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Field performance and economic analysis of different Adlai (*Coixlacryma jobi* L.) cultivars grown under lowland conditions in Cebu city, Philippines

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ABSTRACT

Adlai (*Coixlacryma jobi* L.) had a higher potential alternative crop for rice and corn, but information about this crop is still limited. This study was conducted to; a) evaluate the agronomic component, yield, and yield characteristics; and b) determine the economic analysis of different Adlai cultivars under lowland conditions of Carcar City, Cebu. The area (360 m²) was laid out in Randomized Complete Block Design (RCBD). Three Adlai cultivars were designated as treatments replicated thrice. All treatments were applied uniformly with inorganic fertilizer at the rate of 120-60-60 kg/ha N, P₂O₅, and K₂O using complete fertilizer (14-14-14) and urea (46-0-0). Among cultivars, Tapol and Gulian markedly headed and matured earlier than Ginampay. Tapol cultivar grew taller and produced longer panicles with extended and broader leaves. Meanwhile, Gulian had a higher number of panicles than Tapol and Ginampay. In terms of yield, Tapol cultivar produced a higher grain yield comparable to Gulian and Ginampay. However, only the Tapol cultivar generated the highest gross margin and percent return on investment of PHP 59, 269.79 and 3.51 which indicated as high adaptability of Tapol cultivar under lowland conditions in Carcar City, Cebu.

Keywords: Adlai, *Coixlacryma jobi*, agronomic, yield, net return

1. INTRODUCTION

Philippine government still facing a dilemma regarding food sustainability. Production of domestic foods cannot suffice for the Filipino populace [1]. In turn, effort must be made to attain the issues of food security. Meanwhile, a locally known Adlai (*Coixlacryma jobi* L.), otherwise known as Chinese pearl barley or Job's Tear from the Poaceae family reported as a staple food for Southern

Zamboanga del Sur in the Subanen tribe [2-4]. Further, it was chemically analyzed to have a higher amount of starch, vitamins, and minerals that can lower blood pressure, anticancer, and reduce inflammation [3]. It has also had a higher amount of carbohydrates and energy threefold compared to rice and corn [5]. This crop was long being planted and consumed by upland farmers in highland farmers in Mindanao but was not been given attention.

Though it has had higher potential, information about this crop is still limited [2]. Information on the morphology, yield, and economic return limit only in the Mindanao region. Recently, there have been known cultivars that the isolated part of Mindanao has used as their staple food including Tapol, Gulian, and Ginampay [3]. Characteristically, Tapol is dull and darker in color, yielding more than 4.50 tons per hectare. Ginampay has white grain color and has a yield of more than 4.78 tons per hectare, while Gulian has a light, darker grains and yields 4.80 mt/ha, respectively [6]. However, the yield varies when planted in different topography. Gloria *et al.* (2015) found out that yield of this cultivar was minimally obtained at about 3.5 tons per hectare in other regions [4]. The performance of this cultivar in different regions is in need to determine its potentiality. This information should include the morphology, field characteristics, and economic performance, respectively. A strong foundation about this cultivar is in need which can be utilized for food sustainability. Meanwhile, to give details on these cultivars, a varietal trial was conducted to document their morphology, yield components, and economic returns.

2. MATERIALS AND METHODS

2.1. Experimental Area, Design and Field Layout

The study was conducted at Brgy. Pob. III, Carcar City, Cebu, approximately 2 kilometers away from the town proper of Carcar. Geographically, the area was situated at 10.115° N and 123.63° E and characterized as a flat gradient and dominated by grasses and vegetation therein. The area (255 m²) was arranged in a randomized complete block design (RCBD) with three treatments replicated thrice. Different cultivars were designated as treatments (T1 (Ginampay), T2 (Gulian), and T3 (Tapol)). To facilitate data gathering, replications per treatment plot were separated by 1.5 m and 1 m alleyways. Each plot measured 4 m x 5 m with six rows per plot and ten hills per linear row.

2.2. Crop establishment

Adlai seeds were planted in the furrows with a distance of 90 cm between rows and 60 cm between hills at 2 seeds per hill. One (1) week after germination, thinning at one plant per hill was done while thinned plants were transferred to missing hills to complete the desired plants per plot. Fertilization was done using commercial fertilizer as Complete (14-14-14, N-P₂O₅-K₂O) and Urea (46-0-0, N-P₂O₅-K₂O). Half of the recommended rate (120-60-60) (NP₂O₅K₂O) using complete fertilizer was applied two weeks after emergence, while the remaining half of recommended fertilizer was applied 45 days after planting. First manual weeding was employed three (3) weeks after planting, while second weeding was done 40 days after planting. Integrated Pest Management (IPM) was adopted in the study.

2.3. Harvesting and Processing

Harvesting was done separately to all firmed grains and whitish color for Gulian and Guinampay and pale red for Tapol cultivar. Harvested adlai crops were threshed using the locally made threshing bed called “hampasan” or “lambos”. Grains were then sundried to 14% moisture content and winnowed before gathering all the necessary data.

2.4. Data Gathered

Gathered data was limited on the agronomic characteristics, yield, and yield components, and gross margin analysis. It includes the number of days from planting to heading, number of days from planting to maturity, plant height at maturity (cm), Leaf Area Index (LAI), number of productive tillers per hill at maturity, number of panicle per tiller per hill, number of spikelet per panicles, the weight of 1,000 grains (g), grain yield, dry matter yield, and net income return.

2.5. Statistical Analysis

Data was summarized, tabulated, and statistically analyzed using the Analysis of Variance (ANOVA). Differences between treatment means were further investigated using the Honestly Significant Difference (HSD) Test at a 5 % alpha level.

3. RESULTS AND DISCUSSION

3.1. Agronomic Characteristics

Statistically, Adlai cultivars differed significantly regarding heading time, maturity, plant height, and Leaf Area Index (LAI). Among the three cultivars, Tapol is significantly headed (88 DAS) and matured earlier (141.67), increased plant height (255 cm), and has longer and broader leaves (1.57). However, Guinampay and Gulian are significantly comparable regarding heading, maturity time, and heights. In other regions, agronomic characteristics differed from the result of the study. In Luzon areas particularly in Cordillera valley, ginampay, gulian, and tapol matured at 158- 160 DAP while grows up to 215 to 225 cm tall [5]. In Mindanao

regions particularly in Tangub City, gulian and ginampay matured at 162 DAP and grew up to 256 cm tall.

The study showed that different cultivars of Adlai showed different agronomic characteristics when planted in different areas. A variation in its agronomic characteristics was mainly due to the variability of biotic and abiotic factors [6-7]. Also, crop performance may directly influence on the presence of crop stresses. According to Alizadeh *et al.* (2014) limited or absence of rain or soil water deficiency is the primary stress factor that can affect the growth and development of plants [8]. In addition, Prasad *et al.* (2006) stated that limited soil moisture, stresses plants which hinder its development [2]. Meanwhile, the result of this study implied that under Carcar City, Cebu, the Tapol cultivar outstands the other cultivars. It matures earlier, stands taller and with broader and longer leaves, respectively.

Table 1. Agronomic characteristics of different *Coixlacryma jobi* L. cultivars grown in lowland condition

Treatments	No. of days from planting		Plant Height	LAI
	To Heading	To Maturity		
T ₁ - Ginampay	90.67 ^a	146.67 ^a	198.67 ^b	1.30 ^b
T ₂ - Gulian	90.00 ^a	143.37 ^{ab}	214.67 ^b	1.13 ^c
T ₃ - Tapol	88.00 ^b	141.67 ^b	255.00 ^a	1.57 ^a
(Pr value)	0.0178	0.0302	0.0068	0.002
C. V. (%)	0.7444	0.9821	4.7800	4.330

Table 2. Yield and Yield components of different *Coixlacryma jobi* L. varieties grown in lowland condition

Treatment	Productive Tillers	No.of Panicles	No.of Spikelets	1000 grains(g)	Grain Yield(t/ha)
T ₁ Ginampay	8.00 ^b	35.67 ^c	256.00 ^c	76.67 ^b	0.1455 ^b
T ₂ - Gulian	6.00 ^c	53.00 ^a	259.33 ^b	73.67 ^c	0.1472 ^b
T ₃ - Tapol	10.33 ^a	52.67 ^{ab}	347.67 ^a	86.33 ^a	1.5265 ^a
(Pr value)	0.009	0.045	0.032	0.021	0.042
C. V. (%)	10.87	40.13	42.60	15.73	17.14

Table 3. Gross margin analysis of different *Coixlacryma jobi* L. varieties grown under lowland condition

Treatment	Grain Yield	Gross Income	Total Variable Cost	Gross Margin	Return on Investment (%)
	(tha-1)	(PhPha-1)	(PhPha-1)		
T1-Ginampay	0.4365	21,781.35	16,902.56	4,878.79	0.29
T2-Gulian	0.4415	22,030.85	16,902.56	5,128.29	0.30
T3-Tapol	1.5265	76,172.35	16,902.56	59,269.79	3.51

*Calculation of gross income is based on the current price of Adlai at PhP 499/kg

3.2. Yield and Yield Components

Results showed that the Tapol cultivar significantly produced more number of tillers (10.33), panicles (52.67), a higher number of spikelets (347.67), heavier 1000 weight grains (86.33 g), higher grain yield (1.52 t/ha), and heavier dried matter yield (657 kg/ha). This significant result is attributed to its genetic, environment, and interaction effects [9]. The yield components of these cultivars also vary from region to region. In the Mindanao regions, the Tapol cultivar also had a higher grain yield (3.07 tons/ha), while other cultivars yield varies from 1.67 to 1.85 tons/ha [4]. However, in the Luzon regions, the tapol cultivar showed the lowest yield at 0.59 tons/ha, while ginampay and gulian had higher yields of 0.64 to 0.78 tons/ha, respectively. This shows a wide variation of its yield performance when grown in different regions. Such yield variation may be because of its existing biotic and abiotic factors, which also differ from region to region [10-14].

However, the result implied that Tapol performed best than the other two Adlai cultivars under lowland conditions in Carcar City, Cebu. The performance of this cultivar shows higher tiller productivity and panicles per hill, more spikelets, and heavier grain weight per hectare. But, this field information needs further investigation under several conditions in the location mentioned above.

3.3. Economic Analysis

Table 3 shows the gross margin analysis of different Adlai cultivars grown under lowland conditions in Carcar City, Cebu. Computation of income and cost was based on the actual yield times the current buying price and the cost incurred throughout each cultivars production. Tapol cultivar gave the highest gross margin income of PhP 59,269.79 per hectare, followed by Gulian and Ginampay with a positive gross margin of

PHP 4,878.79 and PHP 5,128.29. Further, the tapol cultivar also had the highest return on investment (3.51), which means that investment in the tapol cultivar could gain threefold more of its cost of production. Therefore, under Carcar City conditions, planting of Adlai (tapol) cultivar could have positive higher economic returns as evident to have increased gross income and return on investment. Economic Analysis

4. CONCLUSION

Based on the results, the Tapol cultivar outstand agronomic characteristics, higher yield and yield components, and higher return on investment. Meanwhile, tapol cultivar was highly recommended under Carcar City conditions. Further study is recommended focusing on the performance of this cultivars relating to food and feed production, formulation, and its socio-economic analysis in national and international level.

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