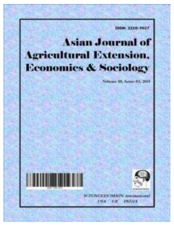

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Effects of Education Attainment and Previous Training on Farm Practices among Pineapple Farmers in Three Barangays in Philippines

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Authors' contributions

This work was carried out in collaboration between all authors. Author MMN designed the study, wrote and supervised the work. Author NNA wrote the first draft of the manuscript. All authors managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

This study assessed the effects of education attainment and previous training on adoption of various cultural management practices among pineapple farmers in three barrangays in Cavite Philippines. The research employed a case study design. Respondents from the three adjacent barangays of Silang, Cavite, Philippines were identified using random sampling technique. A sample size of 60 pineapple farmers was selected for the study. Data were collected using structured questionnaires and analyzed using both descriptive and inferential statistics. Chi square was used to determine the effect of education attainment and previous training on the adoption of various cultural management practices. Results were presented using tables. The study revealed that education attainment did not influence the use of the different types of fertilizers. It was noted that there was a significant difference between education attainment and use of insecticides, fungicides and nematicides with p value of .016, .015, and .007 respectively. The result also shows that college graduate farmers tend

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to use more insecticides, fungicides and nematicides frequently than necessary which resulted to overuse, compared to other farmers. With regard to previous training, the more the farmers attended previous training the less they employ the use of insecticides and fungicides. Therefore, pineapple farmers should be trained on the appropriate cultural management practices that can be adopted to ensure improved soil fertility and productivity.

Keywords: Philippines; barangays; silang cavite province; education attainment; previous training; cultural management practices; soil fertility; productivity.

1. INTRODUCTION

Pineapple (*Ananas comosus* (L.) Merr.) is a terrestrial member of the family Bromeliacea that produces fruit of economic importance [1]. It is a herbaceous perennial with long swordlike leaves arranged in a spiral around a central stem and a terminal inflorescence. Leaves may or may not bear marginal spines depending upon variety and cultural practices. Adult plants may be 3 to 6 feet (0.9-1.8 m) high and wide (Crane 2013). Pineapple is the second harvest of importance after bananas, contributing to over 20% of the world production of tropical fruits (Medina and García 2005). Nearly 70% of the pineapple is consumed as fresh fruit in producing countries. Its origin has been traced to Brazil and Paraguay in the Amazonic basin where the fruit was domesticated (Collins, 1949). Worldwide production started by 1500 when pineapple was propagated in Europe and the tropical regions of the world. Thailand, Philippines, Brazil and China are the main pineapple producers in the world supplying nearly 50% of the total output [2]. Other important producers include India, Nigeria, Kenya, Indonesia, México and Costa Rica and these countries provide most of the remaining fruit available (50%).

It is widely cultivated in the tropics as already stated above as well as in subtropical countries with an annual production exceeding 9.79 million tons. About 70% of the world production and 90% of the pineapples used by the cannery industry came from one variety, 'Smooth Cayenne', while Spanish, 'Queen' and 'Pernambuco' are generally grown for fresh fruit market [3]. Pineapple is extensively cultivated in many parts of the world. At least forty countries are growing appreciable quantities of pineapple of about 100,000 tons or more [4]. Pineapple as a cash crop is extensively cultivated in the Philippines. Its processed products generate significant amount of foreign exchange and its fresh fruit has become a major commodity that provides employment and income to thousands of Filipinos [5]. In 1980, records show that pineapple was planted to 62,670, 25,310 and 2,630 hectares of land in Northern Mindanao, Southern Mindanao and Southern Tagalog, respectively [6]. The rest of few hundred hectares is distributed rather uniformly in other regions of the country while per hectare basis, the average yield of pineapple was 20.4 tons. Northern Mindanao had the highest with 27.0 tons followed by Southern Tagalog with 23.9 tons.

Pineapple production must be increased and sustained through improved cultural management practices (CMPs). Studies show that pineapple that have been grown for many years in the same land continuously removes high amount of essential nutrients from the soil and unless replenished, this will result in a reduction of crop yield. The nutritional status of a plant is influenced by several factors such as soil, fertilizer supply, relative growth rate, yield, climate, and CMPs. Pineapple is a long-maturing crop that takes 18-24 months for the first crop and approximately 14-16 months for the second or ratoon crop with the ability to thrive well under a wide range of soil and climatic conditions. Since the nutrient requirement of the crop is high, nutrient deficiency during this long growth period may reduce the yield appreciably especially if grown on the same piece of land for several years. Hence, the need to return the soil nutrients on a continuous basis [6].

When there are nutrient imbalances in the soil, plants are subjected to nutrient stresses that result in reduced growth and quality. A constant and balance supply of elements to the plant is essential, otherwise, nutrient deficiencies or toxicities will result to plant stress [7]. Farmers in Cavite have different cultural management practices in their management of pineapple farms. The different practices affect the productivity of the pineapple farms differently. Education attainment and precious training influence the adoption of different cultural management practices which affect soil fertility. This scenario prompted the researcher to assess the effects of education attainment and previous training on the adoption of various cultural management practices among pineapple farmers in Silang, Cavite, Philippines.

1.1 Cultural Management Practices in Pineapple Farms

Pineapple farmers in Cavite, Philippines employ various cultural management practices. Among the cultural management practices adopted are;

1.1.1 Soil preparation

The field should be plowed and harrowed two to three times until a fine tilth is attained. Furrows where the seed pieces are planted should be made. Drainage canals are absolutely necessary in areas with heavy rainfall or with poor drainage [8].

1.1.2 Planting

The planting of pineapple by small scale growers is done between March and August. Slip and suckers should be planted eight to ten cm deep, 25 to 30 cm apart in a row, and 80 to 100 cm between rows. These spacing gives a population density of 33,000 to 50, 000 plants per hectare. The required distances are: 25 to 30 cm in a row (A-B), 50 cm within a double row (B-C), and 100 cm between double rows (C-D). This system of planting will result in a population of about 44,000 to 53,000 plants per hectare [8].

1.1.3 Weed control

Control of weeds is accomplished by cultivation and spraying with herbicides, hand pulling, hoeing, or with the aid of other suitable home implements but cultivation by plowing is not recommended. Weeds from the pineapple field should be used as mulch to conserve moisture and add organic matter to the soil [8].

Herbicides are used in large scales pineapple growing. Diuron (brand name) the most commonly applied at 6.4 kg active ingredient per hectare. Diuron should be sprayed immediately after planting, then at two-month intervals to further suppress weed growth. Care must be taken not to apply herbicides that may be toxic to crops grown with pineapple [8].

1.1.4 Intercropping

The planting of other crops beside pineapple is a popular Cropping system practice in Cavite, Batangas, Laguna, and Quezon, Philippines. In Cavite, the plant is intercropped with papaya, coconut, banana, and vegetable. In the case of fertilization, pineapple requires high amounts of nitrogenous fertilizer for vigorous growth of shoots and potash for the development of quality fruits [8].

Intercropping pineapple with various crops is practiced to maximize the use of the area. The usual practice is to grow pineapple under coconut or papaya trees. Sometimes yam is intercropped between pineapple plants. More than two crops are also grown simultaneously with pineapple as the main or secondary crop. While several crops are grown per unit area, in many instances, the fertilizer applied is just the amount required by pineapple. Returns can be greatly increased by supplying the fertilizer requirements of all the crops [9].

1.1.5 Fertilization

Pineapple should be supplied with large amounts of fertilizer to obtain an appreciable yield. Plants adequately supplied with nitrogenous fertilizers grow vigorously and produce large fruits. Potassium containing fertilizers are also important in the production of large and good quality fruit particularly increasing size and sweetness. However, pineapple requires little amount of phosphorous and too much of phosphorus upsets the absorption of nitrogen. By nature, however, most Philippine soils are generally sufficient in Phosphorous [8].

Statistics show that pineapple requires high concentration of N and K present in the soil. Nitrogen is the limiting factor in pineapple production. Significant increases in yield and mean fruit weight with the addition of N were observed by Omotoso and Akinrinde [10]. For optimum yield, annual application of N fertilizer should not exceed 12g N per plant for the main crop and less than this for the ratoon. It was found that optimum N rate to be 12-16 g N per plant per year.

1.2 Effects of Education Attainment and Previous Training on Cultural Management Practices

A study done by Kasirye [11] revealed that farmers with low education and land holdings are less likely to adopt improved seeds and fertilizer, while peer effects play a big role in influencing farmers to either use improved seeds or fertilizer.

Furthermore, cattle keeping farmers in Western Uganda are more likely to abandon fertilizers and possibly resort to organic manure from livestock excreta.

Education has a great impact on agriculture. It positively increases agricultural productivity [12]. The level of education and previous training influences the choice of fertilizer and its application including frequency [13]. A study done by Robles [14] revealed that the level of education influenced the use of protective clothing and application of fertilizer and herbicides. A study by [15] on pineapple farmers in Thailand found out that education had no significant relationship with the decision making to implement good agricultural practice (GAP) systems. Its is because of the inconsistent findings that the researcher sought to determine the effects of education on farm practices among pineapple farmers in the three baranggays in Cavite Philippines. Previous training on specific farm practices has also shown that once farmers are trained on specific farm practices, they tend to adopt farm practices that are beneficial to their farm [16].

Pineapple farmers will source and use information from easily available and accessible sources such as radio and newspaper. Improving the knowledge base of farmers will facilitate information sharing amongst them. Research and extension should therefore develop contents in both radio and newspapers that will expand farmers' knowledge base and practical skills for improved pineapple production [12]. In another study, the results indicated that farmers' education level positively influence their level of production efficiency in pineapple production in the study area. Therefore extension agents should train pineapple farmers to improve production technique [16].

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in three baranggays in Slang Cavite province, Philippines.

The municipality of Silang was a first class landlocked municipality in the province of Cavite Philippines (Fig. 1). It had a population of 213,490 people in an area of 209.4 square kilometers. Silang is located in the eastern section of Cavite. The municipality of Silang is approximately 45 kilometers south of Manila. General Trias, Dasmarinas and General Mariano Alvarez bound it on the north and on the west by Amadeo, Tagaytay on the south. Silang is noted for its relatively cool and invigorating climate. Silang is politically subdivided into 64 barangays three of which were used in the study namely, putting-Kahoy, Lumil and Pasong-Langka.

2.2 Sampling and Data Collection Procedures

This was a case study design of three barangays in Cavite Province, Philippines. A table of random numbers was used to select the three barangays from the 64 barangays based also on those that heavily cultivated pineapples. The study randomly selected sixty farmers in the three barrangays based on the farm size, and the length of time engaged in pineapple farming which resulted into 20 farmers per Baranggay. The study focused on the effects of education attainment and previous training on adoption of various cultural management practices among pineapple farmers in the three barangays of Silang, Cavite, Philippines. The study was carried in three barrangays of Cavite Province; putting-Kahoy, Lumil and Pasong-Langka.

Data were collected using structured questionnaires. Questionnaires were distributed to the respondents with the assistance from the local officials of each baranggay. Descriptive and inferential statistics were used to analyze the data. Frequencies and percentages were used to analyze qualitative data while chi-square was used to determine the effect of education attainment and previous training on the adoption of various cultural management practices.

3. RESULTS AND DISCUSSION

3.1 Educational Attainment of the Respondents

In terms of educational attainment, 28.3% of the respondents were high school graduates followed by elementary undergraduates (23.3%), elementary graduates (15%), vocational courses (11.7%), college undergraduates (10%), college graduates (6.7%) and the remaining 5% were high school undergraduates. This trend was a typical feature of an upland farming (Table 1). However, this figure was relatively high compared to other upland communities from previous studies by Hasan et al. [17] where most farmers were primary graduates. In general, Silang farmers had completed their secondary education.

Education was an important means by which farmers improved farming practices. The level of education and the farmers' understanding of their environment influence the overall feature of the farming system [18]. [19] reported that the higher returns that have been realized in intercropped farms have been attributed to the thorough knowledge of the farmer with regards to the management of intercropped plants. Results of studies also support the proposition that better educated farmers had better access to information which encourages the adoption of more intensive farming systems [20].

3.2 Previous Training on Farm Practices

Majority of the farmers (60%) did not attend any training within the last two years (Table 2). This might be due to lack of interest on the training topic, hectic farm schedule and other household matters. But those who got the opportunity to attend training were able to manifest it in their farm practices, hence, it is confirmed that those who had been trained were more likely to make successful changes to their farm management practices. Other upland groups spend 2-3 years or 2-4 years or an average of 4.56 years in formal schooling [21].

3.3 Effects of Education Attainment on Cultural Management Practices

3.3.1 Education attainment and farm practices

Table 3 presents the chi-square analysis of education versus farm practices.

Table 3 shows that there is no significant difference between the educational attainment and the use of green manure, compost, ammonium sulphate, ammonium phosphate, complete, and combination of organic and inorganic fertilizer. This reveals that education did not determine the use of the different types of fertilizers. Likewise, there was no significant difference between education attainment, length of fertilizer application and amount of fertilizer applied by farmers. This shows that education did not influence fertilizer usage. All farmers used fertilizer regardless of education level, they knew that poor yield was as a result of not using adequate fertilizer. These findings were different by findings by Robels [14] that revealed that the level of education influenced the use of protective clothing and application of fertilizer and herbicides.

It was noted that there was a significant difference between education and use of insecticides, fungicides and nematicides with p value of .016, .015, .007 respectively. The result showed that college graduate farmers tend to use more insecticides, fungicides and nematicides compared to other farmers. This reveals that education influenced farmers in the use of such agrochemicals.

In a previous study, which was designed to collect information on their knowledge, attitude, and behavior related to pesticides in the Guanting Reservoir area, north of China. It was observed that most pesticide end-users took incomplete preventive measures due to lack of extensive pesticide knowledge and information. Pesticide information, instruction, and training among farmers should be promoted, and governmental intervention is needed to ensure proper management regarding public health risks and environmental hazards [22].

Table 1. Distribution of respondents by educational attainment

Educational attainment	Frequency	Percentage
Highest Education:		
Elementary undergraduates	14	23.3
Elementary graduates	9	15
High school undergraduates	3	5
High school graduates	17	28.3
Vocational	7	11.7
College undergraduates	6	10.0
College graduates	4	6.7
Total	60	100

Fig. 1. Map of Cavite province, Philippines
Source: http://www.islandsaccommodations.com/maps/cavite.htm [23]

Table 2. Distribution of farmers by previous training

Previous Training	Frequency	Percentage
Yes	24	40
No	36	60
Total	60	100

Table 4 presents the chi-square analysis between education attainment and years handled insecticides (p=.025), spraying interval (p=.195), experience illness while spraying (p=.204), headache/dizziness (p=.230), vomiting (p=.112), chest pains/skin irritation (p=.016), other illness (p=.713), boots (p=.503), gloves (p=.048), masks (p=.176), eye protector (p=.273), all of the above (p=.139), not using protective (p=.100).

Results showed that regardless of education attainment farmers handled insecticides between 1-3 years. This means that farmers had a period of exposure to insecticides of between one to three years. This indicated that the practice has not been in use for long. That farmers who finished elementary to college experienced chest pains significant at .05 level. Farmers generally did not use protective clothing.

Table 5 present chi-square analysis between education and number of crops per season (p=.522), frequency in tilling the land (p=.636), and length of cultivation, (p=.577).

The results showed that, the number of crops per season, frequency in tilling the land and length of cultivation did not depend on education attainment at all.

3.4 Effects of Previous Training on Cultural Management Practices

Table 6 presents the chi-square results between previous training and fertilizer application for sulphate (p=.034), green manure (p = .236), compost (p= .055), ammonium phosphate (p = .725), complete (p= .410), single element (p=.240), combination of organic and inorganic (p=.725) length of fertilization (p=.026), and amount of fertilizers applied (p= .290), insecticides (p=.011), fungicides (p=.014), herbicides (p=.630), nematicides (p=.093), other pesticides (p=.347) and spraying interval (p=.267).

Table 3. Farm practices and education attainment

	Chi-Square (x^2)	DF	P-value
Education attainment – green manure	10.131	6	.119
_ compost	6.570	6	.362
_ ammonium sulphate	8.481	6	.205
_ ammonium phosphate	3.158	6	.789
_ complete	3.341	6	.765
_ single element	28.966	6	.000**
_ combination of organic/inorganic	3.870	6	.694
_ Length of fertilizer application	27.753	24	.271
_ amount of fertilizer application	19.641	18	.353
_ insecticides	24.707	12	.016*
_ herbicides	3.480	6	.747
_ fungicides	15.830	6	.015*
_ nematicides	17.582	6	.007**
_other pesticides	11.415	6	.076
_ spraying interval	36.325	30	.198

*Note: x^2 correlation is significant at **0.01 and * at 0.05*

Table 4. Educational attainment and years handled insecticides

	Chi-Square (x^2)	DF	P - value
Education attainment _ years handled insecticides	39.344	24	.025
_spraying interval	36.325	30	.198
_ experienced illness while spraying	8.490	6	.204
_ headache/dizziness	8.114	6	.230
_ vomiting	10.318	6	.112
_ chest pains/skin irritation	15.562	6	.016
_ other illness	3.734	6	.713
_ boots	5.322	6	.503
_gloves	12.677	6	.048
_masks	8.955	6	.176
_eye protector	7.550	6	.273
_all of the above	9.667	6	.139
_ not using protective	10.642	6	.100

*Note: x^2 correlation is significant at **0.01 and * at 0.05*

Table 5. Education attainment and crops per season

	Chi-Square (x^2)	DF	P - value
Education attainment_ number of crops per season	17.021	18	.522
_ frequency in tilling the land	9.766	12	.636
_ length of cultivation	16.225	18	.577

Significant results of previous training on the use of ammonium sulphate imply that more farmers with previous training were using ammonium sulphate (Table 6). It was determined that the more the farmer attended the training, the lesser they applied fertilizer to their pineapple farms (Table 7). Previous training and the period of fertilizer application is significant, this indicates that those farmers who attended previous training have used fertilizer for more than 20 years. In addition, most farmers were not using insecticides, this reveals that the more the farmers attended previous training the less the employ the use of insecticides and fungicides (Table 8, Table 9).This finding was similar to findings by [16] that found out that once farmers were trained on specific farm practices, they tend to adopt farm practices that were beneficial to their farms.

Table 10 presents chi-square analysis between previous training and number of crops per season (p=.376), frequency of tilling the land (p=.266), length of cultivation (p=.455).

This result implies that whether or not the farmers have previous training their farm practices was not affected. Previous training does not at all influence the farmer's farm practices.

Table 6. Farm practices by previous training

	Chi-Square (x^2)	DF	P - value
Previous training _ green manure	1.406	1	.236
_ compost	3.682	1	.055
_ ammonium sulphate	4.500	1	.034
_ ammonium phosphate	.123	1	.725
_ complete	.678	1	.410
_ single element	1.379	1	.240
_ combination of organic/inorganic	.123	1	.725
_ length of fertilizer application	11.036	4	.026
_ amount of fertilizers	3.746	3	.290
_ insecticides	8.980	2	.011
_ herbicides	.232	1	.630
_fungicides	6.098	1	.014
_nematicides	2.823	1	.093
_ other pesticides	.883	1	.347
_ spraying interval	6.431	5	.267

*Note: x^2 correlation is significant at **0.01 and * at 0.05*

Table 7. Previous training vs length of fertilizer application

Previous training	1 month – 5 years	6 – 10 years	11- 12 years	13-15 years	16 – 20 years	Total
Yes	2	7	1	1	13	24
No	8	1	0	2	24	35
Total	10	8	1	3	37	59

Table 8. Previous training vs insecticides

Previous training	No	Yes	Not using	Total
No	23	0	1	24
Yes	24	11	1	36
Total	47	11	2	60

Table 9. Previous training vs fungicides

Previous training	No	Yes	Total
No	23	0	23
Yes	27	8	35
Total	50	8	58

Table 10. Farm practices by previous training

	Chi-Square (x^2)	DF	P - value
Previous training _number of crops per season	3.101	3	.376
_ frequency of tiling the land	2.647	2	.266
_ length of cultivation	2.617	3	.455

*Note: x^2 correlation is significant at **0.01 and * at 0.05*

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The level of educational attainment did not influence the usage of different types of fertilizers among pineapple farmers in Cavite Philippines. There was a significant difference between education attainment and the use of insecticides, fungicides and nematicides with p value of .016, .015, and .007 respectively. The result showed that college graduate farmers tend to use more insecticides, fungicides and nematicides frequently than necessary which resulted to overuse, compared to other farmers. Previous training influenced the usage of insecticides, the more the farmers attended previous training the less they employ the use of insecticides and fungicides. Therefore pineapple farmers should be trained on the appropriate cultural management practices with less harmful effects that will increase soil fertility, and productivity.

4.2 Recommendations

Based on the results of this study, the following recommendations were made.

1. Farmers should be trained on the effects of the various cultural management practices on the soil fertility and productivity of pineapples.
2. A study should be done to evaluate the effects of education among farmers on soil fertility in various regions.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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