

A LOOK AT SOME DUTCH GREENHOUSES AND RESEARCH EFFORT

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The symposium on climate control in Wageningen, June, 1985, also had a number of interesting tours for one whose last visit to the Netherlands was ten years ago. More than anything else, the Dutch effort in production and research is awesome. The symposium participants were able to visit the Westland area (**Fig. 1**), with most visits to vegetable production areas (**Figures 2-4**), although a few ornamental ranges were included (**Fig. 5**). The Westland area of about 36,000 acres contains 4,817 acres in greenhouse vegetable production and 3,582 acres in greenhouse ornamental production — or nearly a fourth of the total land area is covered by mostly Venlo-type, single layer, glass houses. More than 10,000 are employed in some 3,200 establishments with an average size of about 100,000 square feet. The owner at the tomato operation (**Fig. 2**) indicated an average yield of up to 14.3 pounds per square foot per year of Beef Steak tomatoes with the major portion being grown in rockwool. The radish operation (**Fig. 3**) produced 7 to 8 crops per year, or about 7 to 8 bunches per square



Fig. 1: Westland area of Holland. According to some jokesters, the Dutch were dissatisfied with God when he divided the waters. So the Dutch did it over again and then covered the land with glass. In traveling, the majority of greenhouses appeared to be the narrow span, Venlo type, single layer glass, with high eaves.

foot annually. The chrysanthemum grower produced 3.7 crops yearly, in the range of 11 to 16 stems per square foot per year. A comment was made that it required about 114 cubic feet of gas per square foot to heat the mum range.

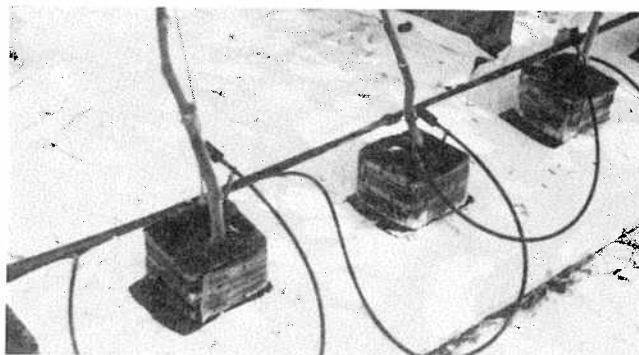


Fig. 2: Tomatoes in GRODAN rockwool. The entire floor plus rockwool cubes covered with white plastic. Made a very impressive sight. Most of the tomato ranges visited used rockwool, although predictions are that the industry will be using something else in a few years. All systems are "open", that is, there is no re-circulation of the nutrients and water.

The research effort in the Netherlands leaves one gasping. There are, in a country smaller than Colorado, a total of 20 research stations, including Wageningen, the Agricultural University. The University has 600 staff, 1,200 technical staff, 70 departments and 6,000 students, with a very heavy involvement in foreign agriculture. At the engineering institute (IMAG), there are three people alone involved in computer development for climate control. The principal ornamental research station has over 200,000 square feet of greenhouses (**Fig. 6**) with nearly every project having some component on postharvest keeping life of plant material. Each of the houses, one of which is shown in **Fig. 6**, were

¹Professor.



Fig. 3: Something seldom seen in the U.S. A greenhouse of radishes and lettuce. A Danish colleague indicated they imported their radishes from Texas. Takes a little figuring on this one.



Fig. 4: Double use of hot water heating pipes. In this tomato crop, the small trolley for carrying the fruit travels over the heating pipe. No steam systems observed. In spite of more bottom heat in greenhouses, some ranges still had a lot of overhead piping — which, of course, reduces sunlight.

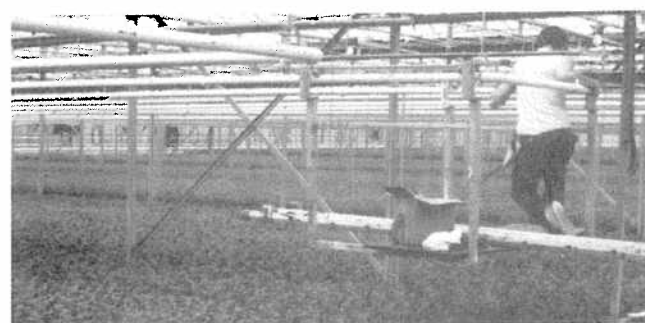


Fig. 5: One way to do a 100% ground area chrysanthemum crop. The heating pipes are fastened to the support system which can be moved up and down, keeping the most heat close to bud level. As noted, the worker gets around with an overhead trolley.

extensively instrumented. Some idea as to the magnitude of the effort is given in **Table 1**, showing the number of specific projects for various plant species. A number of the smaller experiment stations where more demonstration-type work is done may have upwards of 60,000 square feet under cover.

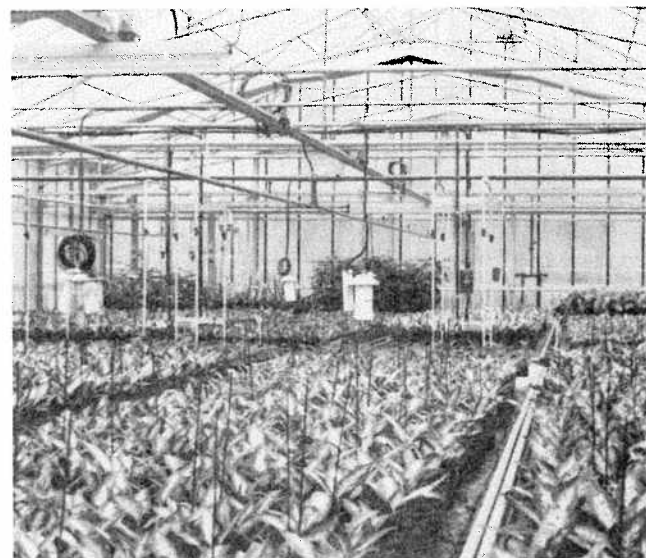


Fig. 6: Experimental greenhouse at Aalsmeer. Each house devoted to a single crop. In this range of several compartments, each compartment had its own CO₂ analyzer. The total area of the Aalsmeer research station is about 200,000 sq. ft., most of it computer controlled.

Table 1: Identifiable research projects at the Netherland's main ornamental research station, Aalsmeer.

Species	Number of projects	Species	Number of projects
Cut flowers			
General	3	Calathea	1
Alstroemeria	6	Calceolaria	1
Carnation	10	Codiaeum	3
Anthurium	3	Columnea	1
Bouvardia	1	Cordyline	1
Chrysanthemum	7	Cyclamen	2
Cymbidium	4	Episcia	1
Euphorbia	2	Gardenia	1
Eustoma	1	Gesneriaceae	2
Freesia	2	Gloxina	1
Gerbera	6	Hibiscus	3
Lily	2	Jacobinia	1
Nerine	3	Kalanchoe	3
Phalaenopsis	1	Peperomia	1
Rose	13	Phalaenopsis	1
Strelitzia	1	Poinsettia	1
Perennials	1	Pot chrysanthemum	1
		Pot roses	1
Pot plants			
General	3	Saintpaulia	1
Aechmea	3	Schefflera	1
Aeschynanthus	1	Sinningia	1
Beloperone	1	Spathiphyllum	1
Begonia	3	Streptocarpus	2
Cacti	1	Whitfieldia	1
		TOTAL:	111

In view of this research effort on the part of the Dutch, **Table 2** was compiled as a means of comparison. Note, that for the Dutch, the greenhouse industry is a major agricultural industry as compared to the U.S. with its much greater total land area, population and high gross national product.

Computer development and new instrumentation is being extensively investigated (**Fig. 7**). As mentioned in a previous bulletin, computer sales are being generated by a number of companies (**Fig. 8**). Mechanization, and some quite expensive methods are being investigated (**Fig. 9**).

Table 2: Some comparisons of greenhouse production.

Data from Flowers Unlimited, 1982. Coop. Vereniging "Verenigde Blemenveilingen Aalsmeer", Aalsmeer, The Netherlands.

Country	Total area (Square miles) (thousand)	Population (million)	Ornamentals (Acres)	Vegetables (Acres) ²	GNP ¹ (billion)
Holland	15.8	14.2	13,000	11,700	\$138
Denmark	16.6	5.1	952	—	57.6
Columbia	439.7	28.8	3,000	—	36.0
Israel	8.0	3.9	3,200	125	16.0
Italy	116.3	57.2	8,474	5,000	345.0
Belgium & Luxembourg	12.8	10.2	3,500	—	123.0
Central America	104.8	13.6	4,200	—	27.0 million
West Germany	96.0	61.7	6,422	3,000	658.0
France	213.0	54.0	5,000	1,000	568.0
Spain	194.9	37.6	3,705	1,800	212.0
U.S.A.	13.6 million	229.8	14,820	575	2.9 trillion
Thailand	198.5	48.1	1,067	—	37.0
Kenya	225.1	17.2	1,000	—	6.8
Great Britain	94.2	55.7	1,286	1,600	525.0
Brazil	3.4 million	123.0	2,470	—	286.0
Singapore	0.3	2.4	845	—	8.4
Japan	143.8	117.6	29,350	1,000	1.1 trillion
Ivory Coast	124.5	8.3	2,600	—	6.4
Australia	3.0 million	14.9	2,744	—	161.0

¹Gross national product in U.S. dollars.

²From Jacobs and Meyaard, 1975.

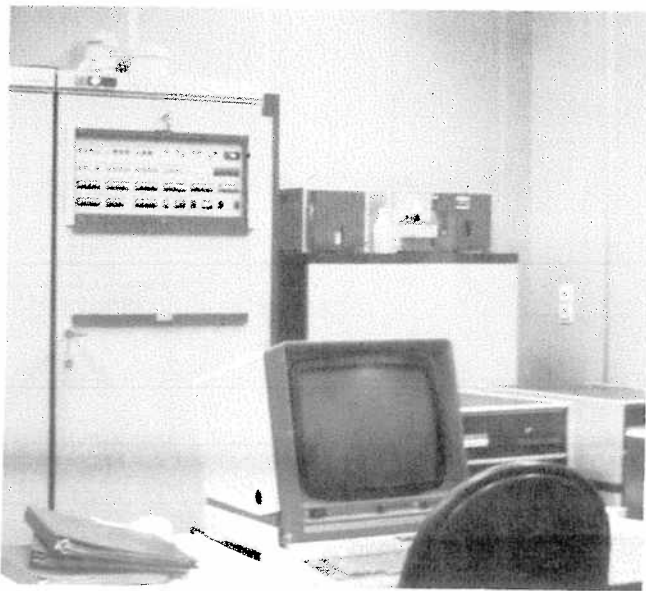


Fig. 7: An older computer controller at the Aalsmeer research station. This, with the newer, multi-level control system is located in a central, air-conditioned room.

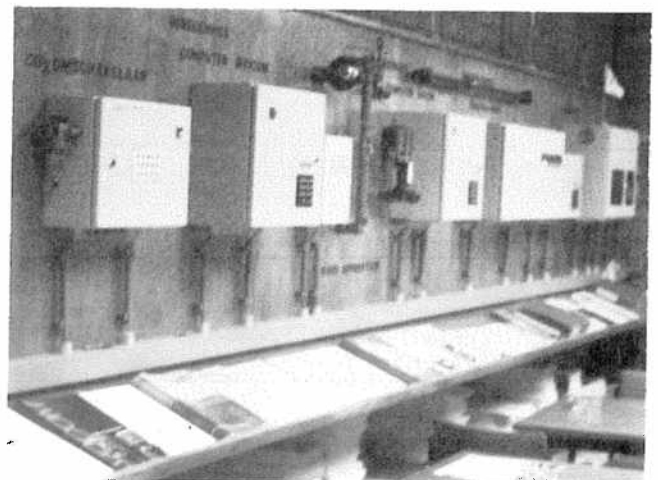


Fig. 8: A control and computer demonstration room at Brinkmans, Inc., The Netherlands. This company, one of several providing greenhouse control computers in Holland, stated they had 85 to 90 people designing, building and writing software in their greenhouse divisions. A central location such as this in the U.S. probably not practical except in areas of major greenhouse concentrations.

Occasionally, the Dutch are kidded about being slow and meticulous — but they eventually get there. The massiveness of this effort is showing fruit, and indicates that the Dutch will be in the forefront of technological advances for a long time. The difficulty in using the information, which is usually available, is the fact that the Dutch climate is completely different from most places in the U.S. For one thing, the latitude of the country places it north of the Canadian border so that extremes of photoperiod are completely different. Secondly, the climate is greatly moderated by the ocean influence (maritime), so that the temperature extremes experienced by the continental U.S. are seldom encountered. The clear-day regimes noted in the Southwest U.S. are not available to Holland. Structures, practices, etc., generally must be adapted for the climatic region.



Fig. 9: One way of doing pot plant culture at IMAG (Engineering Research Center) Holland. The floor is poured concrete with heating pipe embedded. The spots are air holes for warm air. The strip is probably drainage channel as the plants are irrigated by flooding. Advantages are that heat is close to the plant and moving air helps with disease and CO₂ control. Disadvantage is expense. No commercial ranges noted with this system.



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