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## PROCEEDINGS OF THE INTERNATIONAL WORKSHOP

Tropical Bio-resources for Sustainable Development

"The Role of Innovation to Enhance German Alumni in Scientific and Professional Capacities"

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## **Study of characteristics floral and morphological hybrid rice parental lines on different seeding date**

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**Abstract** This research used four female inbred lines (CMS) and seven male inbred lines (restorer). The purpose was to study the flower characteristic and plant morphology of female inbred lines (CMS) and male inbred lines (restorer) of rice hybrid in relation to different planting period. This research was conducted at the Institute for Agricultural Technology, Province of Banten, Indonesia, from November 2012 to September 2013. The experiments used randomized complete block design with three replications. Each replication consisted of five plants so that the total experimental unit was 165 plants for one planting period. During this research was used four planting period namely: 1) November 2012 to February 2013, 2) January-April 2013, 3) April-July 2013 and 4) June-September 2013. The results showed that there was interaction between planting period and female inbred lines (CMS) in panicle exertion, stigma exertion, the duration of the flower opening, and the flower opening angle. The best planting period of all CMS lines is on June-September, where at the time the air temperature and the sun light duration was higher, while the relative humidity, rainfall and the number of rainy day is lower as compare to another planting period. The restorer lines were more stable as compared to CMS lines. During four times of planting period, restorer lines expressed consistently character (no variation between planting period) except in flower opening duration which influenced by the sun light duration. The pair of hybrid rice parental of Hipa 8, Hipa 5, Hipa 11 and Hipa 14 SBU showed the suitability on all observed variables.

**Keywords** rice, hybrid, characteristic, planting time

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### **1. Introduction**

Research on flower characters and plant morphology is needed, especially in places that have never done such hybrid rice seed production in Serang

Banten. This is because the generative growth of rice plants is strongly influenced by environment, especially temperature. The results of this experiment can be used as a foundation in hybrid rice seed production further.

The purpose of this research is to study the differences in flower characters and plant morphology of female parent (CMS) and the male parent (R) of hybrid rice related to changes in the environment (different planting time).

## **2. Materials and Methods**

The study was conducted at the Experiment (KP) Singamerta, BPTP Banten. The study was conducted in four times of planting is 1) November 2012 until February 2013, 2) January to April 2013, 3) from April to July 2013 and 4) from June to September 2013.

The plant material used was 4 genotypes female parent (CMS) and 7 male parental genotypes (restorer). Female parents consists of A1 (parent of HIPA 5 Ceva and HIPA 8), A2 (parent of HIPA 6 Jete), A6 (parent of HIPA Jatim 3, HIPA 10 and HIPA 11) and A7 (parent of HIPA 14 SBU). Male parents were BR168 (HIPA 5), B8049f (HIPA 6), BP51-1 (HIPA 8), SR 88 (HIPA Jatim 3), Bio-9 (HIPA 10), IR40750 (HIPA 11) and BH33d-Mr-57 - 1-2-2 (HIPA 14 SBU). The plant material derived from the Rice Research Center, Sukamandi.

Observations by standard evaluation system for rice (SES) [1], includes the variables of female parent (CMS) and male parental lines (restorer) especially for flower characteristics.

## **3. Results and Discussion**

### **3.1. The variation of CMS character on the four time of planting**

The duration of the open flower is affected by the CMS line and by planting time. Planting time November to March resulted in the highest duration of open flower and does not vary with time of planting from June to October in line A1 and A2. Highest duration of open flower resulting in line A6 of CMS at the planting time from June to October of 101.31 minutes. Lowest duration of open flower was A1 CMS line at planting time from January to April at 43.23 minutes (Table 1).

Interaction between CMS line and planting time significantly affected the flower opening angle. In general, the time of planting from June to October



resulted in the highest opening angle on all the CMS lines (A7/2951°; A2/29.19°; A1/28.98V°) except line A6 CMS is best achieved at the time of planting from April to July 2013 (28.53°). Among lines produce different flower opening angle. A7 line produce the most wide-open angle compared to other CMS lines at all times except when planting time April. A1 line produces flower opening angle is not significantly different from line A6 at all times except at the time of planting time in June.

**Table 1. Characteristics of flowering of CMS line at several different time of planting**

| Planting time                            | CMS line |         |         |         | Mean  |
|--|----------|---------|---------|---------|-------|
|  | A1       | A2      | A6      | A7      |       |
| <b>Stigma exertion (%)*</b>              |          |         |         |         |       |
| Nov 2012                                 | 34.0c    | 44.2ab  | 40.7abc | 44.8ab  | 40.9  |
| Jan 2013                                 | 40.7abc  | 32.0c   | 45.7ab  | 38.01bc | 39.6  |
| Apr 2013                                 | 34.7c    | 37.9bc  | 39.3abc | 46.5ab  | 39.6  |
| Jun 2013                                 | 38.5a    | 47.6ab  | 39.4abc | 46.8ab  | 45.6  |
| Average                                  | 39.5     | 40.4    | 41.3    | 44.1    | 41.3  |
| <b>Flower opening duration (minute)*</b> |          |         |         |         |       |
| Nov 2012                                 | 75.7bc   | 67.7bc  | 99.8b   | 50.9cd  | 73.5  |
| Jan 2013                                 | 43.2e    | 49.6d   | 54.0cd  | 46.9de  | 48.5  |
| Apr 2013                                 | 67.7b    | 66.1bcd | 79.4bc  | 57.2cd  | 67.6  |
| Jun 2013                                 | 62.6bcd  | 66.0bcd | 101.3a  | 52.7cd  | 70.7  |
| Average                                  | 62.3     | 62.4    | 83.6    | 51.9    | 65.1  |
| <b>Flower opening angle (°)*</b>         |          |         |         |         |       |
| Nov 2012                                 | 28.4bc   | 26.3cd  | 26.2cd  | 31.9ab  | 28.2  |
| Jan 2013                                 | 27.2cd   | 24.9d   | 27.7cd  | 28.0bc  | 27.0  |
| Apr 2013                                 | 28.8ab   | 26.0cd  | 28.5bc  | 25.3cd  | 27.2  |
| Jun 2013                                 | 29.0ab   | 29.2ab  | 27.7cd  | 32.2a   | 29.5  |
| Average                                  | 28.4     | 26.6    | 27.5    | 29.4    | 27.9  |
| <b>Pollen Sterility (%)*</b>             |          |         |         |         |       |
| Nov 2012                                 | 86.7     | 89.1    | 66.1    | 96.1    | 84.5  |
| Jan 2013                                 | 100.0    | 95.5    | 68.8    | 94.6    | 89.7  |
| Apr 2013                                 | 89.2     | 87.3    | 72.9    | 93.7    | 85.8  |
| Jun 2013                                 | 91.4     | 96.8    | 65.9    | 90.1    | 86.0  |
| Average                                  | 91.8a    | 92.2a   | 68.4b   | 93.6a   | 86.5  |
| <b>Spikelet number*</b>                  |          |         |         |         |       |
| Nov 2012                                 | 196.4    | 154.5   | 209.1   | 186.4   | 185.8 |
| Jan 2013                                 | 181.7    | 167.5   | 210.6   | 186.6   | 171.6 |
| Apr 2013                                 | 182.3    | 148.6   | 218.8   | 183.0   | 180.7 |
| Jun 2013                                 | 217.9    | 170.5   | 206.9   | 187.2   | 188.1 |
| Average                                  | 194.6b   | 160.3c  | 211.3a  | 185.8b  | 181.5 |

\* Figures followed by the same letter in each parameter are not significantly different by DMRT at level  $\alpha = 0.05$

### 3.2. The variation of restorer lines characters in four different planting times

Panicle length was not affected by planting time is also not different among lines. The mean panicle length among lines ranged 23.1 cm (PK88) to 24.9 cm (BH33d). While the average panicle length among planting time is relatively constant between 23.7-24.6 cm. Panicle lengths were stable between the times of planting. This is very advantageous because pollen transfer opportunities will be relatively the same.

The character of flower of restorer lines which include filament length, anther length and opening angle of flower only influenced by genotype lines and not influenced by time of planting. Line B8049 produces the longest filament length (8.1 mm) and no different from all other lines except with Bio-9 (6.4 mm) and IR40750 (4.6 mm). Anther length was not different for all lines except the line IR40750, the length of anthers was vary 2.0-2.3 mm. Likewise, the opening angle of flower is not different for all lines except the line Bio-9. Opening angle of flower ranging between 25.2°-30.9° (Table 2).

The duration of the open flower is influenced by time of planting and restorer lines. Between the times of planting, the duration of flowering does not different except with the time of planting from January to May 2013. Lines BP51-1 has the longest duration of open flower (63.5 minutes) and it is different with all lines except with Bio-9 (59.8 minutes), while the duration of open flower line BR168 was shortest (47 minutes).

**Table 2. Characteristics of flower restorer lines in several different planting time**

| Planting time | Line                      |       |       |       |        |       |         | Mean |
|---------------|---------------------------|-------|-------|-------|--------|-------|---------|------|
|               | BR168                     | B8049 | PK88  | BH33d | BP51-1 | Bio-9 | IR40750 |      |
|               | Filament length (mm)*     |       |       |       |        |       |         |      |
| Nov 2012      | 6.8                       | 8.5   | 6.5   | 6.6   | 6.5    | 5.7   | 4.6     | 6.4  |
| Jan 2013      | 7.3                       | 8.4   | 7.9   | 7.1   | 7.1    | 6.4   | 5.3     | 7.1  |
| Apr 2013      | 6.8                       | 8.1   | 7.6   | 7.0   | 6.6    | 7.7   | 4.8     | 6.9  |
| Jun 2013      | 5.7                       | 7.3   | 6.8   | 6.9   | 6.3    | 5.7   | 3.8     | 6.1  |
| Average       | 6.6ab                     | 8.1a  | 7.2a  | 6.9ab | 6.6ab  | 6.4b  | 4.6c    | 6.6  |
|               | Anther length (mm)*       |       |       |       |        |       |         |      |
| Nov 2012      | 1.9                       | 2.3   | 2.6   | 2.3   | 2.3    | 2.0   | 1.5     | 2.1  |
| Jan 2013      | 2.2                       | 2.1   | 2.3   | 2.3   | 2.5    | 2.1   | 1.7     | 2.2  |
| Apr 2013      | 2.0                       | 2.3   | 2.4   | 2.3   | 2.3    | 2.3   | 1.4     | 2.1  |
| Jun 2013      | 1.8                       | 1.9   | 1.7   | 2.1   | 2.0    | 1.8   | 1.5     | 1.8  |
| Average       | 2.0ab                     | 2.2a  | 2.22a | 2.2a  | 2.3a   | 2.0ab | 1.5b    | 2.1  |
|               | Flower opening angle (°)* |       |       |       |        |       |         |      |
| Nov 2012      | 25.9                      | 34.8  | 25.0  | 27.9  | 27.3   | 24.5  | 26.1    | 27.4 |

| Planting time                     | Line   |       |        |        |        |        |         | Mean   |
|-----------------------------------|--------|-------|--------|--------|--------|--------|---------|--------|
|                                   | BR168  | B8049 | PK88   | BH33d  | BP51-1 | Bio-9  | IR40750 |        |
| Jan 2013                          | 27.7   | 32.8  | 26.9   | 29.0   | 31.9   | 26.3   | 26.9    | 28.8   |
| Apr 2013                          | 27.3   | 29.5  | 28.1   | 30.0   | 30.3   | 26.3   | 27.6    | 28.4   |
| Jun 2013                          | 25.9   | 26.7  | 26.0   | 31.5   | 27.7   | 23.8   | 25.9    | 26.8   |
| Average                           | 26.7ab | 30.9a | 26.5ab | 29.6ab | 29.3ab | 25.2b  | 26.6ab  | 27.8   |
| Flower opening duration (minute)* |        |       |        |        |        |        |         |        |
| Nov 2012                          | 47.4   | 55.0  | 56.1   | 59.4   | 65.0   | 68.6   | 51.0    | 57.5ab |
| Jan 2013                          | 43.9   | 48.4  | 51.7   | 59.3   | 53.2   | 49.7   | 56.8    | 51.8b  |
| Apr 2013                          | 44.9   | 53.0  | 57.5   | 48.6   | 71.6   | 57.3   | 56.4    | 55.6ab |
| Jun 2013                          | 51.6   | 62.6  | 55.0   | 64.5   | 64.1   | 63.5   | 56.2    | 59.6a  |
| Average                           | 47.0c  | 54.7b | 55.1b  | 57.9b  | 63.5a  | 59.8ab | 55.1b   | 56.1   |

\* Figures followed by the same letter in each parameter are not significantly different by DMRT at level  $\alpha = 0.05$

#### 4. Conclusion

1. There is interaction between the planting time and CMS line especially on variable of panicle exertion, stigma exertion, duration of flower opening and flower opening angle. The best planting time in all CMS lines is on from June to October.
2. Restorer line is more stable than CMS lines. During the time of planting four restorer lines produce consistent character (not significantly different between planting times) except for the duration of opening flower.

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