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Research Article

Exploring Sustainable Agricultural Techniques for Enhanced Pineapple Production in the Municipality of Bataraza, Palawan

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ABSTRACT

Agriculture is one of the important sectors for economic development and food security all over the world. This study described and examined the sustainable agricultural techniques and practices in pineapple cultivation in the Municipality of Bataraza, Palawan. The study utilized descriptive correlational research which was participated by 30 pineapple farmers. Results of the study showed that Pineapple farmers efficiently utilized farming methods to increase the harvest and production of pineapple in Bataraza and gained profitable income that helped them to supplement the needs of their family. The production of pineapple depends largely on the farming methods and techniques they utilized.

Keywords: *Farming methods, Farmers, Pineapple, Production, Techniques*

Introduction

Agriculture is one of the important sectors for economic development and food security all over the world (Smutka et al.,). In the Philippines, Agriculture contributes significantly to the Philippine economy and subsistence of smallholder livelihoods (Alvin Chandra et.al, 2017). Climate variability and change have negatively impact on food security and agricultural livelihoods of the poorest farmers, fishers, and forest-dependent people. coupled with land degradation, increasing energy and food prices, and reduced investment support (Smit, McNabb, & Smithers, 1996) the future of the sector is increasingly uncertain.

Pineapple (Ananas comosus) is the most economically important plant in the family Bromedioideae, which is divided into three subfamilies: Pitcarnioideae, Tillandsiolideae, and Bromedioideae (Bartholomew, Paul, and Rohrbach, 2003). It belongs to the order Bromeliales, genus Ananas, and species Comosus (Bartholomew et al. 2003). It is the second fruit harvest of importance, contributing over 20 percent of the world production of tropical fruits (Coveca, 2002). Pineapple is a wonderful tropical fruit having exceptional juiciness, vibrant flavor, and immense health benefits (Joy, 2010). It is grown both for the fresh and processed products, which makes it an important

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food as it can be eaten fresh or in processed forms (FAO, 2009). The popularity of pineapple is due to its sweet-sour taste containing 15% sugar, malic and citric fruit acids. It is also high in vitamin B1, B2, B6 and C. Its protein digesting enzyme, bromelain, seems to help digestion at the end of a heavy protein meal (Nwosu, 2011).

Pineapple is among the most popular and nutritious tropical fruits grown in most tropical and sub-tropical countries. It is one of the crops with the most potential in the international market and highly profitable (Quijandria et al, 1997). Its production could help to ensure food security, job creation, and launch the country on the path of self-sufficiency, and help in improving lives and health of the populace (All Africa,2011). Pineapple as an economic crop has encouraging potential for foreign exchange earnings. It can increase national income through the expansion of local industries and higher incomes for farmers involved in its production (Fawole, 2008). Pineapple production therefore can be used as a remedy for food security and job generation, help in rural development, launch the country on the path of self-sufficiency, increase food production and help in improving lives and health care delivery services (All Africa,2011).

The working Party on Agricultural Quality Standards of the United Nations Economic Commission for Europe (UNECE) developed the commercial quality standard which help facilitate international trade, encourage high quality production, improve profitability, and protect consumer interests. UNECE standard FFV-9 concerns the marketing and commercial quality control of pineapples. This standard applies to o pineapples of varieties (cultivars) grown from Ananas comosus (L.) Merr. to be supplied fresh to the consumer. UNECE standards are used by governments, producers, traders, importers and exporters, and other international organizations. They cover a wide range of agricultural products, including fresh fruit and vegetables, dry and dried produce, seed potatoes, meat, cut flowers, eggs and egg products. (https://unece.org/fileadmin/DAM/trade/agr/standard/standard/fresh/FFVStd/English/49_Pineapples.pdf)

Worldwide production of pineapple started in the 15th century. Pineapple was distributed in Europe and the tropical regions of the world. The most spread variety is Smooth Cayenne (Cayena lisa), which was first introduced in Europe from French Guyana. Pineapple production is concentrated in the tropical regions of the world. It is grown in over 82 countries with over 2.1 million acres under the fruit. The smooth Cayenne cultivar is extensively cultivated in many tropical countries like Hawaii, Philippines, Australia, South Africa, Puerto Rico, Kenya, Mexico, Cuba, and Formosa. In 2021, the volume of pineapples produced in the Philippines amounted to approximately 2.91 million metric tons, reflecting an increase from the previous year. This was equivalent to around 44.94 billion Philippine pesos in production value. The Philippines was the biggest pineapple producing country globally in 2021, next to Costa Rica and Indonesia. (https://www.statista.com/statistics/298517/global-pineapple-production-by-leading-countries).

According to the Philippine Statistics Authority (PSA), as of the first quarter of 2021, the county has produced 662.50 thousand metric tons of pineapples. The country boasts more than 70,000 hectares of pineapple plantations. These areas have mild temperatures, ranging from 24° to 30°C, and recorded rainfall between 1,000 to 1,500 millimeters annually. They also have full sunlight and an elevation of 150 to 240 meters above sea level. The majority of these are found in Mindanao, especially in Northern Mindanao, accounting for 61-percent of the annual crop, according to the PSA. Ranking next is SOCCSKSARGEN (South Cotabato, Cotabato Province, Sultan Kudarat, Sarangani, and General Santos City) with 28-percent. Davao, Caraga, and Zamboanga are also key producers in the south. In Luzon, Bicol provides 6-percent of the total output, while CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon), Cagayan Valley, and Central Luzon are also key producers. However, the Food and Fertilizer Technology Center notes that the majority of pineapple plantations are classified as small in size (about 2 hectares or less). Most of these farms cater to the local market, while only a few

major brands. such as Dole and Del Monte, handle exportation. These local pineapples are in demand in other countries, so much so that the Philippines ranks second among leading exporters of the fruit, as of 2019 according to the FAO. Exported pineapples account for about 8.3-percent of the total global value, amounting to about USD 172.4 million. (https://foodphilippines.com/story/an-overview-on-philippine-pineapples/)

In the province of Palawan, pineapple plantations can be seen in the municipality of Bataraza. It is known in Palawan as a producer of a sweet variety of pineapple. Pineapple is the OTOP (one-town-one-product) of Bataraza. There are about 500 hectares in the municipality that are planted to pineapple, concentrated mainly in Bulalacao (300 ha) and Tarusan (200 ha) with about 300 IP farmer-producers. Production of pineapple is year-round, and supply is abundant. Other than the pineapple fruit, IP farmers also sell pineapple suckers as planting materials.
(https://pdf.usaid.gov/pdf_docs/PA00N764.pdf)

The current agricultural program remains mostly on a subsistence level in the municipality of Bataraza in Palawan, where pineapple cultivation is one of the components of its agricultural landscape which indigenous peoples (IPs) in the area is dependent on. Frequent natural calamities such as drought, along with a lack of sustainable agricultural practices have affected the local production and because of continues changing climate patterns, traditional farming becomes unsustainable. In 2020, IP farmers in Bataraza struggled in producing locally famous pineapples. Bataraza is facing income losses due to decreased demand this year as a consequence of the pandemic. IP farmers use "kalburo", or calcium carbide, to help the pineapple bear fruits all year round. The peak season hits from June to July, and the harvest is every five to six months. Thus, farmers are not using fertilizer on their plants, and they practice 'kaingin' or upland farming in pineapple. (https://palawan-news.com/special-report-palawan-tribes-struggle-through-pineapple-farming-during-covid-19-pandemic). With favorable climate condition and soil composition as well as the rising demand for pineapple, Bataraza is a potential site for testing new approaches in improving pineapple production. Thus, a need to enhance production efficiency and developing sustainable agricultural techniques is necessary.

Research Questions

This study described and examined the sustainable agricultural techniques and practices in pineapple cultivation in the Municipality of Bataraza, Palawan. It specifically answered the following questions:

1. What are the socio-demographic characteristics of pineapple farmers in terms of age, gender, civil status, average monthly income and farm size cultivated?
2. What existing farming methods are used in by pineapple growers in Bataraza, Palawan?
3. How may the effectiveness of existing agricultural method utilized by pineapple farmers in terms of cultivation and product yields?
4. Is there a significant relationship between the socio-demographic profile of pineapple farmers in Bataraza and their pineapple farming methods?

Methods

Research Design

This study utilized a descriptive correlational research design in order to describe and examine the sustainable agricultural techniques and practices in pineapple cultivation in the Municipality of Bataraza, Palawan. The study identified the socio-demographic profile of the pineapple farmers in terms of age, gender, civil status average monthly income and farm size cultivated. On one hand, it also described the farming methods currently utilized by pineapple farmers in terms of cultivation and product yields. In addition, the study described the effectiveness of the utilized agricultural methods in growing pineapple. Apparently, the study also examined if there would be a significant relationship between the socio-demographic profile of the respondents and their farming methods and techniques in growing pineapple.

Materials/Instrument

The study utilized a researcher-made survey-questionnaire which was based in the study of Carbonell (2015) entitled: *Correlates of Queen Pineapple Farming Practices in Camarines Norte, Philippines*. The survey-questionnaire contained three segments. Part I contained the socio-demographic profile of the respondents while part II contained items pertaining to the existing farming methods used by pineapple growers in Bataraza, Palawan. On the other hand, part III contained items pertaining to the effectiveness of existing agricultural method utilized by pineapple farmers in terms of cultivation and product yields.

The survey-questionnaire was validated by experts in Business Administration consisted by graduate school professors and agriculturists. Thus, use of 4-Likert Scale was employed in order to assess the effectiveness of existing agricultural method utilized by pineapple farmers, 4-Highly Effective, 3-Effective, 2-Not Effective and 1-Highly Not Effective.

Sample and Sampling Procedure

The study utilized purposive sampling whereas selected farmers were included as the samples of the study. The respondents were selected based on the following selection criteria: (1) active pineapple farmers, (2) resident of Bataraza, Palawan and (3) willingness to participate in the study. Apparently, there were thirty (30) respondents who participated in the study.

Table 1. Distribution of the Respondents

Barangay	Total Active Farmers	Sample Size
B1	40	10
B2	65	10
B3	32	10
N=	137	30

Data Gathering Procedure

The researcher created a letter for the subject respondents which contained the nature and objective of the study. Upon the receipt of the approval through verbal expressions made by the respondents, the researcher personally floated the questionnaire to the respondents individually. Before the actual data gathering, the researcher conduct short briefing and discussion to the respondents which significantly stated the purpose, nature and potential contributions of the study to their lives as farmers and to the farming industry in Bataraza, Palawan. Thereafter, the respondents personally answered the printed survey-questionnaires. Thus, verbal consents were provided by the respondents.

Data Analysis

The process of data analysis in this present undertaking included the descriptive and inferential statistics. The descriptive statistics such as frequency and percentage were employed in order to quantify the socio-demographic profile of the respondents in terms of age, gender, civil status, average monthly income and farm size cultivated. On the other hand, using frequency and percentage were employed in order to describe the effectiveness of existing agricultural method utilized by pineapple farmers. Further, mean, overall mean standard deviation were used in order to describe the effectiveness of existing agricultural method utilized by pineapple farmers as assessed by themselves in terms of cultivation and product yields.

Results and Discussion

Production of pineapple arises when there is an efficient and effective farming methods utilized by pineapple farmers.

1. Socio-Demographic Profile of the Respondents

Table 2 presents the socio-demographic profile of the respondents in terms of age, gender, civil status, average monthly income and farm size.

Table 2. Socio-Demographic Profile of the Respondents in terms of Age, Gender, Civil Status, Average Montly Income and Farm Size

Socio-Demographic Profile	f	%
Age		
35-45 years old	12	40
46-56 years old	15	50
57-62 years old	3	10
Total	30	100
Gender		
Male	30	100
Female	0	0
Civil Status		
Single	0	0
Married	27	90
Widow/Widower	3	10
Total	30	100
Average Monthly Income		
Below 15, 000	4	13.33
16,000-25,000	22	73.33
26,000-35,000	2	6.67
Above 36,000	2	6.66
Total	30	100
Farm Size (in hectares)		
0.25-1.99	10	33.33
1.99-2.99	15	50
3.0 and above	5	16.66
Total	30	100

Profile of the Respondents. Majority of the respondents' age ranged from 46-56 years old (f=15) whereas they are engaged in farming at this age since their physical body and knowledge in pineapple farming was already founded. On the other hand, majority of the respondents were male (f=27) whereas their physical body and stamina were susceptible for farming pineapple. Further, majority of the respondents were married (f=27). Meanwhile, majority of the pineapple farmers gained their income which ranged from 16,000- 25,000 pesos (f=22). At this income range, they were able to provide their family needs and subsistence while making sure that the material inputs and other agricultural necessities in farming pineapple have been partaken to the said income. On the other hand, majority of pineapple farmers cultivate pineapple with a farm size of 1.99-2.99 hectares which planted hundreds of pineapple during cropping season.

2. Existing Farming Methods Used by Pineapple Farmers

Table 3 presents the existing farming methods used by pineapple farmers

Table 3. Existing Farming Methods Used by Pineapple Farmers

Farming Methods	f		%	
	Yes	***No***	***Yes***	***No***
Intensive Soil Preparation	30	0	100	0
Planting	30	0	100	
Traditional Irrigation and Water Management	22	8	73.33	26.66
Fertilization through organic fertilizers	0	0	0	
Fertilization through commercialized fertilizers	30	0	0	0

Farming Methods	f		%	
	Yes	***No***	***Yes***	***No***
Pest and disease management	30	0	0	0
Harvesting and Post-harvesting handling	30	0	0	0

Existing Farming Methods. Pineapple farmers were deeply engaged as to the farming methods and techniques they rendered in yielding high-quality pineapples. They were able to intensively prepared the soil and ensure the fertility of the same before planting pineapple. They put exact measurement as to the fertility of the soil by means of using acid testing. On the other hand, they put planting as crucial step in planting pineapple which considered the weather for the whole cropping seasons. They prepared the pineapples beforehand and stored the same in the well-ventilated area or spaces in the farm. Apparently, pineapple farmers utilized traditional irrigation system whereas water supplies were irrigated based on the volumes of water needed to plant and yield pineapples through the irrigation system installed nearby. They managed water supplies efficiently and consistently checked the amount of water supplied among pineapples. Thus, they commonly utilized commercialized fertilizers to put substantial nutrients among pineapples to yield high-quality crops. Alongside with the use of commercialized fertilizers, pineapple farmers also utilized pesticides and insecticides to provide security against pest. In other words, they instituted efficient pest control which resulted to high yielding harvests of pineapples. Apparently, harvesting and post-harvesting were most crucial method as they utilize production technique in the form of consistent checking and monitoring as to the good quality of pineapples were expected to harvests. Thus, during harvesting and post-harvesting handling, pineapple farmers contacted intermediaries channel such as canvassers, traders, processors and retailers where their harvests pineapple were to be sold. The volume of production on one hand, depend largely on the intensive and collective implementation of good farming methods.

The finding is supported by the study of Galvez (2019) which concluded that farming methods were significantly correlated to the amount of production of pineapple as harvested which included area production, farming practices and average production volume.

3. Effectiveness of Existing Farming Methods Used by Pineapple Farmers

Farming methods of pineapple farmers are significant element in yielding good quality pineapple. Thus, farming methods involved the use of techniques in production of pineapple such as management of resources from preparation to post-harvest handling.

Table 4 presents the effectiveness of existing farming methods in terms of cultivation and product yields

Table 4. Effectiveness of Existing Farming Methods Used by Pineapple Farmers

Effectiveness of Existing Farming Methods	**m**	**VD**
Cultivation		
1. Land is cultivated properly	3.45	Highly Effective
2. Propagation is intensely made	3.63	Highly Effective
3. Drip irrigation sprinkles which provide necessary water	3.65	Highly Effective
4. Balanced fertilization is applied during the growing seasons through fertilizers	3.72	Highly Effective
5. Regular weeding is necessary to control weed growth	3.81	Highly Effective
6. Integrated pest management is used	3.67	Highly Effective
7. Proper handling and storage techniques are maintained	3.62	Highly Effective
Overall Mean	**3.65**	Highly Effective

Effectiveness of Existing Farming Methods	m	VD
Product Yields		
1. Intensive conventional farming maximize productivity	3.21	Effective
2. Building soil health and using natural and commercial agricultural inputs	3.34	Highly Effective
3. Resource efficiency and input-output ratios of a farming system	3.67	Highly Effective
4. Temporal productivity and planning crop rotations or multiple harvests	3.14	Effective
5. Metric insights provide productivity control of the individual production units	3.25	Highly Effective
6. Maximize yields in maintaining environmental and economic sustainability	3.45	Highly Effective
7. Yield optimization balancing trade-offs between different objectives such as yield, quality, resource, use and environmental impact.	3.21	Effective
Overall Mean	**3.32**	Highly Effective

Legend: 4.00-3.25-Highly Effective, 3.24-2.50-Effective, 2.49-1.75-Not Effective, 1.74-1.00-Highly Not Effective

Effectiveness of Existing Farming Methods. Cultivation is one key factors that contributed to the increase on pineapple production as it laid scientific agricultural processes in rearing high-quality pineapples. The use of land preparation immensely contributed to the sustainable growth of pineapples resulting to increase on production volumes that also emphasized the means and methods of efficiently using water in the form of irrigation system that supplied substantial nutrients for pineapple production. On the other hand, balanced fertilization was found to be highly effective as it provided both natural and chemical input to help the pineapple plant obtained nutrients from its planting to harvesting phases. Apparently, handling and storage techniques were also highly effective as farming methods were efficiently implemented whereas it helped to the overall economic conversion of harvested pineapples that obtained favorable income for the farmers.

Consequently, farming methods utilized by farmers were highly effective as they maximize soil health, use of resources more practical and economical, efficiently manage productivity control by means of monitoring individual yielding capacity of each pineapple plant. On the other hand, through the utilization of various farming methods, it helped farmers maximize the environmental aspect in farming pineapples, as they considered the preservation of environment while using sufficient amount of commercialized fertilizers. Meanwhile, its economical aspect heavily vested on the production of quality pineapple whereas farming methods found to be highly effective. Apparently, yield optimization required farmers to balance trade-offs that practically converted the production of pineapples into more profitable income rather than obtaining loss to farming pineapples.

These findings were supported by the study of Nyantika and Aming (2015) which concluded that pineapple farmers who employed better farming methods gained more income over than those farmers who relied heavily traditional farming. Thus, training and education for pineapple farmers were also found significant to the increase of pineapple production.

4. Relationship Between the Socio-Demographic Profile of Pineapple Farmers in Bataraza and Their Pineapple Farming Methods

Table 5. Relationship Between the Socio-Demographic Profile of Pineapple Farmers in Bataraza and Their Pineapple Farming Methods

Socio-Demographic Profile		Effectiveness of Farming Methods	
		Cultivation	Product Yield
Age	Correlation Coefficient	**.654***	.314
	Significance	**.011**	.274
	N	30	30
Gender	Correlation Coefficient	.416	.133
	Significance	.139	.651
	N	30	30
Civil Status	Correlation Coefficient	0.000	.325
	Significance	1.000	.257
	N	30	14
Average Monthly Income	Correlation Coefficient	-.218	.286
	Significance	.454	.321
	N	30	30
Farm Size	Correlation Coefficient	**.602***	**.635***
	Significance	**.023**	**.015**
	N	30	30

Legend: *-Correlation is significant at 0.05 level (2-tailed)
**-Correlation is significant at 0.01 level (2-tailed)

Relationship Between the Socio-Demographic Profile of Pineapple Farmers in Bataraza and Their Pineapple Farming Methods. Age was significantly correlated with the effectiveness of farming methods utilized by pineapple farmers in terms of cultivation (r=.654). This implies that the older the farmers, the more likely they utilized effective farming methods that helped increase their harvest and production of pineapple. The farmers' longer years exposure to farming pineapple enabled them to understand and practically assessed the best farming methods they could utilize in order to increase their harvest. On the other hand, farm size was also significantly correlated with the effectiveness of farming methods in terms of cultivation and product yield (r=.602, r=.635). This implies that the larger the size of pineapple farm, the higher the potential it could be cultivated efficiently and effectively towards larger production volume. Apparently, the higher the farm size, the more it could produce high-quality pineapple which could eventually lead to higher potential income for pineapple farmers.

This claim was supported by the study of Tewari (2021) which concluded that utilization of farming methods were influenced by the capabilities of farmers specially their understanding and skills in farming.

Conclusion

Farming pineapple in predominantly agriculture country like the Philippines specifically in the province of Palawan has instituted economic stability by which farmers plant, cultivate and harvest pineapples efficiently through effective farming methods. Pineapple farmers efficiently utilized farming methods to increase the harvest and production of pineapple in Bataraza and gained profitable income that helped them to supplement the needs of their family. The production of pineapple depends largely on the farming methods and techniques they utilized.

Recommendation

The study recommends the conduct of an intensive trainings and seminars that may increase pineapple farmers' awareness on the efficient use of farming methods which may

eventually help them to significantly increase the production of pineapple in the Municipality of Bataraza. Thus, results of this study may be utilized as reference for future studies or may be utilized as logical basis for the creation of projects and programs for pineapple farmers in increasing their production and farming techniques.

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