Agronomic Characteristics and Its Correlation of New Plant Type Promising Rice Lines

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ABSTRACT
Karakteristik Agronomi dan Korelasinya pada Galur-galur Harapan Padi Tipe Baru. Dalam program pemuliaan tanaman padi diperlukan pengetahuan tentang karakter dan korelasinya dengan hasil gabah. Penelitian dilakukan untuk mempelajari karakter tanaman dan korelasinya dari 35 galur harapan PTB dengan Ciherang dan Sintanur sebagai varietas pembanding, ditanam di dua lokasi, Bogor dan Pusakanagara, pada MT 2009 (MK dan MH). Rancangan yang digunakan adalah acak kelompok dengan tiga ulanga n. Bibit umur 21 hari ditanam satu bibit per lubang, jarak tanam 20 cm x 20 cm, pada petak berukuran 2 x 5 m2 per baris. Karakter tanaman bervariasi antargalur dan beberapa di antaranya berbeda nyata dengan varietas pembanding Ciherang dan Sintanur, kecuali untuk hasil gabah. B11742-RS*2-3-MR-34-1-2-1 merupakan galur dengan postur tanaman terendah, hasil gabah rendah, dan umur terpendek. Sebagian besar galur mempunyai karakter padi tipe baru (PTB). Hasil gabah berkorelasi positif dengan semua karakter, tetapi hanya berkorelasi nyata dan positif dengan tinggi tanaman, berkisar antara 91.4-120.7 cm.

Kata kunci: Padi, galur tipe baru, karakter, korelasi.

INTRODUCTION
Rice breeding program is always conducted to increase rice productivity. Improvement of rice grain yield is the main target of breeding program to develop rice varieties. High yield potential improvement programs could be promoted through the establishment of a new plant type of rice (NPT).

NPTs are designed to have more efficient assimilate distribution to the grain. The desired NPT characteristics: 80-100 cm plant height, sturdy stem, 8-10 productive tillers, erect leaves, thick, dark green leaves, long panicle, total grain of 200-250/panicle, mature at 100-130 days, resistant to major pests and diseases (Khush, 2000). In 1995 new initiation began to breed the second generation NPT by crossing tropical japonica NPT lines with the elite indica lines to increase the number of tillers. The development of NPT rice has been conducted by Indonesian Center for Rice Research (ICRR) and Bogor Agricultural University (BAU) that used local variety in Indonesia (Peng et al., 2008; Abdullah et al., 2008).

In a hybridization program, knowledge of the interrelationships among yield and other characters are necessary. Understanding the relationship between yield and its components is of paramount importance for making the best use of these relationships in selection (Sarawgi et al., 1997). However, grain yield is a complex trait, controlled
by many genes and highly affected by environment. In addition, grain yield also related with other characters such as growth duration, and yield components (Yoshida, 1981).

Correlation between two or more positive character which will facilitate the selection because it is will be followed by an increase in other properties. Conversely, if a negative correlation, it is difficult to obtain the expected character. If there is no correlation, then the selection becomes ineffective. The objectives of this study were to figure agronomic characters and correlation of grain yield with yield components among the NPT promising rice lines.

**MATERIALS AND METHOD**

Field studies were conducted from July 2009 to May 2010 at two locations, farmer’s field in Bogor (elevation 200 m above sea level, asl) and Pusakakagara experimental farm (8 m asl), in the 2009 dry season (DS) and 2009 wet season (WS), randomized complete block design (RCBD), in three replications was used. Materials tested were 35 promising aromatic lines and check varieties were Ciherang and Sintanur. The total treatments amounted to 37 lines (Table 1).

The 21-days-old seedling were planted one seedling per hole with spacing of 20 cm x 20 cm, in

| Lines | Combinations |
|-------|--------------|
| IPB 113-F-1 | Pare Bau x Fatmawati |
| IPB 113-F-2 | Pare Bau x Fatmawati |
| IPB 115-F-3-2 | Fatmawati x Lambau |
| IPB 115-F-11 | Fatmawati x Lambau |
| IPB 116-F-3-1 | Pinjan x Fatmawati |
| IPB 116-F-44-1 | Pinjan x Fatmawati |
| IPB 116-F-46-1 | Pinjan x Fatmawati |
| IPB 117-F-1-3 | Fatmawati x Pulu Mandoti |
| IPB 117-F-4-1 | Fatmawati x Pulu Mandoti |
| IPB 117-F-6-1 | Fatmawati x Pulu Mandoti |
| IPB 117-F-14-2 | Fatmawati x Pulu Mandoti |
| IPB 117-F-15-2 | Fatmawati x Pulu Mandoti |
| IPB 117-F-17-4 | Fatmawati x Pulu Mandoti |
| IPB 117-F-17-5 | Fatmawati x Pulu Mandoti |
| IPB 117-F-17-18-3 | Fatmawati x Pulu Mandoti |
| IPB 117-F-45-2 | Fatmawati x Pulu Mandoti |
| IPB 140-F-1-1 | Sintanur x (Fatmawati x IPB26-d-14j-1-1-2) |
| IPB 140-F-2-1 | Sintanur x (Fatmawati x IPB26-d-14j-1-1-2) |
| IPB 140-F-3 | Sintanur x (Fatmawati x IPB26-d-14j-1-1-2) |
| IPB 140-F-4 | Sintanur x (Fatmawati x IPB26-d-14j-1-1-2) |
| IPB 140-F-5 | Sintanur x (Fatmawati x IPB26-d-14j-1-1-2) |
| IPB 140-F-6 | Sintanur x (Fatmawati x IPB26-d-14j-1-1-2) |
| IPB 140-F-7 | Sintanur x (Fatmawati x IPB26-d-14j-1-1-2) |
| IPB 149-F-1 | Lambau x Fatmawati |
| IPB 149-F-2 | Lambau x Fatmawati |
| IPB 149-F-3 | Lambau x Fatmawati |
| IPB 149-F-4 | Lambau x Fatmawati |
| IPB 149-F-5 | Lambau x Fatmawati |
| IPB 149-F-7 | Lambau x Fatmawati |
| IPB 149-F-8 | Lambau x Fatmawati |
| B11249-9C-PN-3-3-2-2-MR-1 | B10589F-KN//Memberamo/IR64 |
| B11738-MR-1-2-Si-1-2 | Gilirang*/BP342F-MR-1-3//Gilirang* |
| B11742-RS*-3-3-1-2-1 | BP360E-MR-79-PN-2/IR71218/BP360E |
| B11823-MR-3-15-1 | BP140F-MR-1-KN-1/Code/BP140F-MR-1 |
| B11955-MR-84-1-4 | B11738-MR-2-5/B11738-MR-6B |
| Ciherang | - |
| Sintanur | - |
a plot size of 2 m x 5 m per genotype; there were 250 plants per plot. The rice plants were fertilized with urea, SP36, KCl at the rates of 250 kg/ha, 100 kg/ha, 100 kg/ha, respectively. Pests and diseases were controlled optimally. Parameters was observed: days to flowering, days to maturity, plant height (cm), number of productive tillers, grain total per panicle, percentage of filled grain, weight of 1.000 grain (g), and yield (t/ha).

The correlation between covariance was analyzed according to the formula of Singh and Chaudary (1979):

\[
r (x_1 \times 2) = \frac{COV (x_1 \times 2)}{\sqrt{\sigma^2(x_1) \sigma^2(x_2)}}
\]

where:
\[
r (x_1 \times 2) = \text{correlation between } x_1 \text{ and } x_2
\]
\[
cov(x_1 \times 2) = \text{covariance } x_1 \times 2
\]
\[
\sigma^2(x_1) = \text{variance of } x_1
\]
\[
\sigma^2(x_2) = \text{variance of } x_2
\]

Correlation of significant different test between characters was calculated by t test,

\[
t = \frac{R (x_1 \times 2)}{\sqrt{1 - r^2 (x_1 \times 2)/df}}
\]

where:
\[
r (x_1 \times 2) = \text{correlation between } x_1 \text{ and } x_2
\]
\[
r^2 (x_1 \times 2) = \text{square of correlation between } x_1 \text{ and } x_2
\]
\[
df = \text{degree of freedom (n-2)}
\]

RESULT AND DISCUSSION

The average of plant characters of agronomic characters, i.e. days to flowering, plant height, panicle length, days to maturity were varied and significantly different from Ciherang and Sintanur as check varieties (Table 2). The same result with yield components, i.e. number of productive tiller, filled grain per panicle, total grain per panicle, percentage of filled grain, 1.000 grain weight, and yield (Table 3).

Days to Flowering

Days to flowering showed significant differences among lines at (Pr=0.0001). It ranged from 87-97 days after sowing (DAS) (Table 2). Lines IPB 113-F-2 and B11742-RS*2-3-MR-34-1-2-1 taking the shortest days to flowering (87 DAS) while IPB 140-F-5 and IPB 149-F-5 took the longest period (97 DAS) and were not significantly different from Ciherang and Sintanur. The average of this character was 92 DAS. However, this flowering time was longer than study of Akinwale et al. (2011) and Kabir et al. (2004) who reported the average days to flowering of rice lines was 85 DAS and 88.8 DAS, respectively.

Plant Height

Plant height showed significant difference (Pr<0.001) among the lines at maturity. The tallest plant was B11249-9C-PN-3-3-2-2-MR-1 (120.7 cm) and the shortest was B11742-RS*2-3-MR-34-1-2-1 line with 91.4 cm height. The average plant height was not significantly different with Ciherang or Sintanur.

Plant height is divided into three categories, namely short (<110 cm), medium (110-130 cm), and tall (>130 cm) (IRRI, 2002). Based on these categories, from the average data on plant height there were 22 lines were medium with plant height ranging from 110.1-120.7 cm, also Sintanur variety (112.2 cm) and 13 lines were short (91.4 cm-109.8 cm), also Ciherang variety (107 cm); none of these lines were tall.

Nematzadeh et al. (2007) reported plant height of 13 high-yielding varieties ranging from 111.61 to 124.5 cm that appeared to be lodging tolerant. Tall plant is not desired because it is sensitive to lodging, and lodging will reduce grain yield (Shahidullah et al., 2009). Reducing plant height is one of the main objectives of rice breeding programs in Afghanistan (Sarhadi et al., 2009).

Panicle Length

The tested lines have panicle length ranging from 25.2 to 31.7 cm. The lines with the longest panicle was IPB 140-F-6; while the shortest was B11742-RS*2-3-MR-34-1-2-1. Rice plants with long panicles potentially have high number of grain total and high yield because there is a positive correlation between panicle lengths with the number of grains per panicle (Haryanto et al., 2008) and weight of 1.000 grain (Akinwale et al., 2011).
Days to Maturity

Days to maturity was measured from sowing to harvest, ranged between 117 DAS to 123 DAS. It followed the same trend with days to flowering with line B11742-RS*2-3-MR-34-1-2-1 taking the shortest period (117 DAS), while IPB 117-F-4-1, IPB 140-F-5, IPB 149-F-3, IPB 149-F-4, IPB 149-F-5, IPB 149-F-7, and B11823-MR-3-15-1 took the longest period to mature (123 DAS).

Table 2. Average of plant growth variables of NPT lines in four environmental conditions, 2009 DS/WS.

| Lines                  | Days to flowering (HST) | Plant heighth (cm) | Panicle length (cm) | Days to maturity (HST) |
|------------------------|-------------------------|--------------------|---------------------|------------------------|
| IPB 113-F-1            | 89 b                    | 110.1              | 31.1 ab             | 118                    |
| IPB 113-F-2            | 87 ab                   | 115.0              | 30.9 ab             | 118                    |
| IPB 115-F-3-2          | 91                      | 106.4              | 31.2 ab             | 118                    |
| IPB 115-F-11           | 92                      | 107.8              | 30.7 ab             | 119                    |
| IPB 116-F-3-1          | 89 b                    | 103.9              | 28.8                | 117                    |
| IPB 116-F-44-1         | 90                      | 106.6              | 29.6 a              | 120                    |
| IPB-116-F-46-1         | 88 b                    | 99.8 b             | 27.6                | 120                    |
| IPB 117-F-1-3          | 91                      | 109.8              | 28.4                | 121                    |
| IPB 117-F-4-1          | 95                      | 108.5              | 29.0                | 123 ab                 |
| IPB 117-F-6-1          | 90                      | 105.1              | 28.2                | 120                    |
| IPB 117-F-14-2         | 91                      | 116.1              | 31.6 ab             | 122                    |
| IPB 117-F-15-2         | 94                      | 117.0 a            | 33.0 ab             | 122                    |
| IPB 117-F-17-4         | 92                      | 116.4 a            | 31.6 ab             | 121                    |
| IPB 117-F-17-5         | 94                      | 114.9              | 31.3 ab             | 122                    |
| IPB 117-F-18-3         | 94                      | 113.8              | 28.3                | 122                    |
| IPB 117-F-45-2         | 89 b                    | 101.9 b            | 28.0                | 119                    |
| IPB 140-F-1-1          | 92                      | 119.2 a            | 28.9 a              | 121                    |
| IPB 140-F-2-1          | 91                      | 115.4              | 27.6                | 119                    |
| IPB 140-F-3            | 93                      | 118.9 a            | 26.7                | 118                    |
| IPB 140-F-4            | 91                      | 115.1              | 28.0                | 120                    |
| IPB 140-F-5            | 97                      | 117.2 a            | 30.7 ab             | 123 ab                 |
| IPB 140-F-6            | 90                      | 116.9 a            | 31.7 ab             | 120                    |
| IPB 140-F-7            | 92                      | 114.1              | 29.3 a              | 120                    |
| IPB 149-F-1            | 94                      | 117.1 a            | 29.6 a              | 122                    |
| IPB 149-F-2            | 94                      | 114.9              | 30.0 ab             | 122                    |
| IPB 149-F-3            | 95                      | 116.9 a            | 30.9 ab             | 123 ab                 |
| IPB 149-F-4            | 96                      | 115.9              | 29.7 a              | 123 ab                 |
| IPB 149-F-5            | 97                      | 111.0              | 28.1                | 123 ab                 |
| IPB 149-F-7            | 95                      | 115.6              | 30.0 ab             | 123 ab                 |
| IPB 149-F-8            | 95                      | 109.0              | 27.6                | 122                    |
| B11249-9C-PN-3-3-2-2-MR-1 | 91                   | 120.7 a            | 28.8                | 120                    |
| B11738-MR-1-2-Si-1-2   | 96                      | 110.2              | 28.1                | 122                    |
| B11742-RS*2-3-MR-34-1-2-1 | 87 ab              | 91.4              | 25.2 b              | 117                    |
| B11823-MR-3-15-1       | 94                      | 98.1 a             | 28.9 a              | 123 ab                 |
| B11955-MR-84-1-4       | 92                      | 105.6              | 28.5                | 121                    |
| Ciherang               | 92                      | 107.0              | 26.7                | 119                    |
| Sintanur               | 94                      | 112.2              | 27.8                | 119                    |
| Average                | 92                      | 111.2              | 29.3                | 121                    |
| CV (%)                 | 1.6                     | 2.6                | 2.3                 | 1.1                    |
| Pr>F                   | **                      | **                 | **                  | **                     |

**Figures in columns with letter a was significantly different from Ciherang, which followed by b was significantly different from Sintanur; that followed by ab were significantly different from Ciherang and Sintanur at 5% level of Tukey test.

Number of Productive Tiller

Number of productive tillers varied significantly among lines. The average numbers of productive tillers of the 37 lines were relatively small. It ranged only 9 to 14 tillers with average 11 tillers. The lowest number of productive tiller were IPB 117-F-14-2, IPB 117-F-15-2, IPB 117-F-17-4, IPB 149-F-1, and IPB 149-F-3 lines; significantly different from check varieties Ciherang and Sintanur.
Sintanur with 15 and 13 tillers, respectively while Ciherang had the highest number. B11742-RS*2-3-MR-34-1-2-1 recorded the highest number among lines (14 tillers). Those numbers of productive tillers are higher than those of aromatic rices in Bangladesh. BRRI dhan37 that is reported to have the highest number of productive tillers has only 11 tillers. Low number of tiller follows the low productivity (Hossain et al., 2005).

### Filled Grains per Panicle

Range of the numbers of filled grains per panicle was from 88 to 213 grains. IPB 117-F-17-4 had the highest filled grains that was significantly higher than those of check varieties; the lowest was B11742-RS*2-3-MR-34-1-2-1 with the number of grains of 88 grains. The filled grain per panicle of

### Table 3. Average of yield components and yield of NPT lines in four environmental conditions, 2009 DS/WS

| Lines                  | Productive tiller | Filled grain per panicle | Total grain per panicle | Percentage of filled grain (%) | 1,000 grain weight (g) | Yield (t/ha) |
|------------------------|-------------------|--------------------------|-------------------------|-------------------------------|------------------------|-------------|
| IPB 113-F-1            | 10 ab             | 189 ab                   | 263 ab                  | 72.5 a                        | 28.6                   | 5.8         |
| IPB 113-F-2            | 10 ab             | 187 ab                   | 261 ab                  | 71.8 a                        | 29.9                   | 6.1         |
| IPB 115-F-3-2          | 10 ab             | 172 ab                   | 290 ab                  | 60.8                          | 27.7                   | 5.8         |
| IPB 115-F-11           | 10 ab             | 171 ab                   | 313 ab                  | 55.3 b                        | 27.2                   | 5.6         |
| IPB 116-F-3-1          | 12                | 182 ab                   | 253 ab                  | 72.1 a                        | 27.9                   | 6.9         |
| IPB 116-F-44-1         | 11 a              | 159                      | 266 ab                  | 60.0                          | 27.0                   | 6.3         |
| IPB-116-F-46-1         | 12                | 143                      | 218 ab                  | 68.7                          | 26.7                   | 6.9         |
| IPB 117-F-1-3          | 11 a              | 147                      | 225 ab                  | 66.1                          | 26.7                   | 6.2         |
| IPB 117-F-4-1          | 10 a              | 169 ab                   | 288 ab                  | 61.0                          | 26.9                   | 6.6         |
| IPB 117-F-6-1          | 11 a              | 146                      | 234 ab                  | 64.2                          | 28.7                   | 6.1         |
| IPB 117-F-14-2         | 9 ab              | 197 ab                   | 298 ab                  | 64.8                          | 30.7                   | 6.9         |
| IPB 117-F-15-2         | 9 ab              | 192 ab                   | 305 ab                  | 63.2                          | 28.8                   | 6.6         |
| IPB 117-F-17-4         | 9 ab              | 213 ab                   | 319 ab                  | 67.7                          | 29.8                   | 7.1         |
| IPB 117-F-17-5         | 11 a              | 176 ab                   | 295 ab                  | 62.1                          | 30.4                   | 7.7         |
| IPB 117-F-18-3         | 11 a              | 177 ab                   | 273 ab                  | 59.3                          | 26.7                   | 6.6         |
| IPB 117-F-45-2         | 11 a              | 147                      | 231 ab                  | 64.5                          | 27.3                   | 6.3         |
| IPB 140-F-1-1          | 11 a              | 175 ab                   | 279 ab                  | 65.8                          | 27.4                   | 6.8         |
| IPB 140-F-2-1          | 11 a              | 190 ab                   | 295 ab                  | 65.5                          | 27.2                   | 7.0         |
| IPB 140-F-3            | 12 a              | 124                      | 154 ab                  | 73.0 a                        | 26.1 ab                | 6.5         |
| IPB 140-F-4            | 11 a              | 171 ab                   | 239 ab                  | 71.9 a                        | 30.1                   | 6.5         |
| IPB 140-F-5            | 11 a              | 152                      | 208 ab                  | 73.8 a                        | 29.6                   | 6.2         |
| IPB 140-F-6            | 12                | 165 b                    | 200 ab                  | 74.9 a                        | 30.5                   | 7.2         |
| IPB 140-F-7            | 12                | 155                      | 228 ab                  | 69.5                          | 28.4                   | 6.9         |
| IPB 149-F-1            | 9 ab              | 182 ab                   | 267 ab                  | 68.8                          | 29.6                   | 6.3         |
| IPB 149-F-2            | 10 ab             | 198 ab                   | 304 ab                  | 66.0                          | 29.6                   | 6.6         |
| IPB 149-F-3            | 9 ab              | 196 ab                   | 300 ab                  | 66.0                          | 28.2                   | 6.4         |
| IPB 149-F-4            | 10 ab             | 182 ab                   | 267 ab                  | 70.0                          | 29.2                   | 6.1         |
| IPB 149-F-5            | 11 a              | 177 ab                   | 260 ab                  | 68.1                          | 29.5                   | 6.3         |
| IPB 149-F-7            | 11 a              | 170 ab                   | 268 ab                  | 65.2                          | 29.8                   | 6.3         |
| IPB 149-F-8            | 11 a              | 155                      | 231 ab                  | 70.0                          | 29.2                   | 6.1         |
| B11249-9C-PN-3-3-2-2-MR-1 | 11 a             | 121                      | 176                     | 69.6                          | 28.6                   | 6.3         |
| B11738-MR-1-2-Si-1-2   | 13                | 110                      | 208 ab                  | 58.3                          | 27.6                   | 6.9         |
| B11742-RS*2-3-MR-34-1-2-1 | 14             | 88                       | 157 ab                  | 54.4 b                        | 27.0                   | 5.6         |
| B11823-MR-3-15-1       | 13                | 117                      | 210 ab                  | 55.9 b                        | 29.0                   | 6.1         |
| B11955-MR-84-1-4       | 11 a              | 162 b                    | 271 ab                  | 60.2                          | 29.9                   | 6.6         |
| Ciherang               | 15                | 121                      | 174                     | 69.0                          | 27.9                   | 6.7         |
| Sintanur               | 13                | 116                      | 169                     | 69.2                          | 27.9                   | 7.7         |

Average: 11 162 248 65.9 28.5 6.5

CV (%) 8.0 8.3 7.0 5.2 4.0 9.1

Pr>F ** ** ** ** ** ** **

*Figures in columns with letter a was significantly different from Ciherang, which followed by b was significantly different from Sintanur; that followed by ab were significantly different from Ciherang and Sintanur at 5% level of Tukey test.
check varieties were relatively small, 121 and 116 grains, for Ciherang and Sintanur, respectively.

In addition to panicle length, the number of grains per panicle is one of yield components that affect the productivity of rice (Hossain et al., 2005). High yield potential of aromatic rice Pusa Basmati-1 was reported by George et al. (2005) because of the large number of productive tillers, long panicle, and more number of grains per panicle.

**Total Grain per Panicle**

Range of total grain per panicle was from 154 (IPB 140-F-3) to 319 grains (IPB 117-F-17-4). Average numbers of total grain were more than 230 grains per panicle. It had more significant value than check varieties Ciherang and Sintanur, which had 174 and 169 grains, respectively. Haryanto et al. (2008) reported that in addition to the number of tillers, panicle length and 1,000 grain weight, the high number of grains total per panicle would also increase rice yield.

**Percentage of Filled Grain**

The percentage of filled grain ranged from 54.4% to 74.9%, while Ciherang and Sintanur had 69%. The shortest and the highest were B11742-RS*2-3-MR-34-1-2-1 and IPB 140-F-6, respectively. There were six other lines which had high percentage of filled grain, not significantly different from IPB 140-F-6, i.e. IPB 113-F-1 (72.5%), IPB 113-F-2 (71.8%), IPB 116-F-3-1 (72.1%), IPB 140-F-3 (73%), IPB 140-F-4 (71.9%), and IPB 140-F-5 (73.8%).

**Weight of 1,000 Grain**

Weight of 1,000 grain ranged from 26.1 g to 30.7 g. The highest weight was recorded in line IPB 117-F-14-2 (30.7 g) followed by IPB 140-F-6 (30.5 g) and IPB 117-F-17-5 (30.4 g). Most of the lines were not significantly different from those of Ciherang or Sintanur, with had value 27.9 g, except in line IPB 140-F-3 (26.1 g).

**Grain Yield**

Average of grain yield was 6.5 t/ha, while it ranged from 5.6 t/ha to 7.7 t/ha and all of the lines had not significantly different from Ciherang (6.7 t/ha) and Sintanur (7.7 t/ha). The highest grain yield (7.7 t/ha) was observed in IPB 117-F-17-5 while the lowest grain yield (5.6 t/ha) was observed in B11742-RS*2-3-MR-34-1-2-1. This result was higher than average grain yield in Bangladesh that yielded 3.5 t/ha (Hossain et al., 2005).

**Characters Correlation**

Correlations are measures of the intensity of association between characters. The selection for one character result in progress for all characters that are positively correlated (Steel and Torrie, 1960). One or more characters even correlated between each other. This could be an effective method for selection in breeding program in order to get some lines with expected character. Plant height was significantly positive correlated with panicle length, days to flowering, number of filled grain per panicle, percentage of filled grain, 1,000 grain weight, and grain yield; while it had negative correlated with number of productive tiller (Table 4). Khan et al. (2009a) reported that grain yield was

### Table 4. Simple phenotypic correlation between characters of NPT lines in four environmental conditions, 2009 DS/WS.

| Characters             | Plant height | Panicle length | Days to flowering | Days to maturity | Productive tiller | Filled grain per panicle | Number of total grain | Percentage of filled grain | 1,000 grain weight | Yield |
|------------------------|--------------|----------------|-------------------|------------------|-------------------|-------------------------|-----------------------|--------------------------|----------------------|-------|
| Plant height           | 0.5**        | 0.4**          | 0.3               | -0.5**           | 0.5**             | 0.3                     | 0.5**                 | 0.4*                     | 0.4*                 |       |
| Panicle length         | 0.2          | 0.2            | 0.2               | -0.7**           | 0.7**             | 0.6**                   | 0.1                   | 0.5**                    | 0.1                  |       |
| Days to flowering      | 0.8**        |                |                   | -0.3             | 0.3               | 0.2                     | 0.0                   | 0.2                      | 0.2                  |       |
| Days to maturity       | -0.3*        |                |                   |                  |                   |                         |                       |                          |                      |       |
| Number of productive tiller | -0.8** | 0.3            | 0.3               | -0.1             | -0.1              | 0.3                     | 0.1                   | 0.1                      |                      |       |
| Filled grain per panicle | 0.9**    |                |                   |                  |                   |                         |                       |                          |                      |       |
| Number of total grain  | -0.2         |                |                   |                  |                   |                         |                       |                          |                      |       |
| Percentage of filled grain | -0.2 |                |                   |                  |                   |                         |                       |                          |                      |       |
| 1,000 grain weight     | 0.3          |                |                   |                  |                   |                         |                       |                          |                      | 0.3   |

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not correlated positively with plant height among 25 rice genotypes collected from various national and international institutes in Pakistan.

Panicle length was significantly positive correlated with number of filled grain per panicle, number of total grain per panicle, and 1.000 grain weight. It negative correlated with number of productive tiller. Days to flowering were significantly positive correlated with days to maturity, while days to maturity were significantly positive correlated with 1.000 grain weight. It negative correlated with number of productive tiller.

Number of productive tiller was significantly negative correlated with number of filled grain per panicle, number of total grain per panicle, and 1.000 grain weight. It was also reported by Sarhadi et al. (2009) in Afghan native rice cultivar that number of productive tiller was not correlated with total grain per panicle, because varieties with the largest number of panicles per plant had the lowest number of grains per panicle. Number of filled grain per panicle was significantly positive correlated with number of total grain per panicle and 1.000 grain weight.

In this study, grain yield has positive correlation with all of the characters but not significant, except for plant height. In other case, panicles per plant, panicle length, and grain weight though had positively non significant correlation with yield (Ramakrishnan et al., 2006). Grain yield was positively associated and not significantly with days to maturity (Khan et al., 2009b). In the research of Sarawgi et al. (1997) grain yield per plant exhibited highly significant positive correlations with hundred grain weight. Surek and Beser (2003) reported that grain yield was significantly correlated with its component characters like the number of productive tillers per square meter and the number of filled grains per panicle.

CONCLUSION

Plant characters of promising varied and there were significantly different from Ciherang and Sintanur as check varieties except for grain yield. B11742-RS*2-3-MR-34-1-2-1 had the lowest plant height, grain yield, and the shortest growth duration. Most of the lines had character as new plant type variety. Grain yield had positively correlated with all characters, but only positive and significantly correlated with plant height.

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