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Historical Changes in Grain Yield and Photosynthetic Rate of Rice Cultivars Released in the 20th Century in Tohoku Region

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Abstract: A retrospective analysis of the physiological basis of genetic yield improvement should provide us a direction for future yield improvement. The objectives of the present study were to evaluate the change in yield in leading rice cultivars that were bred and grown in the Tohoku region in the 20th century, and to find whether apparent photosynthetic rate (AP) is associated with the yield improvement. Ten leading rice cultivars were grown at low- and high-nitrogen conditions, Low-N and High-N, respectively, and three environmental conditions (two years in Sendai and one year in Kashimadai). Yields were higher under High-N than under Low-N in all the cultivars tested, and yield increase was greater in the newly bred cultivars released after 1960s (new cultivars) than in those released before 1960 (old cultivars). The genotypic improvement in yield under High-N was progressive year by year in the old cultivars whereas it was stagnated in the new cultivars. The cultivar difference in AP of the flag leaf one week after heading was small, but that three weeks after heading was larger in new cultivars than in old cultivars except for a few cultivars. A dependence of AP on leaf nitrogen concentration three weeks after heading was evident in the plants grown under High-N. The number of spikelets increased under High-N in all ten cultivars, where the percentage of ripened grains was lower in the old cultivars than in the new cultivars. These results suggest that yield improvement of rice cultivars in the 20th century in the Tohoku region has been accompanied by a greater AP during the ripening stage that might lead to a greater grain filling percentage.

Keywords: [Grain filling](#), [Nitrogen application](#), [Oryza sativa L.](#), [Photosynthesis](#), [Rice](#),

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