

Soybean Growth Characteristic and Mineral Nutrient Evaluations for Excessive Water Tolerance

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콩 생육특성과 무기양분함량의 내습성평가

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Objectives

To identify cultivar differences for the development of breeding materials and to understand stress – tolerance process for the application to production practices.

Materials and Methods

Soybean cultivar : Hannamkong(sensitive)(1) and Taekwangkong(tolerant)(2)

Excessive water treatment

1. conventional plot(control)
2. vinyl-lined plot(1.2 x 4.2 x 0.3m deep)

Planting date : May 21, 1998.

Drip irrigation for excessive water treatment began at V1 growth stage(13 June)

Sampling : Five plants were collected at V3(21 June), V5(28 June) and V7/V8(5 July)

Growth characteristics : stem length, fresh and dry weights of stems and leaves included petioles, and stem and leaf water contents.

Mineral nutrient content of leaves : N, P, K, Ca, Mg, Fe, Mn, Na, Zn and Cu.

Stress index and tolerance index.

Results and Discussion

Three weeks of excessive water treatment reduced all growth parameters measured to soybean plants. Excessive water resulted in decreases of N, P, K, Ca, Mg and Cu, and increases of Fe and Mn contents in soybean leaves.

Stress index of tolerant cultivar under excessive water showed no large difference in soybean growth characteristics measured at three growth stages. However, K, Ca, Mg, Fe and Mn contents in soybean leaves appeared to differ between sensitive and tolerant cultivars.

From the research results, stress and tolerance indices are proposed for a method to test cultivar differences in plant responses within a species under adverse growth environments.

Table 1. Stress and tolerance indices in growth characteristics of soybean cultivars at the three growth stages.

Variable	Cultivar	Stress index			Tolerance index		
		V3	V5	V7/V8	V3	V5	V7/V8
Stem LTH	1	0.88	0.83	0.76			
	2	0.83	0.79	0.75	0.94	0.95	0.99
Stem DW	1	ns	ns	0.48			
	2	ns	ns	0.49	ns	ns	1.02
Leaf DW	1	ns	ns	0.40			
	2	ns	ns	0.38	ns	ns	0.95
Top DW	1	ns	ns	0.43			
	2	ns	ns	0.40	ns	ns	0.93
Stem WC	1	0.90	0.91	0.94			
	2	0.90	0.91	0.93	ns	1.00	0.99
Leaf WC	1	0.91	0.93	0.94			
	2	0.93	0.94	0.94	1.02	ns	ns
L/S ratio	1	0.75	0.70	0.83			
	2	0.69	0.64	0.77	0.92	0.91	0.93

• LTH: Length, DW: Dry weight, WC: Water content, and L/S; Leaf stem.

Table 2. Stress and tolerance indices in mineral nutrients of soybean cultivars at the three growth stages.

Variable	Cultivar	Stress index			Tolerance index		
		V3	V5	V7/V8	V3	V5	V7/V8
N	1	0.53	0.59	0.72			
	2	0.55	0.57	0.79	ns	ns	ns
P	1	0.80	0.66	0.72			
	2	0.70	0.64	0.70	ns	ns	ns
K	1	0.68	0.67	0.70			
	2	0.48	0.56	0.68	0.71	0.84	0.97
Ca	1	0.79	0.84	ns			
	2	0.86	0.94	ns	1.09	1.12	ns
Mg	1	0.66	0.57	0.60			
	2	0.56	0.64	0.70	0.85	1.12	1.17
Fe	1	ns	ns	2.54			
	2	ns	ns	2.37	ns	ns	0.93
Mn	1	2.37	3.42	2.94			
	2	1.87	2.81	3.67	ns	ns	1.25
Cu	1	0.19	0.36	0.33			
	2	0.38	0.35	0.47	ns	ns	ns