ENHANCING AWARENESS ON S&T-BASED PRODUCTION PRACTICES OF MANGO GROWERS

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ABSTRACT

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The project aimed to evaluate the current challenges associated with management practices encountered by both mango growers and spray contractors. One of the highlights of this project was the information dissemination on the production practices in mango production. Proper pruning and appropriate usage of fertilizers and pesticides were also given emphasis. It was observed that mango production relied heavily on chemical-based fertilizers and pesticides. One of the challenges for the spray contractors was the farm elevation and accessibility to water. Other farmers left their mango trees to bear fruit naturally, which resulted in poor production. The capability seminar was attended by both male and female farmers. All of them were satisfied with the inputs given, which focused on the canopy, soil management, flower and pest management, proper harvesting, and post-harvesting. The activity could be an avenue to improve the mango production of the farmers in the area.

INTRODUCTION

The Province of Davao Occidental is one of the suppliers of mango fruits in Davao Region, Visayas, and Metro Manila. The Philippines has accounted to reach about 7,116,409 bearing trees in 2017 with an average yield of 4,800 kg per hectare (Briones, 2014). Based on the crop suitability map, the province of Davao del Sur, including Davao Occidental, is among the mango-producing provinces next to Pangasinan, Zamboanga del Norte, and Cebu. It was reported that Davao Occidental has been producing of mango, 4,304.02 metric tons of banana, papaya, durian, and pomelo (PSA, 2020).

Mango (Mangifera indica L.) is locally known as "Mangga," which belongs to the family Anacardiaceae under the order Sapindales. It originated in the Indo-Burma region (Parmar et al., 2012). It has many strains derived from Carabao Mango, and varieties include Pico and Katchamita (also known as Indian Mango) that are produced domestically. Among these varieties, Carabao Mango or Philippine Super Mango is solely for export due to its fine texture, aroma, sweetness, and eating quality in fresh and processed forms, such as dried, frozen, pureed, and juice, and valued at 16.67 billion pesos from 984.34 metric tons in 2005. From 2015 to 2017, Hong Kong was considered the highest-importing country with a volume of 8,015.11 metric tons, followed by Korea, Japan, Malaysia, and Canada (HVCDP, 2018). It is interesting to note that Davao Occidental has planned to construct and build an Integrated Processing Plant to cater to 20 metric tons per day and is purposely for export in quality packaging into dried unsweetened mango, puree, and vegetable juices.

The majority of mango farmers at this time are dependent on mango contractors who maintain their mango trees for production on a percentage basis. Sometimes farmers have shared their responsibility for these mango trees with contractors because they are thinking more about production and not much about the care and management of trees in terms of canopy pruning, fertilization, and other management practices necessary to sustain and bear fruits for a longer period. Moreover, mango production nowadays is dependent on the chemical (spraying) from flower induction to fruit development until harvesting. The very question now is, how safe are the mango fruits displayed in the local markets, considering the technology being applied and used by contractors, particularly on their chemical residues upon harvesting, and the tolerable level for human consumption?

The Australian Centre for International Agricultural Research (ACIAR), along with State Colleges and Universities (SUCs), including SPAMAST and government agencies, recommended that there was a need to manage the canopy and nutrition in a mango orchard in the Southern Philippines, particularly Davao Occidental. Pruning technique and soil analysis were the major findings of the study that could increase yield while minimizing the

application of fertilizers and pesticides on mango trees. Hence, this extension activity was intended to raise the level of awareness of farmers and contractors on the safety and security of the mango that they produce for consumers. It aimed to assess the status of the mango trees in terms of the technology applied during the production period.

This initiative would be a step towards a harmonious engagement among mango growers and spray contractors in assistance with SUCs and government line agencies with full access to Science and Technology based information. The latter consisted of good agricultural practices in mango for both men and women would result in enhanced capability and resiliency of households, and communities as a whole. The adoption of technology could bring significant growth and a positive impact on the local economic community.

Objectives of the Study

This extension project aimed to demonstrate the production practices of mango and disseminate good agricultural practices of mango production in the selected barangays in Davao Occidental. Specifically, it aimed to:

- To evaluate the current challenges and problems associated with management practices encountered by both mango growers and spray contractors;
- To assess the pesticide application, interval, and dosage used by spray contractors; and
- To demonstrate the proper canopy management and appropriate application of fertilizers and pesticides.

MATERIALS AND METHODS

Pre-implementation phase

This project was organized by a team to look into the participants who were actively engaged in mango production. An inception meeting was conducted, and a courtesy call was made with the Office of the Municipal Agriculture and Fishery of the Municipality of Malita, Davao Occidental, where a list of Mango growers from five selected Barangay Local Government Units of Buhangin, Tubalan, Kidalapong, Talogoy, and Lacaron was obtained. Commitment to support the project was sought among the Barangay Captains to ensure full support for the project implementation.

Implementation phase

A self-made interview schedule was used to determine the responses of mango growers on the number of trees with fruiting and non-fruiting, production date, flowering management, name of the contractor, and the profit sharing between mango growers and contractors. This was done through an interview of the participants who attended the meeting cum

seminar. Awareness seminars were conducted for mango growers in different barangays. The seminars were focused on canopy management. This seminar emphasized a well-structured tree canopy to minimize pests and diseases while yield eventually increases through pruning techniques. Pesticide residues and Pre-Harvest Interval (PHI) observation, on the other hand, emphasized the importance of checking chemical residue on fruits based on Maximum Residue Level (MRL) after harvest and before consumption. Moreover, fertilizers and fertilization are dealt with through soil analysis to obtain a proper method of fertilization to supplement the growth of mango trees. Likewise, pest management focused on the proper application and timing of pesticides to minimize chemical residue on fruits, while flower induction and mango flowering emphasized how the flower inducer works for flowering and how it is applied.

Post-implementation phase

The participants' feedback using the SPAMAST seminar/training evaluation form from 10% of the total attendees was carefully gathered by the team. Before filling out of forms, the host led the floor in helping the evaluator-participants to fully understand the context of the given forms. All of the responses were analyzed and interpreted.

Accomplished outputs

Status of Mango Trees in the Selected Barangays

The gathered parameters were the number of fruiting and non-fruiting trees, the year started fruiting, application of flower inducer (applied and non-applied), name and address of spray contractor, and percentage of profit sharing.

Mango growers

In BLGU-Buhangin, 275 mango trees have already fruited since the year 2000 and responded to the chemical flower inducer. Most of the mango growers resorted to the application of chemical spray and were accepting 70/30 percent net profit sharing. There were four out of 10 growers who allowed trees to be sprayed with chemical spray. A common mango contractor who resided within the Province of Davao Occidental was contacted to do the spraying.

Table 1. *Current status of mango trees at Barangay Buhangin, Davao Occidental*

Mango Grower	Number of trees		Year started Fruiting	Mode of Flowering	Profit sharing percentage
	Fruiting	Non-fruiting			
1	20	20	2017	Natural flowering	*
2	10	*	2018	Natural flowering	*
3	*	*	*	*	*
4	*	*	*	*	*
5	*	*	*	*	*
6	10	*	2020	Chemical Spray	70:30:00
7	10	32	2019	Natural flowering	*
8	8	*	2018	Natural flowering	*
9	5	20	2019	Natural flowering	*
10	5	20	2019	Natural flowering	*
11	*	2	*	*	*
12	25	20	2019	Natural flowering	*
13	40	12	2018	Chemical Spray	70:30:00
14	8	15	2016	Chemical Spray	70:30:00
15	*	10	*	*	*
16	*	*	*	*	*
17	2	*	2010	Natural flowering	*
18	100	*	2016	Chemical Spray	70:30:00
19	50	*	2000	Chemical Spray	70:30:00
20	*	50	*	*	*

21	*	30	*	*	*
22	*	15	*	*	*
23	*	20	*	*	*
24	*	6	*	*	*
25	*	50	*	*	*
26	*	10	*	*	*
27	*	50	*	*	*
28	50	*	*	Natural flowering	*
29	*	50	*	*	*
30	*	6	*	*	*
31	*	6	*	*	*

(*) - No available data

In BLGU-Tubalan, 501 mango trees were naturally flowering while 134 were induced with chemical spray. Most of their fruits were coming from natural flowering, while one respondent got her trees applied with a flower inducer in the year 2002 and eventually ceased due to a high incidence of pests and diseases, resulting in poor-quality fruits. It can be noted that there were centennial trees planted in the area without even being induced by chemical spray. On the other hand, trees that were not sprayed with chemical spray were situated in sloppy areas, had multi-cropping, and were far from water access. These trees produced fruits naturally, but it was not generally productive.

Table 2. *Current status of mango trees at the Barangay Lacaron, Davao Occidental*

Mango Grower	Number of trees		Year started Fruiting	Mode of Flowering	Profit sharing percentage
	Fruiting	Non-fruiting			
1	*	*	*	*	*
2	6	5	1972	Natural flowering	*
3	4	3	1920	Natural flowering	*
4	6	90	1920	Natural flowering	*
5	2	10	1999	Natural flowering	*

6	2	10	2000	Natural flowering	*
7	12	100	2002	Chemical Spray	*
8	5	16	2018	Natural flowering	*
9	2	*	2010	Natural flowering	*
10	*	50	*	*	*
11	5	65	2017	Natural flowering	*
12	80	*	*	Natural flowering	*
13	*	9	*	*	*
14	10	140	2008	Natural flowering	*
15	*	3	*	*	*

(*) - No available data

In BLGU-Kidalapong, all respondents had mango trees that were both naturally fruiting and chemically induced. Among the 31 respondents, nine had naturally grown trees. However, most of them had negotiated with spray contractors and obtained 70/30 and 60/40 percentage shares of net profits. Four spray contractors were not identified and did not indicate their addresses. The 1,616 mango trees started to bear fruit 12 to 15 years ago, while others began fruiting 28 years ago.

Table 3. *Current status of mango trees at the Barangay Kidalapong, Davao Occidental.*

Mango Grower	Number of trees		Year started Fruiting	Mode of Flowering	Profit sharing percentage
	Fruiting	Non-fruiting			
1	15	*	2008	Natural flowering	*
2	15	*	2008	Natural flowering	*
3	2	*	2005	Natural flowering	*
4	*	*	*	*	*

5	2	*	2005	Natural flowering	*
6	13	*	2010	Natural flowering	*
7	10	*	2013	Chemical Spray	70:30
8	300	*	1994	Chemical Spray	70:30
9	500	*	2005	Natural flowering	*
10	14	*	2005	Natural flowering	*
11	80	*	2000	Natural flowering	*
12	10	*	2010	Natural flowering	*
13	15	*	2010	Chemical Spray	70:30
14	50	*	2010	Chemical Spray	70:30
15	20	*	2008	Natural flowering	*
16	150	*	1992	Chemical Spray	70:30
17	70	*	2018	Natural flowering	*
18	20	*	2015	Chemical Spray	60:40
19	20	*	2005	Chemical Spray	60:40
20	8	*	2005	Chemical Spray	60:40
21	10	*	2008	Chemical Spray	60:40
22	108	*	2010	Chemical Spray	70:30
23	16	*	2010	Natural flowering	*
24	35	*	*	Chemical Spray	*
25	100	*	2010	Chemical Spray	70:30
26	35	*	*	*	*
27	100	*	*	Chemical Spray	70:30
28	18	*	2017	Natural flowering	*
29	50	*	2016	Chemical Spray	70:30
30	48	*	2018	Chemical Spray	70:30
31	82	*	2005	Chemical Spray	70:30

(*) - No available data

In BLGU- Talogoy, one respondent had his mango trees sprayed with a chemical inducer. The rest of the respondents have been producing fruits naturally since the year 2000. There were 545 non-fruiting trees, while 325 trees were continuously bearing fruit.

Table 4. *Current status of mango trees at the Barangay Talogoy, Davao Occidental.*

Mango Grower	Number of trees		Year started Fruiting	Mode of Flowering	Profit sharing percentage
	Fruiting	Non-fruiting			
1	20	*	2000	Natural Flowering	*
2	35	*	*	Natural Flowering	*
3	10	*	*	Natural Flowering	*
4	5	*	*	Natural Flowering	*
5	5	495	2019	Natural Flowering	*
6	125	*	2018	Natural Flowering	*
7	25	*	2004	Chemical Spray	70:30
8	50	50	2000	Natural Flowering	*
9	*	*	*	*	*
10	*	*	*	*	*
11	50	*	2010	Natural Flowering	*

(*) - No available data

Lastly, BLGU-Lacaron had 886 fruiting trees, of which 73 were non-fruiting. The trees were treated with chemical spray since 2000, and the rest of the respondents started their harvest from their mango trees 8 years ago. There were seven mango spray contractors identified without addresses and dealt with mango growers on a 70:30 percent net profit sharing.

Table 5. *Current status of mango trees at the Barangay Lacaron, Davao Occidental.*

Mango Grower	Number of trees		Year started Fruiting	Mode of Flowering	Profit sharing percentage
	Fruiting	Non-fruiting			
1	12	*	2015	Chemical spray	70:30
2	100	*	*	Chemical spray	70:30
3	80	*	2016	Chemical spray	70:30

4	27	*	2013	Chemical spray	70:30
5	55	*	2015	Chemical spray	70:30
6	10	*	2015	*	*
7	44	*	2014	Chemical spray	70:30
8	7	3	2019	Natural	*
9	150	*	2015	Chemical spray	70:30
10	2, 100	*	1980, 2000	Chemical spray	70:30
11	96	*	2016	Chemical spray	70:30
12	5	*	2016	Chemical spray	70:30
13		70	2015	Chemical spray	70:30
14	94	*	*	*	*
15	104	*	2016	Chemical spray	70:30

(*) - No available data

The results revealed that there was a need to be taken on the farm, such as rehabilitation and rejuvenation of old mango trees and determination of physical and chemical characteristics of the soil. For mango trees under natural flowering, this could be an avenue for mango growers to produce organically grown fruits. Pest monitoring and the use of organic-based pesticides could also be used for these trees infested with pests. Whereas, trees that were induced with spray contractors chemically to produce flowers should follow the standard protocols for mango production. The conducted seminar impacted the participants because of the helpful information given by the resource speakers. According to Newton (2019), having more extension activities concerning canopy management and fertilization management could increase the level of adoption in the country. This further helps the growers in achieving fruit quality in conjunction with the spray contractors while minimizing the harmful effects of agro-industrial inputs on the environment. Generally, the mango growers' profile would be utilized as baseline information for further implementation of this project. It sought to have an active and responsive farmer-adopter to see to it that the technology would be used and disseminated to other farmers.

Spray contractors

More spray contractors were living in the Municipality of Malalag, Davao del Sur, and engaged in mango production in the Province of Davao Occidental. They were males and were accredited by the Fertilizer and Pesticide Authority (FPA), an agency of the Government that regulates the use of agro-industrial inputs for mango production. However, one of them did

not attend the seminar on Good Agricultural Practices (GAP). This means that the module for GAP should be widely spread among spray contractors to encourage them to be certified in PhilGAP.

Table 6. *Profile and Production Practices of Spray Contractors for Mango Production in the Province of Davao Occidental.*

Contractor's Profile	Spray Contractor	
	No. 1	No. 2
Home Address	Malalag, Davao del Sur	Malalag, Davao del Sur
Production Area	Lacaron, Malita, Davao Occidental	Tibungoy, Sta. Maria, Davao Occidental
Awareness and attendance to seminars and training on Good Agricultural Practices (GAP)	No, did not attend	Yes, attended
Gender	Male	Male
Fertilizer and Pesticides Authority (FPA) Accredited	Yes	Yes
Profit sharing percentage	70% for the contractor 30% for the grower	70% for the contractor 30% for the grower
Production Practices		
Cycle spray of pesticides per cropping	16	17
Pesticides used for the control of pests	Profenofos, Sniper, D'Choice	Penant, Sniper, Megatonic
Pruning management	Yes	Yes
Fertilizer application: Solid fertilizers, Foliar fertilizers	No Yes	No Yes
Fruit bagging	60 Days After Flower Induction (DAFI)	65 or 79 Days After Flower Induction (DAFI)
Tools used during harvesting	Picking a pole and a large mesh basket	Picking a pole and a large mesh basket
Harvested fruits classification	Small, Medium, Large, and Extra Large	Buyer's preference
Observed Pre-harvest Interval and dosage of pesticides	Yes	Yes

Common problems during production	Low price, bad weather, Cecid fly (Buti/ Kurikong)	Cecid fly (Buti/Kurikong)
Strategies employed to manage mango trees	Sanitation, Manual brushing, and weeding under mango trees	Sanitation under mango trees

Pesticide and Farm Management Practices

The pesticides used to control pests included Penant, Sniper (active ingredient: Bifenthrin), Megatonic, among others. The dosage instructions were followed according to the label for the entire spray cycle per crop. Pruning activities were undertaken before flower induction without applying soil fertilizers; however, foliar fertilizers were applied to supplement flowers during fruit development and maturity.

To prevent fruit insect infestation, farmers bagged the fruits 60 to 79 days after Flower Induction (DAFI). This practice helped minimize losses, especially damage to the fruit peel surface during harvest. All fruits were harvested using a pole-picking tool and placed into large mesh baskets. Grading of harvested mangoes was based on buyer preferences and standard sizing classifications: small, medium, large, and extra-large.

According to respondents, common problems affecting mango production included bad weather during the critical flowering stage, pest infestations—particularly by the cecid fly—and low market prices. To sustainably manage these issues, farmers employed on-farm strategies such as sanitation, the removal of all fallen fruits, and manual picking of remaining fruits on the trees.

Based on the results, spray contractors had only applied foliar fertilizers on the trees; application of solid fertilizers based on soil analysis was not yet implemented. Additionally, reports suggest that leaf tissue analysis should be conducted on mango trees to detect deficiencies of macro and micronutrients such as zinc and manganese, which can restrict mango yield (Balamohan et al., 2005).

Furthermore, proper pruning is critical; if not done appropriately, it can lead to tree damage and prevent the development of a well-structured canopy. A properly structured canopy is important to enable trees to intercept sufficient light for photosynthesis, which directly affects yield.

Number of Mango Growers Served

A total of 149 respondents attended the meeting and seminar. BLGU-Buhangin had the highest number of respondents, with 43, followed by BLGU-Kidalapong. These numbers exceeded the team's target of 115 respondents. Among the attendees, there were 78 males and 71 females. Numerically, men appeared to be the majority, which suggests that men often represent their family members at such seminars. This observation aligns with Paris and Rola-Rubzin (2019), who noted that despite low female attendance

in agricultural production seminars, women often access information through their husbands.

The specific engagement of men versus women in mango production activities such as pruning and weeding was unclear. The mango growers in Davao Occidental can further improve their production by adopting appropriate technologies promoted through educational campaigns in the five selected Barangays of the Municipality of Malita. This recommendation supports the collaborative work between the Department of Agriculture, Philippines, and ACIAR, Australia, aimed at enhancing mango production in the Southern Philippines (Newton, 2019).

Table 7. *Several beneficiaries of mango trees from the Malita-Municipal Agriculture Office and respondents during the meeting cum seminar.*

BLGUs	Total Beneficiaries*	Participants during the Meeting cum Seminar**		
		Male	Female	Total
Buhangin	107	19	24	43
Kidalapong	68	18	15	33
Lacaron	176	14	11	25
Talogoy	65	18	7	25
Tubalan	153	9	14	23
TOTAL	569	78	71	149

*Source: Municipal Agriculture Office, Eight (8) Mango Contractors Identified without address

**Target participants- 115 individuals

Issues and Concerns Gathered During the Meeting cum Seminar

During the open forum and individual interviews with the participants, the following issues and concerns were summarized:

- Mango growers expressed the need for inputs such as fertilizers.
- Some mature mango trees did not undergo flower induction due to limited water accessibility and high slope elevation.
- Certain mango spray contractors did not follow good agricultural practices, including proper pruning, fertilization, and the protection and welfare of their laborers.
- However, one respondent advocated for Good Agricultural Practices and organic farming, emphasizing that mango contractors should be mindful of the harmful effects of chemical use near households and highlighting that mango trees can produce quality fruits without relying on harmful chemicals.

Feedback Generated from Participants During the Meeting cum Seminar

The team consolidated the evaluation feedback from attendees, which included:

a) The objectives of the meeting were clearly understood.
b) The topics discussed and covered were relevant and informative.
c) The mango growers appreciated the provision of nutritious snacks and lecture materials, including notes and pens.
d) Participants expressed gratitude to the SPAMAST team for conducting the activity.
e) The mango growers requested expert visits to their farms before mango flower induction for better guidance.

CONCLUSION AND RECOMMENDATION

The mango growers in the selected barangays of Buhangin, Lacaron, Tubalan, Kidalapong, and Talogoy were found to be dependent on chemical sprays. They entered into profit-sharing agreements with spray contractors on a 70:30 percent basis. However, some growers still followed the practice of seasonal natural flowering. An adverse effect reported from pesticide use was a foul odor, which led to the temporary migration of households living near the sprayed areas.

It was noted that the spray contractors do not fully adhere to good agricultural practices (GAP), although they claim registration with the Fertilizer and Pesticide Authority (FPA) and compliance with the pre-harvest interval and pesticide dosage guidelines. However, none of the contractors are currently certified under GAP.

The information gap has been partially addressed through a meeting cum seminar focused on canopy management and the appropriate use of fertilizers and pesticides. This seminar was attended by 149 respondents—both male and female—which exceeded the target of 115. The majority of attendees were male, indicating that men dominate mango farming activities in these areas.

Based on these findings, the researchers propose the following recommendations:

1. Establish linkages with private companies through Memoranda of Agreement (MOA) concerning fertilizers and pesticides. This collaboration will assist both mango growers and spray contractors in better understanding the critical importance of applying pesticides and fertilizers according to manufacturers' recommendations.
2. Encourage and support mango farmers to adopt canopy management and proper fertilization technologies as initial steps towards obtaining GAP certification.

3. Coordinate with the Local Government Unit (LGU) of Malalag, Davao del Sur, to facilitate communication and regulation of the pool of mango spray contractors. Since this municipality has many spray contractors, it is essential to ensure they undergo training and certification in good agricultural practices.

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