



Photosynthesis enhanced oxidative stress tolerance in high-yield rice varieties (*Oryza sativa* var. *japonica* L.) in the field

X.D. Wei*, L. Jin* and X. Li

Institute of Food Crops, Jiangsu Academy of Agricultural Sciences,
Jiangsu High-Quality Rice R&D Center, Nanjing Branch,
China National Center for Rice Improvement, Nanjing, China

*These authors contributed equally to this study.

Corresponding author: X. Li

E-mail: weiyinling@163.com

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ABSTRACT. The objective of this study was to understand varietal differences in photosynthetic characteristics, chlorophyll fluorescence, antioxidant capability, and yield of *japonica* rice varieties. Nanjing 44, *Oryza sativa* var. *japonica* (average yield of 12.7 t/ha), Nanjing 46, and Nanjing 5055 (average yields of 11.3 and 11.5 t/ha) were included as “super” and high-yield varieties, respectively, whereas Wuyunjing 7 (average yield of 10.2 t/ha) was included as a control variety. These varieties were grown under field conditions in Jiangsu Province, China, in 2010-2012. Different organs (panicle, grain, etc.) were measured, before and after flowering, to identify differences of dry matter accumulation and transformation properties. Photosynthesis, the chlorophyll content, and antioxidant enzyme activities of the flag leaf in the days after flowering (DAF) were also investigated. The results

showed that, compared with the other three rice varieties, Nanjing 44 had the highest plant dry weight and number of grains per panicle. It also had a relatively high net flag leaf photosynthetic rate and showed the least inhibition of photosynthesis at noon in DAF, which probably explains the higher yield in this variety. Furthermore, Nanjing 44 also had the highest stem export and conversion rate from stem to grain, exhibiting a strong ability to convert and distribute photosynthetic products. After DAF 42, Nanjing 44 still maintained a high-soluble protein content and a high antioxidant ability in the leaves to clear peroxidation products, which could protect the photosynthetic apparatus of the flag leaves, and maintain the grain-filling activity for longer. The high-yield capability of Nanjing 44 was attributed to its photosynthetic advantages in the leaves during the late developmental stage.

Key words: Rice (*Oryza sativa* var. *japonica* L.); Photooxidation; Net photosynthetic rate; Yield component; Antioxidant enzyme