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Research article

IMPLICATIONS OF THE FARMING, UTILIZATION AND PREFERENCES OF *Coix lacryma-jobi.* L. AS AN ALTERNATIVE STAPLE CROP TO ENVIRONMENTAL MANAGEMENT AND SUSTAINABILITY IN SULTAN NAGA DIMAPORO, LANAO DEL NORTE, MINDANAO, PHILIPPINES

[1*]Cecilia C. Basser, [1*]Sonnie A. Vedra, [1]Jessie G. Gorospe, [1]Rodolfo B. Trinidad, [1]Wenceslao A. Coronado and [2]Richel E. Relox

[1]School of Graduate Studies, Mindanao State University at Naawan
9023 Naawan, Misamis Oriental, Philippines
[2]College of Science and Mathematics, University of Science and Technology in Southern Philippines
9000 Cagayan de Oro City

*Corresponding authors: ccbasser43@gmail.com, and vedrasonni@gmail.com

Abstract

Food security and food shortage are becoming a social problem in agricultural communities, hence the need to explore alternative crops. Hence, implications of *adlay* as an alternative food source are assessed in terms of preferences, farming practices and utilization within the three barangays of Sultan Naga Dimaporo, Lanao del Norte, as perceived by the male and female farmer respondents. In-person survey interviews using survey questionnaire are used in 96 male and female farmer respondents in the three barangays of Sultan Naga Dimaporo. Results showed no significant relationships of the responses of the male and female respondents. This means that both had a common and collective perception as to the preferences, farming practices and utilization of *adlay* and on how it became an alternative food source. The potential of *adlay* being an alternative crop is being perceived positively and agreed by both gender, however, most of them had a relatively low response. This means that the information being

disseminated and the corresponding technology are still very new to them and that they are still in a transition period of adoption. *Adlay* farming in Sultan Naga Dimaporo, is still in a process of adoption, yet positive response is observed, particularly to those farmers who opted to use it, while other farmers opted to plant rice and corn due to the urgent need of income and yield from farms. Information from media and farm technicians are crucial to enhance the technology along with the farmers' motivation, sharing of experience in peer groups and successive learning. This in turn, results to the beginning of a whole chain of *adlay* farming innovations among the culturally-diverse farming communities. It is therefore recommended that personnel of the Department of Agriculture and Local Government Units (LGU) should exert much effort in imparting their knowledge, skills and expertise in persuading the farmers to adopt this promising farming technology. This can be achieved in stressing the human health benefits and the importance in cases of food shortage. Lastly, the production methods adapted to the locality and avoidance of chemical inputs can also be enhanced through improved IEC strategies.

Keywords:alternative crop,*Coix lacryma-jobi.* L. sustainable development, tropical agriculture

INTRODUCTION

The Philippine government develops the agriculture sector through programs like agrarian reform, agricultural modernization and rural finance, however, farmers and fisherfolk remain as the poorest sectors. With exports like mango, banana, and pineapple, as well as fishery products and coconut oil, many still think of the Philippines as an agricultural economy. The agriculture sector remains the main source of income and employment for 30.9% of the working population. It is equivalent to about 12 million of the 38.5 million total employed workers, based on the National Statistics Office's 2013 Labor Force Survey. According to World Bank data, 40.6% of the country's total land area is agricultural and 51% of the total population still lived in rural areas in 2011. While agriculture's role in producing food and generating income in the rural areas is essential, the sector's contribution to the country's gross domestic product (GDP) has been declining over the years. According to the National Statistical Coordination Board, about a third (29.7%) of the country's total output was agricultural back in 1946. By 1995, agriculture's GDP contribution was down to 21%; in 2013, the sector's share had further declined to 12% (Teves, 2014).

The government recognizes the provision of adequate and affordable credit as a key intervention in boosting the agriculture sector. It is especially important to small-scale farmers who rely on credit for their working capital and often, for their subsistence, too. "From the 1970s to the mid-1980s, the government provided loans at highly subsidized rates to bring down the cost of borrowing among targeted sectors. The most famous example of subsidized credit was the supervised credit component of the Masagana 99 rice production program" (Llanto, 2005). Today, interest rates on agricultural loans are highest in the Philippines, where the average interest rate charged by formal lenders is 26.7% per annum, based on a study by the Agricultural Credit Policy Council. Neighboring countries like Thailand's Bank of Agriculture offers 6% per year while Vietnam's Agri Bank and Indonesia's government bank both charge 12% per annum. India's government bank provides 0% interest if a loan is paid within six months while the government bank in China charges 5% per annum, 80% of which is shouldered by the government (PhilRice, 2013).

The Philippine government intervenes in the domestic rice market through the imposition of import tariffs and the provision of producer and consumer subsidies. Local policy makers are aware that these programs carry allocative efficiency costs. Trade analysts have argued for reductions in tariff and non-tariff trade barriers on both the rice sector and the broader Philippine agricultural sector to promote economic efficiency (Magno and Yanagida, 2000; Salehezadeh and Henneberry, 2002; Dawe, 2006; Briones, 2013; Layaoen, 2014). Similarly, there have been many proposals for the abolition or re-design of the Philippine government's rice/paddy subsidy programs, on the grounds that they promote allocative inefficiency, are poorly targeted, and have high budgetary costs (Jha and Mehta, 2008; Cororaton and Corong, 2009; Intal, et al., 2010; Briones and Parel, 2011). Despite the substantial body of policy

analytic work favoring reductions in Philippine rice market support, the continued maintenance of the programs has been justified by government on food security grounds. However, under business-as-usual conditions, the food security benefits of the Philippine's programs look small. For example, the Philippines producer and consumer rice subsidy programs have only a small positive effect on domestic food security, as calculated by comparing the effects of removing the programs on food security indices, relative to a business as usual baseline in which the programs are retained.

The idea of agricultural sustainability does not mean ruling out any technologies orpractices on ideological grounds. If a technology works to improve productivity for farmers, and does not harm the environment, then it is likely to be beneficial on sustainability grounds. Agricultural systems emphasizing these principles are also multi-functional within landscapes and economies. They jointly produce food and other goods for farm families and markets, but also contribute to a range of valued public goods, such as clean water, wildlife, carbon sequestration in soils, flood protection, groundwater recharge and landscape amenity value. As a more sustainable agriculture seeks to make the best use of nature's goods and services, so technologies and practices must be locally adapted and fitted into place. These are most likely to emerge from new configurations of social capital, comprising relations of trust embodied in new social organizations, new horizontal and vertical partnerships between institutions, and human capital comprising leadership, ingenuity, management skills and capacity to innovate. Agricultural systems with high levels of social and human assets are more able to innovate in the face of uncertainty.

Adlay, with scientific name, *Coix lacryma–jobi* L. is a very promising crop because of its multifarious uses. One variety, *Coix lacryma–jobi var. ma–yuen*, aside from being edible, has medicinal benefits for a wide range of ailments; while another variety, *Coix lacryma–jobi* var. *stenocarpa and* var. *monilifer* could be used to make ornaments, such as rosary beads, necklaces, curtains, etc. Moreover, different parts of the weed-like plant have novel uses, such as coffee or tea is made from roasted seeds, while the leaves could be fed to cattle and other small ruminants as fodder.

Also known as Job's tears because of its tear–shaped grains, the tall, freely–branching upright plant is nutritious as it contains 50% starch, 14% protein, and only 6% fat. Grains are usually harvested after four to five months from sowing, depending on the strain/variety, namely: *tapol, ginampay, gulian,* or *pulot*. Separated from stalks through threshing, like rice, seeds are first dried under the sun before milling. The plant grain could be eaten in the same manner as rice.

In the roadmap for the Visayas and Mindanao Cluster for CY 2012–13, Regions 6–13, and the ARMM, were each granted research funds to precisely develop, promote, and utilize *adlai* as an alternative food source. Because of the tremendous potential seen in the plant, a project was launched by DA-Bureau of Agricultural Research (BAR) in late 2010 for on-station Adaptability Yield Trials–cum–Seed Production. This project, which is currently under implementation, explores the possibility of developing production technologies for the purpose of replicating the AYTs in researcher–managed trials on–farm, and subsequently helping promote the widespread adoption of the technologies by farmers in their farms (DA-BAR, 2013).

Adlay (*Coix lacryma-jobi* L.) is a new alternative food source aside from rice and corn. The plant is now endemic in the Philippines but it remains underutilized. Adlay grows organically and contain 50% starch, 14% protein and 6% fat. It is also valued for its medicinal uses with its anti-allergic, anti-cancer and anti-diabetic properties. Adaptability trial was conducted at DA-10 (NOMIARC), Dalwangan, Malaybalay City, Bukidnon during CY 2010-2011 to determine the adaptability of available varieties, develop technologies on cultural management practices, postharvest and processing. It aims to promote adlay's use as feed for livestock and poultry, and recommend varieties for registration to (NSIC). Four varieties were tested in three cropping seasons including ratoon. Results showed that variety Kiboa exhibited the highest grain yield of 5.86 mt/ha, followed by Gulian and Ginampay with 4.80, 4.78 mt ha^{-1}. Tapol got lowest of 4.50 mt/ha (mean of 2 cropping). Percent milling recovery ranged from 43 to 45%. However, Kiboa and Tapol got the same recovery with 45%. Gulians showed the early to flower at 120 DAP while Ginampay had highest number of panicles with 26.0, as well as the longest length of panicles 75.3 cm. Tapol attained the tallest with 307.7 cm height and obtained more grains per panicle with 276.0. Sensory test revealed that varieties did not differ significantly on appearance odor and taste.However, on texture and generally acceptability Tapol and Kiboa had a rating of 7.0 which means liked very much by the tasters. Kiboa obtained the highest RO1 or return on investment of 174% (58,645) followed by Gulian with 123.2% (41,446) (Tumapon, et al., 2012).

Sustainable agriculture technologies and practices must be locally-adapted. They emerge from new configurations of social capital (relations of trust embodied in new social organizations and new horizontal and vertical partnerships between institutions) and human capital (leadership, ingenuity, management skills and knowledge, capacity to experiment and innovate). Agricultural systems with high social and human capital are able to innovate in the face of uncertainty. Sustainable agriculture jointly produces food and other goods for farm families and markets, but it also contributes to a range of public goods, such as clean water, wildlife, carbon sequestration in soils, flood protection, landscape quality. It delivers many unique non-food functions that cannot be produced by other sectorsfor example, on-farm biodiversity, groundwater recharge, urban to rural migration, social cohesion (Pretty and Hine, 2001).

In this context, the focus of this study is to determine the implications of the farming, utilization and preferences of *Coix lacryma-jobi.* as an alternative staple crop among farmer respondents to environmental management and sustainability of the three barangays of Sultan Naga Dimaporo, Lanao del Norte.These factors might rely on the intervention of the government as well as its line agencies, NGOs, GOCCs and private sector in the implementation of the sustainable development projects.

Materials and Methods

The study areas

The three sampling barangays considered in this study were: Barangay Pigkalawag (S1) is located within the coordinates of N8°45.040' and E124°29.082'. The total area is 378.007.hectares with cultivated agriculture area of 49 hectares. This barangay is populated with 3,788. Barangay Poblacion (S2) is located within the coordinates of N8°45.040' and E124°29.092'. The total area is 531.816 hectares with cultivated agriculture area of 466.27 hectares. This barangay is populated with 7,383. Barangay Ramain (S3) is located within the coordinates of N8°45.040' and E124°21.062'. The total area is 1,203.69 hectares with cultivated agriculture area of 500 hectares. This barangay is populated with .2, 352, all in the municipality of Sultan Naga Dimaporo, Lanao del Norte.

Research design and data collection

The method used in this study is descriptive as it involved describing, analyzing and interpreting the existing conditions of the farmers of selected municipalities of Lanao del Norte, Mindanao, Philippines. The study used survey research design. This dealt with the descriptive-normative form wherein a set of questionnaire was used to extract information from the 96 farmer respondents in different barangays within this municipality of Lanao del Norte, Philippines.

Primary data were obtained using a survey questionnaire, which served as the research instrument used in the study. It was written in English and translated in vernacular or Cebuano. The research instrument was pre-tested to some sample respondents within the three stations. The data focused on: (1) socio-demographic andeconomic profile of the respondents and (2) and perceptions on management sustainability strategies in *adlay* production as well as its policies/laws on sustainability of its adoption as an alternative source of staple crop shall also be incorporated

Data analyses

In this qualitative research, the collection and content analysis of the questionnaire-checklist which served as the interviews and the non-verbal data that provided valuable resources for baseline process and values data. The respondents' responses on the survey questionnaire and interview recordings were studied, organized chronologically and tabulated into frequency and percentages by station. Data from the instrument were pooled together. Inconsistencies of the respondents' responses were verified. The physical reactions of the interviewees were differentiated from the responses by enclosing it with a parenthesis and written in italics. Throughout the study, the respondents' responses, viewpoints, thoughts and non-verbal data were reviewed. The respondents were given the opportunity to respond to the initial analysis before a final draft of the study was written.Frequency and

percentage distribution were used to describe the socio-demographic response of the respondents. A chi-square test was also used to determine the relationship between the socio-economic factor of the respondents and their perceptions on the farming preferences and practices as a new technology introduced to address the shortage of staple food, the rice and corn with *adlay* as alternative source of food in Sultan Naga Dimaporo, Lanao del Norte. The score of the respondents' perceptions toward the newly introduced alternative source of staple food was analyzed using a scale of response options with a range of 1-5 (Leong, 1988) (Table 1).

Table 1. The response options scale (Leong, 1988).

Response Option	Range	Mean	Qualitative Description
Strongly Agree	5	4.21-5.00	Very high
Agree	4	3.41-4.22	High
Undecided	3	2.61-3.40	Average
Disagree	2	1.81-2.60	Low
Strongly disagree	1	1.00-1.80	Very low

Results and Discussion

Socio-demographic profile

The gender distribution of the respondents had male farmers greater than the female farmers at 59% (Table 2). These male farmers were usually engaged in heavy farming activities like land preparations (i.e. mostly plowing), planting of the crops, care and maintenance for the crops like weeding, harvesting and post-harvest activities. The females (41%) provided support services for the male farmers. They assisted several farm-related activities, preparing food for the males and marketing of the crops.

Most of the farmers are aged 24 to 44 years old at 1.04% to 7.29% for both male and female farmers (Table 2). These age groups were at the optimum level for their reproductive and productive years, and a very important attribute in a farming community to ensure efficient production in farms. Some respondents were aged 52 to 81 years old (1.04% to 4.16%) for both male and female farmers. This means that they had a life-long farming engagement but farming activities were reduced already due to age-related concerns. A good distribution for both male and female farmers were observed in this particular age group.

Mostly were in married status for both male and female respondents at 55.20% (Table 1). This means that farming is considered a serious activity or livelihood to support the basic needs of the family.

Most of the respondents were at their elementary level at 37.5%, while others had completed elementary education at 24.75% for both male and female respondents (Table 2). Few had completed their secondary and tertiary education levels. An increase in literacy level would affect the internalization of farm-related technologies, which might be relatively difficult for these set of respondents due to a relatively low level of educational attainment. However, hands-on training might help in this context.

Majority of the respondents were Islam at 47.91%, while others were Iglesia ni Kristo at 17.70% for both male and female respondents (Table 3). Some were in Islam and other Christian denominations. Religion in this context of study would not directly affect farming activities as the crops planted were not part of the religious activities or being forbidden in various practices. However, some farming activities might be affected especially during holy and worship days.

Majority of the respondents were members Iranun at 36.45% with 27.08% and 9.37% male and female respondents. It was followed by the Maranaos were at 18.75% and 8.33% male and female respondents (Table 3). This is besides the other IP communities. No farming restrictions or cultural restrictions in farming *adlay* in this context of study.

Most of the families had 2 to 6 children at 14.58% and 15.62%, respectively, for both male and female respondents (Table 3). This means that a relatively less economic pressures would be experienced by the family as little basic needs would be addressed by the family.

Farming constituted the main livelihood of the respondents at 37.5% and 22.91%, respectively, for both male and female respondents (Table 3). This means that the possibility of *adlay* as an alternative crop or even a major crop to be planted is very possible, should rice and corn plantation fail.

Table 2. Mean distribution of gender, age, civil status and educational attainment as part of the socio-demographic profile of the male and female farmer respondents in the three barangays of Sultan Naga Dimaporo, Lanao del Norte.

	Male	Female	Total
Gender	57(59)	39(41)	96(100)
Age			
24	7(7.29)	5(5.20)	12(12.50)
25	6(6.25)	2(2.08)	8(8.33)
27	3(3.12)	3(3.12)	6(6.25)
28	1(1.04)	1(1.04)	2(2.08)
30	3(3.12)	3(3.12)	6(6.25)
33	3(3.12)	2(2.08)	5(5.20)
34	3(3.12)	1(1.04)	4(4.16)
36	2(2.08)	2(2.08)	4(4.14)
39	3(3.12)	1(1.04)	4(4.14)
42	6(6.25)	5(5.20)	11(11.45)
44	3(3.12)	2(2.08)	5(5.20)
52	5(5.20)	2(2.08)	7(7.29)
59	2(2.08)	5(5.20)	7(7.29)
61	2(2.08)	1(1.04)	3(3.12)
63	1(1.04)	1(1.04)	2(2.04)
81	5(5.20)	1(1.04)	6(625)
Civil Status			
Single	4(4.16)	4(4.16)	8(8.33)
Married	35(36.355	18(18.75)	53(55.20)
Widow/er	8(8.33)	7(7.29)	15(15.62)
Separated	10(10.81)	10(10.41)	20(20.83)
Educational Attainment			
No Schooling	4(4.16)	4(4.16)	8(8.33)
Elementary Level	27(28.12)	9(9.37)	36(37.5)
Elementary Graduate	10(10.41)	13(13.54)	23(24.73)
High School Level	4(4.16)	4(4.16)	8(8.33)
High School Graduate	2(2.08)	2(2.08)	4(4.16)
College Level	6(6.25)	2(2. 08)	8(8.33)
College Graduate	4(4.16)	5(5.20)	9(9.37)

Table 3. Mean distribution of religion, ethnic origin, family size and livelihood as part of the socio-demographic profile of the male and female farmer respondents in the three barangays of Sultan Naga Dimaporo, Lanao del Norte.

	Male	Female	Total
Religion			
Islam	27(28.12)	19(19.79)	46(47.91)
Catholic	8(8.33)	5(5.20)	13(13.54)
Seventh Day Adventist	3(3.12)	3(3.12)	6(6.25)
Iglesia ni Cristo	10(10.41)	7(7.29)	17(17.70)
Others	9(9.37)	5(5.20)	14(14.58)
Ethnic Origin			
Iranun	26(27.08)	9(9.37)	35(36.45)
Maranao	18(18.75)	8(8.33)	26(27.08)
Maguindanao			
Tausug			
Other IP's	13(13.54)	22(22.91)	25(26.04)
Size of the Family			
1	4(4.16)	4(4.16)	8(8.33)
2	7(7.29)	7(7.26)	14(14.58)
3	4(4.12)	2(2.08)	6(6.25)
4	8(8.33)	2(2.08)	10(10.41)
5	3(3.12)	7(7.29)	10(10.41)
6	9(9.37)	6(6.25)	15(15.62)
7	4(4.16)	4(4.16)	8(8.33)
8	6(6.25)	3(3.12)	9(9.37)
9	6(6.25)	3(3.12)	9(9.37)
10	6(6.25)	1(1.04)	7(7.29)
Livelihood			
Farming	36(37.5)	22(22.91)	58(60.41)
Fishing	12(12.50)	10(10.41)	22(22.91)
Business	1(1.04)		1(1.04)
Self-Employed	3(3.12)	2(2.08)	5(5.20)
Others	5(5.20)	5(5.20)	10(10.40)

Perception survey for *adlay* preferences

The male and female respondents in the three barangays of Sultan Naga Dimaporo were asked on their views related to *adlay* as a staple crop alternative to rice and corn with their own preferences, farming practices and utilization. Results showed that most of the male and female respondents were undecided (20.83%) whether or not *adlay* is a potential source of alternative staple food. Some respondents had strongly agreed at 16.66% and 11.45%, respectively. Most agreed that *adlay* is easy to grow in their respective barangays at 6.25% and 30.20%, respectively, for both male and female respondents. *Adlay* is a better source of animal feeds at 31.25% based on the response of male and female farmer respondents. Majority of the male (31.25%) and female (26.04%) respondents agreed that *adlay* is a good source of healthy food because of its nutrient content. They also agreed that it is easy to grow because of its resiliency to pests and diseases at 27.08% and 31.25%, respectively, for both male and female respondents. They had agreed that *adlay* is economical to grow because it can be rationed up to five times if grown

in fertile soil even without fertilizer application at 32.29% and 25%, respectively, for both male and female respondents. It can also be grown without the application of pesticides and fertilizers at 34.37% and 23.95%, respectively (Table 4).

The respondents were asked if they can save on farm expenses since *adlay* can produce tillers that are productive, and most of them agreed at 34.37% and 27.08%, respectively. The male and female respondents at 36.46% and 28.12%, respectively, agreed that farmers can save farm inputs since *adlay* can be grown organically. They agreed at 33.33% and 25%, respectively, that *adlay* can be a good source of food when there is shortage of rice because of drought since it is drought-resistant. When asked if *adlay* is a good source of food for health-conscious individuals, most of them agreed at 36.45% and 26.88%, respectively. The male and female respondents both agreed at 35.41% and 25% that *adlay* is manageable because it can survive even weeded only once. *Adlay* is a good source of healthy foods because of its numerous medicinal properties as agreed by both male and female respondents at 35.41% and 23.95%, respectively. Finally, they agreed that *adlay* is accepted as an alternative source of staple food by DA technicians, and by those who have tried and tasted it at 33.33%, 31.25%, 36.45%, and 25%, respectively (Table 5).

Table 4. Perception of *adlay* as a source of staple crop relevant to farming practices, preferences and utilization among the male and female farmer respondents in the three barangays of Sultan Naga Dimaporo, Lanao del Norte.

Statement		Male	Female
Source of alternative staple food	1. Strongly disagree	2(2.08)	3(3.12)
	2. Disagree	1(1.04)	1(1.04)
	3. Undecided	20 (20.83)	20 (20.83)
	4. Agree	12(12.50)	11(11.45)
	5. Strongly agree	16(16.66)	11(11.45)
Easy to grow in LND	1. Strongly disagree	1(1.04)	
	2. Disagree	1(1.04)	1(1.04)
	3. Undecided	5(5.20)	10(10.41)
	4. Agree	21(21.87)	29(30.20)
	5. Strongly agree	22(22.91)	6(6.25)
Source of animal feeds	1. Strongly disagree		1(1.04)
	2. Disagree	2(2.08)	2(2.08)
	3. Undecided	7(7.29)	7(7.29)
	4. Agree	30(31.25)	30(31.25)
	5. Strongly agree	11(11.45)	6(6.25)
Source of healthy foods	1. Strongly disagree	1(1.04)	1(1.04)
	2. Disagree	1(1.04)	
	3. Undecided	8(8.33)	10(10.41)
	4. Agree	30(31.25)	25(26.04)
	5. Strongly agree	10(10.41)	10(10.41)
Resiliency to pests and diseases	1. Strongly disagree	1(1.04)	1(1.04)
	2. Disagree	1(1.04)	2(2.08)
	3. Undecided	8(8.33)	7(7.29)
	4. Agree	26(27.08)	30(31.25)
	5. Strongly agree	14(14.58)	30(31.25)
Economical to grow	1. Strongly disagree	2(2.08)	1(1.04)
	2. Disagree	2(2.08)	1(1.04)
	3. Undecided	5(5.20)	10(10.41)
	4. Agree	31(32.29)	24(25)
	5. Strongly agree	10(10.41)	10(10.41)
Grown without pesticides/fertilizers	1. Strongly disagree	1(1.04)	1(1.04)
	2. Disagree	2(2.08)	2(2.08)

	3. Undecided	4(4.16)	3(3.12)
	4. Agree	33(34.37)	23(23.95)
	5. Strongly agree	10(10.41)	17(17.40)

Table 5. Perception of *adlay* as a source of staple crop relevant to farming practices, preferences and utilization among the male and female farmer respondents in the three barangays of Sultan Naga Dimaporo, Lanao del Norte (**continued)**.

Statement		**Male**	**Female**
Save farm expenses	1. Strongly disagree	1(1.04)	
	2. Disagree	1(1.04)	1(1.04)
	3. Undecided	5(5.20)	5(5.20)
	4. Agree	33(34.37)	26(27.08)
	5. Strongly agree	10(10.41)	14(14.58)
Grown organically	1. Strongly disagree	1(1.04)	1(1.04)
	2. Disagree		1(1.04)
	3. Undecided	4(4.16)	4(4.16)
	4. Agree	35(36.46)	27(28.12)
	5. Strongly agree	10(10.41)	13(13.54)
Drought resistant crop	1. Strongly disagree	1(1.04)	1(1.04)
	2. Disagree	2(2.08)	1(1.04)
	3. Undecided	5(5.21)	6(6.25)
	4. Agree	32(33.33)	24(25)
	5. Strongly agree	10(10.41)	14(14.58)
Good for health conscious individuals	1. Strongly disagree	3(3.12)	2(2.08)
	2. Disagree	1(1.04)	2(2.08)
	3. Undecided	5(5.20)	6(6.25)
	4. Agree	35(36.45)	25(26.88)
	5. Strongly agree	11(11.45)	11(11.45)
Less farm maintenance	1. Strongly disagree	1(1.04)	1(1.04)
	2. Disagree	1(1.04)	1(1.04)
	3. Undecided	4(4.16)	5(5.20)
	4. Agree	34(35.41)	24(25)
	5. Strongly agree	10(10.41)	15(15.62)
Source of medicine	1. Strongly disagree	2(2.08)	2(2.08)
	2. Disagree	1(1.04)	
	3. Undecided	3(3.12)	4(4.16)
	4. Agree	34(35.41)	23(23.95)
	5. Strongly agree	10(10.41)	17(17.70)
Recommended by DA	1. Strongly disagree		1(1.04)
	2. Disagree	1(1.04)	1(1.04)
	3. Undecided	3(3.12)	2(2.08)
	4. Agree	32(33.33)	30(31.25)
	5. Strongly agree	14(14.58)	12(12.50)
Recommended by those who tried	1. Strongly disagree	2(2.08)	1(1.04)
	2. Disagree	1(1.04)	1(1.04)
	3. Undecided	2(2.08)	3(3.12)
	4. Agree	35(36.45)	24(25)
	5. Strongly agree	10(10.41)	17(17.70)

Statistical analysis

Statistical result using a chi-square test showed no significant relationship (P values > 0.05) between the responses of the male and female farmer respondents (Table 6). This means that both had a common and collective perception as to the preferences, farming practices and utilization of *adlay* and on how it became an alternative food source. The potential of *adlay* being an alternative crop is being perceived positively by both gender, however, most of them had a relatively low response (Tables 7 and 8). This means that information being disseminated and the corresponding technology were still very new to them and that they were still in a transition period of adoption.

Table 6. Relationship of the perception of male and female respondents to the implications of *adlay* as an alternative food source in terms of preferences, farming practices and utilization within the three barangays of Sultan Naga Dimaporo, Lanao del Norte.

Statements	F value	P value
Source of alternative staple food	0.91	0.92
Easy to grow in LND	0.21	0.10
Source of animal feeds	2.30	0.67
Source of healthy foods	1.51	0.82
Resiliency to pests and diseases	3.95	0.41
Economical to grow	2.79	0.59
Grown without pesticides/fertilizers	4.49	0.34
Save farm expenses	1.40	0.84
Grown organically	2.26	0.68
Drought resistant crop	2.18	0.70
Good for health conscious individuals	1.44	0.83
Less farm maintenance	2.67	0.61
Source of medicine	5.89	0.14
Recommended by DA	1.38	0.96
Recommended by those who tried	3.97	0.26

Table 7. Weighted mean (WM) on the perception of *adlay* as a source of staple crop relevant to farming practices, preferences and utilization among the male and female farmer respondents in the three barangays of Sultan Naga Dimaporo, Lanao del Norte.

Statement		Male WM	Female WM	Total WM
Source of alternative staple food	1. Strongly disagree	0.04	0.06	0.05
	2. Disagree	0.04	0.04	0.04
	3. Undecided	1.25	1.25	1.25
	4. Agree	1.00	0.96	0.96
	5. Strongly agree	1.67	1.15	1.41
Easy to grow in LND	1. Strongly disagree	0.02	0.02	0.02
	2. Disagree	0.21	0.31	0.31
	3. Undecided	1.31	1.81	1.56
	4. Agree	1.75	2.08	2.09

	5. Strongly agree	2.29	0.63	1.46
Source of animal feeds	1. Strongly disagree	0.00	0.02	0.01
	2. Disagree	0.08	0.08	0.09
	3. Undecided	0.44	0.44	0.44
	4. Agree	2.50	2.50	2.50
	5. Strongly agree	1.15	0.63	0.89
Source of healthy foods	1. Strongly disagree	0.02	0.02	0.02
	2. Disagree	0.04	0.02	0.02
	3. Undecided	0.50	0.63	0.56
	4. Agree	2.50	2.29	2.29
	5. Strongly agree	1.04	1.04	1.04
Resiliency to pests and diseases	1. Strongly disagree	0.02	0.02	0.02
	2. Disagree	0.04	0.06	0.06
	3. Undecided	0.50	0.44	0.47
	4. Agree	2.17	2.33	2.33
	5. Strongly agree	1.46	3.13	2.29
Economical to grow	1. Strongly disagree	0.04	0.02	0.03
	2. Disagree	0.08	0.06	0.06
	3. Undecided	0.31	0.63	0.47
	4. Agree	2.58	2.29	2.29
	5. Strongly agree	1.04	1.04	1.04
Grown without pesticides/fertilizers	1. Strongly disagree	0.02	0.02	0.02
	2. Disagree	0.08	0.08	0.08
	3. Undecided	0.25	0.19	0.22
	4. Agree	2.75	2.33	2.33
	5. Strongly agree	1.04	1.77	1.41

Table 8. Weighted mean (WM) on the perception of *adlay* as a source of staple crop relevant to farming practices, preferences and utilization among the male and female farmer respondents in the three barangays of Sultan Naga Dimaporo, Lanao del Norte (**continued)**.

Statement		**Male WM**	**Female WM**	**Total WM**
Save farm expenses	1. Strongly disagree	0.02	0.00	0.00
	2. Disagree	0.04	0.04	0.04
	3. Undecided	0.31	0.31	0.31
	4. Agree	2.75	2.17	2.46
	5. Strongly agree	1.04	1.46	1.46
Grown organically	1. Strongly disagree	0.02	0.02	0.02
	2. Disagree	0.00	0.04	0.02
	3. Undecided	0.25	0.25	0.25
	4. Agree	2.92	2.25	2.58
	5. Strongly agree	1.04	1.35	1.35
Drought resistant crop	1. Strongly disagree	0.02	0.02	0.02
	2. Disagree	0.08)	0.04	0.06
	3. Undecided	0.31	0.38	0.38
	4. Agree	2.67	2.00	2.33
	5. Strongly agree	1.04	1.46	1.46
Good for health conscious individuals	1. Strongly disagree	0.06	0.04	0.04
	2. Disagree	0.04)	0.08	0.06
	3. Undecided	0.31	0.38	0.38
	4. Agree	2.92	2.08	2.50

	5. Strongly agree	1.15	1.15	1.15
Less farm maintenance	1. Strongly disagree	0.02	0.02	0.02
	2. Disagree	0.04	0.04	0.04
	3. Undecided	0.25	0.31	0.31
	4. Agree	2.83	2.00	2.42
	5. Strongly agree	1.04	1.56	1.56
Source of medicine	1. Strongly disagree	0.04	0.04	0.04
	2. Disagree	0.04	0.00	0.02
	3. Undecided	0.19	0.25	0.25
	4. Agree	2.83	1.92	2.38
	5. Strongly agree	1.04	1.77	1.77
Recommended by DA	1. Strongly disagree	0.00	0.02	0.02
	2. Disagree	0.04	0.04	0.04
	3. Undecided	0.19	0.13	0.13
	4. Agree	2.67	2.50	2.58
	5. Strongly agree	1.46	1.25	1.25
Recommended by those who tried	1. Strongly disagree	0.04	0.02	0.02
	2. Disagree	0.04	0.04	0.04
	3. Undecided	0.13	0.19	0.19
	4. Agree	2.92	2.00	2.46
	5. Strongly agree	1.04	1.77	1.77

The concept of sustainable agricultural production in this context of study is positively responded by the respondent farmers. Yet, it does not mean ruling out any technologies orpractices on ideological grounds since the study showed a relatively low response among the farmer respondents. If a technology works to improve productivity for farmers, and does not harm the environment, then it is likely to be beneficial on sustainability grounds. As a means of sustainable agriculture, production of *adlay* must ensure the best use of nature's goods and services, and that, technologies and practices must be locally adapted and fitted. These are most likely to emerge from new configurations of social capital, comprising relations of trust embodied in new social organizations, new horizontal and vertical partnerships between institutions, and human capital comprising leadership, ingenuity, management skills and capacity to innovate. Agricultural systems with high levels of social and human assets are more able to innovate in the face of uncertainty.

Food security is a priority in this study and tried to explore *adlay* as an alternative food source to prevent food shortage. However, poverty is widespread among the farmer respondents, of which, majority are within the poverty threshold. Agriculture is the primary and often only source of income for poor rural people, most of whom depend on subsistence farming. Some other factors conflicting *adlay* technology included some forms of illiteracy, unemployment and the incidence of poverty, which are higher among indigenous peoples and people living in the upland areas. Among the causes of rural poverty are a decline in the productivity and profitability of farming, smaller farm sizes and unsustainable practices that have led to deforestation and depleted fishing waters. Rural areas lag behind in economic growth and they have higher underemployment partly because poor people have little access to productive assets and business opportunities. They have few non-farm income-generating activities, and people lack access to microfinance services and affordable credit. Indigenous people face specific problems of high illiteracy rates and are affected by the encroachment of modern technology and cultures onto traditional norms and practices. Women have limited roles outside of marketing and family responsibilities (Jatta and Arban, 2009).

A more sustainable agriculture seeks to make the best use of nature's goods and services as functional inputs. This is achieved by integrating the collective efforts of both men and women in the farming communities (Basser and Vedra, 2015; Barrot and Vedra, 2015). It is in this way that farming knowledge and management can be added and made better use of the knowledge and skills to augment self-reliance. Sustainable agriculture technologies and practices must be locally-adapted. They emerge from new configurations of social capital (relations of trust embodied in new social organizations and new horizontal and vertical partnerships between institutions) and human capital (leadership, ingenuity, management skills and knowledge, capacity to experiment and innovate). Agricultural

systems with high social and human capital are able to innovate in the face of uncertainty (Pretty and Hine, 2001).

Conclusion and Recommendations

The implications of *adlay* as an alternative food source in terms of preferences, farming practices and utilization within the three barangays of Sultan Naga Dimaporo, Lanao del Norte, as perceived by the male and female farmer respondents showed no significant relationships. This means that both had a common and collective perception as to the preferences, farming practices and utilization of *adlay* and on how it became an alternative food source. The potential of *adlay* being an alternative crop is being perceived positively and agreed by both gender, however, most of them had a relatively low response. This means that the information being disseminated and the corresponding technology are still very new to them and that they are still in a transition period of adoption.*Adlay* farming in Sultan Naga Dimaporo, is still in a process of adoption, yet positive response is observed, particularly to those farmers who opted to use it, while other farmers opted to plant rice and corn due to the urgent need of income and yield from farms. Information from media and farm technicians are crucial to enhance the technology along with the farmers' motivation, sharing of experience in peer groups and successive learning. This in turn, results to the beginning of a whole chain of *adlay* farming innovations among the culturally-diverse farming communities. It is therefore recommended that personnel of the Department of Agriculture and Local Government Units (LGU) should exert much effort in imparting their knowledge, skills and expertise in persuading the farmers to adopt this promising farming technology. This can be achieved in stressing the human health benefits and the importance in cases of food shortage. Lastly, the production methods adapted to the locality and avoidance of chemical inputs can also be enhanced through improved IEC strategies.

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