Review of Socio-Economic Research and Development Studies 2022
Volume 6 No. 3, 84-103
https://reserds.vsu.edu.ph
Research Article

PROFITABILITYASSESSMENT ON THE ADOPTION OF GOOD AGRICULTURAL PRACTICES (GAP) AMONG CABBAGE FARMERS IN DALAGUETE, CEBU

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The good agricultural practices (GAP) system is a set of principles applied to on-farm production and post-production processes which reduces harm caused by pesticides to consumers and mitigates environmental damage caused by agricultural activities. This study aims to compare the profitability of farmers trained under GAP compared with conventional practice (non-GAP) in cabbage production in Dalaguete, Cebu, Philippines. The GAP-trained farmers employed the recommended practices such as application of organic inputs, soil and water conservation, minimization of pesticide utilization, and application of optimal amount of fertilizer. These practices were taught during programmed trainings by the non-government organizations and the Department of Agriculture. Profitability was measured using gross margin analysis per hectare and results showed that GAP trained farmers are more profitable (PHP 52,107.09 or USD 999.56 per hectare) than the non-GAP trained (PHP 23,684.02 or USD 455.11 per hectare) during dry season. Based on the regression analysis, profitability was significantly affected by educational attainment, adoption to GAP, and availability of irrigation for vegetable production. The study highly recommends to further improve the implementation of the good agricultural practices certification program to the vegetable farmers in Dalaguete, Cebu.

***Keywords*:** profitability, good agricultural practices, gross margin

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Received: May 12, 2022 | Revised: December 27, 2022 | Accepted: December 30, 2022

1. INTRODUCTION

Cabbage, technically known as *Brassica oleracea*, is one of the high-value vegetable crops in the Philippines. It is a leafy green or purple biennial plant, grown as an annual vegetable crop. It is believed to have originated in Eastern Mediterranean (Mabry, 2021). Cabbage is now grown throughout the world with approximately 70,862,165 metric tons total production in 2020 (FAOSTAT, 2022). It is a popular vegetable throughout the world because of its adaptability to a wide range of climatic conditions and soil types, ease of production and storage, and its food value. Cabbage is a good source of vitamin C, vitamin K, folate, and vitamin B6, and widely recognized for its therapeutic benefits (Stefan & Ona, 2020). Known for its anti-inflammatory properties, cabbage is also utilized for medicinal purposes such as treatment for constipation, gastric ulcer, reduction of cholesterol, as well as helps reduce the risk of cancer. Cabbage has anti-aging properties as well which helps in repairing damaged skin. The entire plant can be consumed cooked or raw as a salad.

In 2020, the top 10 producers of cabbage in the world in terms of area harvested were China, India, Angola, Russia, Ukraine, Indonesia, Ethiopia, South Korea, Vietnam, and Japan, respectively (FAOSTAT, 2022). In the same year, Asia contributed around 77.42% in the total world production of cabbage, wherein Philippines contributed about 0.24% to Asia's total production (FAOSTAT, 2022). Philippines is self-sufficient with cabbage production ever since. In fact, the country was exporting cabbage way back in the early 90's, however cabbage exportation halted thereafter. The top five (5) producing regions of cabbage in the country are the Cordillera Administrative Region (77.91%), Central Visayas (6.21%), Northern Mindanao (5.95%), Davao Region (3.71%), and Ilocos Region (2.53%) in 2020 (PSA, 2022). The province of Cebu has the largest share of cabbage production in terms of area harvested (72.63%) in the whole Central Visayas region. Majority of the cabbage production in Cebu hails from Dalaguete.

Dalaguete is a first-class municipality (CMCI, 2022) and is also known as the "vegetable basket" in the province of Cebu (Benavente, 2009). Around 2,919 ha (18.84%) of total land area (15,496 ha) of Dalaguete is devoted for agriculture production (PSA, 2022; COA, 2021). Among the thirty-three barangays of Dalaguete, Mantalongon and the adjacent highlands supply fresh vegetables to the city including chayote, carrots, cabbage, scallion and other high-value crops such as bell pepper, lettuce, celery, and cauliflower.

The conventional way of producing cabbage allows the farmers to use chemical fertilizers, pesticides, herbicides, and other chemical products which are believed to help harvest high yield and reduce risk management. However, these practices are also contributors to environmental destruction such as soil degradation, pollution, and loss of biodiversity (Chausali & Saxena, 2021; Kobierski et al., 2020; Lichtenberg et al., 2017; Foley et al., 2011). Moreover, there are issues on chemical residue on food products caused by these chemical inputs which are assumed to peril the health of both consumers and producers (DA RFU-7, 2015).

Organic farming is an agricultural method which prohibits the use of synthetic fertilizers and pesticides, genetically modified seeds and breeds, preservatives, and additives (FAO, 2022). This approach minimizes the potential environmental and social impacts of agricultural production by using site-specific management practices that promotes sustainable soil fertility rather than utilizing synthetic and off-farm inputs, such as biological fertilizer inputs and management practices including returning crop residues to the soil, integration of nitrogen-fixing legumes through intercropping and cover cropping, and crop rotation to improve soil quality and build soil organic matter (FAO, 2022). Although organic farming is characterized by lower yields and input use, it is distinguished for its higher output prices compared to conventional systems (Belasco & Schahczenski, 2021; Durham & Mizik, 2021; Roos et al., 2018; Seufert & Ramankutty, 2017; Reganold & Wachter, 2016; Nemes, 2009). Organic food products frequently bring higher prices in the market, with net economic returns often equal to or higher than that of conventionally grown crops (Pimentel et al., 2005).

Nurhidayati et al., (2016) showed that the application of various vermicomposting had significantly ($p<0.05$) higher yields and quality of cabbage than the inorganic treatment. Several studies on crop production also found that application of GAP results to higher economic value (Ndungu et al., 2013; Laosutsan et al., 2019; Teck et al., 2021).

There is a growing concern by governments, retailers, and consumers about the safety and quality of food (McDougall et al., 2019). Since products are resourced on a global scale, hence it is important that the origin of the products as well as all the treatments during production can be traced and that the production methods can be verified. Thus, it is fundamental to address food safety beginning from the farm level. Implementing good practices during on-farm production and post-production processes is essential in guaranteeing a safe food supply. The Good Agricultural Practices (GAP) is a "collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agriculture products, while taking into account economic, social and environmental sustainability" (FAO, 2016).

In 2006, the ASEAN introduced the program called "ASEAN Good Agricultural Practice standard (ASEAN GAP)" and published the module titled: "Good Agricultural Practices for the Production of Fresh Fruits and Vegetables for the ASEAN Region" (AADCP, 2015). The ASEAN GAP standard promotes safe and quality fruit and vegetables and eases the trade flow between ASEAN member states. In the Philippines, it is called Phil GAP (Philippine Good Agricultural Practices) and is based on compliance to certain standards on farm structure, environment and maintenance, farming practices and farm management (BAFS, 2017). The beneficiaries in this program are farmers and their families. It is believed that with GAP, they will obtain healthy and good quality produce (Kilic et al., 2020; Laosutsan et al., 2019), thereby generating value addition in their products and better access to markets. In 2015, a total of 82 farms (e.g., farms in Dalaguete, Cebu) were issued as GAP certified across the country (Palizada, 2016).

This study generally aimed to assess the profitability of GAP trained farmers planting cabbage in Dalaguete, Cebu. Specifically, it aimed to (1) describe and the socioeconomic and farm characteristics, (2) compare profitability of GAP trained and non-GAP trained farmers, (3) determine the factors affecting profitability; and (4) provide inputs for policy makers that could enhance the implementation of Good Agricultural Practices (GAP) in cabbage production.

2. METHODOLOGY

This study covered selected barangays of the municipality of Dalaguete, Cebu and the data collected was based on the 2017 cropping period. The gross margin comparison for both cohorts was further subdivided to wet season (May to December) and dry season (January to April) scenarios. Sustainability and distribution of the products were also evaluated in this study.

Location and Respondents

This study was conducted in Dalaguete, Cebu located in Central Philippines from January to June 2018 (Figure 1). The study considered all the farmers who are engaged in cabbage farming and employed Slovin's sampling technique in getting the number of respondents. Twelve villages or locally known as barangays with GAP and Non-GAP farmers were included in the study namely Babayongan, Bulak, Caleriohan, Caliongan, Dugyan, Langkas, Mantalongon, Nalhub, Tabon, Dumalan, Manlapay, Catolohan.

The error tolerance used in this study was 0.10. The population of the study was composed of GAP and non-GAP farmers (308), in which 124 were considered as GAP trained. However, the study only obtained 84 GAP-trained and 61 non-GAP trained cabbage farmers who voluntarily responded to the survey. Other respondents were unavailable for the interview and some choose not to participate in the survey. Prior to the interview, respondents were informed about the objectives of the study, how the data will be stored and assured of the confidentiality of collected information.

Figure 1. Location of Dalaguete, Cebu City, Philippines (Google, 2022).

Profitability and Determinants

The profitability assessment among cabbage farmers in Dalaguete, Cebu was evaluated using the profit function. Profit is mainly determined by two factors, revenue and cost. Profit function can be expressed as:

$$\Pi = TR - TC$$

where, Π = profit; TR = total revenue; TC = total cost. Under the assumption of perfect competition, TR = P*Q where Q is the quantity sold and P as the market-determined price, while Total Cost (TC) is composed of the fixed costs (FC) and variable costs (VC). Thus,

$$\Pi = P(Q) - [FC+VC]$$

For this assessment, only variable costs were considered because the data collection is for only 1 cropping year (Castillo et al., 2021).

Cabbage has the highest production among the high-value crops in Dalaguete, Cebu. Farmers are highly dependent on high-value crops, especially cabbage, which serves as their major source of income. Hence, this study aimed to assess the profitability in applying good agricultural practices (GAP) on cabbage farms in the area.

Figure 2 shows the factors affecting the profitability of cabbage production, such as economic, socio-demographic, management constraints, and institutional factors (Xaba & Masuku, 2013; Centes et al. 2017; Diacamos et al., 2021). Socio-demographic factors include age, gender, education, farm experience, and tenure status. Economic Factors include capital investments and off-farm income. Institutional factors include technical assistance, affiliation of organizational, and credit. Management constraints include water management, variety used, cropping season, and timely input purchase.

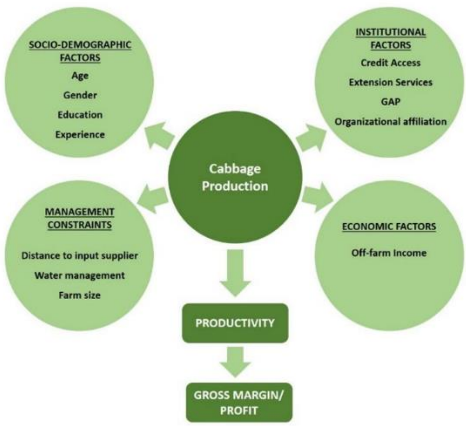

Figure 2. Schematic diagram of factors affecting profitability of cabbage farmers with respect to gross margin in Dalaguete, Cebu.

The regression model for evaluating the determinants of profitability is expressed as follows:

$$Yi = \beta_0 + \beta_1 FAGE + \beta_2 FGEN + \beta_3 FEDUC + \beta_4 FEXPYRS + \beta_5 UFAR + \beta_6 WM + \beta_7 GAP + \beta_8 ORGAFFIL + \beta_9 CREDIT + \beta_{10} OFARINC + \beta_{11} EXTSRVCS + \beta_{12} DISTOFSUP + \varepsilon_i$$

where:

Yi	=	profitability measures as the gross margin of cabbage per hectare (kg/ha)
FAGE	=	farmer's age (years)
FGEN	=	farmer's gender dummy (0 for female, 1 for male)
FEDUC	=	farmer's education (years)

FEXPYRS	=	farming experience (years)
UFAR	=	farm size
WM	=	Water management dummy; 1 irrigated, 0 not irrigated
GAP	=	good agricultural practices dummy; 1 trained, 0 not trained
ORGAFFIL	=	organizational affiliation dummy (1 for affiliated, 0 for not affiliated)
CREDIT	=	credit access dummy (1 for availed loans, 0 didn't availed loans)
OFARINC	=	off farm income dummy (Pesos)
EXTSRVCS	=	extension service dummy (1 for access, 0 for no access)
DISTOFSUP	=	distance of input supplier (km)
β_i	=	regression coefficients
ε_i	=	residuals or remaining error

3. RESULTS AND DISCUSSION

The study interviewed a total of 145 cabbage-farmer respondents, 84 GAP-trained and 61 non-GAP trained. On average, the farmers were in their late forties (47-48 years old) and majority (85.51%) of the cabbage farmers were male.

All GAP-trained and majority (93%) of non-GAP trained farmer respondents were primarily engaged in cabbage farming. Aside from cabbage farming, most of the farmer respondents also had other sources of household income including earnings from sari-sari store, restaurant, family remittance, and wage labor.

Table 1 presents the frequencies for credit access, technical assistance received, and affiliation with organizations focused on high-value crops farming of the farmer respondents. Majority of the GAP-trained (72.62%) and non-GAP trained (86.89%) cabbage farmers relied much on their own resources to finance their farming. The sources of credit for those who availed loans to finance their cabbage farming are rural and local banks, associations, friends, and contact traders—wherein most of the GAP-trained (65.22%) availed it from their respective associations, while most of the non-GAP trained (62.50%) cabbage farmers availed it from friends.

More than half of the GAP-trained farmers (67.86%) were affiliated to organizations related to high-value crops farming. Most of the GAP-trained (67.86%) farmers were influenced by the non-government organizations (NGOs) to engage in cabbage farming, while the rest were influenced by Department of Agriculture – Regional Field Unit 7 (DA-RFU7) (16.66%) and Municipal Agriculture & Natural Resources Office (MANRO)-Dalaguete (15.48%). All of the non-GAP trained farmers were mainly influenced by the NGOs to engage in cabbage farming.

All GAP-trained cabbage farmers received technical assistance from NGOs (67.86%), DA-RFU7 (16.66%), and MANRO-Dalaguete (15.48%), while all non-GAP (60.66%) trained cabbage farmers who received technical assistance were mainly from the NGOs. The technical assistance given by the NGOs and DA technicians included trainings and seminars related with good agricultural practices (GAP), provision of information, education, and communication (IEC) materials such as leaflets related to production of high-value crops. In addition, the Department of Agriculture (DA) technicians did the supervision and monitoring to ensure that the implementations were done correctly and to determine if further help was necessary.

Table 1. Access to credit, affiliation with organizations related to high-value crops farming, and technical assistance among the GAP and non-GAP trained cabbage farmer-respondents in Dalaguete, Cebu, 2017.

VARIABLES	TYPE OF CABBAGE FARMER					
	GAP Trained		Non-GAP trained		Total	
	n	**%**	**n**	**%**	**n**	**%**
Credit						
Availed	23	27.38	8	13.11	31	21.38
Did not availed	61	72.62	53	86.89	114	78.62
Total	84	100	61	100	145	100
Sources of credit						
Rural or Local Bank	2	8.7	-	-	2	6.45
Association	15	65.22	-	-	15	48.39
Friends	4	17.39	5	62.5	9	29.03
Contact traders	2	8.7	3	37.5	5	16.13
Total	23	100	8	100	31	100
Affiliation with organization/association						
Affiliated	57	67.86	12	19.67	69	47.59
Not affiliated	27	32.14	49	80.33	76	52.41
Total	84	100	61	100	145	100
Agency which influenced farming of cabbage						
NGO	57	67.86	37	60.66	94	64.83
DA-RFU7	14	16.66	-	-	14	9.66
MANRO-Dalaguete	13	15.48	-	-	13	8.97
None	-	-	24	39.34	24	16.55
Total	84	100	61	100	145	100
Sources of technical services / assistance						
NGO	57	67.86	37	60.66	94	64.83
DA-RFU7	14	16.66	-	-	14	9.66
MANRO-Dalaguete	13	15.48	-	-	13	8.97
None	-	-	24	39.34	24	16.55
Total	84	100.00	61	100	145	100

**Multiple response*

Table 2 shows the farming characteristics of the cabbage farmers. The GAP-trained farmers' experience in cabbage production ranges from 2 to 40 years and with a mean of around 19 years wherein two (2) years were spent implementing good agricultural practices, while the non-GAP trained farmers' experience in cabbage production ranges from 5 to 40 years and averaging around 20 years. The bulk of GAP-trained (67.86%) cabbage farmers were owner-operators and the rest operates as tenants. Likewise, considerable number of the non-GAP trained (80.33%) cabbage farmers were owner operators, while 19.67% were tenants.

The cabbage farms obtained water through irrigation (53.80%) and rainfed (46.20%). As shown in Table 2, the GAP-trained cabbage farmers owned approximately 0.27 ha of farm land, while the non-GAP trained cabbage farmers owned around 0.32 ha of farm land. These estimates are implications that the farmer respondents were just small farm holders.

Table 2. Farming characteristics of GAP-trained and non-GAP trained cabbage farmer respondents in Dalaguete, Cebu, 2017

VARIABLES	TYPE OF CABBAGE FARMER					
	GAP Trained		Non-GAP trained		Total	
	n	%	n	%	n	%
Average cabbage farming experience (years)	19.38		20.02		19.7	
Average experience in cabbage farming with GAP (years)	2				2	
Tenure status						
Owner-operator	57	67.86	49	80.33	106	73.10
Tenant	27	32.14	12	19.67	39	26.90
Total	84	100.00	61	100.00	145	100.00
Source of Water						
Rainfed	35	41.70	32	52.50	67	46.20
Irrigated	49	58.30	29	47.50	78	53.80
Total	84	100.00	61	100.00	145	100.00
Average Area (ha)		0.27		0.32		0.295
Average distance of farm from farmer's residence (km)		0.94		1.64		1.29
Average distance of farm from National/provincial road		0.63		0.98		0.81
Average distance of farm from nearest supplier of agricultural inputs		6.54		3.66		5.10

The GAP-trained farmers resided near their farms with an average distance of 0.94 km, while non-GAP trained farmers lived relatively farther from their farms with an average distance of 1.64 km. The farms of the farmer respondents were directly accessible to the national road. The GAP-trained and non-GAP trained farmers were approximately 0.63 and 0.94 km away from the national road, respectively.

The farmer respondents did not have any problem regarding accessibility to transportation. From the cabbage farm, the GAP-trained would take an average of 6.54 km distance to get to the nearest agricultural input suppliers, market, or town, while it would take an average of 3.66 km distance for the non-GAP trained.

Table 3 presents the production and management practices of the GAP and non-GAP trained farmer respondents. All farmer-respondents practiced the conventional way of seedbed preparation through on-land method, locally known as *taguran*, with fungicide and pesticide treatment on the seed to ensure the highest percentage of seed germination. The fungicide and pesticide treatment on the seed practice is permitted by the standard set by the MANRO in line with GAP.

With respect to land preparation, all GAP-trained cabbage farmers used manual clearing of weeds, however three-fourths of the non-GAP trained used chemical weedicide. Nonetheless, all of the farmers applied hilling up (*law-ang*) as preparation for transplanting.

Only 15.48% of the GAP-trained applied organic fertilizer after planting such as chicken dung and vermicast as prescribed by the technician, while 84.52% used inorganic, and 22.62% applied a combination of both. Though the organic fertilizer practice can be beneficial, it can also lead to formation of fungi that can cause rotting of the crop if not properly used and especially during unfavorable weather. All of the non-GAP trained cabbage farmers applied inorganic fertilizer only. For pest control, only 4.76% of the GAP-trained used organic pesticide, while the rest of the GAP-trained and non-GAP trained farmers used synthetic pesticide. It can be observed that GAP adoption has still poor performance in terms of pesticide usage, pesticide residue analysis conducted on cabbage farms in Thailand found that there was no discernible difference between the GAP and non-GAP farms (Amekawa et al., 2021).

All of them practiced manual transplanting method with 55 cm x 55 cm planting distance and with only one seedling per hill, which is common and a recommended practice to prevent nutrient competition and produce a high number of healthy seedlings. The reserved seedlings will be used to replace those that will not survive during the early stage of planting. Harvesting was still done through manual method.

Table 4 presents the comparative gross margin analysis of cabbage yield between GAP-trained and non-GAP trained cabbage farmers during the dry season. The GAP-trained farmers obtained higher yield than the non-GAP trained farmers (10,250.47 kg & 10,055.72 kg, respectively). The variable costs included labor payments from land preparation to hauling, fertilizers (organic and inorganic), pesticides, and irrigation. The GAP-trained farmers had lower production expenses (₱173,493.25 or $3,333.84) than non-GAP trained farmers (₱177,105.59 or $3,403.26).

The average gross margin for both cohorts during the dry season was noticeably high with 21.60% net return on every peso spent for production. Overall, the gross margin of GAP-trained (₱52,017.09 or $999.56) was substantially higher—more than two folds higher than non-GAP trained farmers (₱23,684.01 or $455.11). These results can be attributed by the higher yield and higher selling price obtained by GAP-trained at ₱22.00 ($0.42), while non-GAP trained got a relatively lower rate at ₱19.97 ($0.38) only. Moreover, GAP-trained farmers obtained higher price because their cabbage products was marketed by the institutional buyers which non-GAP trained farmers lacks connection with. Direct input costs were comparably the same for both groups.

Table 3. Production and management practices of the GAP and non-GAP trained farmer respondents in Dalaguete, Cebu, 2017

Variables	TYPE OF CABBAGE FARMER					
	GAP Trained		Non-GAP trained		Total	
	n	%	n	%	n	%
Land preparation						
Manual clearing of weeds	84	100.00	15	24.59	99	68.28
Apply Chemical weedicide			46	75.41	46	31.72
Total	84	100.00	61	100.00	145	100.00
Hilling up *(law-ang)*	84	100.00	61	100.00	145	100.00
Organic inputs						
Applied	26	30.95	-		26	17.93
Did not apply	58	69.05	61	100.00	119	82.07
Total	84	100.00	61	100.00	145	100.00
Fertilization						
Inorganic	71	84.52	61	100.00	132	91.03
Organic	13	15.48	-		13	8.97
Combination*	19	22.62			19	13.10
Pest control						
Synthetic pesticide	80	95.25	61	100.00	141	97.24
Organic pesticide	4	4.76	-	-	4	2.76
Total	84	100.00	61	100.00	145	100.00

**Multiple response*

Based on the results, the performance of the GAP-trained farmers showed that the farmers can gain positively and are more profitable than non-GAP trained farmers. The data just shows that GAP-trained cabbage farmers were able to reap the benefits of adopting GAP.

As shown in Table 5, the cabbage yield for both cohorts during the wet season was relatively lower compared to their harvest during the dry season. The GAP-trained farmers obtained higher yield than the non-GAP trained farmers (10,169.04 kg & 9,960.22 kg, respectively).

Table 4. Gross margin analysis of GAP and non-GAP trained cabbage farm-respondents in Dalaguete, Cebu during Dry season, 2017

Item	Dry Season					
	GAP Trained		Non-GAP trained		Mean	
	(PhP)	(USD*)	(PhP)	(USD*)	(PhP)	(USD*)
Yield per hectare		10,250.47 kg		10,055.72 kg		10,153.10 kg
Price per kilo	22.00	0.42	19.97	0.38	20.98	0.40
Gross Revenue	225,510.34	4,333.40	200,789.60	3,858.37	213,051.02	4,093.99
Land preparation						
Clearing of weed	2,445.23	46.99	4,008.20	77.02	3,226.72	62.00
Manual *(law-ang)*	4,869.05	93.56	4,956.04	95.24	4,912.55	94.40
Seeds	2,869.04	55.13	2,989.67	57.45	2,929.36	56.29
Pesticides	66,356.85	1,275.11	67,250.60	1,292.29	66,803.73	1,283.70
Fertilizers	27,525.56	528.93	28,557.78	548.77	28,041.67	538.85
Labor requirements						
Planting	934.52	17.96	979.83	18.83	957.18	18.39
Spraying	6,434.52	123.65	6,754.91	129.80	6,594.72	126.72
Irrigation	745.45	14.32	723.78	13.91	734.62	14.12
Harvesting	9,772.61	187.79	9,950.82	191.21	9,861.72	189.50
Irrigation						
Water	732.73	14.08	711.96	13.68	722.35	13.88
Transport						
To market	10,217.26	196.33	10,070.96	193.52	10,144.11	194.93
Total Variable Cost	173,493.25	3,333.84	177,105.59	3,403.26	175,299.42	3,368.55
Gross Margin	₱52,017.09	$999.56	₱23,684.01	$455.11	₱37,751.60	$ 725.43

*Note: 1 USD = 52.04 (BSP, 2022). Average rate from February-June 2022.

Based on the variable cost figures, pesticide cost of non-GAP trained farmers (₱76,580.33 or $1,471.57) was higher than GAP-trained (₱75,545.24 or $1,451.68). The relatively higher pesticide cost as compared during the dry season was due to infestation of pests and diseases caused by the rainy season. Also, expenditure for fertilizer of non-GAP trained farmers (₱28,490.16 or $547.47) was higher than of GAP-trained farmers (₱20,732.74 or $398.40). Accordingly, GAP-trained farmers' total variable cost was ₱161,438.32 ($3,102.20) which is 7.70% lower than the non-GAP trained farmers' (₱174,911.59 or $3,361.10).

The average gross margin for both cohorts during the wet season was evidently at a loss, with approximately 11.69% net loss on every peso spent for the cabbage production. Overall, the gross margin of GAP-trained (-₱10,645.69 or -$204.57) was substantially higher by 66% compared to non-GAP trained farmers (-₱31,318.09 or -$601.81), however both are still in the bad light because the figures are evidently at a loss.

Table 5. Gross margin analysis of GAP and non-GAP trained cabbage farmers in Dalaguete, Cebu during wet season, 2017

Item	Wet Season					
	GAP Trained		Non-GAP trained		Mean	
	(Php)	(USD*)	(Php)	(USD*)	(Php)	(USD*)
Yield per hectare	10,169.04 kg		9,960.22 kg		10,064.63 kg	
Price per kilo	14.83	0.28	14.42	0.28	14.62	0.28
Gross Revenue	150,792.63	2,897.63	143,593.50	2,759.29	147,193.07	2,828.46
Land preparation						
Clearing of weed	1,930.95	37.11	4,178.33	80.29	3,054.64	58.70
Manual *(law-ang)*	4,762.62	91.52	4,980.32	95.70	4,871.47	93.61
Seeds	2,869.05	55.13	2,909.84	55.92	2,889.45	55.52
Pesticides	75,545.24	1,451.68	76,580.33	1,471.57	74,562.79	1,432.80
Fertilizers	20,732.74	398.40	28,490.16	547.47	24,611.45	472.93
Labor requirements						
Planting	967.26	18.59	995.08	19.12	981.17	18.85
Spraying	6,365.47	122.32	6,990.16	134.32	6,677.82	128.32
Irrigation	722.73	13.89	726.98	13.97	724.86	13.93
Weeding	9,607.14	184.61	9,639.34	185.23	9,623.24	184.92
Harvesting	27,142.67	521.57	28,718.70	551.86	27,930.69	536.72
Irrigation						
Water	734.10	14.11	748.03	14.37	741.07	14.24
Transport						
To market	10,058.35	193.28	9,954.32	191.28	10,006.34	192.28
Total Variable Cost	161,438.32	3,102.20	174,911.59	3,361.10	168,174.96	3,231.65
Gross Margin	-₱10,645.69	-$204.57	-₱31,318.09	-$601.8	-₱20,981.89	-$403.19

*Note: 1 USD = 52.04 (BSP, 2022)

These negative results can be attributed by the higher costs, low yields, and significantly lower buying prices (i.e., ~₱14.00 or ~$0.27) during the wet season. Nonetheless, the results from the non-GAP trained farms then showed that the farmers would have more loss especially during the rainy season due to their conventional way of farming practices, as compared to the GAP-trained farmers.

The GAP-trained farmers were more knowledgeable in pest and disease control and fertilizer application; hence they were able to better control production input usage and consequently lowered their production expenditures.

Table 6 shows the mean gross margin difference between GAP-trained and non-GAP trained cabbage farmers. T-test results reveals that indeed the mean difference in the gross margin between GAP-trained and non-GAP trained was statistically significant at 0.05% level of significance during the dry season. Similarly, studies of Bairagi et al. (2018) and Teck et al. (2021) found that GAP adoption significantly increases farm profitability.

Table 6. T-test for gross margin GAP and non-GAP trained cabbage farmers in Dalaguete, Cebu 2017

Variable	Sig.	t	df	Mean Difference	Std. Error Difference
Gross margin Equal variance assumed	0.012***	2.767	143	28,333.08	10,239.64

**** Significant at $\propto = 0.05$*

The multiple linear regression analysis was used to determine the factors affecting the profitability of the gross margin among GAP and non-GAP trained cabbage farmers. Table 7 shows that the independent variables used was able to explain about 69% of the variation on the gross margin and is highly significant. The model was fit and valid after running the diagnostic test. Variables such as farmers' age, farmers' gender, farmers' educational attainment, farmers' experience, farm size, GAP trained, irrigated, income from other sources, and distance to input suppliers were positively related to gross margin. However, organizational affiliation, credit access, and extension services have negative relationship with the gross margin.

Moreover, only three variables have significantly influenced the gross margin such as farmer's educational attainment, irrigation, and being GAP-trained farmer. This means that farmers with higher educational attainment, farms with irrigation system, and farmers that were GAP-trained tend to be more profitable than those who are not. This result is also similar with Sitorus et al. (2020), that farmers who were more educated and were more active in participating in GAP activities were more likely to reap the benefits of GAP. Additionally, to increase the number of GAP farms, the government should encourage farmers by enhancing water quality, creation of irrigation systems, and water storage dams for agriculture in order to increase farmers' capacity and lower the cost of agricultural production (Laosutsan et al., 2019; Giles et al., 2019).

Table 7. Factors affecting the gross margin between GAP and non-GAP trained cabbage farmers in Dalaguete, Cebu

Variable	Coefficient	Standard error
Constant	-104581.11	56,601.83
Farmers' Age	449.13	973.25
Farmers' Gender	29,005.63	21,969.30
Farmers' Educ. Attainment	6,170.47*	3,664.65
Farmers' Farming Experience	862.24	1,059.24
Farm size	9,429.43	25,681.99
Irrigated	58,727.32***	16,634.15
GAP-trained	58,666.03**	27,894.90
Organizational Affiliation	-12,353.24	17,818.52
Credit Access	-8,006.15	19,305.04
Income from other sources	1.01	1.25
Extension services	-28,860.22	28,039.25
Distance to input supplier	1,595.81	1,799.34
R squared	0.690	
Sig.	0.002***	

****, **,* Significant at ά = 0.01 , 0.05, and 0.10, respectively*

4. CONCLUSION AND RECOMMENDATION

Results of the study showed that GAP trained cabbage farmers obtained higher gross margin than the non-GAP trained cabbage farmers during the two cropping seasons. Average gross revenue for both cohorts during the dry season was higher than during the wet season, because of lower prices and yields (₱213,170.48 and ₱147,193.07, respectively). Total variable cost during dry season was also higher than during wet season due to higher input usage of fertilizers and pesticides (₱175,299.50 and ₱166,674.99, respectively). Overall, the GAP-trained were able to use the inputs efficiently, hence obtaining the desired output. T-test results showed that the mean difference in terms of gross margins was significant between GAP-trained and non-GAP trained cabbage farmers.

The major problems encountered by the farmer-respondents were low price of cabbage, pest and diseases, and natural calamities such as typhoon that brings strong wind and heavy rains. The farmers engaged in cabbage production have adequate farming experience and quite financially capable, they applied combined conventional and organic methods of production practices to obtain maximum output. However, some farmers applied more than the recommended amount, because they felt that those inputs can increase yield especially the non-GAP trained farmers.

The highest possible gross margin was obtained by the GAP-trained cabbage farmers that lead them to be more profitable than the non-GAP trained farmers (₱52,107.09 and ₱23,684.02, respectively). Additionally, multiple linear regression was used to analyze the factors affecting profitability. Profitability was significantly affected by farmer's education, being a GAP-trained farmer, and with the availability of irrigation in the farm.

Educational attainment turned out be a significant factor that influences profitability. This suggests that more seminars and trainings would be beneficial to farmers as these will make them more knowledgeable in their production. Also, the GAP program positively influenced the profitability of farmer-respondents. This means that with GAP, farmers will be able to earn more than those are not adopting the GAP.

Based on the results of this study, it is recommended that GAP-trained farmers should continue to apply the production practices. Furthermore, all influential agencies like MANRO and NGOs should encourage other farmers to adopt the GAP technology since it can provide higher returns to the stakeholder farms. Moreover, investment for better irrigation system could also help the area achieve significant returns.

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