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Seed Vigor Enhancement by Application of Up-to-date Seed Processing  
Technology and Development of Methods Producing High-quality Grafted  
Seedlings in Cucurbitaceous Vegetables

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1999. 12. 27.

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# Summary

## 1. Title of ARPC Project (1995- 1999) in Horticulture

### **Seed Vigor Enhancement by Application of Recent Seed Processing Technology and Development of Methods Producing High-Quality Grafted Seedlings in Cucurbitaceous Vegetables**

## 2. Purpose and Significance of the Research

The objective of this research is to promote the sales and distribution of seeds of cucurbitaceous rootstocks developed and produced by domestic breeders in order to cope with the recent increases in the use of imported seeds and the problems associated with these imported seeds. Primary attention has been given to finding out the causes of poor germination of some seeds supplied by some Korean seed companies as compared to those imported ones and developing ways of promoting seed germination and seedling vigor by supplying high-quality seeds of cucurbitaceous crops, especially the gourd (*Lagenaria siceraria*). In addition, research will also be focused on grafting and distribution of fresh-grafted seedlings in order to encourage mass production of high-quality grafted seedlings and export fresh-grafted seedlings prior to rooting.

## 3. Outline of Research

Worldwide collection of gourd germ plasm and their evaluation will be the first

step for this research. Useful germ plasm will be selected and, after an initial screening test, used for further breeding program. Promising cultivars will be developed by breeding program utilizing the existing and newly-introduced germ plasm. A proper guideline for gourd cultivation for seed production will be provided after a series of experiments on the effects of fruit age, after-ripening, fermentation of fruit flesh, seed extraction and washing, and cleaning of gourd seeds. Various tests will be imposed to the gourd seeds produced. Genetic purity test, test for disease infection including *Fusarium* and cucumber green mottle mosaic virus (CGMMV), and seed and seedling vigor tests will be conducted and systematic schemes for various seed treatments will be developed to maximize the seed and seedling vigor.

Since most of the cucurbitaceous crops are grafted to gourd or pumpkin rootstocks, ways of producing healthy seedlings possessing uniform shape will be investigated by applying various seed processing treatment techniques including the seed infiltration treatment of triazole chemicals to reduce the excessive elongation of hypocotyl and gibberellins (mostly GA<sub>3</sub> and GA<sub>4+7</sub>) to induce the hypocotyl elongation in some rootstocks such as figleaf gourd (*Cucurbita ficifolia*). New methods of distributing grafted seedlings will be developed to facilitate mass production of high-quality seedlings, supply of grafted seedlings at much lower prices, and export of high-quality fresh-grafted seedlings.

## Experimental Results and Suggestions for Practical Applications

### 1. Experimental Results

Total of 560 germ plasm of gourd (*Lagenaria siceraria*) were collected and



some of these were evaluated based upon some prominent characteristics such as *Fusarium* resistance, CGMMV susceptibility, seed size and shape, cotyledon size and shape, and others. Two gourd genotypes, resistant to anthracnose *Colletotrichum orbiculare* or *C. lagenarium*, were selected and, after progeny test, used for hybrid seed production with other parent materials which are highly resistant to *Fusarium* disease. World's first, multiple-disease resistant gourd hybrids, 'Tan-Tan' and 'Best Combi', were developed in 1999. These will be registered for sale in 2000. For the production of high-quality gourd seeds, recommendations will be made to gourd growers and gourd seed producers to harvest the fruits after fully mature (60 days after the fruit set or longer) and let them after-ripening under shade for 20-30 days before seed extraction. Fermentation of fruit flesh, either by adding water or microbial enzymes into the flesh through holes made on the fruit rind, greatly reduced the time required for after-ripening.

Various seed treatment methods have been devised including brushing (BR), dry heat (DH) treatment, and solid matrix priming (SMP), and the combined use of the above-mentioned treatments depending upon the kind of cucurbitaceous crops, cultivars, seed lot, seed age, seed vigor, and seed sanitary status. For SMP treatment, different combinations of various solid materials, mixing ratios with seed and water, chemicals, fungicides and plant bioregulators, were commonly applied. Present research provided the evidence that the highly noxious CGMMV could be eliminated from the seeds only by DH treatment of the seeds. The present research also provided the evidence that the problems associated with the DH treatment (75 for 72 hrs), such as severe phytotoxicity expression in the seedlings, poor germination vigor and rate and shorter storage life, can be significantly improved if the DH and post-DH treatments are conducted properly.

The present research revealed the significance of newly-introduced grafting techniques, their advantage in grafting operation, post-graft care, graft-incompatibility, and the use of graft-take conditioning chamber. The concept and detailed procedure of distribution of freshly-grafted seedlings prior to rooting are highly promising. Grafted seedlings can be safely stored in moist air in a box up to 72 hours without any apparent deterioration of seedling quality and subsequent rooting in cell trays. This technique has been proven to be one of the most promising ways of facilitating mass production of high-quality grafted seedlings, supply of high-quality seedlings at much lower prices, and export of fresh-grafted seedlings.

## 2. Suggestions for Practical Applications.

Complete list of the gourd germ plasm will be prepared and this will be distributed to breeders or other related persons upon request. Other characteristics such as CGMMV resistance, will be added to the description of germ plasm for distribution. The world's first, multiple-disease resistant hybrids, 'Tan-Tan' and 'Best Combi' will be on sale for both domestic and international seed market and it is expected that both cultivars will greatly attract the attention of many seed and seedling growers all over the world. A guidebook for gourd seed production will be prepared and distributed to the seed producers. The copies of this final report will be mailed to over 100 places as requested by the ARPC.

Some SMP treatment combinations will be filed for patent before commercialized. DH treatment has been widely accepted as the only way to eliminate the seed-borne virus and most major seed companies have purchased the DH machine partially based upon the progress reports of this research project.

They are now using the DH machine to most of the vegetable seeds for domestic use as well as for export. However, further researches are urgently needed to reduce the DH-induced phytotoxicity and other problems in seeds and seedlings as pointed out earlier in the results. Newly developed grafting technique, single-cotyledon splice grafting (SCSG), has been exclusively used by large-scale commercial seedling growers for many reasons. The idea of 'distribution of SCSG seedlings before rooting' will certainly contribute a significant influence on the mass production of high-quality seedlings, distribution of SCSG seedlings at much lower prices, and export of SCSG seedlings.

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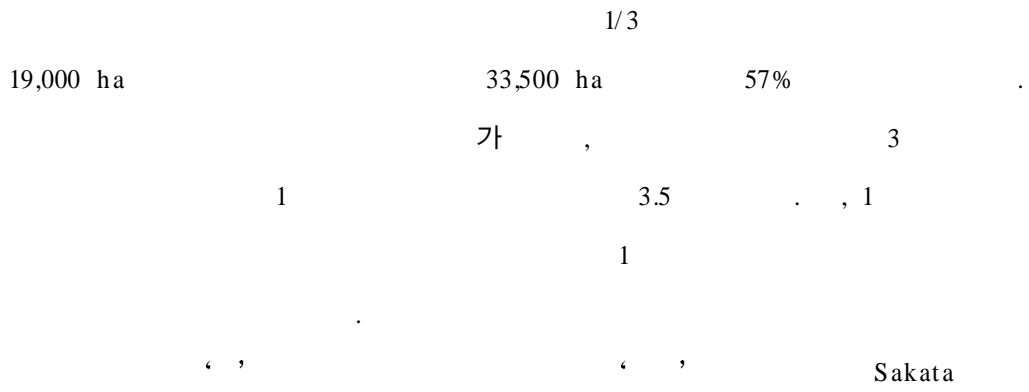
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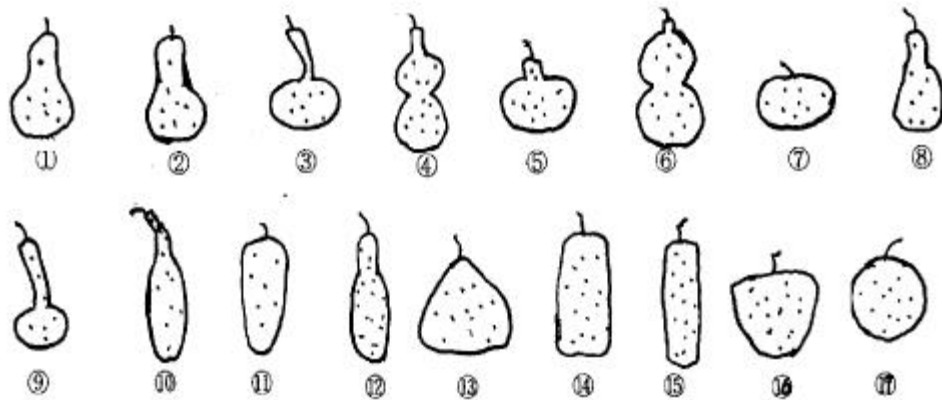
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40	381853			3, 5	"
41	381854			3, 5	"
42	391602			14, 16	,
43	406857			15	,
44	419089			12, 15	,
45	419090			11, 14	,
46	419215			12	,
47	432340			10	,
48	432341			10	,

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BN No.					
49	432342				10
50	438844				13
51- 1	438845				13
51- 2	438845				3
52	438846				13
53	438847				
54	435291				12
55	442368				6
56	442369				
57	451856				
58	451857				"
59	458736				"
60	470260				"
61	487482				8
62	491252				5, 13
63	491266				1
64	491267				1, 2
65	491268				12, 13
66	491269				5, 6
67	491270				2, 3
68	491271				3, 4
69	491272				14
70	491273				3
71	491274				14
72	491275				4, 7
73	491276				7, 11
74	491277				5, 7
75	491278				1, 5
76	491279				5, 16
77	491280				5
78	491281				5
79	491282				10
80	491283				
81	491284				5, 6
82	491285				5, 6
83	491286				5, 6
84	491287				"
85	491288				
86	491289				1
87	491290				2
88	491291				1, 4
89	491292				1, 6
90	491293				5, 7
91	491294				1, 3
92	491295				1, 2
93	491296				1, 7
94	491297				6, 13
95	491298				13, 16

5 ( ).

BN No.					
96	491299				
97	491300				
98	491301			5, 7	"
99	491302				,
100	491303			16	가 가
101	491304				
102	491305				
103	491306				
104	491307			1	가 ,
105	491308				
106	491309			7	,
107	491310			4	
108	491311			2, 5	,
109	491312			1	가 ,
110	491313			5	
111	491314			2	
112	491315			13, 17	가
113	491316			1, 5	
114	491317			2	
115	491318			5	
116	491319			5, 10	,
117	491320			5	
118	491321			2, 10	,
119	491322			12	가
120	491323			4, 17	가
121	491324			4, 5	"
122	491325			3, 7	
123	491326			16	
124	491327				
125	491328				
126	491329				
127	491330			16	
128	491331			7, 8	,
129	491332				,
130	491333			1	,
131	491334			1	"
132	491335			1	
133	491336			1, 2	,
134	491337			8, 11	가 ,
135	491338			8, 10	,
136	491339			2	
137	491340				
138	491341				
139	491342				
140	491343			1, 4	
141	491344			1, 2	"
142	491345			7	가
143	491346			7, 11	

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BN No.					
144	491347				1
145	491348				15, 16
146	491349				3
147	491350				1, 2
148	491351				
149	491352				10, 12
150	491353				1
151	491354				16
152	491355				16
153	491356				
154	491357				
155	491358				9, 17
156	491359				16
157	491360				16
158	491362				7
159	491363				3, 7
160	491364				7
161	491365				14, 16
162	491366				3, 5, 7
163	491367				
164	500815				4
165	500826				5
166	500828				
167	534552				10
168	534553				2
169	534556				10
170	831832				1, 10

6.

BN	(cm)	(cm)	(cm)	(mm)	BN	(cm)	(cm)	(cm)	(mm)	
FR-King	9.0	2.6	2.9	3.24	55	8.8	2.5	3.5	2.85	
	8.6	2.6	2.3	3.08	66	8.1	2.7	3.3	2.73	
	1	8.6	2.5	3.0	3.00	67	8.9	2.6	3.8	3.00
	2	10.2	2.5	3.7	3.25	68	8.6	2.7	3.2	2.75
	3	6.6	1.6	2.2	3.76	74	9.9	2.9	4.2	3.05
	4	9.2	2.6	2.9	3.73	75	10.8	3.2	4.6	3.40
	5	11.6	2.9	5.7	3.72	81	9.5	3.0	4.1	3.05
	7	7.7	2.0	2.1	2.95	90	8.7	2.5	3.2	2.83
	8	7.6	2.1	2.0	2.36	95	10.0	2.6	3.0	3.37
	10	13.3	2.6	4.4	2.64	104	10.2	2.9	4.0	3.34
	11	8.2	2.2	2.5	2.54	106	9.2	3.1	4.1	3.26
	12	9.8	2.8	3.9	3.23	108	9.4	2.8	3.8	3.28
	15	8.2	2.5	2.5	2.78	109	10.1	2.7	3.6	3.35
	16	7.8	2.3	2.3	3.14	128	10.2	2.8	3.9	3.19
	17	9.6	2.7	2.7	3.39	130	8.8	2.6	2.7	2.67
	18	9.7	2.9	3.6	3.08	133	9.0	2.5	2.9	2.98
	19	8.6	2.4	2.9	3.09	135	8.8	2.7	2.9	3.09
	21	9.8	2.8	3.9	3.27	147	10.1	3.1	4.1	3.04
	24	2.1	2.3	2.5	3.41	149	11.6	3.1	4.1	3.56
	25	8.6	2.5	2.6	2.90	152	9.6	2.9	3.9	3.45
	27	8.9	2.7	2.9	2.91	164	10.3	2.7	3.8	3.44
	29	10.0	2.9	4.3	3.32	165	8.5	2.4	2.8	3.00
	32	8.4	2.4	2.4	2.79	168	10.0	2.8	4.1	3.67
	33	7.8	2.1	2.2	2.62	169	7.8	2.1	3.0	2.54
	37	9.3	2.4	3.0	3.22	170	10.0	2.3	2.5	2.65
	39	9.1	2.7	2.8	3.24	171	8.3	2.4	2.9	2.39
	40	9.0	2.5	2.8	2.90	172	8.2	2.3	2.1	2.62
	42	10.2	3.0	3.3	3.57	173	9.3	2.5	2.4	2.98
	43	9.7	2.9	3.4	3.33	174	9.1	2.3	2.5	2.56
	44	8.1	2.3	2.6	2.69	175	10.3	2.7	3.4	3.09
	45	7.4	2.2	2.4	2.45	176	8.2	2.3	2.2	2.39
46	9.9	2.5	3.0	2.88	177	10.0	2.7	2.9	3.25	
50	10.7	2.9	3.6	3.27	178	8.8	2.3	2.5	3.21	
51-1	10.4	3.0	3.9	3.27	179	9.8	2.6	2.8	2.73	
51-2	8.5	2.6	3.4	2.84	180	7.7	2.1	1.9	2.31	
54	9.4	2.7	3.7	3.16	181	9.4	2.4	3.0	2.52	

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ATCC-38363 ( )

$10^3$ ,  $10^4$ ,  $10^5$   $10^6$  spores · mL<sup>-1</sup>

$10^5$  spores · mL<sup>-1</sup>

( 7).

$10^5$  spores · mL<sup>-1</sup>

7.

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(spores · mL <sup>-1</sup> )			(%)
Control	100	0	0
$1 \times 10^3$	100	2	2
$1 \times 10^4$	100	15	15
$1 \times 10^5$	100	75	75
$1 \times 10^6$	100	90	90

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: FR Dantos).

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Dantos ( 3)

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8.

BN No.								(%)	
		1	2	3	1	2	3		
1	PTN	32	32	32	31	31	27	92.7	
2	FR CB	32	32	32	26	32	31	93.1	
3		30	31	32	30	29	30	95.8	
4	FRD	32	32	31	32	30	30	96.9	
5	FR STP	17	9	12	16	9	12	98.0	
7	FR T	-	-	-	-	-	-	-	
8	A	31	26	24	30	26	22	95.8	
9	B	32	31	32	31	29	30	94.7	
10	FR DT	31	30	32	11	25	17	57.3	
11		30	29	31	30	27	27	93.4	
12	PW F <sub>1</sub>	31	28	31	31	28	31	100.0	
14		17	24	21	14	22	19	88.2	
15		-	-	-	-	-	-	-	
16	F <sub>2</sub>	24	26	25	18	25	24	89.1	
17		29	23	25	27	22	21	90.9	
18		32	32	32	22	31	26	82.3	
19	FR 100	15	17	18	15	16	17	96.2	
20	FR	13	21	18	12	18	17	92.7	

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9.

BN									
				1*	2	3	4	5	
1	500818	500818-3	32	2	1	7	8	14	4.03
5	"	477671-3	22	2	10	2	4	7	3.27
6	"	477671-5	15	2	6	4	2	3	3.11
8	"	970-5	32	1	7	4	8	11	3.59
9	358054	358054-5	31	2	8	3	1	30	5.00
10	500823	500823-1	19	2	9	3	3	6	3.21
11	"	500823-2	30		2	4	5	14	3.67
12	500820	500820-2	32	2	7	1	2	19	4.16
13	269508	269508-1	30	1	10	2	3	29	4.93
14	"	269508-2	32	3	6	3	3	28	4.81
15	"	269508-4	30	5	3	4	1	30	5.00
16	500819	500819-2	30		7	2	3	17	4.00
17	"	500819-4	22		2	2	4	5	3.14
18		\$-3	32		5	3	4	29	4.84
19	9458	9458-1	30		10	5	3	25	4.77
20	500814	500814-1	30			4	3	15	3.80
21	"	500814-2	24			1	4	12	3.92
22	"	500814-3	26			4	6	10	3.46
23	"	500814-4	25			4		24	4.92
24	"	500814-5	28			7		18	4.25
26			20					4	3.05
27			32					4	2.81

\* 1( ) 5( )

10.

BN No.												
					1	2	3	4	5			
1	18-1	202-2	100	48		2	3	5	38	4.65		
2	022-2	203-4	100	48	1		5	4	38	4.63	1	
3	04-4	205-3	50	40	1	2	7	9	21	4.18		
4	005-1	206-2	100	48	1	3	2	6	36	4.52	1	
7	14-1	211-2	100	48		1	4	6	37	4.65		
8	08-1	212-1	100	48		3	4	5	36	4.54		
9	20-3	213-3	100	48		1		7	40	4.79		
10	07-5	214-2	100	29	1	1	2	3	22	4.52		
11	006-1	215-3	100	36	2	5	6	7	16	3.63	1	
12	10-1	216-5	100	32		1	1	2	28	4.78		
13	016-1	217-3	100	46			1	5	40	4.87		
14	35-3	218-2	100	48		4	3	2	40	4.68		
15	037-1	219-2	100	24			3	1	20	4.71		
16	39-2	220-8	100	48			1		47	4.95		
18	25-4	223-2	100	23					23	5		
19	40-2	224-4	100	48	1	1	3	4	39	4.64		
20	41-4	225-3	100	32				1	31	4.96		
21	27-2	226-5	100	48	1	2	8	4	33	4.33		
22	36-1	227-2	100	48		2	1	5	40	4.72		
23	26-1	228-1	100	48		5	5	11	27	4.25		
24	33-3	229-3	100	43	1		1	1	40	4.83		
25	30	231-5	80	40	3	4	5	4	24	4.05	2	
26	32	232-2	100	48	2	3	2	8	33	4.39	1	
27	031-1	233-4	100	48	1		1	4	42	4.79	1	
28	078	238-3	100	48					48	5		
30	072-1	240-3	100	47	1	1	3	4	38	4.63	1	
32	073	242-1	100	48					48	5		
33	075-1	243-2	100	8					8	5		
34	93-4	246-	100	30	1	2	2	4	21	4.40		
35	90-5	248-3	100	48	1	2	5	8	32	4.41		
36	81-2	249-3	100	48	11	16	9	5	7	2.60	2	
37	80-1	250-1	100	48				3	45	4.93		
38	86-4	251-2	100	48		2	3	7	36	4.60		
40	083-1	253-2	100	48	1	14	9	7	17	3.52	1	
41	082-3	254-2	100	48	8	22	7	7	4	2.52	2	
42	084-3	255-3	100	48	4	17	6	9	12	3.16	2	
43	85-5	256-4	100	48	8	18	9	6	12	3.22	3	
44	88-2	257-2	100	48	6	11	10	9	12	3.20		
45	89-1	258-1	100	48	5	7	10	7	19	3.58	2	
46	170463	260-3	100	48				1	47	4.98		
47	194994	264-1	100	38				1	37	4.97		
53	288497	284-2	100	48		1		4	43	4.85		
55	358044	287-5	100	48			2		46	4.91		

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BN No.												
					1	2	3	4	5			
56	358051	288-5	100	42		1	4		38	4.85		
57	358053	289-10	100	48			1	2	45	4.91		
58	358056	290-9	100	48	1				47	4.91	1	
59	358045	291-4	100	48					48	5		
60	358046	292-4	100	48					48	5		
61	358048	293-4	100	48					48	5		
62	358049	294-5	100	48			1	1	46	4.93		
63	358050	295-4	100	28				1	27	4.96		
64	358059	297-6	100	48			1	1	46	4.93		
66	368639	299-5	100									
67	370474	300-1	100	48					48	5		
68	370477	301-2	100	48		1	2	2	43	4.81		
69	370478	302-5	100	48			1	2	43	4.70		
72	379366	304-7	100									
73	379367	305-5	100	32				1	31	4.96		
74	381822	306-1	100									
75	381822	306-2	100	43		3	4	6	30	4.46		
76	381823	307-5	100	48			1	6	41	4.83		
77	381825	308-2	100	12				2	10	4.83		
78	381825	308-4	100	17			1	2	14	4.76		
79	497671	3-2	100	28		1	6	6	15	4.25		
80	497671	4-1	100	48	4	20	10	5	9	2.89	2	
81	497671	5-5	100	48		4	3	5	36	4.52		
82	497671	6-1	100									
84	970	8-2	100	48		1	3	7	37	4.67		
85	970	8-3	100	48			2	4	42	4.83		
86	358054	9-8	100	48					48	5		
88	500823	10-5	100	19	3	4	2	4	5	3.05		
89	500823	11-1	100	48	5	5	5	10	23	3.85		
91	500823	11-6	100	48		6	6	7	29	4.22		
92	500820	12-1	100									
94	269508	13-6	100	48				3	45	4.93		
96	269508	13-10	100	48		2	1	2	43	4.79		
97	269508	15-9	100	48				2	46	4.95		
98	269508	15-20	100	48		1		4	43	4.85		
99	500819	17-4	100	48	3	19	8	9	9	3.04		
100	500819	17-5	100									
101	*****	18-1	100	24			1	4	19	4.75		
102	9548	19-2	100	48				3	45	4.93		
105	9548	19-7	100	48				1	47	4.97		
106	500814	24-1	100	28	1	7	7	2	11	3.53		
107	500814	24-5	100									
108	500814	24-6	100	23	2	7	3	6	5	3.21		

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가 가 가

$10^3 \text{ spores} \cdot \text{mL}^{-1} - 2.8 \times 10^6$

$\text{spores} \cdot \text{mL}^{-1}$

( 4).

가

,  $10^6 \text{ spores} \cdot$

$\text{mL}^{-1}$

$10^6 \text{ spores} \cdot \text{mL}^{-1}$

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( 11, 12, 13)

( 5),

F<sub>1</sub>



4.



5.

11.

(1 ).

BN No.										
			1	2	3	4	5			
1	269505	23					23	5.0		
2	269506	25					25	5.0		
3	269507	7					7	5.0		
4	271354	20					20	5.0		
5	287533	25					25	5.0		
7	288503	16					16	5.0		
8	288504	6					6	5.0		
10	368635	22					22	5.0		
11	368638	22					22	5.0		
12	368640	25					25	5.0		
15	381826	18					18	5.0		
16	381827	8					8	5.0		
17	381828	24					24	5.0		
18	381829	23					23	5.0		
19	381830	21					21	5.0		
21	381833	21					21	5.0		
24	381836	22					22	5.0		
25	381837	23					23	5.0		
27	381839	22					22	5.0		
29	381842	25					25	5.0		
32	381845	25					25	5.0		
33	381836	25					25	5.0		
37	381850	17					17	5.0		
39	381852	20					20	5.0		
40	381853	22					22	5.0		
42	391602	25					25	5.0		
43	406857	25					25	5.0		
44	419089	25					25	5.0		
45	419090	25					25	5.0		
46	419215	25					25	5.0		
50	438844	24					24	5.0		
51- 1	438845	25			3	4	18	4.68		
51- 2	438845	25					25	5.0		
54	435291	24					24	5.0		
55	442368	24					24	5.0		
66	491269	25					25	5.0		

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BN No.			*							
			1	2	3	4	5			
67	491270	13				1	12	4.92		
68	491271	17			1	2	14	4.76		
74	491277	25		8		3	14	3.92	2	
75	491278	25					25	5.0		
81	491284	25		1	1	4	19	4.64		
90	491293	25			1		24	4.92		
95	491298	24					24	5.0		
104	491307	25					25	5.0		
106	491309	22					22	5.0		
108	491311	24					24	5.0		
109	491312	21					21	5.0		
123	491326	21		2	2		17	4.52		
130	491333	24	3	8	8		5	2.83	2	
133	491336	18					18	5.0		
135	491388	25		11	9	5		2.76	2	
147	491350	24		20			4	2.67	2	
149	491352	20		3	10		7	3.55	2	
152	491355	25		2	2	2	19	4.52		
164	500815	25		6	7		12	3.72		
165	500826	18			1	1	16	4.83		
168	534553	25					25	5.0		
169	534556	3					3	5.0		
200	FR King	25					25	5.0		
201		20					20	5.0		
170	403 x 406	25					25	5.0		
171	403 x 410	25					25	5.0		
172	403 x 421	25					25	5.0		
173	403 x 431	25					25	5.0		
174	410 x 401	25					25	5.0		
175	410 x 406	25					25	5.0		
176	410 x 421	24					24	5.0		
177	410 x 431	25					25	5.0		
178	431 x 401	25					25	5.0		
179	431 x 403	25					25	5.0		
180	431 x 406	25					25	5.0		
181	431 x 410	25					25	5.0		

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12.

(2 ).

BN No.											
			1	2	3	4	5				
1	P-4	4				4		4.00			
2	LHD5	5				1	4	4.80			
6	288499	11					11	5.00			
9	358657	17					17	5.00			
20	381831	11					11	5.00			
23	381835	6					6	5.00			
31	381844	19					19	5.00			
34	381847	18					18	5.00			
35	381848	10					10	5.00			
41	381854	15					15	5.00			
49	432342	21					21	5.00			
51	438845	13	2				11	4.38	2		
51-1	438845	23	4				19	4.30	4		
62	491252	14					14	5.00			
68	491271	14	10				4	2.14	10		
70	491273	13	1				12	4.69	1		
74	491277	23	11				12	3.07	11		
81	491284	11	5				6	3.18	5		
84	491287	23	12				11	2.91	12		
98	491301	20					20	5.00			
120	491323	24					24	5.00			
128	491331	15	3				12	4.20	3		
130	491333	23	14				7	2.13	14		
131	491334	18	6				12	3.67	6		
135	491338	21	21					1.00	21		
136	491339	12	9				3	2.00	9		
147	491350	23	18				5	1.87	18		
149	491352	14	11				3	1.86	11		
152	491355	21	4				17	4.24	4		
164	500815	12	12					1.00	12		
167		46					46	5.00			
168		45					45	5.00			
169		46					46	5.00			



13.

(3 ).

BN No.					
1	438845	51- 1	31	1.78	
2	438845	51- 2	28	1.81	
3	491270	67	7	2.43	
4	491271	68- 1	12	2.33	
5	491271	68- 2	7	2.47	
6	491271	68- 3	18	2.34	
7	491277	74- 1	42	1.48	
8	491277	74- 2	9	1.29	
9	491277	74- 3	29	1.10	
10	491287	84	19	1.00	
12	491331	128	4	1.10	
13	491333	130- 1	40	2.08	
15	491333	130- 3	7	1.46	
16	491333	130- 4	0	1.00	
17	491333	130- 5	31	2.08	
18	491334	131- 1	16	2.68	
19	491334	131- 2	17	3.63	
20	491338	135- 1	41	1.79	
21	491338	135- 2	4	1.10	
22	491338	135- 3	50	1.98	
23	491338	135- 4	36	1.86	
24	491338	135- 5	11	1.15	
25	491338	135- 6	29	2.72	
26	491338	135- 7	23	2.09	
27	491350	147- 1	9	1.57	
28	491350	147- 2	50	1.76	
29	491350	147- 3	33	3.67	
30	491355	152	32	2.32	
31	500815	164	19	1.86	
35	× 135		44	3.30	
37	× 164		36	2.69	
38	165 × 135		46	2.58	
39	166 × 135		48	3.04	
40	431 × 135		34	5.00	
41	166 × 164		50	3.06	
42	167 × 135		49	2.41	
43			41	5.00	

)

(1) CGMMV

CGMMV CGMMV  
 carborundum (400 mesh) CGMMV  
 CGMMV  
 1 virus  
 , ELISA CGMMV  
 (2) :

ELISA

가

RT-PCR

(High Density Latex Particle Agglutination Test; HDLPAT)

CGMMV

- 10% latex 0.067 M (pH 7.2) 0.5%
- 0.5% latex 10-20  $\mu\text{g} \cdot \text{mL}^{-1}$  IgG 1  
( 600 strokes).
- 2,800  $\times g$  10
- 1% bovine serum albumin PBS 1  
( 600 strokes).
- PBS 2 (2,800  $\times g$  10 )
- 0.05% sodium azide PBS 4 ,  
0.1% 가



15.

				7
	( )		( )	490921- *****
		2 1197 - 4		
		( )		(0331) 213-4321
			( )	
		<i>Lagenaria siceraria</i> STANDL.		
			( )	
⑩			( )	
⑪			( )	
	138	3	111	1
			1999	12
				( )
1.	.		1	
2.				
3.		1	(	
	)			
4.		1	(	)

16.

				7
	( )		( )	490921- *****
		2 1197 - 4		(0331) 213-4321
			( )	
		<i>Lagenaria siceraria</i> STANDL.		
			( )	
⑩			( )	
⑪			( )	
	138 3		111 1	
		1999	12	( )
1.	.		1	
2.				
3.		1 (		
	)			
4.		1 (	)	

### 3

#### 1.

가 ( 30 80% )  
가  
가가 가  
가 가  
가 가  
( , 1994; Taylor , 1992; Basra, 1995).  
가  
가  
(Eldestein, 1995).  
가  
(Chase, 1994; Basra, 1995).  
가  
가  
(Nakayama, 1976; Kozlowski, 1979).

45 (Homes, 1953; Welbaum  
 Bradford, 1989). 40 75  
 (森本, 1978; 鶴見, 1978; , 1995)

(Bewly Black, 1985).

25 가 (Suzuki ,  
 1959; , 1978).

8 9

CGMMV

가.

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 .  
 .  
 .

2.

1996 ( )  
30 28  
2 1996 4 20 50  
23 , 25 ,  
25 , 15  
5 15  
7  
1 4  
( ) 40 10 90 6  
脫種 脫種 ,  
脫種  
20 5 28 暗狀態  
14 , 36% (RH)

가.

( ) 40 10  
90 6 가



가 ( 6). 脫種  
 17 . , 40  
 50 0.3%, 60 1.3%, 90 36.7%  
 가 가

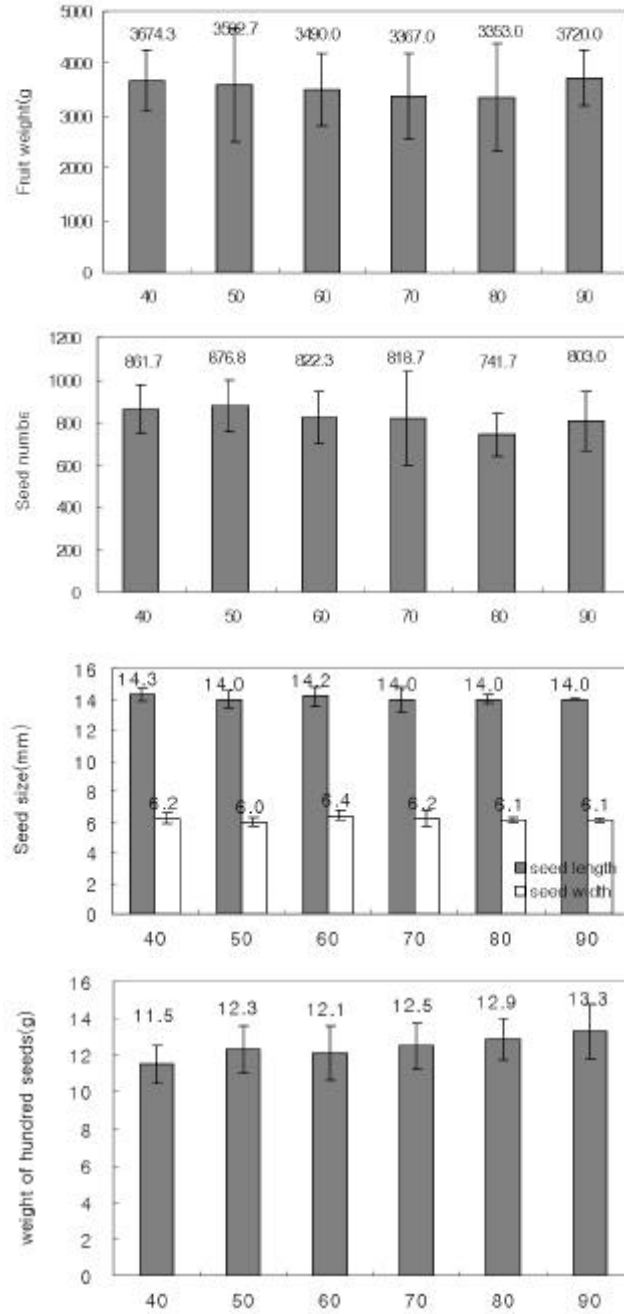
가 .

17. ‘ ’ .

DAP	(g)			
		4	7	
40 <sup>z</sup>	3933.3	861.3	0.0 b <sup>y</sup>	0.0 b
50	3592.0	862.0	0.0 b	0.3 b
60	3490.0	897.0	0.0 b	1.3 b
70	3167.0	919.0	0.7 b	2.7 b
80	3353.0	742.0	4.7 b	8.7 b
90	3720.0	936.0	23.0 a	36.7 a
DMRT	ns	ns	*	**

<sup>z</sup> DAP : Days after pollination.

<sup>y</sup> DMRT



6. ‘ , ( ± ).

3.

가.

1996 . . . . . ( )  
 ( ) 50 10 80 4  
 10 , 20, 30, 40 4 .  
 20  
 5 28 .  
 ,  
 (果齡) 50 10 80 4  
 10 , 20, 30, 40 4 ,  
 가 가 가 ( 18, 19,  
 7).

18.

	0	10	20	30	40	Mean
50	0.3	4.0	31.7	42.8	32.7	14.4 b
60	1.7	1.0	10.0	49.7	65.7	15.2 b
70	2.7	11.3	16.3	45.7	43.8	13.1 b
80	8.7	26.0	33.8	77.3	69.0	30.9 a
Mean	1.1 b <sup>z</sup>	8.2 b	11.3 b	33.7 a	37.9 a	

<sup>z</sup> Mean separation within a column and a row by Duncan's multiple range test, 5% level

19.

	0	10	20	30	40	Mean
50	0.3	4.0	31.7	42.8	32.7	25.2 b
60	1.7	1.0	10.0	49.7	65.7	23.9 b
70	2.7	11.3	16.3	45.7	43.8	21.0 b
80	8.7	26.0	33.8	77.3	69.0	40.4 a
Mean	2.9 c <sup>z</sup>	9.5 c	23.8 b	49.2 a	53.1 a	

<sup>z</sup> Mean separation within a column and a row by Duncan's multiple range test, 5% level.

7

30

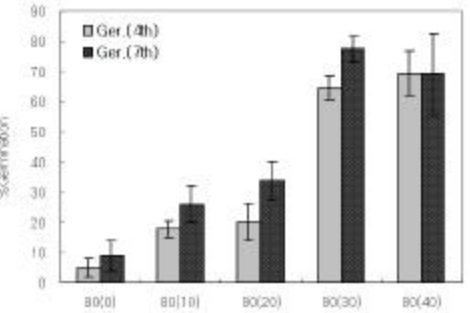
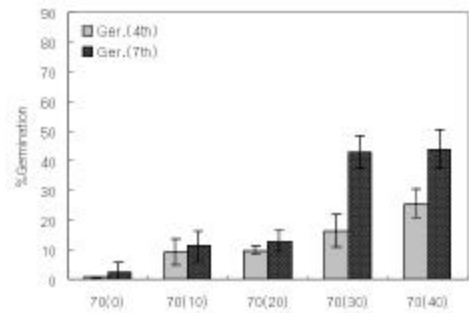
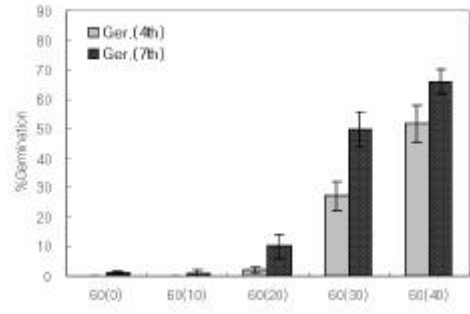
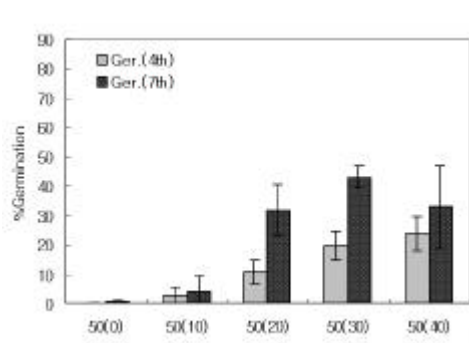
가

( 20).

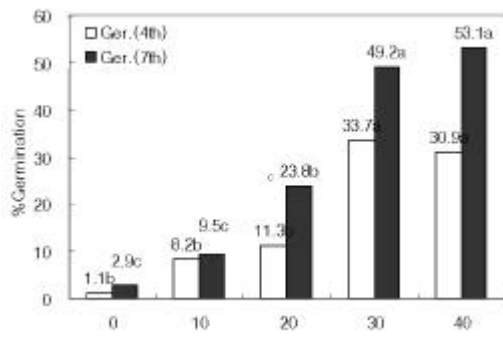
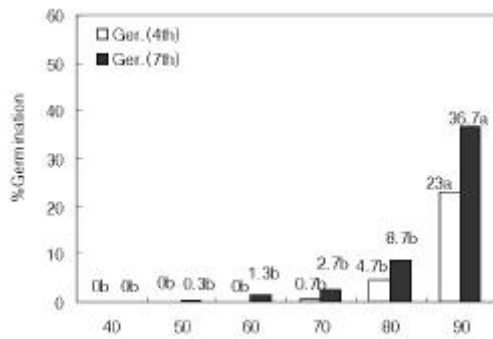
가

가

가



7. ‘ ’



8. 가 ‘ ’

20.

% Germination	Factor	SS (%)	df	F
4	×	1188.39 (22.34)	3	7.22 ***
		3833.63 (72.07)	4	23.30 ***
		297.05 (5.58)	12	1.81 <sup>ns</sup>
7	×	1252.22 (14.19)	3	4.75 ***
		7304.84 (82.80)	4	27.68 ***
		265.11 (3.01)	12	1.00 <sup>ns</sup>

1998

가

. 4

, 5

7

1

4

40

가

40

15, 25, 35

1)

, 2)

, 3)

20

(IPGRI)가

rolling paper towel

method

28 ,

20

5

4

7

T 50

T 90 (

50%

90%

가

)

35

가

가

T 50 T 90 15, 25 ( 21).  
25  
. 35

( 22).

가 ( 23).

가 가

( 25, 9).

( 24).

21. 가 ‘ ’ .

Temperature	% Germination (Day after sowing)		Germination Speed	
	4th	7th	T 50 (days)	T 90 (days)
Control <sup>z</sup>	0.0 c <sup>y</sup>	12.0 c	9.36 a	13.98 a
15	81.0 b	90.0 b	2.56 b	6.43 b
25	86.0 b	88.0 b	2.49 b	5.54 b
35	97.0 a	98.0 a	1.51 c	2.27 c
F value	139.36**	86.54**	165.59**	22.46**

<sup>z</sup> Control : Non after-ripened seeds were extracted from 40-DAP fruits.

<sup>y</sup> Mean separation within columns by Duncan's multiple range test, 5% level.

22.

가 ‘ ’

Temperature	% Germination (Day after sowing)		Germination Speed	
	4th	7th	T 50 (days)	T 90 (days)
Control <sup>z</sup>	0.0 c <sup>y</sup>	12.0 c	9.36 a	13.98 b
15	35.0 b	41.0 b	7.52 b	36.80 a
25	68.0 a	69.0 a	3.18 c	12.06 b
35	0.0 c	0.0 d	.	.
F value	307.92**	154.84**	55.61**	43.49**

<sup>z</sup> Control : Non after-ripened seeds were extracted from 40-DAP fruits.

<sup>y</sup> Mean separation within columns by Duncan's multiple range test, 5% level

23.

가 ‘ ’

Temperature	% Germination (Day after sowing)		Germination Speed	
	4th	7th	T 50 (days)	T 90 (days)
Control <sup>z</sup>	0.0 b <sup>y</sup>	12.0 b	9.36 a	13.98 a
15	51.0 a	70.0 a	4.82 b	9.74 b
25	50.0 a	59.0 a	5.22 b	12.48 ab
35	37.0 a	66.0 a	5.32 b	9.47 b
F value	35.96**	35.82**	27.31**	3.72*

<sup>z</sup> Control : Non after-ripened seeds were extracted from 40 DAP fruits.

<sup>y</sup> Mean separation within columns by Duncan's multiple range test, 5% level.



24. 가 ‘ ’

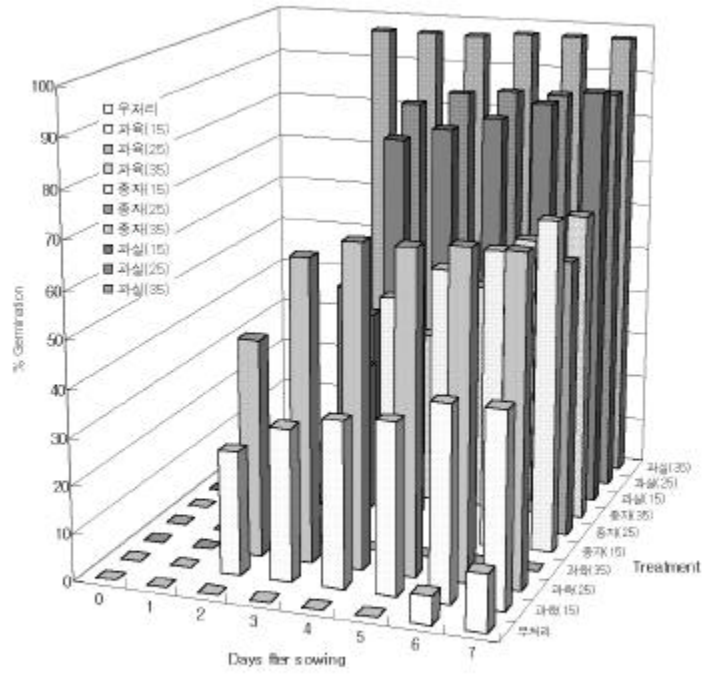
Germination	Factor	df	SS (%)	F
% Germination (7 )	Method	2	14790.17	183.68**
	Temperature	2	1237.12	15.36**
	Method × Temperature	4	8037.78	49.91**
T 50	Method	2	86.12	97.72**
	Temperature	2	14.16	16.07**
	Method × Temperature	4	36.97	27.97**
T 90	Method	2	2363.67	130.85**
	Temperature	2	484.568	26.83**
	Method × Temperature	4	1121.72	41.40**

25. ‘ ’

Treatment	% Germination (Day after sowing)		Germination Speed	
	4th	7th	T 50 (hr)	T 90 (hr)
Control <sup>z</sup>	0.0 c <sup>y</sup>	12.0 c	9.36 a	13.98 b
Fruit	88.0 a	92.0 a	2.19 c	4.75 c
Flesh	34.3 b	36.7 c	5.35 b	24.43 a
Seed	46.0 b	15.72 b	5.12 b	10.56 bc
F value	33.43**	28.47**	40.61**	16.71**

<sup>z</sup> Control : Non after-ripened seeds were extracted from 40-DAP fruits.

<sup>y</sup> Mean separation within columns by Duncan's multiple range test, 5% level.



9. ‘ ’

4.

가.

1996

4 , 5

7 1 4

70

8-10

20 30

28 , 4 20 5

7

30 가

가

70 20 30 20

30 26

가

26.

Treatment (day/method)	% Germination	
	4th	7th
	0.7 b <sup>z</sup>	2.7 b
20/	1.7 b	8.7 b
20/	27.3 b	68.3 a
30/	15.0 b	32.0 ab
30/	65.0 a	69.3 a
DMRT	**	**

<sup>z</sup> Mean separation within columns by Duncan's multiple range test, 5% level.

1999

가

. 4 , 5

7 1 4 가 40

8 10  
3, 6, 9 ( : )  
1 : 7.5 (v/v) ( 10-A).  
( 10-B)

towel method (IPGRI)가 rolling paper  
28 , 20 5  
4 , 7

9 가 ( 27).

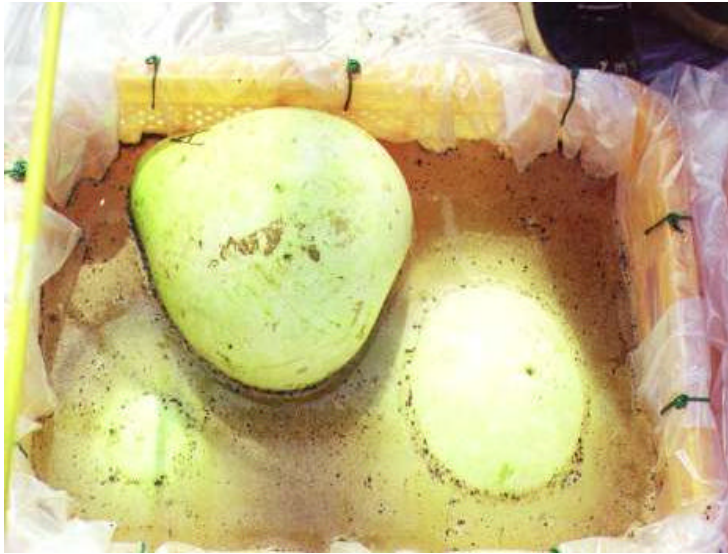
가 가 .

( 11).

9

( 28).

( 29, 30).



(A)



(B)

10.

27.

	+	Embryo	ratio	Germination (%)		
				(g)	ratio (%)	(%)
	0.061	45.60	54.40	0.0	0.7	5.0
3	0.064	45.59	54.41	0.0	0.0	1.5
6	0.066	46.88	53.12	0.0	1.7	9.0
9	0.067	48.97	51.03	0.0	4.7	8.7
3	0.061	43.35	56.65	0.0	0.0	17.0
3	0.062	47.15	52.85	7.0	15.5	29.0
3	0.068	50.72	49.28	11.0	18.0	32.0
3	0.063	43.35	56.65	0.0	0.0	5.0
6	0.067	49.16	50.84	1.3	7.0	21.3
9	0.067	49.30	50.70	40.0	53.0	65.0
F value	1.80 <sup>ns</sup>	5.33 <sup>**</sup>	5.33 <sup>**</sup>	15.91 <sup>**</sup>	19.96 <sup>**</sup>	23.82 <sup>**</sup>

<sup>z</sup> Mean separation within columns by Duncan's multiple range test, 5% level.

28.

	+	Embryo	ratio (%)	% Germination		
				(g)	ratio (%)	(%)
	0.042	48.72	51.27	3.0	5.0	33.0
3	0.043	48.80	51.20	83.0	86.0	92.0
6	0.061	49.39	50.64	72.0	79.0	78.0
9	0.066	49.49	50.51	81.0	88.0	91.0
3	0.048	52.55	47.45	23.0	37.0	51.0
3	0.048	49.87	50.13	81.0	85.0	85.0
3	0.056	53.32	46.68	54.0	68.0	78.0
3	0.041	50.65	49.35	63.0	75.0	85.0
6	0.043	50.15	49.85	67.0	76.0	91.0
9	0.041	53.53	46.47	48.0	66.0	66.0
F value	46.18 <sup>**</sup>	3.74 <sup>**</sup>	3.74 <sup>**</sup>	34.43 <sup>**</sup>	47.44 <sup>**</sup>	20.81 <sup>**</sup>

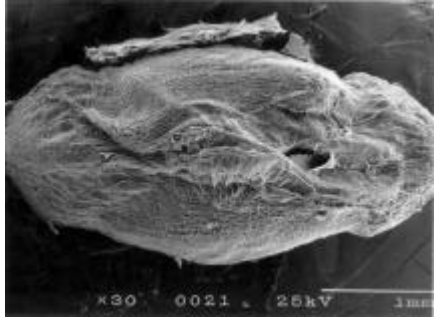
<sup>z</sup> Mean separation within columns by Duncan's multiple range test, 5% level.

29. ‘ ’

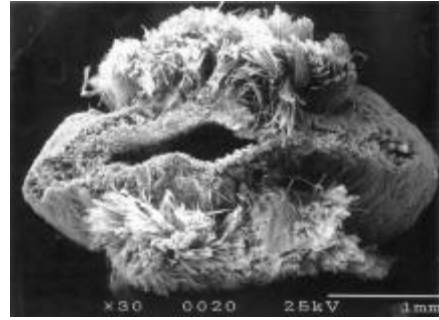
% Germination	Fator	DF	SS (%)	F
4th		2	3822.7 (33.0)	19.80**
		2	3057.8 (26.4)	15.84**
7th	×	4	4716.1 (40.6)	12.22**
		2	4904.2 (24.6)	18.70**
	×	2	9105.0 (45.6)	34.71**
		4	5944.4 (29.8)	11.33**

30. ‘ ’

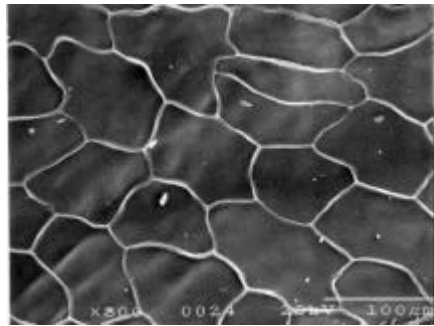
% Germination	Fator	DF	SS (%)	F
4th		2	2173.0 (34.8)	21.58**
		2	1505.2 (24.2)	14.95**
7th	×	4	2552.2 (41.0)	12.67**
		2	1607.5 (36.4)	21.41**
	×	2	848.6 (19.2)	11.30**
		4	1958.7 (44.4)	13.04**



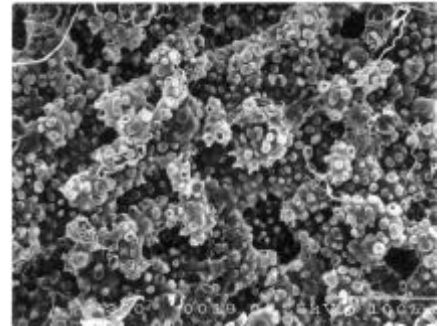
( )



( )



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( )

8.

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5.

'97      '99      '98  
(AVRDC)

60

'97      '99

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,      ,      ,

12    13    1997      1999      3

60      (    40    )

20      (      8

),

3

97    98

98

99

가    97

가

97    가      98

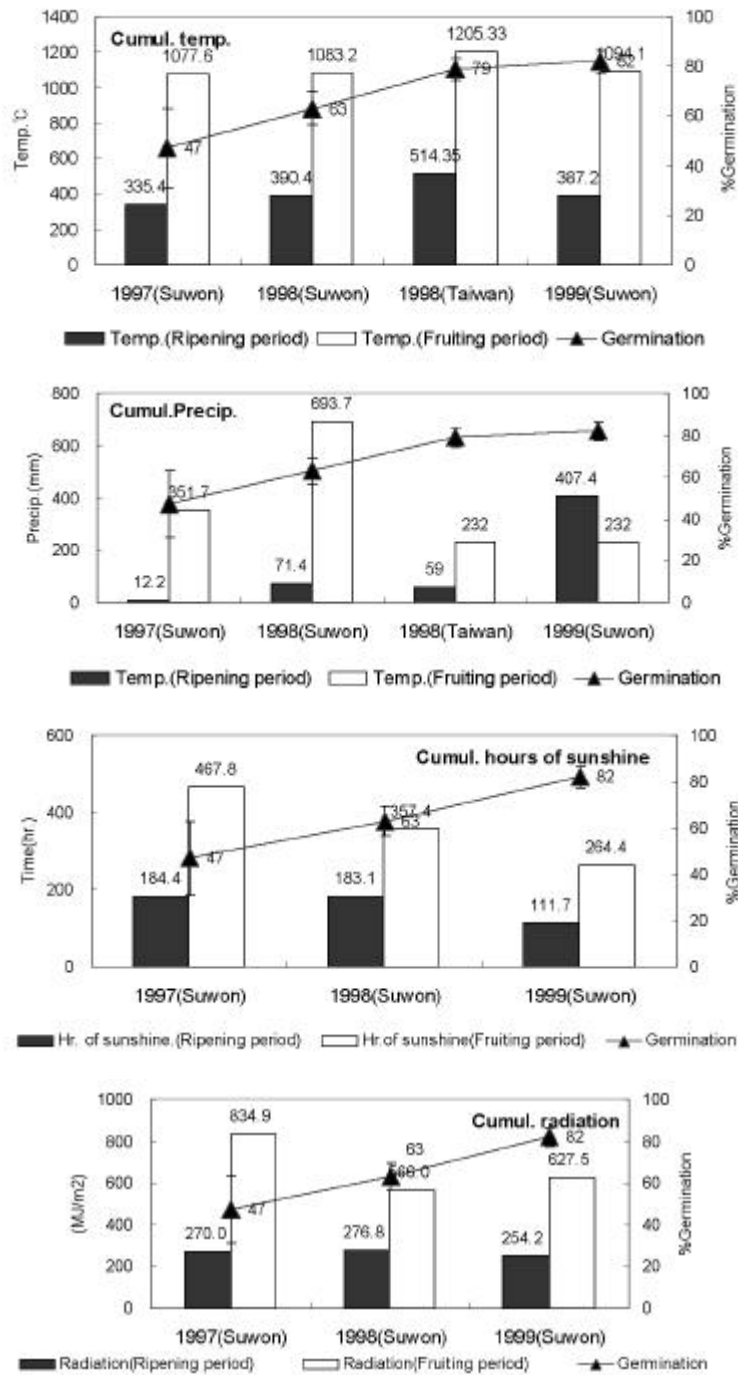
가

97    가 98    99

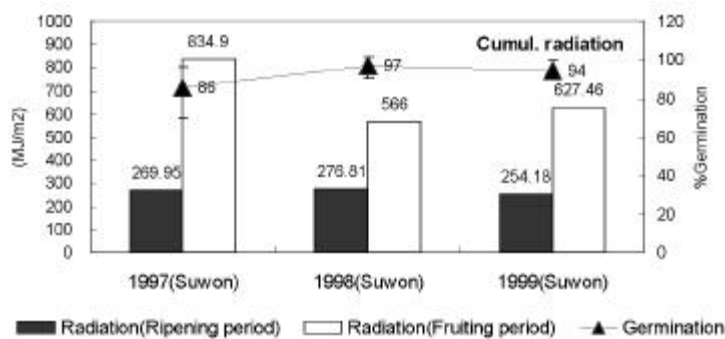
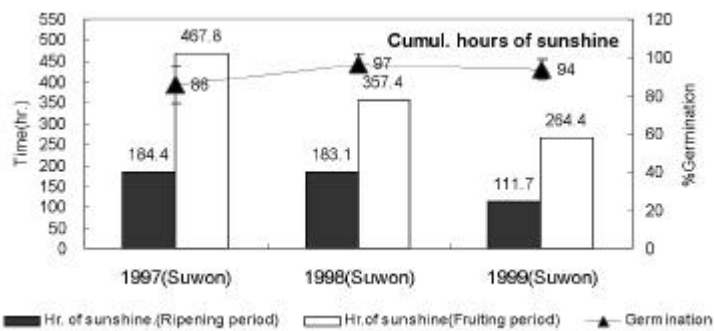
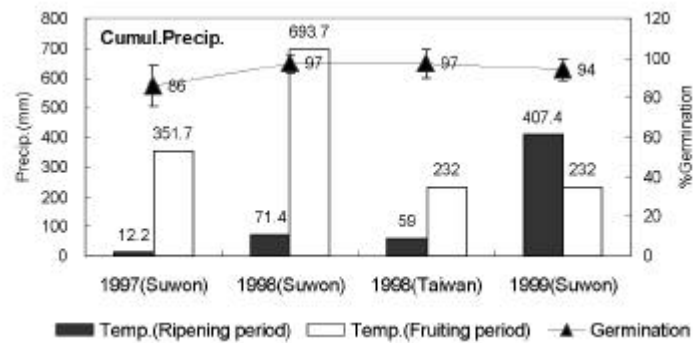
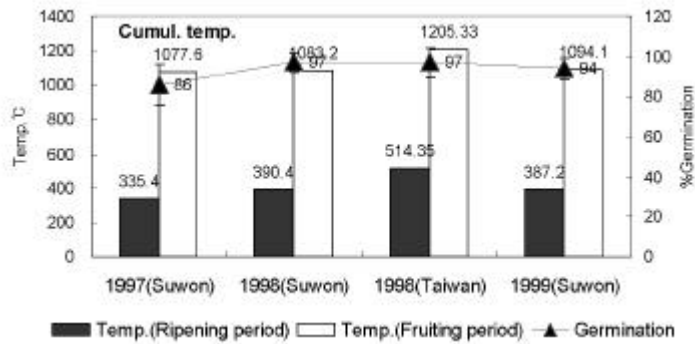
31  
 가  
 12.2 , 12.5  
 69 200  
 mm

31.

	( )				(hrs)	(mm)	(%)
May	17.6	24.0	11.9	12.1	243.5	26.5	70
	16.5	23.4	10.9	12.5	269.3	20.0	66
	17.2	23.4	10.9	12.5	227.3	58.0	60
June	22.3	26.9	18.9	8.0	119.0	286.4	81
	21.1	25.3	18.2	7.1	95.5	179.2	82
	20.9	24.7	17.8	6.9	97.4	316.5	71
July	25.1	29.7	21.5	8.2	158.0	241.1	80
	24.3	28.5	21.2	7.3	169.3	152.8	82
	24.1	28.3	20.7	7.6	169.8	161.0	64
Aug.	26.5	31.0	23.0	8.0	179.0	77.5	78
	25.7	31.0	22.2	8.8	199.3	74.1	77
	25.9	30.7	21.8	8.9	204.2	120.5	57
Sep.	21.7	27.9	16.8	11.1	227.1	9.2	74
	20.6	27.5	15.5	12.0	240.2	6.4	75
	21.2	27.6	15.6	12.0	192.6	35.5	61
Oct.	14.0	20.3	8.8	11.5	181.8	70.0	73
	13.8	20.5	8.5	12.0	189.8	92.2	73
	15.6	22.1	9.2	12.9	208.2	52.0	62
Mean	21.2	26.6	16.8	9.8	1,108.4	710.7	76
	20.3	26.0	16.0	10.0	1,163.4	524.9	76
	20.8	26.1	16.0	10.1	1,099.5	743.5	63



12. ' , 1997 - 1999



13. ‘ ’

1997 - 1999

6.

가

가.

가

30 ± 2

1997

( 32-37 Plate 2 ).

50

30

가

3

35

3

6-8%

silica gel

blue

1998

가

72

24 3

21

가

가  
가

가 가

가 가

seed lot

60

가

3

data

F<sub>1</sub>

F<sub>2</sub>

가

가

가

5

F<sub>2</sub>

(5-10 )

F<sub>2</sub>

bulk

( Plate 2 )

F<sub>1</sub>

32

가 9% 17%  
( 33).

가 (%)  
( 34, 36).

( 35) 가 (HL) (HD)  
HL/HD 가  
(CL) (CW) 가

CL/CW 1.70  
1.78 5% 8

, 6  
( 36).

가

가 가 가 가

가

32. F1

No.											No.		No.		
		1	2	3	4	5	6	7	8	9					
1	:												2		
2	:											3	: 435 cm : 235 cm	3	: 435 cm : 235 cm
3	:											5		5	
4	:											1		1	
5	:											1		1	
6	:											4	3.26 cm	4	3.27 cm
7	:			가								5		5	
8												4	: 0.35 cm : 0.29 cm	3	: 0.34 cm : 0.28 cm
9	:											6	: 1.45 cm : 0.73 cm	6	: 1.46 cm : 0.72 cm
10	2											1		1	
11												3		3	
12												5		5	
13												6		5	
14												4		4	
15												7		7	
16												8	97%	8	97%



33.

Cultivar or inbred line	Seed length (mm)		Seed width (mm)		SL/SW ratio		Seed thickness (mm)		Seed weight (mg)	
	Korea	Indonesia	Korea	Indonesia	Korea	Indonesia	Korea	Indonesia	Korea	Indonesia
G3-3	12.7±0.09 <sup>z</sup>	13.3±0.12	7.3±0.03	7.5±0.08	1.7	1.8	3.2±0.05	3.1±0.02	14.1	16.1
F7-2	15.1±0.14	14.8±v0.16	7.5±0.09	6.5±0.05	2.0	2.3	2.9±0.03	2.8±0.03	14.5	14.2
Mean	13.9	14.1	7.4	7.0	1.9	2.1	3.1	3.0	14.3	15.2
G3-3×F7-2	12.7±0.12	13.8±0.13	7.5±0.07	7.6±0.05	1.7	1.8	3.3±0.06	3.5±0.03	15.0	17.5
F7-2×G3-3	-	14.3±0.16	-	7.0±0.06	-	2.0	-	2.8±0.02	-	13.7
Mean	12.7	14.1	7.5	7.3	1.7	1.9	3.3	3.2	15.0	15.6
Overall mean	13.3	14.1	7.5	7.2	1.8	2.0	3.2	3.1	14.7	15.4
LHD-4	13.3±0.08	15.7±0.13	9.0±0.08	9.6±0.11	1.5	1.7	2.6±0.04	3.3±0.06	11.9	18.2
Partner-7	14.1±0.19	14.8±0.17	6.1±0.04	6.3±0.05	2.3	2.4	2.9±0.03	2.9±0.04	12.1	14.5
Mean	13.7	15.3	7.6	8.0	1.9	2.1	2.8	3.1	12.0	16.4
LHD-4×Partner-7	13.0±0.09	15.5±0.18	8.6±0.03	8.8±0.07	1.5	1.8	2.7±0.03	3.5±0.06	11.1	17.0
Partner-7×LHD-4	-	13.9±0.12	-	6.0±0.03	-	2.3	-	2.6±0.04	-	11.1
Mean	13.0	14.7	8.6	7.4	1.5	2.1	2.7	3.1	11.1	14.1
Overall mean	13.4	15.0	8.1	7.7	1.7	2.1	2.7	3.1	11.6	15.2
Total overall mean	13.3	14.5	7.8	7.4	1.7	2.0	3.0	3.1	13.1	15.3

<sup>z</sup> Mean ± standard error.

34.

Cultivar or inbred line	Hypocotyl length (cm)		Hypocotyl diameter (mm)		HL/HD ratio		Cotyledon length (cm)		Cotyledon width (cm)	
	Korea	Indonesia	Korea	Indonesia	Korea	Indonesia	Korea	Indonesia	Korea	Indonesia
G3-3	11.7±0.15 <sup>z</sup>	11.7±0.45	4.4±0.08	4.8±0.09	2.9	2.5	5.51±0.11	5.83±0.09	3.34±0.06	3.46±0.04
F7-2	11.6±0.25	11.0±0.20	4.7±0.06	4.6±0.05	2.5	2.4	5.83±0.07	5.79±0.10	3.23±0.03	3.11±0.05
G3-3×F7-2	13.0±0.13	10.7±0.27	4.7±0.06	4.4±0.06	2.8	2.5	5.69±0.09	5.65±0.08	3.36±0.04	3.51±0.04
F7-2×G3-3	-	11.9±0.32	-	4.6±0.07	-	2.6	-	5.93±0.08	-	3.48±0.04
Mean	12.10	11.52	4.60	4.60	2.73	2.53	5.76	5.80	3.31	3.39
LHD-4	13.0±0.18	12.3±0.32	4.0±0.07	4.1±0.05	3.2	3.0	5.37±0.10	6.15±0.08	3.31±0.08	3.13±0.09
Partner-7	9.7±0.17	9.1±0.11	4.6±0.13	4.2±0.10	2.2	2.2	5.60±0.09	5.53±0.26	3.19±0.06	3.08±0.08
LHD-4×Partner-7	11.0±0.26	14.6±0.27	4.0±0.04	4.6±0.06	2.8	3.2	5.23±0.14	6.07±0.08	3.23±0.04	3.21±0.04
Partner-7×LHD-4	-	11.4±0.40	-	3.9±0.04	-	2.9	-	5.29±0.05	-	2.97±0.06
Mean	11.23	11.70	4.20	4.09	2.73	2.85	5.42	5.76	3.24	3.10
Overall mean	11.67	11.61	4.40	4.35	2.65	2.67	5.59	5.78	3.28	3.25

<sup>z</sup> Mean ± standard error.

Seed production		Cultivar	Seed production year	Total seed weight (TSW) (mg /seed)	Embryo <sup>z</sup> weight (EW) (mg /embryo)	EW/ TSW (%)	Seed coat weight (SCW) (mg)	SCW/ TSW (%)	Seed length (SL) (mm)	Seed width (SW) (mm)	SL/SW ratio	Seed thickness (mm)	
area	size												
Korea	Small	G3-3	97	117.20	64.60	55.24	52.60	44.76	11.30	6.95	1.63	3.18	
		Power 10x491274- 1	97	143.10	82.90	58.02	60.20	41.98	14.22	6.82	2.09	2.65	
		NC <sup>y</sup>	94	89.40	45.40	50.79	44.00	49.21	12.00	5.70	2.11	2.43	
		Mean		116.57	64.30	54.68	52.27	45.23	12.51	6.49	1.94	2.75	
	Large	G3-3	97	144.90	79.00	54.54	65.90	45.46	12.58	7.31	1.72	3.20	
		Power 10x491274- 1	97	179.90	98.80	55.00	81.10	45.00	16.60	6.84	2.43	2.80	
		NC	94	151.00	73.20	48.51	77.80	51.49	14.90	6.82	2.19	2.73	
		Mean		158.60	83.67	52.68	74.93	47.32	14.69	6.99	2.11	2.91	
	TOTAL KOREA MEAN				137.58	73.98	53.68	63.60	46.32	13.60	6.74	2.03	2.83
	Indonesia	Small	G3-3	98	120.20	66.90	55.75	53.30	44.25	12.31	6.82	1.80	2.98
			Power 10x491274- 1	98	173.70	95.90	55.21	77.80	44.79	14.68	7.16	2.05	2.97
			NC	95	88.80	42.60	47.86	46.20	52.14	11.92	5.80	2.06	2.38
Mean				127.57	68.47	52.94	59.10	47.06	12.97	6.59	1.97	2.78	
Large		G3-3	98	150.90	77.00	51.04	74.00	48.96	13.72	7.08	1.94	3.17	
		Power 10x491274- 1	98	224.90	123.70	55.01	101.20	44.99	16.81	7.92	2.13	3.18	
		NC	95	151.10	71.70	47.49	79.40	52.51	14.75	6.92	2.14	2.69	
		Mean		175.63	90.80	51.18	84.87	48.82	15.09	7.31	2.07	3.01	
TOTAL INDONESIA MEAN				151.60	79.63	52.06	71.98	47.94	14.03	6.95	2.02	2.90	

<sup>z</sup> Embryo+cotyledon+integument.

<sup>y</sup> Nongwoo Chambak.

Seed production area	Seed size	Cultivar or line	Seed production year	Hypocotyl length (mm)	Hypocotyl diameter (mm)	Cotyledon length (mm)	Cotyledon width (mm)	First true width (mm)	First true leaf width (mm)	Seedling fresh weight (mg)	Healthy seedling percentage (%)	
Korea	Small	G3-3	97	64.47	3.76	38.27	27.33	36.53	45.27	2.33	100.00	
		P10×491274-1	97	81.33	3.80	43.40	28.20	42.53	47.07	2.61	83.33	
		NC <sup>c</sup>	94	51.33	3.42	36.73	21.00	29.33	34.80	1.43	83.33	
		Mean		65.71	3.66	39.47	25.51	36.13	42.38	2.12	88.89	
		Large	G3-3	97	80.40	3.90	43.07	26.87	41.07	48.60	2.88	100.00
			P10×491274-1	97	81.87	4.06	48.67	27.40	45.87	47.27	2.95	100.00
	NC		94	54.00	3.88	42.13	22.73	34.67	38.90	1.95	55.56	
	Mean		72.09	3.95	44.62	25.67	40.54	44.92	2.59	85.19		
	Overall mean			68.44	3.78	41.68	25.58	38.02	43.47	2.32	87.30	
	Indonesia	Small	G3-3	98	73.20	3.91	38.73	27.07	36.87	41.87	2.23	97.22
			P10×491274-1	98	72.14	4.10	45.29	30.50	41.64	45.86	3.16	63.89
			NC	95	47.00	3.02	36.00	20.40	28.53	34.53	1.26	44.44
Mean				64.11	3.68	40.01	25.99	35.68	40.75	2.22	68.52	
Large			G3-3	98	70.87	3.97	44.53	27.93	37.27	43.60	2.59	88.89
			P10×491274-1	98	91.20	3.96	43.93	26.47	43.07	46.80	2.93	80.56
		NC	95	47.13	3.89	40.73	23.20	30.87	37.53	1.79	63.89	
Mean			69.73	3.94	43.06	25.87	37.07	42.64	2.44	77.78		
Overall mean				64.06	3.70	41.04	24.80	35.08	40.64	2.16	69.26	

<sup>c</sup> Nongwoo Chambak.

data  
 ( 33-36). 가 60  
 37, 38 ( 37) (SL)  
 13-20 mm 14-16 mm (SW) 6.4-9.5 mm  
 6.4-7.2 mm , SL/SW 1.8-2.2 가  
 118 mg (No. 28) 272 mg (No. 3)  
 130-160 mg

, FR , , ,

NWP (C) 4 cm

F<sub>1</sub> 7-9 cm

2.5-3.5 mm

(CL) (CW) CL/CW

FR (No. 18) 1.77 (10% ) (No. 9)

2.35 2.00

data

39 39

가

가 (r=0.826\*\*)

(r=0.720\*\*).

가

가

/ (SL/SW) SL/SW 가

가 CL/CW 가

39

60 40

CL/CW HL/HW

가

(r=-0.708\*\*)

group

가

( 41).

가

( 42)

-

가

가

가 가

가

가

	Name of cultivar or inbred lines	Seed length (SL) (mm)	Seed width (SW) (mm)	SL/SW	Seed thickness (mm)	Seed weight (g)
1	491274- 1 × NWP3	18.00±0.13	8.97±0.06	2.01±0.02	2.70±0.03	0.184
2	491274- 2 × FRD2	17.18±0.22	9.33±0.34	1.86±0.07	3.36±0.04	0.197
3	491274- 4 × CB5	20.32±0.32	11.06±0.10	1.84±0.02	3.03±0.04	0.272
4	491359- 1 × BG1	16.75±0.13	9.52±0.13	1.76±0.03	2.60±0.04	0.167
5	491359- 4 × Power10	15.08±0.20	8.94±0.10	1.69±0.04	2.81±0.03	0.171
6	CB4	14.68±0.17	7.29±0.08	2.02±0.02	0.23±0.07	0.113
7	CB 5 × FRD1	16.37±0.18	6.88±0.07	2.38±0.03	3.52±0.07	0.143
8	F18- 4 × F20	13.17±0.11	7.05±0.10	1.74±0.15	2.85±0.04	0.125
9	F20- 3 × G3- 6	12.75±0.15	6.31±0.05	2.02±0.02	2.61±0.05	0.109
10	FRD	14.69±0.16	6.85±0.10	2.15±0.03	2.82±0.05	0.128
11	FRD2 X LHD7	14.96±0.12	6.42±0.04	2.33±0.02	2.76±0.01	0.150
12	FR Harmony	13.74±0.18	6.42±0.12	2.15±0.02	2.61±0.06	0.115
13	FRK- II- A	14.24±0.15	6.85±0.09	2.08±0.03	2.81±0.03	0.139
14	FRK- II- C	14.25±0.19	6.92±0.11	2.07±0.03	2.85±0.03	0.136
15	FR Star	14.07±0.21	6.41±0.06	2.20±0.04	2.57±0.03	0.152
16	G3- 6 × F20- 3	14.35±0.11	7.45±0.08	1.93±0.02	3.37±0.04	0.157
17	Gachitoki (ChoongAng)	15.09±0.13	6.87±0.06	2.20±0.02	3.03±0.05	0.152
18	LHD2 × Power2	15.80±0.25	0.86±0.16	1.83±0.05	2.85±0.05	0.170
19	LHD3	14.44±0.13	8.24±0.08	1.75±0.02	2.61±0.02	0.166
20	LHD4	13.12±0.11	9.23±0.09	1.44±0.02	2.75±0.07	0.121
21	LHD5 × 491274- 1	15.49±0.20	7.37±0.09	2.11±0.04	3.08±0.07	0.174
22	LHD7	15.55±0.11	7.35±0.09	2.12±0.04	2.96±0.03	0.166
23	LHD7 × Power7	15.88±0.15	7.03±0.06	2.26±0.03	2.72±0.03	0.155
24	LHD7 × BG1	14.29±0.12	6.95±0.13	2.06±0.05	2.43±0.04	0.094
25	LHD8	15.61±0.14	8.00±0.07	1.95±0.03	3.10±0.08	0.146
26	ND FR Dragon	15.27±0.24	6.55±0.11	2.34±0.04	2.79±0.05	0.137
27	ND FR Ummason	14.42±0.13	7.09±0.07	2.04±0.01	2.74±0.04	0.139
28	NWP (C)	13.88±0.18	6.71±0.08	2.07±0.03	2.79±0.05	0.118
29	NWP (I)	14.42±0.19	6.66±0.11	2.17±0.04	2.67±0.04	0.122
30	NWP1 × CB5	13.77±0.24	6.90±0.05	2.00±0.04	2.63±0.03	0.129
31	NWP3 × LHD2	13.80±0.21	6.78±0.05	2.03±0.03	2.69±0.03	0.128
32	NWP5 × 491359- 2	14.21±0.29	6.41±0.09	2.22±0.04	2.81±0.03	0.135
33	Power2 × LHD1	14.37±0.18	6.92±0.04	2.08±0.03	2.76±0.05	0.141
34	Power6 × CB1	16.07±0.13	6.86±0.06	2.35±0.03	3.10±0.04	0.168
35	Power7	16.11±0.47	7.50±0.06	2.15±0.07	2.76±0.04	0.174
36	Power8 × NWP5	13.69±0.17	7.09±0.05	1.93±0.02	3.00±0.03	0.123
37	Power10 × NWP8	15.00±0.24	6.38±0.06	2.35±0.04	2.85±0.05	0.142
38	Power11 × 491274- 3	16.54±0.22	7.64±0.08	2.17±0.04	3.28±0.06	0.200
39	Power (HGC)	15.59±0.22	6.92±0.06	2.25±0.03	2.96±0.03	0.164

BG: Bushel Gourd, CB: Calabash, FRD: FR Dantos, FRK: FR King (Hungnong), FRYJ: FR Yongja (ChoongAng), LHD: Long Handled Dipper, NWP: Partner (Nongwoo SEED: NW), Power: Hungnong Gangryuk Chambak

	Name of cultivar or inbred lines	Hypocotyl length (HL) (mm)	Hypocotyl width (HW) (mm)	HL/HW	Cotyledon length (CL) (mm)	Cotyledon width (CW) (mm)	CL/CL
1	491274-1 × NWP3	82.37 ± 2.26	3.07 ± 0.04	27.25 ± 0.89	42.35 ± 0.90	20.10 ± 0.42	2.11 ± 0.04
2	491274-2 × FRD2	87.50 ± 1.56	3.16 ± 0.03	27.80 ± 0.67	44.50 ± 1.12	23.70 ± 0.47	1.88 ± 0.05
3	491274-4 × CB5	97.60 ± 3.08	3.11 ± 0.05	31.52 ± 1.11	40.30 ± 0.95	20.80 ± 0.77	1.97 ± 0.05
4	491359-1 × BG1	80.56 ± 1.48	2.77 ± 0.04	29.23 ± 0.81	36.13 ± 0.8	17.56 ± 0.50	2.08 ± 0.05
5	491359-4 × Power10	77.24 ± 1.70	2.69 ± 0.04	28.87 ± 0.83	36.53 ± 0.54	18.53 ± 0.38	1.99 ± 0.05
6	CB4	94.17 ± 2.14	2.45 ± 0.03	39.84 ± 0.98	35.28 ± 0.57	19.89 ± 0.25	1.78 ± 0.03
7	CB 5 × FRD1	96.35 ± 2.34	2.59 ± 0.05	37.27 ± 0.76	39.40 ± 0.63	21.20 ± 0.30	1.86 ± 0.03
8	Chinkyō	52.67 ± 0.84	3.74 ± 0.05	14.13 ± 0.26	50.02 ± 0.66	29.00 ± 0.42	1.73 ± 0.02
9	Daeji	41.27 ± 0.84	3.64 ± 0.07	11.44 ± 0.29	49.03 ± 0.69	25.94 ± 0.90	2.35 ± 0.52
10	F18-4 × F20	55.85 ± 1.92	2.57 ± 0.05	21.71 ± 0.63	32.40 ± 1.22	17.25 ± 0.53	1.88 ± 0.04
11	F20-3 × G3-6	72.67 ± 1.44	2.78 ± 0.03	26.21 ± 0.58	41.83 ± 1.20	23.11 ± 0.50	1.81 ± 0.03
12	FR10 (ChoongAng)	50.07 ± 0.82	3.23 ± 0.06	15.65 ± 0.34	47.23 ± 0.46	26.77 ± 0.25	1.77 ± 0.02
13	FR-1000	44.87 ± 0.82	3.25 ± 0.04	13.85 ± 0.32	47.60 ± 0.65	28.00 ± 0.38	1.70 ± 0.02
14	FR Bokwang	38.90 ± 0.86	3.43 ± 0.05	11.36 ± 0.25	49.74 ± 0.65	28.87 ± 0.45	1.78 ± 0.02
15	FR Bond (-michado)	45.27 ± 1.05	3.63 ± 0.06	12.59 ± 0.35	48.31 ± 0.54	27.73 ± 0.39	1.75 ± 0.02
16	FR Chorus	46.43 ± 0.85	3.48 ± 0.04	13.37 ± 0.27	48.69 ± 0.48	27.37 ± 0.33	1.78 ± 0.02
17	FR Combi	38.00 ± 0.83	3.61 ± 0.05	10.59 ± 0.27	46.65 ± 0.58	26.83 ± 0.32	1.74 ± 0.32
18	FRD	45.20 ± 0.70	3.47 ± 0.06	13.09 ± 0.23	47.12 ± 0.44	26.73 ± 0.24	1.77 ± 0.02
19	FRD2 × LHD7	77.65 ± 1.66	2.82 ± 0.03	27.58 ± 0.60	40.20 ± 0.75	20.15 ± 0.42	2.00 ± 0.02
20	FR Harmony	49.17 ± 0.91	3.49 ± 0.05	14.15 ± 0.32	47.80 ± 0.58	26.53 ± 0.80	1.97 ± 0.21
21	FR Helper	46.60 ± 1.19	3.62 ± 0.06	12.98 ± 0.41	47.22 ± 0.81	27.53 ± 0.41	1.72 ± 0.03
22	FR Jangsoo	40.47 ± 0.81	3.56 ± 0.05	11.41 ± 0.27	52.71 ± 0.78	30.03 ± 0.38	1.76 ± 0.03
23	FRK	48.07 ± 1.14	3.86 ± 0.09	12.61 ± 0.38	49.23 ± 0.45	27.90 ± 0.31	1.77 ± 0.02
24	FRK-II-A	43.03 ± 0.84	3.71 ± 0.08	11.68 ± 0.28	46.55 ± 0.62	27.43 ± 0.40	1.70 ± 0.02
25	FRK-II-C	47.23 ± 1.47	4.97 ± 1.24	12.37 ± 0.55	49.83 ± 0.45	29.67 ± 0.32	1.69 ± 0.02
26	FR Seokwang	37.45 ± 1.00	3.13 ± 0.06	12.02 ± 0.33	41.98 ± 0.76	25.32 ± 0.34	1.66 ± 0.02
27	FR Star	47.80 ± 0.96	3.36 ± 0.05	14.26 ± 0.28	47.03 ± 0.63	27.10 ± 0.31	1.74 ± 0.02
28	FR Supperter	59.03 ± 1.12	3.77 ± 0.11	17.54 ± 2.33	49.35 ± 0.50	28.93 ± 0.26	1.71 ± 0.02
29	FR-Top	46.87 ± 0.82	3.23 ± 0.04	14.58 ± 0.30	46.93 ± 0.60	26.97 ± 0.28	1.74 ± 0.02
30	FRYJ	48.77 ± 0.80	3.40 ± 0.05	14.38 ± 0.25	47.65 ± 0.48	27.27 ± 0.26	1.75 ± 0.02
31	FRYJ (T)	49.90 ± 0.09	3.73 ± 0.05	13.46 ± 0.33	46.87 ± 0.48	27.10 ± 0.30	1.73 ± 0.02
32	G3-6 × F20-3	67.25 ± 1.23	2.57 ± 0.04	26.27 ± 0.69	40.20 ± 1.08	21.25 ± 0.34	1.89 ± 0.03
33	Gachitoki (ChoongAng)	44.73 ± 1.20	3.55 ± 0.04	12.63 ± 0.34	47.11 ± 1.66	27.10 ± 0.37	1.74 ± 0.06
34	Gongripgampyo	36.93 ± 0.63	3.32 ± 0.05	11.23 ± 0.30	47.81 ± 0.59	26.53 ± 0.28	1.81 ± 0.03
35	Hapgoong	42.20 ± 1.05	3.44 ± 0.05	12.30 ± 0.34	43.92 ± 0.44	25.63 ± 0.23	1.72 ± 0.02
36	LHD2 × Power2	92.10 ± 1.85	2.75 ± 0.05	33.89 ± 1.16	40.70 ± 0.77	22.10 ± 0.29	1.85 ± 0.04
37	LHD3	104.25 ± 2.41	3.00 ± 0.05	35.06 ± 1.27	36.20 ± 0.79	21.80 ± 0.44	1.66 ± 0.03
38	LHD4	87.11 ± 2.92	2.67 ± 0.05	32.88 ± 1.28	36.37 ± 1.19	21.11 ± 0.58	1.73 ± 0.05
39	LHD5	61.47 ± 1.20	3.61 ± 0.05	17.08 ± 0.37	54.73 ± 0.59	26.90 ± 0.33	2.05 ± 0.04
40	LHD5 × NWP4	65.13 ± 0.78	3.57 ± 0.03	18.28 ± 0.23	57.05 ± 0.57	30.30 ± 1.89	2.01 ± 0.08
41	LHD5 × 491274-1	83.15 ± 2.03	2.81 ± 0.03	29.69 ± 0.79	41.55 ± 0.77	19.85 ± 0.35	2.10 ± 0.04
42	LHD7	113.60 ± 3.35	2.64 ± 0.03	43.19 ± 1.39	39.65 ± 1.14	21.50 ± 0.60	1.85 ± 0.02
43	LHD7 × Power7	106.25 ± 3.95	2.54 ± 0.04	41.95 ± 1.64	33.50 ± 2.04	19.80 ± 0.72	1.69 ± 0.08
44	LHD7 × BGS1	83.80 ± 1.59	2.32 ± 0.03	36.37 ± 0.99	37.85 ± 0.61	19.45 ± 0.25	1.95 ± 0.02
45	LHD8	116.0 ± 3.30	2.59 ± 0.04	44.98 ± 1.27	40.12 ± 0.67	22.35 ± 0.49	1.81 ± 0.04
46	ND FR Dragon	45.47 ± 0.92	3.52 ± 0.04	13.01 ± 0.37	51.52 ± 0.59	27.33 ± 0.35	1.89 ± 0.02
47	ND FR Ummason	42.03 ± 1.29	3.67 ± 0.05	11.51 ± 0.37	46.71 ± 1.54	27.67 ± 0.34	1.69 ± 0.06
48	NWP (C)	39.77 ± 0.91	3.40 ± 0.04	11.77 ± 0.31	46.72 ± 0.59	26.17 ± 0.32	1.79 ± 0.02
49	NWP (I)	50.20 ± 0.87	3.54 ± 0.04	14.25 ± 0.34	47.67 ± 0.48	26.87 ± 0.25	1.78 ± 0.02
50	NWP1 × CB5	91.45 ± 2.05	2.57 ± 0.04	35.72 ± 0.86	36.90 ± 0.42	19.60 ± 0.26	1.89 ± 0.03
51	NWP3 × LHD2	89.10 ± 2.61	2.72 ± 0.04	32.84 ± 0.94	45.55 ± 0.97	23.30 ± 0.54	1.96 ± 0.03
52	NWP4	42.93 ± 1.10	3.21 ± 0.05	13.38 ± 0.32	49.23 ± 0.71	25.83 ± 0.25	1.91 ± 0.02
53	NWP5 × 491359-2	75.95 ± 2.10	2.67 ± 0.03	28.41 ± 0.70	43.95 ± 1.13	21.60 ± 0.45	2.03 ± 0.03
54	Power2 × LHD1	78.75 ± 1.41	2.85 ± 0.02	27.64 ± 0.55	37.05 ± 1.52	20.95 ± 0.32	1.76 ± 0.06
55	Power6 × CB1	112.20 ± 3.41	2.77 ± 0.03	40.56 ± 1.26	41.75 ± 1.06	22.20 ± 0.65	1.90 ± 0.04
56	Power7	95.75 ± 2.39	2.73 ± 0.03	35.18 ± 1.00	39.40 ± 1.35	20.60 ± 0.55	1.91 ± 0.04
57	Power8 × NWP5	75.60 ± 1.71	2.61 ± 0.06	29.27 ± 0.94	35.55 ± 0.85	21.65 ± 0.40	1.65 ± 0.04
58	Power10 × NWP8	92.68 ± 2.68	2.75 ± 0.03	33.70 ± 1.06	47.40 ± 1.21	24.85 ± 0.67	1.92 ± 0.04
59	Power11 × 491274-3	76.68 ± 3.33	3.06 ± 0.06	25.47 ± 1.33	38.21 ± 1.46	20.05 ± 0.75	1.91 ± 0.03
60	Power (HGC)	61.97 ± 0.76	3.87 ± 0.06	16.11 ± 0.29	49.18 ± 0.41	29.73 ± 0.21	1.66 ± 0.01

BG: Bushel Gourd, CB: Calabash, FRD: FR Dantos, FRK: FR King (Hungnong), FRYJ: FR Yongja (ChoongAng), LHD: Long Handled Dipper, NWP: Partner (NongWoo Seed: NW), Power: Hungnong Gangryuk Chambak

39.

Seed & seedling characteristics	Seed length (SL)	Seed width (SW)	SL/SW	Seed thickness	Seed weight	Hypocotyl length (HL)	Hypocotyl width (HW)	HL/HW	Cotyledon length	Cotyledon width
Seed width(SW)	0.667**									
SL/SW	0.033	-0.718**								
Seed thickness	0.375*	0.163	0.115							
Seed weight	0.826**	0.720**	-0.206	0.284						
Hypocotyl length(HL)	0.387*	0.374*	-0.146	0.241	0.265					
Hypocotyl width(HW)	-0.042	-0.178	0.198	0.284	-0.029	-0.674**				
HL/HW	0.274	0.303	0.156	0.271	0.170	0.971**	-0.803**			
Cotyledon length	0.029	-0.410	0.577**	-0.039	-0.010	-0.568**	0.685**	-0.639**		
Cotyledon width	-0.204	-0.416	0.383*	-0.082	-0.164	-0.639**	0.782**	-0.697**	0.835**	
CL/CW	0.424**	0.080	0.258	0.066	0.293	-0.166	-0.215	0.146	0.173	-0.394*

40. 60

Seedling characteristics	Hypocotyl length (HL)	Hypocotyl width (HW)	HL/HW	Cotyledon length	Cotyledon width
Hypocotyl width (HW)	-0.703**				
HL/HW	0.978**	-0.816**			
Cotyledon length (CL)	-0.640**	0.736**	-0.709**		
Cotyledon width (CW)	-0.708**	0.809**	-0.766**	0.867**	
CL/CW	0.254	-0.265*	0.240	0.067	-0.433**



41.

	Seedling characteristics	Significant positive correlation	Not Significant	Significant negative correlation
Seed length	Hypocotyl length	2 (5.1%)	36 (92.3%)	1 (2.6%)
	Hypocotyl width	1 (2.6%)	37 (94.8%)	1 (2.6%)
	Cotyledon length	2 (5.1%)	35 (89.7%)	2 (5.1%)
	Cotyledon width	0	38 (97.4%)	1 (2.6%)
Seed width	Hypocotyl length	1 (2.6%)	36 (92.3%)	2 (5.1%)
	Hypocotyl width	0	39 (100%)	0
	Cotyledon length	1 (2.6%)	38 (97.4%)	0
	Cotyledon width	0	39 (100%)	0
Seed thickness	Hypocotyl length	0	38 (97.4%)	1 (2.6%)
	Hypocotyl width	2 (5.1%)	37 (94.8%)	0
	Cotyledon length	1 (2.6%)	38 (97.8%)	0
	Cotyledon width	1 (2.6%)	38 (97.8%)	0

42. 60

	Seedling characteristics	Positive correlation	Not Significant	Negative correlation
Hypocotyle length	Hypocotyle width	7 (11.7%)	48 (80%)	5 (8.3%)
	Cotyledon length	13 (21.7%)	44 (73%)	3 (5.0%)
	Cotyledon width	12 (20.0%)	47 (78%)	1 (1.6%)
Hypocotyle width	Cotyledon length	13 (21.7%)	47 (78%)	1 (1.6%)
	Cotyledon width	5 (8.3%)	44 (73%)	1 (1.6%)
Cotyledon length	Cotyledon width	42 (70.0%)	18 (30%)	0

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43.

	(g)	(cm)	(cm)	
2	4481.3 a <sup>z</sup>	27.5 a	21.3 a	728.2 a
3	3950.3 ab	26.5 a	20.8 a	654.5 ab
4	2920.6 bc	23.3 b	19.1 ab	595.1 ab
5	2570.0 c	22.0 b	17.8 b	488.7 b
F value	4.18**	4.93**	3.84*	2.04 <sup>ns</sup>

<sup>z</sup> Mean separation within columns by Duncan's multiple range test, 5% level.

44.

	(g)	+ (%)	(%)	( ) (%)		
				4	7	14
2	16.3 a <sup>z</sup>	51.93 a	48.07 b	17.1 a	19.5 a	19.5 a
3	16.0 a	50.83 ab	49.17 ab	10.3 a	14.7 a	13.5 a
4	15.5 b	49.91 b	50.61 a	14.3 a	17.4 a	17.8 a
5	13.7 c	49.39 b	50.09 a	1.4 b	3.8 b	5.8 b
F value	35.18**	4.77**	4.77**	9.43**	7.02**	5.57**

<sup>z</sup> Mean separation within columns by Duncan's multiple range test, 5% level.

45.

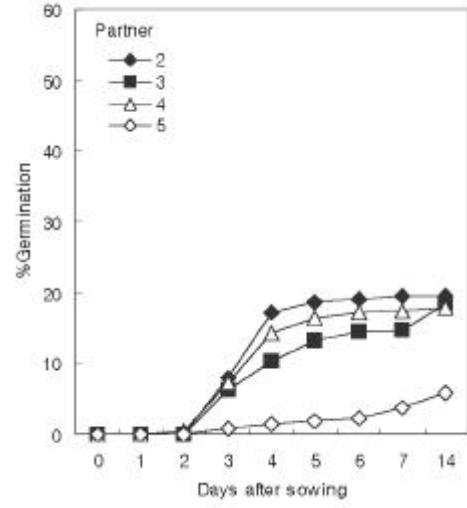
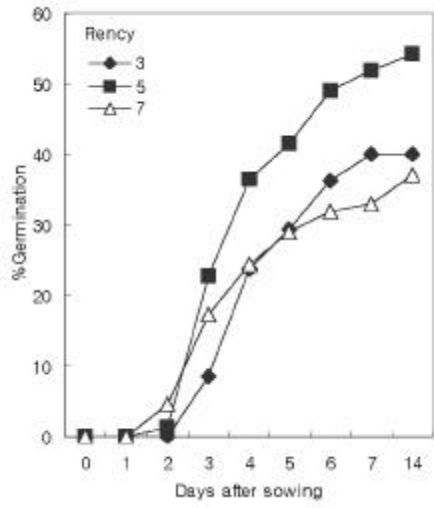
	(g)	(cm)	(cm)	
3	287.6 <sup>z</sup>	18.6	8.7	120.0
5	234.2	17.1	8.3	115.3
7	228.5	17.7	8.1	108.4
F value	1.65 ns	1.41 ns	1.23 ns	0.24 ns

<sup>z</sup> Mean separation within columns by Duncan's multiple range test, 5% level.

46.

	(g)	+ (%)	(%)	% Germination (Day after sowing)		
				4	7	14
3	13.7 a <sup>z</sup>	52.53 b	46.40 a	23.7 b	40.0 b	40.0 b
5	13.0 b	55.53 a	44.47 b	36.5 a	51.9 a	54.2 a
7	13.9 a	55.81 a	44.19 b	24.3 b	33.0 b	37.0 b
F value	148.60**	4.37*	11.20**	6.79**	6863.08**	6335.85**

<sup>z</sup> Mean separation within columns by Duncan's multiple range test, 5% level.



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(1994-1995 )

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F<sub>2</sub>

F<sub>1</sub> 가 F<sub>2</sub>가

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50-60

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30-40

2-3

(風選)

(そ菜種子生産研究會, 1978. 野菜の採種技術).

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. KNO<sub>3</sub> K<sub>3</sub>PO<sub>4</sub> .  
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, seed lot .

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( ). 12 cm petri dish 50 ( , ) 100  
( , ) 8 mL 가 25 ( , ) 30 ( ,  
) .

가 .

(ISTA, 1993. International Rules for

Seed Testing)

(pleated paper) 20-30 1 ( ) 4 ,

14

petri dish  
germination paper (Anchor papers, St. Paul, USA)

( 47, 49).

(細砂)

( 48, 50, 51).

Pleated paper

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가 ( 16)

(data ).



47.

		(%)	(%)	(3 (%) )
	Petri dish + Filter papers	49.33 b <sup>z</sup>	69.33 b	38.67
	Germination papers (2 )	56.67 b	96.00 a	88.00
	Germination papers (4 )	89.33 a	90.67 a	89.33
	Petri dish + Filter papers	64.00 b	74.67 b	48.00
FR1000	Germination papers (2 )	86.67 a	94.67 a	86.67
	Germination papers (4 )	84.00 a	92.00 a	80.00
	Petri dish + Filter papers	92.00 a	94.67 a	49.33
ST5581	Germination papers (2 )	96.00 a	100.00 a	94.67
	Germination papers (4 )	96.00 a	97.33 a	96.00
	Petri dish + Filter papers	94.67 a	96.00 a	62.67
ST5584	Germination papers (2 )	94.67 a	94.67 a	94.67
	Germination papers (4 )	96.00 a	97.33 a	92.00
	Petri dish + Filter papers	70.67 b	73.33 b	36.00
	Germination papers (2 )	89.33 a	93.33 a	80.00
	Germination papers (4 )	92.00 a	92.00 a	88.00

z

DMRT 5%

48.

		(%)		
		70.67	72.00	73.33
	FR 1000	45.33	46.67	46.67
Proper size	ST 5581	92.00	92.00	96.00
	ST 5584	92.00	92.00	100.00
		86.67	86.67	88.00
		30.67	30.67	38.67
	FR 1000	41.33	41.33	46.67
Fine size	ST 5581	74.67	76.00	77.33
	ST 5584	73.33	73.33	78.67
		69.33	69.33	72.00

49.

	(%)	(%)	(3 (%) )
Petri dish + Filter papers	100.00	100.00	40.00 b
Germination papers (2 )	98.67	98.67	98.67 a
Germination papers (4 )	100.00	100.00	100.00 a
Petri dish + Filter papers	98.67	98.67	73.33 b
Germination papers (2 )	98.67	98.67	78.67 b
Germination papers (4 )	98.67	100.00	96.00 a
Petri dish + Filter papers	92.00	94.67	77.33 b
Germination papers (2 )	100.00	100.00	97.33 a
Germination papers (4 )	96.00	96.00	94.67 a
Petri dish + Filter papers	68.00	73.33	42.67 b
Germination papers (2 )	81.33	82.67	80.00 a
Germination papers (4 )	76.00	77.33	72.00 a

50.

Sand size					
	(cm)	(cm)	(cm)	(mm)	
Proper size	4.75	3.55	9.23	3.65	1.75
	4.48	3.09	7.82	3.43	1.59
	4.03	2.82	6.52	3.23	1.73
	4.51	3.47	7.93	3.47	1.74
	4.05	2.87	5.49	3.23	1.92
Fine size	3.89	2.56	5.23	2.98	1.90
	3.00	2.13	3.38	3.20	1.83
	3.42	2.67	5.45	3.54	1.72

51.

Sand size	(%)		
	Proper size	76.00 b	92.00 ab
97.33 a		97.33 a	98.67 a
84.00 ab		84.00 b	85.33 b
72.00 b		73.33 c	80.00 b
66.67 a		69.33 a	70.67 a
Fine size	60.00 a	60.00 ab	60.00 ab
	52.67 b	52.67 bc	56.67 ab
	42.67 c	42.67 c	49.33 b



16. (5, 7)

2.

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(abscisic acid ABA-  
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 Seedburo/Holland  
 Seed brushing machine  
 (Westrup LA-H)  
 drum ( 21.6 cm) brush가 300-600

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 ( 54, 18).

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15	30	45	60	75	90	
0	2	7	20	42	49	
50	95	100	100	100	100	

가

brushing

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( 19).

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brushing

(dust)

ethylacetate, n-butanol,

H<sub>2</sub>O

thin layer chromatography (TLC)

1-2

( 20)

brushing

ethylacetate

4-5

flavonoid

n-butanol

flavonoid

H<sub>2</sub>O

brushing

ethylacetate n-butanol

H<sub>2</sub>O

brushing

가

gelatin

gelatin

가

petri dish

'Grand Rapids'

ethylacetate

가

가

pectin

cellulose

mucilage

가

gelatin

(Esau, 1976).

gelatin

NaOCl

(1%), H<sub>2</sub>SO<sub>4</sub> (Conc.), KOH (10%), K<sub>3</sub>PO<sub>4</sub> (10%)

K<sub>3</sub>PO<sub>4</sub>

가

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가

Cl<sup>-</sup>

가

(Cl<sup>-</sup>)

Cl<sup>-</sup>

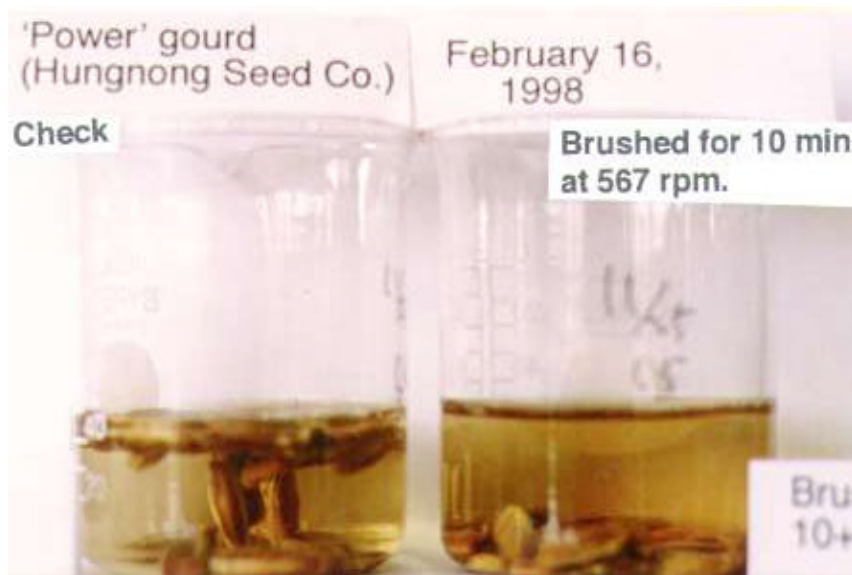
(CGMMV)

K<sub>3</sub>PO<sub>4</sub>

(水洗)가



17. Brushing machine ( ) brushing ( ).



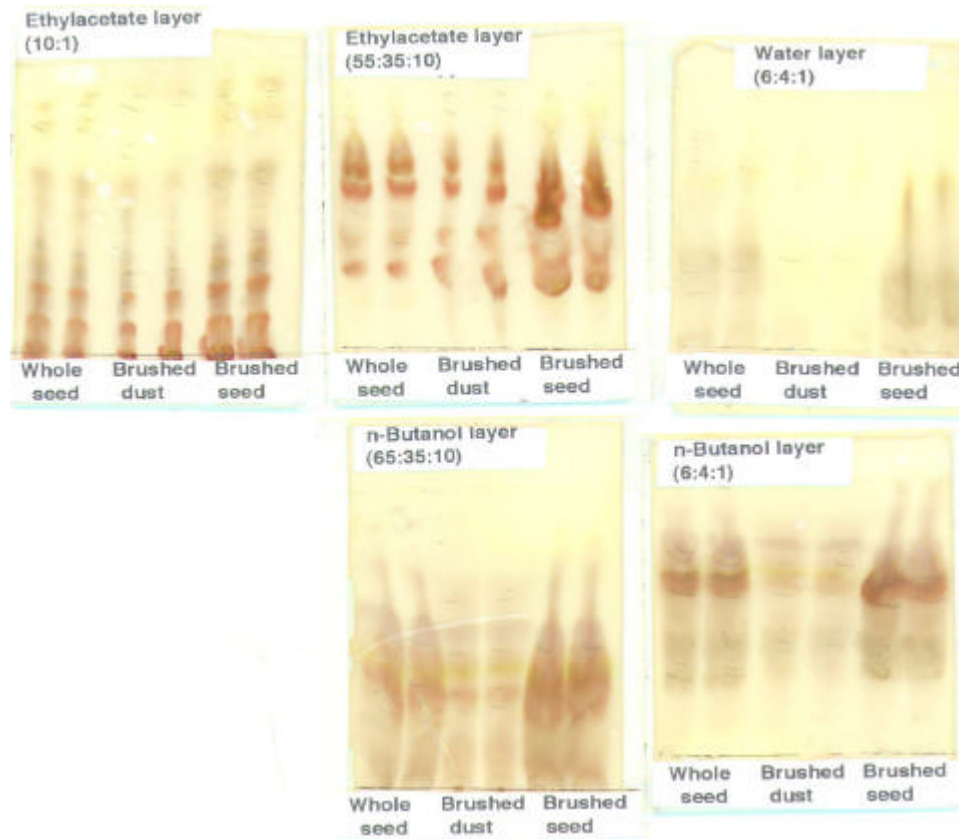
18. Brushing ( 40 ) ( ).





19. Brushing

: brushing (petri dish ).  
 : 1, 3 , 2, 4 ( ).  
 1, 2 ; ( ), 3, 4 ; ( ).



20. TLC  
 Whole seed :  
 Brushed dust : brushing  
 Brushed seed : Brushing

3.

PEG priming  
 (osmoconditioning)  
 ( : Micro-Cel E, Aerosil, fine clay) matriconditioning solid  
 matrix priming (SMP) (Khan , 1995).

osmoconditioning 가

(Khan, 1993) SMP . SMP 가

21 (vermiculite)

SMP chemical priming 가 priming priming 가 가 , 가 55 56 ( ), 57 58 ( ), 22 23 SMP 가 SMP : SMP 23 가 ( ) . SMP 가 SMP SMP ( 55) 가 ( 56)

brushing

가 가

model

( 57)

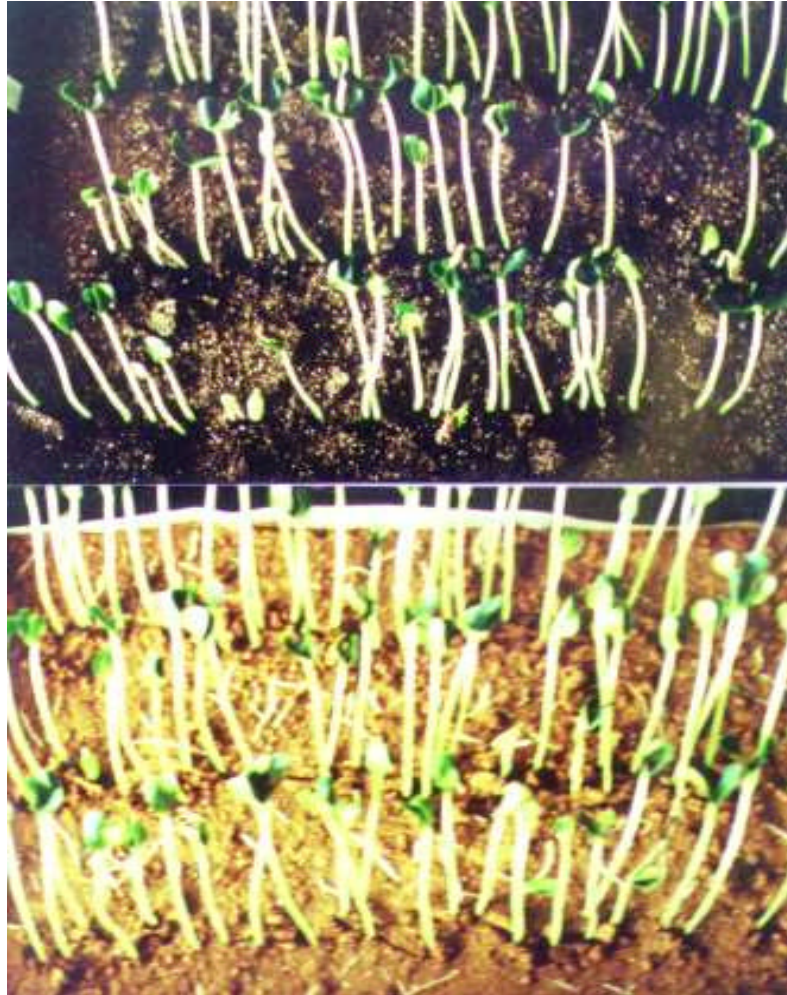
가 가

가

가

3

model



21.

가 가

(vermiculite) ( ) ( )

55. SMP

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Treatment	Germination rate 14 days after sowing (%)	Fresh wt. of seedling (g)	Cotyledon length (cm)	Cotyledon width (cm)	Hypocotyl length (cm)	Hypocotyl diameter (mm)
Control	62.4 ab <sup>z</sup>	1.75 b	4.73 b	2.65 b	7.58 bcd	3.44 ab
Dry heat treatment <sup>z</sup>	38.6 d	1.58 c	4.77 b	2.67 b	7.02 d	3.11 c
Micro- Cel E, 10 : 1 : 3 <sup>y</sup>	56.3 abc	1.95 a	4.82 b	2.69 b	7.90 abcd	3.50 ab
Micro- Cel E, 9 : 1 : 3	61.0 ab	1.90 ab	4.75 b	2.96 a	8.35 abc	3.47 ab
Micro- Cel E, 8 : 1 : 3	58.5 abc	2.06 a	4.83 b	2.72 ab	8.71 a	3.54 ab
Aerosil 200, 10 : 1 : 3	47.1 cd	1.92 ab	4.93 ab	2.75 ab	8.34 abc	3.42 b
Aerosil 200, 9 : 1 : 3	48.8 cd	1.96 a	4.92 ab	2.75 ab	7.34 cd	3.56 ab
Aerosil 200, 8 : 1 : 3	64.6 a	2.01 a	4.89 b	2.73 ab	7.93 abcd	3.55 ab
Aerosil 300, 10 : 1 : 3	62.2 ab	1.93 ab	4.85 b	2.66 b	8.53 ab	3.43 ab
Aerosil 300, 9 : 1 : 3	51.3 bc	1.93 ab	5.10 a	2.78 ab	8.31 abc	3.43 ab
Aerosil 300, 8 : 1 : 3	58.3 abc	1.99 a	4.88 b	2.72 ab	7.82 abcd	3.60 a

<sup>z</sup> 35 : 24 hrs 50 : 24 hrs 75 : 72 hrs<sup>y</sup> Dry seed weight : Priming material weight : H<sub>2</sub>O<sup>x</sup> Mean separation in columns by Duncan's multiple range test at 5% level.

56. SMP

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Treatment	Germination rate 14 days after sowing (%)	Fresh wt. of seedling (g)	Cotyledon length (cm)	Cotyledon width (cm)	Hypocotyl length (cm)	Hypocotyl diameter (mm)
Control (No treatment)	31.7 c <sup>z</sup>	1.80 b	4.82 <sup>NS</sup>	2.64 bc	7.33 b	3.48 ab
H <sub>2</sub> O	33.8 bc	2.04 a	4.88	2.75 ab	8.38 ab	3.50 ab
2% KNO <sub>3</sub>	39.8 abc	2.05 a	4.88	2.74 ab	8.49 ab	3.56 ab
4% Hyponex	42.1 ab	1.86 ab	5.12	2.56 c	7.23 b	3.38 b
0.2% Captan	41.1 ab	1.97 ab	4.77	2.77 a	7.94 ab	3.50 ab
10 ppm Diniconazole	39.0 abc	2.06 a	4.93	2.72 ab	8.34 ab	3.55 ab
2% KNO <sub>3</sub> +4% Hyponex	44.3 a	2.04 a	4.90	2.69 ab	9.13 a	3.53 ab
2% KNO <sub>3</sub> + 10 ppm Diniconazole	38.3 abc	2.05 a	4.86	2.75 ab	8.20 ab	3.57 a
0.2% Captan + 10 ppm Diniconazole	44.0 a	1.93 ab	4.93	2.76 a	8.56 ab	3.51 ab
2% KNO <sub>3</sub> +0.2% Captan +10 ppm Diniconazole	35.3 abc	1.94 ab	4.91	2.77 a	7.33 b	3.58 a

<sup>z</sup> Mean separation in columns by Duncan's multiple range test at 5% level.<sup>NS</sup> Not- significant.

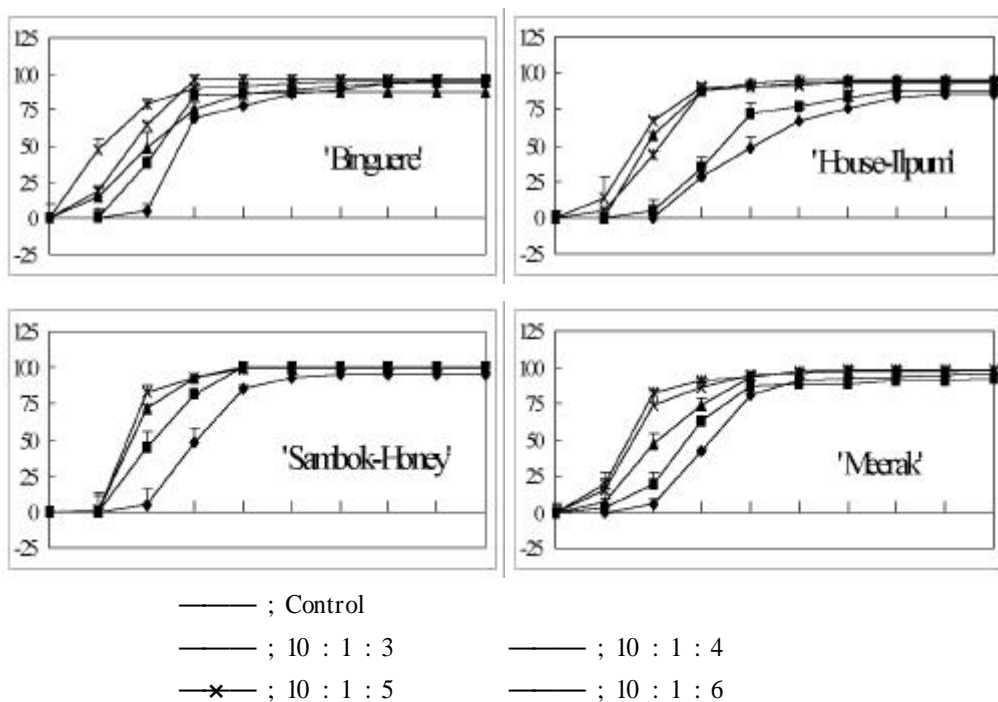
Cultivar	ER <sup>z</sup> (%)					FEP <sup>y</sup> (%)				
	Seed Treatment <sup>x</sup>					Seed Treatment				
	Non-primed	10:1:3	10:1:4	10:1:5	10:1:6	Non-primed	10:1:3	10:1:4	10:1:5	10:1:6
'Gamro'	84.7 c <sup>w</sup>	88.4 bc	91.2 abc	95.8 a	94.4 ab	95.8 a	94.4 a	94.4 a	97.2 a	98.6 a
'Sambok-Honey'	84.7 b	100.0 a	100.0 a	100.0 a	98.6 a	100.0 a	100.0 a	100.0 a	100.0 a	98.6 a
'Meerak'	80.6 b	87.5 ab	93.1 a	94.4 a	93.1 a	100.0 a	95.8 a	98.6 a	98.6 a	98.6 a
'Creampia'	95.8 a	97.2 a	98.6 a	100.0 a	100.0 a	100.0 a	98.6 a	100.0 a	100.0 a	100.0 a
'Binguere'	77.8 b	86.1 ab	86.1 ab	95.8 a	91.7 ab	97.2 a	94.4 ab	88.8 b	95.8 ab	94.4 ab
'House-Ilpum'	48.6 c	72.2 b	93.1 a	90.3 a	90.3 a	84.7 c	87.5 bc	97.2 a	94.4 ab	93.1 abc
'Surowang'	80.6 ab	81.9 ab	72.2 b	90.3 a	87.5 a	90.3 bc	90.3 bc	87.5 c	98.6 a	94.4 ab

<sup>z</sup> Examined 5 days after sowing.

<sup>y</sup> Examined 18 days after sowing.

<sup>x</sup> Seed : Micro-Cel E : water mass ratios.

<sup>w</sup> Mean separation within rows (cultivars) by Duncans multiple range test at 5%.



Seed Treatment <sup>z</sup>	Cotyledon length (mm)	Cotyledon width (mm)	Hypocotyl length (mm)	Hypocotyl width (mm)	Leaf length (mm)	Leaf width (mm)	FW <sup>x</sup> (g)	DW <sup>w</sup> (g)
<b>' Gamro '</b>								
Nonprimed	36.7 a <sup>y</sup>	23.9 b	72.3 b	3.0 a	31.1 a	33.4 a	1.28 a	0.12 a
10 : 1 : 3	38.3 a	25.6 a	77.1 b	3.1 a	33.1 a	36.0 a	1.41 a	0.12 a
10 : 1 : 4	37.8 a	24.9 ab	88.0 a	3.0 a	33.4 a	36.2 a	1.45 a	0.12 a
10 : 1 : 5	37.4 a	24.4 ab	93.7 a	3.0 a	34.5 a	38.5 a	1.53 a	0.13 a
10 : 1 : 6	37.3 a	24.3 ab	93.5 a	3.1 a	34.6 a	37.5 a	1.55 a	0.12 a
<b>' Sambok-Honey '</b>								
Nonprimed	35.4 a	22.5 a	74.2 a	2.9 b	30.8 a	32.3 a	1.22 a	0.10 a
10 : 1 : 3	37.4 a	23.4 a	75.5 a	3.1 ab	31.8 a	34.9 a	1.37 a	0.12 a
10 : 1 : 4	37.9 a	23.6 a	81.0 a	3.1 a	32.2 a	35.9 a	1.38 a	0.12 a
10 : 1 : 5	36.3 a	22.7 a	79.2 a	2.9 ab	29.6 a	33.8 a	1.25 a	0.10 a
10 : 1 : 6	36.4 a	22.9 a	82.7 a	2.9 ab	29.2 a	32.5 a	1.25 a	0.11 a
<b>' Meerak '</b>								
Nonprimed	38.1 a	23.3 a	66.8 c	3.2 a	34.9 a	34.6 ab	1.39 ab	0.12 a
10 : 1 : 3	37.9 a	24.8 a	64.3 c	3.3 a	32.6 b	32.5 b	1.32 b	0.12 a
10 : 1 : 4	37.7 a	24.1 a	75.1 b	3.2 a	35.1 a	34.9 a	1.38 ab	0.11 a
10 : 1 : 5	37.7 a	24.3 a	77.6 b	3.2 a	35.4 a	34.9 a	1.38 ab	0.12 a
10 : 1 : 6	38.7 a	24.1 a	83.8 a	3.2 a	34.8 a	35.2 a	1.51 a	0.13 a
<b>' Creampia '</b>								
Nonprimed	37.7 a	23.2 a	61.8 b	3.0 a	25.6 b	28.5 a	1.18 b	0.10 b
10 : 1 : 3	39.5 a	24.1 a	76.4 ab	3.0 a	30.4 a	35.0 a	1.50 a	0.12 a
10 : 1 : 4	40.1 a	25.1 a	83.7 a	3.0 a	30.8 ab	35.4 a	1.56 a	0.12 a
10 : 1 : 5	39.5 a	24.6 a	81.0 a	2.9 a	29.5 ab	34.2 a	1.43 a	0.12 a
10 : 1 : 6	37.1 a	24.0 a	75.1 ab	2.7 a	27.9 ab	31.3 a	1.38 a	0.11 a
<b>' Binguere '</b>								
Nonprimed	33.6 b	24.1 a	80.6 a	2.7 b	28.5 b	31.5 a	1.16 b	0.09 c
10 : 1 : 3	36.4 a	24.1 a	80.5 a	3.0 a	33.0 a	36.1 a	1.43 a	0.12 a
10 : 1 : 4	35.8 a	24.4 a	72.2 b	2.8 ab	29.1 b	32.3 a	1.16 b	0.10 bc
10 : 1 : 5	36.0 a	24.2 a	78.8 a	2.9 ab	29.9 b	33.5 a	1.25 b	0.11 ab
10 : 1 : 6	36.2 a	24.2 a	78.5 a	2.9 ab	29.4 b	33.3 a	1.24 b	0.11 ab
<b>' House-Ilpum '</b>								
Nonprimed	31.1 c	21.4 b	63.8 c	2.6 c	23.4 b	24.6 b	0.92 b	0.08 b
10 : 1 : 3	32.7 bc	22.5 ab	64.8 bc	2.8 bc	23.9 b	26.7 b	0.98 b	0.09 b
10 : 1 : 4	33.8 ab	23.2 ab	75.1 a	3.0 ab	29.7 a	33.8 a	1.27 a	0.11 a
10 : 1 : 5	35.3 a	23.8 a	72.6 ab	3.0 ab	30.4 a	35.8 a	1.34 a	0.12 a
10 : 1 : 6	35.4 a	24.3 a	74.5 a	3.1 a	33.1 a	39.0 a	1.42 a	0.12 a
<b>' Surowang '</b>								
Nonprimed	34.1 a	22.8 a	65.9 b	3.1 ab	24.8 c	26.6 bc	1.07 b	0.09 ab
10 : 1 : 3	34.2 a	22.8 a	68.0 b	3.0 b	24.1 c	25.7 c	1.06 b	0.09 b
10 : 1 : 4	33.7 a	22.7 a	75.9 a	3.1 ab	29.9 a	32.3 a	1.29 a	0.10 a
10 : 1 : 5	34.8 a	23.4 a	77.1 a	3.1 ab	28.7 ab	30.7 ab	1.11 b	0.10 ab
10 : 1 : 6	34.4 a	22.9 a	76.4 a	3.2 a	26.2 bc	29.4 ab	1.19 ab	0.10 ab

<sup>z</sup> Seed : Micro-Cel E : water mass ratios.

<sup>y</sup> Mean separation within columns by DMRT at 5%.

<sup>x</sup> FW: Fresh weight, 18 days after sowing.

<sup>w</sup> DW: Dry weight, 18 days after sowing.





23. SMP ‘ ’ ( ) ‘ ’ ,  
 3 , 3 SMP ,  
 thermogradient table 1 ( ) 26 , 2 24 , 3 2  
 2 , 4 ( ) 20 . (20 22 ) .



SMP , KNO<sub>3</sub>,  
 가 . SMP  
 가가  
 가 가  
 SMP : : 10 : 1 :  
 3 10 : 1 : 6 25 72  
 가 가  
 KNO<sub>3</sub> 가  
 SMP 가  
 가 가  
 가 가  
 가 가

4. (乾熱處理; dry heat treatment)

가.

가 가 .  
 가 *Fusarium* virus 가 가  
 (dry heat treatment)

75 3-7 *Fusarium* CGMMV  
(Cucumber Green Mottle Mosaic Virus)가  
가 .  
1997 가  
CGMMV 가  
50 가  
가  
1997 CGMMV 2 가  
CGMMV가 가 가  
(乾熱處理; dry heat treatment)  
가 75  
3-7 .  
65 가  
35 24 , 50 24 가  
75  
1%  
, , seed lot  
‘ ’ ‘가 ’ ,  
‘Wonderful’ 85 72  
( 59). ‘ ’ , ‘ ’ , ‘  
, ‘ ’ , ‘ ’ 80-85 가

seed lot

‘ FR ’

가

( 60).

‘ FR ’ ‘ ’

61

가

가

가

59.

( 3 ).

(unit : %)

Treat- ment	Cultivars										
	Watermelon		Squash		Cucumber		Shintozwa		Chambak		Melon
	House ilpum	Bitna	Hongto zwa	Kumto zwa	Baeknok dadaki	Garak manchun	Chilsung	Kumsul	Nong woo	Jung ang	Wonder ful
T-1 <sup>z</sup>	96.67 <sup>a</sup>	96.67 <sup>ns</sup>	95.00 <sup>ab</sup>	96.67 <sup>ns</sup>	98.33 <sup>a</sup>	100.00 <sup>ns</sup>	100.00 <sup>a</sup>	96.67 <sup>a</sup>	73.33 <sup>a</sup>	76.67 <sup>a</sup>	98.33 <sup>a</sup>
T-2	75.00 <sup>bc</sup>	98.33	96.67 <sup>ab</sup>	95.00	85.00 <sup>ab</sup>	100.00	98.33 <sup>a</sup>	95.00 <sup>a</sup>	66.67 <sup>a</sup>	35.00 <sup>b</sup>	100.00 <sup>a</sup>
T-3	81.67 <sup>b</sup>	100.00	100.00 <sup>a</sup>	98.33	86.67 <sup>b</sup>	100.00	98.33 <sup>a</sup>	96.67 <sup>a</sup>	66.67 <sup>a</sup>	15.00 <sup>c</sup>	100.00 <sup>a</sup>
T-4	83.33 <sup>ab</sup>	95.00	95.00 <sup>ab</sup>	96.67	96.67 <sup>a</sup>	100.00	96.67 <sup>a</sup>	98.33 <sup>a</sup>	43.33 <sup>b</sup>	13.33 <sup>c</sup>	95.00 <sup>ab</sup>
T-5	76.67 <sup>bc</sup>	95.00	76.67 <sup>b</sup>	90.00	78.33 <sup>b</sup>	98.33	98.33 <sup>a</sup>	88.33 <sup>b</sup>	30.00 <sup>b</sup>	3.33 <sup>c</sup>	96.67 <sup>a</sup>
T-6	65.00 <sup>c</sup>	91.67	41.67 <sup>c</sup>	88.33	51.67 <sup>c</sup>	98.33	88.33 <sup>b</sup>	86.67 <sup>b</sup>	5.00 <sup>c</sup>	1.67 <sup>c</sup>	90.00 <sup>b</sup>

<sup>z</sup> T-1 : control, T-2 : 35 -24hr 50 -24hr 65 -72hr, T-3 : 35 -24hr 50 -24hr 70 -72hr, T-4 : 35 -24hr 50 -24hr 75 -72hr, T-5 : 35 -24hr 50 -24hr 80 -72hr, T-6 : 35 -24hr 50 -24hr 85 -72hr

<sup>y</sup> Mean separation within columns by Duncan's multiple range test at 5% level.

<sup>ns</sup> Non significant.

60.

( 7 ).

(unit : mm)

Treatment	Cultivars										
	Watermelon		Squash		Cucumber		Shintozwa		Chambak		Melon
	House ilpum	Bitna	Hongto zwa	Kumto zwa	Baeknok dadaki	Garak manchun	Chilsung	Kumsul	Nong woo	Jung ang	Wonder ful
T-1 <sup>r</sup>	78.25bc <sup>y</sup>	90.21 <sup>ns</sup>	56.68 <sup>ns</sup>	54.35 <sup>ns</sup>	110.67a	124.08 <sup>ns</sup>	82.50 <sup>ns</sup>	56.72 <sup>ns</sup>	58.64 <sup>ns</sup>	70.00a	86.30ab
T-2	82.31bc	91.87	58.13	46.82	92.74b	123.75	85.98	56.69	69.60	59.49b	95.83a
T-3	73.32c	88.70	59.43	56.30	84.68b	115.42	76.00	59.34	52.48	49.05c	90.00ab
T-4	89.48ab	85.00	58.45	61.99	111.82a	118.58	75.90	81.84	56.43	53.16bc	86.67ab
T-5	101.05a	100.05	56.74	55.26	86.40b	113.30	78.06	77.06	47.72	39.13d	79.83bc
T-6	77.52bc	88.24	51.67	48.67	82.83b	115.43	66.78	79.21	45.47	31.41d	74.59c

\* See footnote in table 59.

61. ‘ FR ’ ‘ ’ .

(unit : %)

Treatment	Cultivar					
	‘FR Yongja’ (Choong Ang)		‘Power’ (Heungnong)			
	3 DAS <sup>z</sup>	7 DAS	3 DAS	7 DAS		
Control	81.5 a <sup>y</sup>	90.0 <sup>ns</sup>	63.5 a	83.5 a		
35 ; 24 hrs	50 ; 24 hrs	65 ; 24 hrs	55.0 b	88.5	25.0 b	46.5 b
35 ; 24 hrs	50 ; 24 hrs	65 ; 48 hrs	35.0 c	75.0	13.5 bc	46.5 b
35 ; 24 hrs	50 ; 24 hrs	65 ; 72 hrs	16.5 d	90.0	5.0 c	36.5 b
35 ; 24 hrs	50 ; 24 hrs	65 ; 96 hrs	6.5 de	86.5	5.0 c	35.0 b
35 ; 24 hrs	50 ; 24 hrs	65 ; 120 hrs	1.5 e	80.0	1.5 c	36.5 b
50 ; 24 hrs	65 ; 72 hrs		11.5 de	81.5	6.5 c	35.0 b
50 ; 24 hrs	65 ; 72 hrs		15.0 de	83.5	3.5 c	33.5 b

<sup>z</sup> Days after sowing.

<sup>y</sup> Mean separation within columns by Duncan's multiple range test at 5% level.

<sup>ns</sup> Non-significant.

가  
가  
가 가 .

가  
1) . stress

1 .

2) , ,  
. 가 가 가,  
,  
( 24, 25, 26).

3) 가  
( 62, 24, 25, 26).

4) 가 ,  
conditioning .

가 가 .  
( , 'Power'), ( ,  
'Partner'), FR ( , 'FRYJ'), FR1000 ( ) VISION  
(VS - 1203P3) 35 24 , 50 24  
75 72 . 가 ( )  
50-70%) 5-7% silica gel

가

가 .

가가

(人工老化促進處理; artificial accelerated aging)

가 35 × 24

× 12.5 cm

가

6-8 cm가

(AOSA, 1993) 3 cm

45

2.3 liter

가

10 mL

chamber (30 × 19 × 5 cm)

6

cell (10 × 9.5 × 5 cm)

plastic box

3 mm,

5.0 cm

acryl

×

chamber

20

3

stainless

가

100%가

45

72

( 27, ).

가

Anchor Paper

( 27, ).

28

4

‘ , ’

가 가

‘FR - 1000’

가 가 .

‘FR - 1000’

‘ , ’

50%

‘FR

, ‘ , ’

가

seed lot

가

가

2 3

62 *Fusarium* *Mucor* spp. *Rhizopus*가  
75, 80, 85

가

62.

(unit : %)

Pathogen	'Partner-A' <sup>y</sup>				'Partner B' <sup>x</sup>				'Power'			
	Check	I <sup>w</sup>	v	u	Check	I <sup>w</sup>	v	u	Check	I <sup>w</sup>	v	u
<i>Alternaria alternaria</i>	-	-	-	-	6	-	-	-	-	-	-	-
<i>Aspergillus niger</i>	-	-	-	-	-	-	-	-	4	-	-	-
<i>Cladosporium</i>	-	-	-	-	-	-	-	2	-	-	-	-
<i>Fusarium moniforme</i>	4	-	-	-	-	-	-	-	-	-	-	-
<i>Fusarium semitectum</i>	2	-	-	-	-	-	-	-	2	-	-	-
<i>Fusarium</i> spp.	-	-	-	-	2	-	-	-	-	-	-	-
<i>Mucor</i> spp.	-	-	6	2	-	-	-	-	-	2	-	-
<i>Penicillium</i> spp.	-	-	-	-	-	-	-	-	2	-	-	-
<i>Rhizopus</i>	-	6	2	2	2	10	4	4	6	12	4	4
Unknown	-	-	1	-	1	-	-	-	-	-	-	-

<sup>z</sup> Detection method : Blotter.

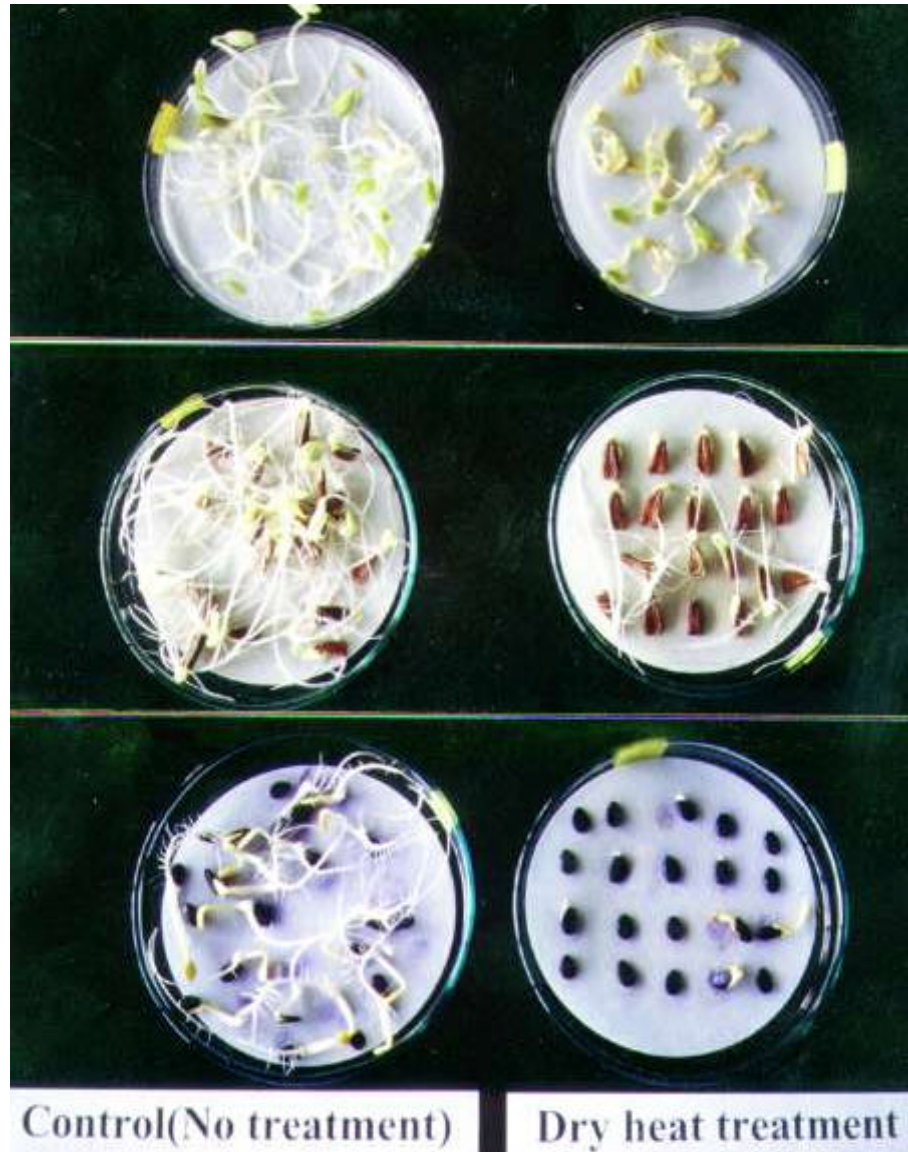
<sup>y</sup> Partner-A : Harvested in China, 1996 with germination percentage of 70-80%.

<sup>x</sup> Partner-B : Harvested in China, 1996 that was selected one time in Kyung Hee Univ. laboratory.

<sup>w</sup> I : 35 (24 hrs) 50 (24 hrs) 75 (72 hrs).

<sup>v</sup> : 35 (24 hrs) 50 (24 hrs) 80 (72 hrs).

<sup>u</sup> : 35 (24 hrs) 50 (24 hrs) 85 (72 hrs).



24. ( ), ( ), ( )





25.

( ) ( )  
 ( )  
 ).



26. . A:  
, B: , C: , D: ,  
, E: , F: .

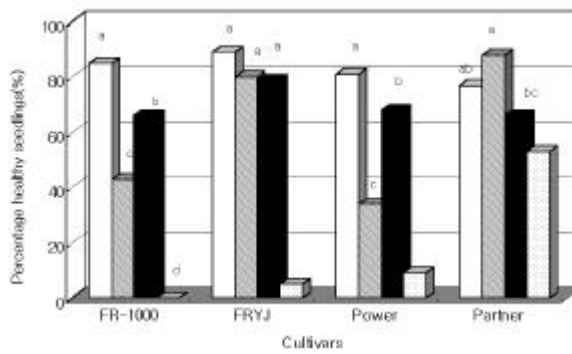
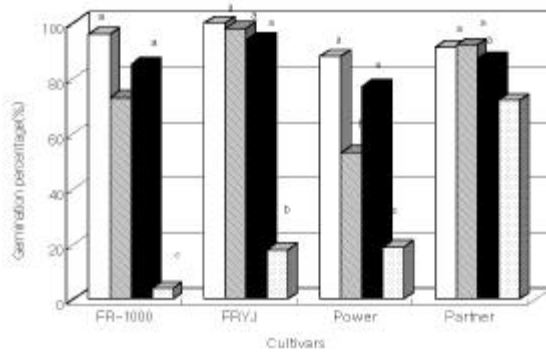
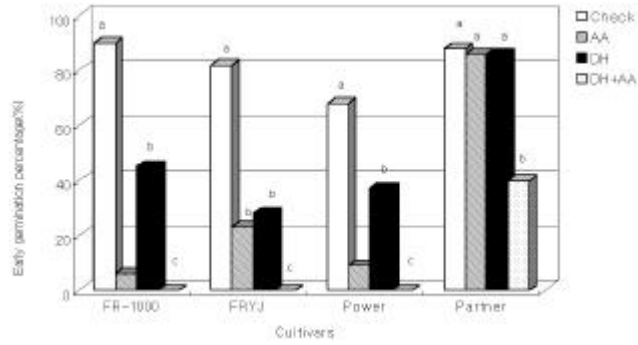




27.

( ) germination paper

( ).



28.

, ,  
( ), ( ) ( ).

4

paper 가 captan 2 g · L<sup>-1</sup> germination  
 captan 100%  
 captan 가 가 가  
 가 가  
 가 SMP  
 captan

5.

가.

( : ,  
 ) thiophanate-methyl 50% thioram 30% 가  
 + ( )  
 1 kg 4 g) (100 g/20 L /20 L )  
 1 ( , 1999,  
 ). ( ) benomyl thiram  
 1 kg  
 3 g ( )가  
 ( 0.5-1.0% ) 10% K<sub>3</sub>PO<sub>4</sub>  
 가

brushing

(Plate 2.

).

1)

( , Sakata seed lot)

( )

가

가

가

(Oda , 1993).

( )

가 (hexaconazole), (penconazole), (fenbuconazole), (bitertanol), (flusilazole), (triadimenol), (difenoconazole), (myclobutanil) (tebuconazole) (diniconazole) paclobutrazole uniconazole

가 가 , , table 6 가 72-128 14-21 (thioram) 63-66

( 63). ( 60, 64). 가 ( 65) uniconazole hexaconazole 가 가 ( 29, 30). 가 ( 66).



29. Hexaconazole

63. 가 , , .

Treatment <sup>z</sup>	Concentration (mg · L <sup>-1</sup> )	% emergence		
		6	13	16 DAS <sup>y</sup>
Control		50	85	88
Thioram	250	50	93	98
Thioram+Paclobutrazol	250+1	23	88	90
Thioram+Paclobutrazol	250+5	13	90	93
Thioram+Uniconazole	250+1	13	80	85
Thioram+Uniconazole	250+5	15	83	90
Thioram+Hexaconazole	250+100	13	85	88
Thioram+Hexaconazole	250+500	7	75	88
Thioram+Diniconazole	250+10	13	88	93
Thioram+Diniconazole	250+50	8	85	90
Thioram+Tebuconazole	250+50	13	83	88
Thioram+Tebuconazole	250+250	3	73	80
Thioram+(Penc.+Capt.) <sup>x</sup>	250+(25+475)	13	80	88
Thioram+(Penc.+Capt.)	250+(125+2375)	13	85	95
Thioram+(Penc.+Chlo.) <sup>w</sup>	250+(20+600)	13	90	95
Thioram+(Penc.+Chlo.)	250+(100+3000)	13	83	90

<sup>z</sup> Dry seeds were soaked in each chemical solution for 6 hours and sown in cell tray.

<sup>y</sup> Days after sowing

<sup>x</sup> Mixed wettable powder (2.5% and 47.5% ai.) formulation of penconazole and captan.

<sup>w</sup> Mixed wettable powder (2% and 60% ai.) formulation of penconazole and chlorothalonil.



Treatment <sup>y</sup>	Concentration (mg · L <sup>-1</sup> )	Cotyledon length (cm)	Leaf wt.(g/plant)	
			Fresh	Dry
Control		4.97 a <sup>x</sup>	1.64 ab	0.116 a
Thioram	250	4.59 b	1.60 bc	0.098 bc
Thioram +Paclobutrazol	250+1	4.50 bc	1.43 d	0.092 cde
Thioram +Paclobutrazol	250+5	3.97 ef	1.32 e	0.082 f
Thioram +Uniconazole	250+1	3.73 fg	1.28 ef	0.086 def
Thioram +Uniconazole	250+5	3.52 g	1.17 g	0.080 f
Thioram +Hexaconazole	250+100	4.15 de	1.29 ef	0.082 f
Thioram +Hexaconazole	250+500	4.16 de	1.32 e	0.084 ef
Thioram +Diniconazole	250+10	4.41 bcd	1.44 d	0.092 cde
Thioram +Diniconazole	250+50	3.90 f	1.20 fg	0.080 f
Thioram +Tebuconazole	250+50	4.31 cd	1.46 d	0.092 cde
Thioram +Tebuconazole	250+250	4.28 cd	1.45 d	0.086 def
Thioram +(Penc.+Capt.) <sup>w</sup>	250+(25+475)	4.49 bc	1.51 cd	0.106 b
Thioram +(Penc.+Capt.)	250+(125+2375)	4.59 b	1.70 a	0.098 c
Thioram +(Penc.+Chlo.) <sup>v</sup>	250+(20+600)	4.52 bc	1.51 cd	0.092 cde
Thioram +(Penc.+Chlo.)	250+(100+3000)	4.41 bcd	1.44 d	0.094 cd

<sup>z</sup> Measurements were taken 18 days after sowing.

<sup>y</sup> Dry seeds were soaked in each chemical solution for 6 hours and sown in cell tray.

<sup>x</sup> Means with the same letter are not significantly different at 5% level by DMRT.

<sup>w</sup> Mixed wettable powder (2.5% and 47.5% ai.) fomulation of penconazole and captan.

<sup>v</sup> Mixed wettable powder (2.5% and 47.5% ai.) fomulation of penconazole and chlorothalonil.

Treatment <sup>y</sup>	Concentration (mg · L <sup>-1</sup> )	Hypocotyl			
		Length (cm)	Diameter (mm)	Weight (g/plant)	
				Fresh	Dry
Control		5.37 a <sup>x</sup>	3.76 bcd	0.67 bc	0.116 a
Thioram	250	5.44 a	3.53 e	0.67 bc	0.096 bc
Thioram+Paclobutrazol	250+1	5.35 a	3.66 cde	0.67 bc	0.092 cde
Thioram+Paclobutrazol	250+5	4.28 a	3.67 cde	0.56 d	0.082 ef
Thioram+Uniconazole	250+1	3.23 f	3.86 abc	0.39 g	0.086 def
Thioram+Uniconazole	250+5	2.80 g	3.76 bcd	0.31 h	0.080 f
Thioram+Hexaconazole	250+100	3.26 f	3.86 abc	0.44 ef	0.082 ef
Thioram+Hexaconazole	250+500	3.93 e	4.02 a	0.57 d	0.084 ef
Thioram+Diniconazole	250+10	3.85 e	3.82 bcd	0.48 e	0.092 cde
Thioram+Diniconazole	250+50	3.34 f	3.62 de	0.38 g	0.080 f
Thioram+Tebuconazole	250+50	5.17 a	3.69 cde	0.67 bc	0.092 cde
Thioram+Tebuconazole	250+250	4.76 c	3.82 bcd	0.66 bc	0.086 def
Thioram+(Penc.+Capt.) <sup>w</sup>	250+(25+475)	4.90 bc	3.97 ab	0.70 b	0.106 b
Thioram+(Penc.+Capt.)	250+(125+2375)	4.46 d	3.95 ab	0.67 bc	0.098 c
Thioram+(Penc.+Chlo.) <sup>y</sup>	250+(20+600)	4.15 a	3.66 cde	0.67 c	0.080 cde
Thioram+(Penc.+Chlo.)	250+(100+3000)	5.31 a	3.96 ab	0.80 a	0.094 cd

<sup>z</sup> Measurements were taken 23 days after sowing.

<sup>y</sup> Dry seeds were soaked in each chemical solution for 6 hours and sown in cell tray.

<sup>x</sup> Means with the same letter are not significantly different at 5% level by DMRT.

<sup>w</sup> Mixed wettable powder (2.5% and 47.5% ai.) formulation of penconazole and captan.

Treatment <sup>z</sup>	Concentration (mg · L <sup>-1</sup> )	% emergence		
		8	10	12 DAS <sup>y</sup>
Control		98 a <sup>x</sup>	100 a	100 a
Thioram	250	58 bc	83 ab	85 abc
Paclobutrazol	10	28 cdefg	68 b	84 abc
Thioram+Paclobutrazol	250+1	28 cdefg	63 b	83 abc
Thioram+Paclobutrazol	250+10	8 g	63 b	68 c
Uniconazole	1	20 g	60 b	72 bc
Thioram+Uniconazole	250+0.1	8 g	68 b	75 bc
Thioram+Uniconazole	250+1	15 fg	78 ab	80 abc
Hexaconazole	250	48 bcde	88 ab	100 a
Thioram+Hexaconazole	250+25	65 b	78 ab	80 abc
Thioram+Hexaconazole	250+250	53 bcd	70 b	83 abc
Diniconazole	5	32 cdefg	72 ab	88 abc
Thioram+Diniconazole	250+0.5	53 bcd	75 ab	80 abc
Thioram+Diniconazole	250+5	38 bcdefg	68 b	80 abc
Tebuconazole	500	28 cdefg	64 b	72 bc
Thioram+Tebuconazole	250+50	53 bcd	85 ab	85 abc
Thioram+Tebuconazole	250+500	35 cdefg	70 b	75 bc
Paclobutrazo · Captan	5000	20 efg	84 ab	92 ab
Thioram+(Penc.+Capt.) <sup>w</sup>	250+(25+475)	43 bcdef	65 b	75 bc
Thioram+(Penc.+Capt.)	250+(250+4750)	25 defg	58 b	73 bc
Paclobutrazo · Chlorothalonil	6200	44 bcdef	80 ab	84 abc
Thioram+(Penc.+Chlo.) <sup>y</sup>	250+(20+600)	38 bcdef	73 ab	88 abc
Thioram+(Penc.+Chlo.)	250+(200+6000)	30 cdefg	73 ab	78 abc

<sup>z</sup> Dry seeds were soaked in each chemical solution for 6 hours and sown in cell tray.

<sup>y</sup> Days after sowing.

<sup>x</sup> Mixed wettable powder (2.5% and 47.5% ai.) fomulation of penconazole and captan.

<sup>w</sup> Mixed wettable powder (2% and 60% ai.) fomulation of penconazole and chlorothalonil.



30.

가

( ) ‘ ’ ( )

가

가 가 .  
가  
(hexaconazole) 가

paclobutrazol  
(diniconazole)

( 29).

가

가

( , 1998)

(PJB, 1994)

2)

‘ ,

가

가

( 31, 32).

Sakata

seed lot

가

gibberellin

Gibberellin

가

가

Sakata

seed lot

( ),

( ) gibberellin 가 GA<sub>3</sub> ( 協和 가 3.1%) Abbott Lab. GA<sub>4+7</sub> 2% 1 , 24 72-128 cell tray 14-21 GA<sub>3</sub> GA<sub>4+7</sub> 1, 5, 25 mg · L<sup>-1</sup> 1 7 (HL) (HD), HL/HD (data ) GA 50%

67 GA<sub>3</sub> 100-1000 mg · L<sup>-1</sup> 가 가 4 가, 4 24 가 (4 )가 250 mg · L<sup>-1</sup> 24 100 mg · L<sup>-1</sup> SMP 가 가 Sakata ( 32).

Treatment	Germination rate 4 days after sowing (%)	Germination rate 7 days after sowing (%)	Germination rate 14 days after sowing (%)	Fresh wt. of seedling (g)	Dry wt. of seedling (g)	Hypocotyl length (HL)(cm)	Hypocotyl diameter (HD)(mm)	HL/HD ratio	Cotyledon length (CL)(cm)	Cotyledon width (CW)(cm)	CL/CW ratio	True leaf
Control	12.5 f <sup>z</sup>	93.0 b	98.6 a	4.419 ab	0.175 d	6.60 e	4.38 ab	14.83 e	6.77 bc	4.65 a	1.46 a	5.37 abc
T-1	88.9 bc	100.0 a	100.0 a	5.191 a	0.234 ab	7.29 cde	4.63 a	15.76 e	7.30 a	4.82 a	1.52 a	5.73 a
T-2	91.6 ab	100.0 a	100.0 a	5.073 ab	0.230 abc	8.09 bcd	4.64 a	7.43 cde	7.19 ab	4.74 a	1.52 a	5.53 abc
T-3	83.3 cd	100.0 a	100.0 a	5.022 ab	0.215 abc	8.42 bc	4.54 ab	18.56 bcd	7.16 ab	4.72 a	1.52 a	5.24 c
T-4	80.5 d	100.0 a	100.0 a	4.804 ab	0.226 abc	8.63 b	4.63 a	18.66 bcd	7.08 abc	4.77 a	1.48 a	5.14 cd
T-5	94.4 ab	100.0 a	100.0 a	4.698 ab	0.208 bc	8.53 b	4.49 ab	19.02 bcd	6.78 bc	4.63 a	1.47 a	5.30 bc
T-6	84.7 cd	98.6 a	98.6 a	4.820 ab	0.231 abc	8.86 b	4.52 ab	19.64 bc	6.85 abc	4.66 a	1.47 a	5.49 abc
T-7	83.3 cd	98.6 a	98.6 a	4.305 b	0.200 cd	7.15 de	4.29 b	16.68 de	6.61 c	4.50 a	1.47 a	5.26 c
T-8	94.4 ab	100.0 a	100.0 a	5.201 a	0.242 a	8.62 b	4.60 a	18.74 bcd	6.97 abc	4.73 a	1.47 a	5.71 ab
T-9	93.0 ab	98.6 a	98.6 a	5.022 ab	0.244 a	9.08 b	4.45 ab	20.42 b	7.02 abc	4.67 a	1.50 a	5.51 abc
T-10	56.9 e	98.6 a	98.6 a	4.327 b	0.207 bc	8.24 bcd	4.45 ab	18.57 bcd	6.92 abc	4.66 a	1.49 a	4.82 d
T-11	93.0 ab	98.6 a	98.6 a	4.785 ab	0.240 ab	8.87 b	4.53 ab	19.57 bc	7.08 abc	4.65 a	1.52 a	5.54 abc
T-12	97.2 a	100.0 a	100.0 a	4.814 ab	0.219 abc	10.55 a	4.40 ab	23.97 a	6.92 abc	4.63 a	1.50 a	5.34 abc

<sup>z</sup> Mean separation within columns within a cultivar by Duncan's multiple range test at 5% level.

Control : Imbibition  $0 \text{ mg} \cdot \text{L}^{-1}$  , 0 hr  
T-1 : Imbibition  $100 \text{ mg} \cdot \text{L}^{-1}$  , 1 hr  
T-2 : Imbibition  $100 \text{ mg} \cdot \text{L}^{-1}$  , 4 hrs  
T-3 : Imbibition  $100 \text{ mg} \cdot \text{L}^{-1}$  , 24 hrs  
T-4 : Imbibition  $250 \text{ mg} \cdot \text{L}^{-1}$  , 1 hr  
T-5 : Imbibition  $250 \text{ mg} \cdot \text{L}^{-1}$  , 4 hrs  
T-6 : Imbibition  $250 \text{ mg} \cdot \text{L}^{-1}$  , 24 hrs  
T-7 : Imbibition  $1000 \text{ mg} \cdot \text{L}^{-1}$  , 1 hr  
T-8 : Imbibition  $1000 \text{ mg} \cdot \text{L}^{-1}$  , 4 hrs  
T-9 : Imbibition  $1000 \text{ mg} \cdot \text{L}^{-1}$  , 24 hrs  
T-10 : Imbibition  $2500 \text{ mg} \cdot \text{L}^{-1}$  , 1 hr  
T-11 : Imbibition  $2500 \text{ mg} \cdot \text{L}^{-1}$  , 4 hrs  
T-12 : Imbibition  $2500 \text{ mg} \cdot \text{L}^{-1}$  , 24 hrs



31. ( )  
(1999, ).





32. ‘   ’

( ) GA<sub>3</sub>

( ).

(osmoconditioning)

solid matrix priming (SMP) 가 (Khan , 1995; Cantliffe, 1997).

SMP (Cantliffe, 1997)

matricconditioning (Khan , 1995)

SMP SMP ,  
, , , , ,  
(Khan , 1995).

SMP Celite calcium silicate

Micro-Cel E ( 68) diatomaceous silica, fine

vermiculite (Expanded vermiculite #5), Agro-Lig, expanded calcined clay

가 (Khan , 1990). Mico-Cel E (MCE)

가가 Aerosil 200, 300, 380 ( )

. Aerosil Degussa AG fumed silica

silicon dioxide (SiO<sub>2</sub>)가 7-40 nm .

Micro-Cel E . Micro-Cel

E 가 1/3 7

SMP : : MCE 15-25

2-5 priming .

가 가

가

MCE가

가

SMP 가 BT  
 1 priming  
 가  
 priming priming 가  
 SMP 가  
 SMP ( 55, 57, 58,  
 22).

68. SMP Micro-Cel E

Physico-chemical property	Micro-Cel E	Expanded vermiculite #5
Water absorption (% by wt) <sup>z</sup>	550	410
Bulk density (kg · m <sup>-3</sup> ) <sup>z</sup>	88	162
Surface area (m <sup>2</sup> · g <sup>-1</sup> ) <sup>z</sup>	95.0	11.4
% particles retained (Tyler method) <sup>z</sup>		
325 mesh	7.0	-
100 mesh	-	80- 100
28 mesh	-	0- 5
pH, 10% water slurry	8.4	7.0
Conductivity (mmho/cm), 10% water slurry	0.48	0.04
Osmotic potential (MPa), 10% extract	Nondetectable	Nondetectable

<sup>z</sup> Data from “Micro-Cel Synthetic Calcium Silicate Functional Fillers” (Bul. FF-427, 1985), Manville, P.O. Box 5108, Denver, CO80217; and “Vermiculite, The Mineral for the '80's” (Bul. V102, 1983) and “Specialty vermiculite” (Bul. V001, 1990), W. R. Grace and Co., 62 Whitmore Ave., Cambridge, MA02140.

69.

SMP

Temp.	Intact					Brushed <sup>z</sup>					Mean
	Control	SMP +KNO <sub>3</sub>	SMP +Captan	SMP +KNO <sub>3</sub> +Captan	SMP +Captan +Din. <sup>y</sup>	Brushed	SMP +KNO <sub>3</sub>	SMP +Captan	SMP +KNO <sub>3</sub> +Captan	SMP +Captan +Din.	
12	0.0	0.0	5.0	0.0	2.5	0.0	0.0	2.5	5.0	0.0	1.5f <sup>x</sup>
15	0.0	12.5	2.5	5.0	10.0	0.0	5.0	12.5	10.0	2.5	6.0f
17	0.0	15.0	30.0	12.5	35.0	0.0	27.5	40.0	47.5	32.5	24.0e
18	2.5	42.5	55.0	40.0	67.5	2.5	37.5	52.0	52.5	72.5	42.5d
20	35.0	77.5	77.5	65.0	75.0	32.5	62.5	85.0	85.0	80.0	67.5c
22	75.0	80.0	85.0	75.0	92.5	72.5	62.5	72.5	77.5	67.5	76.0b
23	60.0	77.5	82.5	90.0	87.5	55.0	80.0	80.0	65.0	65.0	74.3b
26	80.0	90.0	85.0	95.0	100.0	62.5	67.5	77.5	77.5	85.0	82.0a
28	70.0	95.0	87.5	85.0	85.0	75.0	82.5	82.5	87.5	87.5	83.8a
30	72.5	87.5	0.0	90.0	87.5	57.5	85.5	87.5	77.5	90.0	82.5a
Mean	39.5d	57.8b	60.0ab	55.8bc	64.3a	35.8d	51.0c	59.3ab	58.5ab	58.3ab	

<sup>z</sup> Seeds were brushed with Westrup LA-H brushing at 575 rpm for 5 minutes.

<sup>y</sup> Diniconazole (trade name: Vinnari)

<sup>x</sup> Mean separation by Duncan's multiple range test at 5% level.

70.

SMP

Cultivar	'Gamro'		'Sambok-Honey'			'Meerak'		Mean	
	Intact	SMP	Intact	SMP	Intact	SMP			
17	0.0	18.3	9.2d	0.0	21.7	10.8e	0.0	31.7	15.8g
19	10.0	55.0	32.5c	8.3	63.3	35.8d	1.7	73.3	37.5f
21	58.3	83.3	70.8b	26.7	95.0	60.8c	33.3	80.0	56.7e
23	85.0	88.3	86.7a	61.7	98.3	80.0b	60.0	81.7	70.8d
25	91.7	90.0	90.8a	91.7	100.0	95.8a	66.7	88.3	77.5cd
26	91.7	85.0	88.3a	95.0	100.0	97.5a	78.3	86.7	82.5bc
27	96.7	96.7	96.7a	98.3	95.0	96.7a	9.0	91.7	90.8ab
29	98.3	95.0	96.7a	96.7	100.0	98.3a	75.0	83.3	79.2cd
31	100.0	86.7	93.3a	100.0	93.3	96.7a	70.0	85.0	77.5cd
32	98.3	88.3	93.3a	100.0	96.7	98.3a	96.7	95.0	95.8a
Mean	73.0 b	78.9 a		67.8 b	86.3 a		57.2 b	79.7 a	

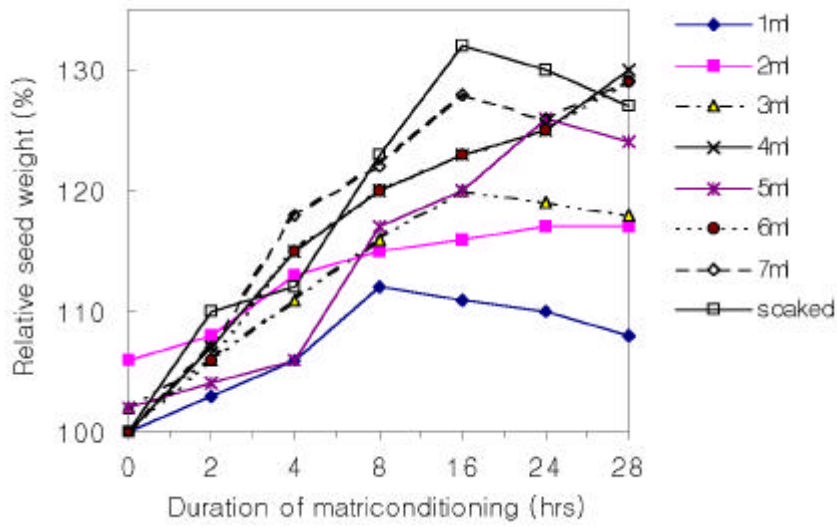
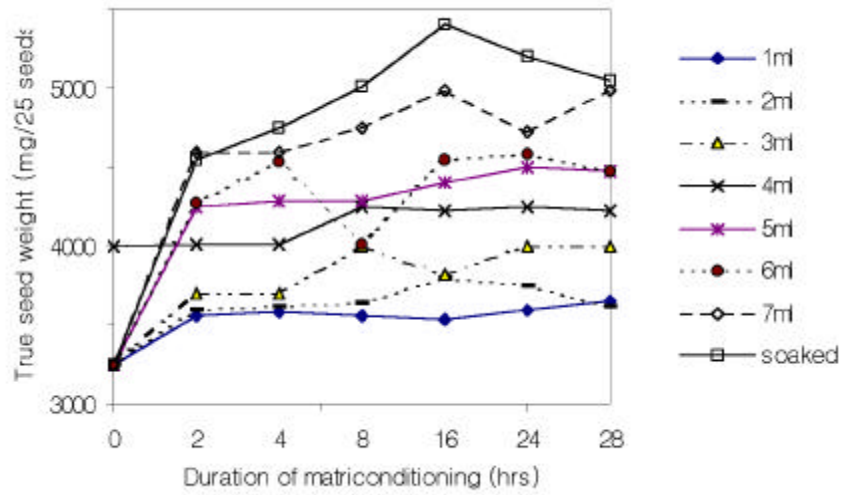
71. SMP

Cultivar	'Gamro'		'Sambok - Honey'			'Meerak'			
	Temp.	Intact	SMP	Intact	SMP	Intact	SMP		
17	10.0	31.7	20.8d	1.7	23.3	12.5e	8.3	55.0	31.7e
19	25.0	68.3	46.7c	20.0	65.0	42.5d	20.0	81.7	50.8d
21	70.0	91.7	80.8b	43.3	96.7	70.0c	65.0	90.0	77.5c
23	96.7	95.0	95.8a	68.3	98.3	83.3b	86.7	96.7	91.7ab
25	100.0	95.0	97.5a	91.7	100.0	95.8a	93.3	95.0	94.2a
26	98.3	96.7	97.5a	96.7	100.0	98.3a	93.3	93.3	93.3ab
27	98.3	96.7	97.5a	98.3	96.7	97.5a	96.7	95.0	95.8a
29	98.3	98.3	98.3a	96.7	100.0	98.3a	87.7	91.7	89.2ab
31	100.0	91.7	95.8a	100.0	96.7	98.3a	75.0	90.0	82.5bc
32	98.3	88.3	93.3a	100.0	96.7	98.3a	96.7	98.3	97.5a
Mean	79.5 b	85.3 a		71.7 b	87.3 a		72.2 b	88.7 a	

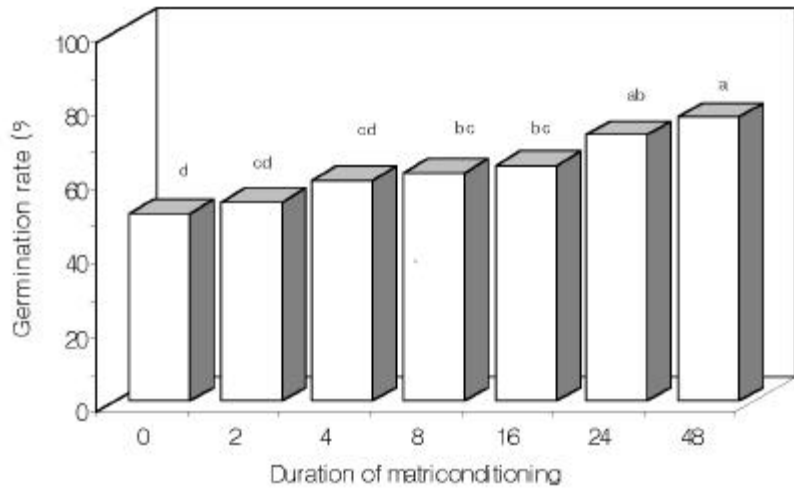
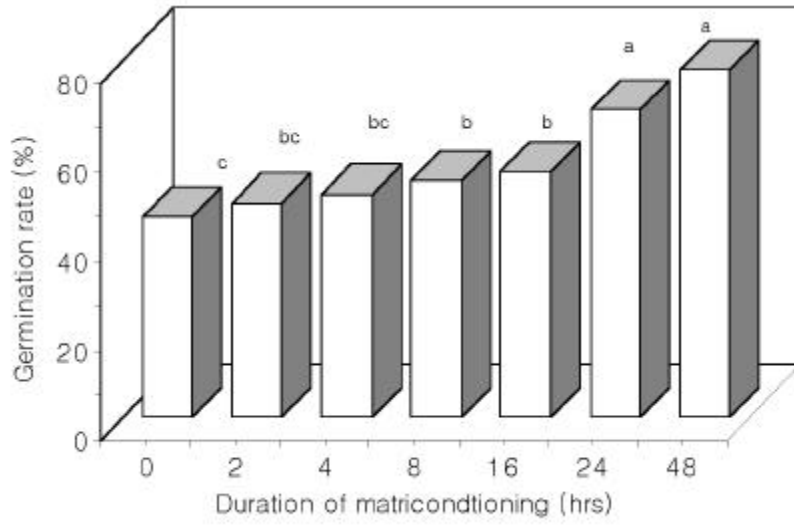
72. SMP (Unit:%)

Cultivar	'Gamro'			'Sambok - Honey'			'Meerak'		
	Temp.	Intact	SMP	Mean	Intact	SMP	Mean	Intact	SMP
17	0.0	0.0	0.0d	0.0	0.0	0.0e	0.0	1.7	0.8f
19	0.0	18.3	9.2d	5.0	40.0	22.5d	0.0	35.0	17.e5
21	46.7	76.7	61.7c	13.3	90.0	51.7c	16.7	75.0	45.d8
23	73.3	86.7	80.0b	38.3	98.3	68.3b	50.0	76.7	63.3c
25	88.3	88.3	88.3ab	83.3	98.3	90.8a	55.0	70.0	52.5c
26	90.0	81.7	85.8ab	88.3	98.3	93.3a	71.7	83.3	77.5b
27	98.3	91.7	95.0a	93.3	93.3	93.3a	83.3	85.0	84.2ab
29	98.3	93.3	95.8a	96.7	91.7	94.2a	63.3	83.3	73.3bc
31	100.0	80.0	90.0ab	100.0	98.3	99.2a	61.7	83.3	72.5bc
32	98.3	91.7	95.0a	100.0	96.7	98.3a	96.7	95.0	95.8a
Mean	69.3 a	70.8 a		61.8 b	80.5 a		49.8 b	68.8 a	

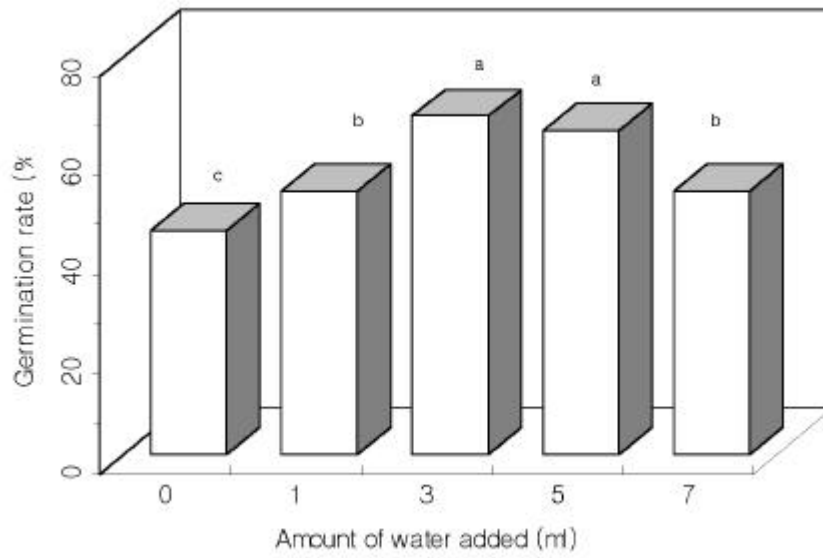
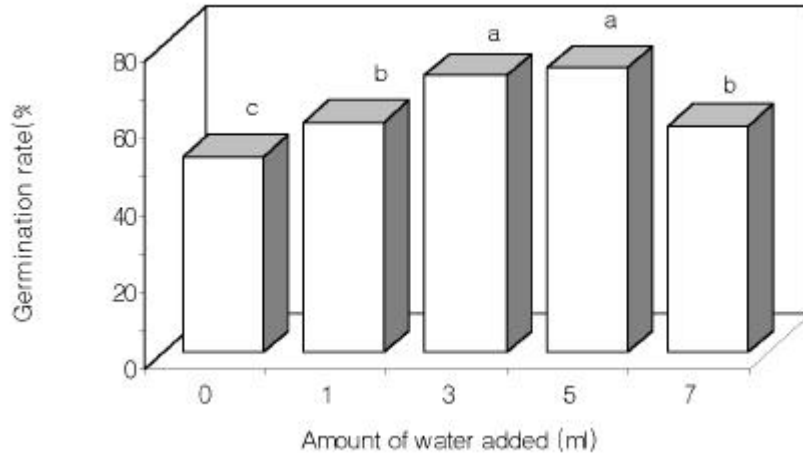
<sup>z</sup> Normal seedling with hypocotyl longer than 1 cm and primary and secondary root.



33. SMP 가 가 (= ).  
 :  
 :



34. ' FR ' SMP  
 SMP 10 : 1 : 3 25  
 : 4  
 : 7



35. ‘ FR ’ 가 .  
 : MCE : 10 : 1 : x .  
 : 4  
 : 7

SMP 가  
 . SMP 가



가

SMP 가

SMP (固形物質) 가

(Khan , 1995). 가

Celite Corp. Micro-Cel E (MCE) 가

( ,

)

MCE

dmf 가 Aerosil

MCE 가 MCE

polymer

, 가

21

(vermiculite)

SMP

clay가

polymer

polymer

MCE

KNO<sub>3</sub>  
K<sub>3</sub>PO<sub>4</sub>,  
NaOCl, CaOCl<sub>2</sub>, KOH, conc. H<sub>2</sub>SO<sub>4</sub>

(混用處理) (複合處理) 가

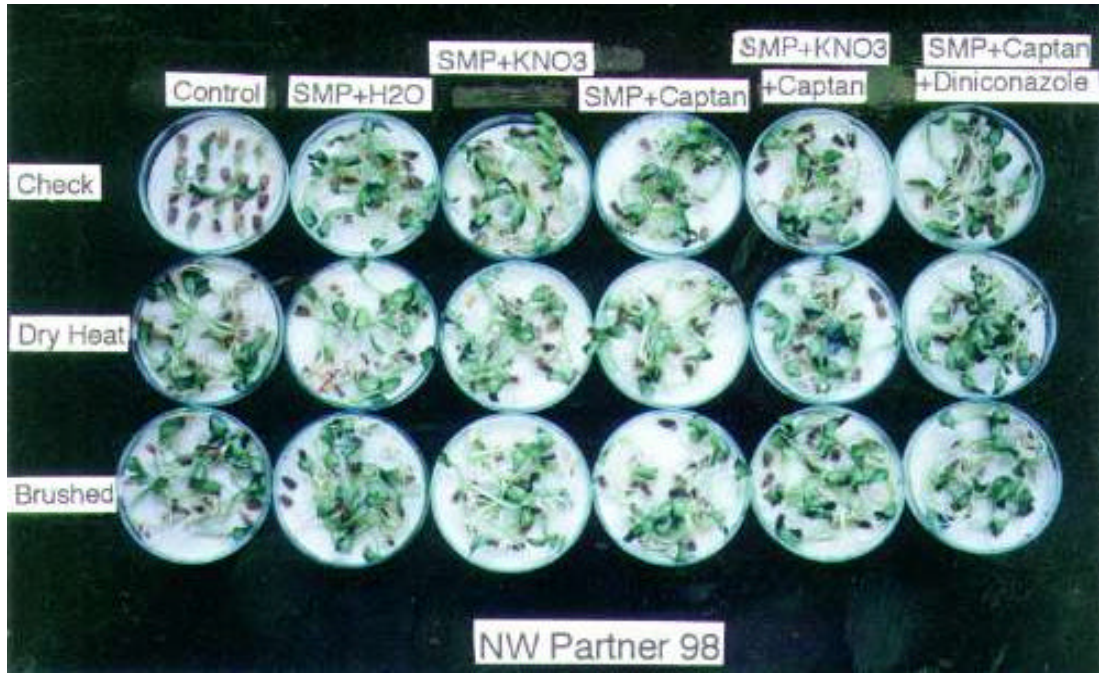
6.

H<sub>2</sub>O<sub>2</sub> O<sub>3</sub> ,  
, methyl bromide ,  
microwave .

7.

가 , ,  
가  
36  
SMP 가 .

73 74 .



36. , brushing , SMP SMP

73.

	<p>database</p> <p>(F<sub>1</sub>)</p> <p>F2                  F1</p> <p>가</p>	<p>가                  F<sub>1</sub></p> <p>가가                  가</p> <p>( )</p>
	<p>( )</p> <p>-</p>	
가	<p>( )-</p> <p>( , , )</p> <p>가</p> <p>- 가</p> <p>- -</p>	<p>20</p> <p>가</p> <p>2-3</p> <p>-</p> <p>-</p> <p>-</p>
	SMP	가가
		-
		가
	( )	

74.

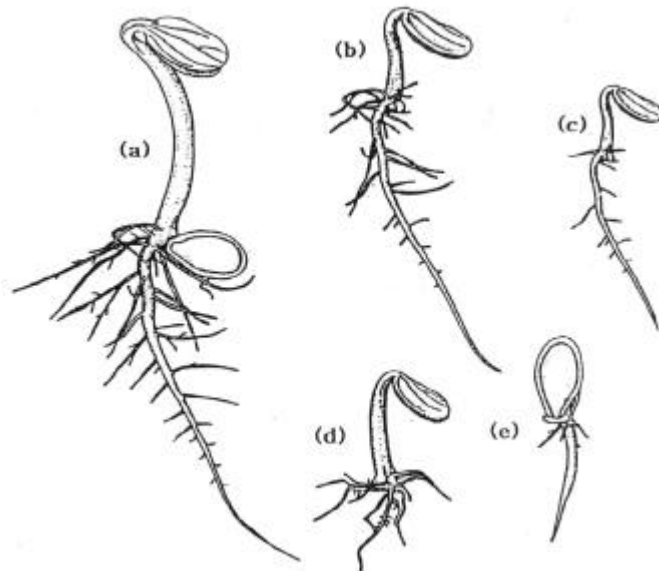
	database	- 가 ( ) 가
	(F <sub>1</sub> ) F2 F1 가	F <sub>2</sub> CGMMV
	( ) -	-
가	( )- ( , , ) 가 - 가 - -	가 3 SMP Brushing
	SMP	가 SMP 가 model 100%
		가 - 가 -
	( )	, brushing,

# 5 가

1.

가, 2 .  
가, conditioning 가 .  
가 (Accelerated or Artificial Aging : AA) .  
seed lot, 40-50% 3  
5-7% .  
AA  
가  
(Anchor Paper Co/St. Paul)  
72- 128  
5 AOSA (AOSA,  
1992) 가 . 5 1 2  
, 4 1 2 , 3 5 cm  
, 2 5 cm 1 2  
, 1 ( 37).

50%  
가 가  
' FR ' 7  
40 72 45  
24 72  
45 72 가  
36 50% 가  
5 가 2  
45 36 1.5  
40 72



37.

(a: 5 , b: 4 , c: 3 , d: 2 , e: 1 ).







75.

가

Duration of aging (hrs)	Percent moisture imbibition (%)	Hypocotyl		Root		Percent increase in fresh weight (%)
		length (cm)	diameter (mm)	length (cm)	density <sup>z</sup>	
A. Aging temperature 40						
Check	-	4.23d <sup>y</sup>	3.29a	10.22cd	4.05bc	327.53bc
24	26.6c	7.33b	2.79c	12.47bc	4.59ab	322.47bc
36	27.8bc	7.95b	2.92bc	13.21ab	4.77ab	409.01ab
48	29.38a	10.98a	2.63c	15.81ab	4.79ab	496.69a
60	27.54bc	5.80c	3.11ab	9.19d	3.76c	300.82c
72	28.43ab	5.86c	2.73c	10.47bcd	4.04bc	314.65bc
B. Aging temperature 45						
Check	-	4.23a	3.29a	10.22a	4.05a	372.53a
24	27.81c	2.07bc	3.30a	7.95ab	3.36b	83.55b
36	30.03bc	1.75bcd	3.16ab	5.39cd	2.87b	45.25c
48	33.46a	1.46cd	2.84b	3.27de	2.16c	51.30c
60	28.37c	2.56b	2.99ab	6.39bc	3.12b	86.35b
72	32.25ab	0.87d	2.42c	2.94e	1.83c	36.52c

<sup>z</sup> Root density evaluation was examined using a scale of 0-5 where 0=no root at all and 5=normal root development.

<sup>y</sup> Means separation in each column by Duncan's multiple range test, 5% level.

2.

stress

가

가

70-80

3

1%

가

가

가

가

35

24

가 50 24 가  
 75 3-7 .  
 가 75 가 75  
 2 .  
 가 , , ,  
 가 . - -  
 가.  
 0-20 5-8% 가 75  
 1-2% 가  
 . 35 , 1 50 , 1 75 , 3-7  
 . 30 (6) 35 (6) 40 (6) 4  
 5 (6) 가 .  
 48 35 75  
 가 .  
 가 가  
 가

가 , 가  
 가 .  
 ,  
 ( 76)  
 ( 77). 가 가  
 가  
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 가

76. 가 .

Crop	Cultivar	Early germination rate (%)					
		Control	65 <sup>z</sup>	70	75	80	85
Water-melon	Houseilpum	96.67a <sup>y</sup>	75.00bc	81.67bc	83.33ab	76.67bc	65.00c
	Bitna	96.67 <sup>ns</sup>	98.33	100.00	95.00	95.00	91.67
Squash	Hongtozwa	95.00ab	96.67ab	100.00ab	95.00ab	76.67b	41.67c
	Kumtozwa	96.67 <sup>ns</sup>	95.00	98.33	96.67	90.00	88.33
Sintozwa	Chilsung	100.00a	98.33a	98.33a	96.67a	98.33a	88.33b
	Kumsul	96.67a	95.00a	96.67a	98.33a	88.33b	86.67b
Cucumber	Baeknokdadaki	98.33a	85.00ab	86.67ab	96.67a	78.33b	51.67c
	Garakmanchun	100.00 <sup>ns</sup>	100.00	100.00	100.00	98.33	98.33
Heukjong	Heungnong	71.67 <sup>ns</sup>	75.00	73.33	78.33	71.67	65.00
	Seoul	98.33 <sup>ns</sup>	95.00	90.00	93.33	91.67	91.67
Gourd	Partner	73.33a	66.67a	66.67a	43.33b	30.0b	5.00c <sup>z</sup>
	FR Yongja	76.67a	35.00b	15.00b	13.33c	3.33c	1.67c
Melon	Wonderful	98.33a	100.00a	100.00a	95.00ab	96.67a	90.00b

<sup>z</sup> High temperature limit for dry heat treatment of gourd seeds.

<sup>y</sup> Means separation within row by Duncan's multiple range test at 5% levels.

<sup>ns</sup> Non significant.

77. 가

Crop	Cultivar	Germination rate (%)					
		Control	65 <sup>z</sup>	70	75	80	85
Water-melon	Houseilpum	98.33 <sup>ns</sup>	76.67	81.67	85.00	78.33	76.67
	Bitna	96.67 <sup>ns</sup>	98.33	100.00	98.33	100.00	98.33
Squash	Hongtozwa	98.33 <sup>ns</sup>	100.00	100.00	98.33	100.00	98.33
	Kumtozwa	98.33 <sup>ns</sup>	98.33	98.33	98.33	90.00	91.67
Sintozwa	Chilsung	100.00a <sup>y</sup>	98.33a	98.33a	100.00a	98.33a	98.33b
	Kumsul	96.67 <sup>ns</sup>	96.67	96.67	98.33	96.67	93.33
Cucumber	Baeknokdadaki	98.33a	93.33a	93.33a	96.67a	91.67a	76.67b
	Garakmanchun	100.00 <sup>ns</sup>	100.00	100.00	100.00	98.33	98.33
Heukjong	Heungnong	73.33 <sup>ns</sup>	73.33	73.33	80.00	75.00	66.67
	Seoul	98.33 <sup>ns</sup>	93.33	93.33	95.00	93.33	95.00
Gourd	Partner	80.00 <sup>ns</sup>	88.33	88.33	85.00	88.33	81.67
	FR Yongja	98.33a	95.00a	95.00a	81.67c	85.00bc	80.00c
Melon	Wonderful	100.00a	100.00a	100.00a	95.00b	100.00a	93.33b

<sup>z</sup> High temperature limit for dry heat treatment of gourd seeds.

<sup>y</sup> Means separation within row by Duncan's multiple range test at 5% levels.

<sup>ns</sup> Non significant.

가 2%  
 +  
 + 1-1.2%, 0.8-1.0%  
 ( 38).  
 가  
 가 가  
 가 가

( , , ).

가

‘ ’ (’97 ), ‘FR King ’ (’97 ), ‘ ’  
 (’97 ), ‘ ’, ‘ ’, ‘ ’ ‘ ’, ‘ ’  
 , ‘ ’ 35 , 24 50 , 24  
 75 72 .

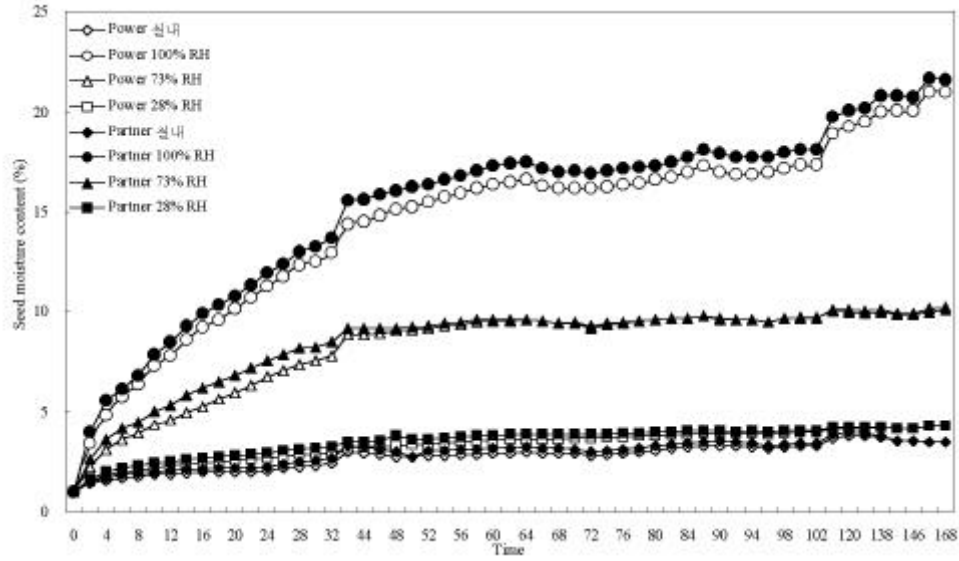
Winston (1960) 95, 93, 89, 87, 86, 84,  
 82, 74, 73, 63, 45, 35, 28, 15 8% 15 5

( )

ISTA

0.75% ,

0.90% ( 78, 79).



± x 38.

78.

RH in chamber	Gourd				Watermelon				Cucumber			
	FR- King II	Partner	Power	Mean	Daegam	Gold	Kumsung	Mean	Eunsung Baekadaggi	New Black Pearl	Winter Sari	Mean
95%	19.18	18.41	18.90	18.83	24.72	24.76	24.74	24.74	22.54	20.90	20.46	20.46
93%	17.47	17.31	16.88	17.22	22.06	20.35	21.63	21.21	18.87	18.66	19.14	19.14
89%	16.41	16.60	15.38	16.13	20.72	18.09	19.41	19.41	17.95	16.67	17.25	17.25
87%	15.24	15.11	14.58	14.98	17.46	16.42	16.69	16.94	15.58	15.30	15.68	15.68
86%	14.83	14.57	14.00	14.47	17.02	15.34	16.47	16.18	15.14	14.86	15.21	15.21
84%	12.77	11.85	12.08	12.23	13.48	12.74	13.11	13.11	12.52	12.15	12.57	12.57
82%	11.52	11.17	11.03	11.24	13.35	11.24	11.63	12.30	11.30	10.90	11.37	11.37
74%	10.58	10.41	10.39	10.46	12.09	10.42	10.83	11.26	10.76	10.33	10.65	10.65
73%	10.48	9.83	10.05	10.12	10.79	9.94	10.36	10.37	10.25	10.09	10.45	10.45
63%	8.85	8.49	8.58	8.64	9.05	8.66	8.90	8.86	8.84	8.45	8.91	8.91
45%	7.47	7.44	7.34	7.42	7.75	7.31	7.89	7.53	7.52	7.26	7.57	7.57
35%	6.69	6.61	6.54	6.61	6.84	6.40	6.73	6.62	6.56	6.27	5.96	5.96
28%	6.08	6.26	6.02	6.12	6.38	5.96	6.48	6.17	6.25	5.94	6.22	6.22
15%	4.90	4.92	4.89	4.90	5.29	4.84	5.23	5.07	5.54	5.02	5.44	5.44
8%	2.08	2.09	3.47	2.55	3.26	1.92	2.39	2.59	2.59	2.31	2.52	2.52

\*

5

24

RH in chamber	Gourd				Watermelon				Cucumber			
	FR- King II	Partner	Power	Mean	Daegam	Gold	Kumsung	Mean	Eunsung Baekadaggi	New Black Pearl	Winter Sari	Mean
95%	18.26	17.95	18.17	18.13	24.14	23.47	23.82	23.81	20.66	20.62	19.96	19.96
93%	17.15	16.90	16.25	16.77	22.05	19.55	20.85	20.80	18.37	18.37	18.19	18.19
89%	16.18	15.63	14.96	15.59	19.32	17.47	19.12	18.40	16.64	15.93	16.18	16.18
87%	14.58	14.46	14.08	14.37	17.05	15.61	16.46	16.33	14.53	14.13	14.53	14.53
86%	14.25	13.50	13.64	13.80	15.78	14.74	16.26	15.26	14.14	13.61	14.15	14.15
84%	12.19	11.63	11.40	11.74	13.13	12.03	12.79	12.58	11.45	11.91	11.59	11.59
82%	11.02	10.70	10.46	10.73	11.59	10.71	11.13	11.15	10.43	10.02	10.47	10.47
74%	10.27	10.02	9.69	9.99	10.54	10.02	10.24	10.28	9.92	9.28	9.95	9.95
73%	10.09	9.45	9.44	9.66	10.35	9.65	9.83	10.00	9.38	9.15	9.55	9.55
63%	8.43	8.10	7.91	8.15	8.56	8.15	8.35	8.36	8.01	7.74	8.00	8.00
45%	6.42	6.50	6.22	6.38	6.87	5.80	6.67	6.34	6.41	5.00	6.45	6.45
35%	5.42	5.51	5.03	5.32	5.51	5.03	5.28	5.27	5.23	4.95	5.23	5.23
28%	4.83	4.54	4.40	4.59	4.89	4.54	4.68	4.72	4.79	4.63	4.78	4.78
15%	3.90	3.69	3.40	3.66	4.01	3.68	4.16	3.85	4.24	3.89	4.08	4.08
8%	1.84	1.65	1.66	1.72	1.82	1.57	2.08	1.70	1.18	1.73	1.93	1.93

substances) (gelatin-like

3  
 39 가 3  
 0- 25% 가  
 가 가 25- 60% 가 75%  
 가 3  
 (data )

가



가 .

가

( 80, 81, 40)

ISTA

51.4%,

56.0%

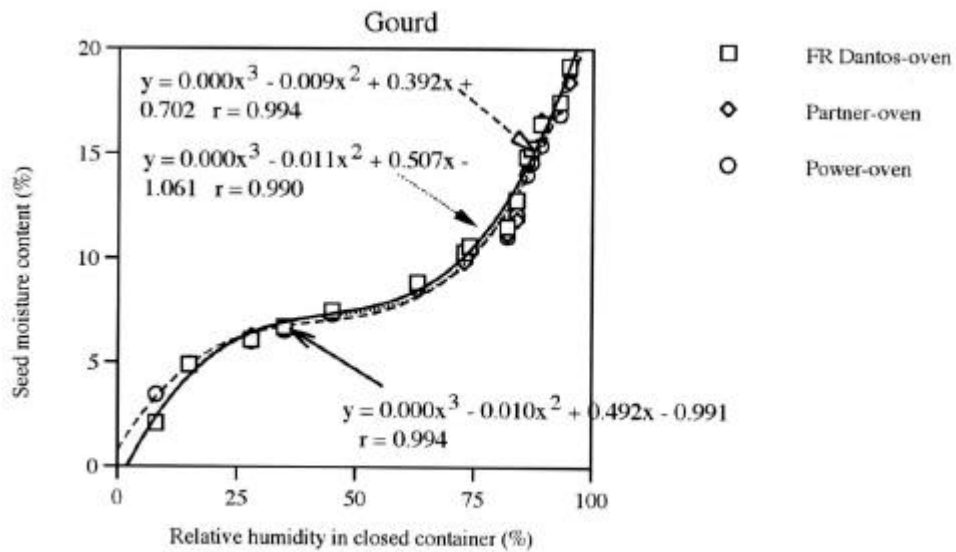
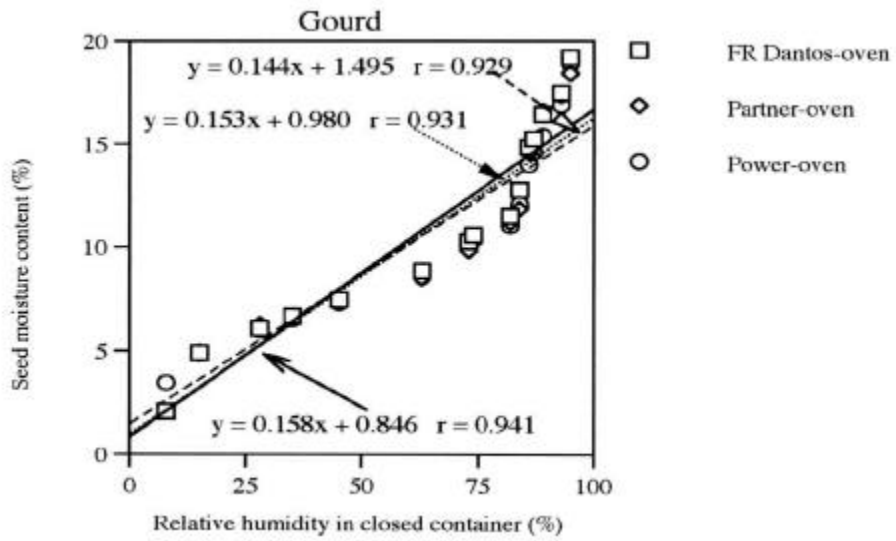
50%

‘ ’

( 40)

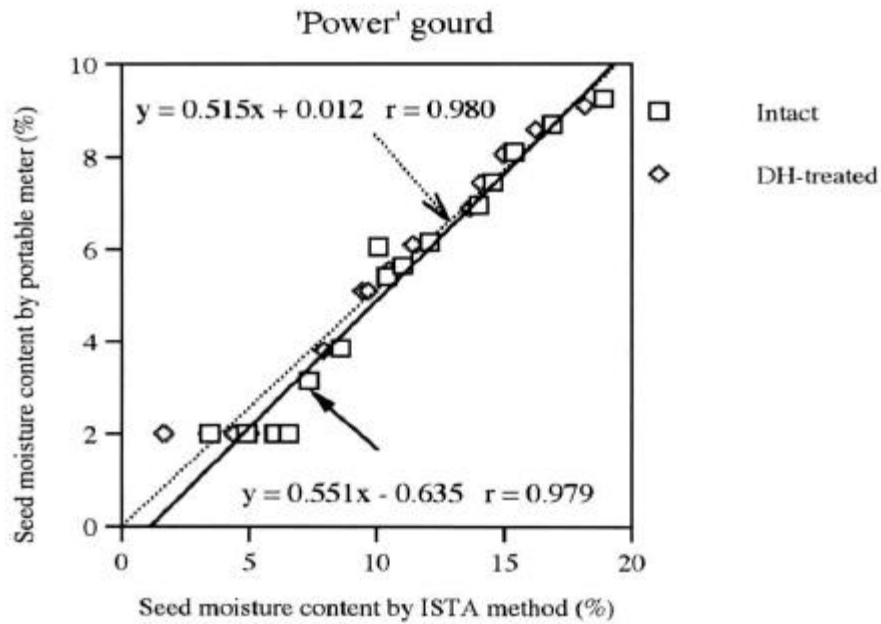
(data ).

( 78, 79 )



39.

5



40. ( , )

80.

RH in chamber	Gourd				Watermelon				Cucumber			
	FR-King II	Partner	Power	Mean	Daegam	Gold	Kumsung	Mean	Eunsung Baekadaggi	New Black Pearl	Winter Sari	Mean
95%	8.85	8.95	9.25	9.02	11.45	10.85	11.45	11.15	9.70	9.58	9.50	9.50
93%	8.40	8.20	8.70	8.43	11.15	10.85	11.30	11.00	9.30	8.70	9.28	9.28
89%	8.50	8.25	8.10	8.28	11.45	10.70	11.45	11.08	9.50	9.05	9.40	9.40
87%	7.45	7.65	7.45	7.52	10.55	9.95	10.65	10.25	8.60	8.50	8.50	8.50
86%	7.05	7.35	6.95	7.12	10.30	9.90	10.35	10.10	8.10	8.00	8.20	8.20
84%	6.10	6.35	6.15	6.20	9.35	9.15	9.20	9.25	7.25	6.95	7.15	7.15
82%	5.70	5.75	5.65	5.70	8.75	8.60	8.75	8.68	6.65	6.60	6.75	6.75
74%	5.00	5.15	5.40	5.18	8.70	8.15	8.60	8.43	6.35	6.30	6.20	6.20
73%	4.85	5.10	6.05	5.33	8.30	7.95	8.05	8.13	6.00	5.95	6.20	6.20
63%	3.95	4.00	3.85	3.93	7.10	7.00	7.25	7.05	5.20	5.20	5.20	5.20
45%	3.05	2.45	3.15	2.88	5.60	5.50	5.95	5.55	Err	Err	Err	Err
35%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err
28%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err
15%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err
8%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err

<sup>z</sup> Err : Error message.

81.

RH in chamber	Gourd				Watermelon				Cucumber			
	FR-King II	Partner	Power	Mean	Daegam	Gold	Kumsung	Mean	Eunsung Baekadaggi	New Black Pearl	Winter Sari	Mean
95%	9.25	8.80	9.10	9.05	11.45	11.25	11.45	11.35	9.85	9.65	9.45	9.45
93%	8.45	8.55	8.60	8.53	11.30	10.85	11.25	11.08	9.45	8.55	9.15	9.15
89%	8.25	8.50	8.05	8.27	11.15	10.45	11.35	10.80	9.45	9.10	9.30	9.30
87%	7.25	7.65	7.45	7.45	10.30	10.00	10.50	10.15	8.50	8.25	8.60	8.60
86%	7.05	7.45	6.90	7.13	10.30	9.80	10.20	10.05	8.25	8.05	8.20	8.20
84%	6.05	6.40	6.10	6.18	9.20	9.00	9.35	9.10	7.15	7.05	7.05	7.05
82%	5.45	5.80	5.55	5.60	8.75	8.40	8.75	8.58	6.65	6.55	6.70	6.70
74%	5.00	5.45	5.10	5.18	8.45	8.20	8.35	8.33	6.35	6.05	5.75	5.75
73%	4.85	5.10	5.10	5.02	8.20	7.95	8.35	8.08	6.00	6.00	6.25	6.25
63%	3.80	3.90	3.80	3.83	7.05	6.80	6.80	6.93	5.10	5.20	5.05	5.05
45%	Err	Err	Err	Err	3.90	Err	3.90	3.90	Err	Err	Err	Err
35%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err
28%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err
15%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err
8%	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err	Err

<sup>z</sup> Err : Error message.

가

가

가,

가

가

가

( 30 )

가

가

( , , , , , ) 가 ( ,

) 가

SMP

가

35 , 24 50 , 24

75 , 72

Micro-Cel E, Aerosil 200 Aerosil 300 SMP

Micro-Cel E calcium silicate functional filter

550% Aerosil , silicon

oxide Micro-Cel E 가 3 가 가

SMP : : 10 : 1 : 3, 9 : 1 : 3, 8 : 1 : 3

25 3 가

24 35 drying oven 48

SMP 가 가 72 cell tray

SMP

. SMP  
Micro cel E 가 가 Aerosil 300,  
Aerosil 200 가  
SMP  
가  
SMP 가 20-30%  
SMP  
가 SMP  
10-16% ( 55 ).  
SMP 20 4  
(30 , 60 ) SMP 가  
SMP , ,  
, 가 가 , , seed lot,  
SMP .

6

1.

(乾熱處理)  
 1998 CGMMV  
 1999 KGMMV  
 full-time CGMMV  
 CGMMV  
 ELISA, RT-PCR, HDLPAT  
 10 1  
 100% 100% 가 1  
 2.

가. ELISA

ELISA (enzyme-linked immunosorbent assay) 1 500  $\mu$ L  
 0.1 M sodium carbonate buffer  
 microplate (96-well) ( ) blocking

buffer 가 37 120 300  $\mu$ L  
 buffer 3 . 150  $\mu$ L 가 37 90  
 . buffer 150  $\mu$ L substrate buffer  
 20 50  $\mu$ L 3 M NaOH 1  
 ELISA plate reader 405 nm (Agrios, 1997; Clark,  
 1981; Kim, 1998).

. RT-PCR

RT-PCR (Reverse Transcription Polymerase Chain Reaction) 1  
 300  $\mu$ L -20 . 1 M  
 Tris-HCl (pH 8.0), 1 M EDTA (pH 8.0), 20% SDS .  
 phenol : chloroform  
 : isopropanol (25 : 24 : 1) 4 10  
 (12,000 rpm). 100 가 90-95  
 template RNA .  
 (Kim, 1998) DNA TAE buffer 1.0% agarose gel  
 100 volts 40 , ethium bromide UV  
 . 400 bp band가 CGMMV

. HDLPAT

HDLPAT ( ; high density latex particle agglutination test)  
 CGMMV IgG (HDLP)가  
 microplate well lattice



(Kim, 1998; Park, 1998).

well

가 HDLP

가 가

( 43 ).

( $10^{-10}$   $10^{-3}$ )

(round bottom) 가

microplate (Costar Co.)

1 800  $\mu$ L (0.1% BSA + 0.001% Tween80 + 0.007% NaN<sub>3</sub>)

30  $\mu$ L well 30  $\mu$ L HDLP .

90 ,

가

2 , .

(Bioassay)

1 2 1 mL 0.01 M phosphate buffer (pH 7.0)

4 24

30-45 (*Chenopodium amaranticolor*) .

7-8 1-2

가 carborundum 95% + bentonite 5%

3 가 ( 45)

3.

가

brushing

CGMMV ( 82)

( 83).

virus

( 84).

86

(control)

1 24 HDLPAT ,

RT -PCR, ELISA 100% 가 50%

virus가

HDLPAT 100% RT -PCR ELISA

50%

82. CGMMV

Cultivar	HDLPAT (%) <sup>z</sup>	Bioassay (%) <sup>y</sup>
FR King <sup>x</sup>	100.0	50.0
FR Dantos	25.0	0.0
Partner	25.0	8.3
FR Yongja	0.0	0.0

<sup>z</sup> Twenty four seeds per cultovar were teswted for detection of CGMMV by high density latex particle agglutination test.

<sup>y</sup> Twenty four seeds per cultivar were tested for detection of CGMMV activation on 24 leaves of *chenopodium amaranticolor*.

<sup>x</sup> Only the infected seeds were obtained from the seed producing company and used for experiment with permission.

83. Brushing		가 HDLPAT	CGMMV	
Seed	Cultivar	Percentage of seeds showing positive response to CGMMV (%)		
		Our seed coat	Inner seed coat	
Brushed	FR King II	100.0 <sup>z</sup>	75.0	
	FR Dantos	37.5	25.0	
	Partner	25.0	25.0	
	FR Yongja	0.0	0.0	
Intact	FR King II	50.0	50.0	
	FR Dantos	0.0	0.0	
	Partner	0.0	12.5	
	FR Yongja	0.0	0.0	

84. 2		CGMMV
Treatment	Percentage of seedlings showing positive response (%)	
Control	0 (0/24) <sup>z</sup>	
95 (1 day)	0 (0/24)	
100 (1 day)	0 (0/24)	
75 (6 day)	0 (0/24)	
75 (7 day)	0 (0/24)	

<sup>z</sup> No. of infected seedlings/ No. of tested seedlings.

85.		HDLPAT	ELISA	RT - PCR
Detection limit <sup>z</sup>		10 <sup>-9</sup> mg/ml	10 <sup>-9</sup> mg/ml	10 <sup>-12</sup> mg/ml
Time required per detection		90 min	1-2 day	1-2day
Procedure		Simple	Normal	Complicated
Facilities needed		Lab.	Lab.	Lab.
Equipment required		-	Reader	PCR cyler
Cost per sample		0.025\$	1.75\$	2.00\$

<sup>z</sup> Purified CGMMV was used.

## 86. CGMMV

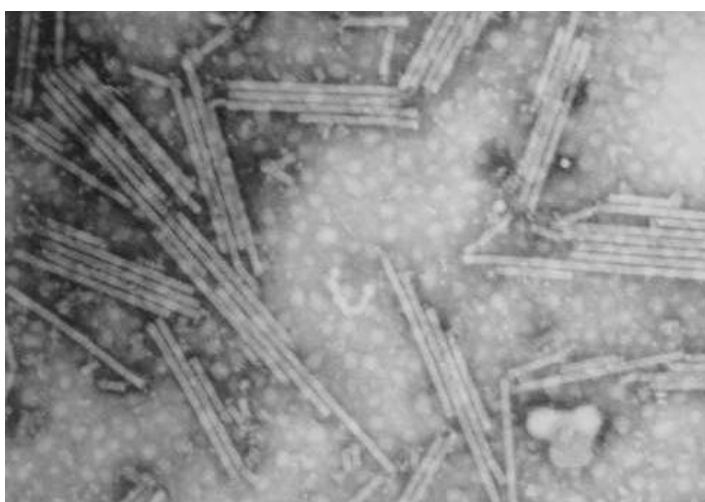
Treatment	Percent detection (%)			
	HDLPAT	RT - PCR	ELISA	Bioassay <sup>z</sup>
Control	100.0 (24/ 24) <sup>y</sup>	100.0 (24/ 24)	95.8 (23/ 24)	50.0 (12/ 24)
85 (1 day) <sup>x</sup>	100.0 (24/ 24)	41.7 (10/ 24)	54.2 (0/ 24)	0.0 (0/ 24)
Na <sub>3</sub> PO <sub>4</sub> 10% +W <sup>w</sup>	8.3 (2/ 24)	20.8 (5/ 24)	29.2 (4/ 24)	16.7 (4/ 24)
K <sub>3</sub> PO <sub>4</sub> 10% +W	16.7 (4/ 24)	29.2 (7/ 24)	29.2 (6/ 24)	25.0 (6/ 24)
NaOCl 1.0% +W	16.7 (4/ 24)	8.3 (2/ 24)	0.0 (8/ 24)	33.3 (8/ 24)
Ca(OCl) <sub>2</sub> 1.0% +W	16.7 (4/ 24)	20.8 (5/ 24)	8.3 (8/ 24)	33.3 (8/ 24)
Benomyl 0.5%	100.0 (24/ 24)	41.7 (10/ 24)	33.3 (4/ 24)	16.7 (4/ 24)
Topsin M 1.0%	100.0 (24/ 24)	8.3 (2/ 24)	37.5 (4/ 24)	8.3 (2/ 24)

<sup>x</sup> The sap extracted from gourd seed was inoculated on the leaves of *Chenopodium amaraniticolor*.

<sup>y</sup> No. of seeds infected/no. of seeds tested.

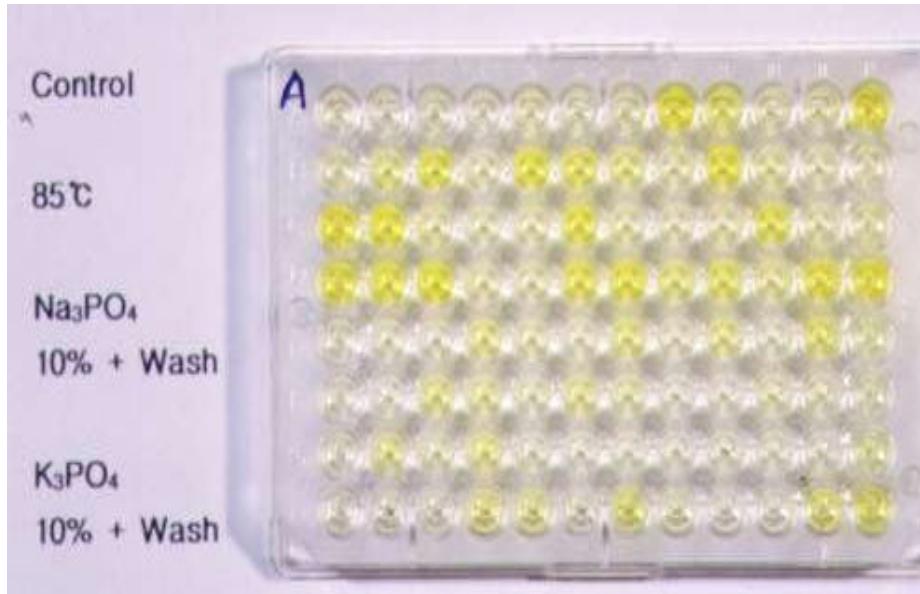
<sup>x</sup> All of the dry heat treated seeds were initially dried in as air-forced drying oven at 35 for 24 hours and, after this initial drying, the temperature of the air-forced oven was raised to 50 to further dry the seeds.

<sup>w</sup> Two hundred seeds were soaked in each solution for 60 minutes followed by washing the seeds with water.

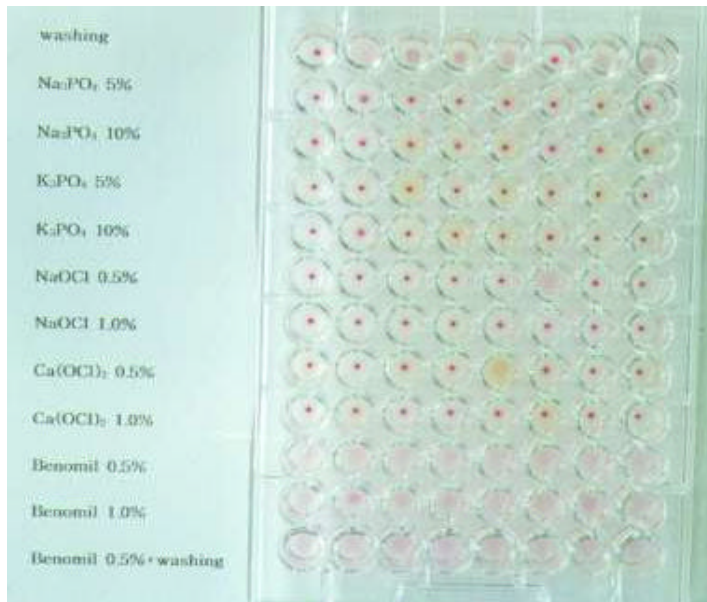


41. CGMMV

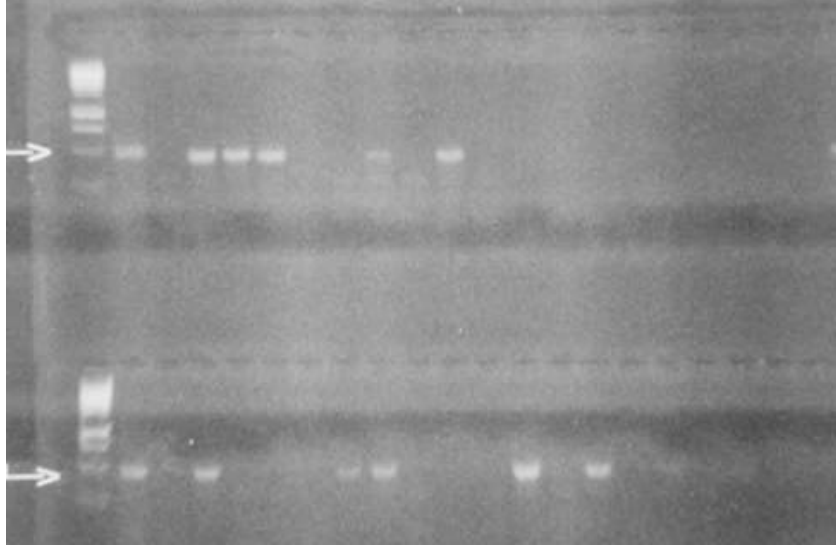
virus.



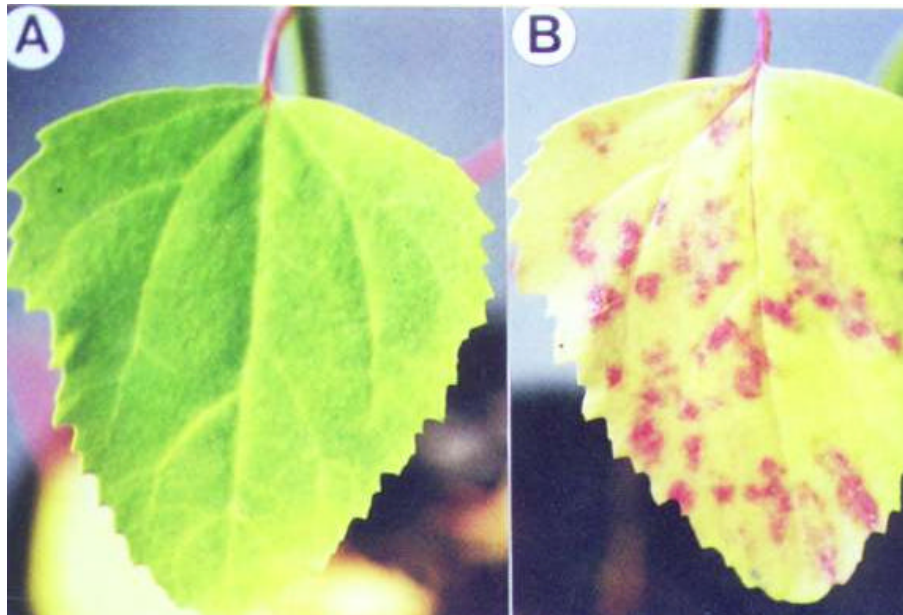
42. ELISA CGMMV 1



43. HDLPAT CGMMV (negative). 1



44. RT-PCR CGMMV . lane 1 .



±x 45. . 1 .

CGMMV

가

가

가

ELISA, RT-PCR,

HDLPAT

가

가

가

가 , , ,

가

, chart

가,

Fusarium

ELISA

, RT-PCR

가,

band

(heat-shock protein)

85

RT-PCR

ELISA가

HDLPAT 85

, 가 ELISA RT-PCR

ELISA kit

가가 IgG 가 가가

RT-PCR

가 .

CGMMV

,

2

2

가

가

86

CGMMV

가

1

100% 가

.

,

1 가

CGMMV가

, 가

가 가

( )

CGMMV



가  
(Kim and Lee, 2000) CGMMV

## 7

### 1. 가

가 100% .  
robot  
(Kurata, 1994; Lee , 1998).

가가 , 100% ,  
가

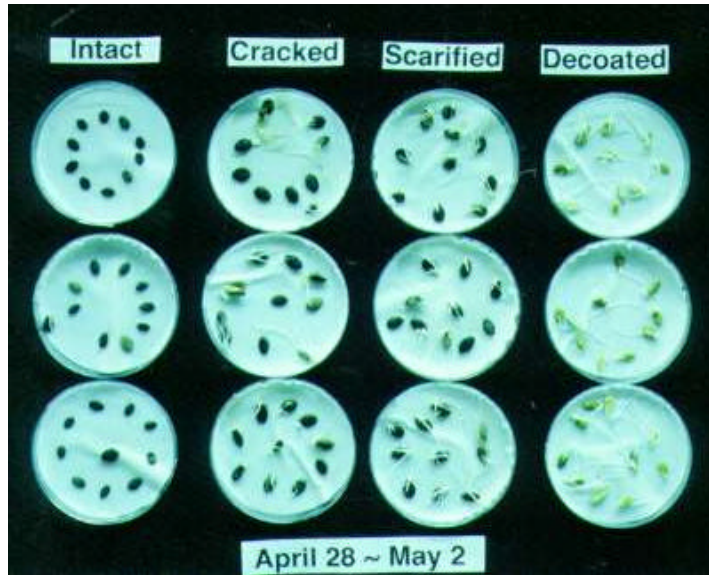
가

가 2-5 mm

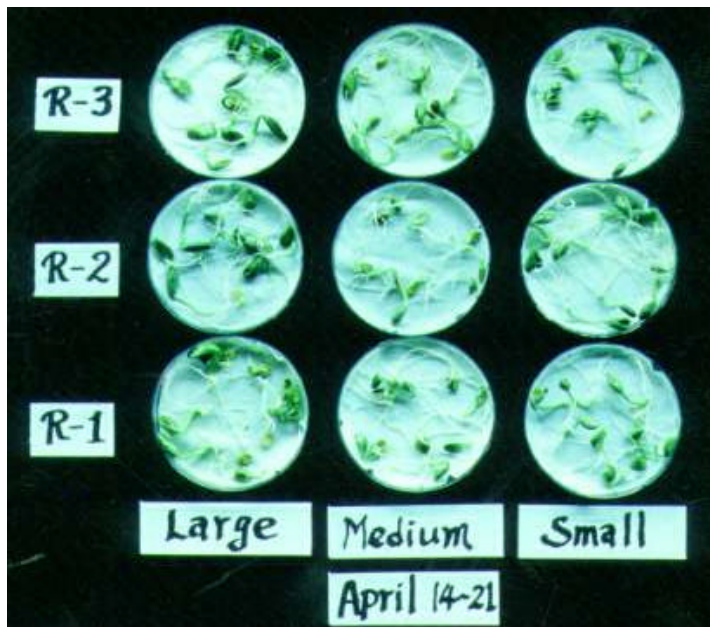
(催芽種子)







46.



47.

87. ( )

Seed treatment	Germination percentage (%) (Days after sowing)								
	1	2	3	4	5	6	7	8	9
Intact	2	2	8	9	9	9	9	9	10
Cracked <sup>z</sup>	36	50	53	56	57	58	60	62	63
Clipped <sup>y</sup>	80	89	90	90	90	91	91	91	92
Decoated <sup>x</sup>	96	100	100	100	100	100	100	100	100

<sup>z</sup> Cracked by adding pressure from both side of seed.

<sup>y</sup> A portion of seedcoat near the micropyle was removed with nail clipper.

<sup>x</sup> Complete seedcoat removal.

88.

	(%)	(%)
	94.4 a	98.9 a
	95.6 a	96.7 a
	100.0 a	100.0 a
(Clipped)	34.5 b	53.3 b
	10.0 c	22.2 c
	14.4 c	24.4 c

\* 25 50 3 pleated paper

가 Micro-Cel E  
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가 H<sub>2</sub>SO<sub>4</sub>

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Plate 4 ( )

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6 2-3

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(Lee , 1999)

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89.

(%).

75	85	80	100	95	95	90	90	85	75	87.0
95	100	85	90	90	85	95	75	100	85	90.0
70	50	75	80	65	75	90	80	85	80	75.0
0	60	50	30	50	45	85	75	85	95	82.5
35	25	25	65	35	85	95	60	75	95	84.5
95	65	90	90	100	95	65	90	80	90	86.0
70	75	40	70	90	5	70	35	90	75	67.0
80	65	35	85	25	20	75	55	20	85	54.5
50	85	25	60	20	25	70	100	80	75	59.0
70	50	90	65	90	85	95	100	85	65	82.0
69.0	66.0	59.5	73.5	66.0	66.5	83.0	96.0	77.0	82.0	

\*

20

14

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87, 90, 86%

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75, 62.5, 67.0%

60-70%

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PBS -buffer (saline)

( , 1999).

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25-28 , 90-93%, (光强  
 度) 3-5 klur, 20-30 cm/ (今西  
 , 1997).

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7

5 가 ( 89)

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	*	**
	7.0-8.0	5.0
	6.0-7.0	4-5
	??	7.0

\* PE film

\*\* ( )

50 3-4 cm

PE film

7-9

가 가

가 가

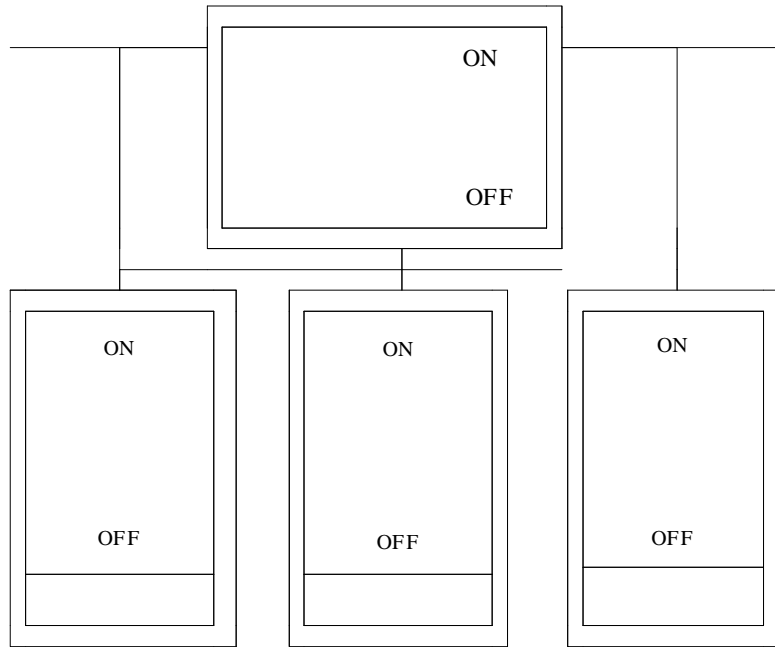
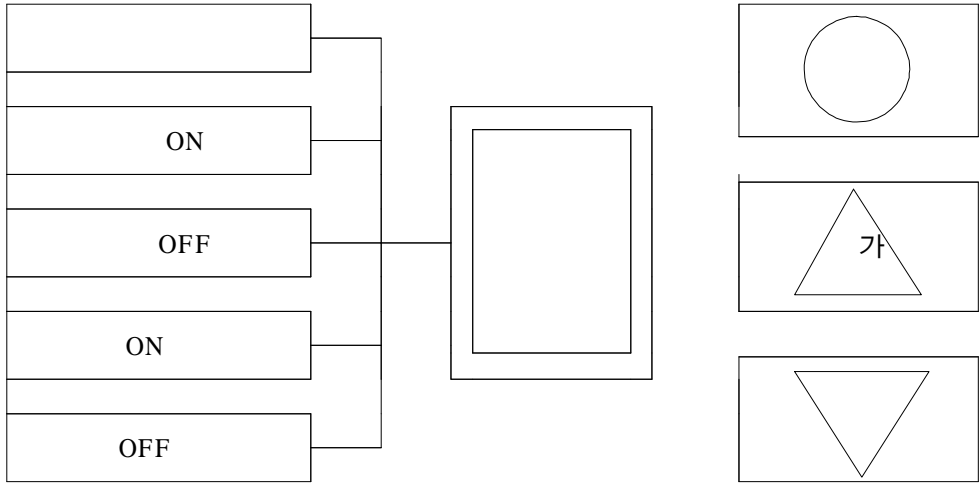
. box 가 ( 48 )  
25-30 , 10 2-3 가

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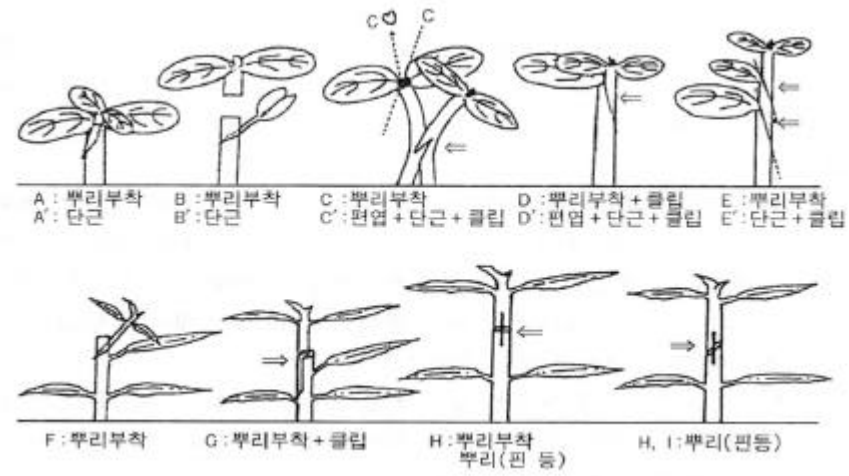
49

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49. ( )  
Iseki 800B ( 880 ).



50.

91.

Grafting machine	Company (Country)	Crops	Efficiency	Others
Grafting robot GR 800B	Iseki Co. (Japan)	Cucurbits	880/hr	Single cotyledon remaining.
Super Angel G-710	Nasmix Co. (Japan)	Cucurbits	600-800/hr	Super Idol 31 silica rubber split tube for fixing.
Super Angel G-720	Nasmix Co. (Japan)	Solanaceous	600-800/hr	Same as above.
Grafting Robot AG 1000	Yanma (Japan)	Solanaceous	1000/hr	
TGR <sup>2</sup> grafting robot	Technical Grafting Res. Institute (Japan)	Cucurbits & Solanaceous	800/hr	Instant glue is used and all 128 seedlings in a tray can be grafted at once.
Pin grafting robot	Takii (Japan)	Solanaceous	— <sup>y</sup>	Ceramic pins are used.
Plug-in grafting robot (-machine)	Osaka Prefecture Univ. (Japan)	— <sup>y</sup>	— <sup>y</sup>	Plug-in method without other grafting clips or glue.
Grafting robot/Korea (Plug-in type)	Kyungpuk Univ. (Korea)	Solanaceous & Cucurbits	700/hr	Being developed as of Dec., 1999.
Pin grafting robot	RDA (Korea)	Solanaceous	— <sup>y</sup>	Being developed.
Semi-automatic grafting machine	Yupoong (Korea)	Cucurbits	400/hr	One operator is needed per machine.

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가 가 7-9

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PE film .

( germination paper )

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20-25

가 13.92 , 8.92 cm, 1.92 g,

0.134 g ( 92).

24 48 가

가 . 72

92.

	( )	(cm)	(g)	(g)	/ (%)
0	13.92 a	8.92 b	1.0767 <sup>NS</sup>	0.0699 <sup>NS</sup>	6.49 <sup>NS</sup>
24	12.36 a	11.00 a	1.4400	0.0954	6.63
48	13.54 a	9.99 ab	1.4233	0.0954	6.70
72	10.78 ab	9.00 b	1.4006	0.0900	6.43
96	6.89 b	8.06 b	1.3933	0.0882	6.33

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93.

	(cm)	(cm)	(cm)	(SPAD)	(g)	(g)	/ (%)
0	3.60 a	4.74 a	1.96 a	40.23 <sup>NS</sup>	1.92 b	0.1341 b	6.98
24	3.78 a	4.80 a	2.38 a	39.79	2.06 b	0.1503 ab	7.30
48	4.04 a	5.04 a	2.30 a	41.01	2.25 a	0.1631 a	7.25
72	3.60 a	4.82 a	2.33 a	39.98	2.05 b	0.1333 b	6.50
96	1.85 b	2.26 b	0.96 b	38.68	1.55 c	0.1048 c	6.76

94.

	( )	(cm)	(g)	(g)
	29.83 ab	15.27 abc	0.4575 a	0.0353 a
12-24	33.60 a	18.70 ab	0.4233 a	0.0291 abc
12-48	28.20ab	16.54 abc	0.3067 b	0.0299 abc
12-72	27.32 b	15.15 abc	0.2933 b	0.0250 bcd
12-96	18.08 d	13.86 c	0.2200 b	0.0194 de
24-24	29.43 ab	19.01 a	0.4333 a	0.0321 ab
24-48	24.93 bc	15.07 abc	0.2800 b	0.022 cde
24-72	20.07 cd	13.47 c	0.2433 b	0.0165 de
24-96	21.00 cd	14.60 bc	0.2533 b	0.0152 e
	22.80 bc	14.94 ab	0.4300 ab	0.0350 a
12-24	24.67 ab	13.90 ab	0.3767 b	0.0313 ab
12-48	25.30 ab	12.86 ab	0.2867 c	0.0260 bc
12-72	27.30 a	12.90 ab	0.1833 d	0.0170 de
12-96	17.78 d	13.69 ab	0.2633 c	0.0277 cde
24-24	22.94 bc	11.64 b	0.4677 a	0.0324 ab
24-48	19.99 cd	15.98 a	0.2900 c	0.0257 bc
24-72	28.27 a	14.45 ab	0.3800 b	0.0244 bcd
24-96	15.90 d	12.13 ab	0.1433 d	0.0149 e

\* DMRT.

	(cm)	(cm)	(cm)	(SPAD)	(g)	(g)
	5.28 a	6.57 ab	5.28 a	29.94 ab	4.56 a	0.3485 ab
12-24	5.55 a	6.64 a	4.50 ab	32.43 a	4.20 abc	0.3215 bc
12-48	5.27 ab	5.92 bc	3.42 bc	30.25 ab	4.06 bc	0.3357 abc
12-72	5.61 a	6.42 ab	3.36 bc	29.05 b	3.88 c	0.3094 c
12-96	4.81 bc	5.45 cd	2.42 c	31.15 ab	3.23 d	0.2323 d
24-24	5.32 ab	6.60 ab	4.22 ab	30.69 ab	4.32 ab	0.3610 a
24-48	5.30 ab	6.07 abc	3.91 b	30.65 ab	3.99 bc	0.3160 c
24-72	3.42 d	3.81 e	3.61 b	26.59 c	2.75 e	0.1848 e
24-96	4.21 c	4.83 d	2.43 c	29.49 b	2.98 de	0.2161 d
	3.49 b	3.91 c	4.55 a	28.32 a	3.85 a	0.2807 a
12-24	3.70 b	4.18 bc	4.71 a	25.14 bc	3.71 ab	0.2404 cd
12-48	4.15 b	4.76 bc	5.08 a	24.98 c	3.46 bc	0.2308 cd
12-72	3.88 b	4.30 bc	5.26 a	24.53 c	3.33 c	0.2162 de
12-96	3.35 b	3.89 c	4.28 ab	25.52 bc	3.04 d	0.1980 ef
24-24	3.70 b	4.99 b	5.22 a	27.41 ab	3.75 a	0.2758 ab
24-48	3.54 b	4.21 bc	4.70 a	26.73 abc	3.39 c	0.2295 cd
24-72	4.50 a	5.84 a	2.92 b	28.57 a	3.39 c	0.2541 bc
24-96	3.44 b	3.94 c	3.59 ab	25.05 bc	2.64 e	0.1864 f

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(Lee, 1994).

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(cytokinins)

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30 cm

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泌液 木部液)

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(篩部液;

phloem sap)

(木部液;

xylem sap)

10

10

24

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250 mL

flask

silica

coating

flask  
 50-mL  
 50-mL  
 plastic centrifuge (Corning) 가  
 EC pH  
 sap 1  
 mL 10 ion chromatograph (Dionex DX-500)  
 XAD  
 - KLH ( , 1999)  
 HPLC (Schreiber,  
 1990).

( 96).  $\text{NH}_4^+$ ,  $\text{NO}_3^-$ ,  $\text{PO}_4^{3-}$   
 가  $\text{Mg}^{2+}$   
 3.24  $\text{mS} \cdot \text{cm}^{-1}$  1.96  $\text{mS} \cdot \text{cm}^{-1}$

sap 가  $\text{PO}_4^{3-}$   $\text{NO}_3^-$   
 가가 , 가  
*trans*-Zeatin riboside  
 (*trans*-ZR)가 *cis*-Zeatin riboside (*cis*-ZR)  
*trans*-Zeatin (*trans*-Z) isopentenyladenine (IP)  
 가  
*trans*-ZR 2 가

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Kato Lou

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HPLC

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Plant	Mineral ion concentrations (me · L <sup>-1</sup> )								Total
	Cations				Anions				
	NH <sub>4</sub> <sup>+</sup>	K <sup>+</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	Cl <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	PO <sub>4</sub> <sup>3-</sup>	SO <sub>4</sub> <sup>2-</sup>	
<b>A. Day time collection (10 hours from 9 AM to 7 PM)</b>									
Cucumber	2.08	5.12	8.75	2.08	1.67	4.94	3.40	4.58	32.62
Cucumber/ FL gourd	1.67	4.50	1.43	2.17	1.56	3.38	2.91	1.24	18.86
Figleaf gourd	2.39	4.74	0.54	1.08	2.27	4.20	4.38	0.77	20.37
Mean	2.05	4.78	3.57	1.78	1.83	4.17	3.56	2.20	23.94
<b>B. Night time collection (12 hours from 7 PM to 7 AM)</b>									
Cucumber	0.06	3.81	5.74	3.12	1.37	0.42	1.03	2.32	17.87
Cucumber/ FL gourd	0.07	4.41	6.04	3.23	2.12	1.46	10.75	0.87	28.95
Figleaf gourd	0.04	4.03	6.61	4.17	2.97	1.94	13.52	1.33	34.61
Mean	0.06	4.08	6.13	3.50	2.15	1.27	8.43	1.51	27.13

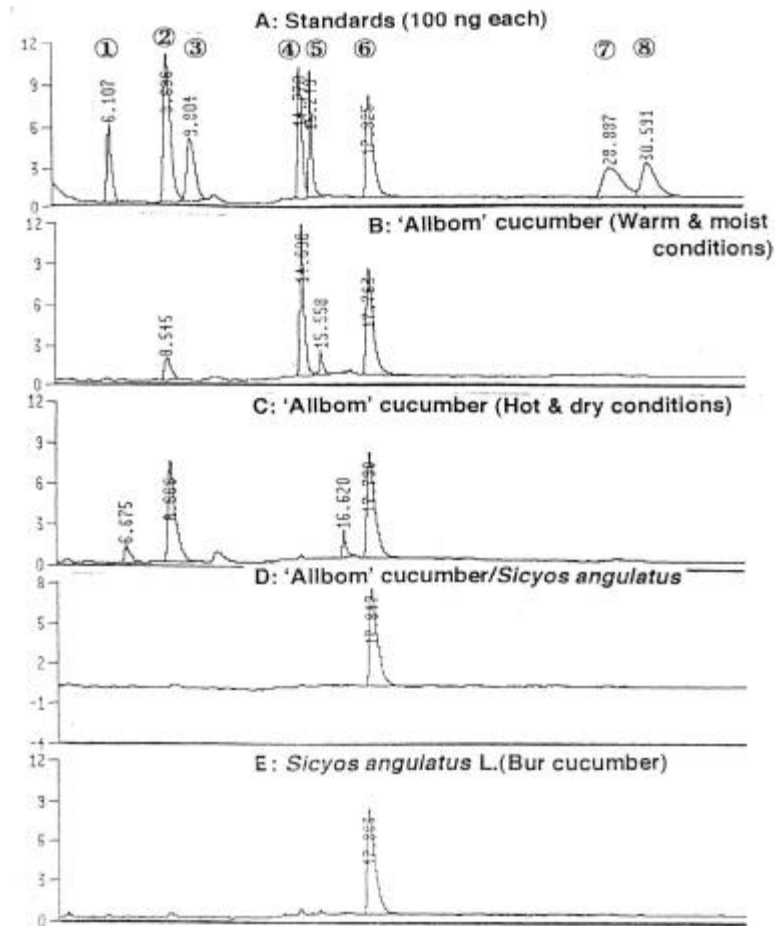
97.

Plant	Endogenous cytokinin contents							
	Total	<i>trans</i> -Z	DHZ	<i>cis</i> -Z	<i>trans</i> -ZR	DHZR	<i>cis</i> -ZR	IP
<b>A. Cytokinin contents per sap volume (ng · 100 ml sap<sup>-1</sup>)</b>								
Cucumber	67.4 b <sup>y</sup>	9.7 a	-	1.4 a	19.4 c	-	33.4 a	3.5
Cucumber/FL gourd	56.9 b	1.6 b	-	0.5 a	39.5 b	-	13.8 b	1.5
Figleaf gourd	173.0 a	6.4 a	-	2.5 a	72.4 a	-	35.0 a	56.7
<b>B. Cytokinin production per unit vine fresh weight (ng · 100 g FW<sup>-1</sup> · 24 hours<sup>-1</sup>)</b>								
Cucumber	53.0 b	7.7 a	-	1.1 a	15.3 b	-	26.2 a	2.7
Cucumber/FL gourd	38.0 c	1.1 b	-	0.3 a	26.4 a	-	9.2 b	1.0
Figleaf gourd	73.3 a	2.7 b	-	1.1 a	30.7 a	-	14.8 b	24.0

<sup>z</sup> Z: zeatin; DHZ: dihydrozeatin; ZR: zeatin riboside; DHZR: dihydrozeatin riboside; and IP: isopentenyl adenine, respectively.

<sup>y</sup> Mean separation within column by Duncan's multiple range test at 5% level.



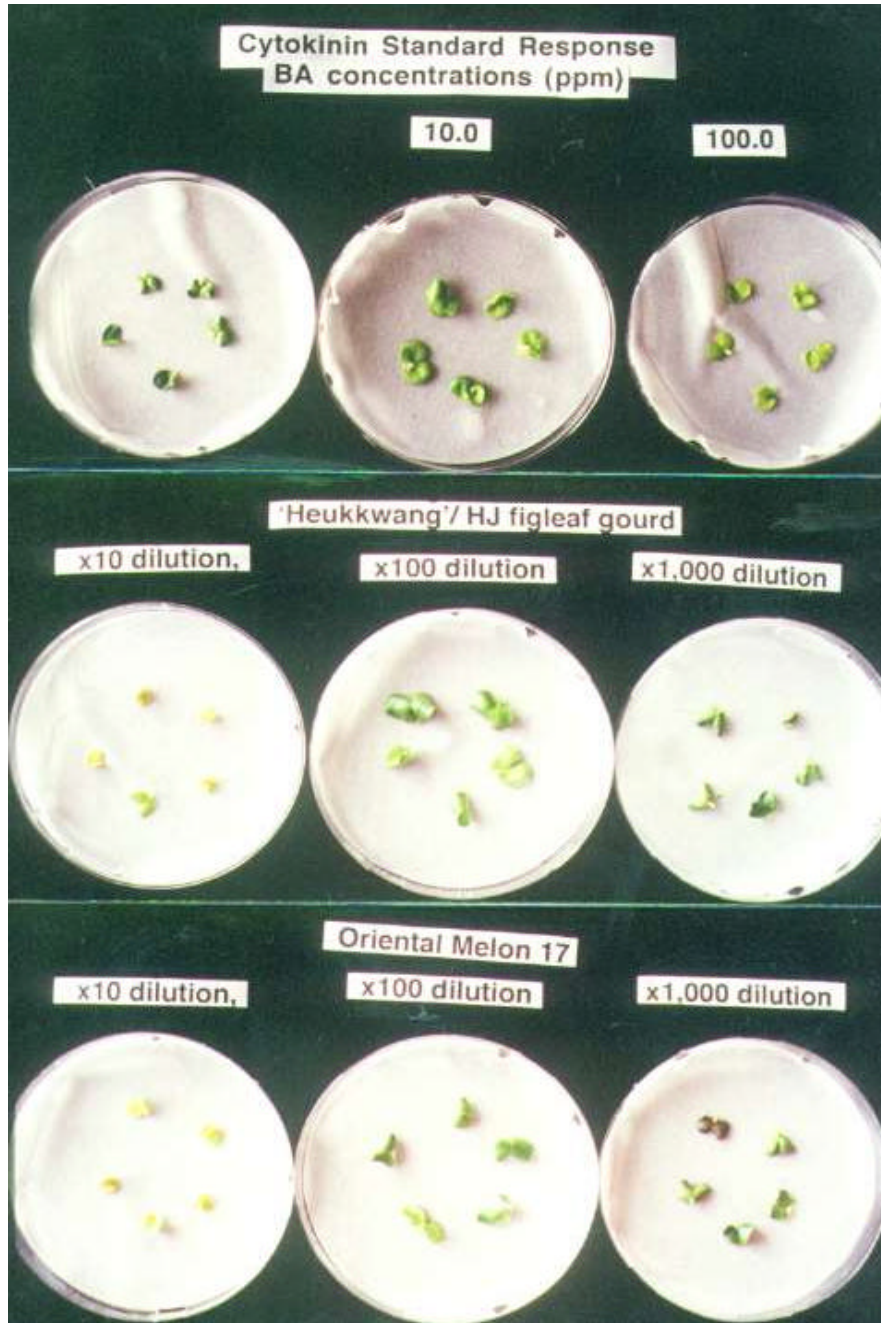


HPLC separation of cytokinins, standards (A) or those extracted from the xylem sap collected from cucumbers and *Sicos angulatus* crops (B-E) cochromatographed with 100 ng kinetin as the internal standard. Extract equivalent to 30 mL sap was injected into HPLC. A: Standards (100 ng each of 1: zeatin-9-glucose, 2: *trans*-Z, 3: DHZ, 4: *trans*-ZR, 5: DHZR, 6: kinetin, 7: iP, and 8: iPA, repectively).

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(B)

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gelatin

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14. 1995  
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16. 가 가 가
17. 1998 , 1999 CGMMV
18. 100%  
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19. Fusarium virus (CGMMV)  
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20. stress  
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21. 20 ( -  
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22. Micro-Cel E Aerosil silica (固形物質; solid) solid  
matrix priming (SMP; )
23. SMP , , 가 , ,
24. seed brushing machine  
. Brushing ,  
, virus 가 .
- 가 (seed lot) brushing  
( )가 .
25. Brushing SMP 가 SMP  
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26. SMP 가가

captan, benomyl, thioram 가  
 27. SMP (原狀)  
 가, (GA<sub>4+7</sub> GA<sub>3</sub>) 가  
 28. (single cotyledon splice  
 grafting) 6  
 29. 72  
 가 가 12 25 가  
 30. 가 Thermogradient table (TGT) seed  
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1.

Item	Accession	Source Country	Plant name	100-Seed weight(g)
<i>Lagenaria siceraria</i>				
2	Grif 11931	United States, Californi	Grif 11931	41.00
3	Grif 11932	United States, Californi	Grif 11932	44.04
4	Grif 11933	United States, Californi	Grif 11933	34.01
5	Grif 11934	United States, Californi	Grif 11934	40.44
214	Grif 11935	United States, Californi	Grif 11935	32.60
6	Grif 11936	United States, Californi	Grif 11936	34.45
7	Grif 11937	United States, Californi	Grif 11937	33.29
8	Grif 11938	United States, Californi	Grif 11938	25.00
9	Grif 11939	United States, Californi	Grif 11939	29.74
10	Grif 11940	United States, Californi	Grif 11940	34.57
215	Grif 11941	United States, Californi	Grif 11941	30.23
11	Grif 11942	United States, Californi	Grif 11942	28.85
12	Grif 11943	United States, Californi	Grif 11943	33.89
13	Grif 11944	United States, Californi	Grif 11944	34.26
14	Grif 11945	United States, Californi	Grif 11945	34.15
15	Grif 11946	United States, Californi	Grif 11946	25.04
216	Grif 11947	United States, Californi	Grif 11947	19.51
16	Grif 11948	United States, Californi	Grif 11948	31.38
17	Grif 11949	United States, Californi	Grif 11949	34.16
18	Grif 11950	United States, Californi	Grif 11950	46.32
1	Grif 9450	Mexico, Jalisco	TWW 250	9.34
213	Grif 970	China, Beijing	Grif 970	12.01
19	PI 170463	Turkey		17.38
20	PI 179298	Turkey	SUKBGI	17.94
217	PI 181913	Syria	MAMA NO 9 LONG	14.70
21	PI 181948	Syria	HOMS NO 9 LONG	17.72
22	PI 188809	Philippines, Luzon	TABUNGAO	20.03
23	PI 194994	Ethiopia Guatemala		18.44
24	PI 195321	Ethiopia		19.84
216	PI 197437	Zaire		15.69
25	PI 247681	Afghanistan		12.31
26	PI 256069	Pakistan		21.44
27	PI 269505	Pakistan	KADU	18.20
28	PI 269506	Pakistan	KADU	17.08
219	PI 269507	Pakistan		16.48
29	PI 269508	Mexico, Federal District BLUE		12.73
30	PI 270456	India		20.05
31	PI 271351	India		18.48
32	PI 271352	India		17.64
33	PI 271352	India		18.24
220	PI 271354	India		19.76

Item	Accession	Source Country	Plant name	100-Seed weight(g)
34	PI 271356	India		14.33
35	PI 271357	India		18.24
36	PI 271359	India		15.72
37	PI 271360	India		17.01
221	PI 271477	India		20.65
38	PI 273662	Ethiopia		19.71
39	PI 273663	Ethiopia		10.59
40	PI 280631	South Africa, Transvaal		21.17
41	PI 280632	South Africa, Transvaal		23.08
42	PI 280633	South Africa, Transvaal		14.33
222	PI 280634	South Africa, Transvaal		24.81
43	PI 280635	South Africa, Transvaal		23.53
190	PI 280636	South Africa, Transvaal		13.71
44	PI 287533	Italy		16.59
45	PI 287534	Italy		13.60
46	PI 288497	India	31	16.53
191	PI 288498	India	36	16.79
220	PI 288499	India	62	16.77
47	PI 288500	India	155	18.98
48	PI 288501	India	167	21.30
49	PI 288503	India	197	20.43
192	PI 288504	India	235	14.76
50	PI 349591	Paoua New Guinea		7.77
224	PI 258044	Yugoslavia		17.11
51	PI 358045	Yugoslavia		19.05
193	PI 358046	Yugoslavia		16.84
52	PI 358048	Yugoslavia		20.02
53	PI 358049	Yugoslavia		14.54
24	PI 358050	Yugoslavia		19.43
55	PI 356051	Yugoslavia		19.98
259	PI 358052	Yugoslavia		20.27
225	PI 358053	Yugoslavia		12.52
56	PI 358054	Yugoslavia		12.66
57	PI 358056	Yugoslavia		12.35
194	PI 358057	Yugoslavia		10.16
58	PI 358059	Yugoslavia		15.99
59	PI 368635	Yugoslavia	ZOLTA	16.28
226	PI 368636	Yugoslavia	DBICNA	20.38
195	PI 368638	Yugoslavia	MESNA	12.17
60	PI 368639	Yugoslavia	OBICNA	12.03
61	PI 368640	Yugoslavia		17.25
62	PI 370474	Yugoslavia		17.13
63	PI 370477	Yugoslavia		17.44
196	PI 370478	Yugoslavia	BARSKA	23.52
227	PI 379365	Yugoslavia	ESKA	18.45
64	PI 379366	Yugoslavia	IVANKOVSKA	20.47
65	PI 379367	Yugoslavia	KLISURSKA	17.80

Item	Accession	Source Country	Plant name	100- Seed weight(g)
197	PI 381821	India, Rajasthan		14.65
66	PI 381822	India, Rajasthan		18.52
67	PI 381823	India, Rajasthan		19.55
68	PI 381824	India, Rajasthan		14.29
69	PI 381825	India, Rajasthan		20.08
70	PI 381826	India, Rajasthan		18.00
71	PI 381827	India, Rajasthan		13.69
72	PI 381828	India, Rajasthan		17.89
228	PI 381829	India, Rajasthan		18.25
73	PI 381830	India, Rajasthan		16.12
74	PI 381831	India, Rajasthan		19.03
75	PI 381832	India, Rajasthan		22.89
76	PI 831833	India, Rajasthan		15.28
229	PI 381834	India, Rajasthan		19.50
77	PI 381835	India, Rajasthan		19.66
78	PI 381836	India, Rajasthan		20.08
79	PI 381837	India, Rajasthan		17.80
80	PI 381838	India, Rajasthan		22.84
230	PI 381839	India, Rajasthan		19.30
81	PI 381840	India, Rajasthan		18.41
82	PI 381842	India, Rajasthan		18.68
83	PI 381843	India, Rajasthan		19.03
84	PI 381844	India, Rajasthan		18.89
231	PI 381845	India, Rajasthan		18.59
85	PI 381846	India, Rajasthan		19.07
86	PI 381847	India, Rajasthan		21.11
87	PI 381848	India, Rajasthan		18.86
88	PI 381849	India, Rajasthan		18.89
232	PI 381850	India, Rajasthan		19.66
89	PI 381851	India, Rajasthan		15.72
90	PI 381852	India, Rajasthan		13.52
91	PI 381853	India, Rajasthan		19.13
92	PI 381854	India, Rajasthan		17.12
233	PI 391602	China, Shaanxi	CHANG- HU- KUA	10.41
93	PI 406857	Honduras		26.51
94	PI 419089	China, Beijing		12.17
95	PI 419090	China, Beijing		11.46
96	PI 419215	Hong Kong		21.08
234	PI 432340	Cyprus		20.89
97	PI 432341	Cyprus		23.01
98	PI 432342	Cyprus		22.51
99	PI 435291	Iraq		21.28
100	PI 438844	Mexico		17.98
235	PI 438845	Mexico		15.78
101	PI 438346	Mexico		16.31
102	PI 438847	Mexico		14.31
103	PI 438848	Mexico		15.63
104	PI 442368	Mexico		20.06
236	PI 442369	Mexico		20.50

Item	Accession	Source Country	Plant name	100- Seed weight(g)
105	PI 451856	Guatemala		11.83
106	PI 451857	Guatemala		11.25
107	PI 458736	Argentina	VAV 5951	23.37
108	PI 470560	Indonesia		22.00
237	PI 487482	Israel		19.02
109	PI 491252	Greece	WP 107	19.25
110	PI 491266	Zimbabwe	T GR 26A	16.53
111	PI 491567	Zimbabwe	T GR 26B	19.37
112	PI 491568	Zimbabwe	T GR 26C	16.25
198	PI 491569	Zimbabwe	T GR 26D	19.53
238	PI 491270	Zimbabwe	T GR 26E	19.26
113	PI 491271	Zimbabwe	T GR 65	16.54
114	PI 491272	Zimbabwe	T GR 66	21.89
260	PI 491273	Zimbabwe	T GR 168	15.62
115	PI 491274	Zimbabwe	T GR 170	27.99
239	PI 491275	Zimbabwe	T GR 247	20.28
116	PI 491276	Zimbabwe	T GR 260	17.89
117	PI 491277	Zimbabwe	T GR 307	15.41
199	PI 491278	Zimbabwe	T GR 315	16.97
118	PI 491279	Zimbabwe	T GR 359	16.20
119	PI 491280	Zimbabwe	T GR 482	17.45
240	PI 491281	Zimbabwe	T GR 512	21.25
200	PI 491282	Zimbabwe	T GR 513	19.17
120	PI 491283	Zimbabwe	T GR 589	21.02
121	PI 491284	Zimbabwe	T GR 595	12.73
122	PI 491285	Zimbabwe	T GR 608	23.68
123	PI 491286	Zimbabwe	T GR 614	17.61
201	PI 491287	Zimbabwe	T GR 631	15.73
241	PI 491288	Zimbabwe	T GR 645	17.30
124	PI 491289	Zimbabwe	T GR 647	15.43
125	PI 491290	Zimbabwe	T GR 650	19.59
202	PI 491291	Zimbabwe	T GR 661	19.47
126	PI 491292	Zimbabwe	T GR 673	18.75
127	PI 491293	Zimbabwe	T GR 674	17.63
242	PI 491294	Zimbabwe	T GR 676	17.29
203	PI 491295	Zimbabwe	T GR 691	19.27
128	PI 491296	Zimbabwe	T GR 698	24.39
129	PI 491297	Zimbabwe	T GR 715	18.88
130	PI 491298	Zimbabwe	T GR 727	18.29
131	PI 491299	Zimbabwe	T GR 728	14.82
204	PI 491300	Zimbabwe	T GR 746	17.11
243	PI 491301	Zimbabwe	T GR 772	15.08
132	PI 491302	Zimbabwe	T GR 784	18.49
133	PI 491303	Zimbabwe	T GR 843A	19.12
205	PI 491304	Zimbabwe	T GR 843B	18.08
134	PI 491305	Zimbabwe	T GR 843C	17.35
135	PI 491306	Zimbabwe	T GR 843D	14.62
244	PI 491307	Zimbabwe	T GR 843E	20.79
206	PI 491308	Zimbabwe	T GR 856	17.61

Item	Accession	Source Country	Plant name	100-Seed weight(g)
136	PI 491309	Zimbabwe	T GR 926	16.75
137	PI 491310	Zimbabwe	T GR 931	17.99
138	PI 491311	Zimbabwe	T GR 1051	17.77
245	PI 491312	Zimbabwe	T GR 1078	16.26
139	PI 491313	Zimbabwe	T GR 1085	21.91
140	PI 491314	Zimbabwe	T GR 1105	18.94
141	PI 491315	Zimbabwe	T GR 1106	17.67
142	PI 491316	Zimbabwe	T GR 1141	17.30
246	PI 491317	Zimbabwe	T GR 1156	18.03
143	PI 491318	Zimbabwe	T GR 1173	24.15
144	PI 491319	Zimbabwe	T GR 1244	20.72
145	PI 491320	Zimbabwe	T GR 1249	16.39
146	PI 491321	Zimbabwe	T GR 1265	19.62
247	PI 491322	Zimbabwe	T GR 1271	19.37
147	PI 491323	Zimbabwe	T GR 1272	19.85
148	PI 491324	Zimbabwe	T GR 1282	19.65
149	PI 491325	Zimbabwe	T GR 1291	21.69
150	PI 491326	Zimbabwe	T GR 1299	15.70
248	PI 491327	Zimbabwe	T GR 1300	13.97
151	PI 491328	Zimbabwe	T GR 1301	14.97
152	PI 491329	Zimbabwe	T GR 1302	16.48
153	PI 4391330	Zimbabwe	T GR 1315	16.42
154	PI 491331	Zimbabwe	T GR 1323	15.41
249	PI 491332	Zimbabwe	T GR 1329	17.31
155	PI 491333	Zimbabwe	T GR 1345	19.05
156	PI 491334	Zimbabwe	T GR 1394	23.46
157	PI 491335	Zimbabwe	T GR 1413	16.81
158	PI 491336	Zimbabwe	T GR 1421	14.87
250	PI 491337	Zimbabwe	T GR 1429	24.19
159	PI 491338	Zimbabwe	T GR 1430	14.99
160	PI 491339	Zimbabwe	T GR 1443	18.09
161	PI 491340	Zimbabwe	T GR 1476	14.45
162	PI 491341	Zimbabwe	T GR 1477	16.57
251	PI 491342	Zimbabwe	T GR 1478	17.08
163	PI 491343	Zimbabwe	T GR 1485	17.15
164	PI 491344	Zimbabwe	T GR 1496	17.40
165	PI 491345	Zimbabwe	T GR 1517	17.56
252	PI 491346	Zimbabwe	T GR 1520	21.26
166	PI 491347	Zimbabwe	T GR 1528	17.49
167	PI 491348	Zimbabwe	T GR 1529	16.07
168	PI 491349	Zimbabwe	T GR 1549	16.51
169	PI 491350	Zimbabwe	T GR 1588	17.98
253	PI 491351	Zimbabwe	T GR 1626	15.35
170	PI 491352	Zimbabwe	T GR 1646	18.84
171	PI 491353	Zimbabwe	T GR 1653	16.55
172	PI 491354	Zimbabwe	T GR 1661	17.63
173	PI 491355	Zimbabwe	T GR 1664	15.26
254	PI 491356	Zimbabwe	T GR 1665	17.64
174	PI 491357	Zimbabwe	T GR 1678	16.17

Item	Accession	Source Country	Plant name	100- Seed weight(g)
175	PI 491358	Zimbabwe	T GR 1682	17.66
176	PI 491359	Zimbabwe	T GR 1715	17.58
207	PI 4391360	Zimbabwe	T GR 1751	16.56
177	PI 491361	Zimbabwe	T GR 1821	20.00
255	PI 491362	Zimbabwe	T GR 1827	17.33
178	PI 491363	Zimbabwe	T GR 1903	18.72
179	PI 491365	Zimbabwe	T GR 1921	16.97
208	PI 491366	Zimbabwe	T GR 1922	18.56
180	PI 491367	Zimbabwe	T GR 1923	21.08
181	PI 497671	Zimbabwe	T GR 1652	16.16
256	PI 500814	Zimbabwe		11.30
209	PI 500815	Zimbabwe		30.23
182	PI 500818	Zimbabwe		11.22
183	PI 500819	Zimbabwe		11.41
184	PI 500820	Zimbabwe		11.57
210	PI 500823	Zimbabwe		11.70
185	PI 500826	Zimbabwe		8.13
257	PI 500828	Zimbabwe		10.13
186	PI 500836	Zimbabwe		13.70
187	PI 534552	Syria	OA 119	23.99
211	PI 534553	Syria	OA 223	19.35
188	PI 534554	Syria	OA 280	16.32
189	PI 534555	Syria	OA 286	22.81
258	PI 534556	Syria	OA 310	18.64
212	PI 540912	Unknow	146	16.18

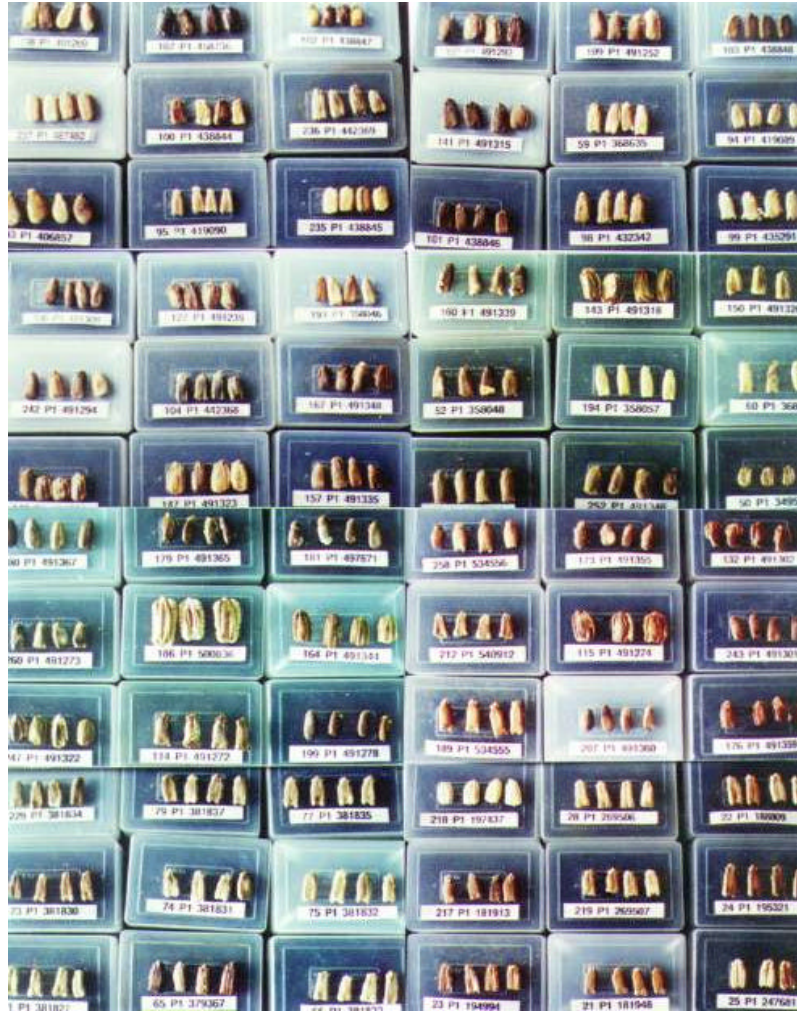


Plate 1-A.



Plate 1-B.





Plate 2. F<sub>1</sub>

F<sub>1</sub>

( 33-36 ).





Plate 4. A. myclobutanil (= ) 가 ‘ , ’

B. paclobutrazol 가 ‘ , ’



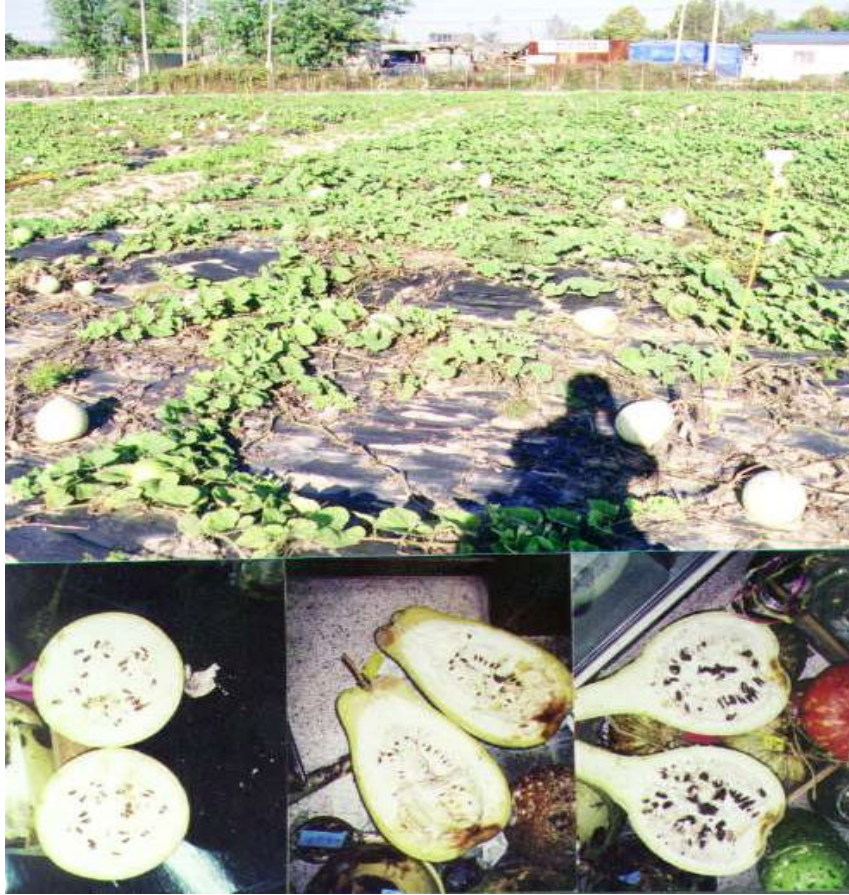


Plate 5. ( ) ( ).

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, , , . 1996. Triazole plug  
. 14(2): 576-577.

, , . 1996. plug Triazole  
. 14(2): 574-575.

, , . 1996. plug Triazole  
. 14(2): 110-111.

, . 1999.  
. 17(2): 214.

, . 1999. Spin out cell tray  
. 17(5): 636.

, . 1999. Spin out brushing 가 plug  
. 17(5): 636.

, , , , , . plug  
brushing . 17(5): 636.

, , . 1999. plug  
. 17(2): 214.

, , . 1999.  
. 17(2): 214.

, , . 1997. Triazole 가  
. 15(2): 176-177.

, , . 1998.  
. 16(1): 93.

, , . 1998. 가  
. 16(3): 417.

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. 16(1): 93.



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, , . 1998. SMP  
16(3): 393.

, , . 1999. 3  
17(2): 201.

, , , . 1998. SMP  
16(3): 334-346.

, , , . 1998. Triazole difenoconazole  
plug . 16(3): 416.

, . 1996. Plug Triazole  
14(2): 104-105.

, , . 1999.  
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, . 1998.  
cytokinins . 16(1): 89.

- , . 1999. , ,  
, . 17(5): 628.
- , . 1999. , ,  
. 17(5): 627.
- , . 1999. ,  
. 17(2): 210.
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17(5): 631.
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14(2): 102-103.
- , . 1997. Triazole  
gibberellin . 15(1): 65-66.
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. 17(2): 232.
- , , . 1998. .  
16(1): 96.
- , , , . 1998. 가  
. 17(5): 109.
- , , , . 1999. 가  
. 17(5): 109.



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(Matriconditioning of gourd seeds with Micro-Cel E).

(Jang, In-Jeong). 1998. 2. 가  
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2.

3. 가