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Production and Productivity of Sakurab (Allium Chinese G. Don) in BARMM, Lanao Del Sur, Philippines

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Abstract

Sakurab production and usage are integral to the region's cultural identity, stressing the importance of conducting a comprehensive investigation into the commodity. The study aimed to investigate the production and productivity of Sakurab in the five municipalities of Lanao del Sur, BARMM, Philippines, which were selected for their Sakurab farming prevalence and stable conditions. Using random sampling, 169 small-scale Sakurab farmers were chosen from the official lists. Data were collected through personal interview. The data were analyzed using descriptive statistics and multiple linear regression to assess production practices, economic performance, and factors influencing Sakurab productivity. The study highlights the diverse factors influencing Sakurab production across municipalities, emphasizing the role of planted area, efficiency, and productivity. While larger areas like those in Madalum typically yield higher total production, this does not necessarily equate to greater efficiency, as demonstrated by smaller yet more productive areas in Madamba. Sakurab farming is shown to be a viable and profitable venture in the BARMM region, with a net return of P6,477 and an ROI of 43%. The study identifies key variables including area planted, education, household size, and market distance as significant determinants of productivity. Larger land areas and household sizes positively contribute to productivity, while education has an inverse relationship, possibly due to the reliance on traditional knowledge and practices passed down through generations. The results suggest that expanding Sakurab cultivation and investing in targeted agricultural practices could enhance productivity and contribute to economic growth in the region.

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INTRODUCTION

Sakurab (*Allium Chinese G. Don*), locally known as Sibujing, is an essential ingredient in *palapa, a highly valued Maranao cuisine*. Sakurab is cultivated primarily in Lanao Del Sur and most Maranaos refer to Sakurab simply as a spice or condiment, reflecting its deep integration into daily life. It is a major spice used to enhance different dishes' flavor (Cruz et al., 2023). It is not only an important part of the cooking but also serves as an appetizer on its own. There is no traditional Maranao meal that feels complete without palapa. This shows how important it is, both as a seasoning in the food and as something to enjoy before the meal (Pimping, 2013).

Beyond its culinary uses, research indicates that Sakurab production can generate revenue for farmers, contributing to the national economy (Masnar, Baladjay, & Magulama, 2023). Especially that Lanao del Sur is the largest producer of Sakurab in the Philippines, with significant cultivation taking place in the municipalities of Balindong, Madalum, Madamba, Ganassi and Piagapo.

The production and use of Sakurab are deeply embedded in the cultural identity of the region. Each of the mentioned municipalities has its own unique production practices that set them apart from others. For instance, the municipalities of Balindong, Madalum, Madamba, Ganassi and Piagapo each have their own unique methods and traditions that influence the flavor and quality of Sakurab. These regional differences contribute to varying consumer preferences and people maintaining the best techniques that they deemed as productive both in farming and selling. According to the personnel from the Provincial Agriculturists Lanao Del Sur, the process of producing Sakurab is notably labor-intensive, involving meticulous steps such as harvesting, cleaning, and drying the Sakurab. This careful attention to detail in the production process underscores the deep cultural significance of Sakurab and highlights the dedication of local producers to maintaining high-quality standards in their spices.

The lack of monitoring by local government units (LGUs) contributes to this gap, as they do not track Sakurab production or its associated challenges. The FAO (2020) highlights the limited availability of data on Sakurab production and marketing, emphasizing the need for more comprehensive studies. While some research, such as Casim (2021) study, has focused on growth and yield performance, there is a notable absence of in-depth analysis of production practices and factors affecting productivity. This gap in knowledge means that crucial aspects of Sakurab farming, such as best practices and challenges faced by farmers, remain underexplored.

This study aims to address the gap in knowledge by gathering detailed information on Sakurab production and productivity in the Bangsamoro Region of Muslim Mindanao (BARMM), Philippines. The goal is to improve understanding and support for local farmers, helping BARMM move towards its vision of a self-reliant, food-secured, and resilient community (Food and Agriculture Organization, 2020). By capturing essential data, the research seeks to formulate recommendations for research and development, as well as effective government interventions to enhance Sakurab farming in the region.

Methodology

Study Area and Site Selection. The study was conducted in selected municipalities within Lanao del Sur, Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), Philippines, where Sakurab farming is prevalent. The municipalities included Balindong, Ganassi, Madalum, Madamba, and Piagapo. These areas were chosen based on their engagement in Sakurab production and the prevailing peace and order conditions, which made them suitable for this research.

Respondents and Sampling Design. The primary respondents were small-scale Sakurab farmers from the selected municipalities. The list of eligible farmers was obtained from the Ministry of Agriculture, Fisheries and Agrarian Reform (MAFAR) or the Municipal Agriculture's Office (MAO). A total of 169 farmers were selected through random sampling across the municipalities. The sample size was determined using G-Power software, developed by Erdfelder et al. (1996), which is commonly used for statistical power analysis in social and behavioral research. The farmer-respondents selected had at least one "malong" (15 x 15 square meters) cultivated for Sakurab and a minimum of one year of experience in Sakurab production.

Data Collection and Coordination. Preliminary official communications were initiated with the Provincial Agriculturist and Municipal Agriculturists to convey the intent of conducting the research and to gather a list of Sakurab farmers. Coordination was established with Sakurab focal persons in each municipality to assist in identifying the locations of the respondents and their farms.

Data Analysis. Descriptive statistics, including means, totals, percentages, and standard deviations, were utilized to evaluate the production practices and performance of Sakurab. The production practices analyzed included cultivation techniques, inputs used, yield, production costs and returns, and other relevant variables. Cost and return analysis was employed to assess the economic performance of Sakurab farming, utilizing profitability analysis formulas.

To identify the factors influencing the productivity of Sakurab farms, multiple linear regression analysis was conducted. The analysis examined the relationship between Sakurab productivity and various factors, including socio-demographic characteristics (age, gender, level of education, household size, and years of experience in Sakurab farming), production inputs (land, labor, and fertilizer), and institutional factors (access to seminars/training, extension services, financial/credit services, and markets).

The regression model used is defined as follows:

$$Yd=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\epsilon i$$

Where ;

Yd = Sakurab productivity (kg)

X_1 = Age (years)

X_2 = Gender (1 = male; 0 = female)

X_3 = Level of education (years of formal education)

X_4 = Household size (number of household members)

X_5 = Years in Sakurab farming

X_6 = Land area (malong)

X_7 = Labor (man-days)

X_8 = Fertilizer (kg)

X_9 = Access to market (km)

$\beta_0,\beta_1,\ldots,\beta_9$ = Regression coefficients

ϵi = Error term

Results and Discussion

Production, Production Practices and Financial Performance of Sakurab

Production Area and Volume

Table 1 presents the documented production volume of Sakurab per cropping across the five municipalities studied. The results indicate significant variation in the area planted and the corresponding production volume. Madalum, with the largest planted area of 168 malong, recorded the highest total production volume of 104,919 kg. In contrast, Ganassi, with the smallest planted area of 10 malong, produced the lowest total volume of 6,695 kg. These findings suggest a general trend where larger planting areas result in higher production volumes, though it is important to note that other factors such as efficiency and productivity also play a crucial role.

When examining efficiency and productivity, it should be noted that despite Madalum's extensive planted area, its average production per cropping (1,345.12 kg) is lower than that of Madamba, which achieved an average of 1,801.27 kg from a smaller planted area of 138 malong. This disparity suggests that Madamba may benefit from more efficient farming practices, superior soil quality, or more favorable environmental conditions, leading to higher productivity despite the smaller scale of operation.

The Province of Lanao del Sur, where the study was conducted, experiences a Type IV climate characterized by frequent and evenly distributed rainfall throughout the year, which is conducive to Sakurab production across all five municipalities. However, most Sakurab production occurs on sloping and hilly terrain rather than on flat land. Cultivating Sakurab on hilly lands helps avoid waterlogging during heavy rains, which can damage the crops and deplete soil fertility. Despite these benefits, Sakurab is highly sensitive to direct sunlight exposure and requires consistent water supply during its growth and development due to its shallow-rooted nature.

Traditional farming practices in the region, such as organic mulching and the application of animal manure, play a significant role in enhancing Sakurab production. Organic mulching helps reduce thermal stress by shielding the plants from excessive heat, while animal manure improves soil fertility and moisture retention, both of which are crucial for the successful cultivation of Sakurab in this region. These practices highlight the importance of tailored agricultural techniques that consider both the climatic and geographical challenges of the area.

Table 1. Documented Production Volume of Sakurab per cropping

Municipality	Actual Area planted (malong)	Avg. Area/ Farm (malong)	Total Vol. of Production per cropping (kg)	Avg. Vol. of Production per cropping (kg)
Balindong	59	2.95	37,660	1,883
Ganassi	10	1.67	6,695	1,115.83
Madalum	168	2.15	104,919	1,345.12

Madamba	138	2.34	106,275	1,801.27
Piagapo	12	2	8,645	1,440.83
Total	387	2.29	264,194	1,563.28

Production Practices

Land Preparation. The production of Sakurab begins with land preparation, where the initial step involves clearing the area to eliminate weeds. Farmers typically use tools such as a bolo, rake, piko, or grab hoe for this task, while some opt for herbicides to assist in the clearing process. Once cleared, the land is plowed and harrowed, either with the help of a cow or manually using the aforementioned tools, until the soil is thoroughly pulverized.

Mulching is a crucial part of the process, with farmers utilizing various organic materials like corn stalks, rice straws, coconut leaves, cogon grass, newspapers, leaf litter, and locally sourced leaves such as Madang and marang leaves. These materials are spread over the field in a 2 to 3 inch thick layer and left for 2 to 3 days or up to a month to decompose, enriching the soil.

Planting. When it comes to planting, farmers plot the area using an "ansag" and dig holes with a "buso" or dibble, placing one Sakurab bulb per hole.

Fertilization and Pest Control. Fertilization is employed by the farmers. It starts one month after planting and continues monthly until harvest. Common fertilizers like 14-14-14, 16-20-0, or urea are applied through broadcasting, where the fertilizer is evenly spread over the field.

Pest control is also essential, particularly when the leaves of the Sakurab show a reddish color, indicating an infestation. In such cases, farmers spray a pesticide, usually applying it twice during the production period to effectively manage the pests.

Harvesting. Sakurab are harvested 3 to 4 months after planting. Harvesting Sakurab is done manually, with farmers using a bolo to loosen the soil before gently pulling out the bulbs. After harvesting, the Sakurab bulbs are bundled into groups of 10 to 15 pieces, depending on their size. These bundles, known as "ompong," are then prepared for market using materials like abaca, waka, saktali, or sack straw for tying. Washing the Sakurab with water is optional and is typically done only if requested by the buyer, ensuring the produce is clean and ready for sale.

Cost and Return Analysis

Table 3 provides a detailed cost and return analysis for Sakurab production per cropping per *malong*. Malong is the basic unit area which measures 15 x15 square meters. Sakurab farmers have two cropping every year. Each *malong* of Sakurab yields approximately 650 kilograms, which, at a selling price of P33.00 per kilogram, generates a total sales revenue of P21,450. This revenue indicates that the current market price of P33.00 per kilogram is sufficient not only to cover production costs but also to generate a profit.

The input costs include Sakurab bulbs, mulching materials, fertilizers, herbicides, and pesticides, amounting to a total of P7,398. Labor costs, on the other hand, encompass various activities such as land preparation, collection and piling of mulch, planting, fertilizer and pesticide application (1 man-day), harvesting and bundling, and washing, which costs P500 per bundle. The cumulative labor costs amount to P7,575.

When input and labor costs are combined, the total cost of Sakurab production per malong reaches P14,973. Notably, labor costs slightly exceed input costs, highlighting the labor-intensive nature of Sakurab farming. This implies that while labor is a significant expense, efficient labor management and the adoption of mechanization, where feasible, could help reduce these costs. Additionally, ensuring fair wages for laborers is essential for maintaining social sustainability within the agricultural sector.

The analysis reveals that Sakurab production per cropping per malong is indeed profitable, yielding a net return of P6,477 and an ROI of 43%. The relatively high ROI underscores the potential for substantial returns on investment in Sakurab cultivation. Despite the higher labor costs, the positive net returns indicate that Sakurab farming is a viable and profitable venture. This profitability could serve as an incentive for further investment in Sakurab production and trading, particularly BARMM, where Sakurab is a key agricultural product. Encouraging investment in this sector could lead to economic growth and development in the region.

Table 3. Cost and Return Analysis of Sakurab per cropping per malong

ITEMS	UNIT	QTY	PRICE (PHP)	TOTAL (PHP)
Sakurab	kg	650	33	21,450
Total Sales				
Input Costs				
Sakurab bulbs	Sack	1	3300	3,300

Mulching materials	Sack	42	19	798
Fertilizer	kg			
Inorganic		42	35	1,470
Organic				
Herbicide	Bottle	1	1650	1,650
Pesticide	Bottle	1	180	180
Total				7,398
Labor Costs				
Land preparation	MD/MAD	2/ 4 days	250	2,000
Collection & piling of mulch	MD	2/ 2 days	100	400
Planting	MD	3/ 3 days	300	2,700
Fertilizer application	MD	1/ 1 day	75	75
Pesticide application	MD	1/ 1 day	100	100
Harvesting & bundling	MD	3/ 3 days	300	1,800
Washing	Bundle	1	500	500
Total				7,575
Total Costs				14,973
Net Returns				6,477
ROI				43%

Factors Affecting Productivity of Sakurab

Table 4 shows the regression estimation result for the model on factors affecting productivity of Sakurab. The over-all model is significant exemplified by the significant F-value ($p<.05$). This means that there is a statistically significant relationship between productivity (dependent variable) and the independent variables such as age, gender, education, household size, farming, area planted, labor, and fertilizer. Further, the R^2 value for the nine variable model is 0.28, which means that the nine independent variables in the regression collectively explain only 28% of the variance in the dependent variable while the remaining 72% is explained by other factors not included in the model. This R^2 value may seem modest, it is important to consider the inherent complexity of the Sakurab production system. It is common to encounter a high degree of variability due to numerous uncontrolled environmental and biological factors. Despite this, the model has identified several key predictors that provide meaningful understanding into the factors affecting productivity of Sakurab.

The three variables originally included in the proposed model—seminars or trainings attended, extension services, and access to credit or loan—were omitted because there was no variation in these variables among the respondents, and their inclusion affected the overall significance of the model. Thus, there are only nine variables included in the model estimated.

Among the nine independent variables included, area planted, education, household size, and market distance are found to be significant variables affecting productivity of *Sakurab*. Area planted measured in terms of the number of malong is significant at 1% level. Meanwhile, education, household size, and market distance are significant at 10% level of significance. These reject the null hypothesis that the regression coefficients for the four variables are zero.

The standardized coefficient of the constant is negative posted at -184.820. The negative constant indicates that the baseline or starting point for productivity is negative when all independent variables are zero. At zero levels of the independent variables, the Sakurab production is not viable, resulting in a negative outcome. This could also be due to fixed costs or inherent disadvantages that are present even when the predictors are at their zero values.

The standardized slope coefficient of area planted is .445 which means that for every unit increase in area planted, yield of Sakurab will increase by .445 unit, holding other things constant. Meanwhile, the standardized slope coefficient of education is -1.887 which means that for every one unit increase in education, yield will decrease by 1.887 unit, holding other things constant. Further, the standardized slope coefficient of household size 1.664 which implies that for every one unit increase in education, yield will decrease by 1.664 unit, holding other things constant. Moreover, the standardized slope coefficient of market distance is 1.880 which means that for every one unit increase in distance, yield will increase by 1.880 unit, holding other things constant. Given these coefficients, the estimated model is presented as:

Yield = -.184.82 -.132Educ +1.664 HS +4.357Area +1.880 Market

Table 4. Regression Result

Variable	Standardized Coefficient	t-value	Sig.
Constant	-184.820	-.176	.861
Age	-.068	-.790	.431
Gender	-.013	-.178	.859
Education	-.132	-1.887	.061
Household Size	.129	1.664	.098
Farming	.026	.310	.757
Area Planted	.445	4.357	.000

Labor	.016	.162	.872
Fertilizer	-.018	-.249	.803
Market Distance	.137	1.880	.062
		F	Sig
ANOVA		6.982	.000
R^2 = .283			

Area Planted

Among the production inputs hypothesized to affect productivity in Sakurab, area planted turns out to be positively significant. The area planted is measured in terms of *malong* where each *malong* has a measure of 15 x15 square meters. The highest number of *malong* cultivated by the farmer-respondent is 7 and the lowest is one while the mean area planted is 2.27. The positive relationship between productivity and area planted explains that the higher the number of *malong* cultivated by the farmer, the higher will be their yield. Land is one of the factors in production and simultaneously, the more land area is allocated for Sakurab production, the higher will be the yield. This result is supported by Koye et al., (2022) who find out that an increase of land cultivated results to increase of productivity or yield.

Education

Education is one of the socio-demographic characteristics affecting Sakurab productivity. However, productivity and years in education turns out to have inverse relationship which means that the higher the number of years in education, the lower the yield or productivity. This result contradicts with the results of Asadullah and Rahman (2005), Kinde (2005), Idiong (2007), and Murthy et al. (2009) who found out that farmer's educational level influenced the farmer's efficiency positively. Nigussie et al. (2015) explained that the higher the level of education together with increased experience could guide to better management of farm activities. This is an opposite case for productivity of Sakurab.

The negative relationship between productivity and education of farmer-respondents can be attributed to the traditional production practices of Sakurab where educational attainment is not required to grow the crop efficiently. That also means that farmer-respondents with lower educational attainment tend to have higher yields. With a history back century, the use of Sakurab is deeply ingrained in the cultural identity of the region. This is because Sakurab production deeply ingrained of the culture that is passed on from generations to generations hence, education is not required to grow the crop. In addition, there is no training or extension services extended to farmer-respondents related to Sakurab production hence, no new knowledge or technology was made available for the commodity.

Household Size. Household size is another demographic characteristic found to be positively significant with the Sakurab productivity. The maximum household size among respondents is 15, minimum is three and the average is eight. The higher the number of household members, the higher the yield or productivity. More household members mean more people available to work on the farm. This can increase the overall labor input, leading to higher productivity as tasks can be distributed and managed more efficiently. Further, with more members, household tasks can be divided, allowing individuals to specialize in specific activities. Specialization can lead to increased efficiency and expertise, contributing to higher productivity. Moreover, a larger household provides a stronger support system. During production, additional household members can assist, ensuring that all tasks are completed on time in the farm. This result is supported by Omotesho et al. (2020) and Abera et al. (2020) who claim that larger households will be more productive.

Farm to Market Distance. Access to market is the only institutional factor turned out to significantly affect the Sakurab productivity however, they are inversely related. This deviates the expected positive relationship with the notion that when farmer is exposed to information regarding the cost of inputs and the price of output more frequently the closer his or her home is to the market center. This is opposite to the findings of Hailu (2020) which posits that distance increases farmers' efficiency level reduces.

The average farm to market distance of the farmer-respondents is at 28.83 Km where the highest is 83.90 km. This explains that most of the farms are located in far flung areas away from the market. Far-flung areas could have more available and possibly more fertile land. Sakurab farmers in BARMM may have access to larger plots and better soil quality, leading to higher productivity. Additionally, remote areas may be less affected by pollution and urban encroachment, which contributes to better Sakurab yields. Specialization can also be the case. Remote farmers may specialize in Sakurab that is well-suited to the specific conditions in the area leading to higher productivity. Farmers may have developed effective techniques and practices adapted to their specific environmental conditions especially that the production is embedded in their culture. These practices might result in higher productivity compared to more conventional methods used in areas closer to markets.

Conclusion

The study reveals significant variation in Sakurab production across different municipalities, driven by differences in planted area, efficiency, and productivity. While larger areas, such as those in Madalum, tend to yield higher total production volumes, this does not always translate to better efficiency, as seen in Madamba, where smaller areas achieved higher productivity per unit of land. The production of Sakurab involves several critical stages, each requiring specific practices to optimize yield and quality. The production practices including land preparation, mulching, planting, fertilization, pest control, and harvesting are integral to successful Sakurab farming. Each step is tailored to local conditions and resources, highlighting the adaptability and specificity required in agricultural practices to achieve optimal results.

Sakurab production proves to be a profitable venture with a net return of P6,477 and an ROI of 43%, making it a promising opportunity for further investment and economic growth in the BARMM region.

Area planted, education, household size, and market distance are found to be significant variables affecting productivity of Sakurab. Larger land areas and household sizes positively affect Sakurab productivity while education has an inverse impact, and greater farm-to-market distances unexpectedly correlate with higher yields. Expanding the land allocated for Sakurab production can enhance overall productivity. Farmers with fewer years of formal education tend to have higher yields which can be explained by the cultural transmission of Sakurab farming techniques. Households with more members can contribute more labor, manage tasks efficiently, and specialize in various farm activities, leading to increased productivity. Farms located further from the market suggests that remote areas may offer larger, more fertile plots, and better conditions for Sakurab cultivation.

Conflicts of Interest

The authors have disclosed no conflicts of interest.

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REFERENCES

Abdulkadir, K.O. (2015). An evaluation of the efficiency of onion producing farmers in irrigated agriculture: Empirical evidence from Kobo district, Amhara region, Ethiopia. International Journal of Agricultural Extension and Rural Development ISSN: 3254-5428 Vol. 2(5), pp116-124. https://www.internationalscholarsjournals.com/articles/an- evaluation-of -the-efficiency-of-onion-producing-farmers-in-irrigated-agricultureempirical-evidence-from-kobo-distric.pdf

Abera, G., Ibrahim, A. M., Forsido, S. F., & Kuyu, C. G. (2020). Assessment on post-harvest losses of tomato (Lycopersicon esculentem Mill.) in selected districts of East Shewa Zone of Ethiopia using a commodity system analysis methodology. Heliyon 6 (4). DOI: 10.1016/j.heliyon. 2020.e03749

Alemu, D., Kitila, C., Garedew, W., Jule, L. T., Badassa, B., Nagaprasad, N., Seenivasan, V., Saka, A., & Ramaswamy, K. (2022). Growth, yield, and yield variables of onion (Allium Cepa L.) varieties as influenced by plantspacing at DambiDollo, Western Ethiopia. Scientific Reports, 12, 20563 (2022). https://doi.org/10.1038/s41598-022-24993-x

Amalia & Putri, A. (2017). Analysis of factors affecting the success of onions development program in Kampar Regency. International Conference on Environment and Technology. Doi: 10.1088/1755-1315/97/1/012038

Asadullah, M. N., & Rahman, S. (2005). Farm productivity and efficiency in rural Bangladesh: the role of education revisited. *Applied Economics*, *41*(1), 17–33. https://doi.org/10.1080/00036840601019125

Casim, R. (2021). *Growth and Yield Performance of "Sakurab" Scallion Green Onion (Allium Fistulusom L.) Under Different Rates of Chicken Dung and Sources of Soil Amendment*. https://doi.org/10.47310/iarjals.2021.v02i01.009

Cruz, J. R. a. V., Gentallan, R. P., Bartolome, M. C. B., Calimpang, I. A., Quiñones, K. J. O., Manting, M. M., Madayag, R. E., Lalusin, A. G., Hernandez, J. E., Manuel, M. C. C., Endonela, L. E., & Borromeo, T. H. (2023). Taxonomic evidences supporting the establishment of 'sibujing', a traditional condiment crop from the Philippines, as Allium chinense G.Don. Nordic Journal of Botany, 2023(11). https://doi.org/10.1111/njb.04054

Dollen, A.T., Magallanes, J.N., Alcarde, M.L., Gonzaga, A.B. and Gonzaga, N.R. (2021). Yield and postharvest performance of green onion (Allium fistulosum L.) as influenced by planting distance and fertilizer application. International Society for Horticultural Science, 1312, 277- 284. https://doi.org/10.17660/ActaHortic.2021.1312.40

Dutta, R., Jayalakshmi, K., Nadig. S., Manjunathagowda, D. C., Gurav, V., & Singh, M. (2022). Anthracnose of onion (Allium cepa L.): A twister disease. Pathogen 2022, 11 (8). doi: 10.3390/pathogens11080884

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, & Computers*, *28*(1), 1–11. https://doi.org/10.3758/bf03203630

Food and Agriculture Organization. (n.d.). Weather or Climatic Conditions. https://www.fao.org/3/ac061e/AC061E16.html

Food and Agriculture Organization. (2020). *Food security and nutrition roadmap: Bangsamoro Autonomous Region in Muslim Mindanao - Philippines*. https://reliefweb.int/report/philippines/food-security-and-nutrition-roadmap-bangsamoro-autonomous-region-muslim-mindanao

Hailu, D. (2020). Determinants of Technical Efficiency in Wheat Production in Ethiopia. *International Journal of Agricultural Economics*, *5*(5), 218. https://doi.org/10.11648/j.ijae.20200505.19

Idiong, C. (2007). Estimation of Farm Level Technical Efficiency in Smallscale Swamp Rice Production in Cross River State of Nigeria: A Stochastic Frontier Approach. *World Journal of Agricultural Sciences*. https://www.researchgate.net/publication/241482594_Estimation_of_Farm_Level_Technical_Efficiency_in_Smallscale_Swamp_Rice_Production_in_Cross_River_State_of_Nigeria_A_Stochastic_Frontier_Approach

Kinde, T. (2005). *Technical Efficiency of Maize Production A Case of Smallholder Farmers in Assosa Woreda*. Scientific Research Publishing. https://scirp.org/reference/referencespapers?referenceid=3218125

Koye, T.D., Koye, A.D., & Amsalu, Z.A. (2022). Analysis of technical efficiency of irrigated onion (Allium cepa L.) production in North Gondar Zone of Amhara Regional State, Ethiopia. PLoS ONE 17(10). https://doi.org/10.1371/journal.pone.0275177

Masnar, Adley L. (2021), Optimizing Production and Management Practices of Sakurab (Allium Chinese G. Don), University of Southern Mindanao, Kabacan Cotabato

Masnar, A. L., Baladjay, A. A., & Magulama, E. E. (2023). Enhancing productivity of Sakurab (Allium chinense G. Don) using corn stalk mulch and suitable fertilizer type. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.8313494

Murthy, S., Sudha, M., Hegde, M. R., & Dakshinamoorthy, V. (2009). Technical Efficiency and its Determinants in Tomato Production in Karnataka, India: Data Envelopment Analysis (DEA) Approach. *Agricultural Economics Research Review*, *22*(2), 215–224. https://doi.org/10.22004/ag.econ.57399

Nigussie, A., Kuma, Y., Adisu, A., Alemu, T., & Desalegn, K. (2015). Onion production for income generation in small scale irrigation users agropastoral household of Ethiopia. Journal of Horticulture, 2 (3): 145. doi:10.4172/2376-0354.1000145

Omotesho, O. A., Douvi, C.P., & Olaghere, I.L. (2020). Economic viability of onion production in the commune of Grand-Popo, Republic of Benin. Journal of Agribusiness and Rural Development, 3(57), 289-2897. http://dx.doi.org/10.17306/J.JARD.2020.01304

Pimping, C. A. (2013). Pagana Meranao: A Royal Feast as an institution. *JPAIR*, *14*(1), 57–77.

https://doi.org/10.7719/jpair.v14i1.235

Stephens, J.M (2015). Rakkayo Allium Chinese G. Don.https://edis.ifas.ufl.edu/pdfiles?MV/MV12100.pdf

Thayaparan, A. & Kajendeni, S. (2020). Socio-economic characteristics and its impact on onion cultivation in Jaffna district of Sri Lanka. Journal of Finance and Accounting, 8(5): 212-217. doi: 10.11648/j.jfa.20200805.11

Van Der Meer, Q. P., & Agustina, L. (2016). Allium chinese: Plant resources of Southeast Asia. https://uses.plantnet-projectorg/en/Allium_chinese_(PROSEA)