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Varietal Evaluation of Buckwheat Cultivars Under Dalwangan, Malaybalay City Conditions

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Abstract
This study evaluated the agronomic and yield performance of three buckwheat (Fagopyrum esculentum) cultivars—Kitawase Soba, Hitachi Aki Soba, and Kumamoto Gensoba—under the Northern Mindanao Agricultural Crops and Livestock Research Complex, Dalwangan, Malaybalay City, Philippines. Buckwheat, a nutrient-rich pseudocereal, is gaining attention due to its high mineral content and health benefits, with increasing market demand globally. The research aimed to identify promising varieties adaptable to the local agroecological setting and assess the cost and return of cultivation. The trial was conducted from December 2023 to March 2024 on "adtuyon" clay soil at 800 masl. Standard cultural practices (organic and inorganic fertilization) were applied. Agronomic parameters, including plant height, number of seed clusters, seeds per plant, and seed weight, were measured alongside yield performance. Results showed that Kitawase Soba was the earliest maturing variety at 57 days and achieved the highest grain yield at 2.487 mtha^{-1}, closely followed by Kumamoto Gensoba at 2.447 mtha^{-1} and Hitachi Aki Soba at 2.295 mtha^{-1}. Also, it generated the highest net income per hectare, indicating its economic advantage. All three cultivars exhibited good adaptation to the local conditions with minimal pests and disease challenges. This study recommends Kitawase Soba and Kumamoto Gensoba as the most promising cultivars for commercial buckwheat production in the region. Further, multi-location trials are suggested to validate these findings. The results highlighted the potential of buckwheat as a viable crop for diversified farming systems, contributing to food security and augmenting rural income generation in Northern Mindanao.

Keywords: agronomic performance, buckwheat cultivars, cost-benefit analysis, varietal evaluation, yield

1. INTRODUCTION

Buckwheat belongs to a group of foods commonly called pseudocereals under Polygonaceae family. The two types of buckwheat that are usually produced for food are the Tartary buckwheat (Fagopyrum tartaricum), which has more nutrients and the common buckwheat (Fagopyrum esculentum). Compared to many other cereals and pseudocereals, buckwheat has a higher mineral content. It has low levels of most vitamins but high levels of magnesium, copper, and manganese (healthline.com). Consuming buckwheat can help to prevent various chronic illnesses, such as hypertension, obesity, cardiovascular disease, and gallstone formation (Wieslander, 2020).

In 2013, Baral et al.'s buckwheat field trial showed the highest yield of 1.282 $mtha^{-1}$ for common buckwheat at a 50 kg/ha seed rate.

Exploring the potential of underutilized crops is a promising strategy to enhance agricultural resilience by diversifying production systems. These crops contribute to sustaining food and nutritional security amidst challenges of climate change and biodiversity degradation. Underutilized crops are often more resilient to environmental stresses such as drought, salinity, and heat, thus requiring a lower amount of inputs while offering higher nutritional value compared to conventional crops. Their integration into farming systems supports ecosystem services, promotes sustainable livelihoods, and mitigates the adverse impacts of climate variability. Emphasizing these crops can therefore improve food sovereignty, dietary diversity, and adaptability in vulnerable regions, aligning well with global efforts to build more climate-resilient and biodiverse agriculture (Zamaratskaia, et. al, 2024)

The market for buckwheat flour is widely increasing since the COVID pandemic in 2021 and is estimated to be worth a million USD in 2022, thus forecasted to reach a readjusted size of USD million by 2028 as reported by Kingping Market Research (2023).

Considering these opportunities, the Department of Agriculture RFO-10, represented by the Regional Executive Director Carlene C. Collado, CPA. And the Carmen Sunrise Exporters, Inc. (CSEI), represented by Mr. Tetsuji Yukawa, the manager, entered into a Memorandum of Understanding (MOU) dated December 22, 2023, for the establishment of Buckwheat Varietal Trial at Northern Mindanao Agricultural Crops and Livestock Research Complex (NMACLRC).

Objectives:

1. To evaluate the agronomic and yield performance of three (3) buckwheat cultivars;
2. To identify promising cultivars of buckwheat under NMACLRC conditions; and
3. To determine the cost and return analysis of buckwheat production.

MATERIALS AND METHODS

The trial was conducted at NMACLRC, Dalwangan, Malaybalay City, from December 27, 2023 to March 8, 2024, with “adtuyon” type of clay soil at an elevation of 800-860 meters above sea level (masl).

Land Preparation, Fertilizer Application and Planting

The land planted with buckwheat was previously planted with corn, cleared and plowed twice using a tractor. In furrowing, it was manually plowed using an improvised bamboo disc plow drawn by a carabao, with a distance of 25cm between rows. Followed by basal application of organic and inorganic fertilizers at a rate of 5 bags and 15 kilograms, respectively, for the total project area of 1,890 sqm. with the planting density of 45 plants per linear meter.

Data gathered

1. **Agronomic Data** (10 sample plants were randomly collected per variety)

Plant height. The plant height was measured from the soil surface to the highest point of the arch of the uppermost leaf.

Number of seed clusters per plant. The number of seed clusters per plant was taken from each sample, counting the number of clusters within a plant.

Number of seeds per plant. The number of seeds per plant was taken per sample from each treatment.

2. **Yield Performance**

Weight of 1,000 seeds. The weight of 1,000 seeds per treatment was taken and weighed using a digital weighing scale.

Grain Yield per Hectare **(**mtha^{-1}**).** The actual yield was determined by harvesting each treatment. The grains were shelled, dried, and cleaned before weighing. The yield (mtha^{-1}) was computed as follows:

Grain Yield (mtha^{-1}) = (actual weight (kg) x 10,000) x (100 MC - Actual MC) / 1,000 Area (100 MC - 14 MC)

2.4. Pest and Disease Management

There were no notable pests and disease infestation even during the critical stages of cropping.

2.5 Harvesting and Post-harvest

Harvested manually at 57-65 days after planting or when 85% of the grains turned dark or black in color. To improve the post-harvest handling, the stalks were air-dried for one day prior to threshing using the multi-crop thresher. After threshing, buckwheat was immediately dried under the sun until 14% moisture content.

Results

Table 1 shows the agronomic characteristics of buckwheat, including its yield and yield components. Kitawase Soba (variety 1) was the early maturing variety of buckwheat at 57 days to maturity, followed by Hitachi Aki Soba (variety 2) and Kumamoto Gensoba (variety 3) with 63 days to maturity. In terms of average plant height, variety 3 had the highest plant height with 105 cm, followed by variety 2 and variety 3 with 93.8 cm and 76.3 cm, respectively. For the average number of seed clusters per plant, varieties 2 and 3 both have an average of nine (9) seed clusters per plant, followed by variety 3 with only seven (7) seed clusters per plant. Thus, Varieties 3, 1, and 2 show a significant average number of seeds per plant with 71, 68, and 64, respectively.

Variety 1 has the highest average weight of 1,000 seeds with 46.53 g., followed by varieties 3 and 2 with 45.67 g and 43.33 g, respectively. With an average yield of 2.487 mtha^{-1}, variety 1 is the best-performing variety in terms of yield, followed closely by variety 3 and variety 2, with 2.447 mtha^{-1} and 2.295 mtha^{-1}, respectively.

Table 1. Agronomic Characteristics and Yield Performance of Three Buckwheat Cultivars under Dalwangan, Malaybalay City Conditions.

Variety	Days to maturity	Plant height (cm.)	No. of seed clusters/ plant	No. of seeds per plant	wt. of 1,000 seeds (g)	Yield @14% MC (mtha^{-1})
Kitawase Soba(1)	57	76.3	7	68	46.53	**2.487**
Hitachi Aki Soba (2)	63	93.8	9	64	43.33	**2.295**
Kumamoto Gensoba (3)	63	105	9	71	45.67	**2.447**
Mean	**61**	**91.7**	**8.14**	**67.51**	**38.51**	**2.409**

Note: Collected 10 plant samples per variety and the actual yield per plot were translated to per hectare

Table 2 shows that cultivar Kitawase Soba gave the highest yield of 2.487 mtha^{-1}, which was also identified as the early maturing cultivar at 57 days after planting (DAP) followed by Kumamoto Gensoba and Hitachi Aki Soba with 2.447 mtha^{-1} and 2.295 mtha^{-1}, respectively, with the same maturity of 63 DAP.

Similarly, Kitawase Soba cultivar gave the highest return of Php43,938.70 per hectare followed by Kumamoto Gensoba with Php42,527.85 and Hitachi Aki Soba with Php37,209.95, with only 3.28 to 15.62% difference from the highest performing variety.

Table 2. Cost and Return Analysis of Three Buckwheat Cultivars Planted at NMACLRC, Dalwangan, Malaybalay City.

Description	KITAWASE SOBA	HITACHI AKI SOBA	KUMAMOTO GENSOBA	Mean
Yield (mtha^{-1})	2.487	2.295	2.447	2.409
Production Costs	43,100.00	43,100.00	43,100.00	43,100.00
Gross Income	87,038.70	80,309.95	85,627.85	84,325.50
Net Income	43,938.70	37,209.95	42,527.85	41,225.50
Return on Capital (%)	**101.95**	**86.33**	**98.67**	**95.65**

Assumption: Price of Buckwheat per kilo is Php35.00

The results of the trial showed that the three varieties of buckwheat are promising varieties in terms of yield and income, with the yield ranging from 2.295 mtha^{-1} to 2.487 mtha^{-1} and additional income from Php37,209.95 to Php43,938.70 harvested at 57-63 DAP.

Discussion

The earlier maturity and highest yield of Kitawase Soba indicate its advantage under the tested conditions. The high mineral content and health benefits, along with favorable economic returns, suggest its potential commercialization. Plant height variation among cultivars did not significantly affect yield. The relatively low pest and disease pressure improved crop performance. Hence, validation through multi-site trials will strengthen these findings and aid in cultivar recommendation.

Conclusion

This study demonstrates that all three buckwheat cultivars—Kitawase Soba, Hitachi Aki Soba, and Kumamoto Gensoba—exhibited strong adaptability to the agroecological conditions of Dalwangan, Malaybalay City, with yields ranging from 2.295 to 2.487 mt ha^{-1} and net incomes from Php 37,210 to Php 43,939 per hectare, underscoring their viability for commercial production in Northern Mindanao. Kitawase Soba emerged as the top performer, achieving the highest grain yield of 2.487 mt ha^{-1} at an early maturity of 57 days after planting, alongside superior economic returns of more than 100% return on capital, positioning it as the premier choice for farmers seeking rapid, high-value harvests. These results affirm buckwheat's role in crop diversification, enhancing food security, nutritional diversity through its rich mineral profile, and rural livelihoods amid climate challenges, with minimal pest and disease issues further bolstering its promise.

Recommendations

Kitawase Soba and Kumamoto Gensoba should be prioritized for immediate adoption by farmers in high-elevation clay soils similar to those in Dalwangan, Malaybalay City, due to their comparable high yields (2.447–2.487 mtha^{-1}) and strong profitability, with net incomes up to Php 43,939 per hectare and returns on capital exceeding 98%. To build confidence in these cultivars across diverse conditions, multi-location

and multi-season trials are essential to validate performance throughout Northern Mindanao and optimize best management practices, including planting density and fertilization. Furthermore, integrating buckwheat into existing farming systems through intercropping or rotation with legumes like soybeans and corn will enhance agroecological sustainability, boost soil health via nitrogen fixation, and unlock market opportunities tied to rising global demand for nutrient-rich pseudocereals.

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