Cocoa Quarantine Project

Department of Horticulture
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Introduction

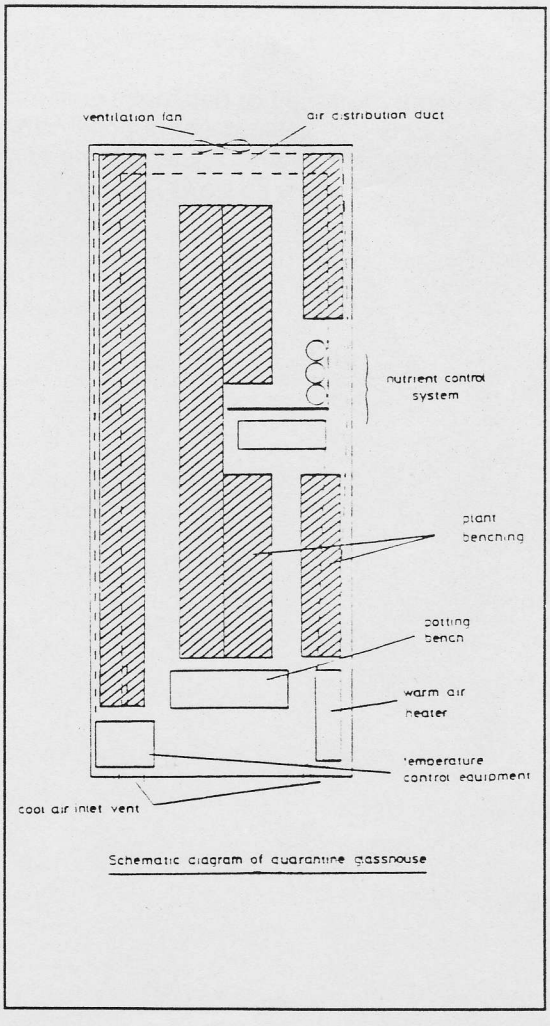
The Cocoa Quarantine project based at Reading University has been set up to enable new and interesting germplasm to be made available to Cocoa breeding programmes. The project is coordinated by the Biscuit, Cake, Chocolate and Confectionary Alliance and is funded via subscriptions by groups interested in receiving material. Under the scheme, germplasm, once available for distribution, is made freely available to all participants. Material is also available to groups not participating in the scheme, however, in these cases a charge will be made per clone supplied.

It is now some 17 months since the Cocoa Quarantine Project began and the purpose of this newsletter is to report on our progress to date. Here we describe the new facilities that have now been established to house the material in quarantine, and some of the plant husbandry and propagation techniques we employ.We have also included a list of clones presently in quarantine and news of likely sources of material that we hope to receive in the coming months.

Quarantine House

The first phase of the project (approximately six months) was devoted to establishing the growing facilities required for the project. The site of the Quarantine Facilities is at the Horticultural Research Laboratories at Shinfield Grange, approximately three miles from the main University Campus. A polythene covered tunnel with a floor area of approximately 100m^2 has been used as the basis of the quarantine house. This utilises much of the technology developed during the construction of our main cocoa research greenhouse. To enable both high temperatures and high humidities to be maintained even in U.K. winter conditions, the house is covered with two layers of a novel polythene film containing an infra red filter to increase its insulating properties whilst retaining a high transmittance to visible light. These films are separated by an air gap produced by an internal fan which blows air from within the greenhouse between the two plastic films. Heating is provided by an oil fired, warm air heater, hot air is distributed evenly around the greenhouse through a perforated polythene pipe. The air heater has been modified so that its main fan is on continuously so that the air within the greenhouse is uniformly stirred. Cooling, when required, is provided by a single 60 cm fan situated at one end of the greenhouse. when this is turned on cool air from outside the greenhouse is drawn through vents at the opposite end of the greenhouse. Heating and cooling is operated by solid state controllers. A motorised high pressure misting system provides additional humidification if this is necessary. The greenhouse is nominally maintained at a day temperature of 28°C and night temperature of 19°C with a 12 hour thermoperiod. Relative humidity is normally between 75% and 85%.

Stock plants are arranged on benches positioned approximately 30 cm above the floor of the greenhouse. Cocoa is very sensitive to nutrient disorders and does not grow well fro long in conventional potting composts. This is because nutrient imbalances build up quickly which rapidly affect the growth of the plant. At Reading we have successfully overcome this by growing plants in a completely inorganic medium of vermiculite, sand and gravel, which is irrigated with a modified 'Long Ashton' nutrient solution rather than using conventional potting composts. The growing medium is free draining so that frequent irrigation can be employed without any danger of waterlogging enabling salts to be washed out of the rooting medium with the drainage from each pot. The nutrient solution is held is a recirculating central

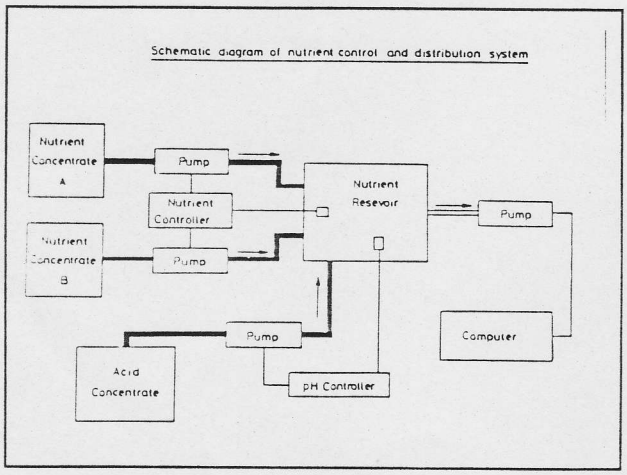


Schematic diagram of quarantine glasshouse

tank (250 litres) which is fed with tap water through a float valve. When required nutrient solution is pumped through a network of drip lines enabling each pot to be irrigated with exactly the same volume of solution. The timing and duration of each irrigation is controlled by a small micro processor controller. As nutrient is pumped out of the central tank it is replaced with tap water. A conductivity probe immersed id the tank is connected to a controller which pumps concentrated nutrient from two stock tanks to maintain nutrient concentration within the tank.

It is very important to maintain soil pH at approximately pH6 , since either too high or too low a pH can also lead to nutrient imbalances due to certain elements being rendered unavailable under these conditions. To achieve this a pH probe senses the pH of the nutrient solution. This is connected to a controller which pumps a mixture of dilute nitric and phosphoric acid into the nutrient solution to maintain the slightly acid conditions required for optimal growth.

The system is set to irrigate the plants on up to seven occasions per day depending on the time of year (fewer irrigations are required during the winter months). The system has the added advantage that irrigation is automatic and requires only replacing the acid and nutrient stock solutions and periodic checks of drip lines for blockages.



Plant Raising

While the quarantine greenhouse was under construction, space was made available elsewhere within the department for raising seedling material for stock plants. These were transferred to the new greenhouse in August 1987. Seed of cv Amelonado was used throughout from mature pods harvested from trees in our main cocoa research glasshouse Once these have produced approximately two flushes of growth they are ready for budding.

Clonal Propagation

Our first budwood was imported from the germplasm collection of the Cocoa Research Unit, Trinidad in October 1987. At first, our budding success rate was low, primarily due to our inexperience in budding cocoa. But through the perseverance of Theresa Lee who has been employed to provide technical assistance for the project these initial problems have been overcome. Once successfully established , the buds have generally grown away quickly and appear to thrive within the quarantine house. During the initial phase of bud growth we have found that some shading is beneficial but later this can be dispensed with.

We have continued to obtain budwood from the Cocoa Research Unit and also from Turrialba, Costa Rica and also Ghana. Our list of clones is growing all the time although progress has been slow more recently because of problems in obtaining material from germplasm collections outside the growing season.. A list of those clones currently in quarantine is given overleaf and this is being added to continuously.

Present Position

Much of the first material to enter the quarantine house is now growing vigorously and we have now progressed to top budding with Amelanado as the last part of the quarantine procedure. Visual symptoms produced on the Amelanado shoots budded onto the clones form the basis for indexing the clones for viruses. As yet we have not detected any other disease problems on the material in quarantine. At this stage it is difficult to predict exactly when the material will be available for distribution, but we hope that this will be in the next few months.

Future Developments

Now that the growing season has begun again in Trinidad, we hope to be receiving more clonal material shortly. We also hope to receive more material from Costa Rica. A major target in the coming year will be to obtain material from Chalmers' collection presently located at Pichilingue, Equador.

We are very interested to hear from those of you who are participating in the project. Do also let us know if you have any particular requirements that you feel we should undertake. Drop us a line !

Paul Hadley

(Project Leader).

LIST OF CLONES IN QUARANTINE AT READING OCT. 1988

AMAZ 3-2*
AMAZ 5-2*
AMAZ 6*
AMAZ 6-3*
AMAZ 10-1*
AMAZ 10-3*
AMAZ 12*
AMAZ 12-4*
AMAZ 15*
AMAZ 15-15
A 196*
BE 2
BE 3
BE 4*
BE 10
CC 11 Puerto Rico
CC 38
COCA 3370-5*
C SUL 3*
C SUL 7*
EET 272
EQX 0*
EQX 69*
EQX 78*
EQX 3308-1*
EQX 3310-3*
EQX 3161*
EQX 3348-44*
EQX 3348-52*
EQX 3360-3*
EQX J5*
EQX 2*
ICS 16*
ICS 100*
IMC 9
IMC 11
IMC 14
IMC 20
IMC 27*
IMC 43*
IMC 47*
IMC 48*
IMC 54
IMC 61
IMC 67
IMC 77
IMC 78
IMC 83
IMC 96
MA 12*
MA 13*
MAN 15-2*
MAN 15-60*
MO 81
MOCO RONGO
MT 1*
MXC 67
NAPO 2*
NA 33*
P-4-A
P-4-B
P-7-B
P-9-C
P-16-A
P-19-A
P-19-B
P-21-A
PA 4
PA 7*
PA 18
PA 20
PA 30
PA 51
PA 56
PA 70
PA 88
PA 107
PA 137
PA 179
PA 300
PUCALA 1
RB 29*
RB 33/3
RB 39*
RB 41*
RB 43*
RB 46*
RB 47*
RB 49*
SC 1
SC 3
SC 4
SC 9
SC 10
SCA 9*
SCA 19
SIAL 93
SIAL 339
UF 669 Cadbury Indi
UF 676
UF 705 Puerto Rico
Y44