOR – FAKTOR SOSIO-EKONOMIK YANG MEMPENGARUHI PENDAPATAN DAN PRODUKTIVITI PENANAM NANAS DI SAMARAHAN, SARAWAK

ABSTRAK

Nanas atau nenas antara buah-buahan tropika yang terkenal selain daripada pisang, manga dan betik. Buah yang unik ini ditanam secara meluas di serata dunia termasuk Malaysia. Pada kebiasaannya, nanas dimakan secara segar atau diproses. Oleh kerana permintaan untuk nanas amat tinggi dalam pasaran dunia, penanaman nanas seharusnya efisien untuk menghasilkan bekalan nanas yang mencukupi, berkualiti dan berterusan. Industri nanas di Malaysia mendapat perhatian Kementerian Pertanian dan Industri Asas Tani, Lembaga Perindustrian Nanas Malaysia (LPNM) dan pihak lain dalam meningkatkan produktiviti industri nanas melalui perlaksanaan beberapa pembangunan. Para penanam nanas juga dibantu bagi menggandakan pendapatan mereka daripada penanaman nanas. Kajian ini telah dijalankan untuk mengenal pasti faktor- faktor sosio-ekonomik yang mempengaruhi pendapatan dan produktiviti penanam nanas di Samarahan, Sarawak. Kajian soal selidik ini telah dijalankan dari bulan Julai ke bulan Ogos 2012. Seramai 55 orang responden telah dipilih dalam kajian ini. Untuk mendapatkan maklumat yang berkaitan, borang soal selidik telah digunakan. Setiap responden telah ditemu ramah berdasarkan borang soal selidik. Melalui perisian SPSS versi 20, analisis *Binomial Logistic Regression,* data diperolehi menunjukkan luas tanah mempunyai kesan signifikan terhadap pendapatan bulanan penanam nanas tersebut (B=.492, p<.05). Selain itu, *Factor Analysis* dan *Mann-Whitney U Test* mendapati bahawa persepsi penanam nanas daripada pendapatan bulanan RM 830 ke bawah dan RM 830 ke atas tidak mempunyai perbezaan signifikan tentang faktor- faktor mempengaruhi produktiviti mereka iaitu faktor input dan kesedaran (Z=-589, p=.556) dan faktor latar belakang ladang (Z=-.288, p=.773). Kesimpulannya, luas tanah mempengaruhi pendapatan penanam nanas di Samarahan. Dari segi produktiviti, penanam nanas bersetuju bahawa produktiviti penanam nanas dipengaruhi oleh faktor input dan kesedaran serta faktor latar belakang ladang. Hasil kajian ini amat penting untuk para penanam nanas serta agensi yang berkaitan dalam meningkatkan kualiti dan produktiviti industri nanas khususnya di Sarawak dan amnya di Malaysia.

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LIST OF SYMBOLS, UNITS AND ABBREVIATIONS

'	Minutes
"	Seconds
%	Percent
°	Degree
°C	Degree Celsius
cm	Centimetre
kg	Kilogram
m	Metre
mm	Millimetre
n	Number of Observations
CAM	Crassulacean Acid Metabolism
DOA	Department of Agriculture
DV	Dependent Variable
FAMA	Federal Agriculture Marketing Authority
IADA	Integrated Agriculture Development Area
IADP	Integrated Agriculture Development Project
IV	Independent Variable
KMO	Kaiser-Meyer-Olkin
LPNM	Lembaga Perindustrian Nanas Malaysia
MARDI	Malaysian Agricultural Research and Development Institute
ML	Maximum Likehood
MOA	Ministry of Agriculture
MPIB	Malaysian Pineapple Industry Board
PCA	Principle Component Analysis
PhD	Doctor of Philosophy
PLI	Poverty Line Index
RM	Ringgit Malaysia
SPSS	Statistical Package for the Social Sciences

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$$\text{logit}(p) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n$$
logit(p) = odds of ratio or likehood ratio
α = constant
X_1 to X_n = independent variables

3.2   Econometric Model of Study   21
$$\text{logit}(p) = \alpha + \beta_1 AGE + \beta_2 GEN + \beta_3 MAR + \beta_4 EDU + \beta_5 EXP + \beta_6 EXT + \beta_7 DIS + \beta_8 SEC$$
$$+ \beta_9 HOUSE + \beta_{10} LANDSTAT + \beta_{11} LANDSIZE$$

logit(p)	= Income of Pineapple Farmers in Samarahan, Sarawak
α	= Constant
AGE	= Age of farmers
GEN	= Gender of farmers
MAR	= Marital status of farmers
EDU	= Education level of farmers
EXP	= Experience in pineapple farming
EXT	= Extension contact
DIS	= Distance between pineapple farm and house
SEC	= Secondary occupation
HOUSE	= Household size
LANDSTAT	= Land status
LANDSIZE	= Land size

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p	= Probability that a case is in particular category
exp	= Base of natural logarithm
a	= Constant of equation
b	= Coefficient of independent variables

CHAPTER 1

INTRODUCTION

1.1 Introduction

Known scientifically as *Ananas comosus*, pineapple or *nanas* is a monocotyledonous plant with short stem and a rosette of long spiny leaves. Its berry-like fruitlets are fused to form multiple fruit which can be consumed fresh or processed (Coppens d' Eeckenbrugge and Leal, 2003). Malaysia was globally renowned as commercial producer of pineapple since 1888 and it was the oldest agro-based industry particularly in canned pineapple compared to oil palm and rubber. In 1960s and early 1970s, the industry expanded rapidly, making Malaysia the largest exporter of fresh pineapple and third largest exporter of canned pineapple (Mat Hassan Othman, 2011). Despite the success of the industry, it faced major fluctuation later and to date, the pineapple industry is being monopolized by neighbouring countries such as Indonesia, Thailand and Philippines. As a result, the global ranking of Malaysia as the major producer and exporter of this tropical fruit dropped.

Recently, Malaysian Pineapple Industry Board (MPIB) reported that in year 2010, Malaysia exported RM 78 million worth of fresh and canned pineapple to United States, Japan, United Kingdom and Middle East, but the export volume was insufficient to meet all the demands. This indicated that the pineapple industry in Malaysia required more development and improvement in many aspects. Issues affecting the pineapple industry should be determined and solved. According to Mat Hassan Othman (2011), the issues limiting the pineapple industry production in Malaysia were lack of private sector participation, high production cost, limited research and development, value chain development and dependence on smallholders.

Lack of private sector participation causes low funding and investment in pineapple cultivation in Malaysia. Meanwhile, high production cost such as labour cost and agricultural inputs of fertilizers, manure, herbicides and so forth caused limitation in the industry. Research and development activities still lacking in areas for instance new and quality pineapple varieties development, mechanization processes and post-harvest handling. Besides that, pineapple cultivation dominantly controlled by smallholders with land size not large enough for large scale cultivation, low level of education and mostly over age of 65 years old.

In order to overcome these issues, there were few strategies implemented by the government. First, the government recognized pineapple as a local fruit to be developed as high value product for export in previous Ninth Malaysia Plan and current Tenth Malaysia Plan specifically under the Third National Agriculture Policy. Through this, there are various programmes and projects planned and some were carried out to achieve the government visions. Next, the participation of private sectors encouraged by government to invest in pineapple industry by providing the private sectors incentives such as tax reliefs, basic infrastructure and pioneer status in pineapple industry. In addition, the efficiency of smallholders also taken to account where it focuses on the smallholders towards more consistent production, higher productivity and better quality of yield. They were promoted to join courses and programs on pineapple cultivation conducted by related agencies. Research and development activities also contribute to the pineapple industry through new varieties and technology. In Malaysia, the agencies in research and development field include Malaysian Agricultural Research and Development Institute (MARDI), Ministry of Agriculture (MOA) and MPIB. As in genetic improvement of pineapple, the interest increased in recent years due to high market demand and high price of improved fresh market cultivars includes program from MARDI (Sanewski *et al.*, 2011). Moreover, the market development will be made to improve marketing scheme that can help to market Malaysian pineapple product to the world market. The focus will be on market niche in Europe, Middle East and also China. The processing industry will also be improved to support the pineapple industry in Malaysia for both small and medium production industries. In addition, the quality of products will be assessed under Good Manufacturing Practice. To date, these on-going efforts and strategies did increase the export volume and cultivation area per hectare from time to time but still inadequate to fulfil the world's market demand.

In smaller scope, this research which was conducted on the pineapple farmers in Samarahan, Sarawak to identify the socio-economic factors affecting their income and productivity, would contribute in one way or another in addressing issues faced by pineapple farmers in Sarawak including the dependency on pineapple smallholders.

1.2 Problem Statement

In the National Agro-Food Policy approved by the Malaysian Cabinet on 28 September 2011, pineapple was among the tropical fruits aimed for productivity increment and export purposes. Based on statement by Sahdan Salim, Chief Director of MPIB, in 2010 Malaysia exported RM 78 million worth of fresh and canned pineapple to the United States, Japan, United Kingdom and Middle East. However, the amount was insufficient to meet the export demands. Thus, in order to fulfil the high demands of pineapple for export, Malaysia must plan strategies to increase pineapple production from time to time.

In Sarawak, Samarahan is one of the pineapple cultivation project areas. This was previously implemented by Integrated Agriculture Development Area (IADA) Samarahan and had been taken over by Malaysian Pineapple Industry Board (MPIB). Samarahan was identified as a strategic and advantageous area for pineapple planting which had deep peat soil, average rainfall of 3,400 mm per year and average temperature of 27°C to 30°C making it as one of the main key players of pineapple production in Sarawak. Four pineapple varieties Samarahan well known of include Moris or locally known as Sarikei, Josephine, the hybrid of Nanas Johor and Sarawak, Gandul, N36 and also Sarawak or Paun. Generally, pineapple cultivation in Sarawak was small scale and only catered for domestic market, but not for export purpose (Abdul Rahman Saili *et al.,* 2005). Therefore, in order to boost the pineapple cultivation in Sarawak and Malaysia on the whole, this study on socio-economic factors affecting the income and productivity of pineapple farmers was conducted in Samarahan.

Relatively, socio-economic characteristics of farmers have been proven to give significant impacts to their income and productivity. In previous studies on socio-economic characteristics of farmers affecting their income, Sultan Ali Adil *et al.* (2004) proved that income of small farmers in Pakistan were affected by family, labour and input cost. Mohammad Samaun Safa (2005) indicated that income of farmers was

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influenced by education, area of land, livestock holding and family size. Based on Moloi (2008), the factors determining the livestock farmers' income were farm size, access to finance, age of household head, membership to farmers' organization and government support. In addition, horticultural farmer's factors that affect their income were farm size, age of household head, land type and extension contact. Besides that, Serin *et al.* (2009) found that formal education and practical education or extension contact could increase the farmers' income level. Ghafoor *et al.* (2010) reported that academic qualification, land holding, agricultural expenditures and number of family members involved in agricultural activities affected the income.

For productivity, Abdul Rahman Saili *et al.* (2005) proved that the pineapple farmers' productivity influenced by their cultivation practice, knowledge and farm recording. Besides that, in a past study conducted by MARDI (2010), the productivity of pineapple farmers' was affected by socio-economic factors, such as, high income in other agriculture activity, land size, age, household size, education level and capital source. Meanwhile, Md. Mahmudul Alam *et al.* (2011) stated that the paddy farmers' race, education level, availability of machines in agriculture activity, secondary occupation, ratio of non-agriculture to agriculture income had significant impact to their productivity. Mbam and Edeh (2011) reported that smallholder rice farmers education years, fertilizer application and improved variety affect their productivity in producing rice.

All those factors mentioned above had been identified as factors which gave impacts on the income and productivity among their target groups. These findings were used as references in this study on pineapple farmers in Samarahan, Sarawak.

1.3   Objectives

The main objective of this study was to determine the effects of socio-economic factors on the income and productivity of pineapple farmers in Samarahan, Sarawak. The specific objectives were:
a. To identify the socio-economic status of pineapple farmers in Samarahan, Sarawak;
b. To identify the income level and productivity of pineapple farmers in Samarahan, Sarawak; and

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c. To determine the relationships between socio-economic characteristics of the pineapple farmers and their income and productivity.

1.4 Significance of Study

The outcome of this study could be used as reference to the Department of Agriculture (DOA), Sarawak, MPIB, IADA Samarahan and other relevant agencies in helping local pineapple farmers on knowledge and technology adaptation to increase their productivity. Besides, this study would be significant for Majlis Daerah Samarahan in order to keep track of the local people agriculture activities. As for the growers, this study could point out their advantages, issues and also limitations in cultivating pineapple in Samarahan for review and further improvement with the help of related agencies.

1.5 Terminology

This section explains the concepts and context of the important terms that were used in the study. The terms included socio-economic and productivity on the conceptual and operational definitions.

1.5.1 Definitions for Socio-economic

The conceptual definition of socio-economic term based on Oxford Dictionary of Economics (2009), it is related to a group of people with similar social and economic status. In this study, socio-economic term was defined as the social and economic characteristics of pineapple farmers in Samarahan, Sarawak including age, gender, marital status, education level, experience in pineapple farming, extension contact, distance between farmer house and farm, secondary occupation, household size, land status and land size. These characteristics were identified to determine their relationship with the farmer's income and productivity (Black *et al.*, 2009).

1.5.2 Definitions for Income

In Oxford Dictionary of Economics (2009), the definition of income is amount of an individual can spend in a period while leaving his or her capital unchanged. For income term, the study focused on monthly income of the farmers gained from their pineapple farming (Black *et al.*, 2009).

1.5.3 Definitions of Productivity

Productivity is a noun from the word produce. It is defined in Oxford Dictionary of Economics (2009) as amount of output per unit of particular factor of production such as labour employed or per unit of land in agriculture or total factor productivity may be measured that involves aggregating different factors. In the study, the term productivity was related to the farmer's total production of pineapple (output) over total land area of pineapple planted (input) (Black *et al.*, 2009).

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

Pineapple is a nutritious tropical fruit that possesses anti-inflammatory characteristics and can help in maintaining a healthy digestive system with high fibre content. It contains high water content, rich in Vitamin C, no cholesterol and low fat (Joy, 2010). It is originated from South America specifically from Orinoco, Rio Negro, River Basins of Northern Brazil, Columbia, Venezuela and Northern Argentina (Smith *et al.*, 2005). It was first discovered by Europeans during Columbus voyage at Guadeloupe Island. Pineapple perceived as a large and delicious fruit by them. Later on, pineapple widely domesticated in America and Caribbean where pineapple referred as *nanas* or *ananas*. As pineapple reached Europe, they shifted cultivation of warm and tropical climate pineapple to their cold climate country through greenhouse cultivation. The first attempt was by Le Cour at Leyden and eventually gained success. Expansion of pineapple cultivation in greenhouse circa 18th and 19th century became popular among the Europeans and this lead to import of many varieties from Antilles. Out of many varieties imported, only Smooth Cayenne and Queen have high demand and cultivated commercially. During 16th and 17th century, Spaniards and Portuguese dispersed other variety through their expeditions and voyages to other continents like Africa and Asia (Rohrbach *et al.*, 2003). Up to this date, pineapple is widely cultivated in other tropical regions such as Thailand, Philippines, Indonesia and Malaysia. Specifically in Malaysia, Rajendran *et al.* (2012) reported that dated back in the 16th century, pineapple was introduced and domesticated in Malaysia by the Portuguese.

2.2   Taxonomy

Pineapple belongs to order of *Bromeliales*, family *Bromeliaceae* and subfamily of *Bromelloideae* with 2,794 species among 56 genera (Coppens d' Eeckenbrugge and Leal, 2003). All pineapples are grouped into one *Ananas* genus based on their inflorescence unique feature. The two main species are *A. macrodontes* and *A. comosus*. Under *A. comosus*, there are five botanical varieties namely *A. comosus* var *ananassoides* or Cerrado Pineapples, *A. comosus* var *erectifolius* or Dwarf Pineapple, *A. comosus* var *parguazen*, *A. comosus* var *comosus* or common pineapple (*nanas*) and *A. comosus* var *bracteatus* or red (wild) pineapple. From the five varieties, there are three prominent pineapple varieties that commonly cultivated including *A. comosus* var *comosus*, a pantropical with large fruit, *A. comosus* var *erectifolius* or, small fruited mainly for fibre and ornamental purposes and also *A. comosus* var *bracteatus*, robust pineapple with multiple uses as juice making, leaves for fences and ornamentals.

2.3   Botany

Pineapple is a monocotyledonous, herbaceous perennial with short stem containing rosette of long narrow spiny leaves. Pineapple has dense terminal inflorescence coalescing to produce synacarp formed by almost fusion of many fruitlets. Coppens d' Eeckenbrugge and Leal (2003) stated that the main morphological structures that distinguish pineapple to other fruits are stem, leaves, peduncle, synacarp or multiple fruit, crown, shoots and roots. The matured plant may reach 1m to 2m of height and 1m to 2m of width in general shape of spinning top.

In addition, pineapple classified as Crassulacean Acid Metabolism or CAM plants that close their stomata during daytime to reduce evapotranspiration and open during night time to collect carbon dioxide. Some distinct features of pineapple that indicator of CAM plants are thick cuticle, water storage tissue, deposition of stomata and trichomes. Plus, these also help in water efficiency in pineapple (Coppens d' Eeckenbrugge and Leal, 2003) (Keeley and Rundel, 2003).

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2.4   Agronomy

The agronomic requirements of pineapple were discussed in a few literatures. Generally, pineapple can grow in temperature ranging below 7°C and above 40°C which can affect fruit quality in terms of acid and sugar content (FAO, 2012). It can grow optimally nearer a mean of 25°C with approximately 10°C diurnal temperature range. This is to ensure the growth rates are balanced with sufficient high rate of assimilation that leads to adequate carbohydrate resources during flower induction. The rate of growth and development, plant and fruit size directly influenced to temperature.

Besides that, pineapple can grow in wide range of soils of organic peat soils, volcanic ash and sandy soils. Optimally, it thrives at sandy loam soil together with good drainage as pineapple is very sensitive towards waterlogging condition (Naturland, 2001). Soils for pineapple growth also must have organic amendments. The best soil pH value is 4.5 to 6.5 (FAO, 2012). Prakash *et al.* (2005) stated that the suitable soil and pH value for pineapple cultivation are laterite soils in hill tops or medium to heavy loams, rich in humus, low calcium with pH of 5.0 to 6.0. Hepton (2003) stated that soils must range on neutral to acidic pH although pineapples grow well in slightly alkaline soils if calcium is low and soil moisture unfavourable for mould growth.

Extensive sunlight exposure is a must for pineapple. Water requirement for pineapple is low since it has high water efficiency due to CAM photosynthetic pathway. Thus, it can grow and adapt in areas of low rainfall (Maléziux *et al.*, 2003). Naturland (2001) stated that optimal annual rainfall is 1,000mm to 1,500mm.

For pest and disease, there are few species had been identified which contribute to the low yield of pineapple. Through identification and understanding of these, the pest and disease management can be done. Pest such as nematodes, mealybugs, ants and fruit mites infest in every growth cycle of seed, planting, growth, forcing, flowering and harvest. Similarly for diseases, mealybug wilt, nematodes and heart rot attacks during the growth cycle stages (Rohrbach and Johnson, 2003).

Pineapple should be harvested early morning as the temperature is low to reduce bruising and ease packing. It can be done using traditional and modern method. Most of the world's pineapple farm still use the conventional method or hand harvesting. For canning purposes, fruit are picked and put into bags or baskets. Then, the fruit will be accumulated at roadsides for transfer to trucks or directly loaded to the transportation. At this stage, harvested fruit should be protected from direct sunlight as it is susceptible to sunburn. Meanwhile, for fresh fruit market, the fruit usually harvested with crowns and cut from plant with short length of peduncle remain attached to fruit (Anderson, 1991) (Hepton, 2003). Some of farms directly packed the harvested fruit in boxes after harvest. Cut surfaces treated with fungicides and waxed to maintain the quality. Modern method of harvesting pineapple also developed assisted by machines. Without much need of labour, machine like truck-mounted receive the fruit and moved by truck carrying the bin. Likewise, tractor-drawn or self-propelled move fruit from picks and then to transportation bin. Machines developed for both canning and fresh fruit harvesting. Some machines also equipped with field packing (Hepton, 2003).

2.5 Worldwide Production of Pineapple

Besides banana and citrus, pineapple is the third most important tropical fruit in the world. Major production for international trade includes canned slices, chunks, crush (solid pack) juice and fresh fruits. Although most of production focuses on canned pineapples, 70 percent of pineapple produced globally consumed as fresh fruit. In countries like Brazil, India, China, Nigeria, Mexico and Columbia, canning is their minor industry and fresh fruit market is their primary industry. Philippines and Thailand are the top countries in production, processing and marketing of canned and fresh fruits. Before that, Hawaii was the centre of pineapple production as well as processing. Meanwhile, Australia and South Africa market fresh and canned pineapples within the country with high efficiency. Recently, chilled fresh cut industry gained attention where the fruit packed as spears or chunks in sealed plastic bags for retails (Rohrbach *et al.*, 2003).

For pineapple, there are only two economical parts, the fruit (flesh) itself and stem. The fruit or flesh is the main economical part of pineapple. The fruit can be consumed either fresh or processed forms that includes canned slices, chunks, juice

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