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COMPARATIVE PRODUCTION PRACTICES AND PRODUCTIVITY OF ORGANIC AND CONVENTIONAL VEGETABLE PRODUCERS IN CAGAYAN VALLEY REGION, NORTHERN PHILIPPINES

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Abstract: *This study aims to document existing practices and productivity of organic vegetables production in Cagayan Valley Region, Northern Philippines. The respondents were 64 organic and 52 conventional vegetable producers. Seven "pinakbet" vegetables were studied, namely, okra, squash, string beans, eggplant, bitter gourd, tomato, and pepper. Descriptive statistics, input-output ratios, and break-even analysis were used to analyze the data. The average area cultivated was 508.55 m^2 for organic and 2,972.19 m^2 for conventional vegetables production. Results show that there was a higher number and longer duration of harvesting of organically grown vegetables than conventionally grown vegetables. Organic vegetable farmer-respondents had higher yield per 1000 m^2 for okra (748 kg), squash (545 kg), and string beans (437 kg) than the conventional farmers while conventional farmers had higher yield per 1000 m^2 on eggplant (1,239 kg), bitter gourd (1,080 kg), tomato (2,054 kg), and pepper (330 kg) than their organic farmer counterpart. The organic vegetable farmers had lower capital-output ratio for all the vegetables, lower land-output ratio for eggplant, tomato, okra, squash, and string beans and higher labor intensity for eggplant, bitter gourd, and tomato than the conventional farmers. These indicate that organic vegetable-farmers were more capital-input productive than the conventional farmers.*

Keywords: *organic vegetable, conventional vegetable, "pinakbet vegetables, input-output ratio, productivity, Northern Philippines*

INTRODUCTION

Consumers are now becoming concern with food quality and safety, as well as the protection of the environment, which therefore stimulate the demand for organic products.

This became the driving force to the development of organic agriculture. Following Executive Order 481 (EO 481) the Philippine government has responded to this demand through the promulgation of Republic Act 10068 of 2010 otherwise known as the Organic Agriculture Act. EO 481 is on the "Promotion and Development of Organic Agriculture in the Philippines." had been enacted in 2005 to enhance and promote organic agriculture, conserve environmental resources and promote social equity and product access to domestic as well as foreign markets. The RA 10068 defines *"Organic agriculture" as those that includes all agricultural systems that promote the ecologically sound, socially acceptable, economically viable and technically feasible production of food and fibers.*

The Cagayan valley region lies within the Northeastern tip of the Philippines. It is bounded on three sides by big mountain ranges: Cordillera to the west, Caraballo to the south, and Sierra Madre to the east. To the north lies the Babuyan channel beyond which is the North China Sea. Tuguegarao City, the regional capital, is about 485 kilometers from Manila via the Maharlika Highway. It is is composed of five (5) provinces, namely Batanes, Cagayan, Isabela, Nueva Vizcaya and Quirino.

The region's land area is the fourth largest in the country with about 2,683,758 hectares which is 9% of the total land area of the Philippines. Of this total area, 965,965 hectares are alienable and disposable (A & D) lands, and 1,717,793 hectares are forestlands.

One of the strategic development interventions of the region as indicated in its Regional Development Plan is to promote and advocate good and sound agricultural practices of local farmers for recognition and possible replication in other provinces and regions. The Department of Agriculture (DA) is massively promoting organic rice and vegetable production throughout the region through its good agricultural practices.

However, despite of the efforts to promote organic agriculture, there are only few farmers who practiced organic agriculture fully. In fact, Conrado et al (2011) found that there is no accredited organic vegetable farm yet. Shifting from conventional to organic vegetable farming is a big decision for the farmer to make about his farm. Crucefix (1998) noted that the heavy exposure of farmers to high powered chemical input advertisements and pro-active extension services, the high-input and high-output as their current practice, high labor cost when it is not available and current mechanized production were major hindrances to conversion to organic farming.

Wholesale-buyers from other Region 03 used to come to the region to buy organic vegetables at higher prices than the conventionally grown vegetables. Despite of this high premium price of organically grown vegetable, still few went into it. The productivity of the farm therefore has yet to be seen before promoting organic vegetable production intensively to farmers.

OBJECTIVES

Generally, this study aims to productivity of organic vegetable production in Cagayan Valley Region, Northern Philippines. Specifically, it aims to:

1. describe the organic vegetables production practices;
2. determine the break-even yield of organic and conventional vegetables production, and
3. determine output-input ratios of organic and conventional vegetables production

METHODOLOGY

This study was conducted in the four provinces of the Cagayan Valley Region. The respondents of the study were 64 organic vegetable producers of "pinakbet" vegetables (ampalaya, eggplant, tomato, okra, squash, string beans and pepper) and 52 conventional vegetable farmers. In the absence of list of organic vegetable producer in the region at the time of the study, the tracer/snowball method was used. The organic farmers are not yet accredited but those who practice traditional farming (without the application of inorganic chemicals), full organic farming but not yet accredited and in-conversion to organic farm. A field reconnaissance survey was first conducted to identify the farmer-respondents in the absence of a priori list of organic producers in the region. All surveyed organic producers were taken as respondents for the primary data gathering while the conventional farmers were taken from the same area. Descriptive statistics such as means, frequency counts and percentages were used to analyze the data. Output-input ratio analysis and break-even yield analysis were used to analyze the productivity of vegetables production in the region. Comparison between organic and conventional vegetable production were also made.

RESULTS AND DISCUSSION

Rice and corn being the major agricultural crops grown in the region, these commodities comprise 20 percent and 29 percent of the total household income of the organic and conventional farmer-respondents, respectively. The average household income from all

sources of the organic farmers was ₱P71,097 lower than the ₱87,140 income of the conventional farmers (Table 1).

The total vegetable farming experience of organic vegetable was 12.22 years lower than the 14.93 years experiences of the conventional farmer. Out of the 12.22 years of vegetable farming experience, they have 6.22 years of experience in organic vegetable production. This indicates that farmers in Cagayan Valley region are still new in organic farming.

The average area planted to organic vegetables production was only 508.55 sq m while the conventional farmers was 2,972.17 sq m. Among the different "pinakbet vegetables, the largest average area cultivated to organic production was on pepper with 235.94 sq m while for the conventional farmer-respondents, the largest area cultivated was on ampalaya (1,082.22 sq m).

Table 1. Farming experience, average household income by source and area cultivated (sq m) by type of vegetable farmer-respondents in Cagayan Valley Region.

Variable	TYPE OF VEGETABLE FARMER			
	Organic		Conventional	
Average Household Income	Amt	%	Amt	%
Regular employment	25,685	34.11	10,615	12.18
Rice and corn	14,889	19.77	25,272	29.00
OFW	10,219	18.71	1,846	2.12
Organic vegetable	9,670	13.11	-	
Conventional vegetable	2,379	3.29	37,740	43.31
Livestock and poultry	2,064	2.74	1,424	1.63
Driving	1,677	2.23	896	1.03
Hired labor-non farm	1,407	1.97	5,458	6.26
Others[a]	3,107	4.31	3,889	4.46
Total household income	71,097	100	87,140	100
Farming experience (years)				
Total		12.22		14.93
Organic		6.22		
Average Farm Area Cultivated (sq m)		508.55		2,972.17
Eggplant		93.86		991.97
Bitter gourd		156.12		1,082.22
Tomato		52.04		1,029.14
Okra		74.45		356.88
Squash		91.01		674.20
String beans		119.40		527.52
Pepper		235.94		202.11

[a]include home-base micro business, farm hired labourer, fruits production

Organic vegetable production practices

The organic vegetable technologies used were towards soil fertility and pest control. Majority of the respondents practice the use of organic fertilizer (79.69%), compost application (71.88%) use of biopesticide (60.94%) and crop rotation (52.56%). Only 18.75 percent of the organic vegetable respondents practiced green manuring.

Table 2. Organic vegetable production technologies used by organic vegetable respondents, Cagayan Valley Region

Organic Technologies Used	Frequency	Percent
Use of organic fertilizer	51	79.69
Compost application	46	71.88
Use of biopesticides	39	60.94
Crop rotation	33	51.56
Use of biological/botanical	26	40.63
Use of indigenous seeds	26	40.63
Green manuring	12	18.75

Fertilizer and nutrient management

Organic vegetable farmers used solid and liquid organic fertilizers. The solid fertilizers are incorporated during plowing and/or through spot method while the organic liquid fertilizers were sprayed to crops/plants. Both solid and liquid fertilizers were applied during seedling, vegetative, flowering and fruiting stages of the crops for all types of organic vegetables (Table 3). Conventional farmers on the other hand used chemical fertilizers which are basally applied and side dressed.

Table 3. Fertilizer and nutrient, insect pest and disease management by type of farmer-respondents, Cagayan Valley Region

Production Technologies	Type of Vegetable Farmer Respondent	
	Organic	Conventional
Vegetable	All vegetables	All vegetables
Fertilizer application method	Incorporated during plowing, spot method and spraying	Basal and side dressing
Kind of fertilizer	Own produced Compost, solid and liquid organic fertilizer, decomposed animal manure and compost	Urea, complete (14-14-14) and ammonium sulphate
Frequency, Rate and Time of application	3 times, vegetative, flowering and fruiting	3 times, vegetative, flowering and fruiting

Insect/Disease Management	Spraying botanical extracts, tiriscide system or hand picking of infested/infected plant leaves	Spraying Lannate, Prevaton, ultimo, karate and other insecticides
Weed Control	Hand weeding; mulching with dried cogon or rice straw; crop rotation; shallow cultivation	Hand weeding; mulching with dried cogon or rice straw; crop rotation; shallow cultivation
Water Source and Management	Hand watering, rainburst or the use of a hose; deepwell, creek	Hand watering, flooding

The production of bio-fertilizer practiced by farmer-respondents shows that they used compost and animal manure as solid bio-fertilizer and liquid bio-fertilizer (Table 4). Solid fertilizers both used IMO as activator and used golden shower leaves, madre de cacao, ipil-ipil leaves, kangkong leaves; rice hull plus chicken dung; and fully decomposed animal manure as raw materials. Kangkong, mango shoots, brown sugar and madre de cacao were used to prepare liquid fertilizer.

Table 4. Organic fertilizer/microbials preparation practices of the organic farmer-respondents, Cagayan Valley Region, 2014

Raw Materials	Steps of Preparation
Solid Organic Fertilizer	
Golden shower leaves, madre cacao, ipil ipil leaves, kangkong rice hull plus chicken dung	Activator: IMO (Indigenous Microorganisms Stake a plot and spread rice hull, spray with IMO, pile the golden shower leaves, madre cacao, ipil ipil leaves, kangkong and add chicken dung then spray IMO. Put another layer of the same materials and put rice hull on top then spray again with IMO.
Animal manure+ rice hull, ipil ipil leaves, madre cacao mani mani,sapal ng soya meal	Mix all the materials and put in one area then harvest for 3 months Activator: IMO (mold cooked rice (buried for 7 days). The bulk solution is prepared by fermenting 1 kg moldy rice, 2L water and 1 kg muscovado sugar for 7 days.
Liquid Organic Fertilizer	
Kangkong, mango shoots + brown sugar	Gather the materials around 5-7AM. Chop the materials and mix it with brown sugar; 1:1. Put it in a jar cover with clean cloth in a cool dry place, then ferment for 15 days , transfer solution in a clean container and spray in crops
Madre cacao, kangkong + brown sugar	Collect young leaves and shoots of madre cacao and kangkong, cut into small pieces and mixed with crude sugar. 3 kg :1 kg sugar. Place the mixture in a net bag put this inside the plastic pail, put weight then cover with paper or cloth. Store in a cool, dark place 5-7 days. Collect fermented juice and place in a glass container and cover

Bio-pesticide preparation

Organic farmers made use of OHN and different plants to prepare their pesticides neem tree and garlic extracts, guard plants and siling labuyo and even soap/detergent. They considered this as effective biopesticide because they can control crawling insects and serve as antibiotic for the crops and readily available in the locality.

Table 5. Raw materials used and preparation for organic pesticides by organic farmer-respondents, Cagayan Valley Region, Philippines

Raw Materials	Procedure for Preparation	Reason for Choice
Ginger , garlic	Chop ginger and garlic (2.5kg)and put in a container. Add 2`.5 liters of beer. Cover and ferment for 12 hours after 12 hours add ½ liter of molasses and ferment for 5 days. Add 1/3 gin and ferment for 10 days. Harvest about four liters.	Controls crawling insects and serve as antibiotic for the crops and readily available in the locality
Neem tree seeds and garlic	Chop neem tree seeds and garlic add molasses and water, ferment for 2 weeks then spray to plants,	Available in the locality, cheap and controls insects and diseases.
Marigold plants as guard plants	Plant Marigold plants in between the rows and around the perimeter of the area	Available and serve as insect repellants

Table 6 shows that organically grown vegetables had higher number of harvesting than the conventionally grown vegetables. This is because the organic vegetables had longer crop standing. Both types of farmer-respondents simply sorted their products through the sizes (small, medium and large) of the fruits.

Table 6. Number of harvest per vegetable and packaging practices by type of farmer-respondents, Cagayan Valley Region

Vegetable	Organic		Conventional	
	No. of Harvest/ crop	Packaging	No. of Harvest/crop	Packaging
Ampalaya	15 – 20	Sorted into	9 – 12	Sorted into
Eggplant	15 – 25	Small,Medium,	15 – 18	Small,Medium,
Okra	15 – 24	Large (S,M,L)	12 – 18	Large (S,M,L)
Pepper	20 – 25	while others are	18 – 20	while others are
String beans	5- 8	assorted	3 – 5	assorted
Squash	3- 5	Packaging: Plastic	3 – 4	Packaging: Plastic
Tomato	8 – 12	bags/ plastic crates/ sacks.	8 - 10	bags/ plastic crates/ sacks

Input utilization and break-even analysis

The average labor inputs (man days and cost) per 1000 square meters by commodity by farmer type in Table 7 shows that except for pepper, organic farmers incurred higher labor days per 1000 sq m for all commodities studied than the conventional farmers. The labor input ranged from 16.79 days (pepper) to 55.79 days (tomato) per 1000 sq m of organic vegetable. This higher labor in organic farming was due to the more visits made to their farms in taking care of their plants since they sparingly used chemicals. The organic farmers did not spray commercial chemicals which are easier to use.

Table 7. Average labor inputs (man days) per 1000 sq m by commodity by type of farmer-respondent, Cagayan Valley Region

Vegetable	ORGANIC (n-64)	CONVENTIONAL
Eggplant	39.03	29.13
Ampalaya	26.74	21.18
Tomato	55.79	19.84
Okra	43.28	40.86
Squash	35.59	19.94
String beans	31.45	29.90
Pepper	16.79	22.83

The break-even analysis used in this study is the break-even yield (BEY) which refers to the yield required to recover the variable costs incurred in the production of the vegetable at the given input and output prices.

Organic vegetable farmers had higher yield for okra (748 kg/1000 sq m), squash (545 kg/1000 sq m) and string beans (437 kg/1000 sq m) than the conventional farmers with 131 kg, 261 kg and 236 kg per 1000 sq m, respectively. On the other hand, conventional farmers had higher yield on eggplant (1,239 kg,1000 sq m), ampalaya (1,080 kg/1000 sq m), tomato (2,054 kg/1000 sq m) and pepper (330 kg/1000 sq m) than the organic farmers (Table 8).

In terms of the value of production per 1000 sq m, organic farmers had higher value of produce for the different vegetables except for ampalaya and pepper than the conventional farmers. The higher value of produce of organic vegetables is attributed to the higher yield and higher price received per unit.

Based from the yield and the cost of production, break-even yield analysis shows that higher yields are required for the conventional farmers than the organic farmers in order to

recover the cost of production in all vegetables under study. This is because generally, the conventional farmers used commercial inputs which are more costly and they received lower price of their outputs.

Table 8. Average yield (kg) and value of produce (₱) of vegetables per 1,000 sq m, documentation of organic vegetables in Region 02, 2009-2010

	Production per 1000 sq m		Value of Production/1000 sq m		Break-even Yield	
COMMODITY	Organic	Conventional	Organic	Conventional	Organic	Conventional
Eggplant	594.18	1,238.70	12,882.45	11,806.55	294.33	1,032.05
Ampalaya	256.72	1,080.29	6,682.48	11,581.56	194.35	973.17
Tomato	1,079.06	2,054.50	30,143.61	8,356.92	371.96	1,800.29
Okra	748.27	131.00	10,611.55	1,615.50	456.36	1,253.74
Squash	544.79	260.65	10,721.77	3,407.67	312.37	442.80
String beans	437.19	236.01	13,092.55	6,090.54	150.07	411.52
Pepper	128.48	329.65	5,454.90	19,165.41	66.40	131.58

Capital-output ratio

Except for tomato and squash, organic vegetables had lower cost of production than the conventionally grown vegetables. The cost of organic vegetable production was highest in tomato with only ₱8,723.05/1000 sq m. For conventionally grown vegetables, the highest was on okra with ₱16,186.19/1000 sq m.

The capital-output ratio (COR) is the ratio between total cost of production and the value of total output which implies how intensive capital was used (Table 9). Low COR value implies a relatively high input productivity. The organic farmers had capital-output ratio of less than one for all vegetables. This means that organic farming had high input productivity. Among the vegetables, pepper had the lowest capital-output ratio (0.251) which means that it has the highest input productivity among the vegetables in organic farming. Ampalaya on the other hand had the highest capital-output ratio with 0.757 among the organic vegetables studied. This means that ampalaya production requires 75.7 centavos as capital to have an output value of ₱ 1.0. Generally, the organic vegetable farmers had lower input ratio for all the vegetables than the conventional farmer-respondents. Three vegetables (okra, squash and string beans) had more than one COR for the conventional farmers. This result indicates that the organic vegetables were more input productive than the conventional farmers. Noémi Nemes (2009) in their assessment of 50 different studies found that majority of

cases studies show that organic farms are more economically profitable, despite of frequent yield decrease. The higher outcomes generated by organic agriculture are due to premium prices and predominantly lower production costs which this study also found the same.

Table 9. Cost of Production/1000 sq m and capital-output ratio of vegetables by type of respondent, Cagayan Valley Region

Vegetable	Cost of Prouction/1000 sq m		Capital-Output Ratio	
	Organic	Conventional	Organic	Conventional
Eggplant	6,361.48	9,835.45	0.495	0.832
Ampalaya	5,048.46	10,432.40	0.757	0.812
Tomato	8,723.05	7,327.16	0.470	0.741
Okra	6,450.83	16,186.19	0.610	7.349
Squash	6,075.29	5,787.43	0.659	1.758
String beans	4,418.52	10,621.34	0.338	1.821
Pepper	2,900.33	7,649.96	0.251	0.510

Labor-output ratio

Labor-output ratio (LOR) is the ratio between total farm labor (MD) and total value of output. The farm labor input and value of production are presented above. Low labor-output ratio (LOR) implies the low man-labor intensity required in organic production process. The low man-labor intensity implies that very low quantity of labor was required in the production process. In general, organic farmer-respondents had higher LOR for eggplant, ampalaya and tomato than the conventional farmers (Table 10). This indicates that the organic farmers had higher labor intensity on these vegetables than the conventional farmers. Okra, squash and string beans in the conventional farmers had higher LOR with 0.02, 0.006 and 0.005, respectively than the organic farmers.

Table 10. Labor-output ratio and land-output ratio by commodity type of farmer-respondents, Cagayan Valley Region

Commodity	Labor-Output Ratio		Land-Output Ratio	
	Organic	Conventional	Organic	Conventional
Eggplant	0.003	0.002	0.078	0.085
Ampalaya	0.004	0.002	0.150	0.086
Tomato	0.003	0.002	0.054	0.120
Okra	0.004	0.020	0.094	0.606
Squash	0.004	0.006	0.104	0.293
String beans	0.002	0.005	0.076	0.164
Pepper	0.002	0.002	0.183	0.052

Land-output ratio

The land-output ratio (FOR) shows the productivity of land. It is the ratio between the cultivated area and total value of output. Low FOR means that the land was productive, that is more output for a given size of land cultivated to vegetables. Table 9 shows that organic vegetable respondents had lower land-output ratio for eggplant, tomato, okra, squash and string beans than the conventional farmers. This means that the organic farmers had higher land productivity in these vegetables than the conventional farmers. The land productivity of the conventional farmers on the other hand was higher in ampalaya and pepper with 0.085 and 0.052, respectively.

CONCLUSIONS AND RECOMMENDATIONS

- In general, Organic vegetable production in the region is still in the early stage as there are no fully accredited growers yet. The average farm size is small which is around one-six of the area grown to conventional vegetable production.
- Organic vegetables had higher labor inputs but lower total cost of production for most of the vegetables studied. This is due to the non-use of commercial inorganic inputs which is costly.
- Organic vegetable production in the area is promising given the higher yield for most of the seven “pinakbet” vegetables.
- Although organic vegetables production generally incurred higher labor cost than the conventional vegetables production, organic vegetables command higher price than the non-organic vegetables which led to higher value of produce than the conventional farmers.
- Organic vegetable farmers had higher yield for okra, squash and string beans than the conventional farmers. On the other hand, conventional farmers had higher yield on eggplant, ampalaya, tomato and pepper than the organic farmers.
- Higher yields are required for the conventional vegetable production than organic vegetable production in order to breakeven or to recover its vriable costs incurred in the production of vegetables.
- In general, organic farmer-respondents had higher labor-output ratio for eggplant, ampalaya and tomato than the conventional farmers.

- Organic vegetable respondents had lower land-output ratio for eggplant, tomato, okra, squash and string beans than the conventional farmers indicating a higher land productivity in these vegetables than the conventional farmers.

Thus, it is recommended that organic farming should be intensively promoted in the region and the farm practices can still be improved to increase productivity of land, labor and capital.

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