

最終
研究報告書

花卉類 施設栽培 温度下降方法 究明研究

Studies on the Dropping Method of Air Temperature
in the Protected House for Summer Culture of Flower Crops

市立大 學校

農 林 部

提 出 文

農林部 長官 貴下

本 報告書 “花卉類 施設栽培 溫度下降方法 究明研究” 課
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1997. 12. 29.

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研 究 員： ()

研 究 員： ()

研 究 員： ()

.

.

가

가

가

.

.

1. : 가
(1)

가. 가

- 1) : , , ()
- 2) 가 : **600** 가(4 가)
- 3) : ,

.

- 1) : , , , , , ,
- 2) :

1T1 : (: , , :
,)

1T2 : ()

1T3 :

1T4 : sprinkling

1T5 : + sprinkling

* T2 T5 11 15

3) : , , ,

2. : (2)

1) : , (2), , ,

,

2)

2T1 = +

2T2 = + (55%)

2T3 = () = 6.6m

2T4 = (:55%) +

(45%)

2T5 = (45%) +

3) : 11 16

.

4) : , ,

3. : (3)

1) : , (), , ,
 , ,

2) : ()
. (3 : 28, 30, 32)

$$3T1 = 28 ; (45 /) + 30 ; (\\) + 32 ;$$

$$3T2 = 28 ; + 30 ; + 32 ;$$

$$3T3 = 28 ; + 30 ; + 32 ;$$

$$3T4 = 28 ; + 30 ; + 32 ; ()$$

$$3T5 = 28 ; + 30 ; + 32 ;$$

3) :

4) : , ,

.

1. : 가

(1)

4 가

, 4 가 3 가 가 ,

, 1 가 turn-key
 computer + + +
 .
 가 , , 가
 .
 가
 IT1 ()가 가 가
 6 2.7 , 6 4.6
 20% . IT5 6 2 , 6 4.6
 . 7 8 .
 가 가 IT2 6 1.5 .
 IT3 IT4 가 IT3 IT4가 가
 . , (=0) IT2가 가 가 .
 IT2가 가 IT4, IT3 .
 IT1 20% 가 , IT5 32%
 . IT1, IT3, IT4 80% .
 .
 IT3 가 , IT2 ,
 () IT1 가 , IT3, IT4가 .
 IT5 IT1 ,
 , , 가 IT2 . IT2 가 IT5
 IT4 IT3 .
 IT4 , IT2 .

2. : (2)

6 가 가 2T2() 2T4
 2T5 . 2T1 2T3 가 ,
 6 8 , 5-7 . 6 2T4
 , 2T1 가 . 2T1 가 2T3 가
 . 7, 8 6 2T2 1T4 가 2T3, 2T1 .
 .
 () 2T1 가 2T3
 . 2T2 2T4 . 2T1 2T3 가
 2T2 2T5 . 2T4 가 . 2T1
 가 2T3, 2T2 . 2T3 가
 2T1 .
 2T1 2T3 가 2T4 .
 2T3 2T1 . 2T5
 , 2T1 2T4가 가 .
 2T5 2T1 2T4가 가 .
 2T5 . 2T2 2T5
 , 2T2, 2T5, 2T2 .
 2T2, 2T4, 2T3 2T1 2T3 .
 2T5, 2T3, 2T4 .

3. : (3)

95, 96
 , 6 가 가

$3T5$, $3T3$ $3T2$.
 $(3T2, 3T3, 3T5)$ $(3T1, 3T4)$ 가 .
 7 8 . +
+ 가
. $3T4$ $3T1$ $3T5, 3T2, 3T3$.
 $3T4$ $3T2$ 가
, $3T1$ 가
. $3T3$ 가 .
 $3T3$. $3T4$ $3T3$
, $3T2$ 가 $3T1, 3T3, 3T5$
 $3T4$ 가 . $3T1$ $3T4$
 $3T5$ 가 가 . 가 .
 $3T3, 3T5$
 $3T1$ 가 .

1.

	T 2, T 4, T 1
	T 3
	T 4, T 3
	T 2, T 1, T 3
	T 2
	T 4
	T 4

4. :

가.

1)

2)

3)

.

1)

2)

60 m

3)

.

1)

()

2)

()

.

:

(:)

.

1)

: 5 (5) :

.

Workshop :

(1997. 8. 11)

Summary

To know how to drop of air temperature in the protected house for summer culture of flower crops, three kinds of study were conducted for three years, the results were summarized as follows;

A. Investigation of protected greenhouse for professional flower farms during summer seasons and study to drop air temperature using single method (1st year study)

In investigation of air temperature control in four flower farms, three farms used to manage economically using shading with plastic net and natural ventilation with ceiling and side windows for dropping summer high temperature.

However, one farm which was built venro type of glasshouse from Holland which were ventilated by forced and natural ventilation with aluminium shade net materials by turn-key contract's clause for use controlled by computer automatically. They could be dropped at 29.7 in minimum temperature and 32.9 in maximum temperature from June to August.

In the five simulation plastic houses which were built same size in The University of Seoul, five treatments which included inside and outside shading (hereinafter referred to as 1T1), Fog & Fan (hereinafter referred to

as 1T2), roof streaming with water (hereinafter referred to as 1T3), roof sprinkling (hereinafter referred to as 1T4), outside shading with white net and roof sprinkling (hereinafter referred to as 1T5), were installed and evaluated in effect of dropping temperature and growth and flowering with several flower crops. The results were as follow;

Among them, 1T1 was the best dropping effect in the mean air temperature of June. Mean air temperature at 13:00 PM in June of 1T1 was recorded at 2.7 lower in mid June, 4.6 in end June than its outside.

Next was 1T5, which showed more dropping at 2 in mid June, 4.6 in end June than outside temperature. These trended similar toward July and August too. The highest temperature among them were shown in 1T2, it was resulted at 1.5 higher than outside in mid and end of June. 1T3 and 1T4 were similar shown for dropping air temperature, whereas 1T3 was a little drop effect than 1T4. In condition of the closed plastic film with five their houses, 1T2 was the most dropping effect in air temperature. There showed highest humidity in 1T2, next was 1T4, 1T3 in order of relative humidity.

In light transmission ratio, the lowest one was 1T1 as 20% compare with natural light, next showed 1T5 as 32%. Whereas there resulted over 80% in 1T2, 1T3 and 1T4. The operating time in 1T2, 1T3 and 1T4 for dropping of air temperature were shown more about 10% shading than non-operating.

In the evaluation of seven flower crops in five treatments of plastic

houses, *Rosa hybrida* was the best growth in 1T3, whereas *Lilium* oriental hybrid was in 1T1, *Cymbidium hybrida* in 1T5 and 1T1, *Phalaenopsis schilleriana* in 1T5, *Epipremnum aureum* in 1T2 and 1T3, *kalanchoe blossfeldiana* in 1T4, *Coleus blumei* in 1T2.

B. Study to drop air temperature using single and complex methods in protected green house of flowers during summer season (2nd years study)

Dropping effects of air temperature in June showed the best to be 2T2 plot among five treated methods and next was 2T4(see method and materials), 2T5 in order.

The plots such as 2T1 and 2T3 which were treated without shading using its net were higher temperature than those with shading. They resulted higher at 8 in middle of June and 5 to 7 in late of June than the others.

Relative humidity recorded the highest at 2T4 treatment and the lowest at 2T1 treatment in June. Soil temperature resulted the lowest at 2T1, while 2T3 showed the highest among them. These temperature recording in June were similiar those in July and August. Another environments were also discussed and evaulated among them.

In net phothosynthesis ability among flowers crops, *Rosa hybrida* made the most photosynthesis at 2T1, next at 2T3, whereas 2T2 and 2T4 were the least their ability. *Lilium* oriental hybrid was the highest of their

ability in 2T1 and 2T3, and next was 2T2 and 2T5 in order. There were showed it the highest at 2T1 and 2T4 in *Clivia miniata*, and at 2T4 in *Cymbidium hybrida*. *Ficus benjamina* showed it the best at 2T1, next 2T3 and 2T2. While *Euphorbia pulcherrima* resulted for it the best at 2T3, and 2T1 in the following. These showed similiar with amount of growth of them.

In growth amount, *Rosa hybrida* had the most of it at 2T1 and 2T3, while 2T4 showed the least among them. *Lilium* Oriental hybrid were shown the good growth at 2T5, but 2T1 showed high at 2T1 in total fresh weight, while it was the worst in 2T4. Bulb circumference had more in no-shading plots whereas its flower quality showed the good at 2T5 of shading plot. Growth quantity in *Cymbidium hybrida* resulted the best at 2T2 and 2T5 and also 2T4, 2T5, 2T2 in upper part fresh weight, and it of *Clivia miniata* showed better in 2T2, 2T4, 2T3, and it of *Ficus benjamina* was in 2T1 and 2T3 than others. While *Euphorbia pulcherrima* showed good growth at 2T5, 2T3, and 2T4.

C. Study to drop air temperature using complex method in protected green house of flowers during summer season (3rd years study)

The studies were conducted to look for the best methods to drop summer high air temperature in the base of data of 1995 and 1996 study. The results were summaried as follows;

The best temperature dropping plot was at 3T5 in June, next was 3T3

and 3T2. Shading materials covered over plastic house which materials were better in aluminium one than black one for dropping air temperature.

These also showed similar tendency in July and August. Therefore there was the most its dropping effect as fan ventilation and aluminum shading over plastic house with water springkling over it.

The light transmission ratio showed high at 3T4 and 3T1, and low at 3T5, 3T2, 3T3 in order.

In growth and flowering, *Rosa hybrida* were shown the most 3T4 and 3T2 in fresh weight of mean value, while they did not find significant difference statistically among all plots, and net photosynthesis ability resulted the most at 3T1 in mean value but not to see significant difference among them.

Lilium oriental hybrid had the most at 3T3 in fresh weight and dry of it, and resulted the best at 3T3 in net photosynthesis ability. Cyclamen of net photosynthesis ability and fresh weight were evaluated the best at 3T4 and 3T3, while *Cymbidium hybrida* was best at 3T2, and there were not significant difference in 3T1, 3T3 and 3T5 and showed the least at 3T4 in fresh weight.

Its photosynthesis of *Cymbidium hybrida* showed high in mean value at 3T1 and 3T4, but it was the least in 3T5.

There were not significant difference at 5% DMRT level all plots of it in *Ficus benjamina* and *Rhapis humilis*, In *Clivia miniata* of fresh weight, they were not significant difference in mean value, while their photosynthesis were high at 3T3, 3T5, and the lowest at 3T1.

Contents

. Introduction	19
. Materials and Methods	23
. Results and Discussion	34
. Complex Discussion	156
. Summary	
Literature cited	
Appendix	

·	.....	19
·	.....	23
1.	가 (1	
)	.....	23
1)	가 23	
2)	.....	24
2.	(2) 26	
1)	.....	26
2)	.....	26
3)	.....	28
4)	.....	28
3.	(3) 29	
1)	.....	29
2)	.....	29
3)	.....	32
4)	.....	33
·	.....	34
1.	가 (1	
)	.....	34
1)	가 34	
2)	.....	41
(1) 6	· 42	
(2) 7	· 44	
(3) 8	· 46	
(4) 9	· 47	
(5) 14	..... 48	
(6) 8	..... 49	
(7)	..... 50	
(8) 9 14	..... 52	
(9)	() 53	

(10)	가	.....	54
		.....	54
㉓		.....	54
		.....	55
		.....	56
(11)		.....	56
		.....	56
	( )	.....	57
		.....	58
		.....	59
		.....	60
		.....	61
(12)		.....	61
		.....	61
	( )	.....	62
(13)		.....	63
		.....	63
		.....	64
		.....	65
		.....	66
		.....	66
		.....	67
		.....	68
2.	(2 )	.....	73
1) 6	·	.....	73
(1) 13		.....	73
(2) ,	13	.....	75
(3) 13		.....	75
2) 7	·	.....	76
(1) 13		.....	76
(2) ,	13	.....	77
(3) 13		.....	78
3) 8	·	.....	78
(1) 13		.....	78
(2) ,	13	.....	80
(3) 13		.....	80
4) 9	·	.....	81
(1) 13		.....	81

(2)	,	13	.....	81
5) 14	6,7,8,9		.....	82
6)			.....	83
7)	9	18	.....	85
8)	9	18	.....	86
9)	9	18	.....	88
10)	9	18	.....	89
11)			.....	90
12)			.....	91
(1)			.....	91
(2)	(	)	.....	93
(3)			.....	94
(4)			.....	94
(5)			.....	95
(6)			.....	96
13)			.....	97
(1)			.....	97
(2)	(	)	.....	100
(3)			.....	104
(4)			.....	106
(5)			.....	107
(6)			.....	109
3.		(3	)	..... 114
1) 6	,	,	.....	115
(1) 13			.....	115
(2)	,	13	.....	116
(3) 13			.....	117
2) 7	,	,	.....	118
(1) 13			.....	118
(2)	,	13	.....	119
(3) 13			.....	119
3) 8	,	,	.....	119
(1) 13			.....	119
(2)	,	13	.....	121
(3) 13			.....	121
4)			.....	121
5) 6	9	9	18	..... 123
6)			.....	129

(1)	.....	129
(2)	()	133
(3)	.....	137
(4)	.....	139
(5)	.....	142
(6)	.....	144
(7)	.....	146
.	.....	156
.	
	
	

•

WTO IMF

가 가
가 ,
가

IMF 가
가 1980 7,322ha, 1985 17,171ha, 1990
25,444ha, 1993 36,074ha, 96 42,668ha 1996 1980
5.8 가 (,
1996). 95 3,054ha 3 92 2,483ha
23% 가 (, 1995).

가

(小島忠, 1962; 金 , 1995).

가

가
가 가

(, 1989; , 1993; , 1995a, b; , 1995; , 1995; , 1995).

(小島, 1962; 高田 , 1975; 本 , 1981; 高在 , 1985; 高在 , 1986; 高 , 1988; Suhardiyanto, 1992; 山本 , 1997).

6, 7, 8 3

(李, 1997; 權, 1997). 가

(李 , 1993; 李, 1994; 朴, 1994).

, Fan-and-Pad , 가
(黑住 , 1988; 趙 , 1994).

가 가 (李 , 1994; 朴 , 1994).

(Carpenter, 1959; Katokawa , 1961; 林 , 1964; 三原, 1973; 小島 , 1980; 朴 , 1982; Herry , 1992; 朴 , 1994; , 1995),
(Kauzo , 1991; Suhardiyanto , 1992; 趙, 1994),

(南, 1994),

가

(古在

, 1985;

, 1988a;

, 1988b)가

5 9

6, 7, 8 가

가

(三原 . 1980).

가

(李 .

1994; 朴 , 1994).

, , , ,

(黒住 , 1988),

(李 ,

1994),

CO2

(Kinball , 1979; 李 , 1994),

(岩堀 , 1967)가

가

가

가

가

가

가

가

가

가

가

가

.

•

1. : 가 (1)

1) 가 4 가 . 가 (1-1).

1-1z 가

	53- 6	600	()
	976	600	()
	1045	1,724	()
	286	1,700	()

z1 1 .

가 .

1.5m 10 13 (10 13
), . , 가 600
 가 가 . 4
 가 , (), , 가
 가 .

2)

8가

(1-2).

1-2.

	3	
	5 cm	
	3	C- 1
	1	S- 2
	3	P- 2
	1	
	1	

(simulation plastic house)

5 8가

. 5.6 m 9 m 1.6 m 2.6 m ().

+ :

0.2 m ,

0.2 m .

45% (:가) , 45%

(:) .

() : (10 kg/cm²

50 cc/) . (DVN2030 135m³/min)

.

:

0.2 m

·
:
(3 m) 2 m
·
+ : 45%
) 0.2 m ,
·

PE 0.05 mm

1-3

1-3.

1T 1Z	+
1T 2	Fog Fan
1T 3	
1T 4	sprinkling
1T 5	+ sprinkling

ZT1

1

T1

2. :

(2)

1) : , , , , (),

6

2-1.

	4		96 6 5
A	7 8 cm		96. 6. 5.
" B	3 4 cm		96. 6. 5.
	18 cm		96. 6. 12.
	12 cm		96. 6. 12.
	12 cm		96, 6. 12.
	18 cm	V 10	96, 6. 5.

2) (2-2)

2-2.

2T1	+
2T2	Fog Fan + (55%)
2T3	Pad Fan(6. 6cm)
2T4	(55%) + (45%)
2T5	(45%) +

(1) 5

+ :

(16)

(1 m)

가 . 3 (2)

6 가 11 16

(流水) . 45

Fog Fan() + (55%) :

40 μ

1 m

20 cm

Pad Fan() : pad(: 100 X

100 X 10 cm) 6.6 m 20 cm

11 16 ,

pad U .

2.25 m 3 pad

+ : 20 cm

(55%)

, 20 cm

(:가 ; 45%) .

+ : 20 cm

(45%) ,

가 11 16 .

(2) (simulation plastic house) : 5.6 cm × 2.6 m ×
9 m (: 15 , : 108 m³)

(3) : 0.2 m
: 0.2 m

(4) : 6 1 9 30 ,
11 16 ()

* 10

(5) : PE 0.05 mm

3) :

4)

(1) , , : 13 , ,

(2) Datalogger computer

: 6 1 9 30 30

(3) : =
= 1

= (Li-corr, 6200)

3-2.

	()
3T1	$A(28) = (45 /)$ $B(30) = A +$ $C(32) = B +$
3T2	$A(28) = (45 /)$ $B(30) = A +$ $C(32) = B + \text{Fog Fan}$
3T3	$A(28) = (45 /)$ $B(30) = A +$ $C(32) = B + \text{Pad Fan}$
3T4	$A(28) = (45 /)$ $B(30) = A +$ $C(32) = B +$
3T5	$A(28) = (45 /)$ $B(30) = A +$ $C(32) = B +$

(1)

가 ()
 This 1000N 40 100) ,
 feed back on-off
 , 가 . 12 V,
 D/C 24 V, Pad, Fog , (water
 curtain) 220 V .
 1 .

(2)

3T1 : 3 , 28, 30, 32
 가 28 가 (45
)가 , 가 30 가 가
 (, 45%) .
 32 가 가 (16)가
 2 2) 가 .
 가 가 가 가
 가 .
 .
 2 .

3T2 : 28 가 45 ,
 30 가 (,
 55%) . 32 가
 500
 1 m fog (40 μ)
 . 가
 () .

3T3 : 28 가 45 , 30 가
 (, :55%)
 32 가
 .
 3000
 .

(10 x 100 X 100 cm)

2.25 m 3

(). 가

(3)

3T4 : 28 가 45

, 30

(가 , 45%) . 32 가

3,000

(1 m)

. 가 .

3T5 : 28 가 45

, 30 가

(,

55%) . 32 가 3,000

. 가

3)

3-3. simulation plastic house 5 .

	5.6 m 9 m 1.6 m 2.6 m
	5 252 m ² (76) (1 : 50.4 m ² (15)
	0.2 m 가 5
	가 PE (0.12 mm)
	3T3

- ()
 : (3
 : 28, 30, 32)
 , 가
 .

4)

- : 13 . , . ,
 . , 13
 Datalogger(LI-1000) 30 6 8
 , , PC
 - , :

1. 가
(1)

1) 가 : 4 .

(1) : 600 2 가
(1-4).

1-4.

	53-6 () 600 2

:

, 35%

PE

50 cm

PE 1

(

1-5).

1-5.

		+			
	35%		+	PE	+ 50cm PE
2	+		35%		

: 6 23 8 10

, 29.4 34
 . 20.8 , 24.6 . 10
 25.5 , 28.1 , 80.2 89.4%

가 .

80% 2.6

1.1 .

가 . 7 가
 6 , 7 4.5 7 8
 가 . 가

0.3 2.5 . 10 가 0.1 2.5
 , 8 0.1 가 가 (

1-6).

1-6.

(6/23 8/10)

10											
10											
/								%			
6/23	30	29.4	21.3	26.0	25.9	24.1	1.4	89.4	34.0	19.3	27.5
7/01	10	28.9	20.8	26.5	26.3	23.7	2.6	80.2	33.3	18.3	29.0
7/11	20	30.6	22.3	25.5	25.5	24.5	1.1	91.3	28.9	21.0	25.6
7/21	30	31.9	24.6	27.4	27.6	26.2	1.5	89.4	33.5	24.3	28.5
8/01	10	34.0	23.1	28.1	28.1	26.1	1.6	86.9	34.4	24.4	28.0

(2)

: 6,000 (100×200m) 15 가가
 36 ()
 turn-key 가
 . 가 . 95
 , 45 (1-7).

1-7.

	976
	()
	()
	6,000 (100m× 200m)
	15

:

(1-8).

(, ,)

1-8.

	() + ()

: 6 1 8 31

29.5 32.9

6 7 가 1.1 4 7

1 (0.2 0.8) 가 .

16.4 23.6

가 0 3.5 . 6 가 가 7

8 가 . 10 24.6

28.7 가 .

54.9

82.9% 가 (1-9).

1-9.

(6/1 8/31)

		10							10			
		(B)	(D)	(F)			(A)	A-B	(C)	C-D	E-F	(E)
	/					%						
6/1	10	29.7	16.4	24.6	24.6	56.4	25.7	-4	12.9	-3.5	20.4	-4.2
6/11	20	30.4	19.4	25.3	25.3	54.9	28.6	-1.8	16.3	-3.1	22.8	-2.5
6/21	30	30.3	20.1	25.4	25.4	63.7	28.5	-1.8	18.4	-1.7	24.9	-0.5
7/1	10	30.4	19.7	25.6	25.6	74.0	28.5	-1.9	18.5	-1.2	23.6	-2.1
7/11	20	28.2	22.0	25.6	25.6	80.9	27.1	-1.1	21.5	-0.5	24.7	-0.9
7/21	31	32.5	23.0	28.2	28.2	75.3	32.7	0.2	22.7	-1.0	28.3	0.1
8/1	10	32.9	24.9	28.3	28.3	80.2	33.5	0.6	24.9	0	28.7	0.4
8/11	20	32.8	23.6	28.7	28.7	81.1	33.5	0.7	23.4	-0.2	28.6	-0.1
8/21	31	29.5	21.2	26.7	26.7	82.9	30.3	0.8	20.5	-0.7	25.9	-0.8

(3)

()

: 1,724 2 가
 . 가
 (1-10).

1-10.

	1045
	()
	1724
	2

(4) ()

1700 2

(1-13).

1-13.

	286
	()
	1700
	2

: 80

30%

(1-14).

1-14.

	30%

: 7 16 7 22

가 22 30

. 가 0 3 7

. 7 21 .

18 20 가 0 3

fog fan, , sprinkling
 , , (), ,
 , , , 7 6 20
 10 10 가
 simulation

(1) 6 (1-16)

1-16.		6 simulation		13 ()		
6/10	1T1z	28.8(-3.6)y	18.0(0)	23.3(-2.7)	79.0(-1.4)	
	1T2	35.0(2.5)	17.8(-0.2)	27.5(1.5)	75.8(-4.6)	
	20	1T3	35.3(2.8)	17.3(-0.7)	27.3(1.3)	67.3(-13.1)
		1T4	34.3(1.8)	17.8(-0.2)	26.0(0)	76.0(-4.4)
		1T5	31.3(-1.2)	18.5(0.5)	24.0(-2.0)	60.5(-19.9)
		32.5(0)	18.0(0)	26.0(0)	80.4(0)	
6/20	1T1	29.8(-5.5)	19.9(1.1)	25.1(-4.6)	68.1(2.9)	
	1T2	37.5(2.2)	18.9(0.1)	31.2(1.5)	71.4(6.2)	
	30	1T3	37.9(2.6)	19.8(0.9)	29.8(0.1)	68.4(3.2)
		1T4	35.4(0.1)	18.8(0)	29.7(0)	70.5(5.3)
		1T5	30.3(-5.0)	19.5(0.7)	25.6(-4.1)	61.3(-3.9)
		35.3(0)	18.8(0)	29.7(0)	65.2(0)	

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (: 1T1-)

13 ()
 + 1T1 가 6
 (6/10-6/20) 2.7 , 6 (6/20-6/30) 4.6 . 13
 1
 , 6 13 1T1 2.7 , 1T5
 2 23.3 , 24 .

가 . 3 (1T2, 1T3, 1T4)

1.3 , 1.5 26

. 6 1T1

4.6 , 1T5 4.1 가 . 13

. 13 가 11 30 15

30

. 1 6 1T1 가

가 3.6 1T5 1.2 . 가

1T3 1T2 2.8 , 2.5 35

.

6 가 35.3 1T3 2.6 37.9

1T2 37.5 가 .

6 1T1

1T5 0.5 . 0.2 0.7

. 6 가 1

.

6 6 . 60 79%

가 6 .

1T5 가 6 1T1 1.4%

가 . 6 1T2 .

(2) 7 (1-17)
 1-17. 7 simulation

		13 ()			
7/01	1T1z	31.6 (-7.6)y	18.9 (1.2)	27.2 (-5.6)	70.6 (-6.3)
	1T2	39.5 (0.3)	18.8 (1.1)	33.0 (0.2)	73.1 (-3.8)
10	1T3	40.3 (1.1)	19.4 (1.7)	32.9 (0.1)	70.8 (-6.1)
	1T4	40.9 (1.7)	19.2 (1.5)	33.2 (0.4)	70.2 (-6.7)
	1T5	32.5 (-6.7)	20.3 (2.6)	27.8 (-5.0)	61.4 (-15.5)
		39.2 (0)	17.7 (0)	32.8 (0)	76.9 (0)
7/11	1T1	28.0 (-5.3)	21.8 (0)	25.5 (-3.2)	82.8 (-6.9)
	1T2	34.8 (1.5)	23.0 (1.2)	29.5 (0.8)	84.6 (-5.1)
20	1T3	34.2 (0.9)	22.7 (0.9)	28.7 (0)	84.3 (-5.4)
	1T4	33.7 (0.4)	22.6 (0.8)	28.8 (0.1)	86.5 (-3.2)
	1T5	29.5 (-3.8)	23.1 (1.3)	25.7 (-3.0)	70.9 (-18.8)
		33.3 (0)	21.8 (0)	28.7 (0)	89.7 (0)
7/21	1T1	34.9 (-3.7)	22.0 (0.6)	31.9 (-2.3)	65.3 (-3.7)
	1T2	43.4 (4.8)	23.8 (2.4)	36.5 (2.3)	64.4 (-4.6)
31	1T3	43.0 (4.4)	21.0 (-0.4)	36.7 (2.5)	64.5 (-4.5)
	1T4	40.3 (1.7)	22.1 (0.7)	36.7 (2.5)	65.1 (-3.9)
	1T5	36.0 (-2.6)	22.3 (0.9)	32.3 (-1.9)	58.9 (-10.1)
		38.6 (0)	21.4 (0)	34.2 (0)	69.0 (0)

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (: 1T1- .)

7 13 () 7 30

가 . 5 1T1 가

5.6 , 3.2 2.3 . 1T5 가

5.6 , 3 , 1.9 .

1T2, 1T3, 1T4 7 0.5

, 7 0 0.8 ,

2.5 . 7 1T1 1T5 28

1T2, 1T3, 1T4, 32

. 7

1T1 3.2 , 1T5 3 26

28 . 7 가 .

. 1T1 2.3 , 1T5 1.9 1T2,

1T3, 1T4 2.3 2.5 .

. 7 1T1

7.6 , 1T5 6.7 . 가

. 7 가 1T3 1T4

40 , 1T2가 43.4 .

fog fan 가

가 가

. 11 30

16 가

가 ,

.

.

1T5가 가 ,

sprinkling

. 1T5 가

, , . 7 가 가 1T2,

1T3, 1T4 2.3 2.5

. 13 1T2가 가 .

1T2, 1T3, 1T4가 .

(3) 8 (1-18)

1-18. 8 simulation

		13 ()			
		%			
8/1	1T1z	34.3(-2.4)y	24.6(0.3)	30.2(-1.9)	74.5(-3.7)
	1T2	39.5(2.8)	24.8(0.5)	32.6(0.5)	76.7(-1.5)
10	1T3	38.3(1.6)	25.2(0.9)	31.3(-0.8)	72.3(-5.9)
	1T4	35.8(-0.9)	24.6(0.3)	31.5(-0.6)	76.0(-2.2)
	1T5	34.1(-2.6)	24.8(0.5)	31.5(-0.6)	65.3(-12.9)
		36.7(0)	24.3(0)	32.1(0)	78.2(0)
8/11	1T1	34.5(-3.5)	23.8(0.9)	31.8(-2.6)	70.4(-4.3)
	1T2	39.9(1.9)	25.5(2.6)	35.5(1.1)	69.2(-5.5)
20	1T3	34.9(-3.1)	24.7(1.8)	32.2(-2.2)	71.7(-3.0)
	1T4	35.1(-2.9)	24.5(1.6)	35.2(0.8)	73.0(-1.0)
	1T5	34.7(-3.3)	24.2(1.3)	34.6(0.2)	64.7(-10.0)
		38.0(0)	22.9(0)	34.4(0)	74.7(0)
8/21	1T1	31.5(-2.7)	20.9(-0.6)	28.4(-1.6)	73.0(-7.1)
	1T2	34.6(0.4)	25.5(4.0)	30.5(0.5)	79.5(-0.6)
31	1T3	32.9(-1.3)	21.5(0)	29.8(-0.2)	74.5(-5.6)
	1T4	32.5(-1.7)	21.3(-0.2)	29.7(-0.3)	77.1(-3.0)
	1T5	32.3(-1.9)	21.2(-0.3)	29.9(-0.1)	66.9(-13.2)
		34.2(0)	21.5(0)	30.0(0)	80.1(0)

z1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (: 1T1-)

8 13 8 1T2
 , 1T1 가
 6 7 . 8 35
 30 . 1T2 가
 1
 13 1T2가 0.4 2.8

1T1 가 . 1T5 , 1T3, 1T4
 . 13 1T1 1T5 가
 2.4 , 2.6 , 3.5 , 3.3 가 2.
 7 , 1.9 . 1T3 1T4 , ,
 .
 . 1T2 1T4가 80% .

(4) 9 . (1-19)

1-19. 9 simulation .

		13 ()			
		%			
9/01	1T1z	29.6 (-5.8)y	18.8 (0.3)	25.8 (-2.6)	71.7(-4.6)
	1T2	34.9 (-0.5)	19.6 (1.1)	28.0 (-0.4)	76.6(0.3)
10	1T3	31.9 (-3.5)	19.7 (1.2)	26.2 (-2.2)	70.4(-5.9)
	1T4	31.8 (-3.6)	19.5 (1.0)	26.7 (-1.7)	73.9(-2.4)
	1T5	30.6 (-4.8)	19.3 (0.8)	26.7 (-1.7)	61.8(-14.5)
		35.4 (0)	18.5 (0)	28.4 (0)	76.3(0)
9/11	1T1	28.8 (-5.6)	13.0 (0.3)	26.7 (-3.8)	56.1(-0.8)
	1T2	36.9 (2.5)	14.3 (1.6)	32.0 (1.5)	60.8(3.9)
20	1T3	31.9 (-2.5)	13.6 (0.9)	28.7 (-1.8)	56.2(-0.7)
	1T4	31.8 (-2.6)	13.8 (1.1)	29.8 (-0.7)	57.4(0.5)
	1T5	31.2 (-3.2)	13.4 (0.7)	28.6 (-1.9)	51.7(-5.2)
		34.4 (0)	12.7 (0)	30.5 (0)	56.9(0)
9/21	1T1	26.1 (-5.0)	11.4 (1.0)	24.2 (-3.3)	55.8(-2.1)
	1T2	33.1 (2.0)	11.6 (1.2)	28.4 (0.9)	58.0(0.1)
30	1T3	29.9 (-1.2)	11.9 (1.5)	25.6 (-1.9)	56.6(-1.3)
	1T4	30.1 (-1.0)	11.7 (1.3)	27.2 (-0.3)	56.3(-1.6)
	1T5	28.4 (-2.7)	11.6 (1.2)	26.0 (-1.5)	47.1(-10.8)
		31.1 (0)	10.4 (0)	27.5 (0)	57.9(0)

zT1 : , 1T2 : Fog Fan, 1T3 :

1T4 : sprinkling, 1T5 : sprinkling
 y 9 13 (: 1T1-) 30 1T2가
 1T1 1T2, 1T3, 1T4가 2
 가 .
 1T2 9 60%
 . 8 가 . 1T1 1T3
 1T4 1T5 . 1T2
 가 .
 1T1 가 가
 . 1T2 가 .
 1T1 1T5 가
 1T1 가 . 1T2
 가 .

(5) 14

Datalogger data 14

1-20 .

1-20. simulation 8 5 14

\	7	10	11	15	16	20	21	25	26	31
1T1z	29.3		37.1		32.5		32.8		28.6	32.06
1T2	29.2		38.6		33.2		32.9		29.1	32.60
1T3	29.1		37.5		33.0		33.3		29.5	32.48
1T4	29.4		37.5		32.9		33.1		29.8	32.54
1T5	29.2		36.9		32.4		32.8		28.7	32.00

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling 1T5 : sprinkling
 13 15 8
 14 . 8 11 15 가 가
 1T2가 가 1T5가 가 1T1
 37 39 . 26 31 가
 . 8 1T2, 1T4, 1T3, 1T1,
 1T5 1T1 1T5 0.06 .
 14 8 32 (1-21).

1-21. simulation 9 14

\	1	5	6	10	11	15	16	20	21	25	26	30
1T1z	30.3	24.2	28.5	31.1	26.7	26.7	27.9					
1T2	30.9	24.7	29.9	33.8	28.3	28.5	29.4					
1T3	30.6	24.4	29.2	32.6	27.6	27.7	28.7					
1T4	30.7	24.6	29.2	32.4	27.4	27.6	28.7					
1T5	30.2	24.1	28.5	31.6	27.0	27.6	28.1					

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 9 8 8 . 가
 1T1 1T5 6 , 7 8 .
 8 16 20 가 가 (全區)가 31 8
 28 . 가 1T2
 29.4 . 1T3 1T4 .
 sprinkling (1-21).

(6) 8
 9 18 30 Datalogger
 , 8 1T2가 가 , 1T4, 1T3, 1T1, 1T5

. 1T1 1T5 0.02 1T3 1T4
 0.08 . 8 30
 (1-22).

1-22. simulation 8 5
 (30 12 (AM 9 PM 6)) (:)

	7	10	11	15	16	20	21	25	26	31
1T1z	29.3		35.2		29.9		29.4		27.8	30.32
1T2	29.7		36.7		30.4		30.3		28.7	31.16
1T3	29.4		35.8		30.3		29.9		28.7	30.82
1T4	29.5		35.7		30.2		29.9		29.2	30.90
1T5	29.2		35.1		29.8		29.4		28.0	30.30

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling

9 8 3 4 가 26 .
 1T1 25.88 가 1T5가 26.01 1T2가
 27.36 가 .
 computer (1-23).

1-23. simulation 9 5
 (30 12 (AM 9 PM 6)) (:)

	1	5	6	10	11	15	16	20	21	25	26	31
1T1z	28.3	23.3		26.0		27.5		25.5		24.7		25.88
1T2	29.4	24.0		27.5		29.7		27.2		26.4		27.36
1T3	28.8	23.6		26.7		28.6		26.4		25.6		26.61
1T4	28.9	23.8		26.6		28.4		26.2		25.5		26.56
1T5	28.3	23.3		26.0		27.7		25.7		25.1		26.01

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling

(7)
 가

가 . fog sprinkling 가

()

1T1 19.6% 가

80% 가 가 1T1 112.3

wm2s-1 가

1T5 32%

1T2, 1T3, 1T4 1T4가 가 70%

가 1T3 75%

1T2, 1T3, 1T4

1T2 16%, 1T4 18%

1T3 6.4% (1T3)

sprinkling(1T4)

가 5.7%

가 (1-24).

1-24. simulation (95. 8. 16 8. 23) (: WM2S-1)

			(%)	-	(%)
1T1z	112.3	571.7	19.6	0	
1T2	440.3	494.5	89.3	-15.9	
1T2	513.4	699.2	73.4		
1T3	527.2	646.6	81.4	-6.4	
1T3	545.4	728.7	75.0		
1T4	372.4	429.1	87.6	-18.3	
1T4	485.5	699.6	69.3		
1T5	165.9	521.0	32.0	0	
1T5	160.3	537.8	32.2		

IT1 : , IT2 : Fog Fan, IT3 :
 IT4 : sprinkling IT5 : sprinkling

1-25.

(: 95. 8. 4. 14: 00- 15: 00)

			(A)	(B)	A-B
	45%	36	35	33	2

2

가 .

(8) 9 14

1-26. simulation 14

(: WMS-1)

	8								9											
5	10	15	16	20	21	25	26	31	1	5	6	10	11	15	16	20	21	25	26	30
IT1z	179.2	76.9	68.7	122.6	104.5	92.5	123.2	136.3	93.2	96.8	(19.6)y									
IT2	671.1	287.9	257.3	459.2	391.2	346.5	461.3	510.4	349.1	362.4	(73.3)									
IT3	914.4	392.3	350.5	625.6	533.0	472.1	628.5	695.4	475.6	493.8	(100.0)									
IT4	633.6	271.8	242.9	433.5	369.4	327.1	435.5	481.9	329.5	342.2	(69.2)									
IT5	294.4	126.3	112.8	201.4	171.6	152.0	202.3	223.9	153.1	158.7	(32.2)									

IT1 : , IT2 : Fog Fan, IT3 :
 IT4 : sprinkling IT5 : sprinkling
 IT3() 100

가 IT3 IT2, IT3, IT5

IT1 가 . 9 26 30

IT3 100 IT2 (73.3%), IT4 69.2%,

IT5 32.2%

IT1 IT3 1/5

IT5 1/3

(9)

1-27. simulation

13 ,
(95. 6. 14. 13 14)

	13 ()	(%)
1T1z	33.0 (-4.0) 29.0	86 (-15) 71
1T2	32.0 (-2.0) 30.0	93 (0) 93
1T3	38.0 (-6.5) 31.5	66 (2) 68
1T4	40.0 (-6.0) 34.0	59 (-4) 55
1T5	39.0 (-6.5) 32.5	61 (-10) 51

1T1 :
1T4 :
y =

1T2 : Fog Fan, 1T3 :
1T5 : sprinkling sprinkling

가 1T2 1T4 40 , 1T5 39
10 30 . 1T1 가
29 1T2 30 . 1T2
. 1T2가 1T4, 1T2,
1T3 . 4
6 . 가 1T3
1T5 . 1T2 가 fog fan
가
. 1T2
가 .
4% 15% . 1T2 1T3

(10)

가

95 6 14, 15

가

4

가

2

(:) :

2

1T2, 1T3, 1T4가

가

1T1 1T5

가 (1-28).

1-28.

(:) 가

(95. 8. 8)

	(cm)	(cm)	(cm)	(cm)	(cm)
1T1z	65. 6aby	21. 0b	10. 3a	8. 5a	18. 0b
1T2	57. 3ab	37. 8a	12. 5a	8. 4a	37. 6ab
1T3	58. 3ab	40. 3a	11. 3a	8. 4a	35. 6ab
1T4	64. 0ab	32. 3ab	12. 5a	8. 6a	33. 6ab
1T5	52. 6b	26. 0ab	10. 6a	8. 7a	23. 0b
x	80. 3a	37. 0a	12. 0a	9. 1a	52. 0a

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .
 x +

(, :) : 1T1 1T5

1T6 가 .

(1-29).

1-29. 가 (, :)
(95. 8. 8)

	(cm)	(cm)	(cm)	(cm)	
1T1z	62. 0ay	18. 3a	10. 1a	1. 2a	72. 3a
1T2	50. 8ab	18. 5a	10. 0a	1. 4a	58. 0ab
1T3	53. 0ab	19. 7a	10. 0a	1. 2a	63. 0ab
1T4	57. 0ab	19. 0a	9. 6a	1. 3a	55. 3ab
1T5	55. 0ab	17. 0a	8. 8a	1. 3a	57. 0ab
x	38. 3b	17. 1a	8. 8a	1. 3a	51. 3b

z1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .
 x +

. 1T1 .
 : , ,
 가 .
 1T2 1T4 . 1T1
 (1-30).

1-30. (P-1) 가
(95. 8. 8)

	(cm)	(cm)	(cm)	(cm)	
1T1z	8. 6aby	18. 0a	14. 1a	6. 7a	4. 6a
1T2	12. 0a	22. 8a	12. 6a-c	5. 7a	5. 3a
1T3	9. 1ab	14. 0a	10. 0c	6. 4a	5. 0a
1T4	10. 3a	18. 6a	10. 5bc	6. 0a	5. 3a
1T5	6. 0b	21. 0a	12. 8bc	5. 7a	5. 0a
x	5. 7b	23. 0a	13. 1ab	6. 0a	4. 6a

z1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .
 x +

: 가
가 1T3 1T5 (1-31).

1-31. (:) 가
(95. 8. 8)

	(cm)	(cm)	(cm)	(cm)	
1T1z	8. 5aby	7. 16ab	4. 6bc	1. 10b	10. 0a
1T2	7. 5bc	7. 50ab	4. 5bc	0. 80c	11. 0a
1T3	6. 6c	5. 00b	3. 6c	0. 83bc	10. 0a
1T4	8. 3ab	8. 16a	5. 3ab	1. 00bc	11. 6a
1T5	7. 7bc	5. 26b	4. 0bc	0. 86bc	8. 6a
x	8. 8a	8. 73a	6. 5a	1. 80a	12. 0a

z1T1 : , 1T2 : Fog Fan, 1T3 :
1T4 : sprinkling, 1T5 : 가 sprinkling
y (5%)
x +

1T4 1T1 1T3

(11)

system(Mbd. LI-6200)

portable photosynthesis

: 1T2가 가 1T3, 1T4, 1T1, 1T5
1T5 1T2 2. 7 1T5 1T1

가 1T1 1T5 1T2 1T3 가
 가 .
 1T2가 가 1T3 1T4 1T2 가 가
 .
 CO2 1T2 1T3 가 가
 . 1T2 1T1 1T5 가
 (1-32).

1-32.

(95. 8. 31)

	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (mg/L)	(cm s^{-1})
1T1z	3.87bcy	0.55b	354.2a	1.39b
1T2	7.56a	0.45c	301.9d	1.14c
1T3	6.94a	0.60b	303.2d	1.55ab
1T4	4.57b	0.61b	315.3c	1.54ab
1T5	2.76c	0.68a	324.0b	1.71a

1T1 :
 1T4 : sprinkling,
 y
 1T2 : Fog Fan,
 1T5 : (5%) 가
 1T3 :
 sprinkling .

() : 1T2가 가 1T1,
 1T3, 1T4, 1T5 1T5가
 가 . 1T2
 가 . 1T2가 가 0.31 $\mu\text{mol m}^{-2}\text{s}^{-1}$
 . 1T5가 가 1T4, 1T1, 1T3 .

CO₂ 1T4, 1T5가 1T2가
 (:) 1T2, 1T3,
 1T4 가 1T1 1T5가
 (1-33).

1-33.

(95. 8. 31)

	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO ₂ (ng/L)	(cm s^{-1})
1T1z	4.96by	0.42c	326.2a	1.07c
1T2	6.85a	0.31d	290.4c	0.81d
1T3	4.66b	0.36cd	303.7b	0.93cd
1T4	5.03b	0.64b	322.1a	1.62b
1T5	3.17b	0.79a	323.3a	1.99a

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .

:

1T3 가 , 1T5가 가 1T2
 1T1 가 , 1T2 CO₂ 가
 1T5 (1-34).

1-34.

(: 95. 8. 31)

	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO ₂ (ng/L)	(cm s^{-1})
1T1z	1.92ay	0.15d	322.5a	0.40d
1T2	1.79a	0.10d	286.8b	0.26d
1T3	2.46a	0.33c	319.3a	0.84c
1T4	1.02a	0.54b	327.2a	1.37b
1T5	1.92a	0.64a	327.1a	1.60a

1T1 : , 1T2 : Fog Fan, 1T3 :

1T4 : sprinkling, 1T5 : sprinkling
y (5%) 가 . 1T1 1T5
1T3 가 .
. .
: 1T4가 가
1T5 . 1T2 1T3 .
가 . 1T4 1T5
1T4가 .
1T4 1T5 1T1, 1T2 .
가 . CO2
1T3 CO2 가 . 1T1 1T2 .
1T2 1T3 가 .
1T1, 1T4, 1T5 가 (1-35).

1-35.

(95. 8. 31)

	(μ mol m ⁻² s ⁻¹)	(mol m ⁻² s ⁻¹)	CO2 (mg/L)	(cm s ⁻¹)
1T1z	0. 01by	0. 11d	0. 28d	329. 5b
1T2	-2. 08c	0. 14d	0. 37d	351. 6a
1T3	-0. 32b	0. 26c	0. 67c	345. 4a
1T4	3. 46a	0. 56b	1. 43b	325. 7b
1T5	2. 21a	0. 38a	2. 08a	328. 0b

1T1 : , 1T2 : Fog Fan, 1T3 :
1T4 : sprinkling, 1T5 : sprinkling
y (5%) 가 .

: 1T2, 1T3
 1T5 . 1T5
 1T5가 1T1, 1T2, 1T3 . CO2 1T1
 가 1T2 가 .
 1T5가 가 1T1, 1T2, 1T3 . 1T5
 , CO2 .
 1T1, 1T2, 1T3 CO2 1T1
 1T2가 가 (1-36).

1-36.

(95. 8. 31)

	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (mg/L)	(cm s^{-1})
1T1z	5.32ay	0.24c	303.6b	0.63c
1T2	1.66b	0.21c	327.1a	0.54c
1T3	1.46b	0.21c	314.2ab	0.55c
1T4	6.52a	0.71b	319.3ab	1.79b
1T5	8.38a	0.97a	314.1ab	2.45a

z1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .

1-37.

(95. 8. 31)

	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO_2 (ng/L)	(cm s^{-1})
1T1z	4. 89ay	0. 55b	329. 4bc	1. 39bc
1T2	-2. 87c	0. 31b	351. 6a	0. 80c
1T3	2. 51ab	0. 52b	317. 0c	1. 34bc
1T4	0. 77b	0. 56b	335. 6ab	1. 77ab
1T5	1. 87b	0. 89a	327. 3bc	2. 24a

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .

① : 1T1 가 1T2
 . 1T4 1T5
 . 1T1 1T4
 1T2 가 1T5 가
 . CO_2 1T2 가 1T3 가 .
 1T5 가 1T2 가 .
 1T1
 1T5 (1-37).

(12)

:
 . 2 .
 가 . 1T3 가

1T5 가 1T1, 1T2, 1T4 .
 1T2, 1T3가 가 1T5가 가 .
 1 cm (花首徑) 1T1, 1T3가 가 1T4
 가 가 1T2, 1T3 가 1T1 1T5가 가
 1T2, 1T3 가

(1-38).

1-38. (:)
 (開花始)

	(cm)	(cm)	(cm)	(cm)	(cm)
1T1z	24. 8xy	2. 25ab	2. 21b	1. 0c	47. 28a
1T2	22. 2a	2. 30ab	2. 30ab	3. 0ab	42. 89ab
1T3	23. 5a	2. 36a	2. 73a	3. 0a	46. 55a
1T4	22. 8a	2. 22ab	2. 22b	2. 0b	38. 54b
1T5	24. 2a	2. 19b	1. 98bc	1. 0c	42. 97ab

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .
 7/1

(, :) : 1T5가 가 1T1 가
 1 2 1T2 1T4
 가 , 1T3 1T5가 가 .
 1T1 , 1T3 가 .
 1T2가 가 1T5, 1T3 ()
 1T2가
 1T3 1T5 (1-39).

1-39. (, :)
(開花始)

	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
1T1z	38.2	7.1ab	13.7ab	52.8a	4.0bc	0.34a
1T2	37.3ab	7.5a	14.3a	44.4cd	5.0a	0.34a
1T3	37.5ab	7.0b	13.0c	43.2d	3.0d	0.23b
1T4	36.5bc	7.5a	14.0a	46.4bc	5.0ab	0.36a
1T5	36.1c	6.9b	13.1bc	46.8b	4.0c	0.34a

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .
 7/1

(13)

7

: 1T3 가 1T1, 1T2 가
 . 1T4 1T5 가 . 1T5 1T1 가
 . 1T2가 .

1T2,

1T3, 1T4 1T1 1T5 .
 . 1T3

1T3

가 (1-40).

1-40.

(:)

(:95. 10. 10)

	(cm)	(cm)	(g)			(g)		
1T1z	100. 78aby	47. 33b	3. 11b	69. 2a	78. 2b	45a	36. 9a	27. 0b
1T2	101. 78ab	52. 89ab	4. 78a	119. 9a	103. 4b	55a	51. 2a	37. 1b
1T3	107. 44a	49. 00ab	3. 78b	124. 1a	163. 6a	60a	51. 4a	62. 5a
1T4	86. 56b	48. 33ab	3. 00b	103. 1a	84. 1b	37a	43. 4a	24. 9b
1T5	85. 22b	62. 00a	3. 56b	46. 0a	69. 9b	38a	22. 1a	22. 2b

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .

:

가 1T1 가 1T5가 가 1T3, 1T4가

(

1-41).

1-41.

(, :)

(:95. 10. 10)

	(cm)	(cm)	(g)			(g)			(cm)	(cm)	(cm)
1T1z	60. 78ay	19. 11b	45. 0a	46. 8ab	69a	7. 9a	11. 2bc	5. 3ab	3. 4ab	16. 0ab	
1T2	57. 00ab	19. 67b	33. 9a	58. 0a	57b	10. 2a	17. 7ab	5. 6ab	3. 6ab	16. 9ab	
1T3	48. 56c	17. 00b	37. 7a	62. 1a	63ab	7. 5a	20. 6a	5. 6ab	3. 7 a	16. 2ab	
1T4	54. 22b	18. 67b	37. 4a	62. 4a	64ab	7. 2a	21. 0a	6. 0a	3. 7a	17. 6a	
1T5	59. 56ab	22. 67a	32. 6a	29. 7b	61ab	5. 8a	8. 1c	4. 4b	3. 1b	13. 8b	

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling

y (5%) 가 .

1T2 가 가 . 1T4 1T2가 1T1 1T5가 가
 . 1T1
 1T2, 1T3, 1T4

:

1T2가 .
 1T5 가 1T1 1T2 2g
 1T1 1T5 . 1T3 1T4

1T5

1T1

(1-42).

1-42.

(:95. 10. 10)

	(cm)		(g)		(g)		
1T1	25.0a	30.7a	2.0a	20.0a	36.9a	3.0a	4.4a
1T2	26.5a	35.7a	1.7a	22.4a	44.3a	4.8a	3.5a
1T3	28.7a	36.5a	2.0a	11.0a	20.2a	2.4a	2.0a
1T4	30.2a	29.2a	1.5a	15.2a	29.3a	3.7a	2.8a
1T5	25.7a	36.5a	1.7a	25.0a	49.6a	5.8a	4.1a

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling

y : (5%) 가 . 가 가
 . . 1T1, 1T2가
 1T3 1T5 가 . 1T2, 1T3, 1T5 1T1 가
 . 1T2 가 .
 1T2 가 1T1 1T4
 . 1T2 가 1T5 1T4
 1T3 .
 1T1 1T2 1T4
 (1-43).

1-43.

(:95. 10. 10)

	(cm)	(cm)		(g)	(g)		(g)
1T1z	22.0	10.0	4.0	28.7	37.2	1.7	2.6
1T2	12.0	24.0	6.0	32.6	30.2	2.1	1.8
1T3	6.0	24.0	4.0	26.6	27.4	1.5	1.9
1T4	11.0	19.0	4.0	26.8	38.7	1.9	2.5
1T5	6.0	23.0	5.0	20.7	33.1	1.4	2.3

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling

:

1T2, 1T3 1T4가

1T1, 1T2, 1T3

1T4

(1-45).

1-45.

(:)

(:95. 10. 10)

	(cm)	(cm)	(g)		(g)		
1T1z	9.3	5.3	2.0	15.8	3.5	1.5	0.5
1T2	3.0	4.3	2.0	14.5	1.1	1.6	0.1
1T3	7.3	4.5	2.0	25.3	1.5	2.8	0.2
1T4	8.3	9.0	4.0	42.4	3.9	4.0	0.4
1T5	11.7	11.3	5.0	14.3	1.6	1.4	0.2

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .

: 1T2 .

1T2, 1T4

. 1T1 1T3, 1T4 가

1T5 가 . 1T2 가 1T3

가 . .

1T2

(1-46).

1-46.

(:95. 10. 10)

	(cm)	(cm)		(g)		(g)		(g)
1T1z	61. 5ay	75. 0a	56. 0a	554. 1b	87. 5a	427. 5d	68. 5b	20. 5c
1T2	81. 0a	118. 0a	48. 5bc	878. 1a	108. 2a	598. 0b	97. 0a	34. 7a
1T3	62. 5a	85. 0a	51. 5ab	447. 1c	85. 1a	536. 0c	57. 4c	19. 6c
1T4	63. 0a	108. 0a	53. 5ab	617. 0b	100. 7a	647. 5a	73. 6b	33. 6ab
1T5	65. 5a	75. 5a	44. 5c	578. 1b	85. 5a	586. 0b	61. 8c	22. 6bc

1T1 : , 1T2 : Fog Fan, 1T3 :
 1T4 : sprinkling, 1T5 : sprinkling
 y (5%) 가 .

가

가

가

computer system

data

2

data가

가

가 (: , , : , , , , :) 가

1

가 가

가

(15) (simulation) 5

5가

1. 4

가 , 4 가 3 가 가

1 가

turn-key

computer

+ + + , 가 가 6 8 가 29.7

32.9

2.

5 simulation

(1T1), Fog Fan(1T2), (1T3),
sprinkling(1T4), sprinkling(1T5) 5

(), , , , ,
7 6 20 10 10 ,

1) 1T1 가 가 6 13 가 6
2.7 , 6 4.6 1T5 6 2 ,
6 4.6 . 7 8

2) 가 가 1T2 6 1.5
. 1T3 1T4 가 1T3 1T4
가 가 . (0%) 1T2가
가 가 .

3) 1T2가 가 1T4, 1T3 .

4) (%) 가 1T1 20% ,
1T5 32% . 1T2, 1T3, 1T4 80% . 1T2, 1T3, 1T4
10%
2

5) 7

①

1T3 가 , 1T2 .

⑤

가 , 1T1
가 , 1T5가 가 1T3, 1T4가 .

③

가 1T5 1T1
가 가 1T2 .

④

1T2 가 1T5
1T4 1T3 .

②

1T2, 1T3
1T4가

⑥

1T4가 가 ,
1T5 .
1T2가 가 , 1T3 .

, ,
.

2. (2)

1) 6 (2-3)

(1) 13

2-3. 6 simulation

		13 ()						
		z						
		%						
6/1	10	2T1	20.0(-1.0)y	44.0(7.1)	35.9(8.4)	66(- 8.0)	25.8	25.3
		2T2	19.3(-1.7)	35.0(- 1.9)	28.6(1.1)	80(6.0)	24.6	26.2
		2T3	25.6(4.6)	39.0(2.1)	36.1(8.6)	80(6.0)	27.8	26.6
		2T4	22.5(1.5)	31.9(- 5.0)	29.9(2.4)	85(11.0)	22.1	26.0
		2T5	20.6(-0.4)	38.0(1.1)	30.7(3.2)	80(6.0)	25.9	28.0
			21.0(0.0)	36.9(0.0)	27.5(0.0)	74(0.0)	-	-
6/11	20	2T1	21.2(0.7)	41.0(10.8)	35.0(7.9)	72(-12.0)	24.3	24.7
		2T2	20.0(-0.5)	30.7(0.5)	27.9(0.8)	81(- 3.0)	23.0	25.0
		2T3	20.3(-0.2)	42.7(12.5)	36.0(8.9)	82(- 2.0)	27.0	25.4
		2T4	20.1(-0.4)	32.1(1.9)	29.3(2.2)	85(1.0)	22.1	25.6
		2T5	22.0(1.5)	34.3(4.1)	29.9(2.8)	81(- 3.0)	24.0	25.8
			20.5(0.0)	30.2(0.0)	27.1(0.0)	84(0.0)	-	-
6/21	30	2T1	21.1(1.9)	35.4(8.0)	29.2(5.3)	82(- 9.0)	22.4	22.6
		2T2	19.8(0.9)	28.0(0.6)	24.6(0.7)	89(- 2.0)	21.7	23.2
		2T3	19.8(0.6)	38.8(11.4)	30.9(7.0)	90(- 1.0)	25.1	23.6
		2T4	19.8(0.6)	29.4(2.0)	26.0(2.1)	92(1.0)	20.5	23.5
		2T5	21.7(2.5)	30.9(3.5)	26.5(2.6)	90(- 1.0)	22.7	23.1
			19.2(0.0)	27.4(0.0)	23.9(0.0)	91(0.0)	-	-
		z						
2T1 :	Fan,	2T2 : Fog	Fan +		2T3 : Pad	Fan,		
2T4 :				2T5 :		+ sprinkling		
y	(: 2T1-)					

1 13 14 12

16 가 가
 2T2(Fog Fan +)
 .
 .
 11
 가 27.5 39 6
 1.1 .
 2T4
 가 2.4 29.9 . 1
 (+)
 가 (1 1-16).
 + ,
 . 2T5
 3.2
 .
 2T1 .
 35.9 8.4 가 .
 (全) 가
 .
 60 70 36
 8.6 36 .
 36 3
 () .

6

(2) , 13 : 2T1
가 . ,

44 7

39 .

가 13

, 2T2 2T4 가 .

가 2T3

2T4 가 ,

가 .

2T3 2 가 . 3

가 가 가

(3).

(3) : 6 . . ,

2T4 가 2T1 가 .

2) 7 (2-4)

2-4. 7 simulation

		z		13 ()				
7/01	10	2T1	20.2(1.9)y	43.1(11.9)	37.1(10.8)	71(- 16.0)	25.6	25.7
		2T2	18.2(-0.1)	32.5(1.3)	28.6(2.3)	81(- 6.0)	23.8	24.9
		2T3	17.7(-0.6)	46.2(14.0)	39.3(13.0)	80(- 7.0)	27.3	26.6
		2T4	18.5(0.2)	33.9(2.7)	31.0(4.7)	87(0.0)	22.1	25.5
		2T5	21.0(2.7)	36.4(5.2)	32.5(6.2)	82(- 5.0)	23.9	26.3
			18.3(0.0)	31.2(0.0)	26.3(0.0)	87(0.0)	-	-
7/11	20	2T1	22.8(2.2)	40.7(9.0)	32.3(5.9)	83(- 6.0)	23.7	23.9
		2T2	21.4(0.8)	31.6(- 0.1)	26.5(0.1)	88(- 1.0)	23.5	25.2
		2T3	21.1(0.5)	40.6(8.9)	33.8(7.4)	89(0.0)	26.5	25.0
		2T4	21.1(0.5)	33.3(1.6)	29.5(3.1)	91(2.0)	22.3	25.5
		2T5	22.8(2.2)	34.2(2.5)	29.4(3.0)	90(1.0)	24.7	25.7
			20.6(0.0)	31.7(0.0)	26.4(0.0)	89(0.0)	-	-
7/21	31	2T1	27.3(3.5)	39.8(6.3)	35.0(5.5)	78(- 8.0)	25.4	26.0
		2T2	23.9(0.1)	33.5(0.0)	29.3(- 0.2)	88(2.0)	25.1	26.4
		2T3	23.5(-0.3)	42.2(8.7)	36.0(6.5)	88(2.0)	27.5	25.9
		2T4	23.7(-0.1)	34.6(1.1)	30.8(1.3)	90(4.0)	23.8	26.8
		2T5	26.5(2.7)	34.8(1.3)	33.5(4.0)	90(4.0)	26.1	26.8
			23.8(0.0)	33.5(0.0)	29.5(0.0)	86(0.0)	-	-

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + sprinkling
 2T5 :
 y (:2T1-)

(1) 13 : 7 . . 6 가 2T2 2T4
 가 2T5 . 7 2T3 2T1
 , 39.3 13 .
 가

가
가
7 7 2T2 0.2
가
7 , 가
(2) , 13 : 6
7 가 가
2T1 2T3 2T3 가
가 2T2 , 2T4, 2T5
2T3 가
가 ,
(長波放射)가 (被服逆轉)
6
2T1
2T3 가 (27) 2T1 2 3
2T1 37 25
12
8
17.5

(3) : 7 2T1, 2T2, 2T3 2T1(71%)

가 . 가 2T5

2T4 .

3) 8 . (2-5)

(1) 13 : 8 6, 7 8

, 가 6, 7 30 . 30

가 . 가

2T2 2.2 . 8

0.9 가 가 가 .

25.6 . .

2T1 2T3 가 2T3 33 .

40 10 가 .

2-5.

8

simulation

						13 ()			
		z							
8/01	10	2T1	32.3(6.7)y	47.7(11.3)	40.3(8.8)	76(-12.0)	27.6	28.3	
		2T2	24.8(-0.8)	38.1(1.7)	33.7(2.2)	82(- 6.0)	27.4	28.1	
		2T3	24.3(-1.3)	47.2(10.8)	40.5(9.0)	85(- 3.0)	31.3	27.7	
		2T4	24.6(-1.0)	38.7(2.3)	33.7(2.2)	90(2.0)	25.8	29.1	
		2T5	30.7(5.1)	41.8(5.4)	35.2(3.7)	91(3.0)	28.7	28.7	
			25.6(0.0)	36.4(0.0)	31.5(0.0)	88(0.0)	-	-	
8/11	20	2T1	25.3(1.4)	45.6(8.9)	43.6(8.5)	72(-10.0)	28.9	28.6	
		2T2	24.0(0.1)	36.7(0.0)	34.2(- 0.9)	79(- 3.0)	27.6	28.8	
		2T3	23.5(-0.4)	48.5(11.8)	45.6(10.5)	81(- 1.0)	30.3	27.9	
		2T4	24.1(0.2)	38.3(1.6)	36.4(1.3)	88(6.0)	26.9	27.9	
		2T5	30.8(6.9)	40.9(4.2)	38.3(3.2)	89(7.0)	28.1	29.0	
			23.9(0.0)	36.7(0.0)	35.1(0.0)	82(0.0)	-	-	
8/21	31	2T1	20.5(0.7)	37.7(9.3)	33.0(7.4)	76(-14.0)	23.0	23.2	
		2T2	20.4(0.6)	30.7(2.3)	27.6(2.0)	87(- 3.0)	22.9	24.6	
		2T3	19.9(0.1)	40.2(11.8)	33.0(7.4)	89(- 1.0)	25.7	23.9	
		2T4	20.7(0.9)	31.9(3.5)	28.2(2.6)	94(4.0)	22.3	24.6	
		2T5	28.1(8.3)	33.5(5.1)	28.5(2.9)	95(5.0)	23.6	24.6	
			19.8(0.0)	28.4(0.0)	25.6(0.0)	90(0.0)	-	-	

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : (:2T1-) , 2T5 : + sprinkling y

가 95 97

8

8

가

가 6, 7, 8

(2) , , 13 : 가

2T1 2T3 8 . 47 . 가

8 2T3

11.8 .

가 8 36.4 , 36.7

가

36 .

2T1 가 2T2, 2T3, 2T4 . 13 2T1

2T3 2T1 2T2, 2T4, 2T5

. 97 3

.

(3) : 6 , 7 . 2T1, 2T2, 2T3

, 2T1 가 . 가 2T4

2T5 .

4) 9 (2-6)

2-6. 9 simulation

		z		13 ()					
9/01	9/10	2T1	18.1(- 0.5)y	41.3(9.4)	36.2(8.5)	72(- 9.0)	23.2	22.7	
		2T2	18.9(0.3)	33.4(1.5)	31.2(3.5)	81(0.0)	23.7	25.2	
		2T3	18.9(0.3)	42.8(10.9)	38.7(11.0)	76(- 5.0)	26.0	24.4	
		2T4	18.7(0.1)	33.5(1.6)	30.7(3.0)	84(3.0)	22.4	24.2	
		2T5	28.9(10.3)	35.4(3.5)	32.1(4.4)	92(11.0)	24.4	25.2	
			18.6(0.0)	31.9(0.0)	27.7(0.0)	81(0.0)	-	-	
9/11	9/20	2T1	17.1(- 0.8)	39.3(6.2)	36.4(8.0)	70(-11.0)	22.8	23.1	
		2T2	18.2(0.3)	33.1(0.9)	30.4(2.0)	79(-2.0)	23.4	25.0	
		2T3	16.9(-1.0)	42.5(10.3)	37.6(9.2)	81(0.0)	26.0	24.8	
		2T4	17.6(-0.3)	32.1(-0.1)	30.4(2.0)	85(4.0)	22.4	24.2	
		2T5	30.0(12.1)	34.9(2.7)	32.2(3.8)	93(12.0)	24.1	24.9	
			17.9(0.0)	32.2(0.0)	28.4(0.0)	81(0.0)	0.0	0.0	
9/21	9/30	2T1	14.2(0.0)	37.5(7.3)	34.4(9.8)	66(-5.0)	22.1	22.4	
		2T2	15.5(1.3)	30.7(0.5)	29.2(4.6)	73(2.0)	21.9	25.2	
		2T3	13.6(- 0.6)	42.8(12.6)	37.6(1.3)	79(8.0)	24.7	24.3	
		2T4	15.7(1.5)	31.1(0.9)	29.2(4.6)	84(13.0)	21.0	23.3	
		2T5	27.0(12.8)	33.1(2.9)	30.4(5.8)	85(14.0)	22.5	25.4	
			14.2(0.0)	30.2(0.0)	24.6(0.0)	71(0.0)	0.0	0.0	

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + sprinkling, 2T5 : y (: 2T1-)

(1) 13 : 9 가 28 . 6, 7, 8

가 2T2, 2T4 가 2T5 .

2T1 2T3 2T3 .

(2) , , 13 : 9

. 가 2T3 2T1 .
 18 14 . 2T1 2T3 가
 . 13 가
 2T4가 가 .

5) 14 6, 7, 8, 9 (2-7)

2-7. simulation 6, 7, 8, 9 14

(:)

ㄷ	6()			7			8			9								
	1	10	11	20	21	30	1	10	11	20	21	30	1	10	11	20	21	30
2T1	30.7	31.9	29.3	32.9	29.9	34.0	41.4	38.3	27.9	33.2	31.9	30.7						
2T2	26.9	28.4	26.6	29.4	27.0	31.0	37.6	33.9	25.3	28.8	28.4	27.5						
2T3	30.1	33.0	31.2	38.7	32.7	37.4	47.3	47.4	32.3	35.3	33.1	29.0						
2T4	27.5	29.5	27.7	30.1	28.1	32.8	39.8	35.9	26.1	30.9	30.1	28.9						
2T5	27.0	28.4	27.1	29.6	27.3	32.0	38.5	35.8	26.0	30.0	30.7	29.3						

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + sprinkling, 2T5 :

1 12 16

가 13 14 가 가 . 14

. 1 14 8 가 .

13 2T2 가 가 . 가

2T3 2T1 . 2T2 6 7 30

가 7 8

. 8 . 2T4

2T5

2T5가 2T4

가

97

가

2T3

14

가

8

47

가

2T1 2T3

8

41

6)

(2-8)

2-8.

(: 96 8 14 10)

		()			()			(μmol/s)			(%)			(.)
		(A)	(B)	A-B	(A)	(B)	A-B	(A)	(B)	% A/B	(A)	(B)	A-B	
2T1 ()		31	32	-1	28	24	4	302.7	1341	22.5	81.2	76.2	4.6	10:25
		30	31	1	29	27	2	354.8	1437	24.6	78.9	71.6	7.3	10:30
		31	32	-1	26	25	1	418.3	1038	40.2	62.6	57.4	5.2	10:40
		30	30	0	28	24	4	990.6	1238	80.0	78.9	71.6	7.3	10:35
2T3 (Pad Fan)		29	31	-2	29	26	3	341.5	1773	19.2	68.6	63.7	4.9	10:50
		30	32	-2	27	25	2	452.6	1276	35.4	65.6	69.1	-3.5	10:55
		30	31	-1	28	27	1	458.7	1467	31.2	77.4	69.6	7.8	11:05
		30	31	-1	28	25	3	950.1	1606	59.1	65.4	63.4	2.0	10:45

*1)

(1) 2T1 가 1 1

(2) 2T3 2 , 2 , 가 1

(3) Pad Fan 1

2T1 2T3 가 가 .

96 8 14 10 25 11 05

. , 1 가

2T1 2T3 가 . 1 .

가

가 . 55% 2T1 22.5%, 2T3

19.2% 가 .

가 .

가 3

가 .

7) 9 18 (2-9)

2-9. simulation

(:)

		z 9	10	11	12	13	14	15	16	17	18	
6	16	2T1	22.2	23.9	25.6	25.8	29.8	33.7	33.4	32.2	28.1	26.8
		2T2	21.7	22.6	24.1	23.9	26.6	29.9	30.1	28.7	26.8	26.2
		2T3	22.5	24.2	25.8	25.5	29.5	32.5	33.5	33.2	29.9	27.7
		2T4	21.5	22.5	23.9	24.2	27.3	30.8	31.4	30.2	25.9	25.5
		2T5	22.4	23.5	24.6	24.4	27.0	34.7	30.0	28.9	26.4	26.3
7	19	2T1	30.5	34.0	35.2	37.1	38.7	37.7	37.5	36.7	33.5	30.3
		2T2	29.1	31.9	32.6	32.7	34.0	33.2	32.9	33.0	31.9	29.7
		2T3	34.0	40.0	41.9	43.8	46.8	43.6	42.5	41.6	37.4	32.6
		2T4	28.3	31.6	32.5	34.4	35.9	34.9	34.9	34.9	32.0	29.6
		2T5	28.7	32.0	32.4	32.9	34.2	33.6	34.0	33.4	31.4	29.2
8	15	2T1	32.5	36.1	36.2	34.9	35.8	37.3	33.2	34.2	33.1	31.2
		2T2	30.5	33.2	32.9	31.9	32.8	34.1	30.5	32.4	33.0	30.9
		2T3	38.1	48.6	47.9	44.6	45.9	49.0	39.3	42.0	40.9	34.4
		2T4	29.9	34.5	35.2	33.9	34.8	36.6	32.4	34.0	35.2	35.3
		2T5	29.4	34.6	35.1	32.7	33.1	34.6	30.5	31.6	32.1	31.4
9	15	2T1	25.5	30.1	32.6	33.9	34.2	34.2	32.7	32.6	29.8	26.4
		2T2	22.9	26.2	29.0	29.7	30.8	30.8	29.9	30.5	29.6	26.5
		2T3	26.4	34.0	38.4	38.2	39.3	37.3	34.9	34.5	31.4	26.5
		2T4	22.3	26.6	30.4	31.3	32.9	33.4	32.3	32.8	30.9	26.7
		2T5	22.1	27.3	31.6	31.9	33.7	33.6	31.4	31.9	29.5	26.5

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + 2T5 : + sprinkling

13 14 가

2T3 8 15 14 49 . 가

2T2 6 16 14 29.1 .

2T2, 2T5, 2T4 2T3, 2T1 .

가 10 13
 18 가 . 8 15 6, 7, 9 가

8) 9 18

2-10. simulation

(: $\mu \text{ mol m}^{-2} \text{ s}^{-1}$)

z		9	10	11	12	13	14	15	16	17	18	
6	16	ZT1	43.1	164.3	220.2	204.6	537.3	812.7	657.6	342.9	99.0	59.1
		ZT2	29.2	111.3	149.2	138.6	363.9	556.6	445.5	232.3	67.1	40.1
		ZT3	42.4	161.4	216.4	200.6	527.9	807.3	646.2	336.9	97.3	58.1
		ZT4	24.4	93.0	124.6	115.7	304.1	464.9	372.1	194.0	56.0	33.5
		ZT5	31.7	120.6	161.7	150.2	394.6	603.5	483.1	251.9	72.7	43.4
		60.2	229.4	307.4	285.6	750.0	1147.0	918.1	478.8	138.3	82.5	
7	19	ZT1	300.9	390.2	591.6	764.8	804.0	554.8	430.4	323.7	197.3	106.0
		ZT2	203.8	264.3	400.8	518.1	544.6	375.9	291.5	219.3	133.6	71.8
		ZT3	295.6	383.4	581.3	751.4	789.9	545.2	422.9	318.1	193.8	104.2
		ZT4	170.2	220.8	334.8	432.8	454.9	313.9	243.5	183.2	111.6	59.9
		ZT5	220.9	286.6	434.5	561.4	590.5	407.5	316.1	237.8	144.9	121.4
		419.9	544.6	825.8	1067.5	1122.3	774.5	600.7	451.9	275.3	148.0	
8	15	ZT1	663.7	694.3	674.8	717.7	657.9	742.3	338.5	383.1	276.9	82.2
		ZT2	304.0	470.4	457.1	486.2	445.7	503.8	229.3	259.5	187.6	119.3
		ZT3	440.9	682.2	643.9	705.2	649.4	729.2	332.6	376.4	272.2	68.7
		ZT4	253.9	392.9	381.8	406.1	372.3	420.0	191.6	216.8	156.7	77.9
		ZT5	329.7	509.9	495.6	527.2	483.2	545.2	248.7	281.4	203.5	41.1
		626.5	969.2	941.9	1001.8	918.3	1036.1	472.6	534.7	386.7	169.4	
9	15	ZT1	303.1	499.3	683.3	724.7	675.9	545.9	400.8	344.8	153.5	27.8
		ZT2	205.3	338.2	462.8	490.9	457.9	369.8	271.5	233.6	103.9	40.4
		ZT3	297.8	490.5	671.3	712.0	664.1	536.3	393.8	338.8	150.8	23.3
		ZT4	171.5	282.5	386.6	410.1	382.5	308.9	226.8	195.1	86.9	30.2
		ZT5	222.6	366.7	501.9	532.4	496.4	400.9	294.4	253.3	112.7	0.0
		423.1	696.9	953.7	1011.6	943.4	761.9	559.4	481.3	214.2	57.4	

ZT1 : Fan, ZT2 : Fog Fan + , ZT3 : Pad Fan,
 ZT4 : + , ZT5 : + sprinkling

2T1 가 12 14
 . 가 6 16 14 1,147 $\mu\text{mol m}^{-2} \text{s}^{-1}$
 . 가 6 16 2T1 14
 813 $\mu\text{mol m}^{-2} \text{s}^{-1}$, 2T3
 . 6 가 .
 가 2T4 12 14 6
 12 116 $\mu\text{mol m}^{-2} \text{s}^{-1}$, 7 314 $\mu\text{mol m}^{-2} \text{s}^{-1}$, 8 372 $\mu\text{mol m}^{-2}$
 s-1 .

9) 9 18

2-11. simulation

(:)

z		9	10	11	12	13	14	15	16	17	18	
6	15	2T1	25.7	32.5	34.7	33.8	34.4	32.9	32.7	31.5	28.3	25.6
		2T2	24.8	30.3	30.7	29.7	30.2	29.1	29.1	28.5	27.5	25.2
		2T3	27.3	38.0	38.5	35.8	36.6	33.6	33.8	32.8	30.2	26.2
		2T4	24.1	29.3	30.8	30.8	31.7	30.0	29.6	29.0	26.7	24.7
		2T5	24.6	29.5	30.6	29.7	30.2	28.8	28.6	28.3	27.2	25.7
7	14	2T1	22.5	22.5	24.2	29.8	29.9	30.9	30.0	28.6	29.1	29.7
		2T2	22.4	22.3	23.4	26.2	26.3	27.3	26.9	26.2	28.4	29.3
		2T3	23.6	23.6	25.5	33.2	33.8	35.7	33.4	31.1	34.1	34.6
		2T4	22.3	22.2	23.5	27.6	27.9	28.8	28.2	26.8	28.7	32.0
		2T5	22.2	22.1	23.2	26.3	26.8	27.4	26.7	25.7	27.7	28.7
8	23	2T1	27.4	28.2	26.2	25.9	23.9	25.4	25.6	24.2	23.2	22.6
		2T2	26.0	26.4	24.5	23.9	22.6	23.6	24.0	23.0	23.0	22.5
		2T3	31.2	31.9	27.8	26.9	23.9	28.1	29.5	26.4	24.3	23.1
		2T4	25.9	26.5	25.3	24.9	23.5	24.9	25.7	24.2	23.1	22.5
		2T5	26.0	26.6	25.2	24.1	22.8	23.9	24.2	23.2	22.8	22.4
9	13	2T1	24.4	25.8	24.2	22.5	29.2	30.9	31.9	29.0	26.6	24.6
		2T2	23.8	24.7	23.4	21.5	25.7	27.2	28.1	26.8	26.0	24.4
		2T3	26.8	28.8	26.3	22.9	30.8	31.7	33.6	29.8	27.3	24.6
		2T4	23.6	24.4	23.4	21.9	26.7	29.2	30.6	28.4	26.0	24.3
		2T5	23.3	24.2	23.1	21.4	26.2	29.1	30.3	28.4	26.1	24.4

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

13 14 .

가 2T2 가 2T3 가 .

7 14 2T3 14 36 .

가 2T2 8 23 13 .
 10 13, 14
 2T3 8, 9 31 2T1

10) 9 18

2-12. simulation (: $\mu\text{mol m}^{-2}\text{s}^{-1}$)

z	9	10	11	12	13	14	15	16	17	18	
6 15	2T1	214.7	567.3	588.5	603.6	480.9	327.4	311.6	223.8	81.1	35.0
	2T2	145.4	384.3	398.7	408.9	325.8	221.8	211.0	151.6	54.9	23.7
	2T3	210.9	557.4	578.3	593.0	472.5	321.7	306.1	219.9	79.9	34.4
	2T4	121.4	321.0	333.1	341.5	272.2	185.3	176.3	126.7	45.8	19.5
	2T5	152.7	416.7	432.3	443.3	353.3	240.5	228.8	164.4	59.5	25.7
		299.7	791.9	821.5	842.5	671.4	457.1	434.9	312.5	113.2	48.9
7 14	2T1	59.1	60.6	149.8	419.5	354.6	427.5	298.5	211.6	221.4	134.8
	2T2	40.6	41.0	101.5	284.2	240.2	289.6	202.2	143.3	149.9	91.3
	2T3	58.9	59.5	147.2	412.2	348.4	420.1	293.3	207.9	217.0	132.5
	2T4	33.9	34.3	84.8	237.4	200.7	241.9	168.9	119.7	125.3	76.3
	2T5	44.0	44.5	110.1	308.2	260.5	314.0	219.2	155.4	162.6	99.0
		83.6	84.6	209.2	585.6	495.0	596.8	416.6	295.4	309.0	188.2
8 23	2T1	217.4	177.5	127.5	102.9	51.9	218.9	221.0	107.8	58.9	29.4
	2T2	147.3	120.2	86.4	69.7	35.1	148.9	149.7	73.0	39.9	19.9
	2T3	213.6	174.4	125.3	101.1	50.9	215.4	217.2	105.9	57.9	28.9
	2T4	123.0	100.4	72.2	58.2	29.3	124.4	125.1	61.0	33.3	16.7
	2T5	159.7	130.4	93.6	75.6	38.1	161.5	162.3	79.2	43.3	21.6
		303.4	247.7	178.0	143.6	72.4	306.9	308.5	150.5	82.3	41.1

	2T1	158.7	202.7	96.8	100.4	377.2	370.6	356.9	158.6	75.7	35.4	
	2T2	107.5	137.3	65.6	67.9	255.5	251.0	241.8	107.4	51.3	24.0	
9	13	2T3	155.9	199.2	95.2	98.6	370.6	364.1	350.7	155.8	74.4	34.8
	2T4	89.8	114.7	54.8	56.8	213.5	209.7	202.0	89.7	42.8	20.0	
	2T5	116.6	148.9	71.1	73.7	277.1	272.2	262.2	116.5	55.6	26.0	
		221.6	283.0	135.2	140.1	526.5	517.3	498.3	221.4	105.7	49.5	

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
2T4 : + , 2T5 : + sprinkling

80% . 가 12

, 가 2T1 2T3 . 가

6 15 2T1 13 603 μmol m⁻²s⁻¹ 가 8 23 2T4

(2-12).

11)

가 가 6 13

2T1 71.6% .

+ Fog Fan 48.5% . 2T3

가 70 71% .

() 2T4 40.5% .

2T5 가 52%

.

, 2T2, 2T4, 2T5

2T5 가 (2-13).

2-13. simulation

(: 6 13 , 9 5)

z ()	($\mu\text{mol m}^{-2}\text{s}^{-1}$)		(%)
2T1	713.0	960.2	71.6
2T2	485.4	857.5	48.5
2T3	627.9	884.8	70.3
"	634.4	892.6	71.1
2T4	417.1	810.3	40.5
2T5	471.5	837.8	52.6
"	485.8	824.2	52.4

2T1 : Fan, 2T2 : Fog Fan + ,
 2T3 : Pad Fan, 2T4 : + ,
 2T5 : + sprinkling

12)

(1)

6/5

8/29

2T1 2T3

가

2T5

2T2, 2T4

3

가

)

(3

).

2-14.

(: 8 29)

z	($\frac{1}{1}$ mol m ² s ⁻¹)	(mol m ² s ⁻¹)	CO2 (ng/L)	(cm s ⁻¹)	(μ g cm ⁻² s ⁻¹)
2T1	32. 86a	2. 63c	331. 1a	6. 43c	0. 023d
2T2	16. 01c	2. 27c	318. 6b	5. 55c	0. 023d
2T3	32. 13a	4. 36b	317. 9b	10. 70b	0. 032c
2T4	18. 35c	4. 28b	320. 2b	10. 52b	0. 033b
2T5	27. 25b	5. 97a	314. 9b	17. 48a	0. 037a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + sprinkling, 2T5 :

2T2, 2T4 2T5

3

2T5 가 2T2 가 . CO2
 2T1 가 2T4 2T5 가 .
 2T2가 가 2T1 2T5가 가 .
 2T5가 가 2T1 2T2가 가 (2-14).

(2) ()

2-15. ()

(: 8 29)

z	($\mu\text{mol m}^{-2} \text{s}^{-1}$)	($\text{mol m}^{-2} \text{s}^{-1}$)	CO2 (ng/L)	(cm s^{-1})	($\mu\text{g cm}^{-2} \text{s}^{-1}$)
2T1	35.47a	2.01b	306.5c	4.92b	0.02c
2T2	26.00b	2.85a	314.2ab	6.95a	0.02c
2T3	31.71a	2.85a	317.6a	7.02a	0.02b
2T4	18.07c	2.55a	316.6ab	6.26a	0.02b
2T5	23.53b	2.82a	313.5b	7.00a	0.03a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + sprinkling, 2T5 :

가

가

. 2T1

가 2T3 . 가

2T4 . 2T2 2T5

가

가

2T1

가 . CO2 2T1 가

. 2T2가 가 2T5가 가 . 2T5가

가 2T4, 2T3 .

(3)

2-16.

(: 9 18)

z	($\mu\text{mol m}^{-2} \text{s}^{-1}$)	($\text{mol m}^{-2} \text{s}^{-1}$)	CO2 (mg/L)	(cm s^{-1})	($\mu\text{g cm}^{-2} \text{s}^{-1}$)
2T1	12.35ay	0.36bc	294.9c	1.29b	0.01c
2T2	7.65b	0.26c	242.9d	4.97a	0.00d
2T3	8.98b	0.41bc	302.9bc	1.12b	0.01b
2T4	12.24a	0.62a	308.6ab	1.54b	0.01a
2T5	9.13b	0.54ab	317.1a	1.33b	0.01b

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + sprinkling y 5%

2T1 2T4가 가 가 .
2T2, 2T3, 2T5 가 . 2T4
가 . CO2 2T5 .
2T2 가 2T3 2T4 가 .

(4)

2-17.

(: 8 31)

z	($\mu\text{mol m}^{-2} \text{s}^{-1}$)	($\text{mol m}^{-2} \text{s}^{-1}$)	CO2 (mg/L)	(cm s^{-1})	($\mu\text{g cm}^{-2} \text{s}^{-1}$)
2T1	2.45by	1.04c	318.0a	2.63c	0.025b
2T2	3.63b	2.15b	322.9a	5.30b	0.027b
2T3	2.78b	2.75a	317.3a	6.88a	0.035a
2T4	5.15a	0.31d	308.4b	0.77d	0.006c
2T5	2.92b	0.30d	308.2b	0.76d	0.005c

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + sprinkling y 5%

2T4 가
 가 . 2T2 .
 . 2T3 가 2T4 2T5 가 .
 CO2 2T1, 2T2, 2T3 2T4, 2T5 300mg/L
 . 2T3 가 2T4, 2T5
 . 2T3 가 . 2T3
 가 가 .

(5)

2T1 가 2T2, 2T3 .
 2T4 가 . 가
 . 2T1 2T2, 2T3
 . 가 (2T4) 가
 가
 CO2 2T4가 가 2T1, 2T5가 가 .
 2T4가 가 2T1 2T5가 가 . , 2T1, 2T5
 가 3 .

2- 18.

(: 8 31)

z	CO2				
	($\mu\text{mol m}^{-2} \text{s}^{-1}$)	($\text{mol m}^{-2} \text{s}^{-1}$)	(mg/L)	(cm s^{-1})	($\mu\text{g cm}^{-2} \text{s}^{-1}$)
2T1	12. 51ay	1. 16c	311. 0c	2. 91c	0. 022b
2T2	6. 06bc	2. 63b	320. 9b	6. 56b	0. 032a
2T3	7. 53b	2. 44b	316. 8b	6. 12b	0. 032a
2T4	3. 15d	3. 11a	327. 6a	7. 75a	0. 033a
2T5	5. 61c	0. 46d	306. 7c	1. 15d	0. 011c

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : 5% + , 2T5 : + sprinkling
 y

(6)

2- 19.

(: 8 29)

z	CO2				
	($\mu\text{mol m}^{-2} \text{s}^{-1}$)	($\text{mol m}^{-2} \text{s}^{-1}$)	($\text{mg} \cdot \text{L}^{-1}$)	(cm s^{-1})	($\mu\text{g cm}^{-2} \text{s}^{-1}$)
2T1	28. 89by	4. 61c	316. 4c	11. 32c	0. 03b
2T2	22. 93c	5. 76bc	320. 7b	14. 08bc	0. 03b
2T3	35. 84a	8. 26b	319. 3b	20. 42b	0. 04b
2T4	8. 82d	4. 19c	328. 4a	10. 30c	0. 03b
2T5	25. 04bc	12. 60a	327. 6a	31. 21a	0. 23a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : 5% + , 2T5 : + sprinkling
 y

2T3 가 , 2T1 2T5 , 2T4 가
 . 가
 가 .
 2T3 1/4 , 2T5 가
 . CO2 320mg · L-1 .
 2T5가 가 .

13)

(1)

2-20.

z	(cm)				(cm)							
	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15
2T1	30.5b	46.3ab	68.0b	36.5a	23.5b	34.66b	44.9ab	22.00a	3.00b	3.50b	5.25a	2.00a
2T2	40.6ab	55.0ab	85.8ab	30.0a	35.1a	33.75b	42.5ab	26.50a	3.41b	3.66b	3.58ab	1.00a
2T3	49.0a	66.4a	104.0a	26.5a	40.4a	50.66a	58.2a	29.50a	5.58a	6.33a	4.08ab	1.00a
2T4	41.4ab	49.9ab	68.6b	23.5a	30.7ab	29.08b	32.3b	19.50a	3.25b	3.00b	3.00b	1.50a
2T5	37.3b	41.3b	66.0b	35.5a	30.3ab	29.91b	45.2ab	23.00a	2.58b	2.66b	3.83ab	1.50a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

6/5 40 7 15 2T3 가 , 8
 9 2T3 가 . pad fan
 . 10 15

2T2가 .

2-21.

(10 15)

z			(g)			(g)		
	(g)	(cm)						
2T1	7.90ay	13.00ab	17.15a	14.70a	2.45ab	5.67a	4.87a	0.80a
2T2	4.81ab	17.50a	10.47ab	8.07ab	2.40ab	3.70ab	2.55ab	0.55b
2T3	6.70ab	12.00ab	13.35ab	10.60ab	2.75a	4.15ab	3.65a	0.50b
2T4	1.71b	9.00b	4.36b	3.29b	1.06b	0.95b	0.75b	0.20c
2T5	4.20ab	11.50ab	12.15ab	9.20ab	2.95a	3.30ab	2.65ab	0.65ab

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : y 5% + , 2T5 : + sprinkling

2T1 2T3 가 .
3
가 . 2T4

2T4 가 가 2T1 1/4 .
2T3 2T2, 2T5 가 .
가 . 2T1 가
2T3, 2T2, 2T5 . 가 2T1
가 2T4 4.5 가 . 2T3 2T5가 가
2T4가 가 3 .
2T1 가 2T4 가

6 .

2T1 가 2T3 가 2T2 2T5 2T4 6.5 , 4 가
 가 ,
 ()가

2-22. ()

z	y	(cm)	(cm)	(cm)	(cm)
2T1	42.4bx	5.4a	1.9a	3.6b	0.18a 34.30b
2T2	63.4a	2.3b	2.6a	5.3a	0.25a 60.00a
2T3	55.6ab	6.1a	2.6a	4.8ab	0.27a 52.47a
2T4	45.0b	1.6b	2.2a	4.1ab	0.16a 46.46ab
2T5	51.8ab	2.0b	2.8a	5.0ab	0.38a 52.38a

2T1 : Fan, 2T2 : Fog Fan +
 2T3 : Pad Fan, 2T4 : +
 2T5 : + sprinkling
 $\frac{y}{x} = 1$
 5%

2T1 가 2T2 가
 2T3 2T1 가 , 2T4
 가 . 가 (李,
 1995) 2T3 2T4

3.8

2T1 2T2 2T5
 가 , 가
 2T2가 , 2T2, 2T3, 2T5
 2T3 가

(2) (:)

2-23. ()

Z	(cm)				(cm)			
	7/15	8/1	9/15	10/15	7/15	8/15	9/15	10/15
2T1	46.90a	82.60a	79.75b	88.00a	16.20b	33.10b	33.25a	32.00ab
2T2	47.10a	71.80b	80.10b	85.00a	18.00b	42.00a	30.90a	32.00a
2T3	37.40b	75.60ab	74.80b	79.50a	16.10b	28.80b	25.80b	31.00ab
2T4	55.40a	88.60a	82.20ab	96.00a	21.40a	28.00b	25.20b	27.50b
2T5	54.30a	86.40a	92.40a	87.50a	21.60a	28.10b	31.40a	31.50ab

2T1 : Fan, 2T2 : Fog Fan + ,
 2T3 : Pad Fan, 2T4 : + ,
 2T5 : + sprinkling

가
 . 7 15 2T3 가 , 2T4가 가 .
 ()
 . 7 15 2T4, 2T5 가
 2T2 (2-23).

2-24. (:) (10
 15)

Z	(g)				(g)			
	(g)	(cm)	(g)	(g)	(g)	(g)	(g)	(g)
2T1	73.70a	14.50b	309.70a	116.25a	193.45a	97.26a	22.05a	75.21a
2T2	59.10a	25.50ab	252.10ab	93.85a	158.25ab	68.16ab	15.16b	53.00ab
2T3	50.90a	23.00ab	227.55b	86.15b	141.40bc	67.98ab	17.16ab	50.82ab
2T4	60.45a	31.00a	209.40b	107.00a	102.40c	47.01b	15.51b	31.49b
2T5	68.90a	20.00ab	281.75ab	109.45a	172.30ab	74.33ab	18.55ab	52.78ab

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

2T1 2T4

2T1 가 2T5

2T2 가 2T3 2T4

2T3 가

2T4가 가 2T1 가

2T4가 가

가 2T1 가

2T4 가

2-25.

(:) 가

Z	(cm)	(cm)	
2T1	6.8a	21.9a	7.0a
2T2	6.7a	19.5b	8.0a
2T3	6.8a	21.2a	6.0a
2T4	5.9a	18.5b	5.0a
2T5	6.0a	19.4b	7.5a

2T1 : Fan,
 2T2 : Fog Fan + ,
 2T3 : Pad Fan,
 2T4 : + ,
 2T5 : + sprinkling

가 (全)

가 2T4 2T5가 가 2T1

2T3 가 2T2, 2T4, 2T5

2T5가 가 2T2가 가

2-26.

(:)

	z					y				
	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
2T1	31.00a	12.57ab	19.14b	72.28b	2.85b	0.54a	83.00bc	31.71ab	4.28b	0.99a
2T2	27.28bc	13.14a	20.92a	74.28ab	3.28ab	0.55a	86.85abc	32.28ab	5.14a	0.98a
2T3	29.42b	11.85b	17.35c	68.14b	3.57ab	0.51a	78.85c	28.57b	4.17b	1.04a
2T4	28.00bc	12.85ab	19.14b	82.14a	2.85b	0.55a	91.85ab	31.00ab	4.81a	0.87a
2T5	27.85bc	12.42ab	20.57ab	83.42a	3.85a	0.55a	97.28a	35.71a	5.10a	0.99a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + ,
 2T5 : + sprinkling
 y

2T1 가 가 . 2T3
 가 . 2T4 2T5 가 2T1, 2T3 .
 2T5 가 2T2, 2T3 가 . 2T1 2T4 가
 . 가
 .
 2T3 가 2T5가 가 . 2T3
 2T1 가 가 .
 . 2T5
 2T2 .

2-27.

(:)

z	(cm)			(cm)		
	7/15	8/15	9/15	7/15	8/15	9/15
2T1	17.64c	33.86bc	28.28b	9.35b	15.57b	13.14b
2T2	21.14b	41.57ab	41.00a	12.14a	14.42a	18.28a
2T3	14.92c	25.57c	26.85b	7.28c	12.28b	13.00b
2T4	24.71a	42.28ab	42.28a	12.28a	18.28ab	17.50ab
2T5	25.57a	45.14a	47.85a	13.42a	14.28ab	17.00ab

2T1 : Fan, 2T2 : Fog Fan + ,
 2T3 : Pad Fan, 2T4 : + ,
 2T5 : + sprinkling

2T3

2T1 9 15 2T1, 2T3

2T2, 2T5, 2T4 1.5 가

2T1 2T3 가 7

9 2T2, 2T5, 2T4

2-28.

(:)

z	(cm)			(cm)			(cm) ^y			
	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	
2T1	16.71a	7.00a	10.78a	32.71a	1.71a	0.40a	36.14a	15.00a	4.88a	0.58b
2T2	13.42b	5.78a	9.28ab	29.14a	1.00ab	0.30ab	34.14a	13.42a	4.34ab	0.66ab
2T3	13.14b	1.14b	2.00b	4.71b	0.14b	0.07b	5.57b	2.14b	0.97b	1.61ab
2T4	11.57b	3.57ab	6.42ab	17.00ab	0.42b	0.17ab	20.57ab	8.28ab	3.34ab	0.63ab
2T5	10.57b	6.02a	9.71a	31.57a	1.00ab	0.32a	35.14a	12.85a	5.04a	0.68a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

2T5 가 2T2, 2T3, 2T4
 가 . 2T1 가 가 2T5 6
 . 2T1 가 2T2 2T5 가 2T3
 가 . 2T3 가 2T1 가 . , ,
 , , , ,
 .
 가 . 2T1,
 2T2, 2T5 .

(3)

2T5 가 , 2T2 7 15 10 15
 . 2T4 가 2T3 2T1
 가 .
 2T3 . 가
 . 2T2 2T5 .

2- 29.

z	(cm)				(cm)							
	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15
2T1	74.40bc	78.80bc	73.40b	68.50b	97.80a	106.20a	106.60a	89.50a	6.00a	6.80a	6.80ab	7.00a
2T2	79.20ab	92.00a	86.20a	81.00a	91.00a	99.00a	105.40a	128.50a	5.60a	5.60a	5.20ab	7.00a
2T3	73.20bc	79.40b	68.40b	69.00ab	96.20a	104.80a	85.20b	108.50a	5.40a	5.80a	4.20b	6.50a
2T4	69.60c	73.00c	75.40b	73.50ab	93.00a	103.20a	115.40a	104.00a	7.60a	8.00a	7.40a	7.50a
2T5	82.20a	86.80a	85.10a	78.00ab	100.80a	105.60a	99.40ab	122.00a	5.80a	6.20a	5.60ab	6.00a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

2- 30.

(10 15)

z	(g)				(g)			
	(cm)							
2T1	19.00a	1088.00a	308.15b	779.90a	164.25a	67.15a	97.10a	
2T2	21.50a	924.20a	377.85ab	546.40b	135.94a	71.20a	64.75a	
2T3	18.00a	833.50a	295.65b	537.90b	118.60a	60.25a	58.35a	
2T4	21.50a	1101.00a	568.40a	536.60b	178.00a	99.01a	78.98a	
2T5	19.00a	1006.70a	411.50ab	595.25b	158.22a	84.22a	74.00a	

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

2T2 2T4 .

가

2T4 .

2T4가 가 .

가

가

2T1 가

가

가

가

(4)

2-31.

z	(cm)				(cm)							
	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15
2T1	28.00a	28.50a	27.43a	24.75a	27.12c	32.12a	30.37b	25.25b	6.75a	7.25a	7.37b	9.00a
2T2	18.12c	17.12c	17.87b	20.50a	35.37a	35.37a	37.62a	37.50ab	7.25a	8.25a	9.00a	9.00a
2T3	23.25b	26.62ab	27.87a	25.00a	28.37bc	34.25a	29.50b	33.50ab	6.87a	7.37a	8.12ab	9.00a
2T4	19.93bc	23.50b	22.56ab	24.00a	32.25ab	32.75a	35.93a	42.00a	7.37a	8.12a	9.37a	9.50a
2T5	21.75bc	24.62ab	25.75a	20.75a	32.37ab	33.12a	38.00a	39.00ab	7.37a	7.12a	8.00a	8.00a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

7 15

2T1 가

2T2가 가

10 15

가

2T1 가

2T2가 가

2T1

가

8 9

2T2 2T4

2T1, 2T3, 2T5

50%

(2-31).

2-32.

(10/15)

z	(g)				(g)		
	(cm)						
2T1	16.00c	174.20ab	47.75b	126.45a	12.29a	3.38a	8.91a
2T2	20.50bc	196.50ab	58.75ab	137.75a	16.61a	6.16a	10.45a
2T3	28.50a	209.05a	62.15ab	146.90a	18.14a	7.89a	10.25a
2T4	26.50ab	199.50ab	71.05a	128.45a	16.29a	7.64a	8.65a
2T5	17.50c	138.85b	48.30ab	90.55a	14.95a	6.02a	8.93a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + , 2T5 : + sprinkling

2T3, 2T4 가 2T1, 2T5 가 . 2T3 가 2T1, 2T2, 2T4 가 . 2T5 가 . 2T4가 가 2T1 가 . 2T5가 가 . 2T3 2T2가 .

(5)

2-33.

z	(cm)				(cm)			
	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15
2T1	29.80ab	36.30b	51.30a	48.50a	38.00a	50.00a	55.80a	52.00ab
2T2	26.50b	28.50c	34.80c	39.00a	33.60ab	37.50b	48.60ab	68.00a
2T3	31.30a	40.00a	44.70b	52.50a	32.10b	42.00b	50.50a	61.00ab
2T4	27.70b	36.40b	38.75c	45.00a	34.90ab	38.30b	42.26b	43.00b
2T5	29.40ab	34.50b	45.80b	42.00a	34.60ab	41.30b	55.60a	63.00ab

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan, 2T4 : + , 2T5 : + sprinkling

7 15 10 15 2T3 가
 2T3 2T1
 2T2 2T4가 (10/15) 가
 2T4가
 가 가 2T1 2T3

2-34. (10 15)

z			(g)		(g)			
	(g)	(cm)						
2T1	100.80a	33.50a	190.10a	146.50ab	43.60a	44.49a	35.80a	8.69a
2T2	66.40b	30.00a	130.45b	96.90c	33.55ab	29.84b	22.88b	6.96a
2T3	104.95a	29.50a	197.40a	154.85a	42.55ab	44.56a	36.43a	8.13a
2T4	37.73c	22.00a	66.54c	51.88d	14.66c	15.25c	12.16c	3.08b
2T5	83.50ab	35.50a	144.35b	117.55bc	26.80bc	34.28ab	27.88ab	5.40ab

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + 2T5 : + sprinkling

2T1 2T3 가 2T3 가 2T2 2T5
 가 2T1 2T3 가
 가
 가 2T4 가 가
 가
 가
 2T1 2T3
 2T4 가
 2T1 2T3 2T4

3 가 . 2-18

가

가 2T4(40%) 가 . 가 2T1, 2T3

(6)

2-35.

z	(cm)				(cm)				(cm)			
	7/15	8/15	9/1	10/15	7/15	8/15	9/15	10/15	7/15	8/15	9/15	10/15
2T1	46.90a	82.60a	79.75b	96.00a	16.20b	33.10b	33.25a	127.50a	8.40ab	8.40ab	9.40ab	15.00a
2T2	47.10a	71.80b	80.10b	104.50a	18.00b	42.00a	30.90a	105.00a	5.00b	5.20b	5.20b	8.50a
2T3	37.40b	75.60ab	74.80b	112.50a	16.10b	28.80b	25.80b	113.00a	12.40a	12.40a	13.40a	14.50a
2T4	55.40a	88.60a	82.20ab	108.00a	21.40a	28.00b	25.20b	108.00a	12.80a	13.00a	13.20a	6.00a
2T5	54.30a	86.40a	92.40a	112.50a	21.60a	28.10b	31.40a	112.50a	5.00b	8.20b	9.20ab	10.00a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

7 15 2T3 가
 10 15 가 . 가
 9 15 2T2가 10 15 가 . 7/15
 2T5 2T3, 2T4 .

Z (cm)	(g)				(g)		
	2T1	41. 7a	2128. 3a	1458. 7a	669. 5a	541. 8a	331. 3a	210. 5a
2T2	42. 0a	1378. 0a	989. 3a	388. 6a	265. 3a	164. 7a	100. 6a
2T3	36. 0a	2327. 0a	1752. 3a	578. 6a	641. 5a	426. 6a	214. 8a
2T4	32. 0a	905. 5a	689. 3a	216. 1a	155. 9a	98. 6a	57. 3a
2T5	35. 0a	1810. 3a	1273. 6a	536. 7a	532. 6a	368. 8a	163. 9a

2T1 : Fan, 2T2 : Fog Fan + , 2T3 : Pad Fan,
 2T4 : + , 2T5 : + sprinkling

가 . 2T2, 2T1
 2T4 . 2T4가 가 2T3
 . 가 .
 가 2T4 가 2T3 2.5 가 2T1 2.1
 . 2T1 2T3 ,
 . 2T3 가 2T4가 가
 가 4 .
 가 . 2T3, 2T1
 , 2T2, 2T4 .

2 .
 1. , ,
 1) 6 13 가 가 2T2(+
) 2T4(+
) 2T5() . 2T1() 2T3(

) 가 6 ,
 8 , 5 7 . 6 , , 2T4(
)가 가 2T1 가 . 2T3 가
 2T1()
 .
 2) 7 6 2T2 2T4 가 2T3 가
 2T1 . 2T2 가 7
 0.2 . 가
 .
 3) 6, 7, 8 8 가 40 .
 6, 7 2T3 가 .
 4) 9 , 가 가
 2T3 42.8 . 13 2T4가 가
 2T2 . 가
 2T4가 가 .

2.
 2T1 2T3 가 . 2T3
 0.8% . 2T5 0.6%
 가 . 2T2 48.5%, 2T5 52.6% .

3. 6, 7, 8 14
 1 14 6, 7, 8 8 가 . 14
 2T2가 가 . 가 2T3 2T1 .

4. (2T1 2T3)

2T1

가 1 1 . 2T3
2 , 2 , 1 .
1 .

5.

13 14 2T3 49

. 2T2 가 34

2T1 가 12 14 .

6 가 . 13 2T4가 가 6 16

304 $\mu\text{mol m}^{-2}\text{s}^{-1}$ 가 .

6.

13 14 가 가 , 2T2가 가

2T3 가 . 8 9 30

가 .

80% 6 15 13

2T4 272 $\mu\text{mol m}^{-2}\text{s}^{-1}$ 가 (2T1: 480 $\mu\text{mol m}^{-2}\text{s}^{-1}$) .

8 23 13 35 $\mu\text{mol m}^{-2}\text{s}^{-1}$.

7.

1) 2T1 가 2T3 .

2T5 2T2 2T4 .

2) 2T1 2T3 가 2T2 2T5

- 3) 2T1 2T4 가 . 2T2, 2T3, 2T5
- 4) 2T4 가 가 . 2T3 가 .
- 5) 2T1 가 2T3, 2T2가
- 6) 2T3 가 2T1 .

8.

- 1) 2T3 가 2T2 . 2T1 2T3 가 2T5 . 2T4 가 . 2T3 가 2T1
- 2) 2T5 가 2T3 2T1 . 2T1 가 , 2T5, 2T2, 2T3 2T4가 가 가 2T1, 2T3 2T2, 2T4, 2T5 . 2T5 가 . 2T2 .
- 3) 2T2 2T5 2T4, 2T5, 2T2 .
- 4) () 2T2 2T4 . 2T1, 2T3, 2T5 . 2T3 , 2T4 .
- 5) 2T1 2T3 가 2T4 가

6) 2T5 2T3, 2T4
2T3, 2T1 2T2, 2T4

3. (3)

11

가 .

가

가

(

),

(), 가 .

가 가

가 ,

(6 7)

가 , 가

3 95 96

1) 6 , ,

(1) 13

3-4. (simulation) 6

z		13 ()							
						(A)		(B)	(A-B)w
		%							
6/1 10	3T1	15.9	35.6	32.5(4.5)x	71(-4.0)y	19.1	23.3	-4.2	
	3T2	15.6	32.0	30.2(2.2)	67(-8.0)	19.9	23.3	-3.4	
	3T3	16.0	31.8	30.0(2.0)	75(0.0)	20.8	23.7	-2.9	
	3T4	15.6	34.7	31.8(3.8)	65(-10.0)	21.8	23.5	-1.7	
	3T5	14.8	32.3	29.4(1.4)	66(-9.0)	20.9	23.4	-2.5	
		13.3	34.6	28.0(0.0)	75(0.0)	0.0	0.0	0.0	
6/11 20	3T1	18.1	42.6	39.0(5.2)	66(6.0)	21.1	24.7	-3.6	
	3T2	18.0	37.9	34.5(0.7)	62(2.0)	23.1	24.9	-1.8	
	3T3	17.3	38.0	34.4(0.6)	71(11.0)	22.6	25.1	-2.5	
	3T4	17.9	37.9	35.8(2.0)	62(2.0)	24.6	24.8	-0.2	
	3T5	18.9	36.4	33.7(-0.1)	63(3.0)	23.9	24.7	-0.8	
		18.5	35.5	33.8(0.0)	60(0.0)	0.0	0.0	0.0	
6/21 30	3T1	19.0	36.8	35.9(4.9)	78(13.0)	22.7	25.5	-2.8	
	3T2	20.8	33.4	31.9(0.9)	72(7.0)	23.4	25.6	-2.2	
	3T3	19.9	33.4	31.9(0.9)	75(10.0)	23.6	25.5	-1.9	
	3T4	19.4	34.3	32.2(1.2)	77(12.0)	23.3	25.9	-2.6	
	3T5	19.9	32.4	32.1(1.1)	77(12.0)	23.8	25.5	-1.7	
		19.6	32.1	31.0(0.0)	65(0.0)	0.0	0.0	0.0	

3-2
 x (-)
 y (-)
 w (-)
 *6

13 39 .

6 13 3T5가 가 .

7 8 . +

()+ .

가

96

. 3T3 + +

. 3T2
 + +
 . 3T3 3T2 2 . 3T4
 + + ()
 . 5 가
 3T1 + + .
 . 4.5
 .
 가
 가 . 95, 96
 . 가 .
 가
 . 97 3T2, 3T3, 3T5 3T1,
 3T4 . 6 ,
 , .
 (2) , 13
 96 .
 6 3T2, 3T3, 3T5 . 3T1 가
 3T4 , 3 .
 13 .
 13 16 , 17 19
 , 20 . 13 가

3T1 가 . (16)
4.2 가 19
21 , 22 24 . 19
가 가

(3) 13
6 . 가
(75%) 3T3 pad .
5.6m 가
30 60m 가 가 30m
가 2.25m
3 simulation
가
3T2 3T4 . 3T2 10
 μ 가
0.3m/s
가
가

2) 7 , ,

3-5. (simulation) 7

		13 ()								
z								(A)	(B)	(A-B)w
7/1 10	3T1	24.4	42.3	30.3(4.2)x	86(0.0)y	23.0	22.9	0.1		
	3T2	24.6	40.9	28.4(2.3)	86(0.0)	23.2	22.7	0.5		
	3T3	22.6	40.5	28.6(2.5)	88(2.0)	23.1	22.6	0.5		
	3T4	21.4	41.5	28.8(2.7)	85(-1.0)	23.1	22.9	0.2		
	3T5	22.6	40.4	28.3(2.2)	85(-1.0)	23.5	23.0	0.5		
		14.0	37.1	26.1(0.0)	86(0.0)	0.0	0.0	0.0		
7/11 20	3T1	23.4	44.2	34.8(5.0)	77(-2.0)	23.4	25.8	-2.4		
	3T2	23.9	38.7	31.6(1.8)	82(3.0)	24.4	26.3	-1.9		
	3T3	22.6	41.3	31.9(2.1)	84(5.0)	24.0	26.1	-2.1		
	3T4	21.1	39.0	33.4(3.6)	78(-1.0)	24.6	26.1	-1.5		
	3T5	22.2	40.1	31.6(1.8)	80(1.0)	24.1	26.1	-2.0		
		18.2	36.7	29.8(0.0)	79(0.0)	0.0	0.0	0.0		
7/21 31	3T1	24.6	41.9	37.7(3.6)	82(13.0)	24.6	27.0	-2.4		
	3T2	23.6	39.5	34.5(0.4)	89(20.0)	26.5	26.9	-0.4		
	3T3	24.7	40.0	35.0(0.9)	83(14.0)	26.4	26.7	-0.3		
	3T4	20.3	38.8	35.5(1.4)	78(9.0)	26.4	26.7	-0.3		
	3T5	21.7	38.3	34.9(0.8)	79(10.0)	26.1	26.8	-0.7		
		21.2	35.6	34.1(0.0)	69(0.0)	0.0	0.0	0.0		

3-2
 x (-)
 y (-)
 w (-)

(1) 13

13 가 가
 6 가 3T5 . 3T2, 3T3, 3T4 3T1 가
 0.4 4.2

10.6 , 6.8
가 가 . 가

(2) , 13
7 37 가
2 7.5
가 . 13 가 3T5
가 3T3 3T2 3T1 가 7
44 . 0.5
10.6 가 . 21 24 , 21 23 , 21
24 , 3T3, 3T4, 3T5 . 13

3T1 가
가 , 가
가 .

(3) 13
7 가 86%
86% . 3T1 3T4

3) 8 , ,

(1) 13
8 6, 7 . 3T2, 3T3, 3T5

가 3T1 3T4 . 3T1 8
 가 6,7 2.8 .
 3T2, 3T3, 3T5 가 33
 0.3 . 0.5 0.9
 . 3T5 3T3 2 3T5 가
 . 3T2 8 3T3 .

3-6. (simulation) 8

		1 ()							
z									
					(A)			(B) (A-B)w	
		%							
8/1 10	3T1	24.8	40.5	35.4(2.8)X	89(17.0)y	27.3	28.8	-1.5	
	3T2	24.8	35.6	33.1(0.5)	83(11.0)	26.5	28.6	-2.1	
	3T3	24.3	33.1	33.4(0.8)	84(12.0)	26.9	28.7	-1.8	
	3T4	23.5	37.9	34.1(1.5)	78(6.0)	27.3	28.5	-1.2	
	3T5	23.3	37.0	33.4(0.8)	80(8.0)	27.1	28.7	-1.6	
		21.8	35.1	32.6(0.0)	72(0.0)	0.0	0.0	0.0	
8/11 20	3T1	23.4	41.2	37.6(5.3)	89(-1.0)	27.1	28.6	-1.5	
	3T2	22.3	37.2	33.8(1.5)	81(-9.0)	26.9	28.2	-1.3	
	3T3	21.1	38.9	35.2(2.9)	80(-10.0)	26.8	28.6	-1.8	
	3T4	20.7	38.3	34.7(2.4)	76(-14.0)	27.0	28.4	-1.4	
	3T5	21.6	36.9	34.3(2.0)	76(-14.0)	26.8	28.6	-1.8	
		20.0	35.4	32.3(0.0)	90(0.0)	0.0	0.0	0.0	
8/21 31	3T1	22.2	37.9	36.4(5.5)	72(-4.0)	-	-	-	
	3T2	23.1	35.9	34.0(3.1)	70(-6.0)	-	-	-	
	3T3	23.2	36.7	35.3(4.4)	75(-1.0)	-	-	-	
	3T4	22.1	35.7	33.9(3.0)	71(-5.0)	-	-	-	
	3T5	22.4	35.8	33.4(2.5)	66(-10.0)	-	-	-	
		21.0	33.0	30.9(0.0)	76(0.0)	-	-	-	

3-2
 x (-)
 y (-)
 w (-)

(2) , , 13

8 8 33
 . 3T3 가 , 3T5가 가 . 가
 3T1 6, 7 . 21
 가 3T1, 3T2, 3T3가 . 13 8
 가 26 27 .

(3) 13

가 .
 3T5 . 80 89%, 76 89%, 66
 75% .

4)

3-7. (simulation)
 (97 8 27 , 9 18 , : mol m⁻²s⁻¹)

z			(%)
3T1z	378.7	1088.0	32.0
3T2	272.4	1088.3	25.0
3T3	255.2	1128.0	22.6
3T4	403.9	1144.0	35.3
3T5	299.3	1107.0	27.0
3T5	818.5	1103.0	74.0

z 3-2 .

95, 96

3 6

가

. 가

3T3 22.6%

3T2 25%

3T5 27%

55%

()

3T5

74%

47%

3T2, 3T3, 3T5

3T1 3T4

가

가

5) 6 9 9 18

(1)

3-8 (6-9) (simulation)
) (日中) (:)

	z/	AM 9	10	11	12	13	14	15	16	17	18
(/)	3T1	29.2	31.9	35.7	38.4	40.3	42.4	41.5	33.5	35.7	34.6
6/19	3T2	28.8	30.9	31.7	34.3	36.4	42.1	39.0	32.1	32.1	32.8
	3T3	29.4	31.4	33.9	38.0	38.8	44.6	41.9	33.6	33.8	33.7
	3T4	26.7	30.0	34.8	36.4	38.7	40.7	38.9	33.3	34.0	32.7
	3T5	28.3	33.3	36.2	38.4	39.4	42.5	39.5	32.2	34.0	33.2
		28.3	29.5	31.2	33.4	34.4	35.6	35.4	34.2	34.5	33.9
7/11	3T1	27.0	29.6	32.1	33.7	36.9	38.0	38.1	37.9	36.3	33.4
	3T2	26.5	29.6	31.3	31.8	32.4	32.4	33.0	33.0	32.1	31.7
	3T3	27.6	31.1	33.2	33.8	35.3	36.3	36.9	36.8	34.9	33.1
	3T4	26.6	29.7	32.3	34.0	37.7	39.0	39.0	38.2	36.2	33.3
	3T5	25.8	28.7	31.2	32.5	34.9	35.4	34.6	34.2	33.3	31.9
		28.9	30.1	32.3	35.4	38.8	39.4	39.7	37.5	35.5	28.2
8/13	3T1	26.7	28.8	30.9	32.3	33.8	34.9	35.2	35.4	35.0	33.7
	3T2	24.4	28.8	29.9	30.3	30.2	31.0	31.6	31.5	31.0	30.4
	3T3	21.5	26.7	30.3	31.2	31.7	32.5	33.0	32.0	30.9	30.4
	3T4	21.9	26.1	29.8	31.3	31.7	33.0	33.3	33.1	32.4	31.1
	3T5	21.8	25.1	29.5	30.1	30.6	31.4	31.9	31.9	31.4	31.5
		25.6	27.8	29.6	30.4	31.2	32.1	32.6	32.5	32.2	31.7
9/3	3T1	16.3	18.7	20.4	23.1	26.6	27.9	29.1	29.4	26.9	25.1
	3T2	16.2	18.5	20.1	22.4	25.7	26.5	27.1	27.1	25.9	34.2
	3T3	16.7	19.4	21.9	25.1	27.3	27.8	28.1	28.0	27.3	25.1
	3T4	16.3	18.3	19.7	21.8	25.0	25.8	26.6	26.8	25.2	23.4
	3T5	16.3	18.0	19.3	21.3	24.9	26.2	27.2	27.3	25.8	23.9
		15.8	18.0	19.4	21.2	23.9	25.0	26.3	26.6	25.3	24.2

z 3-2

3-8 Datalogger

6 9

가 .

가 13 15 . 6

가 6/19 14 3T3 44.6 .

9 . 3T3

가 가

가 3T5, 3T2

3T1, 3T4 .

가 11 가 14 15
 16 . 6 가 가 7
 가 가 8 7 , 9 8 9 3
 30 . 97 9 95, 96

(2)

3-9. (6 -9) (simulation
) (日中) (: $\mu\text{mol m}^{-2}\text{s}^{-1}$)

	z/	AM 9	10	11	12	13	14	15	16	17	18
(/) 7/11	3T1	190.2	192.4	197.1	260.5	331.2	348.0	262.6	231.3	181.6	123.2
	3T2	190.2	213.7	212.1	292.1	352.3	325.1	347.2	281.5	191.9	125.7
	3T3	234.2	182.0	258.5	258.5	321.1	304.5	328.9	273.7	231.2	126.8
	3T4	219.9	231.1	154.8	321.6	336.9	361.7	353.4	260.8	245.2	154.4
	3T5	143.8	149.5	167.1	169.8	226.6	235.4	268.4	226.0	204.5	131.1
		243.7	255.1	284.0	480.9	698.6	743.8	667.1	421.7	347.4	216.7
8/13	3T1	30.0	288.6	227.0	198.5	195.2	220.8	244.3	255.3	161.6	82.3
	3T2	32.9	183.0	194.0	116.1	159.3	229.6	263.1	276.8	195.6	120.5
	3T3	32.6	108.6	180.2	126.9	180.1	256.6	213.7	209.8	122.4	66.7
	3T4	33.8	194.0	218.9	306.4	306.0	311.4	328.2	386.7	247.8	115.1
	3T5	24.6	197.8	212.8	243.4	246.6	248.4	217.0	178.1	119.1	78.0
		78.1	393.6	645.8	665.9	726.6	724.8	667.1	658.7	447.4	116.7
9/3	3T1	59.8	108.6	107.7	108.2	110.1	119.3	142.5	200.3	134.0	75.9
	3T2	73.5	130.9	132.1	128.8	158.3	105.8	168.7	248.8	166.2	95.3
	3T3	51.1	100.6	101.0	112.2	101.5	103.6	126.3	129.0	112.5	61.7
	3T4	67.3	119.1	123.1	113.3	122.2	106.5	153.8	213.8	129.9	77.6
	3T5	29.4	53.4	53.9	104.4	109.5	132.1	121.0	116.8	120.4	54.5
		116.4	155.6	176.5	106.3	254.0	121.9	202.7	379.5	112.9	144.1

z 3-2

7 9 9 18 7/11 14 가 8/13
 9/3 13 . 3T1 3T4
 3T2, 3T3, 3T5 . 7 가 8
 9 7 1/2 1/3 .
 10 13 14 가 17 가

(3)

Datalogger

8 8 9 . , 9 가 가

14 가 15 . 13 15

가 가 . 가 7/11 3T1

가 8/13 3T2, 3T5 .

가 가 .

3-10.		(6 -9) (simulation									
)		(日中) (: %)									
z/		AM 9	10	11	12	13	14	15	16	17	18
(/)	3T1	72.5	58.8	48.6	40.1	34.0	31.5	47.7	44.5	53.9	49.7
	3T2	76.1	63.3	57.8	58.3	57.5	53.1	45.3	47.2	50.5	48.9
	7/11 3T3	79.3	63.3	57.3	56.7	52.1	46.7	39.7	41.4	46.9	51.1
	3T4	77.0	64.2	57.7	53.6	43.9	36.9	32.3	35.0	40.6	45.9
	3T5	78.2	66.0	58.6	56.9	50.3	45.1	41.2	43.2	46.8	48.4
			73.7	60.0	52.7	49.6	39.9	35.3	32.9	36.9	39.3	44.5
8/13	3T1	66.1	61.0	54.9	50.0	46.9	44.8	43.8	44.2	45.2	49.1
	3T2	73.2	60.6	58.4	57.6	58.5	57.2	55.7	56.4	58.4	60.5
	3T3	88.4	71.2	60.7	56.4	54.9	54.6	53.2	56.2	61.2	62.4
	3T4	82.5	69.9	59.6	55.5	54.3	51.8	50.5	51.7	54.6	58.9
	3T5	82.1	71.4	59.2	59.3	58.5	55.7	55.8	55.8	57.8	56.0
			69.5	63.8	59.8	56.7	54.8	53.2	52.1	52.8	53.7	55.2
9/3	3T1	87.0	71.4	63.3	55.3	46.3	43.6	41.7	40.9	43.8	48.5
	3T2	87.8	71.2	63.2	56.8	47.3	45.3	45.0	45.0	44.7	49.6
	3T3	93.3	81.0	70.0	58.8	49.1	47.1	45.7	73.6	72.3	74.9
	3T4	88.0	73.1	64.5	57.5	47.7	46.4	88.2	79.0	77.9	78.6
	3T5	85.9	72.6	65.4	58.8	48.1	45.0	43.7	44.0	44.1	49.1
			89.6	72.9	65.8	60.2	52.7	50.1	48.0	47.1	47.3	50.6

z 3-2

(4)

3-11.

(6 -9)

(simulation

)

(日中)

(:)

	z/	AM 9	10	11	12	13	14	15	16	17	18	
(/)	3T1	21.8	21.4	21.6	21.9	22.3	22.5	21.7	21.2	20.9	20.9	
	3T2	21.9	21.6	22.9	22.1	22.6	22.7	21.9	21.2	20.8	20.9	
	6/25	3T3	22.2	21.8	22.2	22.4	22.8	23.0	22.2	21.5	21.2	21.2
	3T4	22.5	22.1	22.3	22.4	23.1	24.0	22.6	21.4	21.2	21.6	
	3T5	23.5	22.9	23.2	23.5	29.8	29.6	25.4	23.3	22.6	21.2	
		24.1	23.8	25.5	28.6	30.6	31.7	27.3	25.5	24.6	20.5	
7/15	3T1	22.2	21.9	23.0	24.6	24.8	24.6	23.7	23.7	23.9	23.9	
	3T2	22.1	21.8	22.7	24.2	24.5	24.2	23.5	23.6	23.7	23.7	
	3T3	22.7	22.4	23.5	25.2	25.4	25.2	24.6	24.4	24.4	24.3	
	3T4	22.2	21.9	22.9	24.3	24.5	24.4	23.7	23.7	23.8	23.8	
	3T5	22.1	21.8	22.5	23.6	24.0	24.0	23.3	23.5	23.6	23.5	
		17.1	18.9	20.5	24.6	23.2	26.7	24.5	24.7	25.4	21.7	
8/18	3T1	27.2	27.5	29.9	32.2	32.0	31.9	32.1	31.3	30.3	30.0	
	3T2	27.3	27.7	29.7	30.6	30.7	30.5	30.6	30.4	30.2	29.8	
	3T3	27.8	28.5	30.4	31.4	31.5	31.4	31.4	31.2	30.8	30.6	
	3T4	27.1	27.4	29.5	30.9	30.6	30.6	30.7	30.4	30.0	29.7	
	3T5	26.9	27.3	29.3	30.5	30.0	30.0	30.0	30.1	29.7	29.6	
		27.1	27.2	29.6	31.3	31.2	31.6	31.2	30.7	30.2	29.8	
9/2	3T1	26.1	26.4	26.5	25.8	25.8	25.3	24.8	26.1	25.8	24.9	
	3T2	26.2	26.6	26.6	26.0	26.0	25.5	25.0	26.5	26.1	25.2	
	3T3	27.0	27.5	28.0	27.2	27.1	26.6	26.3	28.5	28.3	26.9	
	3T4	26.0	26.0	25.9	25.4	25.5	25.0	24.7	26.0	25.8	24.9	
	3T5	26.0	26.2	26.2	25.7	25.7	25.3	24.8	26.1	25.8	25.1	
		25.6	25.9	26.1	25.6	25.6	25.1	24.3	25.7	25.5	24.7	

z 3-2

가

13

15

14 가 가

8 가

6

7

6 (6/25)

7

3T1 3T2가 가

8

3T2, 3T4, 3T5

. 가

8/18

3T1

3T5

(5)

3-12.		(6 -9)										(simulation		
)		(日中)										(: $\mu\text{mol m}^{-2}\text{s}^{-1}$)		
z/		AM 9	10	11	12	13	14	15	16	17	18			
(/)	3T1	11.8	19.0	100.8	103.8	99.1	59.7	57.9	50.9	33.1	12.7			
	3T2	16.8	21.7	123.3	123.3	102.9	73.7	69.4	62.8	48.5	19.0			
	7/15	3T3	17.0	25.1	131.0	131.0	108.9	79.5	73.2	67.0	49.5	21.2		
	3T4	17.4	25.2	124.0	124.0	102.4	74.1	69.9	69.9	48.8	18.8			
	3T5	15.4	11.5	112.7	108.7	96.2	68.2	60.0	50.0	34.4	9.6			
		18.8	26.5	152.5	152.8	152.8	154.3	156.8	110.7	88.0	23.0			
8/18	3T1	63.0	130.7	220.4	408.3	327.9	308.7	287.9	174.4	126.9	83.1			
	3T2	101.5	196.7	180.8	299.6	240.8	241.5	221.2	129.8	82.8	59.1			
	3T3	102.0	182.7	154.7	268.2	214.1	211.0	189.9	107.8	64.1	41.5			
	3T4	75.0	148.7	243.5	423.8	349.0	349.9	313.2	185.4	127.9	71.8			
	3T5	125.9	117.1	196.1	158.1	128.5	124.8	122.0	115.2	112.2	31.5			
		221.1	247.0	422.4	448.4	363.8	392.8	392.8	288.5	248.9	210.4			
9/2	3T1	59.9	108.6	107.7	77.7	110.1	55.0	142.5	200.3	122.9	81.4			
	3T2	73.5	130.9	132.1	95.8	158.3	69.5	168.7	248.8	166.2	95.4			
	3T3	51.0	104.6	125.1	68.2	101.5	44.7	126.3	129.0	112.5	61.8			
	3T4	67.3	119.1	123.1	85.3	122.2	55.5	153.8	213.8	129.9	77.6			
	3T5	70.4	108.7	112.1	76.6	121.5	44.2	119.1	116.8	102.3	64.5			
		144.1	151.4	248.7	132.7	186.9	111.1	102.7	290.5	189.9	102.1			

z 3-2

7

8

가

. 가

12

9/2

13

. 가

3T5

3T1

가

. 10

12

가

16

(6)

3-13.

(6 -9)
(日中)

(simulation
(: %)

	z/	AM	9	10	11	12	13	14	15	16	17	18
(/)	3T1	94.5	97.5	94.8	90.2	90.3	91.8	94.9	96.2	95.7	96.5	
	3T2	94.8	97.2	95.0	90.7	91.3	92.6	95.1	96.2	95.7	96.6	
	7/15	3T3	94.9	97.3	96.7	90.9	91.1	92.0	93.5	95.2	95.2	95.8
	3T4	93.6	96.4	94.4	90.0	90.7	91.5	94.0	95.3	94.9	95.9	
	3T5	92.9	95.5	94.6	91.3	91.4	92.0	94.5	95.1	94.5	95.6	
		99.2	93.6	91.9	99.4	99.8	92.1	90.9	91.8	89.4	78.5	
8/18	3T1	89.4	89.7	77.6	69.2	70.1	69.4	68.5	69.6	72.5	73.5	
	3T2	88.2	88.7	78.2	75.0	75.2	74.8	74.2	73.1	73.1	74.0	
	3T3	87.2	86.5	77.4	71.9	72.2	71.6	71.0	71.0	71.9	72.7	
	3T4	88.0	88.5	78.3	72.8	74.2	73.4	72.6	72.4	72.7	73.6	
	3T5	87.4	87.6	77.4	73.4	75.1	74.4	74.1	72.1	72.5	72.8	
		90.6	92.9	79.8	73.1	73.9	73.3	72.4	72.5	73.8	74.8	
9/2	3T1	91.6	86.6	83.6	85.2	84.0	86.0	88.5	79.6	79.0	79.3	
	3T2	90.8	85.2	82.1	83.9	82.9	84.6	87.6	77.9	77.5	78.2	
	3T3	91.5	85.1	80.3	82.6	82.4	83.4	86.4	73.6	72.3	74.9	
	3T4	91.2	87.2	84.7	85.6	84.7	86.5	88.2	79.0	77.9	78.6	
	3T5	89.3	84.5	81.7	83.0	82.1	83.7	86.9	77.4	76.7	77.0	
		96.4	90.2	86.2	87.5	86.1	88.1	92.3	82.2	81.1	81.2	

z 3-2

7

90%

8

가

가

12

15

가 가

2

3T1

가

8/18

68.5%

9/2

6)

(1)

3-14. (simulation)
y'

z	(cm)		(cm)				(SPAD502, %)	
	8/1	9/1	8/1	9/1	8/1	9/1	8/1	9/1
3T1	62.3ax	76.3a	49.3a	63.7a	13.7a	14.3a	44.2a	48.9a
3T2	56.9a	63.3a	63.7a	64.3a	7.7b	9.7b	41.0ab	47.8a
3T3	55.5a	79.0a	47.0a	64.0a	5.0bc	6.3b	42.2ab	43.1a
3T4	67.5a	95.7a	64.8a	68.7a	5.0bc	5.3b	42.9ab	50.5a
3T5	71.4a	81.7a	45.8a	66.3a	2.7c	4.3b	39.2b	45.7a

z 3-2 .
x 5%
y :97 5/25.

68 8/1 3T1 3T4, 3T5 3T2
3T3 . 99 9/1
. 8/1 9/1 가
3T3, 3T4, 3T1 가 3T2 3T5 .
가
3T1, 3T2, 3T3, 3T5 3T4 . 가
3T1 가 . 8/1 3T5가 가 3T3, 3T4
가 . 9/1 3T1 3T2 3T5
. 8/1 3T1 가 3T5 가
3T2, 3T3, 3T4 3T1 3T5 가 . 9/1

가 .
 가 5 가 .

3-15.) y (simulation

z	y	(cm)	(cm)	(花首徑, cm)	(cm)	
3T1	87.3ax	9.3a	4.1ab	8.2a	0.41a	51.7a
3T2	88.3a	6.7ab	3.9ab	8.0a	0.41a	56.5a
3T3	90.8a	7.1ab	3.8b	8.0a	0.47a	58.6a
3T4	92.8a	5.8b	3.9ab	7.5a	0.46a	58.9a
3T5	87.3a	6.0b	4.2a	8.0a	0.41a	57.8a

z 3 .
 x :97 5/25. y :97/9/22. 5%

가 3T1
 가 3T4 가 .
 . 3T2, 3T3 3T1 가
 3T1, 3T2, 3T3 가 가 .
 . 4 (, ,
 ,) 3T5 가 3T3 가 3T1,
 3T2, 3T4 가
 , 가 .
 5 가

3-16.

(simulation

) y

z	(g)		(g)	
3T1	138.0ax	43.9c	57.1a	15.8b
3T2	182.0a	61.0bc	47.4a	22.1b
3T3	110.6a	79.7ab	39.9a	30.6ab
3T4	189.8a	100.9a	46.8a	41.7a
3T5	120.1a	34.7c	53.9a	12.6b

z 3 .
 x
 y :97 5/25. y :97 5% 9/22.

4

가 .

3T4 3T2 3T3 3T5 .

3T1, 3T5 3T3 . , 3T4 가

3T1 3T5 가 . 3T4가

3

가 . 가

가 . 3T4가 가

3T3 . , pad

3T3 .

60m

pad

60m

Pad

가

가

60m 가 . 3T3 3T1, 3T2, 3T5
 가 .

3-17. (simulation) y

z	8/1 (y67)				9/1 (98)			
	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm^{-1})	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm^{-1})
3T1	10.15ax	0.47a	288.50a	0.85c	10.29d	0.43a	338.40a	0.93b
3T2	8.96a	0.42a	287.45ab	0.94a-c	14.14b	0.46a	325.60b	0.88b
3T3	9.49a	0.46a	289.30a	0.87bc	11.70cd	0.34b	321.40b	1.17a
3T4	9.93a	0.38a	279.55c	1.02a	11.08d	0.42a	337.20a	0.94b
3T5	9.60a	0.39a	281.35bc	0.99ab	15.42a	0.45a	324.55b	0.88b

z 3-2 .
 y :97 5/25.
 x

5%

8/1 (67) .
 3T1 가 3T4, 3T5 .
 CO2 3T3 3T2
 가 3T4 3T5 가 . 3T4, 3T5, 3T2
 3T1, 3T3 . 3T1
 9/1 3T5 가 3T2 . , 3T1 3T4
 가 . 가 가 가 3T2 3T5
 가 가
 , 3T1 3T4 가
 가 . 8/1 9/1

가 . , 3T3
 가 . CO2 3T1 3T4

(2) ()

3-18. (simulation)
 y()

z	(cm)		(cm)				(SPAD502, %)	
	8/1	9/1	8/1	9/1	8/1	9/1	8/1	9/1
3T1	86.3ax	88.9a	28.7b	37.3a	32.3a	33.3a	53.8c	65.9ab
3T2	87.3a	94.7a	31.3ab	38.3a	46.3a	49.3a	64.8ab	67.9a
3T3	97.7a	98.3a	31.3ab	40.3a	40.7a	42.7a	62.0ab	63.9ab
3T4	91.4a	92.0a	35.3a	35.7a	36.3a	39.7a	58.1bc	60.6b
3T5	87.0a	91.7a	34.3a	40.3a	35.7a	38.3a	66.6a	67.5a

z 3-2 .

x 5%

y :97 5/25.

8/1 9/1 가 .
 가 가

8/1 3T1

9/1 가 .

8/1 9/1 가 .

, 3T2, 3T5 8/1 , 9/1

, 3T1 3T4 .

가 3T2, 3T5 3T1, 3T4

가 .

3-19.

(simulation)

()

z	y	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	(cm)
3T1	68.4ax	88.2a	33.2a	0.58a	2.8a	13.0a	19.4ab	78.6a	0.58ab	11.1bc
3T2	68.6a	81.2a	33.4a	0.57a	3.0a	12.3a	20.8ab	70.6a	0.54b	11.1bc
3T3	62.6b	86.6a	28.0a	0.57a	2.2a	12.3a	20.1ab	79.6a	0.56ab	12.3a
3T4	65.0ab	87.4a	29.6a	0.59a	2.4a	12.2a	17.8b	80.9a	0.49c	10.3c
3T5	65.4ab	86.1a	33.2a	0.62a	2.6a	14.8a	21.1a	72.3a	0.59a	11.4b

z 3-2 .

x 5% .

y :97 5/25. :97 8/5.

3T3 가 3T1, 3T2 가 . , 3T4, 3T5
 가 . 가 6
 . , , , , 가 .
 . , , 가 3T4가 가
 3T5가 가 . , 3T5가 가 3T4가 가 3T2
 . , 3T3 가 3T4 가 3T5
 . , , ,
 ,
 .

3-20. Simulations

y()

	z	(cm)	(cm)	(cm)	(cm)	(cm)
	3T1	83.2ax	30.0a	18.5c	53.2ab	18.2a
	3T2	83.5a	32.5a	22.5b	47.5b	16.6a
	3T3	92.5a	32.5a	30.0a	54.4ab	18.9a
	3T4	93.5a	34.0a	13.5d	52.6ab	18.4a
	3T5	82.5a	29.5a	28.5a	64.1a	19.5a

z 3-2 .
 x
 y :97 5/25. y :97 5% 9/22.

9/22 , 가 3T5,
 3T3 가 3T1 가 . 3T5가 가 . 3T2 가
 3T1, 3T3, 3T4 가 .
 3T2 3T5가 .

3-21.

(simulation) y
 ()

z	(g)	(g)	(g)	(g)
3T1	76.2bx	124.9ab	14.8a	56.0a
3T2	68.6b	119.9b	12.4a	49.6a
3T3	140.4a	170.2a	24.3a	44.4a
3T4	89.1b	179.0a	16.4a	83.5a
3T5	86.2b	167.8ab	11.7a	71.7a

z 3-2 .
 x
 y :97 5/25. y :97 5% 9/22.

3T3 가 가
 3T4가 가 3T1, 3T3, 3T5

가 , 3T2 가 3T1, 3T5 가 .
 , 가
 가 . 3T3 가 3T4 가 .

3-22. (simulation)

z	8/1 (y67)				9/1 (98)			
	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm^{-1})	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm^{-1})
3T1	5.12bcx	0.21bc	279.05a	1.95a-c	12.74a	0.30a	316.95c	1.31c
3T2	5.28bc	0.16c	261.50a	2.50a	8.08d	0.25b	325.20b	1.61b
3T3	10.03a	0.30a	272.20a	1.31c	8.71c	0.26ab	333.25a	1.51b
3T4	6.07b	0.24ab	278.80a	1.64bc	4.83e	0.12c	306.30d	3.39a
3T5	4.59c	0.19bc	281.95a	2.20ab	9.23b	0.24b	310.40d	1.66b

z 3-2 .

x 5%

y :97 5/25.

8/1 3T3 가 3T5 가 3T1, 3T2,
 3T4가 . 3T3 가

가 가 .

3T3, 3T4가 가 3T2가 가 CO2

가 . 3T3, 3T5 가 3T3 가

3T3 가 . 9/1 8/1

. 3T1 가 3T4가 가

. 가 8/1 가 3T3

. 3T1, 3T3 3T4가 가 3T2, 3T5

. , CO2 3T3 가 3T1 가 .

3T1 가 3T4가 가 . 9/1 9

가 8/1 .

(3)

8/1 , 9/1
 3T3 가 . 8/1 3T3
 9/1 3T1 가 3T3
 가 . 가
 가 가
 8/1 가
 9/1 3T4 가 가

3-23. (simulation)
 y'

Z	(cm)		(cm)		(SPAD502, %)	
	8/1	9/1	8/1	9/1	8/1	9/1
3T1	15.3ax	18.7a	28.7b	28.9b	52.0a	55.4ab
3T2	13.3a	14.3a	31.7b	31.8ab	55.8a	59.8a
3T3	14.4a	18.9a	41.7a	45.7a	51.0a	53.2ab
3T4	13.6a	14.3a	33.3b	34.3ab	48.8a	48.6b
3T5	11.5a	12.7a	31.9b	33.7ab	49.4a	52.9ab

z 3-2 .
 x 5% .
 y :97 5/25.

3-24. (simulation)

z	y		(g)	
	(g)	(g)	(g)	(g)
3T1	83.4ax	72.8b	10.2a	12.9a
3T2	79.6a	80.9b	10.9a	11.7a
3T3	117.2a	80.2b	28.3a	10.7a
3T4	142.9a	120.1a	16.7a	10.6a
3T5	84.9a	76.5b	12.0a	11.8a

z 3-2 .
 x : 97 5/25. 5%
 y : 97 9/22.

9/22 가 3T3, 3T4
 , 3T4 가
 가 가
 3T3 가 3T1 가

3-25. (simulation)

z	8/1 (y67)				9/1 (98)			
	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm ⁻¹)	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm ⁻¹)
3T1	5.64cx	0.43a	301.40a	0.93c	8.67a	0.32a	337.55a	1.21d
3T2	4.15d	0.21a	284.00ab	2.03b	3.27c	0.15d	342.75a	2.72a
3T3	9.21a	0.51a	297.05a	0.77c	8.67a	0.26b	308.30c	1.52cd
3T4	7.35b	0.29a	277.60b	1.37bc	4.95b	0.21c	334.90ab	1.91bc
3T5	1.26e	0.49a	291.60ab	4.39a	3.94bc	0.16d	323.60b	2.44ab

z 3-2 .
 x : 97 5/25. 5%
 y : 97 5/25.

8/1 3T3 가 . ,
 3T5 가 . 3T5 3T3 7 가 . 3T4
 3T2, 3T1, 3T5 . 가
 가 . , CO2 3T1 3T3 가 3T4
 가 . 3T5가 가 3T1 3T3
 9/1 3T3 3T1 . 3T2, 3T5
 3T1, 3T3 .
 가 가 . , 3T2, 3T5
 가 .

(4)

3-26. (simulation)
 y'

z	(cm)		(cm)				(SPAD502, %)	
	8/1	9/1	8/1	9/1	8/1	9/1	8/1	9/1
3T1	37.3ax	43.7a	65.1a	67.6a	3.3a	4.8a	54.9a	58.0a
3T2	35.7a	36.3ab	64.0a	65.7a	3.0a	4.5a	57.7a	57.8a
3T3	36.0a	39.7ab	58.0a	61.0a	3.7a	4.7a	49.0a	49.7a
3T4	31.5a	36.0b	53.0a	68.5a	3.7a	4.3a	48.8a	55.8a
3T5	41.6a	44.7a	62.3a	63.2a	3.7a	4.1a	54.2a	58.5a

z 3-2 .
 x 5% .
 y :97 5/25.

8/1 . 9/1 3T4가 가
 가 . ,
 가 .

8/1 , 9/1

3T1, 3T2, 3T5

가

(10 15)

blasting

3-27.

(simulation

)

z	(g)	(g)
3T1	66.3abx 164.8a	14.4a 19.3a
3T2	68.2a 158.3a	14.0a 17.9ab
3T3	57.6ab 124.0a	13.0a 13.4a-c
3T4	34.6b 99.2a	7.7a 9.8c
3T5	40.9ab 72.9a	9.7a 10.8bc

z 3-2 .
 x 5%
 y :97 5/25. :97 9/22.

3T4가 가

3T2가 가

가

가

3T1, 3T2, 3T3

3T1, 3T2, 3T3

가

3T4

가

가

3-28. (simulation)

z	8/1 (y67)				9/ 1 (98)			
	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO_2 (ng/L)	(s cm $^{-1}$)	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO_2 (ng/L)	(s cm $^{-1}$)
3T1	1.93ax	0.08a	278.10a	4.67cd	3.67c	0.12b	326.95b	3.29b
3T2	0.67c	0.06a	292.70a	6.43b	4.48b	0.11b	309.50c	3.69b
3T3	1.81ab	0.12a	297.35a	3.18d	2.56d	0.11b	346.65a	3.52c
3T4	1.17a-c	0.07a	286.00a	5.72bc	6.67a	0.16a	303.85c	2.53c
3T5	1.07bc	0.22a	270.70a	10.79a	1.82e	0.07c	360.90a	5.49a

z 3-2
x
y :97 5/25.

8/1 3T1 가 . 3T3, 3T4 가
 CO2 가
 3T5가 가 3T3, 3T1 가 3T1
 9/1 3T4가 가 . 3T2, 3T3, 3T1
 3T5 가 3T4가 가 3T5
 가 가 가 CO2 3T
 3, 3T5가 가 3T2, 3T4가 가 3T5가 가
 3T4가 가 8/1
 3T1 3T5 가 3T5

가

(5) ()

8/1 9/1

3T5가 가

가 8/1

3T3 가 9/1 가 3T3

3-29. (simulation)
y'

	z (cm)		(cm)				(SPAD502, %)	
	8/1	9/1	8/1	9/1	8/1	9/1	8/1	9/1
3T1	28.0a	34.3a	42.6a	52.7a	11.0a	14.3a	42.7a	45.5a
3T2	28.0a	35.0a	45.7a	52.7a	11.0a	14.4a	44.2a	44.3a
3T3	27.0a	35.3a	41.0a	56.0a	13.7a	16.7a	43.6a	45.6a
3T4	27.2a	35.3a	48.5a	55.0a	10.0a	11.0a	41.1a	44.5a
3T5	26.7a	31.3a	43.2a	52.7a	10.3a	11.3a	34.7a	43.5a

z 3-2
x : 97 5/25.
y 5%

3-30. (simulation)

z	(g)		(g)	
3T1	54.9ax	15.9a	13.6a	3.6b
3T2	87.6a	26.2a	21.9a	5.1ab
3T3	74.6a	20.7a	18.3a	3.9ab
3T4	75.7a	21.0a	16.8a	5.8a
3T5	70.1a	16.0a	15.7a	3.2a

z
x
y :97 5/25. y :97 5% 9/22.

가 . 3T2가 가 . 3T2가
3T1 .

3-31. (simulation)

z	8/1 (y67)				9/1 (98)			
	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm ⁻¹)	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO2 (ng/L)	(s cm ⁻¹)
3T1	5.21ax	0.27bc	293.40a	1.49ab	6.88b	0.33b	343.05b	1.19a
3T2	1.17a	0.19c	311.65a	2.20a	9.36a	0.41a	336.25b	0.97b
3T3	5.91a	0.28ab	292.60a	1.38ab	5.84b	0.42a	359.40a	0.96b
3T4	2.83a	0.33ab	309.10a	1.20b	4.32c	0.37ab	364.00a	1.07ab
3T5	5.84a	0.35a	295.80a	1.11b	8.60a	0.37ab	344.95b	1.07ab

z 3-2
E 5% . y :97 5/25.

8/1

3T1, 3T3, 3T5 3T2, 3T4 3T5
 가 3T2 가 CO2 가
 3T2 가 3T4, 3T5 가
 9/1 3T2, 3T5 가 3T4 가 3T1, 3T3
 3T1 가 가
 CO2 3T3, 3T4가 가 3T1, 3T2, 3T5가
 3T2, 3T3 가
 가 3T2 3T5
 3T2 가

(6)

3-32. (simulation)
 y

z	(cm)		(cm)				(SPAD502, %)	
	8/1	9/1	8/1	9/1	8/1	9/1	8/1	9/1
3T1	27. 7a	28. 8a	34. 3a	38. 8a	8. 7a	10. 7a	55. 5a	54. 9a
3T2	33. 3a	40. 5a	43. 0a	40. 5a	9. 3a	10. 3a	53. 8a	52. 8a
3T3	33. 0a	39. 0a	38. 3a	39. 0a	8. 3a	9. 7a	53. 3a	58. 0a
3T4	27. 5a	37. 3a	39. 0a	37. 3a	9. 0a	12. 7a	49. 7a	51. 4a
3T5	37. 7a	36. 7a	37. 2a	36. 7a	9. 7a	11. 7a	51. 3a	63. 3a

z 3-2
 x :97
 y : 5/25. 5%

가
 가 5가
 가 3T2, 3T3, 3T5
 3T4, 3T5

3-33. (simulation)

z	(g)		(g)	
	3T1	37.2ax	59.1a	12.5a	21.0a
3T2	38.8a	47.6a	14.6a	17.9ab
3T3	43.5a	40.0a	14.2a	13.0b
3T4	40.1a	32.5a	18.1a	13.8ab
3T5	43.6a	38.9a	14.1a	12.2c

z 3-2 .
 x :97 5/25. y :97 5% 9/22.

가 가
 3T1 가 3T5가 가
 3T3 가 3T1 3T2

3-34. (simulation) y

z	8/1 (y67)				9/1 (98)			
	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO ₂ (mg/L)	(s cm ⁻¹)	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO ₂ (mg/L)	(s cm ⁻¹)
3T1	1.08bx	0.12a	298.05a	3.50a	1.00d	0.10c	359.70a	3.89a
3T2	4.63a	0.13a	258.80c	3.02a	6.10b	0.14bc	300.20a	2.89bc
3T3	2.39b	0.14a	291.20a	2.96a	8.58a	0.19a	297.10c	2.07c
3T4	2.02b	0.10a	286.45ab	3.44a	5.06bc	0.16ab	320.75b	2.63bc
3T5	2.51b	0.11a	276.55b	3.70a	3.63c	0.11c	315.30bc	3.53ab

z 3-2 .
 x :97 5/25. y :97 5% 9/22.

8/1 3T2가 가 .

가 . 가
 . CO2 3T1, 3T3 가 3T2가 가 .
 9/1 3T3 가 3T2 3T1
 가 . 3T3 가 3T4 가
 3T1, 3T4 가 . CO2 3T1, 3T2가 3T3 가
 3T2, 3T3, 3T4가 .
 3T1 3T2 3T3
 가 .

(7)

3-35. (simulation)
 y ‘ ’

	z (cm)		(cm)		(SPAD502, %)			
	8/1	9/1	8/1	9/1	8/1	9/1	8/1	9/1
3T1	31.3ax	42.0a	43.3a	48.5a	14.3a	19.3a	79.6a	80.3a
3T2	35.7a	45.0a	40.3a	47.3a	12.7a	18.7a	77.3a	82.5a
3T3	36.7a	47.6a	43.3a	49.0a	11.0a	16.3a	80.3a	81.3a
3T4	36.7a	47.3a	41.4a	46.5a	15.3a	16.3a	76.5a	78.3a
3T5	32.0a	42.3a	47.0a	47.3a	13.7a	15.7a	66.7b	64.9a

z 3-2 .
 x
 y :97 5/25.

가 4 가

가 3T5가

가 .

3-36. (simulation)

z	y	
	(g)	(g)
3T1	284.9abx	684.7a
3T2	311.9ab	751.0a
3T3	272.8b	803.2a
3T4	376.5a	766.7a
3T5	146.5c	184.3b

z 3-2 .
 x 5%
 y :97 5/25. y :97 9/22.

3T4 가 3T2, 3T1, 3T3
 3T5가 가 3T1, 3T2, 3T3 ,3T4 가 3T5가
 가 3T4가 가 3T5가 가
 3T5 가

3-37. (simulation)

z	8/1 (y67)		9/1 (98)					
	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO ₂ (mg/L)	(s cm ⁻¹)	($\mu\text{mol m}^{-2}\text{s}^{-1}$)	($\text{mol m}^{-2}\text{s}^{-1}$)	CO ₂ (mg/L)	(s cm ⁻¹)
3T1	2.17cx	0.18b	305.40a	2.30a	4.41c	0.20a	286.90c	2.03ab
3T2	2.48bc	0.18b	300.00a	2.26a	6.39b	0.16a	334.50a	2.45a
3T3	4.41a	0.20b	286.90b	2.03a	7.51a	0.21a	310.30b	1.85b
3T4	3.07bc	0.18b	296.95ab	2.12a	5.08c	0.19a	322.70ab	2.10ab
3T5	3.44ab	0.27a	304.75a	1.50b	4.83c	0.16a	327.15a	2.16ab

z 3 .
 x 5%
 y :97 5/25.

8/1 3T3 가 3T1 가 .
 3T5가 가 가
 . C02 3T3 가 가 .
 3T5가 가 .
 9/1 3T3 가 3T2
 가 . 가 .
 C02 3T1 가 3T2 3T5 3T3 .
 3T3 가 . 3T3

3 .

1). 가 13 ,

- 6

(1) 가 가 3T5 3T3 3T2
 . 3T4
 3T1 가 . , , .
 0.9 5.2
 (11).

(2) 60 75% 3T3가 가 3T1
 . 6 가 . 3T1 가
 3T4 3T5 .

(3) (16) 3T1 가 3 4
 3T4 가 .

- 7 6 가 ,
 . 3T5 가 가 3T2, 3T3,
 3T4 . 7 80%
 가 3T3 가 .
 . 3T2 3T3 가 3T4 가
 . 3T1 가 3T4 .
 - 8 3T2 3T5 가 3T4 3T5
 가 3T4 3T5 . 3T1 가
 가 3T3가 3T4 .
 0.5 5.5 .
 가 3T4, 3T5 3T1 3T3
 . 3T1 3T4 가 .
 3T4 -1.7 .

2). 3T4 3T1

3T5. 3T2, 3T3 .
 74% .

3). 6 9

- 13 15 가 가 6/19 3T3 14
 44.6 . 9 . 3T2 가
 . 7 가 가 8 7 , 9
 8 6 , 2 가
 . 3T2 3T5 .
 - 가 13 15 가 14
 가 가 . 8 가 6 7

. 6 (6/25) 7 3T1, 3T2가 가 8
 3T2, 3T4, 3T5 . 가 8/18 15 3T1 .
 4). 7 9
 - 9 가 가 14 가 15
 . 13 15 가 가 . 13 15
 가 7/11 3T1 , 가 8/13
 3T1, 3T5 . 7 90%
 .
 8 가 12 15 가 가
 . 3T1 가 68.5% . 9
 .
 5). 7 9
 13 15 가 3T1 3T4
 3T2, 3T3, 3T5 . 8 3T3
 9 3T3가 가 .
 7 8 . 가
 .
 6).
 - 68 8/1 3T1 3T4, 3T5
 3T2 3T3 .
 99 9/1 . 8/1 9/1
 가 3T3, 3T4, 3T1 가
 3T2 3T5 .

3T2 3T4 . 8/1 3T1 가 3T5
 가 . 9/1 .
 8/1 3T5가 가 3T1 가 9/1
 가 .
 - 가
 3T1 가 3T4 .
 9 22 가 3T4
 3T1 가 .
 가 3T5 .
 .
 . 3T4
 가 .
 - 3T4 3T2가 .
 3T4 3T3, 3T2가 3T1 3T5 .
 .
 - 8/1 3T1 가 .
 9/1 3T5 가 3T2
 가 . 가 3T1 가
 . 8/1 가 9/1
 3T3가 가 . 002 3T1,
 3T2, 3T3가 9/1 3T1 3T4 .
 8/1 3T4가 가 3T1 가 . 9/1 3T3가
 가 .

7. (:)

- 8/1 9/1 , ,

. 3T3 .

3T5 3T2, 3T3가 3T1 3T4 .

가 .

3T5 가 3T2, 3T3 9/1

.

- 3T3가 가 3T4, 3T5 3T1, 3T2가 가

.

, , , ,

가 3T5, 3T1, 3T3

3T3 3T4 가 .

- 3T3 가

. 3T3가 .

3T2 .

- 8/1 , 9/1 3T3 . 8/1

3T3 3T2 . 002 가

3T3 가 . 9/1 3T1, 3T3

가 3T4 . 002 3T3 가 3T4,

3T5 .

3T4가 가 3T1 3T3

.

8.

- 8/1 9/1 가 3T3가 가
3T1 가 . 8/1
9/1 3T4 가 .
- 3T4 3T3 3T2 가 .
3T3 가 .
- 8/1 , 3T3 가 3T4, 3T2, 3T1, 3T5
3T5 가 . 002 3T3
가 가 .
3T3가 3T1 가 . 9/1
3T3 ,

9.

- 8/1 , 9/1 , , ,
3T5 3T1
3T2 가 3T1, 3T3, 3T5
3T4 가 .
3T1, 3T2, 3T3 3T4 가 .
3T1, 3T2, 3T3 .
- 8/1 3T1 가 3T3, 3T4
3T2, 3T5 . 9/1 3T4가 가
3T5 가 . 8/1

3T5 가 . 9/1 3T4 .
C02 3T3 .

10.

- (8/1 , 9/1) , , , .
- 3T2 3T1 .
- 3T3, 3T5, 3T1 3T2
3T4 . C02
- 3T1 가 .
- 3T1 3T5 .

11.

- , , , .
- 3T1 3T5 .
- , .
- 8/1 3T2 가 9/1 3T3 가
3T1 가 .
8/1 .
C02 3T1 8/1 가

9/1 3T3가 가 .

12.

- (8/1, 9/1) , , ,

- , .

- 3T3, 3T5 가 3T1 가 .

3T5 9/1

. 3T3 C02

13.

(: 3T2, 3T4, 3T1 . : 3T3 . : 3T4, 3T3 .

: 3T2, 3T1, 3T3 . : 3T2 .

: 3T4 . : 3T4)

•

가 . 3

가

3,054ha('95) 2,910ha 95%

52.4ha 1.7%

20 , 15

() 18 20 , 12 16 , 10 15

20

()가 11 가

가 가 0 30 60

50 가

가 가

가

가

3

simulation () 가

. 95, 96 97

. 95 1 가

.
 . 3 가 (4 가)
 1 가 turn-key
 + + +
 .
 (35%
 + PE + 50 cm PE +
) 가 가
 . 29.4 34 .
 32.9 .
 가 가
 . 가
 가
 5 (1T1: 1
 T1), (1T2), (1T3),
 (1T4), (1T5) 5
 7 , 6 9 .
 가
 3 . ,
 ,
 .

1T1 가 가 6 13 가
 6 2.7 , 6 4.6 . 1T5 6
 2 , 6 4.6 . 7 8
 . 가 가 1T2 6
 1.5 . 1T3 1T4 가 1T3 1T4
 가 가 , (=0) 1T2가 가 가
 . 1T2가 가 1T4, 1T3 .
 가 1T1 가 20%
 , 1T5 32% . 1T2, 1T3, 1T4 80%
 . 1T2, 1T3, 1T4 10% ,
 () .

3 가 . 가 , 1T5

1.5

가 . 가 가 ,
 3 가
 , , 7 , ,
 , 1T2 1T3 .

1T1 1T3, 1T4가
 1T5 1T1 1T2

1T2, 1T3가 1T2, 1T4, 1T5 , 1T4가 가 1T2가
 가

가

2 1 5 5
 가

(16) (2T1)
 (2T2) ()
 2T3) 1 , 2
 (2T4) .
 (2T5) .

6 13 2T2 가 가 , 2T4
 2T5 . 가

. 2T1 2T3 가 6 , 8
 , 5 7 .

6 . 2T3
 가

60

30 60 m 가 , 60 m 30 m

가 5.6m

2.5m (7.6m) 3

가 3

(Carpenter Willis, 1959; 中川, 1967) 3

5

2T1

가 2T3 가 (3

) . 7 2T2 2T4

가 6 , 13 2T3 가 2T1 .

3 . 2T2

가 가 , 7 0.2 .

8 96 8 2T1 2T3

40

가 2T4가 가

2T1 2T3 , 2T3

(0.8%) , 2T2 48.5%, 2T5 52.6%

가

가

2T1 2T3

. 1
 . 2T3 가 2T2 . 2T4
 .
 2T1, 2T3 2T4가 가 .
 2T5 가 2T1 2T4 .
 가 . 2T2 2T4
 2T4 .
 , 2T4 가 95
 . 2T2, 2T5
 2T4, 2T5
 . , 2T1,
 2T3 2T3, 2T5
 . 1 2
 .
 3 1 (95), 2 (96)
 가 . 3
 가 가 . 3 가 1, 2
 .
 가 ,
 .
 (This 1000N, 가: 15) 가 . ,
 가 28 가 45 30
 가 32 가 , ,
 가

. 28 가 가 45
, 30 가 3T1 , 3T2 ,
3T3 , 3T4 , 3T5
, 32 가 3T1 , 3T2 , 3T3 , 3T4
(), 3T5 . 3가

6 13 3T5 가 가 . ,
가
. 3T3 3T2 .
, 3T4 , 3T1 가 .
, , .

95, 96 가
가 .
.

95, 96 5.2
5 가 .
60 75% 3T3 가 3T1 .
3T1 가 , 3 4
3T4 가 .
가 .

가 . 3T1
 가 , 3T1 3T2, 3T4
 . 가 . 3T3
 .
 3T3 3T4 3T2, 3T1, 3T3
 . , 3T2 가 가
 3T4 가 . ,
 3T4 가 . 3
 3 , , ,
 가 .
 . ,
 가가 .

•

가 가
 3 3 .
 .

1. 가

(1)

1) 4 가

, 4 가 3 가 가

, 1 가

turn-key

+

+

+

2) 가

, ,

가

.

가

가 .

3) 1T1 ()

가 가

6

2.7 , 6

4.6

20%

.

1T5

6

2 , 6

4.6

.

7

8

.

4) 가 가

1T2 6

1.5

. 1T3 1T4

가

1T4가 1T3

가 .

(=0)

1T2가

가

가

.

5) 1T2가 가

1T4, 1T3

.

6)

1T1

20% 가

,

1T5

32%

.

1T2, 1T3, 1T4 80%

.

2 .

7) 1T3 가 , 1T2 ,
 () 1T1 가 , 1T3, 1T4가 .
 1T5 1T1
 , , , 가 1T2 . 1T2 가
 1T5 1T4 1T3 .
 , 1T4 , 1T2
 .

2. (2)

1) 6 가 가 2T2 2T4 2T5 .
 2T1 2T3 가 , 6
 8 , 5-7 .

2) 6 , , 2T4 , 2T1 가 .

3) 2T1 가 2T3 가 . 7, 8 6
 2T2 1T4 가 2T3, 2T1 .

4) () 2T1 가 2T3
 . 2T2 2T4 . 2T1 2T3 가
 2T2 2T5 . 2T4 가 . 2T1
 2T4 2T4 . 2T1
 가 2T3, 2T2 . 2T3 가
 2T1 .

5) $2T1, 2T3$ 가 $2T4$.
 $2T3$, $2T1$, $2T5$
 $2T5$, $2T1$, $2T4$ 가 가 .
 $2T5$, $2T1$, $2T4$ 가 가 .
 $2T2, 2T5$, $2T4, 2T5, 2T2$
 $2T2, 2T4, 2T3$, $2T1, 2T3$
 $2T5, 2T3, 2T4$.

3. (3)

1) 95, 96

, 6 가
가 $3T5$, $3T3, 3T2$.
2) $(3T2, 3T3, 3T5)$ $(3T1, 3T4)$
가 . 7 8 .
+ + 가

3) $3T4, 3T1$ $3T5, 3T2, 3T3$.

4) $3T4, 3T2$ 가
, $3T1$ 가
. $3T3$ 가 .
 $3T3$. $3T4$
 $3T3$, $3T2$ 가 $3T1, 3T3, 3T5$

3T4 가 . 3T1 3T4
 3T5가 가 .
 가 .
 3T3, 3T5 3T1 가 .

5)

(3-44).

3-44.

	z
	3T 2, 3T 4, 3T 1
	3T 3
	3T 4, 3T 3
	3T 2, 3T 1, 3T 3
	3T 2
	3T 4
	3T 4

z 3-2 .

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1. 가 (97. 8).

		가		
	3,000L	350,000	1	350,000
	1/2	70,000	1	70,000
	100 × 100 × 10cm	150,000	1	150,000
		1,000	10	10,000
		8,000	1	8,000
		12,000	1	12,000
T/C		150,000	1	150,000
B.K/S,MC/S		22,000	1	22,000
		150,000	2	300,000
	55%	1,630	1 m2	1,630
	15	50,000	1	50,000
		120,000	1	120,000
		180,000	1	180,000
		11,500	1	11,500
	1	200,000	1	200,000



그림 1. 온도하강을 위한 증양제어장치 콘트롤 박스

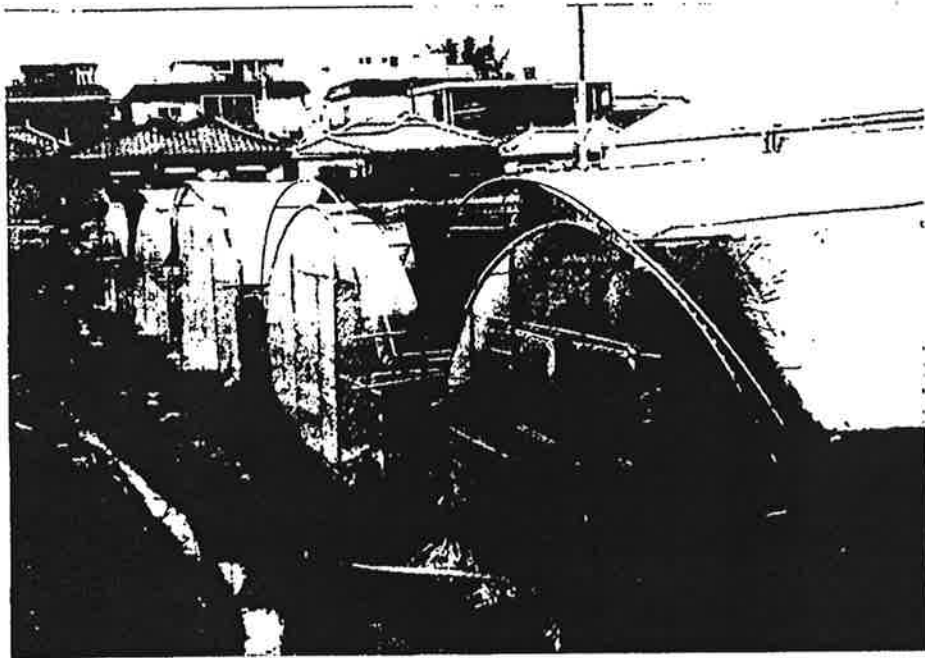


그림 2. 본 연구에 사용한 simulation 비닐온실과 외부수시차광 전경

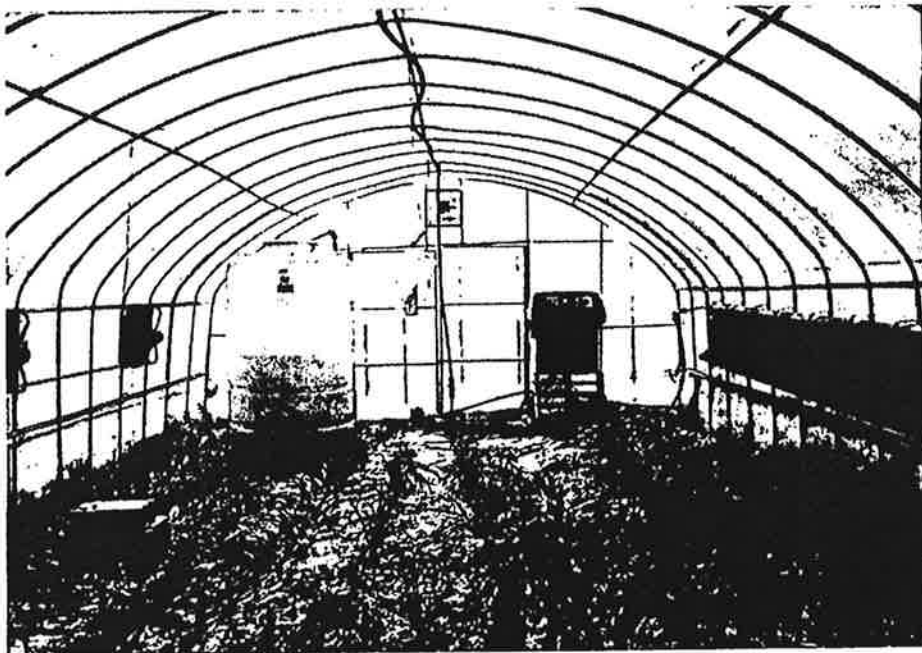
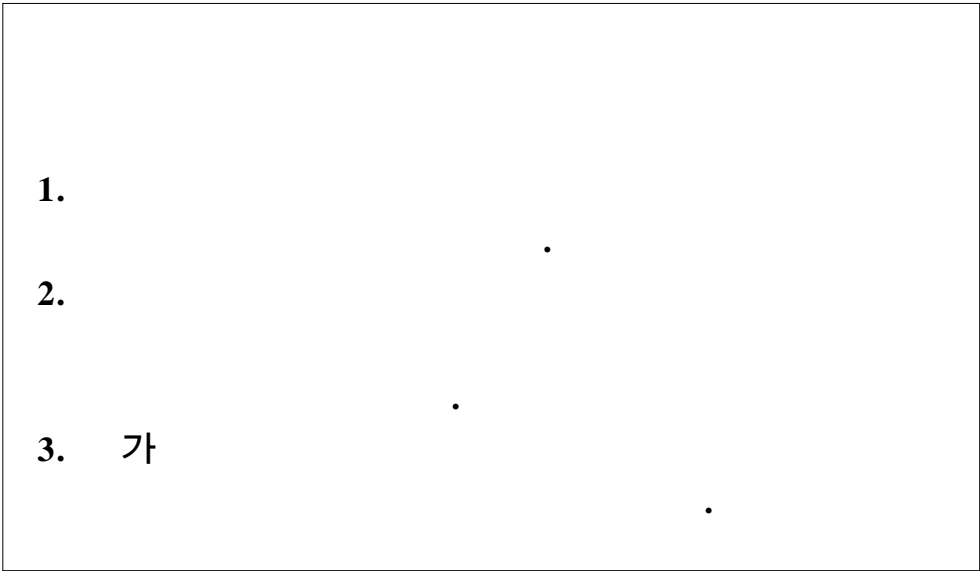


그림 3. 본 연구에 사용한 패드냉방과 복합환경제어 콘트롤 박스



1