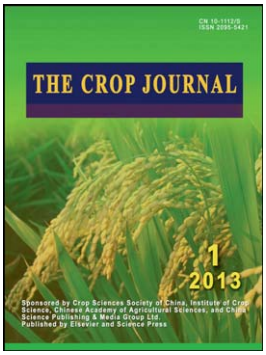

Genome-wide association mapping of vitamins B1 and B2 in common wheat

Jieyun Li, Jindong Liu, Wei'e Wen, Pingzhi Zhang, Yingxiu Wan, Xianchun Xia, Yan Zhang, Zhonghu He

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Genome-wide association mapping of vitamins B1 and B2 in common wheat

Jieyun Li[a], Jindong Liu[a], Wei'e Wen[a], Pingzhi Zhang[c], Yingxiu Wan[c], Xianchun Xia[a], Yan Zhang[a,*], Zhonghu He[a,b,*]

[a] Institute of Crop Science, National Wheat Improvement Center, Chinese Academy of Agricultural Sciences, Beijing 100081, China

[b] International Maize and Wheat Improvement Center (CIMMYT) China Office, c/o CAAS, Beijing 100081, China

[c] Crop Research Institute, Anhui Academy of Agricultural Sciences, Hefei 230001, Anhui, China

Abstract: Vitamin B is essential for maintaining normal life activities in humans and animals who have to intake the microelement from the outside, especially from cereal products. In the present study 166 Chinese and foreign wheat cultivars planted in two environments were characterized for variation in vitamin B1 and B2 contents. A genome-wide association study (GWAS) using the wheat 90K SNP assay identified 17 loci for vitamin B1 and 7 for vitamin B2 contents. Linear regression analysis showed a significantly positive correlation of the number of favorable alleles with vitamin B1 and B2 contents. Marker-trait associations (MTAs) at *IWB43809* (6AS, 0 cM) and *IWB69903* (6AS, 13 cM) were new and stable, and significantly associated with vitamin B1 content across two environments. The loci identified in this study and associated SNP markers could be used for improvement of vitamin B1 and B2 contents to obtain superior quality along with grain yield in wheat.

Keywords: 90K SNP assay; GWAS; Vitamin B1; Vitamin B2; *Triticum aestivum*

1. Introduction

Vitamin B, one of the important microelements, is essential for maintaining normal life activities in human and animals. The vitamin B complex comprises eight water-soluble components, viz. thiamin (vitamin B1), riboflavin (vitamin B2), pantothenic acid (vitamin B3), nicotinic acid (vitamin B5), pyridoxine (vitamin B6), biotin (vitamin B7), folic acid (vitamin B9), and cobalamine (vitamin B12) that play important roles in the metabolism of carbohydrates, proteins and fats. Thiamin deficiency is associated with neurological problems, including Alzheimer's disease, cognitive deficit and encephalopathy [1–2]. Riboflavin deficiency destroys mucosal membranes in the digestive system and can lead to cardiovascular disease and colorectal cancer [3–4]. Instead of biosynthesizing these vitamins within their own bodies, humans and animals must obtain them from external sources in order to remain healthy.

Vitamins B1 and B2 often occur together in the same foods and were initially regarded as a single component. In cereals, the most important staple food sources, the complex vitamin B complex is concentrated in the bran and germ, with 32% to 64% of the vitamin B1 and 26% to 37% of the vitamin B2 being present in the aleurone layer and embryo, respectively [5–6]. A number of studies of vitamin B1 and B2 contents in wheat have been reported. For example, Davis et al. [7] evaluated 231 cultivars grown at 49 locations over three years and determined variation in vitamins B1 and B2 levels ranging from 3.3 to 6.5 μg g^{-1} and 1.0 to 1.7 μg g^{-1}, respectively. Batifoulier et al. [8] determined the variation in vitamin B1 (2.6–6.1 μg g^{-1}) and vitamin B2 (0.5–1.1 μg g^{-1}) contents in 49 wheat cultivars. Shewry et al. [9] showed that there were large and significant variations in B1 and

*Corresponding authors: Yan Zhang, E-mail address: zhangyan82108741@163.com; Zhonghu He, E-mail address: zhhecaas@163.com.

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