

**Synergistic Effects between Low Dose Gamma Radiation and Phytohormone  
in Rice (*Oryza sativa* L.)**

**I. Effects on Seed Germination and Seedling Growth**

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벼에서의 저선량 방사선과 식물호르몬간의 상승작용 효과

**I. 발아와 유묘생장에 미치는 영향**

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**Objectives**

Ionizing radiation at low dose frequently has a stimulating effect on the growth of organisms. Irradiation of seed before planting can stimulate early plant growth, leading to advanced maturity and increased yield. Also, gibberellic acid(GA<sub>3</sub>), indole-3-butyric acid(IBA) and benzyladenin(BA) are known to affect growth. Thus, the aim of this study was to investigate synergistic effects between low dose gamma radiation and phytohormones with very low concentration on seed germination and seedling growth.

**Materials and Methods**

- o Rice (*Oryza sativa* L., cv. Seorak-byeo) seeds were irradiated with various doses from 0 to 8 Gy by an irradiator (<sup>60</sup>Co, ca.150 TBq of capacity, AECL). Seeds harvested in 1999 and stored at room temperature by June 4, 2003 were used.
- o After irradiation, seeds were sterilized with 3% sodium hypochlorite for 15 min and washed thoroughly with distilled water. Then, petri-dishes (9 cm) containing two sheets of Whatman No.2 filter paper moistened with 10 ml of distilled water (control) and test solutions. Test solutions contained GA<sub>3</sub>, IBA and BA with various concentration from 0 to 0.01 ppm. Each petri-dish contained 20 seeds with 5 replications. All samples were germinated in 30°C incubator.
- o Germination rate was determined from 2 days after sowing (DAS) to 6 DAS. Seedling growth was determined at 6 DAS.

**Results and Discussion**

- o Synergistic effect between low dose gamma radiation and low concentration of phytohormones (0.0001 and 0.001 ppm) was shown at two days after sowing, although it was not noticeable. The seedling growth differently responded to low dose gamma radiation and phytohormones.
- o These results suggest that the synergistic effect on seed germination and seedling growth could be differently induced by low dose gamma radiation and phytohormones.

Table 1. Synergistic effects of low dose gamma radiation and phytohormones on germination rate (%) in rice.

Concentration (ppm)	Dose (Gy)	GA <sub>3</sub>		IBA		BA	
		2 DAS	6 DAS	2 DAS	6 DAS	2 DAS	6 DAS
0	0	21 b	94 a	21 ab	94 ab	21 c	94 a
	4	23 b	88 a	23 ab	88 ab	23 bc	88 a
	8	22 b	90 a	22 ab	90 ab	22 c	90 a
0.0001	0	32 ab	92 a	23 ab	87 b	31 abc	90 a
	4	28 ab	89 a	23 ab	97 a	41 a	90 a
	8	30 ab	92 a	21 ab	90 ab	39 a	96 a
0.001	0	39 a	89 a	28 a	92 ab	35 a	94 a
	4	28 ab	85 a	27 ab	92 ab	34 ab	93 a
	8	20 b	89 a	30 a	91 ab	39 a	91 a
0.01	0	23 b	88 a	16 b	96 a	30 abc	94 a
	4	26 b	90 a	21 ab	93 ab	30 abc	89 a
	8	23 b	88 a	16 b	95 ab	32 abc	92 a

Values of 3, 4 and 5 DAS (days after sowing) were not represented. Values with same letters are not significantly different within each column at 5% level by DMRT.

Table 2. Synergistic effects of low dose gamma radiation and phytohormones on seedling growth (cm) in rice.

Concentration (ppm)	Dose (Gy)	GA <sub>3</sub>		IBA		BA	
		Shoot length	Root	Shoot length	Root	Shoot length	Root
0	0	2.2 cdef	2.7 ab	2.2 cd	2.7 abc	2.2 cde	2.7 abc
	4	2.5 ab	2.8 ab	2.5 ab	2.8 abc	2.5 b	2.8 abc
	8	2.1 def	2.7 ab	2.1 de	2.7 abc	2.1 de	2.7 bc
0.0001	0	2.5 abc	2.1 cd	2.4 abcd	3.1 a	2.0 e	2.9 ab
	4	2.6 a	3.1 a	2.4 abc	2.8 abc	2.3 bcd	2.5 bc
	8	2.3 abcd	2.6 ab	2.1 de	2.5 bc	2.3 bcd	3.2 a
0.001	0	2.1 def	2.5 bc	2.3 bcd	2.7 abc	2.1 de	2.9 ab
	4	2.3 bcde	2.4 bc	2.6 a	2.9 ab	2.1 de	2.7 abc
	8	2.0 ef	1.9 d	2.1 de	2.7 abc	2.4 bc	2.9 ab
0.01	0	1.9 f	1.8 d	1.9 e	2.3 c	2.9 a	2.8 abc
	4	2.0 def	2.1 cd	2.2 cd	2.7 abc	2.5 bc	2.7 abc
	8	2.2 cdef	2.1 cd	2.2 cd	3.0 ab	2.3 bcd	2.3 c

Values with same letters are not significantly different within each column at 5% level by DMRT.