Abstract

The estimation of grain yield increase rate due to cultivar releases is one of the approaches to determine the presence of a yield plateau or the success of a breeding program. The objective of this study was to determine the yield increase rate due to the release of semi-dwarf cultivars by the Rice Experiment Station (RES) from the 1970s to the 2000s. Twenty-five semi-dwarf cultivars released by RES were planted in yield trials in 2012 and 2014. The yield increase rates due to cultivar releases were estimated to be 60 and 38 kg/ha/year based on the 2012 and 2014 yield trials, respectively, for a mean for 49 kg/ha/year.

Introduction

Rice productivity per unit area has been increasing over the years. This has been attributed to better management practices, such as for soil fertility, water, insect pests, diseases, and weeds, and also to improved rice cultivars. Rice grain yields in California are the highest in the United States and these have increased from 5,250 kg/ha in 1960 to 9,350 kg/ha in 2011 (Fig. 1) (USDA-ERS, 2012).

The primary mission of the California Cooperative Rice Research Foundation, Inc. (CCRRF). Rice Experiment Station (RES) is to develop improved rice cultivars for all grain and market types to sustain high and stable grain yield and quality with minimum environmental impact for the benefit of California rice growers. Yield gains in commercial medium grain rice production in California was estimated to be 42 kg/ha/yr for the 1981 to 2011 period and 74 kg/ha/yr for the 1996 to 2011 period (McKenzie et al., 2014).

In 2012 and 2014, 25 RES-released cultivars were grown in yield trials. These included L-206, M-205, M-206, and S-102, which produced averaged grain yields of 11,510, 12,560, 11,420 and 10,570 kg/ha, respectively, in the 2012 Statewide Yield Trials at RES (CCRRF, 2012). Plots of these trials served as sampling units for the comparison of rice cultivars released by RES for California. This study enabled the determination of changes in grain yield and yield- and quality-related traits due to the release of cultivars. This poster focused on the estimation of grain yield increase rates from semi-dwarf cultivars, released by RES from the 1970s to the 2000s, in yield trials conducted in 2012 and 2014.

Purpose

The objective of this study was to determine the grain yield increase rate due to semi-dwarf cultivars released by the Rice Experiment Station from the 1970s to the 2000s.

Methods and Approaches Used

Twenty-five semi-dwarf cultivars released by RES (Table 1), which were composed of conventional long, medium, and short grain types, were planted in replicated yield trials at RES in 2012 and 2014. Several traits were measured from each cultivar, namely, tiller density, days to heading, panicle length and weight, flag leaf length and width, numbers of filled and unfilled grains per panicle, plant height, and grain yield, which is focus of this poster. Regression analyses were used to determine the significance of the linear relationship between grain yield and year of cultivar release, and also to estimate grain yield increase rate.

Results and Discussion

Year and cultivar had significant effects on grain yield, while year × cultivar interaction did not. Mean grain yield was significantly higher in 2014 (11,270 kg/ha) than 2012 (10,390 kg/ha). Cultivar grain yields ranged from 9,060 kg/ha (Calrose-76) to 12,030 kg/ha (M-206) in 2012, and from 9,700 kg/ha (M7) to 12,590 kg/ha (M-205) in 2014. The release of cultivars have increased grain yields (Fig. 2). There were significant linear relationships between grain yield and year of cultivar release in both the 2012 and 2014 yield trials. Grain yield increase rates due to cultivar releases were estimated to be 60 and 38 kg/ha/year based on the 2012 and 2014 yield trials, respectively, for a mean for 49 kg/ha/year.

Conclusion

Results from this study will not only be useful in analyzing past and current cultivars and trends, but will also be useful in planning and breeding for the future.

The rice grain yield increase rates attributed to cultivar releases by RES were estimated to be 60 and 38 kg/ha/year based on the 2012 and 2014 yield trials, respectively, for a mean for 49 kg/ha/year. The positive increase rates demonstrate the breeding success of the Rice Experiment Station in improving grain yield of semi-dwarf cultivars, and also indicates that grain yields have not plateaued in its breeding program.

References
