ABA와 Kinetin 處理에 따른 벼 發芽中 鹽害輕減에 關한 研究

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Studies on Effects of ABA and Kinetin on Alleviating NaCl Stress in Rice(*Oryza sativa* L.) Germination

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實驗目的

本 研究는 볍씨發芽에 있어 環境 stress中 鹽害(NaCl 1.3%)毒性에 對한 發芽率 增大 및 鹽毒性 輕減을 위한 栽培技術對策의 一環으로 植物生長調整劑인 ABA와 kinetin을 浸種處理하여 發芽 및 生長促進과 아울러 鹽害輕減에 對한 基礎資料를 얻고자 遂行하였다.

材料 및 方法

本 研究는 統一型인 多産벼와 香米벼 1號, 一般型인 一品벼, 고시히까리의 4 品種을 供試材料로 하여 草長, 根長, 生體重 및 發芽率 等의 生育特性과 澱粉, 糖, 遊離 proline 含量을 調査하였다.

結果 및 考察

1. 一般型인 一品벼의 草長은 NaCl 1.3%에서 1.3cm로 ABA 10^{-3}M와 ABA 10^{-5}M 處理를 除外하면 모든 處理에서 草長의 生育이 비슷하였고 ABA 10^{-4}M 處理에서 1.80cm로 나타나 오히려 kinetin 處理보다 生育이 促進되었다.
2. 統一型인 香米벼 1號의 境遇 草長은 NaCl 1.3%가 0.68cm인 것 보다 植物生長調整劑 및 濃度間에 差異는 認定되었으나 kinetin 10^{-3}M에서 生育이 良好하였다.
3. 鹽毒性에 따른 水稻 品種間 葉綠素 含量은 모든 品種에서 植物生長調整劑인 kinetin 處理區가 ABA 處理區보다 높은 含量을 보였고 特히 kinetin 處理中 濃度에 따른 含量의 變化는 4個 品種 모두 kinetin 10^{-3}M에서 높은 含量을 보였다.
4. 澱粉 및 糖含量의 變化는 一品벼의 境遇 澱粉含量이 無處理가 NaCl 1.3% 處理보다 增加하였고 糖含量은 澱粉의 含量이 增加함에 따라 減少하였다.
5. 遊離 proline 含量은 一品벼의 境遇 無處理에서는 生體 g當 2,220μmole이었으나 NaCl 1.3% 處理에서는 3,648μmole로 鹽害處理에서 높은 含量을 나타내었고 特히 ABA 10^{-3}M 處理에서 5,941μmole로 가장 높은 含量의 增加를 보였다.
6. 品種間 鹽害에 對한 遊離 proline 含量의 差異는 一品벼, 香米벼 1號, 多産벼, 고시히까리 順으로 一品벼가 가장 높은 含量의 增加를 보였다.

Table 1. Effect of plant growth regulators, ABA and kinetin on NaCl toxicity in four rice cultivars

Cultivars	Treatments*	Plant height (cm)	Root length (cm)	Fresh wt. (g/30 plants)	Germination rate (%)
Ilpumbyeo	Untreated control	2.80 a	7.00	1.85	98.8 a
	NaCl 1.3 %	1.30 c	0.42	1.13	58.2 d
	ABA 10^{-3} M	-	-	0.89	26.5 e
	ABA 10^{-4} M	1.80 b	1.31	1.12	90.4 c
	ABA 10^{-5} M	0.78 e	0.32	1.33	90.8 c
	Kinetin 10^{-3} M	1.35 c	0.63	1.78	91.2 b
	Kinetin 10^{-4} M	1.31 d	0.61	1.76	93.2 b
	Kinetin 10^{-5} M	1.30 d	0.58	1.73	91.9 b
Hwangmi-byeo I	Untreated control	3.70 a	3.54	2.21	97.0 a
	NaCl 1.3 %	0.68 d	0.20	1.15	56.9 d
	ABA 10^{-3} M	-	-	0.84	14.3 e
	ABA 10^{-4} M	0.60 d	0.44	1.22	89.7 c
	ABA 10^{-5} M	1.86 bc	0.92	1.34	88.8 c
	Kinetin 10^{-3} M	2.04 b	0.74	2.04	91.1 b
	Kinetin 10^{-4} M	0.60 d	0.30	1.23	86.0 c
	Kinetin 10^{-5} M	1.38 c	1.16	1.44	87.8 c
Dasanbyeo	Untreated control	3.64 a	2.74	2.68	98.0 a
	NaCl 1.3 %	0.53 c	0.11	1.10	53.1 c
	ABA 10^{-3} M	-	-	0.97	9.5 e
	ABA 10^{-4} M	0.41	0.15	0.99	75.9 b
	ABA 10^{-5} M	0.73 b	0.17	1.43	44.0 d
	Kinetin 10^{-3} M	0.57 c	0.24	0.98	6.0 f
	Kinetin 10^{-4} M	0.51 c	0.14	1.25	41.9 d
	Kinetin 10^{-5} M	0.27 d	0.18	1.20	47.7 d
Koshihikari	Untreated control	3.60 a	5.18	2.44	98.8 a
	NaCl 1.3 %	0.87 d	1.13	1.47	57.1 d
	ABA 10^{-3} M	-	-	0.10	6.0 e
	ABA 10^{-4} M	1.44 b	1.98	1.98	91.7 c
	ABA 10^{-5} M	0.61 d	0.70	1.16	90.3 c
	Kinetin 10^{-3} M	1.46 b	0.51	1.58	93.9 b
	Kinetin 10^{-4} M	1.21 c	0.48	1.35	94.1 b
	Kinetin 10^{-5} M	0.88 d	0.44	0.96	94.4 b

Means in each column followed by the same letter are not significantly different at the 5% level into one cultivar according to Duncan's multiple range tests.
* Kinetin treatments were seed soaking for 24hrs at room temp., and then placed into petridish containing NaCl 1.3%.

Table 2. Chlorophyll content as affected by plant growth regulators, ABA and kinetin on NaCl toxicity in four rice cultivars

Cultivars	Treatments*	Chlorophyll content (mg / g fresh wt.)
Ilpumbyeo	Untreated control	1.43 a
	NaCl 1.3 %	1.16 c
	ABA 10^{-3} M	-
	ABA 10^{-4} M	1.11 d
	ABA 10^{-5} M	1.14 c
	Kinetin 10^{-3} M	1.40 a
	Kinetin 10^{-4} M	1.37 b
	Kinetin 10^{-5} M	1.33 b
Hwangmibyeo I	Untreated control	1.38 a
	NaCl 1.3 %	1.20 c
	ABA 10^{-3} M	-
	ABA 10^{-4} M	1.03 d
	ABA 10^{-5} M	1.18 c
	Kinetin 10^{-3} M	1.37 a
	Kinetin 10^{-4} M	1.35 b
	Kinetin 10^{-5} M	1.32 b
Dasanbyeo	Untreated control	1.39 ab
	NaCl 1.3 %	1.10 c
	ABA 10^{-3} M	-
	ABA 10^{-4} M	1.09 d
	ABA 10^{-5} M	1.15 c
	Kinetin 10^{-3} M	1.42 a
	Kinetin 10^{-4} M	1.33 b
	Kinetin 10^{-5} M	1.32 b
Koshihikari	Untreated control	1.46 ab
	NaCl 1.3 %	1.13 d
	ABA 10^{-3} M	-
	ABA 10^{-4} M	1.10 d
	ABA 10^{-5} M	1.33 c
	Kinetin 10^{-3} M	1.48 a
	Kinetin 10^{-4} M	1.45 b
	Kinetin 10^{-5} M	1.39 c

Means in each column followed by the same letter are not significantly different at the 5% level into one cultivar according to Duncan's multiple range tests.
* Kinetin treatments were seed soaking for 24hrs at room temp., and then placed into petridish containing NaCl 1.3%.

Table 3. Starch, free sugar contents as affected by plant growth regulators, ABA and kinetin on NaCl toxicity in four rice cultivars

Cultivars	Treatments*	Content (mg /fresh wt.) Starch	Sugar
Ilpumbyeo	Untreated control	11.4 b	0.84 a
	NaCl 1.3 %	10.1 c	0.23 c
	ABA 10^{-3} M	12.6 a	0.24 c
	ABA 10^{-4} M	11.9 b	0.26 bc
	ABA 10^{-5} M	11.2 b	0.29 b
	Kinetin 10^{-3} M	12.4 a	0.18 e
	Kinetin 10^{-4} M	10.1 c	0.22 d
	Kinetin 10^{-5} M	8.9 d	0.24 c
Hwangmi-byeo I	Untreated control	8.4 c	0.70 a
	NaCl 1.3 %	8.3 c	0.21 b
	ABA 10^{-3} M	11.3 a	0.16 d
	ABA 10^{-4} M	8.4 c	0.18 c
	ABA 10^{-5} M	8.1 c	0.20 b
	Kinetin 10^{-3} M	9.9 b	0.11 f
	Kinetin 10^{-4} M	8.2 c	0.13 e
	Kinetin 10^{-5} M	7.3 d	0.15 d
Dasanbyeo	Untreated control	9.0 b	0.74 a
	NaCl 1.3 %	8.6 c	0.21 b
	ABA 10^{-3} M	12.0 a	0.16 bc
	ABA 10^{-4} M	8.8 c	0.17 bc
	ABA 10^{-5} M	8.5 c	0.19 b
	Kinetin 10^{-3} M	9.6 b	0.10 e
	Kinetin 10^{-4} M	8.5 c	0.11 e
	Kinetin 10^{-5} M	7.4 d	0.14 d
Koshihikari	Untreated control	12.0 c	0.61 a
	NaCl 1.3 %	11.0 d	0.18 d
	ABA 10^{-3} M	14.5 a	0.20 c
	ABA 10^{-4} M	13.7 b	0.21 c
	ABA 10^{-5} M	12.2 c	0.23 b
	Kinetin 10^{-3} M	13.9 b	0.16 e
	Kinetin 10^{-4} M	11.2 d	0.18 d
	Kinetin 10^{-5} M	9.8 e	0.23 b

Means in each column followed by the same letter are not significantly different at the 5% level into one cultivar according to Duncan's multiple range tests.
* Kinetin treatments were seed soaking for 24hrs at room temp., and then placed into petridish containing NaCl 1.3%.

Table 4. Free proline content on NaCl toxicity in four rice cultivars

Cultivars	Treatments*	Free proline content* (μmole/ g fresh wt.)
Ilpumbyeo	Untreated control	2,220 e
	NaCl 1.3 %	3,648 b
	ABA 10^{-3} M	5,941 a
	ABA 10^{-4} M	2,863 c
	ABA 10^{-5} M	2,861 c
	Kinetin 10^{-3} M	2,854 c
	Kinetin 10^{-4} M	2,729 d
	Kinetin 10^{-5} M	2,849 c
Hwangmi-byeo I	Untreated control	2,470 e
	NaCl 1.3 %	3,571 b
	ABA 10^{-3} M	6,872 a
	ABA 10^{-4} M	2,438 e
	ABA 10^{-5} M	2,744 c
	Kinetin 10^{-3} M	2,436 e
	Kinetin 10^{-4} M	2,768 c
	Kinetin 10^{-5} M	2,643 d
Dasanbyeo	Untreated control	2,647 e
	NaCl 1.3 %	3,427 d
	ABA 10^{-3} M	6,990 a
	ABA 10^{-4} M	2,144 f
	ABA 10^{-5} M	4,101 b
	Kinetin 10^{-3} M	6,473 b
	Kinetin 10^{-4} M	4,226 c
	Kinetin 10^{-5} M	3,863 d
Koshihikari	Untreated control	2,318 d
	NaCl 1.3 %	3,421 b
	ABA 10^{-3} M	6,348 a
	ABA 10^{-4} M	2,347 d
	ABA 10^{-5} M	2,511 c
	Kinetin 10^{-3} M	2,476 c
	Kinetin 10^{-4} M	2,234 e
	Kinetin 10^{-5} M	2,220 e

Means in each column followed by the same letter are not significantly different at the 5 level into one cultivar according to Duncan's multiple range tests.
* Data were checked at the 7 days after treatment of NaCl 1.3%.
* Kinetin and ABA treatments were seed soaking for 24hrs at room temp., and th placed into petridish containing NaCl 1.3%.