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Traditional maize farming management practices and family involvement of smallholder farmers in Aurora, Zamboanga del Sur, Philippines

Villaver, J. P. [1*], Alivio, E. M.[2], Hajim, J. A.[2] and Laylay, R. J. H.[2]

[1]College of Agriculture, Zamboanga del Sur Provincial Government College, Aurora, Zamboanga del Sur, Philippines; [2]College of Education, Zamboanga del Sur Provincial Government College, Aurora, Zamboanga del Sur, Philippines.

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Abstract The smallholder farmers' existing farming practices in Aurora, Zamboanga del Sur was determined. The survey revealed that most of the farmers adopted an integrated farming system (69.8%) and preferred native corn (96.2%) for their consumption. They till a loamy soil (73.6%) with a rolling topography (58.5%) at an area of less than 1 hectare (67.9%). The soil is prepared in a minimum tillage system (56.6%) using an animal-drawn plow (83.9%). Most of them applied herbicide (77.2%) before furrowing. Farmers used inorganic fertilizers (98.1%) like ammonium sulfate, urea, complete fertilizer, and ammonium phosphate. The farmers encountered problems like lack of capital (98.1%), adverse environmental conditions (86.8%), low crop production (69.8%), invasion of pests and diseases (58.5%), and cheap market price (56.6%). Their farms are situated less than 500 meters to the barangay road (75.5%) and more than 1 km to the national road (90.6%). They transported their products manually or with the aid of a motorcycle (96.40%). As to family participation, the father ranked number 1 as the main actor in farming. A mother ranked as the second performer in farming activities in support of the father. A son (rank 3) and daughter (rank 4) were seldom involved in farming activities. This investigation found out that the government should consider corn production training with access to capital or funding institutions to achieve a successful production. Family involvement in farming is also encouraged to strengthen the common goal of attaining food sufficiency. An in-depth understanding of the needs and traditional farming practices would arrive at a better design intervention of the policymakers to improve the existing practices, increase production and income of the smallholder farmers in Aurora, Zamboanga del Sur, Philippines.

Keywords: Assessment survey, Family involvement, Maize, Smallholders, Traditional practices

Introduction

Corn (*Zea mays* L.) is one of the staple foods of Filipinos. Its by-products can be used as feedstuff, and stalks can be processed into silage for poultry and

[*] **Corresponding Author:** Villaver, J. P.; **Email:** jepoy_villaver@yahoo.com.ph

livestock (Anser Ali and Hussain, 2012). Corn is rich in carbohydrates but low in glycemic index (28-35), potential food for diabetic patients (Flores-Silva *et al*., 2015). Corn is easily cultivated, and it can be harvested at 90 and 120 days after planting (DAP) for native and hybrid, respectively (Li *et al*., 2013). According to Gomez (2019), corn production in the Philippines is expected to increase by 2.5% or 8.1 million metric tons (MMT) in the 2019-2020 market due to higher demand. The ordinary corn plant is very susceptible to pests and diseases, particularly in the low elevation area (Abera *et al*., 2013). Asiatic corn borer, fall armyworms, earworms, silkworms are the most common insect pests (Santiago *et al*., 2013). Asiatic corn borer can be evaded with Bt corn or stacked; however, planting materials' prices are higher than ordinary corn (Ostry *et al*., 2010). An insect pest infestation can also be reduced using biological control and proper cultural practices (Figueiredo *et al*., 2015). Bacterial stalk rot, downy mildew, banded leaf and sheath blight (BLSB), and southern rust are the most common diseases in corn (Subedi, 2015). Planting resistant varieties (Olaoye, 2009) can reduce pest and disease infestation. After harvest, another pest will attack the corn grains during storage (Mendoza *et al*., 2017). Pesticides can control pests and diseases. Improper use of pesticides can be very harmful to the consumers. The pesticides can be used when the damage is beyond the economic threshold level (Blanco *et al*., 2014). Fall armyworms (FAW) are very resistant to insecticides. To avoid FAW infestations, planting corn out of season should be avoided (Midega *et al*., 2018). Improper application of pesticides is very harmful to the environment (Mahmood *et al*., 2016).

Growing corn is an interesting venture for farmers (Villaver, 2020). There should be a sufficient amount of nutrients to maximize maize yield. Inorganic fertilizers' application is the farmers' usual practice to meet the nutrient requirements (Kalhapure *et al*., 2013). Intensive application of inorganic fertilizers degrades the soil fertility (Marenya and Barrett, 2009). The conventional tillage system also destroys the soil profile and aggravates global warming due to the release of carbon dioxide into the atmosphere (Shokati and Ahangar, 2014). The use of pesticides, inorganic fertilizers, and intensive cultivation are not sustainable solutions for improving crop production to meet the increasing demand for corn in the country or world as well (Rains *et al*., 2011).

Government interventions are very necessary to find sustainable solutions for the abovementioned problems. The academe will take part in developing suitable technologies that would benefit the people in the community. It is very important to restore the degraded and depleted environment. Organic farming and conservation agriculture are potential technologies to maximize farmers'

profit without compromising the environment. The integration of poultry and livestock in farming is a very promising strategy for booster farmers' income.

The research was conducted to benchmark the existing farming practices in corn production and find suitable solutions that would benefit the people in Aurora, Zamboanga del Sur, Philippines.

Materials and methods

The study was conducted at the municipality of Aurora, Zamboanga del Sur, from December 1 to February 2020. The researchers used the descriptive survey method using a questionnaire to gather the needed data and information. The data of corn farmers in each barangay was obtained from the Municipal Agriculture Office (MAO). The researchers asked permission from the Municipal Mayor, Barangay Captains, and farmers before the study was conducted. Fifty-three farmer-respondents were used as the samples from the total population of 118 farmers based on a 95% confidence level and a value of 10 confidence interval or margin of error. A stratified random sampling technique was used to determine the sample in each barangay.

The three-point Likert scale was used to quantify the farmers' responses to family members' roles in the farm activities. The rating scale was interpreted as follows: 3=very much participated, 2 = participated, and 1 = no participation.

The data obtained from the farmer respondents were done through a questionnaire that includes the socio-demographic profile, farming systems and practices, problems encountered, biophysical information of the area, and the role of family members. After the interview, the data were consolidated and inputted in the IBM SPSS version 21 software. The data were analyzed using descriptive statistics such as frequency count, percentage distribution, and weighted arithmetic mean to measure the farmers' responses. A principal component analysis was used to determine the relationships of some parameters like civil status, the number of children, educational attainment, tribe, annual income, tenurial status, years in farming, types of corn planted, and the farming system adopted.

Results

The summary statistics of smallholder farmers are summarized in Table 1. The data revealed that most of the respondents were males, married, with 3-4 children. The respondents had an age bracket of 41-50 years, less educated (elementary level), affiliated as Roman Catholic, and a Cebuano by the tribe. They relied on farming, with an annual income of 10,001.00 – 20,000.00 in

their cornfield. Mostly, the respondents were not members of any organization, a tenant, and engaged in farming for more than ten years.

Table 1. Summary statistics of smallholder farmers

Socio-demographic profile		N	Minimum	Maximum	Mean	Std. Error	Std. Deviation
a.	Civil status	53	1.00	3.00	2.0000	.04666	.33968
b.	Number of children	53	1.00	4.00	3.1132	.13646	.99345
c.	Sex	53	1.00	2.00	1.3962	.06783	.49379
d.	Age	53	2.00	5.00	4.2642	.12962	.94362
e.	Educational attainment	53	2.00	8.00	3.2642	.23815	1.7337
f.	Religious affiliation	53	1.00	5.00	1.2642	.11156	.81219
g.	Tribe	53	1.00	3.00	1.0566	.04186	.30478
h.	The main source of income	53	1.00	7.00	1.6792	.21681	1.5784
i.	Annual income	53	1.00	6.00	2.2642	.18498	1.3467
j.	Tenurial status	53	1.00	3.00	1.5849	.12177	.88652
k.	Years in farming	53	1.00	3.00	2.8113	.07646	.55666
l.	Membership in organization	53	1.00	4.00	1.7358	.12093	.88036
Valid N (listwise)		53					

Notes: civil status (2.0=married), number of children (3.0= 3-4), sex (1.0=male), age (4.0=41-50 years), educational attainment (3.0=elementary graduate), religious affiliation (1.0=Roman Catholic), tribe (1.0=Cebuano), main source of income (1.0=farming), annual income (2.0=10,001.00 – 20,000.00, tenurial status (1.0=tenant), years in farming (3.0=>10 years), membership in organization (1.0=none).

Respondents' farming background

The farming systems and farming background of the respondents are shown in Table 2. The data showed that the respondents had practiced the integrated farming systems (69.8%), which they grew crops and treated animals as their income source. The farmers preferred to grow native corn (96.2%) for their consumption. Other farmers also sell some of their corn products. The respondents had a loamy soil (73.6%) in a farm size of less than 0.5-hectare (37.7%). The topography of their farms was rolling (58.5%), while others were flat (24.5%) and hilly (17%). The respondents practiced the minimum tillage system (56.6%) while others adopted conventional or full tillage system (43.4%). Most of them used herbicide (58.5%) as efficient control for weeds.

Table 2. Farming background of smallholder maize farmers

Variables	Frequency	Percent	Cumulative Percent
a. Farming System			
Monocropping	5	9.4	9.4
Intercropping	11	20.8	30.2
Integrated farming system	37	69.8	100.0
Total	53	100.0	
b. Types of Corn			
Hybrid	2	3.8	3.8
Native	51	96.2	100.0
Total	53	100.0	
c. Respondents' intention			
Own consumption	29	54.7	54.7
Both consumption and marketing	24	45.3	100.0
Total	53	100.0	
d. Types of Soil			
Sandy	9	17.0	17.0
Loamy	39	73.6	90.6
Clayey	5	9.4	100.0
Total	53	100.0	
e. Topography			
Flat	13	24.5	24.5
Rolling	31	58.5	83.0
Hilly	9	17.0	100.0
Total	53	100.0	
f. Size of Corn Farm			
< .5 ha	20	37.7	37.7
.6 – 1 ha	16	30.2	67.9
1.1 – 2 ha	15	28.3	96.2
2.1 and above	2	3.8	100.0
Total	53	100.0	
g. Land Preparation			
Conventional/full tillage	23	43.4	43.4
Minimum tillage	30	56.6	100.0
Total	53	100.0	
h. Pesticides Used			
Insecticide	4	7.5	7.5
Herbicide	31	58.5	66.0
None	18	34.0	100.0
Total	53	100.0	

Scree plot of selected parameters

The scree plot of the selected variables is presented in Figure 1. The data showed that the first to the fourth principal components are considered in the correlation because the eigenvalues had greater than 1.

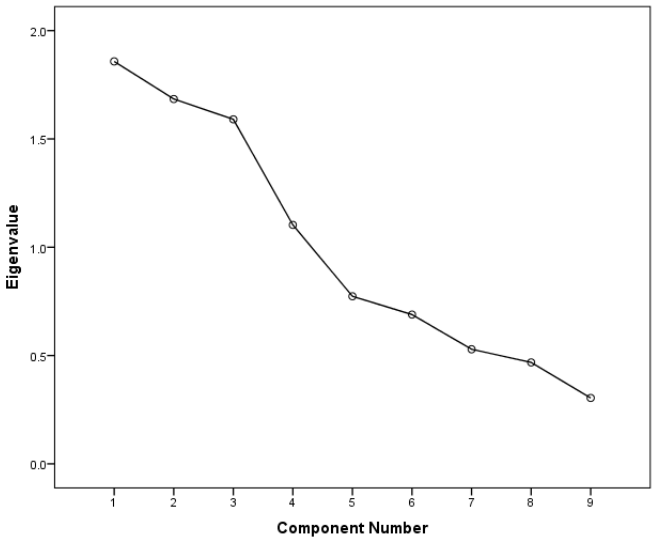

Figure 1. Scree plot of selected variables

Table 3. Principal component analysis of selected variables

Variables	Component			
	1	2	3	4
Civil status	-.027	.541	-.165	-.099
Number of children	.042	.544	.061	.038
Educational attainment	.365	-.224	-.219	-.038
Tribe	-.103	-.047	.160	.651
Annual income	.452	.063	.112	.079
Tenurial status	.256	.065	-.152	.412
Years in farming	-.051	.028	.468	-.100
Types of corn planted	.096	-.133	.587	.218
Farming system	.340	.068	.097	-.263

Note Extraction method: principal component analysis, rotation method: varimax with Kaiser normalization, component scores.

Principal component analysis of selected variables

The relationship between selected variables is presented in Table 3. The educational attainment (.365), annual income (.452), and farming system (.340) had the highest positive loadings in component 1. The data imply that the smallholder farmers' annual income correlated with their educational attainment and the type of farming system. Mostly, educated individuals were more knowledgeable in a suitable farming system, resulting in increased family income. In component 2, civil status (.541) and the number of children (.544)

had the highest positive loadings. The married individual had raised more children, which can be used in their farming activities. In component 3, years in the planting and the types of corn planted had the highest positive loadings. The most experienced smallholder farmers used the native variety, preferably because they may be available anytime for free. In component 4, the tribe (.651) and tenurial status (.412) had the highest positive loadings. Cebuano people were more inclined in farming, although, most of them were tenant in this study.

Farm implements used by the respondents

The farm implements used by the respondents in cultivation are shown in Table 4. It revealed 52 or 83.9% that used animal-drawn plow, while only 10 or 16.1% that used sharp bolo. The result implies that the farmers rely on the traditional method of farming. They are not equipped with modern technologies in the farming system.

Table 4. Farm implements used in the cultivation

Farm Implements	Responses		Percent of Cases
	N	Percent	
Animal drawn plow	52	83.9	98.1
Blunt bolo	10	16.1	18.9
Total	62	100.0	117.0

Specific fertilizers used by the respondents

The specific fertilizer used by the respondents is shown in Table 5. The data showed that the farmers used ammonium sulfate (45%), urea (28.8%), complete fertilizer (16.3%), ammonium phosphate (8.8%), and vermicompost (1.3%). The data imply that farmers are well-informed on synthetic fertilizers while only a few of them used organic fertilizer.

Table 5. Specific fertilizers used by the respondents

Specific Fertilizer	Responses		Percent of Cases
	N	Percent	
Vermicompost	1	1.3	1.9
Ammonium sulfate	36	45.0	67.9
Urea	23	28.8	43.4
Complete fertilizer	13	16.3	24.5
Ammonium phosphate	7	8.8	13.2
Total	80	100.0	150.9

Common problems encountered by the farmers

The common problems encountered by the respondents is depicted in Table 6. Result showed lack of capital (98.1%), adverse environmental conditions (86.8%), high cost of inputs (81.1%), low production (69.8%), pests and diseases (58.5) and low market price (56.6%). The data clearly showed that the farmers were incapable of upgrading their farming system due to a lack of farm capital. Moreover, the environment may not be favorable for their crops due to climate change.

Table 6. Common problems encountered by the respondents

Common Problems	Responses		Percent of Cases
	N	Percent	
Pests and diseases	31	11.7	58.5
Lack of capital	52	19.6	98.1
Availability of inputs	6	2.3	11.3
Transportation of products	10	3.8	18.9
Availability of labor	1	0.4	1.9
Knowledge	4	1.5	7.5
Low market price	30	11.3	56.6
Adverse environmental conditions	46	17.4	86.8
Low production	37	14.0	69.8
The high cost of inputs	43	16.2	81.1
Laborious	4	1.5	7.5
Political interventions	1	0.4	1.9
Total	265	100.0	500.0

Biophysical information of the respondents' farms

That most farmers had established their farms at less than 500 meters (75.5%) from the barangay road and more than 1,001 meters from the national road (Table 7). Considering the distance, farmers had ease in transporting their products.

Table 7. The distance of farm to barangay and national road

Distance of farm to barangay road	Frequency	Percent	Cumulative Percent
<500 meters	40	75.5	75.5
501 to 1,000 meters	9	17.0	92.5
>1,001 meters	4	7.5	100.0
Total	53	100.0	
Distance of farm to the national road			
<500 meters	2	3.8	3.8
501 to 1,000 meters	3	5.7	9.4
>1,001 meters	48	90.6	100.0
Total	53	100.0	

Mode of transportation

The farmers had preferred to transport their products manually or with the aid of motorcycles (49.1%) since their harvest was minimal as portrayed in Table 8. Only a few of them used horses and carabao with 1.8% each.

Table 8. Mode of transportation of products by the respondents

Mode of Transportation	Responses		Percent of Cases
	N	Percent	
Motorcycle	26	47.3	49.1
Manual + motorcycle	27	49.1	50.9
Horse	1	1.8	1.9
Carabao	1	1.8	1.9
Total	55	100.0	103.8

Table 9. Involvement of family members in farming activities

Farming Activities	Father		Daughter		Son		Mother	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
1. Slashing/clearing of the land	2.83	0.074	1.23	0.064	1.70	0.096	1.96	0.097
2. Herbicide application	2.79	0.082	1.10	0.045	1.60	0.106	1.43	0.087
3. Plowing/off-barring/hilling-up	2.81	0.076	1.20	0.059	1.70	0.100	1.60	0.095
4. Fertilizer application	2.81	0.076	1.43	0.106	1.87	0.111	2.00	0.104
5. Planting	2.81	0.076	1.47	0.102	1.89	0.113	2.25	0.100
6. Weeding	2.77	0.084	1.32	0.084	1.77	0.107	1.98	0.099
7. Application of chemicals	2.60	0.109	1.10	0.045	1.49	0.103	1.38	0.090
8. Harvesting	2.83	0.075	1.72	0.125	2.02	0.122	2.36	0.097
9. Caring for animals	2.81	2.811	1.30	0.074	1.89	0.110	2.10	0.102
10. Selling of products	2.64	2.642	1.20	0.061	1.40	0.87	2.62	0.094
11. Budget planning	2.20	2.189	1.06	0.042	1.15	0.063	2.85	0.073
12. Planning of farm activities	2.47	2.472	1.11	0.052	1.28	0.078	2.60	0.087
13. Food preparations	1.74	1.736	1.58	0.099	1.28	0.073	2.88	0.058
14. Washing of clothes	1.47	1.472	1.72	0.115	1.36	0.077	2.87	0.060
15. Fetching of water	2.23	2.226	1.34	0.081	1.85	0.122	1.83	0.100
16. Purchasing of farm inputs	2.53	2.528	1.25	0.065	1.30	0.083	2.68	0.092
Overall Mean	2.52		1.31		1.60		2.21	
Overall Decision	VMP		NP		NP		P	

Legend:1.00-1.67 = not participated (NP); 1.68-2.35 =participated (P); 2.36-3.00 = very much participated (VMP)

Family involvement in farming activities

The involvement of family members in farming activities is presented in Table 9. The father plays an important role in farming activities as it gained a mean of 2.52 or very much participated. The father is mostly involved in all activities except for washing clothes, which is done mostly by a mother and daughter. Next to the father is the mother, who plays many roles, as revealed by a mean of 2.21 (participation in the activity sometimes). Among the activities where a mother mostly participation are slashing and cleaning the land, fertilizer application, planting, weeding, harvesting, caring for animals, selling products, budget planning, food preparations, and fetching of waters. Next to the mother is the son, who performs in slashing/clearing the land, plowing/off-barring, fertilizer application, planting, weeding, harvesting, caring for animals, and fetching water. The daughter had lesser involvement in farming activities, although it can perform like harvesting and washing clothes. The father is mostly involved in activities from 1-10, while the mother is involved in 11-14 and 16 (Figure 2).

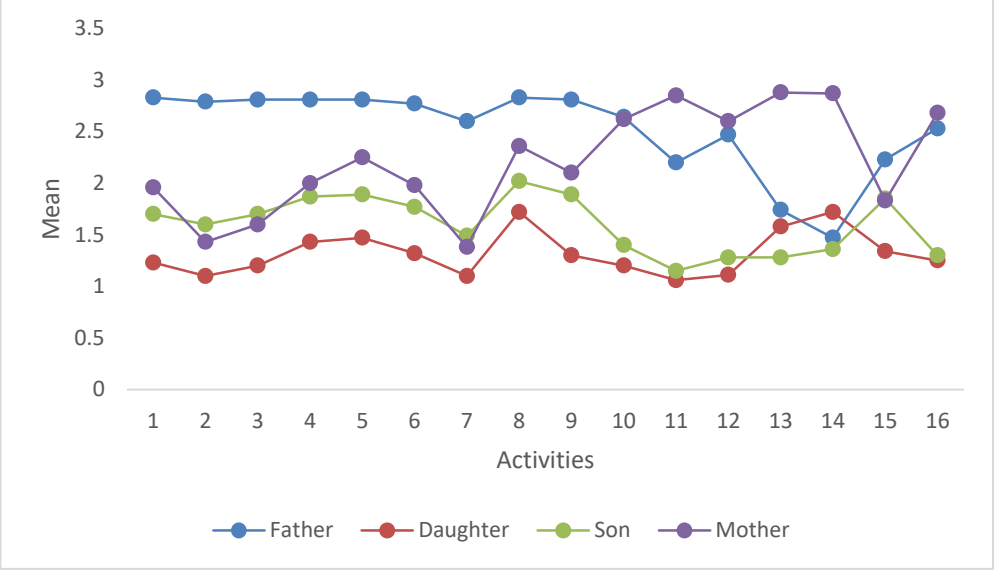

Figure 2. The role of family members in the involvement of farming activities
Legend: 1 – slashing/clearing of the land, 2 – herbicide application, 3 – plowing/off-barring/hilling-up, 4 – fertilizer application, 5 – planting, 6 – weeding, 7 – application of chemicals, 8 – harvesting, 9 – caring for animals, 10 – selling of products, 11 – budget planning, 12 – planning of farm activities, 13, food preparations, 14, washing of clothes, 15, fetching of water, and 16 – purchasing of farm inputs.

Discussion

Most of the respondents involved in maize farming in Aurora are males, elementary graduates, with an annual income of less than 20,000.00 based on the interview's information. The demographic profile results were the same from the study conducted by Marechera and Ndwiga (2015) where males had less educated, and the low-income individuals which engaged in maize farming. The study conducted by Aurangzeb *et al*. (2007) mentioned that most smallholder maize farmers were tenants. This study revealed that the farmers' preference is inclined to increase more income in the integrated farming system. As stated by Archer *et al*. (2019), the integrated farming system included growing crops and animals. Adopting an integrated farming system is a very good choice for the farmers because it will help the farmers augment their income; however, there are also hindrances in the implementation due to limited capital. Intercropping is another farmers' choice necessary to minimize weed infestation, maximize yield, and maintain the soil's biological activities (Dwivedi *et al*., 2015).

The farmers are growing corn mostly for their consumption. Others also sold their products to attain household needs. The study conducted by Makate *et al*. (2017) revealed that the farmers set aside their maize products for sale or personal use. The farmers established their maize farm in rolling topography. Maize production is greatly affected by the topography of the land (Heredia *et al*., 2020). Hilly or rolling farms are the most prone to leaching or soil degradation (Metwally *et al*., 2019). Aside from that, the farmers in Aurora are not aware of cultivating the rolling and hilly areas. They relied mostly on the use of herbicides, which soften the soil or eventually cause erosion. Thus, the production of maize by smallholder farmers in Aurora is low.

The relationship of some selected variables revealed that educational attainment and annual income had influenced the farming system's choice. The number of children is more likely to increase with less-educated individuals. The study conducted by Patidar and Patidar (2015) explained that educational attainment has a significant effect on farming system choice.

The farmers are using animal-drawn plow in furrowing while others are using blunt bolos to remove weeds. Farmers are fully aware of the application of inorganic fertilizers. The common problems encountered by the farmer respondents in Aurora are lack of capital, adverse environmental conditions, high cost of inputs, low production, pests, disease occurrence, and low market price. Lack of capital is one of the major problems in production. Farmers will not be able to perform their best practices in the absence of funds. The investigation of Agyekumhene *et al*. (2018) presented a digital platform for

smallholder farmers to access credit provision. Too much rain or drought also impede the growth of corn. Wind speed may also cause root lodging of corn (Xue *et al*., 2016). Dowswell (2019) reported that the decrease of maize prices had worsened exporting countries' economic situation. Low production is not only a local but a global problem. The occurrence of aflatoxin is also a problem after harvesting, which will degrade maize products' quality and lower the market price (Maina *et al*., 2016).

The involvement of family members in farming is very important for success and sustainability (Galeski, 2020). Every member of the family can participate in terms of planning or implementation of farming activities. As revealed in this study, the father is very important in leading decision-making, especially in farming practices. However, a female may also greatly contribute to desirable planning in improving maize farming (Gebre *et al*., 2019). A son and daughter may be active in farming during weekends.

The study concluded that the integrated farming system is accepted to be the most adopted method of farming by the respondents. The farmers used native corn at a minimal area of 0.5 hectares. The farmers implemented inorganic fertilization. They also used herbicides to control weeds and to minimize disturbance of the soil. The farmers lack enough capital to upgrade their status of production. They have also encountered adverse effects of the environment and pests and disease occurrence due to climate change. The father is the dominant role player in farming activities, followed by a mother, son, and daughter. In this study, it was found out that the government's participation is very important for providing training in corn production, access to credit for capital investment, subsidy for inputs, and provide sustainable projects based on their needs and capacity to achieve a greater harvest and income. Family involvement also is a very promising tool for the success of the farming activity. Substantial knowledge in the existing farming practices will lead to a sustainable solution for the betterment of human lives.

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