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Impact of Intergrated Crop Management (ICM) on the Income of Small-Scale Vegetable Farmers in Cabintan, Ormoc City, Leyte

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ABSTRACT

This study aims to assess the impact of the project titled Integrated Crop Management (ICM) implemented from 2013-2018. The ICM project aimed to increase vegetable profitability and food security in the Philippines particularly in Cabintan, Ormoc City, Leyte. Using quasi-experimental designs, this study compares the income differences of small-scale vegetable farmers between project beneficiaries (Cabintan farmers) and non-beneficiaries (Danao farmers). A total of three hundred ninety-three vegetable farmers were surveyed, of which 253 were from the beneficiary group and 140 were from the comparison group. Descriptive statistics show that farmer respondents are mostly men, married, with an elementary level of education. The average age is 40 years old, with four household members, and farm income ranging from PhP 6,000 to PhP 12,000 per month. Women are involved in farming activities including land preparation, seedling raising, field mulching, crop fertilization, protective cropping, irrigating, pest control, and marketing. Multiple linear regressions reveal that the socio-economic background, the use of manure in production, and water management are important factors in explaining the increased farm income of vegetable farmers. To estimate the impact of the project intervention, the propensity score matching with the nearest neighboring technique was used. Results reveal that the ICM project was able to increase vegetable farm income by PhP35,098.23 per hectare per year. Because of this, local government units and stakeholders may consider providing training related to integrated crop management to boost the income of small-scale farmers.

Keywords: Integrated Crop Management, Vegetable Farming, Propensity Score Matching

INTRODUCTION

The Australian government's project HORT 2012/020, also known as "Integrated Crop Management (ICM) to enhance vegetable income and food security in Southern Philippines and Australia," aimed to help smallholder vegetable farmers in the southern Philippines improve their livelihoods and food security (McDougall et al 2019). The ICM project has five major objectives including: (1) to increase the income of the small-scale vegetable farmers through integrated crop

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management (ICM), (2) develop component technologies for the management of key insect pests and diseases, (3) develop a commercial clean seed potato production system, (4) develop component technologies for the management of key agronomic constraints for each target site, and (5) build capacity in ICM skills and research capacity with collaborative Philippine Organizations (McDougall et al 2019). This is to address the challenges of small-scale farmers in increasing production because of changing climatic conditions, increasing prices in farm inputs, and many other factors (Castillo et al 2021; Diacamos et al 2021; Giles et al 2019; Ruales et al 2020).

The ICM intervention program trained farmer beneficiaries on growing vegetables using protected cropping structures, seedling production methods, bed mulch, soil amendments, irrigation systems, and grafting rootstock. McDougall et al (2019) discovered that ICM directly improved the economics of smallholder farmers in the Philippines' south. ICM is environmentally-friendly in farming because it improves ground cover, prevents soil erosion, produces fertile soil, efficient fertilizer, genetic diversity, and controls deforestation. Protected cropping structures produce more survival seedlings than open field farms because they create a conducive environment for plant health and growth. They may also provide economic, environmental, and social benefits (Rabbi et al 2019). The seedling production method is critical in producing high-quality young plants that can grow with high-value products during crop establishment (Adesina et al 2020). Keeping the plot covered with bed mulch keeps the soil from being eroded which helps retain the soil moisture and even eliminate the growth of weeds around the plant (Khan et al 2022). Irrigation reduces labor in maintaining plant moisture as it grows (Cypher et al 2023). Grafting root stock allows the plant to bear fruits at a very young stage (Albornoz 2020).

This research aims to evaluate the impact of Integrated Crop Management (ICM) on the income of the small-scale vegetable farmers in Cabintan, Ormoc City, Leyte and compare this with the income of non-beneficiaries in Danao, Ormoc City, and Leyte. This presented the characteristics of vegetable farmers, identified gender roles in farming, identified factors that affect the income of small-scale vegetable farmers, estimated the impact of intercropping management on the income of small-scale vegetable farmers, and provided inputs and recommendations for enhancing vegetable farm income in Ormoc City, Leyte.

METHODOLOGY

Location and respondents

The study was conducted in Cabintan and Danao, which are vegetable-growing barangays in Ormoc City. Cabintan has a population of 2,623 people (2020 Census) and 484 households (2015 Census). Cabintan is located on the island of Leyte at approximately 11.0835, 124.7209. The elevation at these coordinates is estimated to be 645.7 meters (2,118.4 feet) above mean sea level, and it shares a border with barangay Danao. According to the 2020 Census, barangay Danao has a population of 2061 people and 379 households, according to the 2015 Census. Danao is located onthe island of Leyte at approximately 11.0726, 124.7014. At

these coordinates, the elevation is estimated to be 698.1 meters or 2,290.3 feet above mean sea level. Participants in this study included Cabintan and Danao vegetable farmers, the barangay local government unit, and the researcher. This study included two groups of vegetable farmers: the beneficiary group (Cabintan) and the non- beneficiary group (Danao), both of whom were considered small-scale vegetable farmers. Respondents in Cabintan were farmers who were able receive intervention through attendance in various ICM capacity-building activities and farming field school. In comparison, farmers in Danao did not participate in these interventions.

Sample size

This study adapted Israel's (2018) study from the University of Florida, in which he explains the use of Cochran sampling in an assumed large population with unknown variability to estimate the number of farmers who want to adopt the new practice. The computation of the targeted sample size was based on the 2,072 farmers trained during the training but only 968 received inputs to replicate the ICM farming. The 968 farmers represented roughly half (46.72 %) of the trained farmers. Using the proportion of farmers provided and the highest variability of 0.5 for p and q, a desired precision of or margin of error of 0.05, and a confidence level of 95 %, the sample size is 385 vegetable farmers. However, because the sample size was greater than desired in this study, the margin of error was reduced, resulting in more accurate results (Islam, 2018). Cabintan has 253 vegetable farmers, who account for 52% of the household population while only 45.54% of the barangay's population in Danao took part in the study.

Table 1. Distribution of Respondents by Address

GROUP	NUMBER OF HOUSEHOLD	SAMPLE	PERCENTAGE
Cabintan	484	253	52.25%
Danao	379	140	36.93%
Total	863	393	45.54%

Primary and secondary data were used in this study. Secondary data included a list of vegetable farmers in the barangay so that respondents could be easily identified. This information was obtained from barangay officials. The primary data in this study were the first-hand data gathered by the researchers using a semi-structured questionnaire designed by the researcher. The information was gathered from February to March 2022.

The questionnaire's goal was to assess the impact of integrated crop management (ICM) on vegetable farmers' income in Cabintan, Ormoc City, Leyte. It was developed using information on farming strategies taught to farmers in Cabintan by the project HORT 2012/020 during the farmer field school training. Cabintan and Danao barangay officials assisted in pretesting the questionnaire. The instrument was divided into the following parts: (1) farmer's basic information,

strategies, (4) gender roles in farming, and (3) farmers' recommendations for vegetable farming.

Descriptive statistics, such as frequencies and percentages, mean, standard deviations, and range were used to describe the characteristics of vegetable farmers, household and farming assets profile, gender role in farming, and the amount of time spent by males and females in farming activities. Multiple linear regression explained the factors that influence farm income. The dependent variable was the farm income per hectare in the year 2021 of the vegetable farmers, while the independent variables were the protected cropping structures, seedling production methods, bed mulch and some soil amendments, irrigation systems, a profile of the respondents, and the gender role for farming. If a p-value was less than 0.05 but greater than 0.01, it is a significant factor in explaining vegetable farm income. If the p-value was less than 0.01 and it is highly significant in explaining the vegetable farm income.

Impact Estimation

A quasi-experimental design is an alternative to randomized control trials when the conditions for control trial research are not ethical, viable, or accepted (Heining 2021). In a quasi-experimental approach, propensity score matching compares the differences of the farm income per hectare per year between beneficiaries (Cabintan Farmers) and non-beneficiaries (Danao Farmers). It is as if the researchers were conducting an experiment assuming that VSU intervention through beneficiaries makes a difference in the income of vegetable farmers. Propensity-score matching, one of the most important innovations in developing workable matching methods, allows this matching problem to be reduced to a single dimension (Heinrich et al 2010; Seriño et al 2021). It is a statistical method capable of identifying and reducing the impact of confounding factors (Littnerova et al 2013). It is a valuable statistical methodology that may create an "apples to apples" comparison while reducing bias due to confounding (Staffa et al.2018).

To estimate the impact of integrated crop management on the income of the small-scale vegetable farmers in Cabintan, Ormoc City, Leyte, a propensity score matching (PSM), in which variables will be matched for the comparison of those who were beneficiaries (Cabintan farmers) and non- beneficiaries (Danao farmers), was done. PSM concentrated on the outcome of interest, which in this study was gross income per year per hectare. In the absence of experimental data, the method of propensity score matching was employed to account for the selection bias for observational studies (Dehejia & Wahba 2006). The use of PSM allows to deduce the multidimensional characteristic of matching the beneficiaries and the non-beneficiaries to unidimensional that is interpreted using conditional probability (Rosenbaum & Rubin 1989). The propensity score is an estimate of individual i's probability of being a beneficiary. After computing the propensity score, the second step was matching the beneficiaries and non-beneficiaries. This study used common matching techniques, namely nearest neighbor matching, radius matching, and kernel matching. The common support region and balancing property must be satisfied through propensity scores before

calculating the average treatment effect of the treated. The T-test is used too compare beneficiaries and non- beneficiaries. With the help of statistical packages (SPSS and Stata), the farm income per year per hectare of vegetable farmers in beneficiaries and non- beneficiaries should be comparable. The final algorithm used is the nearest neighboring technique.

Moreover, pros and cons have been identified in using the PSM. Cham et al (2016) highlight that successful propensity score analysis reduces bias in estimating the average treatment effect in a nonrandomized study, making the estimate more comparable with that obtained from a randomized experiment. However, Shipman et al (2017) discovered that in accounting research when the treatment is not binary, PSM tends to confine analyses to a subsample of observations where the effect size is likely to be the smallest. Shipman further explains that it shows innocuous design choices that significantly impact sample composition and estimates the average treatment effect (ATE). Furthermore, Caliendo and Kopeining (2008) suggested that the matching quality must be assessed when doing PSM, and treatment effects and standard errors must be estimated.

Table 2. Socio-demographic profile of the small-scale vegetable farmers

VARIABLE	CABINTAN n = 253		DANAO N=140	
	Frequency	Percentages	Frequency	Percentages
GENDER (%)				
Male	171	67.59	112	80.00
Female	82	32.41	28	20.00
MARITAL STATUS (%)				
Single	62	24.51	36	25.71
Married or Widow	191	75.49	104	74.29
HIGHEST EDUCATIONAL ATTAINMENT (%)				
Elementary Level	81	32.02	50	35.71
Elementary Graduate	70	27.67	2	1.43
High School Level	61	24.11	34	24.29
High School Graduate	25	9.88	15	10.71
College Level	13	5.14	12	8.57
College Graduate	3	1.19	1	0.71
AGE MEAN	39.48		43.12	
Standard Deviations	13.14		13.11	
Range	71 (18 -89)		59 (16 -75)	
HOUSEHOLD SIZE MEAN	4.8		3.83	
Standard Deviations	2.12		1.57	
Range	15 (1 -16)		7 (1 -8)	
HOUSEHOLD INCOME PER MONTH				
MEAN	6,674.21		12,664.9	
Standard Deviations	10,836.18		13,193.88	
Range	119,500 (500 -120,000.00)		99,844 (156 -100,000)	

Table 3 displays the characteristics of the respondents in terms of their farm profile. In Cabintan most are landowners (62.06 %), while in Lake Danao almost all are tenants (93.57 %). Cabintan respondents owned an average of 2.36 machinery, which can vary by 1.67 unit. Their farm experience ranged around 14.92 years, varying by 9.57 years, with an average farm size of 0.52 hectares, varying by 0.45 hectares. Their gross farm income per hectare per year is approximately PhP123,086.9, which may vary by PhP 88,297.4 per hectare, while their farm cost per hectare per year is approximately PhP 78,184.81, which may vary by PhP 55,162.13.

The Danao (non-beneficiary group) respondents owned an average of 0.62 units of machinery per farmer, which could vary by 0.49 units. In this barangay, the repsondent's farm experience is approximately 17.04 years, which may vary by 12.54 years. They cultivate an average of 1.21 hectares per farmer, which may vary by 0.29 hectares. Their farm gross income per year per hectare is on average PhP98,044.02 and can vary by PhP92,619.08, while it can cost them around PhP 51,948.81 per hectare, which can vary by PhP 42,474.39.

Table 3. Farm profile of the small-scale vegetable farmers

VARIABLE	CABINTAN n = 253	DANAO N=140
Land Ownership		
Rent	96 (37.94%)	131 (93.57%)
Owned/ Tenant but Rent Free	157 (62.06%)	9 (6.42%)
Number of Machinery Owned		
Mean	2.36	0.62
Standard Deviations	1.67	0.49
Range	6 (0-6)	1 (0-1)
Farm Experience (Year)		
Mean	14.92	17.04
Standard Deviations	09.57	12.54
Range	44 (1-44)	58 (2-60)
Farm Size (ha)		
Mean	0.52	1.21
Standard Deviations	0.45	0.29
Range	2.875 (0.125 -3)	2.75 (0.25 -3)
Farm Gross Income Per Year /ha		
Mean	123,086.9	98,044.02
Standard Deviations	88,297.4	92,619.08
Range	790,000 (10,000.00 -800,000.00)	483,334.00 (6,666.67 – 490,000)
Farm Cost Per Year /ha		
Mean	78,184.81	51, 948.81
Standard Deviations	55,162.13	42,474.39
Range	434,000.00 (6,000.00 -440,000.00)	291,500.00 (8,500 -300,000)

Figure 4 depicts the frequency distribution of crops grown in the study sites. As shown in the graph below, the most common crops grown in Cabintan are Cabbage (37.94 %), Sweet Pepper (32.41%), Chinese Cabbage (30.43 %). There were no Water Spinach, Potato, and Bitter Gourd. On the other hand, Brgy. Danao cultivated Onion (47.86 %), Tomato (29.29 %), Cabbage (22.14 %), Raddish (0.71 %), and Water Spinach (0.71%).

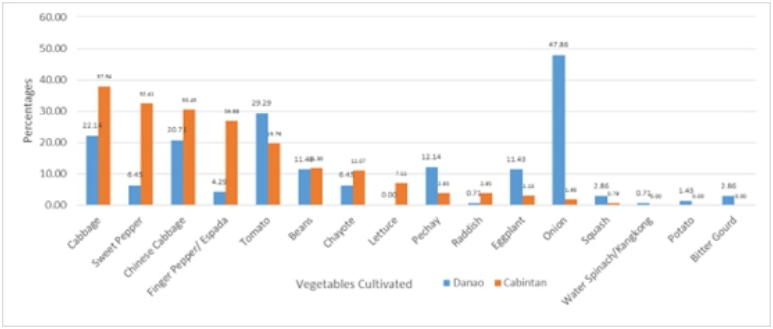

Figure 4. Crops cultivated of small scale vegetable

Table 4 depicts the small-scale vegetable farmers' household asset index. On average, 2.67 people in Cabintan are 18 years old or older the minimum age of domestic employment (Thi et al, 20210), which can vary by 1.35 people. There are around 2.38 people who are 18 years old or younger, which can also vary by 1.35 people. Their household labor force is approximately 2.71, which may vary by 1.62. The average number of female workers per Farmer in Cabintan is 2.67, but this can vary by 1.36. The male labor force in Cabintan is 1.38 on average, but this can vary by 0.85. Cabintan has an average of 0.11 college graduates in terms of educational attainment, which can vary by 0.40. There are on average 0.35 atmost college-level farmers, which can vary by 0.68. In contrast, Cabintan farmers have on average 4.32 below college level farmers, which can vary by 1.79.

The Danao group has on the average 1.78 people who are 18 or older, which may vary by 0.83 people. In comparison, there are only 1.94 people per farmer under 18 years old, which may vary by 0.98 people. Each farmer has an average of 2.09 people working, varying by 1.09 people. An average of 1.24 female worker per farmer, which can vary by 1.09, while an average of 1.24 male worker per farmer, which can vary by 1.08 male worker per farmer. The average Farmer in Danao has 0.12 people who are at least college graduates, which can vary by 0.39 at least college graduates. On average, per Farmer in Danao has only 0.07 people with the highest level of education as the working force, which may vary by 0.27, while below college has 1.65 people on average, which may vary by 0.85 people.

Table 4. Household asset index of the small-scale vegetable farmers

HOUSEHOLD WORKING FORCE	CABINTAN n = 253	DANAO N=140
Age:		
18 years old and above		
Mean	2.67	1.78
Standard Deviations	1.35	0.83
Range	7 (1-8)	4 (1-5)
18 years old below		
Mean	2.38	1.94
Standard Deviations	1.35	0.98
Range	8 (1-8)	5 (1-6)
Household Working Force		
Mean	2.71	2.09
Standard Deviations	1.62	1.09
Range	7 (1-8)	5 (1-6)
Gender		
Female		
Mean	2.67	1.24
Standard Deviations	1.36	1.08
Range	7 (1-8)	4 (0-4)
Male		
Mean	1.38	1.81
Standard Deviations	0.85	1.04
Range	6 (1-7)	4 (0-5)
Educational Attainment		
At least College Graduate		
Mean	0.11	0.12
Standard Deviations	0.40	0.39
Range	3(0-3)	2 (0-2)
At Most College Level		
Mean	0.35	0.07
Standard Deviations	0.68	0.27
Range	4 (0-4)	1(0-1)
Below College Level		
Mean	4.32	1.65
Standard Deviations	1.79	0.85
Range	13 (1-14)	5 (1-6)

In terms of land preparation, the beneficiary group did more tilling (diff= 19.51 %) and harrowing (diff= 20.04 %) (Table 5). In conservation agriculture, tillage should be required to control weeds while growing the crop (Gonzaga et al 2019). However, according to Yadav et al (2017), tilling has no significant effect on yield. Danao, on the other hand, puts in more organic materials (diff =51.06 %). The use of organic fertilizer in farming is estimated to increase the log of productivity and crop income of the household using Propensity score matching (Martey 2018).

Cabintan used seed boxes more, with a percentage difference of 52.27 %, while Danao uses seedling trays and the bagging method more. According to Sengxua et al (2018), farmers adopt direct seeding to save labor, help in timeliness of operations, improve productivity, have lower investments, or a combination of these factors. When it comes to mulching, the non-beneficiary group had a higher rate of adoption that the beneficiary group, with a difference of 82.78 %. The use of mulching without sacrificing crop yields or farmer income could result in a higher crop yield, agriculture net profit, and cost-benefit ratio (Zheng et al 2022). Most program beneficiaries and non- beneficiaries are not using protective cropping, contrary to the findings of the Prakash et al (2020), which found that protective cropping in highly valuable crops is important in increasing farmer productivity and income. Cabintan also used more inorganic materials than Danao, with a 69.22 % difference. The use of commercial fertilizers is quite popular with farmers because of its easy application and fast absorption of nutrients in plants (Seleiman 2021). The beneficiary group continued to use conventional watering, which is sprinkling, with a percentage difference of 54.85 %. This group did more pest control than the non-beneficiary group, including applying pesticides (28.43 %), pruning (40 %), and pulling weeds (1.43 %).

Table 5. ICM adoption of the small-scale vegetable farmers

VARIABLE	CABINTAN n = 253		DANAO N=140		DIFFERENCE
	Freq.	%	Freq.	%	%
Land Preparations					
Tilling	109.00	43.08	33.00	23.57	19.51
Harrowing	226.00	89.33	97.00	69.29	20.04
Putting of Organic Materials	19.00	7.51	82.00	58.57	-51.06
Method of Raising Seedlings					
Direct Seeding	40	15.81	91	65.00	-49.19
Seed Box	220	86.96	48	34.29	52.67
Seedling Tray	9	3.56	48	34.29	-30.73
Bagging	0	0.00	6	4.29	-4.29
Type of Mulching					
Bare Soil	251	99.21	23	16.43	82.78
Hagonoy	0	0.00	11	7.86	-7.86
Rice Hall	0	0.00	0	0.00	0
Silver Plastic	0	0.00	1	0.71	-0.71
Black Plastic	1	0.40	2	1.43	-1.03
Type of Fertilizer Used					
In-organic Fertilizers	242	95.65	37	26.43	69.22
Vermicast	0	0.00	1	0.71	-0.71
Dung	17	6.72	111	79.29	-72.57
Wokozim	0	0	0	0	0
Bio-Green	2	0.79	1	0.71	0.08
Sea Crop	0	0	0	0	0
Wood Vinegar	0	0	0	0	0
Protective Cropping or Open Field					
Open Field	136	97.14	249	98.42	-1.28
High Strength Steel	0	0	0	0	0
Cocolumber	0	0	0	0	0
Flexible Bamboo	0	0	0	0	0
High and Low Tunnels Roofs with Plastic or Net Cover	4	1.58	4	2.86	-1.28
Water Delivery System (Drip or Conventional)					
Sprinkle	152	60.08	61	43.57	54.85
Drip Bottle	42	16.60	34	24.29	-7.69
Drip Hose	62	24.51	53	37.86	-13.35
Pest Control					
Pesticides	240	94.86	93	66.43	28.43
Pruning	127	50.20	14	10.00	40.2
Pulling of Weeds	253	100.00	138	98.57	1.43

Figure 5 depicts the proportion of farmers who used integrated crop management on their farms. ICM was used by only 29.5 % of farmers, as shown in the graph below. ICM is practiced by nearly half of the farmers in Cabintan (43.87%), but only a small percentage of those in Lake Danao (3.57 %). This result indicates that the beneficiaries have implemented farming strategies such as type of land preparations, methods of raising seedlings, mulching materials, type of fertilizers used, protective cropping, type of irrigations, and pest control practices from the Gonzaga et al (2019) project in their farming strategies. Moreover, empirical evidence supports that using ICM such as intercropping, sowing, weeding, water, and retting could significantly increase the livelihood of marginal landholders (Singh et al 2019).

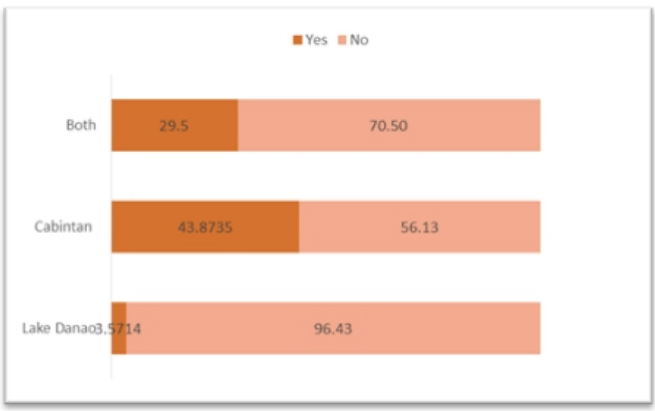

Figure 5. Percentage of small-scale vegetable farmers who applied ICM

Figure 6 shows the percentage distribution of the main crops cultivated by farmers who used intercropping. According to the data gathered, those who use intercropping in their farming commonly planted cabbage as their main crop (30.17 %), followed by Chinese cabbage (25.86 %). The least planted was coconut (0.86 %).

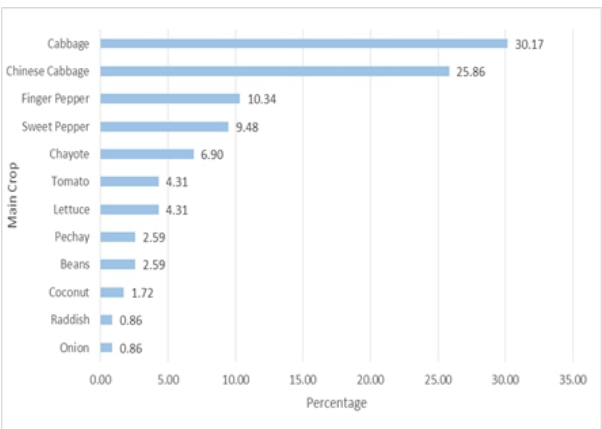

Figure 6. Main crops cultivated for intercropping

Identifying Gender Roles of Farming in Cabintan and Danao, Ormoc City

Figure 7 depicts the percentage distribution of male and female field workers based on farm activities. The figure below clearly shows that most of the farm workers were men. Male labor was concentrated in land preparation (81.6 %), followed by fertilizing the crop (74.2 %), while the least was in harvesting (37.6 %). Females, on the other hand, were primarily involved in marketing (17.60 %), mulching the field (15.2 %), irrigating (12.4 %), and harvesting (6.40 %), with the least involvement in protective cropping (1.4 %). The result supports the study of Seriño et all (2017) where men primarily focused on intensive labor tasks than women. When both male and female workers were present, harvesting (52.9 %), field mulching (40.9 %), and protective cropping (32.9 %) take up the majority of their time. In contrast, land preparation took up the least amount of time (12.8 %). Similar findings were also reported by Cagasan and Centino (2019) and Centino et al. (2021) in their study on the adaptation strategies of women farmers in Ormoc City, Leyte.

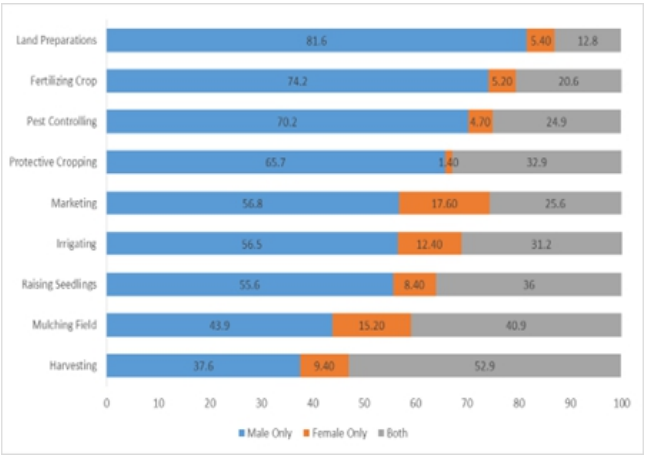

Figure 7. Gender Role in terms of sexuality farming activities involvement

The Impact of ICM on the Income of Small-Scale Vegetable Farmers in Cabintan

Table 6 shows the average number of hours male and female workers spend in farming in a given day. For land preparation, male farmers work an average of 6.75 hours per day, while female farmers work 6.47 hours per day, giving male farmers an average of 0.28 hours more than female farmers. Still, males (6.43 hours) spend 1.32 hours more than females (5.11 hours) on average when raising seedlings. On average, males spend 3.17 hours (8 hours) more time mulching the field than females (4.83 hours). The large disparity is due to the amount of time and effort required to mulch the field. Mulching entails controlling weeds, planting holes in the mulch, and tying the mulch to the ground. The number of hours spent fertilizing the crop by males (4.47 hours) and females (4.22 hours) is nearly

identical, with a 0.25-hour difference. Males work more hours in a day on protective cropping (7.15 hours) than females (4.8 hours), a difference of 2.35 hours. Regarding irrigating farms, males (6.38 hours) work longer than females (4.8 hours) by 0.74 hours. Regarding pest control, males (3.91 hours) outwork females (3.41 hours) by a half hour.Finally, regarding crop marketing, males (3.12 hours) work longer than females (1.95 hours) by 1.17 hours. pest control, males (3.91 hours) outperform females (3.41 hours) by a half hour. Finally, regarding crop marketing, males (3.12 hours) outperform females (1.95 hours) by 1.17 hours.

Table 6. Average number of hours spend by Male and female in farming in a day

HOUSEHOLD WORKING FORCE	MALE	FEMALE	DIFFERENCE
Land Preparations			
Mean	6.75	6.47	0.28
Standard Deviations	1.87	1.87	0
Range	14 (2-16)	7 (1-8)	7
Raising Seedlings			
Mean	6.43	5.11	1.32
Standard Deviations	3.40	4.33	-0.93
Range	13 (2-15)	14 (1-15)	-1
Mulching the Field			
Mean	8.00	4.83	3.17
Standard Deviations	2.39	0.78	1.61
Range	14 (2-16)	4 (3-7)	10
Fertilizing the Crop			
Mean	4.47	4.22	0.25
Standard Deviations	2.42	2.39	0.03
Range	15 (1-16)	7 (1-8)	8
Protective Cropping			
Mean	7.15	4.8	2.35
Standard Deviations	2.11	0.95	1.16
Range	18 (3-21)	5 (3-8)	13
Irrigating			
Mean	6.38	5.64	0.74
Standard Deviations	2.20	1.92	0.28
Range	11 (1-12)	7 (1-8)	4
Pest Controlling			
Mean	3.91	3.41	0.5
Standard Deviations	2.37	1.78	0.59
Range	10 (1-11)	10 (1-11)	0
Marketing			
Mean	3.12	1.95	1.17
Standard Deviations	2.89	1.50	1.39
Range	9 (0-9)	5 (0-5)	4

Factors that Affect on the Income of Small-Scale Vegetable farmers in Cabintan and Danao, Ormoc City, Leyte

Table 7 shows the Multiple Linear Regressions with controlling covariates that were used to explain the dependent variable, farm income per hectare per year. The explanatory variables in the table were extracted from a table with many variables (see appendix B). These variables are the only ones presented in this objective because they demonstrate significant factors in explaining the dependent variable.Table 7 shows four multiple linear regression models used to identify the significant factors influencing the income of small-scale vegetable farmers. The first model explains the 5.7 % from the respondents' demographic profile. It demonstrates that being a male and or married results in a significant increase in household income per hectare of PhP 42,466.00 and PhP 17,813.00, respectively. The second model included farm area, which explains 23.6 % and shows that being male or married results in a significant increase in farm income per year per hectare, while the number of households below college level results in a significant decrease in farm income per year per hectare by PhP 5,099. The farm income has been reduced by PhP 73,327.00, which may vary by PhP 7,707.00 as a unit increase in the farm area. The soil application ICM was added to the model, explaining 31.6 %. In this model, being male, married, or having completed at least one year of college has a positive effect. However, there is a significant decrease in the farm area, putting organic material, and simply using bare soil instead of mulching. Furthermore, using chicken dung as fertilizer increases farm income per year per hectare by PhP 29,270.00, which can vary by PhP 11,532.00. Finally, the final model included a water irrigation system, accounting for 33.5 % of the data. In this model, being male, married, having at least one household member in college, and using dung for fertilizer are still important in explaining farm income. Model 4 also demonstrates that as farm area increases, putting organic material and bare soil has a negative effect on income. On the other hand, the irrigation system increases farm income by PhP 29,648.00 or PhP 26,965 when sprinkling or drip hose are used.

Table 7. Multiple linear regression for identifying significant factors that affect the income of small-scale vegetable farmers

	DEMOGRAPHIC	FARM INFO	SOIL APPLICATIONS	WATER DELIVERY
Male	42,466***	44,761***	39,335***	36,980***
	(9,982)	(9,001)	(8,670)	(8,614)
Married	17,813*	30,992***	21,844**	22,694**
	(10,443)	(9,515)	(9,218)	(9,139)
Number of Household Member Atmost College Level	3,801	10,607	14,205**	13,471**
	(7,815)	(7,080)	(6,870)	(6,796)
Number of Household Member below College Level	2,010	-5,099**	-4,073*	-4,342**
	(2,043)	(1,988)	(2,172)	(2,159)
Farm Area (ha)		-73,327***	-71,663***	-72,014***
		(7,707)	(8,193)	(8,129)
Land Preparation (Putting of Organic Material)			-71,853***	-72,709***
			(10,995)	(10,881)
Mulching: Bare Soil			-25,359**	-30,334**
			(12,535)	(12,496)
Fertilizer Used: Dung			29,270**	24,071**
			(11,532)	(11,511)
Irrigation System: Sprinkle				29,648***
				(9,513)
Irrigation System: Drip Hose				26,965***
				(10,282)
Constant	63,057***	127,592***	159,536***	143,171***
	(12,510)	(13,159)	(17,136)	(17,670)
Observations	393	393	390	390
R-squared	0.057	0.236	0.316	0.335
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Impact of Integrated Crop Management on the Income of Small-Scale Vegetable Farmers in Cabintan, Ormoc City, Leyte.

Table 8 compares groups based on observable household characteristics prior to matching. Age and being male were significantly different in Cabintan and Danao before matching the data, both with a p-value=0.009. Cabintan and Danao, on the other hand, have nearly the same number of a married couple (p-value=0.792), and years of farming (p-value=0.061).

Table 8. Comparison of groups on observable household characteristics BEFORE matching

VARIABLE	BENEFICIARIES (CABINTAN)	NON - BENEFECIARIES (DANAO)	T-VALUE	P>|t|
Age	39.48	43.11	-2.62**	0.009
Male	0.68	0.8	-2.64**	0.009
Married	0.76	0.74	0.26	0.792
Years Farming	14.917	17.036	-1.88	0.061

Significance level: *** p<0.01, ** p<0.05, * p<0.1

Table 9 compares groups based on observable household characteristics after matching. Cabintan and Danao have nearly the same age (p-value=0.508), being male (p-value=1.00), married (p-value=0.836), and years farming (p-value=0.558) after matching.

Table 9. Comparison of groups on observable household characteristics AFTER matching

VARIABLE	BENEFICIARIES (CABINTAN)	NON - BENEFECIARIES (DANAO)	T-VALUE	P>|t|
Age	39.48	40.22	-0.66	0.508
Male	0.68	0.68	0.00	1.00
Married	0.76	0.76	-0.21	0.836
Years Farming	14.917	14.36	0.59	0.558

Significance level: *** p<0.01, ** p<0.05, * p<0.1

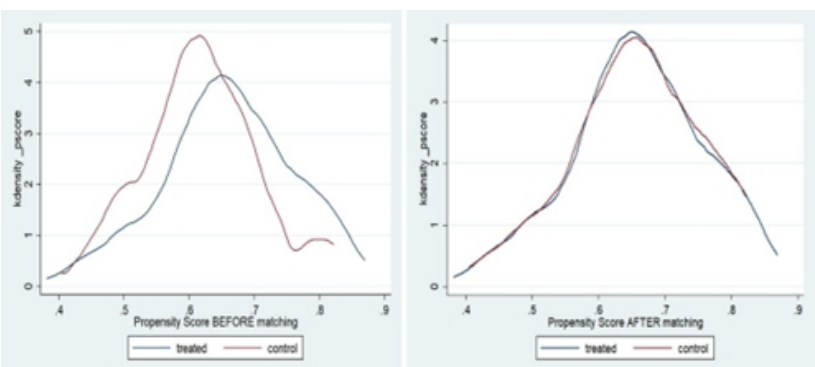

Figure 8. Distribution of the Propensity scores before and after matching

Table 10 shows the estimated impact of the three matching algorithms based on the average treatment effect of the treated (ATT). Using the nearest neighboring technique, bootstrapping by 100 reps to reduce the standard error estimate (SE: PhP 17,489.71) resulted in a significant effect of ICM in Cabintan, which increased

the vegetable farmers' farm income per hectare per year for PhP 37,599.47. The exact number of replication for bootstrapping was used in radius matching to significantly reduce the standard error estimates and increase the PhP 29,867.51 income in Cabintan, per year per hectare. Kernel matching, on the other hand, yields a zero standard error estimate. However, the result of an increase of the beneficiary group by PhP 30,665.57 is not statistically significant.

Table 10. Impact estimate using average treatment effect of the treated (ATT) using three matching algorithms

FARM INCOME	NEAREST NEIGHBOR	RADUIS MATCHING	KERNEL MATCHING
Beneficiary (Cabintan)	123,086.93	123,086.93	123,086.93
Non -beneficiary Group (Danao)	85,487.43	93,219.40	92,421.33
ATT (PhP/Hectare)	37,599.474*	29,867.505**	30,665.571
Bootstrapped SE (100 reps)	17,489.71	10,170.414	14,908.80
Z	2.15	2.937	1.72
P>|z|	0.032	0.003	0.09
Sample Size of Recipients	253	253	253
Sample Size of Recipients	91	137	140

Significance level: *** p<0.01, ** p<0.05, * p<0.1
1 USD= 58 PHP).

The nearest neighbor matching with Mahalanobis distance metric was used to match the exact number of respondents using the average treatment effect of the treated. The pvalue is 0.000, indicating that the result is significant at 1 %. The average treatment effect of the program is PhP 35,098.23 per hectare, with a standard error estimate of PhP 9,685.03, (Table 11). The result support the study of Singh et al (2019) that using ICM such as intercropping, sowing, weeding, water, and retting could significantly increase the livelihood of marginal landholders.

Table 11. The average treatment effect of the treated using the nearest neighbor matching technique using Mahalanobis distant metric

CABINTAN (n)	LAKE DANAO (n)	ATT (PHP)	STD . ERROR	Z	P>|z|
253	140	35,098.23**	9,685.033	3.62	0.000

Significance level: *** p<0.01, ** p<0.05, * p<0.1
1 USD= 58 PHP).

CONCLUSIONS

This study discovered that farmers in Cabintan and Danao in Ormco City are men, married, in their elementary level of education, around 40 years old, with four household members, and mostly had a farm income ranging from PhP 6,000 to PhP 12,000 per month. Intercropping was more common in Cabintan. The high value indicates that Cabintan vegetable farmers adopted intercropping as an outcome of the Hort2012/02 project. Sweet peppers were still the main crop or one of the crops grown as part of the project Hort2012/02's five crops. Despite intercropping, the Cabintan farmers depended on cabbage as their primary crop because it is a robust vegetable that is not too difficult to cultivate. It is also a consumer's daily consumable food that high market demand. The project HORT 2012/020 involved the use of harrowing for land preparations, use of seed box in raising seedlings, using bare soil instead of mulching, and using inorganic fertilizers. Only a few did protective cropping with high and low tunnel roofs with plastic or net cover, use sprinkling in watering the plants, and economically pulled weeds for pest control. Beneficiaries were usually landowners with an average area of 0.52 hectares, owned 2.36 machineries, and had 14.9 years of farming.

The prevalent male work in farming requires hard work, which corresponds directly to a man's working strength. In terms of gender roles, men continue to outnumber women. However, this study shows that while male farmers work on the farm most of the time, female farmers are still involved in every farm task. Female involvement and skills in vegetable farming should be encouraged in order to maximize production and entrepreneurial skills (Naval et al, 2021).

Being male or married, regardless of how many covariates are included in the model, is a significant factor in increasing the income of small-scale vegetable farmers. Those who have household members who have completed or are currently enrolled in college tend to work harder to support educational expenses. On the other hand, there is a significant decrease for those with less than a college education because farmers with less education tend to have many children in the family regardless of the family's income. It is also notable that this data shows that a unit increase in farm area significantly decreases farm income in a year at around PhP 70,000 per hectare. Moreover, despite covariates, this study shows that as farm area increases, farm income decreases by PhP 7,000 per year per hectare. The decrease is concerning because farmers may not be physically, skillfully, or financially prepared to handle larger-scale farming operations. As a result, training should be provided in both Cabintan and Danao. Moreover, the use of organic materials in land preparation also results in a significant decrease of around PhP70,000.00 in farmer income. A significant decrease in bare soil is also observed in mulching, indicating that using mulching materials may significantly increase the income of vegetable farmers. It is best to use manure as fertilizer and water the plants with sprinkling or drip hose.

The Hort 2012/02 project implemented by the Visayas State University increased small-scale vegetable farmers' income by PhP 35,098.23 per hectare per year, which may differ by PhP 9,689.03. This result is greater than the economic impact assessment of the project HORT 2012/020, in which the income of the beneficiaries increased from PhP 21,2911.92 to PhP 32,936.65 over time. The

increase suggests that the farmer training in Cabintan was successful.

Finally, farmers in Ormoc City should attend trainings that focus on larger areas, improving the use of organic materials during land preparations, strictly implementing ICM, particularly the use of diverse crops in intercropping, and receiving assistance for ICM inputs.

RECOMMENDATION

This study is recommended as a supplement to the Hort2012/02 project in evaluating the impact of the program it implemented years ago. The LGU of Ormoc could use this study to gather information on vegetable farmers' current socio-economic and farming profiles in the barangays of Cabintan and Danao. It is suggested that they receive additional training on the benefits of intercropping on their farms in Cabintan and Lake Danao. Future researchers who want to pursue similar studies should specify the number of household members working on the farm. A focus group should also be held to collect additional qualitative data from respondents regarding the reasons for the study's findings. Farmer and local government unit coordination of the small-scale vegetable farmers in Cabintan, Danao, and all surrounding barangays should be given training, equipment, and financial assistance by the LGU of Ormoc. Farmers' associations must work together, especially since the government is releasing farm machinery to help farmers. Farmers should be encouraged to join the organization and actively participate in and care for the LGU's inputs.

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