

벼 뿌리의 호흡, α -Naphthylamine 酸化力, TTC還元力, 養水分吸收 및 溢泌에 대한
窒素 및 磷酸施用量, 遮光, 水分 potential 및 溫度處理의 影響

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Respiration, α -Naphthylamine Oxidizing Ability and TTC Reducing Ability of Roots and Uptake of
Water and Nutrients and Bleeding as Affected by the Level of Nitrogen and Phosphorous Application,
Shading, Water potential and Temperature in the Rice Plants.

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실험 목적

本研究는 벼 뿌리의 生理的 活力的 지수로 이용되고 있는 根呼吸, α -Naphthylamine 酸化力,
TTC還元力, 養水分吸收能力 및 溢泌을 알아보기 위해, 幼苗期 및 營養生長기에 벼 뿌리의
生理的 活力差를 유도하기 위한 窒素 및 磷酸施用量, 遮光, 水分 potential 및 溫度處理를
하여, 이들이 뿌리의 활력에 미치는 影響을 검토하고자 실시하였다.

재료 및 방법

실험品種은 幼苗期에는 거포벼, 상포벼(一般系), 삼포벼, 궁천벼(多收系)를 이용하였고,
窒素水準은 5, 7.5, 10g/m², 인산수준은 5, 10, 15g/m²이었다. 영양생장기에는 거포벼, 삼포벼를
이용하였고 질소수준은 10, 15, 20kg/10a, 인산수준은 5, 10, 15kg/10a 이었다. 遮光은 自然光,
50% 및 70% 차광처리를 하였고, 온도는 25/16°C 및 26/22°C에서 각각 2주일간 처리하였다.
모판 木科栽植은 하여 水分포텐셜 -0.5, -1.0, -3.0, -5.0 bar 및 溫度 15, 17, 20, 25, 30°C의
조건하에 뿌리흡수, 증산량, 根呼吸, α -Naphthylamine (α -NA)산화력, TTC환원력 및 溢泌을
측정하였다.

실험 결과 및 고찰

1. 뿌리의 呼吸能力, α -NA 酸化力, TTC還元力은 窒素 및 磷酸施肥, 차광, 온도처리에
의해 影響을 보여 알았고, 품종간 차이도 있었다.
2. 窒素의 供給량에 依한 根呼吸은 窒素수준에 依한 根呼吸의 흡수량이 현저히 많았고, 幼苗期에 있어서
질소소비량에 대한 吸收反應은 根呼吸 > 인산 > 삼포벼 질소 = 磷酸의 순으로 작았으며, 차광처리에
의해는 흡수량이 감소하는 반면 夜溫 22°C에서 생육한 경우에는 흡수가 증진되는 경향을 보였다.
3. 栽培 環境 습수량은 질소 및 인산소비량이 증가함에 따라 증가되었고, 차광처리에 의해는 감소되었으며,
야간온도가 22°C였을 때 16°C에 비하여 증가하였는데, 일별량은 질소소비량의 증가, 온도 처리에 의하여
증가되었으나, 인산 소비에 의해는 一樣성을 보이지 않았고, 차광에 의해는 감소하는 경향을 보였다.
4. 養液의 水分포텐셜의 低下에 따라 溢泌 및 蒸散량이 감소하였고, 뿌리의 呼吸 및 α -NA산화력의
溫度에 대한 반응은 相異하였다.

Table Effects of nitrogen and phosphorus application levels, shading and temperature at seedling stage on the root activities of rice plants.

Activity	Cultivar	Nitrogen level (g/m ²)				Phosphorus level (g/m ²)				Shading (% sunlight)				Temperature (°C)	
		5	7.5	10	LSD ₀₅	5	10	15	LSD ₀₅	0	50	70	LSD ₀₅	25/16	26/22
O ₂ consump.	Gihobyee	2.31	3.41	3.70	0.43	2.71	2.31	2.01	0.23	4.92	3.20	3.60	0.34	4.92	4.43
(μmoles/√ Root/min)	Sangpungbyeo	5.04	2.99	2.83	1.14	4.40	5.04	5.25	0.37	4.18	3.15	2.11	0.10	4.18	3.26
	Jungwonbyeo	2.97	2.37	3.10	0.11	4.20	2.97	5.25	0.54	2.98	2.45	1.23	0.63	2.98	2.14
α-NA oxidiz.	Gihobyee	0.37	0.24	0.49	0.13	0.22	0.24	0.30	0.43	0.23	0.18	0.25	0.07	0.23	0.29
(μg/√ Root/hr)	Sangpungbyeo	0.69	0.73	0.84	0.18	0.97	0.73	1.04	0.30	0.20	0.16	0.32	0.08	0.20	0.13
	Jungwonbyeo	0.01	0.09	0.19	0.09	0.38	0.09	0.12	0.10	0.07	0.02	0.10	0.06	0.07	0.07
TTC reduc.	Gihobyee	0.22	0.19	0.20	0.08	0.16	0.19	0.17	ns	0.13	0.13	0.09	ns	0.13	1.14
(μmoles/√ Root/hr)	Sangpungbyeo	0.24	0.24	0.35	0.08	0.20	0.24	0.24	ns	0.20	0.10	0.04	0.06	0.20	0.20
	Jungwonbyeo	0.13	0.15	0.13	ns	0.15	0.15	0.16	ns	0.22	0.24	0.16	0.05	0.22	0.20
	Jungwonbyeo	0.09	0.12	0.10	ns	0.09	0.12	0.12	ns	0.19	0.17	0.13	ns	0.19	0.21

* Root activities were measured at the end of treatment.

Table Effects of nitrogen and phosphorus application levels, shading and temperature at seedling stage on the nutrients uptake of rice plants.

Nutrient	Cultivar	Nitrogen level (g/m ²)				Phosphorus level (g/m ²)				Shading (% sunlight)				Temperature (°C)	
		5	7.5	10	LSD ₀₅	5	10	15	LSD ₀₅	0	50	70	LSD ₀₅	25/16	26/22
NH ₄ ⁺ (μmoles/plant)	Gihobyee	3.3	3.2	4.1	0.6	3.2	3.2	3.2	ns	1.7	2.1	1.9	0.2	1.7	4.4
	Sangpungbyeo	2.6	3.1	3.1	0.4	2.2	2.1	1.4	0.6	0.6	3.1	1.7	0.4	3.6	3.6
	Jungwonbyeo	3.7	2.8	2.4	0.9	2.7	2.8	1.6	0.8	4.9	2.5	2.2	0.9	4.9	4.0
	Jungwonbyeo	3.6	1.7	1.8	0.8	1.2	1.7	0.3	0.9	3.6	3.1	2.0	0.7	3.6	3.6
NO ₃ ⁻ (μmoles/plant)	Gihobyee	58.0	66.3	73.0	5.4	69.7	66.3	66.1	ns	17.7	11.0	3.8	3.7	17.7	19.1
	Sangpungbyeo	68.1	77.6	80.5	6.2	75.8	77.6	75.4	ns	12.5	7.0	4.8	2.9	12.5	21.0
	Sangpungbyeo	64.4	83.0	84.8	3.9	81.1	83.0	82.7	ns	17.6	8.2	9.6	1.3	17.6	21.4
	Jungwonbyeo	60.9	72.6	80.8	7.2	78.6	72.6	65.8	0.9	13.4	6.4	0.4	3.0	13.4	21.8
P (μg/plant)	Gihobyee	8.0	9.2	13.7	2.2	9.8	9.2	8.1	0.7	4.2	5.6	1.8	1.4	4.2	5.6
	Sangpungbyeo	9.5	12.7	18.4	3.0	7.3	12.7	7.5	2.6	2.8	3.2	1.0	1.3	2.8	2.6
	Sangpungbyeo	4.3	5.0	6.3	1.1	5.6	5.0	6.4	ns	3.6	2.9	4.4	0.8	3.6	4.2
	Jungwonbyeo	7.4	2.6	7.1	1.6	5.4	2.6	2.2	2.1	3.5	10.1	9.8	3.7	3.5	3.3
SiO ₂ (μmoles/plant)	Gihobyee	0.11	0.12	0.13	ns	0.08	0.12	0.11	ns	0.04	0.04	0.02	ns	0.04	0.05
	Sangpungbyeo	0.13	0.13	0.12	ns	0.12	0.13	0.11	ns	0.03	0.03	0.03	ns	0.03	0.04
	Sangpungbyeo	0.11	0.11	0.17	ns	0.10	0.11	0.12	ns	0.05	0.03	0.06	ns	0.05	0.04
	Jungwonbyeo	0.11	0.09	0.12	ns	0.09	0.09	0.09	ns	0.06	0.03	0.03	ns	0.06	0.03

* Nutrient uptake was measured for 2 days after treatment.

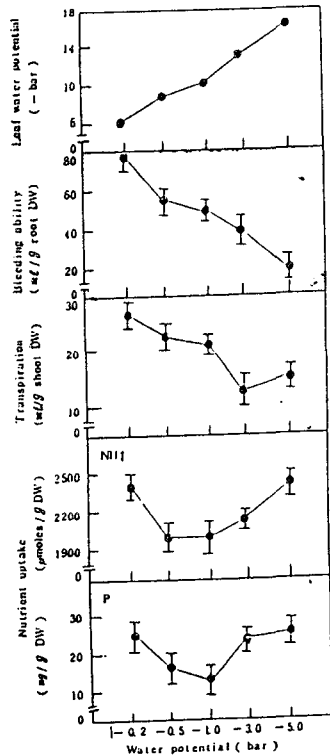


Fig. Effect of water potential on bleeding, transpiration, nutrient uptake and leaf water potential of the rice seedlings.

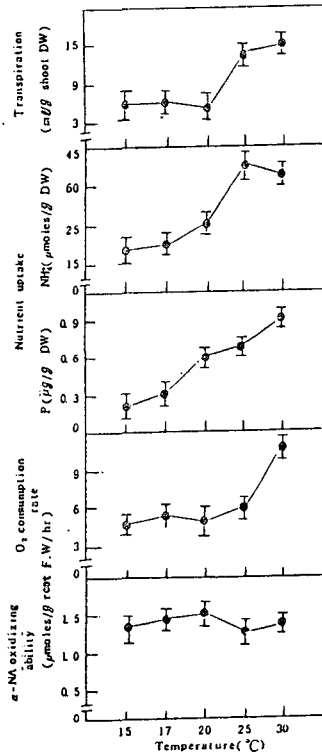


Fig. Effect of temperature on transpiration, nutrient uptake and root activities of the rice plants.

Table Effects of nitrogen and phosphorus application levels, shading and temperature on the water uptake of rice plants.

Growth stage	Cultivar	Nitrogen level (g/m ²)				Phosphorus level (g/m ²)				Shading (% sunlight)				Temperature (°C)	
		5	7.5	10	LSD ₀₅	5	10	15	LSD ₀₅	0	50	70	LSD ₀₅	25/16	26/22
Growth stage	Gihobyee	22.7	28.7	33.7	4.6	23.7	27.7	31.7	5.2	34.7	30.7	21.0	3.6	34.7	48.0
	Sangpungbyeo	22.3	21.3	37.3	3.9	24.3	21.3	25.3	2.7	33.3	27.7	18.0	4.7	33.3	49.7
	Jungwonbyeo	24.3	39.1	40.3	6.7	32.0	39.1	37.3	4.6	40.3	38.7	32.0	4.1	40.3	47.7
Seedling	Gihobyee	19.3	26.3	36.0	5.8	24.0	26.3	26.3	ns	40.7	23.3	34.0	3.3	40.7	48.0
	Sangpungbyeo	10.1	10.4	9.4	8.4	8.0	10.1	10.1	9.6	21.5	11.7	7.5	10.4	21.5	26.3
	Jungwonbyeo	96	88	89	6.7	73	88	89	4.8	230	128	87	35.2	230	253

* Water uptake was measured for 2 days after treatment.

Table Effects of nitrogen and phosphorus application levels, shading and temperature on the bleeding of rice plants.

Growth stage	Cultivar	Nitrogen level (g/m ²)				Phosphorus level (g/m ²)				Shading (% sunlight)				Temperature (°C)	
		5	7.5	10	LSD ₀₅	5	10	15	LSD ₀₅	0	50	70	LSD ₀₅	25/16	26/22
Growth stage	Gihobyee	0.48	0.49	0.63	0.21	0.53	0.49	0.50	0.36	0.32	0.20	0.17	0.14	0.32	0.99
	Sangpungbyeo	0.50	0.55	0.54	0.33	0.48	0.55	0.66	0.50	0.39	0.27	0.18	0.14	0.39	0.52
	Jungwonbyeo	0.63	0.83	0.76	0.72	1.09	0.83	0.67	0.42	0.41	0.41	0.17	0.11	0.41	0.54
Seedling	Gihobyee	0.60	0.65	0.69	0.62	0.74	0.65	0.99	0.26	0.39	0.23	0.21	0.13	0.39	0.66
	Sangpungbyeo	3.5	10.7	10.5	2.3	13.0	10.7	10.4	2.1	25.1	18.2	18.6	2.7	25.1	19.1
	Jungwonbyeo	2.3	5.9	6.1	1.8	14.3	5.9	7.8	3.3	16.7	14.9	9.0	1.8	16.7	16.1

* Bleeding was measured for 1 day after treatment.