

FARMERS SATISFACTION ON COFFEE REJUVENATION, HARVESTING & DRYING TECHNIQUES TOOL KIT**Robert A. Rodolfo**

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ABSTRACT

In Kalinga's coffee industry, low farm yields, poor harvesting methods and inadequate post-harvest practices hinder farmers' returns. Despite available technologies, they need more knowledge and support to improve their effective use. The researcher develop a toolkit and training program to address this. This initiative targets rejuvenating coffee trees, optimizing harvests, and improving post-harvest processes. It involves raising awareness through media, setting up demo farms, and aiding technology adoption in Kalinga.

Kalinga State University (KSU) leads this effort, focusing on disseminating Good Agriculture Practices (GAP). The study look into the satisfaction of coffee farmers on the develop tool kit after actually demonstrating in their farms. Most engaged coffee farmers are satisfied in using the tool kit. The result recommends that the tool kit be utilized in wider scope in disseminating coffee good agricultural practices.

Keywords: Coffee Rejuvenation, Drying Technique, Coffee Harvesting, Coffee Industry

INTRODUCTION

Coffee is the one-town one-product of the Kalinga province, and Kalinga State University, the lone university in the province, has chosen coffee as its banner program in its Research Development and Extension activities, working with the Philippine government to support the coffee industry and the coffee farmers by developing and disseminating technologies to increase organic coffee production, improve coffee quality, and create cost-effective and climate resilient production technologies.

Coffee plantations in Kalinga province have played a significant role in conserving forest ecosystems and biodiversity. The practice of growing coffee under shade trees, such as narra, rain trees, and other leguminous tree species, has created complex agroforestry systems that support a variety of habitats and biodiversity. Shade-grown coffee is also considered superior in flavor and less bitter than full-sun grown coffee. This method of coffee cultivation not only conserves biodiversity but also improves coffee quality, leading to higher prices in the market and improved farmer revenues.

Kalinga coffee has established its name in the local and international market, but it faces a great challenge in meeting the increased demand due to declining coffee yield and quality. This decline is attributed to aged trees, abandoned trees, wildlings, weeds, pests, and diseases.

To address this challenge, the Kalinga government and other stakeholders are implementing a number of interventions, including providing training and support to coffee farmers on good agricultural practices, promoting the use of organic coffee production methods, and linking coffee farmers to markets and buyers.

The most crucial factor for low coffee yield in Kalinga is the age of the coffee trees. Ikalingas treasure their heirloom coffee trees, but these trees have gone beyond their best years of productive life.

Coffee rejuvenation technology can be used to improve production from old coffee trees. Rejuvenation involves cutting the vertical stems or trunks of old coffee trees to induce growth of new sprouts. This brings back 100 percent of the coffee green bean yield and reduces labor cost up to 50 percent. Rejuvenation is generally recommended when coffee trees are ten (10) years old. Grafting may also be used to improve coffee productivity.

Coffee rejuvenation technology is a promising solution to the problem of low coffee yield in Kalinga. It is a sustainable and affordable way to improve the productivity of old coffee trees, without having to replace them with new ones.

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Coffee quality is a primary consideration by consumers and is an important competition factor for coffee. The quality of coffee is a result of several practices, from the moment the tree is planted until the coffee is consumed.

Improving coffee quality requires the adoption of a new set of values, attitudes, and behaviors in the production cycle to customer satisfaction. This includes planning, coordination, organization, and control and quality assurance.

With aggressive implementation of rejuvenation technology in old coffee plantations and appropriate harvesting and post-harvesting techniques, the province of Kalinga can produce more exceptional quality coffee. This could lead to higher prices for coffee farmers, as evidenced by the Kalinga Coffee Cluster Agricultural Cooperative's experience at the 2019 national cupping competition.

Improving coffee quality in Kalinga is essential for increasing the income of coffee farmers and boosting the local economy. By adopting best practices in harvesting, drying, and post-harvest processing, Kalinga farmers can produce exceptional quality coffee that is in high demand both locally and internationally. This could lead to higher prices for coffee farmers, as well as a more sustainable and profitable coffee industry.

Coffee production in Kalinga is facing a number of challenges, including: aged trees that have gone past their prime in production, harvesting methods that do not encourage the picking of ripe berries, and coffee processing practices that do not produce good quality green coffee beans.

These challenges are leading to a decrease in production and sub-optimal quality of Kalinga coffee.

Rejuvenation technology is a promising solution to the problem of aged coffee trees. However, farmers hesitate to adopt this technology due to the perceived loss of income at the time the trees are cut, inadequate knowledge on the technology, and lack of support systems.

In addition to rejuvenation technology, farmers could also improve the quality of Kalinga coffee by upgrading harvesting and drying methods. For example, picking only ripe berries and sun drying coffee cherries in a single layer on a clean surface can improve coffee quality.

The Kalinga provincial government and other stakeholders can play a role in supporting coffee farmers to adopt these best practices. This could involve providing training and support on rejuvenation technology, harvesting and drying methods, and coffee processing practices. The government could also work to develop markets for high quality Kalinga coffee.

By taking these steps, Kalinga can build a more sustainable and profitable coffee industry that produces high quality coffee that is in demand both locally and internationally.

The Kalinga Provincial Government is working with various national agencies and local government units to support the province's "one-town one-product" coffee industry. They are implementing research development and extension projects, such as rejuvenation technology, seedlings distribution, and trainings on harvesting and post harvesting techniques.

Rejuvenation technology is a way to address the problem of aging coffee trees by reducing the branches that compete for nutrients and reducing plant height. This allows for the practice of "picking red" coffee cherries, which improves quality.

The university develop a tool on kit coffee rejuvenation, harvesting, and processing and introduced it to coffee farmers through training programs and establishment of demonstration farms. Hence, the study evaluated the satisfaction level of the engaged coffee farmers.

METHODS

This research used a mixed methods approach through action research. Data was collected through a questionnaire, interviews, direct observation, and documentation. Focus group discussions were also conducted

with key informants from farmers' groups, resource persons, and coffee focal persons of various agencies with programs related to coffee.

Twenty farmers agreed to participate in the intervention. The demonstration farm showcased the rejuvenation technology and was used to confirm the content of the tool kit. Lecture-training sessions on pick ripe and proper drying techniques were also conducted on-location at two sites.

The data was analyzed using descriptive statistics to identify patterns and trends, and the results of the analysis were used understand the level of satisfaction on the utility of the tool kit in coffee rejuvenation technology and harvesting and post harvesting techniques. The tool kit was intended to be used by coffee farmers to increase their coffee production and improve the quality of their green coffee beans.

RESULTS AND DISCUSSION

Field Observation on the different coffee farms, their harvesting and coffee drying practices in the province of Kalinga

Based on personal interviews to farmers, stakeholders, and even reports from the Office of the Provincial Agriculturist, the yield of coffee in the province is declining. This can be attributed to old coffee trees, abandoned coffee plantations, attacks of some pests and diseases and conversion to other land uses shown in Figure 1. The decline in quantity is alarming because the number of coffee processor and consolidators in the province is increasing. The increase in the number of processors requires more volume of green coffee beans. With the decline of production, the quantity cannot be supplied by the local coffee producers in the province. This scenario will put the coffee industry in the province in uncertain scenario since there will be limited coffee produce in the province which the customers are looking for.



Figure 1. Causes of coffee declining productivity

Most of the farmers also revealed that they still employ the stripping method “armalite” of harvesting coffee cherries. This practice lowers the quality of green beans which results in cheaper price.

The farmer will harvest unripe and ripe cherries because of the impracticality of going back again to the branches through climbing. The mixed harvest will result to uneven cup quality, since unripe coffee cherries will have inferior flavor compared to the ripe cherries.

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Many coffee farmers do not have the knowledge of proper post handling techniques. They dry their coffee cherries by spreading them on cemented pavement. This practice is shown in Figure 2. The cherries are left to dry under sun and rain. This practice further lessens the cup quality of the coffee.



Figure 2. Traditional drying techniques.

During the interview conducted, the coffee farmers agree that they lack the necessary information on the proper harvesting and post-handling techniques. For them, the most important thing is that their dried coffee cherries will be sold to merchants.

Drying of coffee cherries along roads and highways are the prevailing practice of coffee farmers in drying their coffee cherries in the province of Kalinga. Many cuppers said that Kalinga coffee has the potential to be a fine Robusta if coffee farmers implement pick ripe in harvesting and proper drying and post handling techniques.

A total of twenty Memorandum of Agreement was notarized. The farmer-partners are from different parts of the province. These coffee farmers showed interest in implementing the rejuvenation technology and practice later the pick ripe and proper drying techniques. Their participation showcased the technology in a wider scope. When their coffee farms were transformed through rejuvenation, coffee farmers from nearby communities were encouraged to duplicate the technology in their coffee farms with aged coffee trees.

The response of improved innovation is a significant motor of development for smallholder farmers in developing countries. However, levels of innovation adoption remain disappointingly low and data limitations are viewed as a significant obstruction to adoption (Jack, 2011 cited in Emerick et al., 2016).

The toolkit used

The province of Kalinga One town one product is coffee, hence a Toolkit on Coffee Rejuvenation, Harvesting and Post Handling Techniques is important in the revitalization of the coffee industry in the province shown in Figure 3 & 4.

COFFEE REJUVENATION, HARVESTING AND POST HANDLING TECHNIQUES



Current Situation of the Coffee Farm



Old coffee trees with underneath wildlings that compete specifically for nutrients and water.



Low yield as a result of old coffee trees and unattended coffee farms coupled with depleted soil nutrients.



Difficulty of harvesting coffee cherries from old coffee trees.



Harvesting of both ripe and unripe cherries.

Rejuvenation Technology as Intervention



Remove coffee wildlings and other weeds prior to cutting the old coffee trees.



Cut old coffee branches prior to the main stem cutting. This is to avoid breakage of the main stem. Broken stem can be a way for harmful microorganism attack.



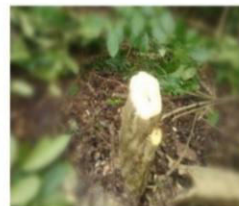
Collect the severed or cut branches.



Remove the leaves and smaller branches with the use of a bolo. These branches can be used as fuel wood or can be made into key chains or even small chairs.



Cut the main stem one foot above the soil surface with the use of a small chainsaw. The direction of cut must be slant. Be sure that the blades are sharp.



This is what a newly, rejuvenated old coffee tree looks like after cutting.



Three months after severing the main stem, new shoots will arise. Select only three to four healthy shoots equally distant from each other to allow better branch formation and remove the other shoots.



In case you missed to visit your rejuvenated old coffee trees, more shoots will arise. Remove all new shoots to maintain the three to four healthy shoots.



This is what a rejuvenated old coffee tree looks like when four shoots are maintained.



This is a rejuvenated old coffee with equally-spaced selected branches bearing flowers 8 months after rejuvenation.



For plant nourishment, on the onset of rainy season, apply 600 grams of complete fertilizer (14-14-14) per tree or as recommended based on soil analysis. Make a shallow canal about 5 cm deep around the plant and place the proper amount of fertilizer. Cover it with soil.

Figure 3. The current situation of coffee farms and the rejuvenation procedures.

COFFEE REJUVENATION, HARVESTING AND POST HANDLING TECHNIQUES



Rejuvenation Technology as Intervention (Continued)



In order to maximize the productivity of the area of rejuvenated coffee trees, intercrop hot pepper and ginger as a source of income for the first year.



Detopping or topping is undertaken to cut back shoots of coffee trees preferable at 1 to 1.5 m high.



Eighteen months after rejuvenation depending on soil fertility and cultural management practices applied, cherries can now be harvested. Pick bright red cherries; this is the best state to harvest coffee cherries. Do not harvest green cherries (unripe) and avoid harvesting dull red in color (advanced ripened stage).

Post Harvest Handling

a. Wet Process



Clean newly harvested cherries.



Fill a pail with water and place the newly harvested cherries in the pail. Remove all cherries that float then drain the water.



Manually and/or mechanically depulp good cherries. Dry depulped cherries (parchment coffee) under the sun. Use clean canvass in drying. Maintain 5 cm thickness of parchment coffee when drying and turn or rake the beans at least three times a day. Store dried parchment coffee with moisture content of 11-12%.



b. Dry Process



Place the harvested coffee cherries in clean sacks. If possible, the red cherries shall be spread equally on a clean canvass within 24 hours after harvesting for sun drying.



In drying coffee cherries, an elevated wooden frame may be used. Spread the coffee evenly about 5 cm thick but not to exceed 30 cm. This is to avoid the development of Ochratoxin A (OTA) that is carcinogenic.



During drying, turn the coffee at least three times a day for equal drying. Sundry it for 15 to 21 days, depending on the weather condition. Dried coffee may be tested by shaking the coffee near the ear. If shaking sound can be heard, then the coffee is dried. Store dried coffee in dry and clean storage areas.



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Figure 4. Continuation

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Training on Coffee Rejuvenation and Pruning Technology cum Harvesting and Drying Techniques to Improve Yield and Green Beans Quality

The researcher coordinated with the Department of Agriculture-Regional Field Office regarding the conduct of on-site training on coffee rejuvenation. The training was conducted at Magabangon, Tabuk City, Kalinga with at least 20 participants including students of the Bachelor of Science in Forestry. The on-site training aimed to demonstrate knowledge and skills for farmers to get first-hand experience. The demonstration farm was owned by Mr. Crispin Gayagay who agreed to be the farmer-partner in this project. The coffee trees subject for rejuvenation did not bear cherries for the harvesting period, which was the main reason for the owner to offer the site for demonstration purpose. The on-site training gave opportunities to the participants' to ask relevant questions in rejuvenation and pruning technology. All their queries regarding coffee rejuvenation and pruning were answered and they themselves were satisfied with the answers.

Another on-site training was conducted at Nambucayan, Tabuk City, Kalinga. The coffee farmers have the opportunity ask questions and demand answers. They also demonstrated an improved stumping method by cutting first the branches of the old coffee trees. This practice is a new learning because, stumping were conducted directly to the main stump without cutting first the branches. Their sharing means a lot specifically in the non-breakage of the main stem during cutting. Broken main stem can be an avenue for microorganism's entrance, which can give disease to the rejuvenated coffee trees.

The satisfaction survey rating of the participants who were randomly picked is shown in Table 1. Most of the indicators obtained a score of 5 which means they are highly satisfied with the training. Majority of them rated it as relevant, with the lecturer as expert of the subject matter.

Table 1. Client satisfaction rating of the coffee farmers on the Coffee Rejuvenation and Pruning Technology cum Harvesting and Drying Techniques Improving Yield and Green Beans Quality
Coffee Farmers (n=20)

Particulars	Highly dissatisfied	Not satisfied	Neutral	Satisfied	Highly Satisfied	Mean
Provision of new information/knowledge/Skills	0	0	0	0	20	5.0
Relevance to present work/functions	0	0	0	1	19	4.95
Effectiveness in attaining program objectives	0	0	0	1	19	4.95
Suitability/Appropriateness	0	0	0	2	18	4.90
Availability/Adequacy of training materials	0	0	0	2	18	4.90
Knowledge of subject matter	0	0	0	0	20	5.0
Clarity/Effectiveness of presentation	0	0	0	0	20	5.0

Adopters on the rejuvenation, harvesting techniques, and drying method

Table 2. Client adoption on rejuvenation, harvesting techniques, and drying method

INDICATORS	Yes	NO	Percentage
1. Adoption of rejuvenation technology	20	0	100
2. Pick ripe in harvesting	20	0	100
3. Drying using elevated dryer using locally available materials	20	0	100

Coffee farmers who voluntarily submitted to become the farmer-partners for the implementation of the rejuvenation technology demonstration farms started to clean their farms. With the students and other coffee farmers, the cutting of the main stem of the aged coffee trees were conducted.

Technology demonstration farm are essential element of agricultural extension. Demonstration farms are significant device for empowering farmers to learn directly about improved agricultural production efficiency. Similarly as an image expresses a thousand words, demo farms can impart a rich range of messages for farmers. On one hand, best demo farms can entice and empower farmers on technology intervention. When farmers can see and experience for themselves that an innovation works, they are bound to expand or imitate it. On the other hand, inadequately displayed demo farms can adversely influence the taking-in process and discourages farmers from receiving another practice.

Demonstration farms give a chance to hands-on, getting the hang of, empowering farmers to perceive what does and doesn't function as they evaluate new cultivating advancements. Demonstration farms offer a domain that is favorable for adult learning, as adults recollect a greater amount of what they realize experientially than what they do of what they realize orally or outwardly (Mthinda 2015).

Demonstration farms permit farmers to think and consider the adaption of the technology in a small parcel of land to ensure it works before they apply it to a wider area. They can select what aspects most appeal to them, and try those on their own farm. This brings down the chance for new advances, permitting farmers to take on just what they are happy with attempting.

Demonstration farms can be an effective method for reaching out to numerous farmers, particularly when they around farmer gatherings. They give a helpful stage to congregating and preparing farmers. In circumstances where a falling (preparing of mentors) approach is utilized for expansion outreach, demonstration farms fill in as a homeroom, where lead farmer can meet to find out about imaginative practices so they can imitate demonstration farms on their homesteads. Each demonstration farm at one point turns into a locus for learning and dispersal, empowering effective scale-out of innovations.

Demonstration farms have been utilized in augmentation for such a long time that they have become a default approach. It is difficult to envision an expansion framework that doesn't include demonstration farm.

The post-harvest processing begins right after the harvest. The farmers placed all the cherries on a tarp to remove all unwanted materials, such as leaves, small branches, overripe fruit, and others that mixed while gathering cherries. Sorting for the optimum ripeness of cherries was also done using a refractometer.

After sorting, soaked the cherries in a water-filled basin. Any that floats to the top is either hollow or unhealthy and must be removed to produce uniform green coffee beans with the minimum defects. Then the cleaned cherries were placed on the elevated bed for drying.

All the respondents revealed that they adopted the elevated drying technique. Drying is the most critical step in coffee processing methods. Drying is performed to reduce the moisture content of the coffee bean to the required level (10–12%) and to separate the parchment from the coffee bean easily, and most importantly, to avoid the development of molds (*buot*) which lead to significant losses and affect coffee quality.

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The coffee farmer cooperators dried out the whole freshly picked coffee cherries over the elevated drying bed. They mix thoroughly the coffee cherries at least every hour to avoid deterioration or degradation of the quality of the coffee and to maintain uniform temperature from the top to the bottom layer.

Conduct of Coffee Cupping

In order to show the cup quality of beans produced from various harvesting and drying method, cupping quality of coffee in the province was conducted. This is to show to the farmers the effect of the different harvesting and post harvesting technique. The result is shown in Table 3.

Table 3. Cupping result of Robusta coffee.

Date of cupping	Method of Harvest and Process	Average Score
February 12, 2020	Strip method, floatation and honey processed but mixed with other process	79.50
February 12, 2020	Strip method, direct drying, hulling and sorting	69.25
February 12, 2020	Strip method, floatation and honey processed	80.25
February 12, 2020	Picked ripe, dry process, floatation, drying partially, sorted before roasting	80.13
February 13, 2020	Strip method but minimal unripe berries, direct dry process (no floatation) very well sorted before roasting	82.00
February 13, 2020	Honey processed, partially sorted before roasting	77.25
February 13, 2020	Honey processed, partially sorted before roasting	80.63
February 13, 2020	Honey processed	78.75
February 13, 2020	Strip method, direct drying, hulling and sorting	71.00

It can be digest that ripe cherries that are dried and sorted carefully have higher cup quality that those with strip method. The result show the importance of sorting beans prior to roasting.

CONCLUSION

The research found that teaching coffee farmers about ways to improve their coffee, like how to rejuvenate it, harvest it, and dry it, is a helpful way to give them guidance. When farmers actually try out these techniques, they're more likely to use them in their own coffee production. Also, the study showed that farmers learned how important it is to dry and sort the coffee beans properly to make sure the coffee tastes good.

RECOMMENDATIONS

The university can create programs to share the toolkit for improving coffee with more people. They can organize events where farmers can see how these techniques work firsthand, and they can invite others like government officials and private sector representatives to learn too. The farmers who have used these techniques successfully can talk about their experiences. It's also important to mentor young technicians to keep these projects going. Starting a program on the radio can help spread the word about coffee farming to even more people, especially those in rural areas. Holding a yearly competition to judge the quality of coffee can remind farmers how important it is to take care of their crops. When planning new research and projects, involving coffee farmers is key. Topics like better farming methods, dealing with climate change, the role of women in the coffee industry, and preserving traditional coffee varieties should be a priority.

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