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Understanding pojada and the challenges of harvesting abaca in Zamboanga Peninsula, Philippines

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Abstract In Zamboanga Peninsula, Philippines, abaca plays a significant role in providing alternative income as an intercrop to tree crops like coconut. However, the sustainability of the abaca industry is greatly affected by instances when the abaca is left unharvested and situations where the pojada system overharvests. Results revealed that 92% of the respondents used decorticating machines during harvesting. Instead of harvesting three to four times a year, harvesting was done once or twice, comparable to the pojada system. The respondents perceived pojada as a system that had favorable and detrimental impacts on abaca. The leading problem of the respondents was the delay or absence of harvesting due to the lack of skilled harvesters, insufficient financial capital, distant markets/traders, limited buying of deco fiber, and lack of spindle stripping machines. These challenges suggested that the government provide support such as labor-efficient machines, skills training, trade capitalization, and incentives to harvesters for the sustainability of the abaca industry in the region.

Keywords: Abaca intercropping, Abaca market, Decorticated abaca, Farm mechanization, Pojada

Introduction

Musa textilis Nee, locally known as abaca, is an indigenous Philippine plant that resembles bananas and is classified under the *Musaceae* family. It grows best in shade and is commonly planted with coconut, ipil-ipil, dapdap, and other trees. Unlike bananas, where the fruit holds commercial value, the stalks are necessary for abaca. Abaca stalks are collected and processed manually or through a fiber-extracting machine to obtain dry fiber for sale (PhilFIDA, n.d.-a).

Abaca has numerous commercial applications and is one of the country's agricultural exports. The Philippines led the world trade for abaca, supplying 86.1 percent of the abaca fiber needs, while Ecuador and Costa Rica provided

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the remaining 13.7 percent and 0.2 percent, respectively, for 2019. As of that year, abaca was cultivated in an effective area of 86,854 hectares by 126,508 abaca farmers with a fiber yield of 69,829 metric tons. Exports of abaca fiber and products generated an annual average of 119 million US dollars (2010-2019). With proper agricultural practices, 1 hectare of abaca will yield a return on investment of 103.01% at an average initial investment of Php 68,270.00 (PhilFIDA, n.d.-b).

Traditionally, abaca fiber has been used for ropes and cordages because it can tolerate seawater corrosion and is durable for marine transportation. It is also used for garments and furniture upholstery. The automotive, aerospace, shipping, building, furniture, and abaca handicraft industries increasingly use nanomaterials, biodegradable materials, and composite materials made of abaca. This means fiber-producing countries' markets and revenue are growing, with abaca as the best natural fiber (Simbaña *et al.,* 2020). Moreover, abaca plays an essential ecological function. In rainforest and past monoculture plantations, intercropping abaca, especially with coconut palms, can help with erosion control and biodiversity restoration. Abaca increases the soil's water-holding capacity; thus, erosion, floods, and landslides are reduced (FAO, n.d.)

Harvesting abaca can occur between 16 and 24 months after planting, and with good agricultural practices, subsequent harvesting can occur every 3 to 4 months after that. Harvesting is of utmost significance in abaca farming since it promptly transforms production into cash. Harvesting abaca stalks is a multifaceted process that includes topping, tumbling, tuxying, fiber extraction, drying, and bundling. It is a challenging task that demands skills in both manual and machine-assisted harvesting.

Abamo and Aragon (2005) stated that the abaca industry was plagued by low production, inconsistent fiber quality, limited market access, and viral disease infestation. Considerable discourse has been focused on abaca diseases, such as disease diagnosis and prevention (Buenconsejo and Linsangan, 2021; Patayon and Crisostomo, 2021; Barbosa *et al*., 2020; Koh *et al*., 2020; Galvez *et al*., 2020; Cruz *et al*., 2016; and Qazi, 2016), and disease management (Werdiningtyas *et al*., 2023; Señeris *et al*., 2022; Salomon, 2017; Boguero *et al*., 2016; Kumar *et al*., 2015; Lalusin and Villavicencio, 2015; Nuñez, 2013; and Raymundo and Pangga, 2011). However, the information available concerning the challenges during the harvesting process is quite limited.

According to PhilFIDA, the pojada harvesting system presents obstacles to abaca fiber production. The term pojada refers to the unsustainable practice of forcefully and indiscriminately cutting immature abaca stalks during harvesting, which can lead to overharvesting. This practice reduces the harvesting frequency from three to four times per year to once per year or less. Consequently, the pojada system can reduce fiber quality and induce diseases and weeds (PhilFIDA, n.d.-a); however, very limited knowledge supports this assertion.

While harvesting is an essential economic activity for abaca, assessing the harvesting condition and the challenges and opportunities farmers face in abaca harvesting, including their perceptions of the pojada system is imperative. This will provide a basis for national government agencies, including the Philippine Fiber Industry Development Authority (PhilFIDA), the Department of Agriculture (DA), and local government units, in developing and implementing policies, programs, and projects aimed at improving the abaca harvesting system for a sustainable abaca industry.

Materials and methods

Study sites

The study was conducted in Region IX or the Zamboanga Peninsula region, which lies at the southernmost portion of the Philippine archipelago at the western tip of the island of Mindanao. Around 51% of the land is marked by undulating topography, which includes steep slopes and elevations that vary from 100 to 1,000 meters above sea level. About 60,000 hectares of agricultural land are now not being used, while about 310,000 hectares of coconut land have the potential for multi-cropping and grazing. The region experiences climates classified as type 3 and 4. Rainfall can be observed year-round; however, the period from December to May is characterized by dry weather. The mean annual precipitation is 2,372 millimeters, making it conducive for agricultural activities. The region comprises three provinces, including Zamboanga del Norte, Zamboanga Sibugay, and Zamboanga del Sur, as well as five cities, which are Dapitan, Dipolog, Pagadian, Zamboanga, and Isabela City in Basilan (DTI, n.d.).

Zamboanga del Norte and Zamboanga del Sur are among the top-producing provinces of coconut in the Philippines (PCA, n.d.), wherein abaca, as a shade-loving plant, is also cultivated alongside coconut. The study sites were located in these areas comprising one city and twelve municipalities, namely Aurora, Bayog, Josefina, Kumalarang, Lakewood, Tigbao, and Sominot in the province of Zamboanga del Sur and Dapitan City and the municipalities of Baliguian, Jose Dalman, Mutia, Pinan, and Sindangan in the province of Zamboanga del Norte.

Respondents

The respondents of this study were abaca farmers who cultivated abaca under coconut for a minimum of 2 years. The purposive selection of respondents was made to cover the harvesting period of abaca necessary for data collection. PhilFIDA identified the respondents as requested by the researcher and provided a list of 37 farmers. Out of the list, only 33 had participated.

Research instruments and data gathering

This study utilized a mixed-methods approach, integrating both quantitative and qualitative data. The data-gathering process involved a survey of farmers, which was reinforced by in-depth interviews and focus group discussions (FGD). Before collecting data, the questionnaires and guide questions were translated into the Cebuano dialect and tested outside the target area, specifically in Talisayan, Misamis Oriental. After testing, the said instruments were finalized. Data gathering was conducted in the last quarter of CY 2023.

Data analysis

Using version 29 of the IBM SPSS software, descriptive statistical measurements such as weighted mean, frequency, and percentage were computed. Using the same software, an independent T-test was undertaken to compare the yield between harvesting frequencies. Moreover, the qualitative data was coded explicitly focusing on harvesting and sharing schemes, fiber trading, and the challenges and opportunities in harvesting abaca. Thematic analysis was employed to examine the coded data.

Ethical consideration

Approval from the Institutional Ethics Review Committee of Central Mindanao University was obtained per permit number 0656 s.2023, which facilitated adherence to the research protocol and ethical principles. Before performing the survey, in-depth interview, and FGD, courtesy visits were made to the local officials in the study area. At the beginning of the interview, the participants were provided with information regarding the research objectives. Their consent was obtained, including permission to use video, cameras, and recorders and utilize the resulting data for publication.

Results

Background of the respondents and their farms

Respondents of this study were mostly male (64%), while just 36% were female. The majority (84%) of them were above 40 years old and were generally married (88%); others were single (6%) and widowed (6%). Most respondents (36%) were elementary level, 24% were high school, 27% were college-level, and 12% were college graduates. Regarding ethnicity, Bisaya (76%) was the dominant group, compared to Subanen (24%). Almost all respondents (91%) owned the farmland, and only 9% were tenants.

In terms of area planted to abaca, more than half (54.55%) of the respondents were cultivating abaca under coconut in relatively small areas, less than 3 hectares, with the majority of them (94%) planting Kutaykutay cultivar of abaca than the Lunhan cultivar (6%). Meanwhile, the maximum number of years recorded in abaca cultivation under coconut in the region was 23 years. However, most respondents (79%) had planted abaca under coconut within 2-10 years. It also showed that the coconut areas planted with abaca were already old, with coconut established already ahead of abaca more than ten years ago (24% planted 10-19 years ago, and 30% planted more than 50 years ago).

Process of harvesting abaca

Harvesting abaca is one of the most intricate and essential activities in abaca production. The process is characterized by its labor-intensive nature. It involves topping, tumbling, sheath disaggregation/tuxying, fiber extraction, drying, and bundling before the final sale (Figure 1). The stalk is topped before being tumbled to prevent damage. This is done by removing all leaves using a sickle attached to the top of a bamboo pole. However, the respondents observed that it was not practiced on their farm as it added more labor; instead, the harvesters found a way for the stalk to fall in strategic areas without causing damage to other plants during tumbling.

Tumbling of the stalk is done by cutting a slanting position at the base to prevent water build-up. Tumbling is followed by tuxying, which involves the separation of the outer layer of the leaf sheath using a thin ledge and a double-bladed knife. Tuxying is only done for spindle stripping and manual fiber extraction. In decortication, leaf sheaths are only disaggregated instead of tuxying, leaving the whole layer intact; this method is easier than tuxying. To avoid the tuxy/leaf sheath from becoming discolored, fiber extraction has to be done the day after tuxying/leaf sheath disaggregation. After fiber extraction, the abaca fiber is sun-dried or air-dried and then bundled and ready for sale. Fiber extraction can be manually done using a hand-stripping device or machine-assisted by decorticating or spindle stripping machines. Results showed that the majority of the farmers (92%) adopted the use of decorticating machines, while only a few used spindle stripping machines (4%) and manual fiber extraction (4%).

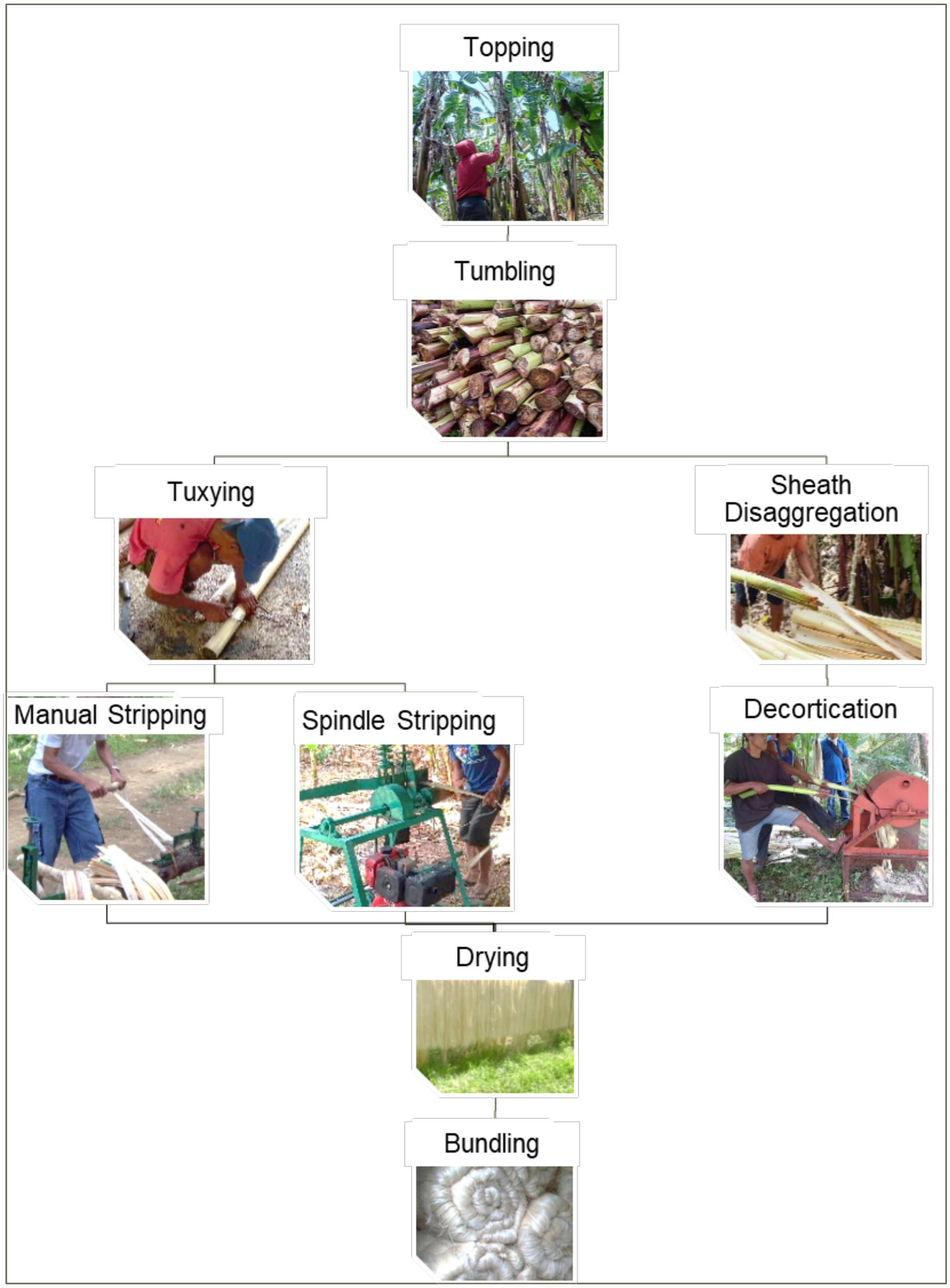

Figure 1. Process of harvesting abaca

System of harvesting

Harvesting the abaca plant is typically done at maturity to produce high-quality fiber. It should begin when the flag leaf first emerged. This is the selective system of harvesting, which only harvests mature abaca. In this system, harvesting abaca can be done 18-24 months from planting and every 3-4 months after that, with about 3-4 harvests per year. Another harvesting system is the pojada system, which includes harvesting immature stalks, eventually reducing the harvesting frequency to one per year or less.

However, the study found that most participants (68%) only conducted one harvest per year, while the remaining participants (32%) reported conducting two harvests yearly. Regarding annual yield, the respondents who harvested once a year obtained an average of 712 kg per hectare compared to those who harvested twice a year with 676 kg, as shown in Figure 2. An independent T-test showed that the yield differences were not statistically significant despite the variations in the numbers. This implied no discernible difference between harvesting twice or once per year.

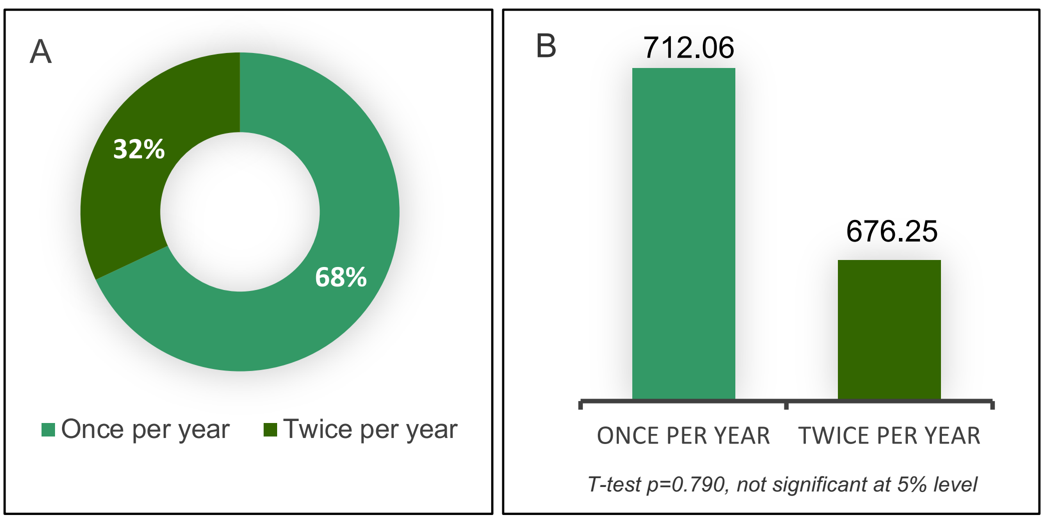

Figure 2. Percentage of respondents per harvesting frequency (A) and the corresponding annual yield (kg) of abaca (B)

Harvesting schemes and sharing arrangement

The respondents revealed that they highly depended on the group of skilled harvesters for their abaca. This group was financed by a concessioner who had abaca fiber stripping machines and provided the daily needs of the skilled harvesters. Farmers with extensive abaca plantations, usually with 3 hectares or more (45%), typically owned decorticating or spindle stripping machines and employed skilled workers to operate their farms. They often became the concessioners in the area. Most farmers (55%) were small-scale farmers who cultivated abaca on less than 3 hectares and did not participate in harvesting activities. They had to wait for the availability of the concessioners to harvest their abaca, and in worst cases, if there were no available concessioners in the area, delayed harvesting or even the absence of harvesting occurred.

Three sharing arrangements were identified in the harvesting and sale of abaca fiber. The first scheme was a 60:40 arrangement, where the concessioners received 60% of the dry fiber output, and the farm owner retained the remaining 40%. Under this arrangement, the concessioners provided the machinery, employed the harvesters, and funded the harvesting process. Typically, the concessioners compensated the harvesters based on the dried fiber output at Php20.00 to Php25.00 per kilogram.

The second scheme involved a 70:30 sharing structure, where the concessioner retained ownership of 70% of the entire output while the farm owner received 30%. The concessioner supplied the machines in this scheme and financed the harvesting operation. However, the share of the concessioner in this scheme was subjected to deductions for expenses such as fuel and oil. After deducting these expenses, the remaining balance was divided among the harvesters, including only one share for the concessioner. Mr. Diosdado, who employed this scheme, noted that harvesting was exceedingly labor-intensive and that harvesters must receive adequate compensation; otherwise, they will not engage in the harvesting operations. Additionally, the fuel price is high; the 60:40 scheme was losing on the side of the concessioners and harvesters.

Through the aforementioned schemes, farm owners can either get the fiber share in cash or sell it to other traders. Based on the respondents' feedback, the purchasing price of dried decorticated abaca fiber varied between Php46.00 and Php57.00 per kilogram, depending on quality. The manual and spindle-stripped fiber ranges from Php60.00 to Php70.00 per kilogram.

The last arrangement involved the concessioners taking over the farm's operations using their machinery and expert harvesters and buying the whole fiber production from the owner at a mutually negotiated price, often ranging from Php15.00 to Php24.00 per kilogram, depending on the farm's distance. The concessioner was usually a Class D abaca fiber trader in this scheme.

Trading and sale of abaca fiber

The trading process is the crucial value chain for abaca. Without it, the yield cannot be converted into cash, thereby preventing harvesting. Abaca trading is classified as D, C, B, and A.

Beginners can acquire a Class D license and buy fiber weighing less than 25,000 kg annually. Class C traders can acquire between 25,000 and 49,999 kilograms per year, while class B traders can acquire between 50,000 and 74,999 kilograms. Class A traders, on the other hand, can purchase between 75,000 and 1,000,000 kilograms per year.

A Class A trader will sort, classify, grade, and pack the fiber in bales and sell it to Grading/Baling Establishment (GBE) or Trader-Exporters. However, only one Class A trader and four Class D traders were registered in the study area. Consequently, farm owners with huge abaca farms harvested their abaca and directly sold their fiber to Class A traders. At the same time, small-scale farmers often worked with concessioners or Class D traders to sell their abaca fiber. Then, the Class D traders sold the fiber to the Class A trader.

Farmers' perspectives on the pojada harvesting system

Farmers' perceptions of the pojada system are presented in Table 1. Accordingly, they agreed that using pojada was more manageable and labor-efficient. They also agreed that pojada encouraged the growth of more weeds and that fiber produced from pojada was lower in quality. However, they were still uncertain whether pojada increased the disease incidence and whether the pojada system provided more income from abaca. With all these, the respondents disagreed with practicing the pojada system on their farms.

Table 1. Perceptions of respondents to the pojada system of harvesting

Indicators	Mean	Description
1. The Pojada system is easy to manage.	3.79	A
2. The Pojada system encourages the growth of more weeds	3.73	A
3. Abaca fiber from pojada is lower in quality.	3.52	A
4. The Pojada system is labor efficient.	3.48	A
5. The Pojada system enhances the disease incidence of abaca.	3.36	U
6. There is higher net income with the pojada system than the selective harvesting system.	3.30	U
7. The pojada system provides more income from abaca.	2.85	U
8. I will practice the pojada system on my farm.	2.00	DA

Legend: Mean Value

Score	*Mean Range*	*Description*
5	*4.21-5.00*	*Strongly Agree (SA)*
4	*3.41-4.20*	*Agree (A)*
3	*2.61-3.40*	*Uncertain (U)*
2	*1.81-2.60*	*Disagree (DA)*
1	*1.00-1.80*	*Strongly Disagree (SD)*

Challenges and opportunities in harvesting abaca

The respondents' leading problem in abaca farming was the delay or absence of harvesting. This problem was due to the lack of skilled harvesters, insufficient financial capital to finance the harvesters' daily needs, distant markets/traders, the limited buying of deco fiber, and a lack of spindle stripping machines.

Mr. Delfin, a farmer with a 3-hectare abaca plantation alongside coconut trees, expressed that despite owning a decorticating machine, he lacked the skilled laborers to aid him in harvesting. Accordingly, he only harvested his farm to a limited extent and could not assist the neighboring farms. On the other hand, Mr. Bienvenido, the Abaca Farmers' Association president, stated that there were harvesters in their area. However, they lacked financial capital to support the daily needs of the harvesters, prompting the latter to seek alternative employment that offered immediate daily wages to support their families, resulting in reduced harvesting operations in abaca.

A farmer engaged in abaca cultivation and trading has reported a decreased demand for decorticated abaca fiber. The exporter of abaca pulp, Newtech Pulp Incorporated, based in Balo-i, Lanao del Norte, only granted a limited number of purchase orders for decorticated fiber to Class A traders. The decorticated abaca fiber is less superior in quality compared to spindle-stripped and hand-stripped fiber. Because decorticating abaca fiber is much simpler and has a better fiber recovery rate, most of the abaca fiber in the region was produced using decorticating machines. However, traders reduced the buying of decorticated fiber. This became a problem for the majority who were used to the decortication process. Joel, an abaca farmer-trader, asserted that transitioning from decortication to spindle stripping would be challenging due to the former's superior recovery rate, greater ease of execution, and the absence of spindle stripping machines. If the market limits the purchase of deco fiber, they will halt operations, as they need government assistance to provide them with spindle stripping machines.

Moreover, the tedious and skill-requiring process of harvesting abaca impeded most farm owners from doing the actual harvesting operations. They relied on the work of skilled harvesters. These circumstances increased the likelihood of excessive harvesting during the harvest operation to maximize the use of time, available harvesters, and volume gains, particularly in remote farms.

Discussion

As a result of the complex characteristics and labor-intensive nature of abaca harvesting, more than half of the abaca farmers included in the research did not engage in this process. This scenario corresponded to the findings of Plenos (2022), indicating the intensiveness of abaca farming to the extent that males exhibited more significant levels of involvement than females. Moreover, the study found that the abaca decorticating machine was more widely used than other harvesting methods. Using a deco machine was more manageable as it eliminated the labor-intensive and time-consuming tuxying process. Although fiber produced from a decorticating machine may have a lower price than hand-stripped and spindle-stripped fiber due to the inclusion of parenchymatous components (BAFS, 2019), it produced less waste and a higher recovery rate. One of the drawbacks of decorticated abaca fiber is the minimal market, with traders receiving just a few purchase orders for this type of fiber, which is critical because farmers cannot generate sales without a market.

Moreover, the respondents only harvested their abaca once or twice per year, which was similar to the findings of Cortez *et al*. (2015) in Catanduanes, Bicol, Philippines. Their study found that harvesting occurred in a 6-8-month cycle, with an average yield of 600 kg using the hand stripping method. However, the frequency of harvesting was primarily determined by the price of fiber, unlike in this study, which depended on the availability of harvesters. Additionally, farm owners themselves participated in the hand stripping of fiber, which was not the case in this study.

The harvesting frequency adopted by the farmers in this study is comparable to the pojada harvesting system. In the pojada system, harvesting frequency is reduced from 3-4 annually to 1 or less. The pojada system, as described by the PhilFIDA (n.d.-a), is an unconventional method of harvesting abaca. It involves the collection of immature stalks rather than those that have already produced flowers or reached the flag leaf growth stage. The causes of using the pojada harvesting technique were the lack of fiber supply, which enticed them to make more, the scarcity or lack of skilled abaca strippers, and the desperate need for fast cash.

Although respondents agreed that pojada increased weed occurrence, produced lower-quality fiber, improved labor efficiency, and was easier to manage, they were unsure regarding disease transmission and income growth. Since most respondents were not actively participating in harvesting operations, managing the harvesting system effectively would be challenging. Moreover, the perception of low fiber quality contradicted the findings of Moreno and Protacio (2012), who observed that immature fibers, such as those found in the pojada system, did not significantly differ from mature fibers in terms of their physical and chemical properties, as determined by fiber analysis. Therefore, both types of fibers can be used for pulp production. Considering these circumstances, including variations of other growth factors such as nutrient management and cultural practices, conducting field experiments to confirm the findings is imperative.

On the other hand, Abamo and Aragon (2005) stated that investing in the abaca business is economically lucrative due to its productivity and global competitiveness. However, they did not indicate who among the industry players benefited the most economically. Based on the 60:40 sharing scheme, at an average yield of 676 kg and an average price of Php57.00, the farm owner, who has a 40% share, received Php15,412.80. The harvesters, who are paid Php25.00 per kilo, received Php16,900.00. The concessioner, who provided the machine, fuel, and maintenance, got the remaining Php6,219.20.

Cortez *et al*. (2015) stated that harvesting abaca necessitates 60 man-days per hectare. With a team of two individuals, it will require one month to harvest one hectare. Under these conditions, each harvester received a monthly payment of Php8,450 from their Php16,900.00 portion. This amount falls below the country's poverty level, which was set at Php9,550 per month for a household of 5 persons to cover their daily expenses (PSA, 2024), making it unappealing to Filipino workers.

Furthermore, since abaca is grown alongside coconut, the farm owner's share is a good revenue supplement to coconut as abaca farmers provide low-maintenance activities and less fertilizer and pesticide application on their farm (Calica *et al*., 2024; Cortez *et al*., 2015, and Armecin, 2008). In addition, with proper agricultural practices, abaca production could be enhanced to 1700 kg per hectare for the Kutaykutay cultivar, as set by the (BAFS, 2019), provided farmers are assisted in achieving this.

The need for more skilled harvesters is crucial to the sustainability of the abaca industry since the impediment of harvesting can frustrate farmers from pursuing abaca production and hinder the potential expansion of abaca farms. Addressing the scarcity of skilled harvesters is a formidable challenge due to young people's waning interest in agriculture, rural migration, and inadequate remuneration. Younger people often sought education, vocational training, and white-collar employment in urban areas, whereas older generations remained in farming (Magallon *et al*., 2022). However, this can be an opportunity to create jobs in the community, especially for out-of-school youth.

Furthermore, only a limited number of abaca traders operated remotely. This situation placed a heavy load on farmers, resulting in delayed or even absence of harvesting in abaca. This aligned with the finding made by Celestino *et al*. (2016) in Samar, which revealed that the abaca industry needs more individuals dedicated to driving the development of entrepreneurial skills and establishing a sustainable abaca enterprise. Encouraging investors to become concessioners and traders of abaca in the area can help finance harvesting activities and attract more farmers to engage in abaca production. This is particularly important given the limited number of traders in the area, who are geographically distant from the abaca production sites. However, this is a purely voluntary engagement and is challenging to accomplish. Nevertheless, it is suggested that the government provide financial assistance through capitalization to underprivileged farmers' associations for abaca trading.

In like manner, providing spindle stripping machines is vital in improving fiber quality (Calica *et al*., 2024) and meeting market demands. Nonetheless, research and development on the efficacy of these devices regarding location-specific preferences, transportability (Abamo and Aragon, 2005), and streamlining the labor-intensive harvesting procedure are crucial.

Generally, abaca cultivation in the Zamboanga Peninsula has the potential to offer an alternate source of income for coconut farmers and other tree farmers. Abaca thrives in shaded environments, making it suitable in diversifying income streams. Furthermore, it can generate employment as it necessitates various players in the production process. This farming system enhances environmental conservation and balance, as it requires less harmful inputs such as fertilizers and pesticides. However, the lack of skilled harvesters is critical to the industry's long-term viability and needs urgent support from its stakeholders. A significant option could be developing and providing transportable, user-friendly spindle stripping machines that decrease labor requirements while enhancing quality and efficiency. Also, younger generations must be encouraged to participate in harvesting by providing them with skills training and offering them programs, incentives, and remuneration that do not fall below the poverty threshold.

Moreover, organizing and capacitating the abaca farmers to become abaca entrepreneurs in their locality will foster development and enhance the abaca fiber industry. Consistently promoting excellent agricultural practices for abaca through communication campaigns and improving knowledge through research and development, such as conducting field experiments on pojada practice, would contribute to the advancement of the industry. The industry's success dramatically relies on government support from DA, PHILFIDA, and the local government units. However, forming alliances and collaborations with private institutions and other research and development bodies can substantially help.

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