Changes of Anthocyanin pigment Cyanidin-3-glucoside, Oryzanol Content and Antioxidant Activity as Affected by Ripening Temperature in Rice Varieties

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Abstract

This study was carried out to investigate the effect of ripening temperature on anthocyanin Cyanidin-3-glucoside(C3G), oryzanol content, and antioxidant activity in pigmented rice varieties. Two pigmented rice varieties, Heugjijubyeo and Heugnambyeo and brown rice variety, Ilpumbyeo were grown in Wagner pots under field condition and treated with temperatures of 17, 21, 24 and 27? during the ripening stage in a phytotron. The brown rice yield of 3 rice varieties were significantly higher at ripening temperatures of 21~24?. C3G content and C3G production per pot were significantly higher at 24? in Heugjijubyeo and Heugnambyeo. Oryzanol content and antioxidant activity by DPPH were also significantly higher at 21~24? in the 3 varieties.

Media summary

The content and production of anthocyanin C3G, oryzanol, and antioxidant activity in pigmented rice was influenced by ripening temperature and was significantly higher at 21~24?.

Key words

anthocyanin, cyanidin-3-glucoside, C3G, oryzanol, antioxidant activity, pigmented rice, ripening temperature.

Introduction

In the blackish purple pigmented rice varieties, high amounts of anthocyanin were contained (Choi & Oh, 1996) and these pigments were reported to show a higher functions such as a antioxidant activity (Nam et al, 2002: Ryu et al, 2000: Jung et al, 2000) and anticancer effects(Nam & Kang, 1997: Nam & Kang, 1998). The contents of the functional components of pigmented rice were different according to the cultivation conditions and their total production per unit area depended on the brown rice yield(Jung et al, 2003). Researchers have reported that the contents of the functional components of pigmented rice were significantly increased according to the level of N-fertilizer, and normal planting conditions showed significantly higher effects than early or late plantings and the contents were different according to the planting region(Jung et al, 2003). In order to investigate whether temperature affected the different contents of functional components depending on planting season and region, we researched antioxidant contents variation according to the ripening temperature.

Materials and Methods

Tested varieties: Heugjijubyeo, Heugnambyeo, Ilpumbyeo

Ripening temperature (day/night): 18? (21/15?), 21? (24/18?), 24? (27/21?), 27? (30/24?)

Plot design: Completely randomized design with five replications in 1/5000a wagner pots.

Analysis method:
Extract solvent : 0.1% TFA-95% EtOH, 95% EtOH
Analysis device :

HPLC : Waters 501 Pump, Millipore gradient controller, Waters 480 UV-Vis spectropotometer
Column : ODS-5(4.6 ? 250, Nomura Chemical Co. Ltd., Japan)
Detector: 530nm

Results

Brown rice yield of tested varieties

The yield of brown rice at the different temperature treatments during the ripening stage are shown in Figure 1. The three varieties, Heugjinjubyeo, Heugnambyeo, Ilpumbyeo, showed a significantly higher yield of brown rice at 21? and 24?, but significantly lower at 18? and 27?. Heugnambyeo and Ilpumbyeo did not ripen normally at 18?.

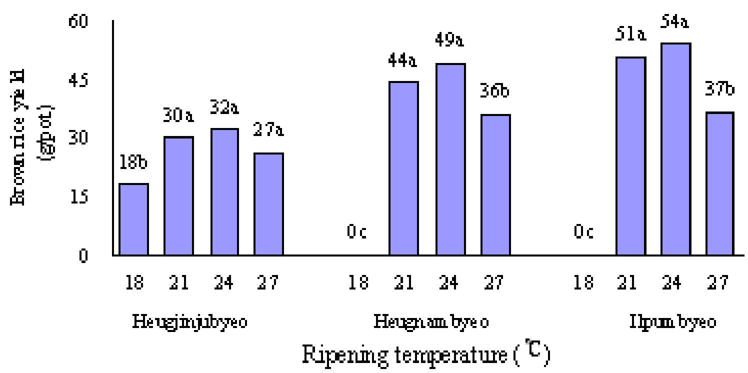


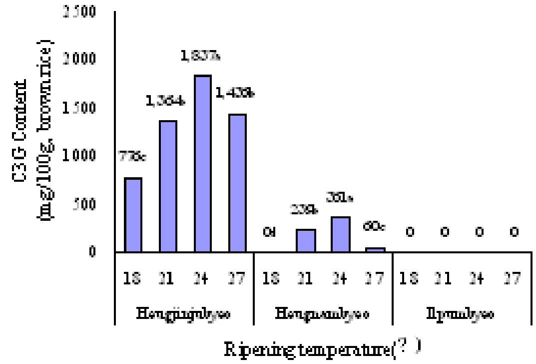
Figure 1. Effect of ripening temperature on yield of rice varieties.

C3G content and production by ripening temperature

Figure 2 shows the variation in the anthocyanin pigment(C3G) contents at the different ripening temperature treatments. The C3G contents of Heugjinjubyeo and Heugnambyeo were significantly higher at 24? than at 21? and 27?. The C3G content at 18? were significantly lower. The C3G contents of Heugjinjubyeo which was 1,837mg/100g brown rice at 24? was higher than that of Heugnambyeo (361mg/100g brown rice). Ilpumbyeo, a white colored normal cultivar, did not have the C3G pigment. The C3G production which was C3G content multiplied by the brown rice yield are showed in Fig. 3. The production of C3G at different ripening temperatures showed a similar trend to the C3G contents. At 24? , the production of C3G Heugjinjubyeo and Heugnambyeo was 591mg/pot and 177mg/pot respectively.

Oryzanol content and production by ripening temperature

Figure 4 and Figure 5 show the effect of the different ripening temperature treatments on the Oryzanol content and production. The Oryzanol contents of the three tested cultivars were somewhat different according to the ripening temperature treatments. Considering the brown rice yield and contents, the production of the Oryzanol was highest at 21? and 24?. The production of the Oryzanol of Heugjinjubyeo, Heugnambyeo and Ilpumbyeo were 6.7~6.8 mg/pot, 11.8~13.4 mg/pot and 14.3~15.3 mg/pot , respectively.



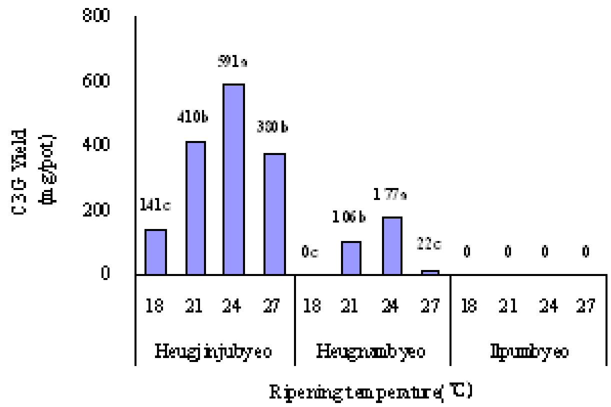
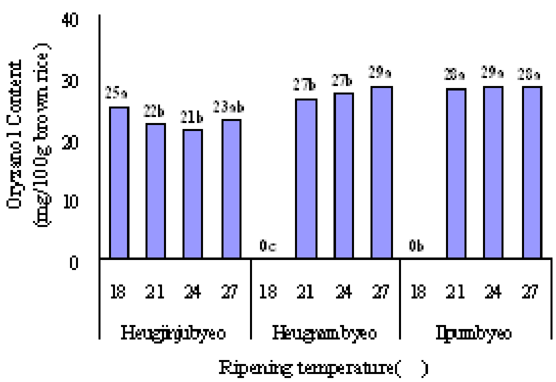


Figure 2. Anthocyanin pigment cyanidin-3-glucoside content as affected by? ripening temperature in rice varieties.

Figure 3. Anthocyanin pigment cyanidin-3-glucoside yield as affected by ripening temperature in rice varieties.



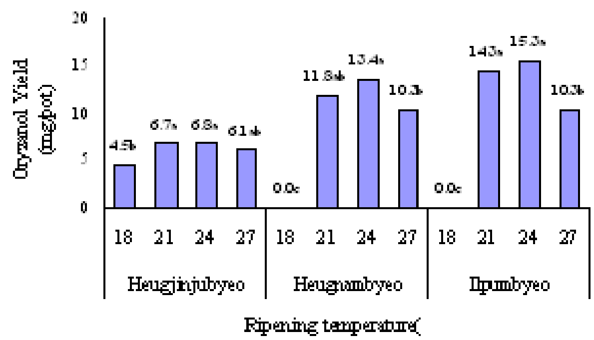


Figure 4. Oryzanol content as affected by ripening temperature in rice varieties.

Figure 5. Oryzanol yield as affected by ripening temperature in rice varieties.

Antioxidative activity by ripening temperature

The variation of the antioxidative activity of the extract of the three tested cultivars varied according to the different ripening temperature treatments. This is shown in Figure 6. The DPPH scavenging effect on the extract of each cultivar treated at 21? and 24? were significantly higher. As a result, production of the antioxidants seems to be higher when ripened at 21~24?.

Therefore, it was thought that the pigmented rice varieties should be cultivated at 21? to 24? to increase the production of high antioxidative activity compounds.

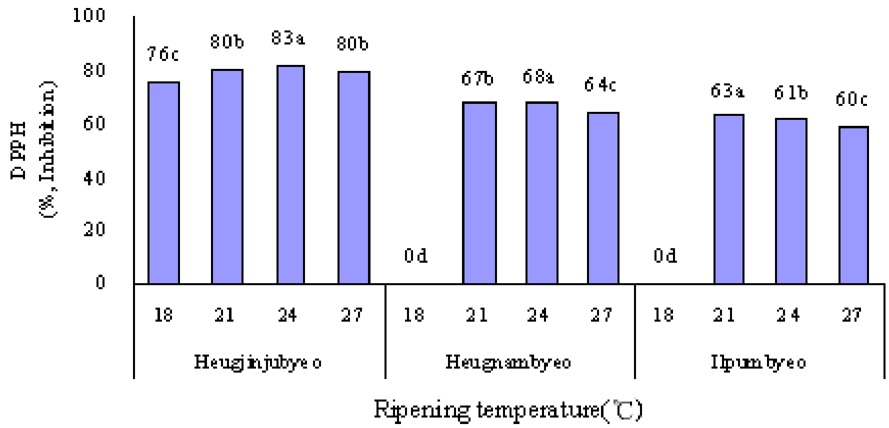


Figure 6. Effect of ripening temperature on antioxidant activity by DPPH free radical in?rice varieties.

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