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.

INTRODUCTION
Nature and Importance of the study
The Philippine government still facing the dilemma regarding food sustainability. Production of domestic foods cannot suffice the Filipino populace (Simeon, 2019). In turn, effort must be made to attain the issues on food security. Hereafter, a locally known Adlai (Coixlacryma – jobi L.), otherwise known as Chinese pearl barley or Job’s Tear (Simeon, 2019) from the Poaceae family (Gaitan and Gaitan, 2017) reported as a staple food for Southern Zamboanga del Sur in the Subanen tribe (Gloria et al., 2015). It was chemically analyzed to have higher amount of starch, vitamins, and minerals that can lower blood pressure, anticancer, and reduce inflammation (Gaitan and Gaitan, 2017). Though it has had higher potential, information about this crop is still limited (Gaitan and Gaitan, 2017). Information on the morphology, yield and economic return limit only in Mindanao region. Recently, there have been known cultivars that the isolated part of Mindanao has used as their staple food (Gaitan and Gaitan, 2017) including tapol, gulian and ginampay. 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 light, darker grains and yields 4.80 mt/ha (Dela Cruz, 2011), respectively. However, 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. Meanwhile, to give detailed on this cultivars, a varietal trial was conducted to document its morphology, yield components and economic returns.

MATERIALS AND METHODS
Experimental Area, Design and Field Layout
The experiment 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 10.115111 latitudes and 123.639954 longitudes and characterized as a flat gradient and dominated by grasses and vegetations 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.

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.
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.

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 panicle, the weight of 1,000 grains (g), grain yield, dry matter yield, and net income return.

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.

RESULTS AND DISCUSSION
A variation in its agronomic characteristics were mainly due to the variability of biotic and abiotic factors (Gould & Higgins, 2009; Jobbágy & Jackson, 2004). 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. In addition, Prasad et al. (2006) stated that limited soil moisture, stresses plants which hinder its development. 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.

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 (DiLalla et al., 2009). 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 (Gloria et al., 2015). 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 (Clavijo, 2016), which also differ from region to region (Christensen et al., 2013; Doblas-Reyes et al., 2013; Parmesan and Hanley, 2015; Anderson and Song, 2020). 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 need further investigation under several conditions in the location mentioned above.
Table 2: Yield and Yield components of different Adlai (Coixlacryma-jobi L.) varieties grown in lowland condition in Carcar City, Cebu, Philippines

| Treatment | Productive Tillers | No.of Panicles | No.of Spikelets | 1000 grains (g) | Grain Yield (t/ha) |
|-----------|--------------------|----------------|-----------------|-----------------|-------------------|
| T1-Ginampay | 8.00b              | 35.67c         | 256.00c         | 76.67b          | 0.1455 b          |
| T2 -Gulian | 6.00c              | 53.00a         | 259.33b         | 73.67c          | 0.1472 b          |
| T3- Tapol   | 10.33a             | 52.67ab        | 347.67a         | 86.33a          | 1.5265a           |
| (Pr value) | 0.009              | 0.045          | 0.032           | 0.021           | 0.042             |
| C. V. (%)  | 10.87              | 40.13          | 42.60           | 15.73           | 17.14             |

Means followed by the same letters are not significantly different at 5 % alpha level using HSD test

Table 3: Gross margin analysis of different Adlai (Coixlacryma-jobi L.) varieties grown under lowland condition in Carcar City, Cebu

| 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

ECONOMICAL ANALYSIS
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

CONCLUSION AND RECOMMENDATION
Based on the results, the Tapol cultivar outstands 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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