ABSTRACT

ANGELITA PUJI LESTARI. Genotype Environment Interaction of Yield Components, Yield, and Aroma in Aromatic New Plant Type (NPT) Promising Rice Lines. Under supervision of HAJRIAL ASWIDINNOOR (Chairman), BUANG ABDULLAH, and AHMAD JUNAEDI (members of advisory committee).

Quality of rice grain is determined by physical appearance and chemical content of the grain. Generally, consumers prefer good quality rice grain. Therefore, rice breeding program will focus on not only quantity, but also on quality of rice grains. Good quality of rice grains in the market is identified by consumers from their aroma and taste. The objectives of this research were to evaluate the level of grain yield and aromatic character of rice grain of breeding lines, to study the stability of yielding ability aromatic character, and yield potential of NPT lines in response to different environmental condition. The study was conducted from July 2009 through April 2010, at two planting seasons (2009 DS and 2009/2010 WS), in two locations, Bogor (200 m ASL) and Pusakanagara (8 m ASL). The design used was Randomized Complete Block Design (RCBD), with three replications. The study tested 35 NPT aromatic lines and two varieties Ciherang and Sintanur as check varieties. The 21 day-old seedlings were planted one seed per hole, at a spacing of 20 cm x 20 cm. The size of experiment plots planted to NPT lines was 2 x 5 m² per line. Stability of all characters was analyzed using regression coefficient (bi), average value of yield and AMMI. Aroma was analyzed by using three methods, namely: leaf aroma with KOH, rice aroma test in the test tube, and cooked rice. Crops protection against pests and diseases were controlled optimally. Coefficient of genetic variation (CGV), heritability, and genetic advance were high for productive tillers, number of filled and total grain per panicle. There was a positive correlation between those characters and grain yields. There were lines yielded more than Ciherang, but mostly did not differ significantly, i.e. IPB 116-F 3-1, IPB 116-F 46-1, IPB 117-F 14-2, IPB 117-F 17-4 and MR-B11738-1-2-Si -1-2. Stability analysis of Finlay-Wilkinson and AMMI did not show the same results of lines stability. Four lines that were aromatic identified by different methods, were: IPB 140-F-6, B11249-9C-PN-3-3-2-2-MR-1, B11742-RS*2-3-MR-34-1-2-1, and B11955-MR-84-1-4. Lines which parents were introduced from the high altitude of South Sulawesi did not show consistent aroma when tested using different aroma testing methods. All lines tested had good grain quality.

Keywords: aromatic, grain quality, new plant type, rice, yield stability

Kata kunci: aromatik, mutu beras, padi tipe baru, stabilitas hasil
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There are two major programs to increase yielding ability and quality of rice grain and the stability of both characters through rice breeding. Resistances against biotic and abiotic stresses are prerequisite for rice variety having high yielding ability and good grain quality. The program to increase yield potential has been pursued by creating new plant type (NPT) and hybrid rice varieties. This research tested NPT rice lines that might have different productivity and grain quality. Aroma is one major indicator of good quality of rice grains. Consumer preference to aromatic rice is considered by traders in the rice market. 2 AP, 2-acetyl-1-pyrroline is a compound determining aroma of rice grain. Individual phenotype is affected by genotype (G), environment (E), and their interaction (G x E interaction). Stability analysis is important to characterize the appearance of varieties in different environmental condition.

The objectives of this research were to evaluate the level of rice grain aroma of NPT lines, to observe stability of the aromatic character under various environmental conditions (seasons and locations), and to investigate yielding ability of NPT lines in different environmental conditions. Research tested 35 aromatic NPT promising lines, with Ciherang and Sintanur as the check varieties, in two locations (Bogor and Pusakanagara) and in two season, 2009 dry and wet season (DS and WS). The lines were resulted from breeding program of Bogor Agricultural University and Indonesian Center for Rice Research. Agronomic characters, yield components and yields were data collected. Aroma was analyzed utilizing three methods, i.e. leaf aroma using KOH solution, rice aroma tested in the test tube, and rice aroma of cooked rice grains. Grain quality was tested at laboratory in the Muara experimental farm. Finlay-Wilkinson and AMMI (Additive Main Effects and Multiplicative Interaction) were used for stability analysis.

Results of combined analysis of variance of all characters showed that lines, the environment, and the interaction between lines and the environment were significantly different. In another words, the characters of individual lines reacted differently to the environmental conditions. There was no significant different of panicle length of each replication in a single environment.

Some early duration NPT lines started flowering 85 days after sowing (DAS), while medium duration of NPT lines was 116 – 127 DAS. Plant height in Bogor in 2009 WS was taller than the other environmental conditions but they were not significantly different in Pusakanagara in 2009 DS. Panicle length, on the average, was significantly longer in Pusakanagara in 2009 WS than the other compared with those in the other seasons.

Number of total grains was more than 200 grains per panicle. The highest total grain per panicle was observed in Bogor in 2009 DS with an average of 280 grains. There were no significant different of 1000 grains observed in Bogor in
Percentage of filled grain was relatively low.

The coefficient of genetic variability (CGV), heritability, and genetic advance were high for the number of productive tillers, number of grains per panicle, and grain total. There was significant positive correlation between grain yield and the three characters. Stability analysis of Finlay-Wilkinson of several lines showed the regression coefficient that was not significantly different from one, with yield above the general mean, i.e. IPB-116-F-3-1, IPB-117-F-4-1, IPB-117-F-14-2, IPB-117-F-15-2, IPB-117-F-17-5, IPB-140-F-1-1, IPB-140-F-2-1, IPB-140-F-3, and IPB-149-F-2, including Ciherang and Sintanur. Those lines were stable in different environmental conditions and widely adaptable. AMMI method showed lines adapted to specific location, namely: IPB-117-F-17-5, IPB-140-F-6, IPB-140-F-7 lines adapted to environment 1 (Bogor, 2009 DS); IPB-140-F-3 was specific to environment 2 (Pusakanagara, 2009 DS); lines specific to environment 3 (Bogor, 2009 WS) were IPB-113-F-1, IPB-117-F-6-1, IPB-117-F-1-3; IPB-116-F-46-1 and B11742-RS*2-3-MR-34-1-2-1 were specific to environment 4 (Pusakanagara, 2009 WS). Four aromatic lines identified by different methods, were: IPB-140-F-6, B11249-9C-PN-3-3-2-2-MR-1, B11742-RS*2-3-MR-34-1-2-1, and B11955-MR-84-1-4.

Percentage of milled rice grains was above 65%; range of head rice yields varied from 38% to 74%. Levels of amylose content were between medium to high. The highest amylose content owned by B11742-RS*2-3-MR-34-1-2-1 (26.3%) with cooked rice texture was hard. Gelatinization temperature of some lines were intermediate (70 – 74 °C) and some were relatively low (55 – 69 °C).

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