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Gibberellin A_4 Modify Fine Structure of Amylopectin with Altered α-Polyglucans and Endogenous Plant Hormones in Rice Endosperm

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지베렐린에 의한 벼 전분 미세구조의 알파-폴리글루칸 패턴과 식물 호르몬의 변화

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Objectives

Little is known about the possible physiological roles of plant hormones, especially gibberellin A_4 (GA_4) in relation to fine structure of rice starch. To confirm the possible change of fine structure of starch applied with GA_4, patterns of X-ray diffraction, capillary electrophoresis were investigated.

Materials and Methods

- ○ Plant material : A japonica rice cv. Goamibyeo
- ○ Application of plant hormone : 200 ppm GA_4 was foliar-sprayed to whole plants at the 7-d post anthesis for 3-d.
- ○ Sampling : 20-d post anthesis (DPA) for ABA and GA, 56-DPA for starch pattern
- ○ Analysis : Starch structure (X-ray diffraction), branch chain length distribution of α-polyglucans (Capillary electrophoresis), ABA and GAs (GC-MS)

Results

- ○ Polyglucans in the control and GA4-treated rice all showed A-type x-ray diffraction patterns, although the degree of 2 Theta in the GA_4-treated rices was different at 3.5 to 3.8 ranges.
- ○ Endogenous ABA contents levels decreased about 4.5 times by exogenous GA_4 in comparison to the control. Endogenous GA_4 content in GA_4-treated rices was much more increased than the control, otherwise endogenous GA1 was comparatively high in the control.
- ○ Exogenously applied GA_4 induced the change of chain length distribution in amylopectin of rice endosperm. When gibberellin was applied during rice grain filling, the proportion of short amylopectin chains of DP≤9 increased and that of short and intermediate chains of DP=10-30 decreased.

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Table 1. Effect of exogenously applying gibberellin A_4 on X-ray diffraction pattern, endogenous ABA and gibberellin in rice endosperm.

Treatment	XRD pattern (2θ)	ABA (ng/g DW)	Gibberellin (ng/g DW)	
			A_1	A_4
Control	A-type (3.84)	23.18±1.08[3]	4.29±0.43[3]	1.55±0.09[3]
GA_4 200 ppm	A-type (3.51)	4.92±0.87[4]	2.51±0.31[3]	12.47±1.15[3]

Values are means±SE of measurements made on a number of replications (shown in brackets)
Plant hormones were checked at 30 days after post anthesis.

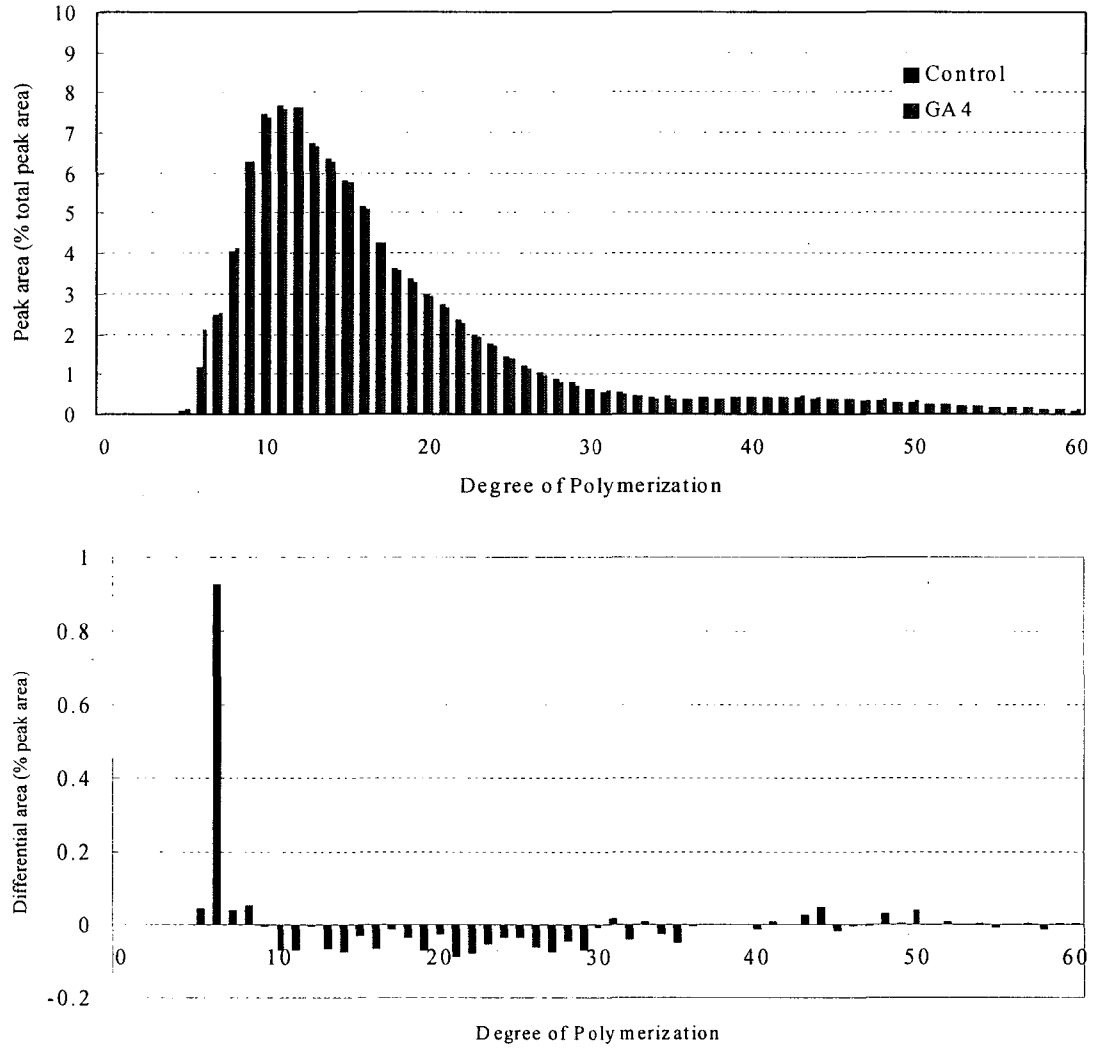

Fig. 1. Effects of GA_4 on chain length distribution of α-polyglucans in rice endosperm of Goamibyeo. (A) Chain length distribution of total α-polyglucans in control and GA_4-treated rice endosperm. (B) Differences in chain length distribution of total α -polyglucans in the control and GA_4-treated rice endosperm.