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전남 지방에 있어서의 양송이 재배에 최적한 환경조건 조절법 분석에 관한 연구*

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Study on the Controlling Mechaniques of the Environmental Factors in the Mushroom Growing House in Chonnam Province*

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SUMMARY

The important results which have been obtained in the investigation can be recapitulated as follows.

1. As demonstrated by the experimental results and analyses concerning their effects in the on-ground type mushroom house, the constructions in relation to the side wall and ceiling of the experimental house showed a sufficient heat insulation on effect to protect insides of the house from outside climatic conditions.

2. As the effect on the solar type experimental mushroom house which was constructed in a half basement has been shown by the experimental results and analyses, it has been proved to be effective for making use of solar heat. However there were found two problems to be improved for putting solar house to practical use in the farm mushroom growing:(1) the construction of the roof and ceiling should be the same as for the on-ground type house, and (2) the solar heat generating system should be reconstructed properly.

3. Among several ventilation systems which have been studied in the experiments, the underground earthen pipe and ceiling ventilation, and vertical side wall and ceiling ventilation systems have been proved to be most effective for natural ventilation.

4. The experimental results have shown that ventilation systems such as the vertical side wall and underground ventilation systems are suitable to put to practical use as natural ventilation systems for farm mushroom house. These ventilation systems can remarkably improve the temperature of fresh air which is introduced into the house by heat transfers within the ventilation passages, so as to approach to the desired temperature of the house without any cooling or heating operation. For example, if it is assuming that X is the outside temperature and Y is the amount of temperature adjustment made by the influence of the ventilation system, the relationships that exist between X and Y can be expressed by the following regression lines.

Underground iron pipe ventilation system.

$$Y=0.9X-12.8$$

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Underground earthen pipe ventilation system.

$Y=0.96X-15.11$

Vertical side wall ventilation system.

$Y=0.94X-17.57$

5. The experimental results have shown that the relationships existing between the admitted and expelled air and the CO_2 concentration can be described with experimental regression lines or an exponent equation as follows:

5.1 If it is assumed that X is an air speed cm/sec. and Y is an expelled air speed in cm/sec. in a natural ventilation system, since the Y is a function of the X, the relationships that exist between X and Y can be expressed by the regression lines shown below:

Regression lines relating to ventilating air speed cm/sec.

Kinds of vent. sytsem	Admitting		Expelling		Experimental regression equation
	Vent.	Control (%)	Vent.	Control (%)	
GE-CV	GE	100	CV	50	Y=1.01X−1.65
GE-CV	GE	100	CV	100	Y=0.42X+2.03
VS-CV	VS	100	CV	100	Y=0.85X+0.96

Note : The symbols used indicate as follow.
GE : Underground earthen pipe ventilation arrangement.
CV : Ceiling Ventilation arrangement.
VS : Vertical side wall ventilation arrangement.

5.2 If it is assumed that X is an admitted volume of air in m^3/hr. and Y is an expelled volume of air in m^3/hr. in a natural ventilation system, since the Y is a function of the X, the relationships that exist between X and Y can be expressed by the regression lines shown below.

Regression lines relating to ventilaitng air volume

Kinds of vent. system	Admitting		Expelling		Experimental regression line
	Vent.	Control (%)	Vent.	Control (%)	
GE-CV	GE	100	CV	50	$Y=2.59X-10.88$
GE-CV	GE	100	CV	100	$Y=2.16X+26.53$

5.3 If it is assumed that expelled air speed in cm/sec. and replacement air speed in cm/sec. at the bed surface in a natural ventilation system are shown as X and Y, respectively, since the Y is a function of the X, the relationships that exist between X and Y can be expressed by the following regression line:

GE(100%)−CV (50%) ventilation system.

$Y=0.54X+0.84$

5.4 If it is assumed that the replacement air speed in cm/sec. at the bed surface is shown as X, and CO_2 concentration which is expressed by multiplying 1000 times the actual value of CO_2 % is shown as Y, in a natural ventilation system, since the Y is a function of the X, the relationships that exist between X and Y can be expressed by the following regression line:

GE(100%)−CV(50%) ventilation system.

$Y=114.53-6.42X$

5.5 If it is assumed that the expelled volume of air is shown as X and the CO_2 concencration which is expressed by multiplying 1000 times the actual of CO_2% is shown as Y in a natural ventilation system, since the Y is a function of the X, the relationships that exist between X and Y can be expressed by the following exponent equation:

GE(100%)—CV(50%) ventilation system.

$Y=127.18\times1.0093^{-x}$

5.6 The experimental results have shown that the ratios of the cross sectional area of the GE and CV vent to the total cubic capacity of the house, required for providing an adequate amount of air in a natural ventilation system, can be estimated as follows:

GE(admitting vent of the underground ventilation)

0.3—0.5% (controllable)

CV(expelling vent of the ceiling ventilation)

0.8—1.0% (controllable)

6. Among several heating devices which were studied in the experiments, the hot-water boilor which wasmodified to be fitted both as hot-water boiler and as a pressureless steam-water was found most suitable for farm mushroom growing.

적 요

본 논문은 1968년 과학기술처 Trust Fund에 의하여 실시된 연구로서 전남 지방에 있어서 최적합한 양송이 재배사를 구명하기 위하여 이미 구미에서 연구된 결과를 토대로 하여 우리나라의 기후적 조건과 경제적 조건을 고찰한 자연공기 순환법을 적용, 양송이 재배에 최적한 환경 조건과 이의 조절법을 구명코저 지상식재배사와 지하실에 구축한 태양열을 이용하는 태양열식 재배사를 본실험용으로 구축하고 전자에 대하여서는 외기의 온도의 영향을 받지 아니하는 측벽구조와 천정의 구조, 환기구의 위치 및 그 환기량등에 관하여 검토하였으며 후자에 관하여는 태양열 이용 효과에 대하여 검토하였다. 또한 동기에 있어서의 계속적 재배를 가능케 하기 위하여 양송이 재배사의 보온에 적합한 가열장치에 대하여서도 검토하였다.

1. 실험용 지상식 양송이 재배사의 효과에 관하여는 이미 실험결과 및 그 분석에서 지적된 바 있거니와 그 측벽 및 천정의 구조는 재배사를 외계의 기상조건에서 격리하는데 충분한 효과가 있는 것으로 고려된다.

2. 반지하실에 구축한 실험용 태양식 양송이 재배사의 효과에 관하여는 실험결과 및 그 분석에 지적한 바와 같거니와 태양열을 이용하는데 있어 충분한 효과가 있는 것으로 고려된다. 그러나 이것을 농가에 적용하기 위하여는 다음과 같은 제점이 개선되어야 할 것으로 고려된다. 즉 (1) 태양식의 지붕과 천정은 실험용 지상식재배사의 그것과 동일히 하고, (2) 태양열 수열장치는 적당히 재고되어야 할 것으로 고려된다.

3. 본 실험 연구에서 실시한 각종의 환기법중 GE—CV 및 VS—CV 환기법이 가장 효과적인 것으로 본다.

4. 측벽수직 및 지중 환기장치는 이미 지적한 바와 같이 농가용 양송이재배사의 자연환기법으로 실용적 가치가 충분하다. 그것은 이들 환기장치는 그 환기로를 통하여 사내에 유입되는 외기의 온도를 인공적으로 가열이나 또는 냉각하지 않고 사내 온도에 접근하지 않도록 조절하는 효과가 있기 때문이다. 지금 외온을 X°C로 할때 각종 환기로에 의하여 흡수되는 온도 Y°C를 X의 함수로 하는 실험식은 다음과 같이 회귀직선으로 표시된다.

GP… $Y=0.9X-12.8$

GE… $Y=0.96X-15.11$

VS… $Y=0.94X-17.57$

5. 재배사내에 유입되는 공기 및 사외로 배출되는 공기에 관한 실험식은 다음과 같이 회귀직선 및 지수곡선으로 표시된다.

5.1 배출속도 Ycm/sec.를 유입속도 Xcm/sec.의 함수로 하는 회귀직선식

GE—CV(50%)법… $Y=1.01X-1.65$

GE—CV(100%)법… $Y=0.42X+2.03$

VS—CV(100%)법… $Y=0.85X+0.96$

5.2 배출량 Ym³/hr.를 유출량×m³/hr.의 함수로 하는 회귀직선식

GE—CV(50%)법… $Y=2.59X-10.88$

GE—CV(100%)법… $Y=2.16X+26.53$

5.3 상면 공기이동 속도 Ym/sec.를 배출공기 속도

(p.12에 계속)