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Growth and Seed Quality Affected by Growing Condition in Soybeans

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Objectives

The purpose of the study is to identify the influence on growth, yield components, and major ingredients of the seed when cultivating soybeans in a paddy field and to obtain basic materials for promoting soybean cultivation in a paddy field as a substitution for controlling the supply of rice.

Materials and Methods

◦ Testing cultivar : Taegwangkong, Saeolkong, Pongsannamulkong, Eunhakong
◦ Experiment soil - Paddy field : Chilgok series loam(top soil : silty clay loam)
- Upland : Chilgok series loam(top soil : sandy clay loam)
◦ Sowing time : June 14('02), June 16('03)
◦ Planting density : 60×15㎝
◦ Fertilization : Non application, pH control(6.5)
◦ Isoflavones analysis : Eun-Hee So *et al.*(2001)
◦ Fatty acids analysis : Anna Whipkey *et al*(1988), and Metcalfe *et al.*(1961)
◦ Amino acids analysis : Sakano K.(1981), and Sulistyo J. *et al.*(1988)

Results and Discussion

The soil of the paddy field was silty clay loam before the experiment. However, after two years had passed since soybeans were cultivated, the soil of the paddy field turned to sandy clay loam with an increased content of sand. When cultivating soybeans in a paddy field, the flowering date and stem length of the soybeans did not change significantly compared to when the soybeans were cultivated in a upland. However, the maturation date was three days later and the number of branches per plant was 0.4 more. Furthermore, the number of pods per plant was more by 10 when soybeans were cultivated in a paddy field and the 100-seed weight was heavier by 2.2g. The seed yield increased by 25%. Compared to the soybeans in the upland, the isoflavone content of the seed in the paddy field showed higher by 27%. In particular, the contents genestein and daidzein found among the ingredients of the isoflavones were remarkably higher. On the other hand, there was no difference in the composition of fatty acids and amino acids.

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Table 1. Chemical and physical composition of experiment soils of paddy field and upland.

Growing condition		pH (1:5)	OM (g/kg)	P_2O_5 (mg/kg)	Ex. cation ($cmol^+/kg$)			Soil particle (%)		
					K	Ca	Mg	Sand	Silt	Clay
Paddy field	Before	5.8	3.5	233	1.1	6.0	1.7	16	56	28
	After	6.1	2.9	256	0.9	8.1	2.0	22	57	21
Upland	Before	6.5	2.8	645	1.7	10.1	3.1	22	57	21
	After	6.4	2.8	636	1.5	10.7	2.7	22	59	19

Table 2. Growth characteristics by cultivation conditions.

Growing condition	Flowering date	Maturing date	Stem length (cm)	Branch no. per plant	Loading (0 ~ 9)	Nodulation (no./plant)		
						'02	'03	Mean
Paddy field	July 30	Oct. 3	50	4.2	4	33.5	77.9	55.7
Upland	Jyly 30	Sep.31	49	3.8	2	43.6	40.5	42.1

Table 3. Yield components and yield by cultivation conditions.

Growing condition	No. of pod per plant	No. of seed per pod	100-seed wt. (g)	Seed yield (kg/10a)	Index
Paddy field	51	2.2	17.5	241	125
Upland	41	2.3	15.3	193	100

Table 4. Content of isoflavones in soybean seed according to cultivation conditions.

Growing condition	Isoflavones ($\mu g/g$)				Index
	Glycitein	Daidzein	Genistein	Total	
Paddy field	116	387	514	1,017	127
Upland	119	290	393	802	100

Table 5. Content of fatty acids in soybean seed according to cultivation conditions.

Growing condition	Palmitic acid (C16:0)	Stearic acid (C18:0)	Oleic acid (C18:1)	Linoleic aicd (C18:2)	alpha-Linolenic acid (C18:3)	Total (mg/g)	Index
Paddy field	11.05	3.11	27.22	51.44	7.17	181.32	102
Upland	11.20	3.16	26.25	51.81	7.58	177.98	100

Table 6. Content of amino acids in soybean seed according to cultivation conditions.

Growing condition	Amino acids (mg/g)																		Index
	Cys	Met	Asp	Thr	Ser	Glu	Gly	Ala	Val	I-le	Leu	Tyr	Phe	Lys	His	Agr	Pro	Total	
Paddy field	6.4	5.3	42.4	15.0	20.3	70.9	16.1	16.1	14.0	13.3	28.2	12.5	19.1	23.9	11.1	24.7	18.7	358.0	100
Upland	6.4	4.9	42.3	15.0	20.5	70.6	16.1	16.0	14.0	13.5	28.0	12.4	18.8	23.9	11.3	23.9	18.8	356.3	100