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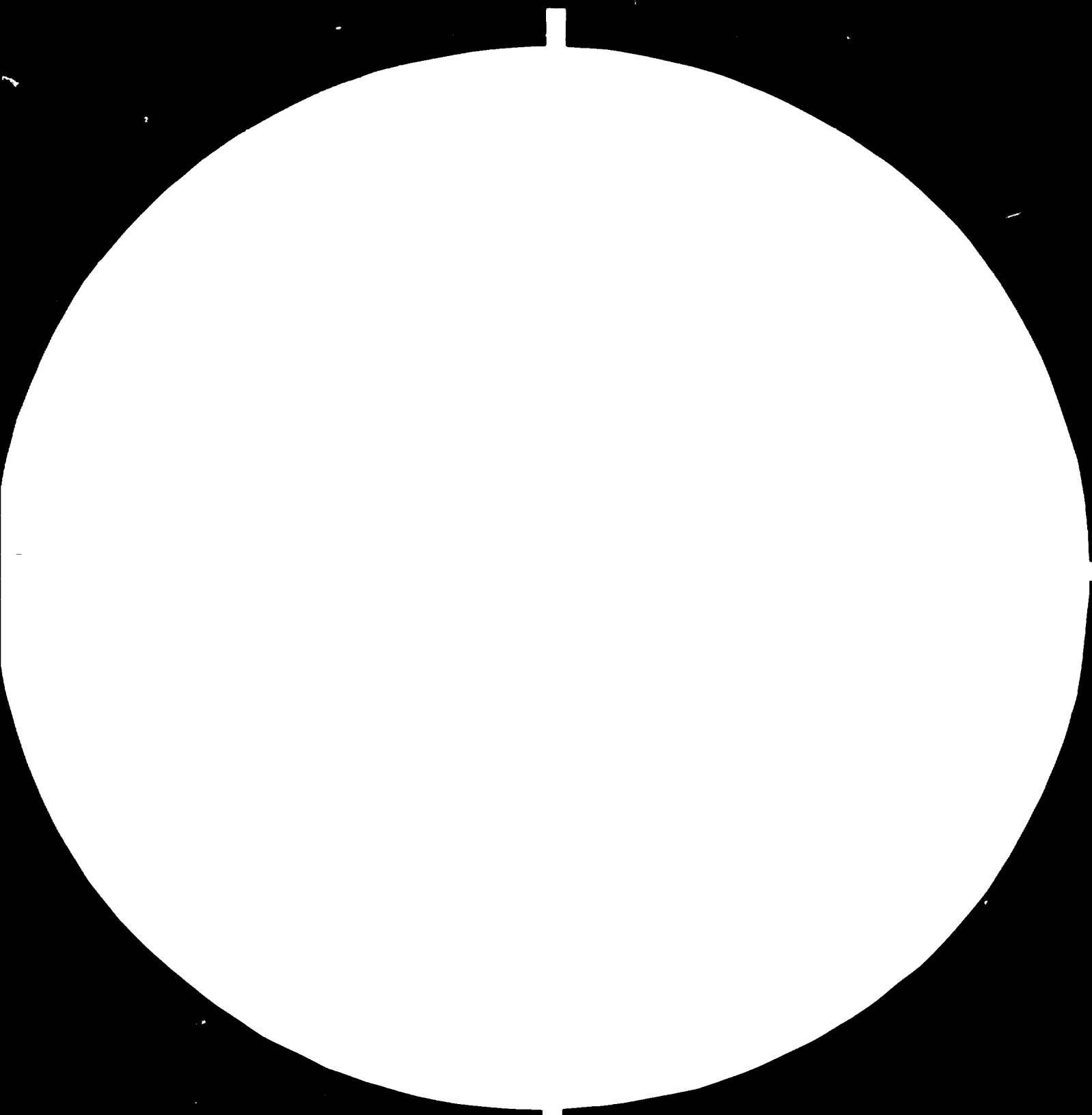

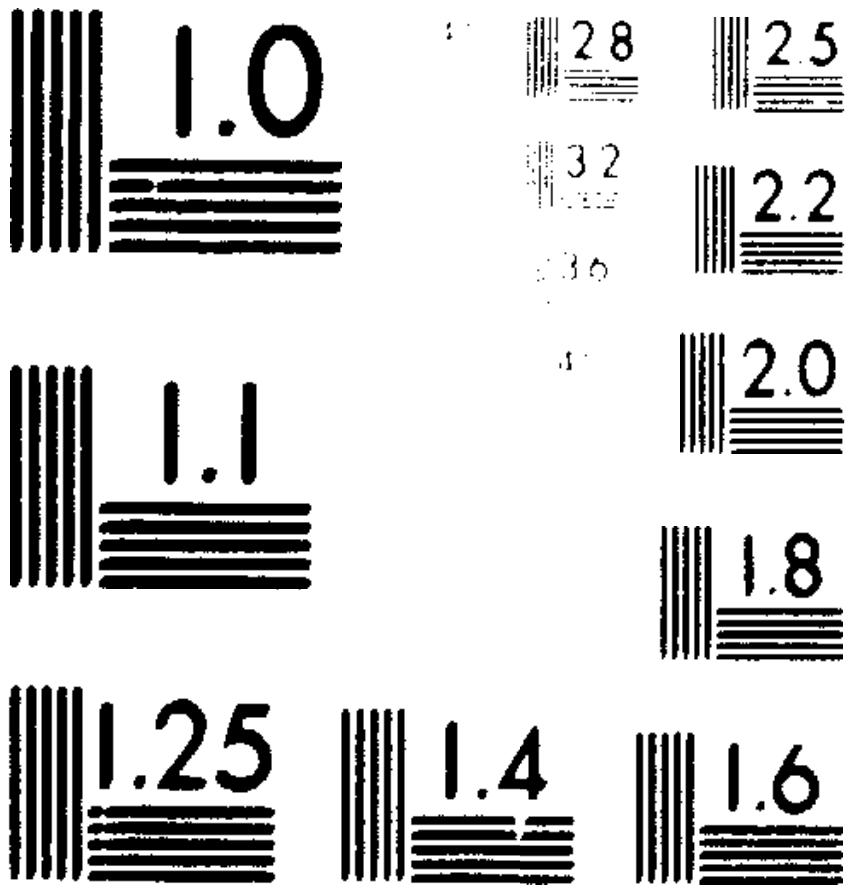

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Visit to Mexico,
6 January to 4 February 1981

Report by
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N.B. In order to avoid the waste of time involved in travelling to Mexico City for debriefing, this "final" report is being prepared on 1 February 1981 so that it can be submitted to UNDP Mexico prior to the proposed departure on 4 February 1981. By this means it is hoped that two extra working days can be profitably used at the duty station of CIQA, Saltillo.

1. Introduction

The period between 8 January and 4 February 1981 was spent at the duty station of Saltillo. Considerable practical progress has been achieved since the visit in November 1979, particularly in the erection of more greenhouses and an area of low tunnels, and the station has purchased a small John Deere 4-wheel tractor.

Also since the end of 1979, the two technical horticultural staff then employed on 'plasticulture' had left CIQA to be replaced with three new graduates, one of whom has special responsibility for the greenhouse. CIQA seems fortunate in its choice of these new people.

Very severe weather in Saltillo, with the heaviest snowfall for several years, occurred in the early part of the visit. Happily, some of this bad weather coincided with discussions with CIQA staff, deciding on a programme of work, and purchasing required materials. Most of the field work detailed below took place in the last two weeks of January, when the weather was good.

2. Work Accomplished

A. Discussions with CIQA staff

Considerable time was spent in showing transparencies of 'plasticulture' activities in other parts of the world, and deciding which applications would be relevant to Mexican conditions. Following these discussions, a proposed work programme was formulated. Also, some technical leaflets were photocopied for retention at CIQA, and some slides were selected for duplication.

B. Windbreaks

The field station at CIQA is exposed and it was agreed that a demonstration windbreak should be erected. This was completed on 24 January 1981. Constructional details are as follows:

Ten timber posts, each 3 m long and 4" x 4" in cross-section, were placed in line at 5 m intervals and buried to a depth of 1 m, thus the completed windbreak was 2 m high. A strong galvanized steel wire was tensioned along the top of the posts and fixed to stout anchors at each end.

The only suitable netting locally available was galvanized wire sheet netting with a mesh size of 4" x 6". Each roll was 40 m long by 1 m wide. Two rolls were secured to the timber posts and strips of black polyethylene film, 4" wide and approximately 150 microns thick were threaded through alternate meshes. Thus the windbreak had a 50% permeability factor. Such a windbreak will provide acceptable protection for an area nine times the height of the windbreak (in this case 18 m) to its leeward side.

Note that this windbreak is expensive. Costs could be reduced by:

i) Substituting sawn timber supports for less costly uprights. Round-pole timber (as cut from the tree) should be cheaper but no local source could be found.

ii) Substituting the metal mesh for a suitably durable synthetic (plastic) net. It is most likely that suitable netting is available in Mexico.

C. Silage

A small silage 'clamp' was made on 15 January 1981, using a single sheet of black polyethylene sheeting some 7 m wide x 14 m long, with a thickness of about 150 microns. 42 bales of alfalfa each weighing about 30 kilograms were ensiled . The clamp was made airtight by stapling the edges of the top and bottom sheet together, then rolling the stapled edges tightly. On a farm, the whole silo would then be covered with soil or old motor car tyres - anything that would keep the plastic in close contact with the ensiled material. On this small trial, the exposed plastic sheet was left uncovered, with instructions that it should be regularly inspected for any tear or pinholes which, if found, were to be repaired with plastic adhesive tape.

It is understood that samples of the silage are to be extracted for analysis at regular intervals during the storage period.

D. Ventilation of Large Tunnel Greenhouses

It has been found that the 4 m wide tunnels and the large 5 m wide tunnel erected in November 1979, although only 50 feet long, were becoming unacceptably hot on sunny days, even as late in the season as November. These tunnels have been covered with PVC sheeting which , because of its transmission properties, would endanger higher temperatures than polyethylene film.

The problem was to provide as much ventilation as possible for use in hot weather while at the same time being able to make the tunnel as air-tight as possible during colder periods.

The solution chosen and demonstrated on one 4 m wide tunnel was to ventilate along the whole length of one tunnel, as described below.

A timber 'rail' of 3" x 2" cross-section was secured to the metal hoops at 1.5 m from, and parallel to, soil level along the whole length of one side of the tunnel. Circular holes were then cut in the film between the timber batten and soil level so that about one half of the plastic in this area was completely removed. If found necessary, the number of holes can be increased in size or number so that up to 3/4 of the plastic film along the ventilation strip can be removed. Strips of new plastic sheeting, each 1.5 m wide by a little over 3 m long were then secured along one long edge to the timber batten so that each piece of plastic, when rolled up and secured to the timber rail left the whole of the ventilated area free of obstruction. When these pieces of plastic were unrolled downwards over the ventilation area the greenhouse becomes as airtight as previously. Provision was, of course, made to secure the plastic 'blinds' securely both along the timber rails and at ground level.

It is thought likely that adequate ventilation (cooling) will be achieved by this method, even in the hottest weather. However, if ventilation is still inadequate the same procedure can be adopted on both sides of the tunnel.

E. Manufacture and Erection of 4 m Wide Tunnel Greenhouse for CONAZA

A 4 m wide tunnel, 10.5 m (35 feet) long was fabricated from $\frac{1}{2}$" diameter galvanized steel tubing at CIQA and erected and covered on a CONAZA station in Saltillo between the 28 and 30 January 1981. Construction was identical to that made previously at CIQA in 1979, except that provision was made for continuous side ventilation as outlined in 2.D. above.

The exercise gave CIQA staff useful experience.

F. Shade Area

It was decided to erect a shade area covering 20 m x 30 m (600 sq. metres) since this area fitted conveniently the site available. The specification was that the shade material should be of adequate height to permit tractor cultivation beneath it and the height chosen was 2.10 m.

The supporting uprights were of sawn timber, each 2.5 m long and $3\frac{1}{2}$ x $3\frac{1}{2}$" in cross-section. They were put into the ground at intervals of 5 m in each direction, so that the top of the shade was 2.10 m above soil level. A lattice of tensioned wires was secured to the tops of the posts in each direction (e.g. along and across the rectangular area of land covered) and each wire was secured to anchor posts at 5 m distance from the outside posts. The supporting framework was completed on 27 January 1981.

On the 2 February 1981 a nylon monofilament net, 3" x 3" mesh, 5 m wide, was received at CIQA. Work started on covering the shade area on the afternoon of that day. On 3 February 1981 work started on threading strips of black polyethylene film through alternate meshes of the net.

3. Suggestions

A. Plastic Shade Netting

In Europe and USA woven or knitted plastic shade netting is being used on an increasing scale in horticulture. In Italy and France in particular plastic netting is widely used to protect fruit from hail damage. It can also offer very limited amount of frost protection during blossom time. Apples are similarly protected (against hail) in fruit growing areas near Saltillo.

If such netting is manufactured in Mexico and is available at an economic price, consideration should be given to its use for

i) shade areas
ii) windbreaks
iii) as a covering material for tunnel greenhouses used (particularly for propagation) during the hotter months.

Note that the manufacturers of such netting may not be aware of the potential market, and, perhaps more important, may not appreciate that such netting must contain appropriate U/V stabilizers for outside use.

4. Observations

A. Quality of Black Polyethylene Films

The black polyethylene film used on the windbreak (2.B. above) was not adequately loaded with carbon black and consequently cannot be expected to have a long life outside. A good simple test of outside durability is to hold a piece of film up to the sun and, in a film with adequate carbon black, the outline of the sun should not be visible. It is quite possible to make films as thin as 40 microns which will pass this simple test.

The question of sufficient black pigmentation can also be very important for mulching films, particularly when these are used for crops which will last for more than one season e.g. fruit trees.

B. Low Temperature Brittleness of PVC Sheeting

Some damage to the PVC cladding on the tunnel greenhouses occurred during the unusually cold spell in early January. It was not definitely

established whether the damage was due to vandalism or low temperature brittleness, or a combination of both factors. However, as things stand, the manufacturer should be questioned on the low temperature properties of the film and asked to modify the formulation if it does become brittle at low temperatures.

C. Flat Roof Pitch on the Ridge and Furrow Greenhouses

It was noticed that rain tends to collect in pools or puddles on top of the plastic on some of the panels of the greenhouses which have a gentle roof pitch, particularly if the plastic had not been tightly stretched over the framework. Such pools of water can, in sunshine, act as lenses which focus the sun's energy on to the crop below, with scorching effect. The pooling can be reduced by stretching wires tautly at intervals of about 30 cms between ridge and cave, but it would be difficult to do this properly without removing the plastic.

5. Recommendations

A. Tunnel Greenhouses - Protection of 'Hot Spots'

One of the major cost inputs of cultivation in plastic greenhouses is the replacement of the plastic cladding. Any method of increasing the life span of the plastic is therefore important. On greenhouses the film degrades most rapidly at those places where it is stretched tautly over the supporting structure since, at these 'hot spots' the film becomes hot when the sun shines and the photo-degradation of the plastic accelerates at high temperatures. The film can easily be protected at 'hot spots' by painting it on the outside with any paint which will shield the plastic from ultra-violet radiation. Aluminium paint is most commonly used.

In France, any guarantee given by the makers of 'long-life' greenhouse films is conditioned on the film being painted at these critical points.

It is therefore strongly recommended that, at CIQA, painting of 'hot spots' should proceed as standard practice as soon as possible after cladding any tunnel greenhouse.

B. Greenhouses - Propagation Practice

Growing in greenhouses, and, to a lesser extent, growing under low tunnels is expensive, but hopefully the expected yields justify the costs involved by being earlier (and consequently of higher value) or heavier, or of better quality, or a combination of these factors.

It is vitally important that crops should have the best possible environment and receive minimum check to growth at the stage between seed-sawing and planting out the young plants.

It is suggested that current practice at CIQA could be improved by:

i) Using sterilized soil for seed sawing, and for transplanting the seedlings into individual containers at the cotyledon stage, even if this means importing compost of known provenance.

ii) Using one greenhouse (most probably a 4 m wide tunnel) exclusively for plant propagation. The greenhouse should be equipped with benches and some form of heating - at least sufficient for frost protection.

iii) Seed is relatively cheap and a number of plants in excess of those expected to be required should be raised as a matter of course, to compensate for any unexpected losses.

C. Greenhouses - Fertilizer Application

Because of the high cost of production in greenhouses no loss of output can be tolerated from inadequate nutrition. Normal practice for greenhouse production when the crops are grown in soil is initially to apply a 'base dressing' of fertilizer in amount and proportion according to a soil analysis and subsequently to liquid feed the crop at intervals throughout its life.

Simple and precise liquid feeding recommendations for the major crops (tomatoes, cucumbers, peppers) are given in the leaflets from the Lee Valley Experimental Horticulture Station (England) "Cropping in plastic tunnels" and the Kinsealey (Dublin) booklet of similar title, copies of which are available at CIQA.

Liquid fertilizer application can conveniently be made by either of two methods:

i) Using a commercial diluter, in which a concentrated solution is injected into the water supply at a pre-determined rate.

ii) Equipping the greenhouses with a tank raised $1\frac{1}{2}$ to 2 metres above soil level. The required amount of fertilizer is dissolved in the tank and the diluted solution can be applied to the crop by gravity at perhaps weekly intervals.

D. Plastic Mulches - Conventional Plastic Mulch

Present mulching practice at CIQA is to cut a circular hole in the plastic before planting the seedling (or sawing seeds). Better results may be obtained by planting or sawing through cross-cuts in the mulch, each cut being at right-angles to the other, and about 10 to 12 cms long.

E. Plastic Mulches - Reflective Mulch

During the summer months reflective mulches may have surprising advantages over conventional black mulch, particularly for plants of the cucurbit family, and it is therefore recommended that trial quantities of black/silver or black/white mulching films are imported. A known supplier is: Polyagno Plastics Inc., Second and Depot Streets, Bridgeport, Pa. 19405, USA.

F. Low Tunnels

While the present low tunnels at CIQA are well made and practical, farmers might complain that the cost per square metre covered is high. This could be reduced, especially for narrower tunnels, by using supporting hoops made from high tensile galvanized steel wire in 6 or 8 S.W.G. (Standard Wire Gauge). 6 S.W.G. has a diameter of about 5 mm and 8 S.W.G. of about 4 mm. It is important to use High Tensile wire, since this will not distort or bend under any load imposed on it. This observation (concerning cost reduction) is particularly true if the width of the tunnel does not exceed 1 metre. In the early part of the year tunnels narrower than 1 m could be very useful to enhance the earliness of plants which will subsequently be grown without protection.