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Effect of Nitrogen Application Rate and Timing on Grain Yield and Protein Content of the Bread Wheat Cultivar 'Minaminokaori' in Southwestern Japan

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Abstract: The effect of nitrogen (N) application rates at active tillering and anthesis on grain yield and protein content of a bread wheat cultivar, 'Minaminokaori', was examined in the field study conducted in Fukuoka, Japan. Number of spikes, leaf area index (LAI), and SPAD value at anthesis increased significantly (P<0.05) with increasing N application rate at active tillering. Grain yield also increased significantly (P<0.05) because of the increased number of spikes. However, grain yield did not increase significantly (P>0.05) with increasing N application rate at anthesis. The slope of the relationship between N application rate at active tillering and grain yield was about 3 times that of the relationship between N application rate at anthesis and grain yield. These results indicate that N application at active tillering is more effective than N application at anthesis for increasing grain yield. Increasing N application rate at active tillering and anthesis generally increased grain protein content. However, the slope of the relationship between N application rate at anthesis and grain protein content was about 2 times that of the relationship between N application rate at active tillering and grain protein content. These results indicate that N application at anthesis is more effective than N application at active tillering for increasing grain protein content. The interaction between N application rates at active tillering and anthesis was significant (P<0.05) for grain protein content. With the application of 4 g N m^{-2} at active tillering, grain protein content increased linearly at a rate of about 0.5% per 1 g N m^{-2} (from 10.9% to 14.0%) with increasing N application rate (from 0 to 6 g N m^{-2}) at anthesis. However, the rate of increase in grain protein content with increasing N application

rate at anthesis was greater with 0 g N m^{-2} at active tillering than that with 4 g N m^{-2} at active tillering, whereas that with 8 g N m^{-2} at active tillering was smaller than that with 4 g N m^{-2} at active tillering. Application of 8 g N m^{-2} at tillering resulted in the highest SPAD value at anthesis; this was followed by the results for 4 and 0 g N m^{-2}. Therefore, the SPAD value may be an important trait to decide N application rate at anthesis.

Keywords: Active tillering, Anthesis, Bread wheat, Grain protein content, Grain yield, 'Minaminokaori', *Triticum aestivum* L., Wheat

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