*Original Research Article*

# Identification of morphological and agronomy characters rice plant (*Oryza sativa* l.) bc1f1 purple pandan/goat//purple pandan

Comment [NSN1]: Corrected


## ABSTRACT

This research was conducted toknow percentation of the pertitization andmorphological andagronomic character of paddy (*Oryza Sativa* L.) $BC_1F_1$ Pandan Ungu/Kambang//Pandan Ungu.This research was conducted from January to December 2018 at theScreen House AgricultureofFacultyMulawarmanUniversity.Thisresearchused the castrationbackcrossmethodbetweenPandan Ungu/Kambang females and Pandan Ungu males to produce $BC_1F_1$. The castration from 214spikelets was obtained from 20 fertilegrains (4,60%) from that seed only 10 seeds were to ablegerminate(50%) and only 4 plants (40%) were able to grow. Results showed Morphological characteristics;number of productive tillers that have the criteria of medium (1 plant), slight (1 plant), and very few(2 plants); long panicles that have the criteria of medium (3 plants) and long (1 plant); the length ofthe seed that has the criteria is very long (4 plants); the width of the seed 2.5-3 mm (4 plants); andthethicknessoftheseed1.6-2mm(4plants).OntheAgronomiccharacters,plantheightisshort (3 plants) and high (1 plant); the kink of the rod has the criteria of somewhat strong (4plants); the age of the plant has the criteria of very early maturing (4 plants); and weight of 100grains of dry unhusked have 2,80 g (1 plant), 2,33 g (1 plant) and 2.28 g (1 plant). The achievementof Morphological characters and Agronomic practices, namely; the Length of the panicle following thecharacter (Pandan Ungu) and (Kambang), the length of the seed following (Kambang), plant heightfollowing the character (Kambang)and the age of the plant follows the character(Pandan Ungu).As for new characters are obtained, namely; the number of productive tillers, the width of the seed, the thicknessof the seed, the kink stem, andtheweight of 100grains ofdrymilledgrain.



*Keywords:CrossBehind,RicePlantsBC$_1$F$_1$,Morphological Characters,and Agronomic.*


Comment [NSN2]: Corrected

## 1.INTRODUCTION

Comment [NSN3]: Corrected

Rice is the main basic need for the Indonesian population which must be fulfilled. The need for rice in Indonesia continues to increase from year to year along with the increase in population. Data [1] shows that in 2017 rice production was 81.3 million tons or the equivalent of 47.29 million tons of rice (58.17%), and population growth reached 261.89 million people multiplied by the consumption level of 114.6 kg/capita/per year so that the need for rice is 30.012 million kg which must be met. Rice production experienced a surplus reaching 33.47 million tons (57.53%).

Specifically for the province of East Kalimantan, in recent years there has been a decline in rice production which has resulted in a decrease in rice stocks. Data from [2], shows that there has been a decline in rice production from 439,239 tons of GKG or 280,802 tons of rice to 408,782 tons of GKG or 261,212 tons of rice. The decline in rice production is a serious problem that needs to be resolved as quickly as possible, so that rice availability can again

meet the needs of the people of East Kalimantan, amounting to 390,637 tons of rice (66.87%). One of the factors causing the decline in rice production, namely; environmental factors and genetic factors. Efforts that can be made to increase rice production are by the mandate of [3] concerning Food, one of which is plant breeding techniques by assembling varieties and using local rice germplasm to produce new varieties with high yields. quite a lot in East Kalimantan.

Local rice germplasm plays an important role in developing new superior varieties. There are 5 (five) cultivars identified as a result of the selection of 12 local Kalimantan lowland rice cultivars, 2 (two) of which are the Purple Pandan rice cultivar and the Kambang rice cultivar which have the potential to be further cultivated on tidal swamp land. Tidal swamp land is synonymous with land that is generally acidic and has low soil fertility so not all varieties are suitable and can adapt well to that land. The use of germplasm of local lowland rice cultivars, which are generally able to adapt well to the growing environment of tidal swamps, by assembling new superior varieties is expected to be able to contribute to efforts to increase production in the agricultural sector.

Efforts to increase rice production are one of the main plant breeding programs for breeders [4]. This research is a small part of one of the efforts to increase plant productivity using plant breeding techniques. Plant breeding is aimed at producing new varieties with high yields on ecosystem, social, cultural conditions, and community interests.

The rice plant breeding that is often used is a conventional system in the form of crossing. The crossing technique is divided into 5 methods, namely: single cross (SC), top cross (TC), double cross (DC), back-cross (BC), and multi-cross crossing method ( MC) [5] (Harahap, 1982). The backcross method involves crossing parents, namely the parent who wants to be improved (recurrent parent) and the parent who is used as a gene source (donor parent) [6].

Based on the results of previous research, F1 seeds were obtained from crossing Purple Pandan rice with Kambang [7]. The characteristics of the elder rice plant are the Purple Pandan rice cultivar with the criteria for a seed width of 1.7 mm, medium plant height, strong stem stiffness, very early maturity of the plant (P<110 DAT), and a slightly fragrant aroma. Kambang rice cultivar with the criteria of being tolerant of acidic soil, a large number of tillers, medium panicle length, very long seed length (>7.50 mm), short plant height, and early plant maturity [8].

The research aimed to determine the percentage and fertilization and morphological and agronomic characteristics of rice plants (*Oryza sativa* L.) BC1F1 Purple Pandan/Kambang//Purple Pandan.

## 2. MATERIALS AND METHODS

Comment [NSN4]: Number section added

The first stage of research, namely crossbreeding for making BC1F1 seeds, was carried out from January 2018 to May 2018 and the second stage of research was the identification of the Morphological and Agronomic Characters of BC1F1 seeds which was carried out from September to December 2018 at the Screen House, Faculty of Agriculture, Mulawarman University, Samarinda.

The materials used in this research were local rice cultivar seeds collected by Mr. Rusdiansyah, namely F1 seeds resulting from crossing Purple Pandan/Kambang rice and Purple Pandan rice. Other materials also used are planting media, manure, Pelangi NPK fertilizer (15:15:15), urea, insecticides, rodenticides, and tracing paper. The tools used in carrying out this research are; buckets, scissors, tweezers, raffia rope, seedbed, hoe, sprayer, stationery, caliper, measuring tape, ruler, and others.

The crossing method used to produce BC1F1 seeds is the backcross method, while the backcross identification method used is the single planting selection method.

In identifying BC1F1 seeds, observations were made by observing as follows : (1) Percentage of Crossing Success and Growth of BC1F1 Seeds; and (2) Percentage of Plant Characters in BC1F1 Seeds, namely; morphological characters of BC1F1 plants (number of productive tillers, panicle length, seed length, seed width, seed thickness) and agronomic characters of BC1F1 plants (plant height, stem stiffness, plant age, weight of 100 seeds).

## 3. RESULTS AND DISCUSSION

Comment [NSN5]: Number section added

### 3.1 Results of Phase 1 Research (BC1F1 Seed Formation)

Comment [NSN6]: Number subsection added

A backcross between F1 Purple Pandan/Kambang//Purple Pandan plants was pollinated with pollen from the male parent from the Purple Pandan cultivar. As many as 5 panicles or 214 spikelets (grain). The results of this crossing obtained 20 spikelets which produced seeds and a grain fertilization percentage of 4.60% as in Table 1.

**Table 1. Data from crosses (Purple Pandan/Kambang//Purple Pandan)**

Comment [NSN7]: Corrected

| No. | Crosses between Varieties | Number of Panicles (panicles) | Number of Spikelets | Successful Spikelets (seeds) | Unsuccessful Spikelets (seed) | Grain Fertilization Percentage (%) |
|---|---|---|---|---|---|---|
| 1 | PU/K//PU | 1 | 40 | 0 | 40 | 0 |
| 2 | PU/K//PU | 1 | 20 | 0 | 20 | 0 |
| 3 | PU/K//PU | 1 | 38 | 0 | 38 | 0 |
| 4 | PU/K//PU | 1 | 29 | 0 | 29 | 0 |
| 5 | PU/K//PU | 1 | 87 | 20 | 67 | 22,99 |
| | Total | 5 | 214 | 20 | 194 | 22,99 |

Description: PU = Purple Pandan, K = Kambang

The low percentage of crosses that can be produced is due to several factors that influence the success of the cross, namely; internal factors and external factors.The internal factor that influences the results of the cross is the difference in flowering time between the male parent and the female parent which influences the cross process. This difference in flowering makes it difficult to properly pollinate the flowering of the female parent so that the time, when the male parent comes first, the pollen used in pollination may no longer be good for use, the maturity of the pistils is not yet suitable for pollination and the castration and emasculation activities carried out on The female parent is one of the determinants of the success of a plant cross.

Comment [NSN8]: Corrected

External factors that are thought to influence the success of the crossing are rain which occurs immediately after the crossing; temperature which influences the maturity of the stigma and pollen; and gusts of wind which affect the fall of pollen before it is used to fertilize the female.The seeds obtained from the backcross of Purple Pandan/Kambang//Purple Pandan were 20 seeds or 4.60%, only 10 seeds or 50% of the cross of Purple Pandan/Kambang//Purple Pandan can be seen in Table 1 which successfully germinated and were then planted in buckets located in the Screen House, Faculty of Agriculture, Mulawarman University, after which identification was carried out in the field. The number of BC1F1 plants that were able to continue living and could be observed until the harvest was 4 buckets of plants or 40% of the total seeds germinated, while the remaining 6 plants, or 60% died. The plant dies due to influencing external and internal factors. The condition of the seeds is weak (hybrid weakness) so the seeds cannot develop perfectly and this condition is included in the internal factors. As explained by Bra and Khush (1986), the obstacles after pollination in crosses are hybrid seeds resulting from crosses that are weak or difficult to grow, death of F1 plants resulting in chromosome elimination, and sterile hybrids.

Comment [NSN9]: Corrected

The external factors (environmental) that influence the cause of the death of BC1F1 plants are attacks from Plant Pest Organisms (OPT). Plant Pest Organisms (OPT) that attack rice plants are classified as pests, for example, birds (*Passeridae*) and rats (*Rattus argentiventer*). These pests cause obstacles to the proper growth of rice plants and cause damage to the point that the plants cannot produce the expected production. Identification of the morphological and agronomic characters of rice plants is carried out at the 4th growth stage (Primordia) or when the plant is 45 days after planting (DAP) until the time of harvest.

### 3.2 Percentage Results of Plant Characters in BC1F1 Seeds

Comment [NSN10]: Corrected

#### a. Morphological Characters

#### 1) Number of Productive Tillers

Saplings are plants that consist of a stem, roots, and leaves and can produce flowers. Rice tillers also produce panicles but may not produce any after 60 days after planting. Tillers that are capable of producing panicles are called productive tillers [9].In the results of character identification, the number of productive tillers has obtained the following data: moderate (10-19 saplings/plant) amounting to 1 or 25%, few (5-9 saplings/plant) amounting to 1 or 25%, and very few (<5 saplings). /plant) amounts to 2 or 50%. Based on the percentage results of character identification, the number of productive offspring proves that there are new characters that are different from the characters of Purple Pandan and Kambang. The new characters obtained are included in very few categories (<5 saplings/plant) with the highest percentage being 50% which can be seen in Table 2.

Comment [NSN11]: Corrected

**Table 2. Data From Observations of the Number of Productive Offspring**

Comment [NSN12]: Corrected

| No | Number of Productive Saplings | Number of Plants |
|---|---|---|
| 1 | Very many (>25 saplings/plant) | 0 |
| 2 | Lots (20-25 saplings/plant) | 0 |
| 3 | Medium (10-19 saplings/plant) | 1 |
| 4 | Few (5-9 saplings/plant) | 1 |
| 5 | Very few (<5 saplings/plant) | 2 |
| | Total | 4 |

#### 2) Panicle Length

Panicle length is an important variable in determining production. The longer the panicle, the greater the chance of forming the number of grains per panicle (Utama and Haryoko, 2009). In the results of panicle length character identification, the following data were obtained: short (15.1-20 cm) amounted to 0 or 0%, medium (20.1-25 cm) amounted to 3 or 75%, long (25.1-30 cm) amounting to 1 or 25%, and Very Long (>30 cm) amounting to 0 or 0% can be seen in Table 3.

**Table 3. Data from Observations of Panicle Length**

Comment [NSN13]: Corrected

| No | Panicle Lenght | Number of Plants |
|---|---|---|
| 1 | Short (15.1-20 cm) | 0 |
| 2 | Medium (20.1-25 cm) | 3 |
| 3 | Length (25.1-30cm) | 1 |
| 4 | Very Long (>30 cm) | 0 |
| | Total | 4 |

Length character identification that hasbeenobtained; it can be seen that the panicle length of the Purple Pandan/Kambang//Purple Pandan cross is in the medium category (20.1-25 cm) with the highest percentage being 75%. The long panicle character follows the characters of Purple Pandan and Kambang.

Comment [NSN14]: Corrected

**3) Seed Length**

Identification of seed length characters obtained the following data: very long (>7.50-mm) totaling 4 or 100%, long (6.61-7.50 mm) totaling 0 or 0%, medium (5.51-6 .60 mm) amounting to 0 or 0%, and short (<5.51 mm) amounting to 0 or 0% can be seen in Table 4.

**Table 4. Data from Observations of Seed Length**

Comment [NSN15]: Corrected

| No | Seed Lenght | Number of Plants |
|---|---|---|
| 1 | Very Long (>7.50 mm) | 4 |
| 2 | Length (6.61-7.50 mm) | 0 |
| 3 | Medium (5.51-6.60 mm) | 0 |
| 4 | Short (<5.51 mm) | 0 |
| | Total | 4 |

Based on the results of the percentage identification of seed length characters that have been obtained, it can be seen that the seed length of the Purple Pandan/Kambang//Purple Pandan cross is in the very long category (>7.50-mm) with the highest percentage, namely 100%. The dominant seed length character follows the Kambang character.

**4) Width and Thickness of Seed**

Identification of seed width characters obtained the following data: seed width size (1-2 mm) amounted to 0 or 0%, seed width size (2.1-2.5 mm) amounted to 0 or 0%, and seed width size (2 .5-3 mm) amount 4 or 100%. Based on the results of the percentage identification of seed width characters that have been obtained, it can be seen that the seed width of the Purple Pandan/Kambang//Purple Pandan cross is found in the seed width size (2.5-3 mm) with the highest percentage, namely 100%.Identification of seed thickness characteristics obtained the following data: seeds with a thickness size (1-1.5 mm) amounted to 0 or 0% and seeds with a thickness size (1.6-2 mm) amounted to 4 or 100%. Based on the results of the character identification percentage of seed thickness measurements that have been obtained, it can be seen that the seed thickness of the Purple Pandan/Kambang//Purple Pandan cross is seed thickness (1.6-2 mm) with the highest percentage, namely 100%, which can be seen in Table 5.

**Table 5. Data from Observations of Seed Thickness**

Comment [NSN16]: Corrected

| No | Seed Thickness | Number of Plants |
|---|---|---|
| 1 | 1.0 – 1.5 mm | 0 |
| 2 | 1.6 – 2.0 mm | 4 |
| | Total | 4 |

**b. Agronomic Character**

**1) Plant Height**

Rice that has a high posture is less attractive to farmers because plants that have a tall posture are more susceptible to lodging [11]. Looseness will inhibit the transport of nutrients,

minerals, and photosynthesis due to damage to the xylem and phloem vessels, which ultimately inhibits the formation of panicles and the grain becomes empty [12]. In the results of identifying the height characteristics of BC1F1 rice plants, the following data were obtained: Short (<110 cm) totaling 3 plants or (75%), Medium (110-130 cm) totaling 0 or (0%), and Tall (>130 cm) amounting to 1 plant or 25%. Based on the results of the percentage identification of plant height characters that have been obtained, it can be seen that the most dominant plant height following the Kambang character is in the short category (<110 cm) with the highest percentage being 75% which can be seen in Table 6.

Comment [NSN17]: Corrected

**Table 6. Data from Observations of Plant Height**

Comment [NSN18]: Corrected

| No | Plant Height | Number of Plants |
|---|---|---|
| 1 | Short (<110 cm) | 3 |
| 2 | Medium (110-130 cm) | 0 |
| 3 | Height (>130 cm) | 1 |
| Total | | 4 |

**2) Stem Kink**

Identification of the stiffness character of this stem obtained the following data: strong (not curved) amounting to 0 or 0%, somewhat strong (mostly slightly curved) amounting to 4 or 100%, medium (some curved) amounting to 0 or 0%, weak (mostly slightly lying) amounts to 0 or 0%, and very weak (the entire plant is flat) amounts to 0 or 0%. Based on the results of the percentage identification of stem stiffness characters that have been obtained, it can be seen that stem stiffness is a new character that is different from the characters of Purple Pandan and Kambang which are in the rather strong category (mostly slightly curved) with the highest percentage, namely 100%, which can be seen in Table 7.

**Table 7. Data from Observations of Stem Stiffness**

Comment [NSN19]: Corrected

| No | Stem Kink | Number of Plants |
|---|---|---|
| 1 | Strong (not bent) | 0 |
| 2 | Somewhat Strong (mostly slightly curved) | 4 |
| 3 | Medium (some curved) | 0 |
| 4 | Weak (mostly slightly collapsed) | 0 |
| 5 | Very Weak (the whole plant is flat) | 0 |
| Total | | 4 |

**3) Plant Age**

The number of tillers produced in the vegetative phase determines whether or not the plant enters the flowering phase quickly, the more tillers produced, the longer it will take [13]. Flower age is positively correlated with harvest age [11]. The longer the flowering period, the longer the harvest will be. The flowering phase of varieties in tropical areas is generally 35 days and the ripening phase is 30 days [14].In the results of the identification of plant age characters, the following data were obtained: very early (P<110 DAP) totaling 4 or 100%, early maturing (110<P<115 DAP) totaling 0 or 0%, medium (115<P<125 DAP) amounting to 0 or 0%, and in (125<P<150 HST) amounting to 0 or 0%. Based on the results of the percentage identification of plant age characters that have been obtained, it can be seen that the most dominant plant age following the Purple Pandan character is in the very early maturing category (P<110 DAP) with the highest percentage, namely 100%, which can be seen in Table 8.

**Table 8. Data from Observations of Plant Age**

Comment [NSN20]: Corrected

| No | Plant Age | Number of Plants |
|---|---|---|

| | | |
|---|---|---|
| 1 | Very Early (P <110 DAP) | 4 |
| 2 | Early (110 < P < 115 DAP) | 0 |
| 3 | Medium (115< P < 125 DAP) | 0 |
| 4 | In (125 < P <150 DAP) | 0 |
| Total | | 4 |

Source: Diptaningsari, 2013 Information: P = Age of Harvest,

**4). Weight of 100 Grains of Milled Dry Grain**

The weight of 100 seeds is determined by the size of the grain, the larger the size of the grain, the heavier the weight of 100 seeds. The size of the grain determines the potential yield (Yoshida, 1981). In the results of identifying the characteristics of the weight of 100 grains of dry milled grain, the following data was obtained: grain weighing (1.99 g) amounted to 1 plant or (25%) (100 grains were not sufficient but only produced 69 grains), grain weighing (2, 80 g) amounts to 1 plant or (25%), grain weighing (2.33 g) amounts to 1 plant or (25%) and grain weighing (2.28 g) amounts to 1 or (25%). Based on the weight percentage of 100 milled dry grains, it has been obtained that the percentages are all the same but the weight of 100 milled dry grains from each plant is different, as can be seen in Table 9.

**Table 9. Data from Observations of the Weight of 100 Milled Dry Grains**

Comment [NSN21]: Corrected

| No | Weight of 100 milled dry grains (g) | Number of Plants |
|---|---|---|
| 1 | 1.99* | 1 |
| 2 | 2.80 | 1 |
| 3 | 2.33 | 1 |
| 4 | 2.28 | 1 |
| Total | | 4 |

Description: * Plant number 1 (one) produces 69 grains of grain

## 4. CONCLUSIONS

Comment [NSN22]: Number section added

Based on the results of research on the identification of the morphological and agronomic characters of the BC1F1 Purple Pandan/Kambang//Purple Pandan rice plants, the following conclusions can be drawn.

1. Backcrossing between Purple Pandan/Kambang and Purple Pandan is carried out using 5 panicles or 214 spikelets (grain) capable of producing 20 fertile seeds (4.60%), which can germinate 10 plants (50%), and Plants capable of growing to produce grain (harvest) reached 4 plants (40%).
2. Morphological characters, number of productive tillers with medium criteria (1 plant), few (1 plant), and very few (2 plants); panicle length with medium (3 plants) and long (1 plant) criteria; seed length with very long criteria (4 plants); seed width with criteria 2.5-3 mm (4 plants); and seed thickness with criteria of 1.6-2 mm (4 plants). Meanwhile, for Agronomy characters, plant height is short (3 plants) and tall (1 plant); stem stiffness with criteria rather strong (4 plants); plant age with very early maturity criteria (4 plants); and the weight of 100 grains of ground dry grain is 2.80 g (1 plant), 2.33 g (1 plant) and 2.28 g (1 plant).
3. Achievement of Morphological and Agronomic characteristics, namely;
   a. Morphological Characters
      The length of the panicle follows the character of the female parent (Pandan Purple) and the male parent (Kambang) while the length of the seeds follows the female parent (Kambang). The new characters obtained are; productive number, seed width, and seed thickness.
   b. Agronomic Character
      Plant height follows the character of the male parent (Kambang) and plant age follows the character of the female parent (Pandan Ungu). The new characteristics

obtained are; the stiffness of the stem and the weight of 100 grains of dry-milled grain.

## 5. SUGGESTIONS

Comment [NSN23]: Number section added

Based on the research results, several suggestions that can be made are as follows:

1. This research must be carried out intensively accompanied by complete and good documentation.
2. Further research is needed to determine the unknown morphological and agronomic characters from the backcross results of Purple Pandan/Kambang//Purple Pandan or BC1F1 in the next generation.

## COMPETING INTERESTS

Comment [NSN24]: Name section added

**Authors have declared that no competing interests exist.**

Comment [NSN25]: Added

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