Chapter 1

Introduction

1.1 Background

Rice provides the staple food for almost half of the world's population, about 2/3 of calorie intake for more than 3 billion people in Asia and 1/3 of the calorie intake of nearly 1.5 billion people in Africa and Latin America (FAO, 1995). Rice is by for the most important food crop in Asia which contains over 50% of the world's still-expanding population with a global population increasing at a rate of 76 million per annum. Thus, it is through increased rice production that a large segment of mankind will continue to be nourished.

By 2030, the world must produce 70% more rice than it produced in 1995 to meet demand created by increasing populations and incomes (Rothschild, 1998). FAO (1995) reported that about 147.5 million hectares of rice were harvested in 107 countries, producing about 527.4 million tons of paddy in 1993, which were 1.17 times of the amount of paddy produced in 1983. This increase in paddy production was the bare minimum to satisfy the demand for rice of the growing world population. This can be achieved only by mounting accelerated production programs in those major rice - growing countries in which yields are now below 4 metric tons per hectare. This production increase must be achieved on less land, with less labor, less water and less pesticide and it must be sustainable (Chandler Jr., 1979).

Although Thailand is one of the biggest rice exporters in the world, the grain yield is still lower than the others. The average grain yield per unit area is about 380 kg per rai or 2.2 tons per hectare (Center for Agricultural Information, 1999). There

are limiting factors which are not only physical factors such as erratic rainfall pattern, irrigated areas and soil fertility, etc, but also biological factors, pests and rice varieties. To increase production and productivity in the irrigation ecosystem, new efforts are needed. Paroda (1998) proposed that some genetic approaches involve 1) a new plant type based on physiological and genetic manipulation, 2) new biological tools to increase potential yields, and 3) yield heterosis in hybrid rice. Especially, rice varieties with higher yield potential and better management practices are needed for increasing rice production (Khush, 1996). Increasing the yield potential of rice varieties is considered an important strategy for this challenge. Thus, using hybrid variety is one of possible tools to increase grain yield throughout the hybrid vigor.

Hybrid rice is approached for utilization of heterosis or hybrid vigor. So hybrid rice means rice crop grown from F1 seeds of a cross between two genetically-dissimilar parents (Virmani *et al.*, 1997). These approaches are concerned in three types that are utilization of intercultivar heterosis, utilization of intersubspecific heterosis and utilization of distant heterosis (Li and Yuan, 2000). Van der Have (1979) described the advantages of hybrid varieties:

1. Yields are high as a result of hybrid vigor.
2. Desirable dominant characters are readily combined.
3. Crop development and the harvested product are both uniform, owing to homogeneity.
4. The breeder is protected against fraudulent use of breeding products (of importance especially in countries without breeder rights).

However, hybrids also have a number of disadvantages as follow:

1. Extensive use of a single cytoplasmic source in cross-pollinated species may result in increased vulnerability to epidemic diseases and pests.
2. Hybrid seed is comparatively expensive.
3. Farmers are forced to buy a new sowing material each season.

More than 50% of the total rice areas in China are planted to hybrid rice, and many countries outside China are developing and exploiting hybrid technology (Virmani *et al.,* 1997). There are many aspects of hybrid rice that must be studied in terms of male sterility, fertility restoration, heterosis, combining ability and yield trial that will lead to raise yield potential of hybrid varieties.

1.2 Objectives

The study on the utilization of male sterility in hybrid rice production has the following objectives:

- To find out the restorer lines for hybrid rice production.
- To evaluate heterosis and combining ability of F1 hybrid and their parents.
- To evaluate yield ability and agronomic characters of F1 hybrids.