CHAPTER V
CONCLUSION

The diversity of rice (*Oryza sativa* L.) offers the useful genetic resources for functional genomic analysis. Rice is a model plant of monocots; therefore, knowledge of its gene functions could be widely applied to the other cereals. The expression system that spatially and temporally regulates the transcription of target genes plays a crucial role in functional genomic analysis. An ethanol-inducible system derived from *Aspergillus nidulans* is suitable for this purpose. However, this system requires two transcription units to drive gene expression. The ethanol responses of normal plants suggest that this system may be present in plants. Thus, the use of a single transformation unit containing an ethanol-inducible promoter derived from plants leading to regulation of a target gene expression is of interest. To attain this goal, ethanol-inducible genes in young panicles from ethanol-treated rice plants of the Pathumthani 1 cultivar were identified in this study. The effects of ethanol on the growth of rice plants at the seedling, reproductive, and ripening stage were determined. The results showed that 1% ethanol was non-toxic to the plants. Using cDNA-AFLP, thirty-four transcript-derived fragments (TDFs) from panicles showed differential responses to ethanol application. The ethanol-inducible TDFs corresponded to genes involving different pathways including metabolisms, biosynthesis, signal transduction, transcriptional regulation, stress response, membrane transport, and cell cycle. Using semi-quantitative RT-PCR, five TDFs, which were homologous to *Os07g0240300*, *Os02g0175700*, *Os05g0392100*, *Os03g0569000*, *Os07g0627300* and *adh2*, were up-regulated. Among them, *Os07g0627300* encoding for a Myb-related protein is highly conserved during evolution and generally

expressed in several rice tissues. Therefore, it could possibly be used to control gene expression in different tissues and in a wide range of organisms. The 5' upstream region (UTR) of *Os07g0627300* from Pathumthani 1, an *Indica* cultivar, was isolated and analyzed for *cis*-acting regulatory elements. The results indicated that the 5' UTR was a TATA-less promoter containing a number of motifs involved in stress responses.

Rice is a sustainable resource. Both edible and inedible parts of the rice plants including seedlings, grains, brans, seed husks, and straw have been used as major components in various industries. The extracts from different parts of rice possess various phytochemicals and exhibit antioxidant and/or biological activities. The differences in the chemical compositions and antioxidant activity among different rice cultivars indicate that the diversity of rice could provide potent resources for the development of new value-added products. Therefore, this study was conducted to provide the useful information on the antioxidant activity, the total phenolic content, and the total monomeric anthocyanins of rice grass juices from various Thai rice cultivars for developing functional foods or functional food ingredients. Seven cultivars from both colored and white rice were selected for this study. The antioxidant activity of juices squeezed from rice grass harvested at the jointing stage was analyzed in parallel with wheatgrass juice using four different antioxidant assays including DPPH, FRAP, BCB, and TBARS assays. The total phenolic and total monomeric anthocyanin contents were also determined. Colored rice grass juices containing anthocyanins demonstrated more effective antioxidant activity than green juices from white rice and wheat. The colored rice cultivar Kum Doisaket significantly exhibited the highest antioxidant activity in all assays. A relationship

between the antioxidant activity, total phenolic content, and total monomeric anthocyanins of rice grass and wheatgrass juices was analyzed using Pearson correlation analysis. The results indicated that the total phenolic and the total monomeric anthocyanin contents were responsible for the antioxidant activity. Grass juices from wheat and two colored rice cultivars Kum Doisaket and Kum Noi, which exhibited high antioxidant activity, were selected and subjected to DNA nicking assays to evaluate DNA protective properties. Only the Kum Doisaket cultivar, which contained the highest level of total monomeric anthocyanins, demonstrated a dose-dependent DNA protective effect. This result suggested that the anthocyanins in colored rice grass juice may be responsible for the DNA protective effects. The notable antioxidant efficacy for the Kum Doisaket cultivar may be influenced by the high level of anthocyanins present in its grass juice.

This study offers an alternative way to control the expression of genes of interest in plants. The rice ethanol-inducible promoter could be used as a useful tool for functional genomic analysis and the production of transgenic crop plants with designed traits. The obtained results of antioxidant activity of juices squeezed from Thai rice grasses also suggest the possibility of developing functional foods and food supplements from colored rice grasses. Furthermore, using the ethanol-inducible promoter from rice along with the information of Thai rice cultivars that exhibit high antioxidant activity would be helpful in crop improvement programs.