Development of Online Reference of Indonesian Rice Variety

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Abstract

Rice (Oryza sativa) is an important food crop of Indonesia. It was cultivated over an area of 11.786 thousand hectares with average paddy yield of 4.62 ton per hectare during the year 2006. With continuous increase in population, the demand of rice is also growing; confirming that task of increasing rice production to all related components.

Many factors contribute to the yields. Among others are seed quality and suitable varieties. The strategies for increasing yield are including supply of quality seed of varieties with high yield potential. Hundreds of improved varieties have been developed and introduced to the society. Those improved varieties usually are developed with specific purpose (criteria), such as certain pest resistance, certain taste (aromatic rice), certain grain shape, etc. However, due to ineffective information sharing and dissemination system, adoption of the improved varieties for specific location and preference is often become problematic.

This paper discussed about a work being carried out for developing an online reference system for rice cultivation with special emphasis on rice variety. The system consists of database of improved rice varieties and its characteristics, application program for identifying the recommended rice variety for certain location and preference, and application program for estimating harvest time and yield based on transplanting time input. Location indicates agro-ecological aspect of rice cultivation such as soil characteristics, altitude, rain intensity as well as irrigation method while preference is dealing with expectation of the system users on several rice characteristics. Heat units (degree-days) concept is used for estimating the harvest time and potential yield. The system is developed by using VB.Net. It is intended to be used by researchers, consultants, field extension officers, and or practitioners in exploring the available rice variety and rice variety selection for cultivation.

Keywords: Indonesia, rice variety, rice preference, variety selection, appropriate variety

Introduction

Rice (Oryza sativa) is an important food crop of Indonesia, because it is the staple food for nearly 90% of its population. With a population of about 210 million people in year 2000 and consumption rate of about 139 kg/capita/year, Indonesia was consuming about 26 million tons of rice a year. Assuming population growth rate of about 1.3% yearly, it is predicted that the rice demand will become 32.5 million tons in 2010 (Kominfo-Newsroom, 2007). On the other hand, with about 11.786 thousand hectares of paddy field and average paddy yield of 4.62 ton per hectare during the year 2006, the national production was about 54 million tons of paddy (or with 60% milling recovery it was about 32.4 million tons of rice). The recent trend indicates that rice production grows at a lower rate than the population that cause for concern in terms of...
food security. This is a reason why increasing rice production in Indonesia continuously becomes an important concern of all related components.

Land, soil characteristics, water, and climate are abiotic factors that influence rice production. Other factors that affect rice production include agronomic constraints such as pest and disease stresses, seed quality and suitable varieties. The strategies taken for increasing rice production are including increasing water availability and improving delivery systems, adoption of soil amelioration technologies, pest and disease control measures, introduction of mechanization, and supply of quality seed of varieties with high yield potential. Development of location specific varieties and technologies for crop management as well as technology transfer and adoption, coupled with manpower development are parts of the development agendas.

Related with rice variety, hundreds of improved varieties have been developed by research centers and introduced to the society within the last six decades (since 1940), but only about 10 – 20 varieties that are dominantly cultivated by farmers (SEMBIRING, in Suprihatno, et al, 2007). Beside for higher yield, the improved rice varieties were developed with specific purpose (criteria), such as for certain pest resistance, certain taste/palatability (aromatic rice), certain grain shape, as well as for better tolerance on submergence, drought, and low-temperature damage in high-elevation areas. With the available rice varieties in Indonesia, potential yields under well managed conditions ranged from 5.78 to 7.08 ton per hectare. However, there is still large yield gap between what is achievable against what have been achieved (Makarim, 1999).

Yield gaps in various regions are highly influenced by soil problems, socio-economic factors such as low technical capability of extension officers as well as poor management skills of farmers, rate of farmer’s response to new technologies and their adoption, and difficulties faced by many growers in procuring reliable inputs (Makarim, 1999). Most of the problems are considered to be the result of an ineffective transfer and information sharing/dissemination systems from universities and research centers as source of technologies to farmers/practitioners as well as extension officers.

This work is aimed to develop an online reference system for rice cultivation in Indonesia as parts of the knowledge transfer mode on rice production technology. For the first step special emphasis is placed on rice variety based on the fact that dissemination, adoption rate and selection of appropriate rice variety tend to become the most crucial problems in the field. The system is intended to be used by researchers, consultants, field extension officers, and or practitioners in exploring the available rice variety and rice variety selection for cultivation.

**System Structure and Description**

The system consists of database of improved rice varieties and its characteristics, application program for identifying the recommended rice variety for certain location and preference, and application program for estimating harvest time and yield based on transplanting time input. Figure 1 shows the system structure.

There are two main tables in the database, i.e. rice varieties data base and climate database. The rice varieties database organize the information of the improved rice varieties and its characteristic, including name of variety, maturity class, characteristics of disease and pest resistance, characteristics to environmental stress, husk color, grain shape, taste/palatability, plant height, lodging resistance, threshing characteristic, and potential yield. A simple query dialog is prepared to allow the user to search rice variety with specific criteria or to get information on characteristics of a certain rice variety.
The application program for identifying the recommended rice variety (Program A) will require several user’s inputs such as location, elevation, type of rice field (irrigated rice field, rainfed rice field, or upland rice field), soil fertility level, and the level of potential infestation of major pests and diseases in the respective area. Other inputs are related with user’s preference of plant as well as rice characteristics such as maturity class, threshing characteristic, yield, husk color, grain shape, and taste/palatability. User’s preference may be influenced by their (own) preference, or by the market demand as well as the potential selling price they would be able to gain after the harvest. The users also can provide a set of priority on their preference.

Based on user’s input, the system will assign score ranging from 0 to 1 to each characteristic of variety in the database. Score 1 is given when the characteristic is suitable for abiotic condition or match with user’s preference, and 0 when it has the opposite condition. Weights are given to the score of characteristics prioritized by the user. The database then is sorted based on total score of each variety. Five varieties with the highest total score will be the output of the program, means as the recommended varieties.

The application program for estimating harvest time and yield can be used by using input given in Program A and its respective recommendation, or specific input directly given to the program, especially location and rice variety. Other important input for this program is the planting date.

Based on data location input, the program will access the respective climate database, especially rain intensity, temperature, and day-length. Together with rice variety input, this data will be used to estimate harvest time and potential yield based on heat units (degree-days) concept (Robertson, 1973) as well as calculation of biomass accumulation. Degree days are a way of incorporating both temperature and time into one measurement to quantify the rate of plant or insect development. All plants and insects develop in response to temperature, but all of these species have a cutoff temperature below which no development occurs. This base temperature, or developmental threshold, differs depending on the species (Delahaut, 2002).

**Progress on Computer Programming**

The computer program is developed by using VB.Net programming language of Visual Studio 2005, while the databases are structured by using Microsoft Access. User interface is developed with menu system to ease the use of the program. Considering the targeted users are included farmers/practitioners and extension officers, all data and prompts are prepared in bahasa

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**Figure 1. Structure of the system**

- User Interface
  - Identifying Recommended Variety
  - Database Query
  - Estimation of Harvest Time and Yield
  - Rice Variety Database
  - Climate Database
Indonesia. Despite the program is intended to be web based application to enable access through internet (on-line), for the time being it is still work on PC basis and when necessary it is distributed on CD. Conversion to the appropriate format by using available tools should be carried out to make it accessible through internet. A total of 72 records of rice varieties have been inputted to the database and it will be continuously updated. Application program for estimating harvest time and yield also have not been ready yet due to work being in progress on standardizing the degree-day accumulation value for physiological as well as harvest maturity of specific varieties. Figures 2 and Figure 3 demonstrate the representative page screens of the program.

![Figure 2](image1.png)

**Figure 2.** Pages for user’s input; rice field characteristics and user preferences (left) and preference priority setting (right).

![Figure 3](image2.png)

**Figure 3.** Page compiling user’s input for checking (left) and recommended varieties output form (right)

**Discussion**

The program has been technically tested and worked well in various computer specifications. It has also been communicated with the representative targeted users for trial. A total of 6 researchers from research centers/experimental farms, 4 farmers/practitioners and 10 senior undergraduate students have been involved in program/system trial. In general positive feedbacks have been given by the respondents. Among others, 75% of the respondents were satisfied with system performance. The respondents from researchers group prompted that the recommended varieties resulted from users inputs are considered to be accurate and have high
information value. This means that problems on dissemination of variety improvement results may be alleviated by the system. Most of the respondents also suggested some additional functions to the system such as recommendation system for fertilizing, information pages on certain seed (variety) growers/suppliers. Addition of more records on database and publication of the system on web are very much expected.

References


