HORTICULTURAL RESEARCH, 1991 - OVERTON

RESEARCH CENTER TECHNICAL REPORT 91-1

Texas A&M University Agricultural Research & Extension Center
at Overton

Texas Agricultural Experiment Station
Texas Agricultural Extension Service

Overton, Texas

June 20, 1991

TULIP CUT FLOWER PRODUCTION USING A LOW ENERGY INPUT GREENHOUSE

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INTRODUCTION

A potential exists for the greenhouse production of cut flowers in east Texas. Over 400 million dollars worth of nursery and floral products are sold at the wholesale level in Texas each year, but only a very small percentage is from cut flower products. Conventional greenhouse practices that demand high labor and energy inputs make local production uncompetitive with international producers, such as Mexico and Colombia, which have mild climates and inexpensive labor, and even with domestic production in California where the climate is conducive to year-round field production.

If production is to become competitive in east Texas, production cost must be reduced. One method of reducing cost is the use of pre-existing structures and cultural techniques modified to reduce heating and cooling expenses. These modifications include retrofitting a conventional greenhouse with collapsible or roll up sides, construction of raised ground beds, and a modified crop schedule to allow for lower growing temperatures.

For the purpose of this study, tulips were selected as a possible cut flower crop targeted for the Valentine's Day market (February 14). The structure used in this study was a Quonset style plastic covered greenhouse. The objectives of this study were threefold. First, to find out if a pre-existing Quonset greenhouse could be modified as a low energy input structure as described above. Second, to ascertain if a cut flower crop, in this case tulip, could be scheduled and successfully grown for a specific market under local conditions. Third, to determine the effects of shading on tulip stem length during production, a stem length over 14 inches being commercially desirable.

MATERIALS AND METHODS

Greenhouse Modification

A 20' x 80' Quonset greenhouse equipped with pad and fan cooling, and LP gas-fired heating was selected for modification. This greenhouse was of a style that had continuous curved bows with no vertical side walls. A system of PVC pipe, ropes,

and pulleys was connected to a running board attached to a perlin 5' above the ground. This system allowed for the sides of the greenhouse to be rolled up and down by a single operator. The heater thermostat was lowered to 50°F.

Modifications included the construction of two raised ground beds each 3 ft wide, 32 ft long, and 12 inches high. These were constructed of landscape timbers and secured by metal spikes.

Bed Preparation

A commercial grade pine bark/sand growing media [3 parts ground bark to 1 part sand (v/v), with dolomitic lime] was mixed with a fine sandy loam soil on a 1:1 basis in the raised beds. Resulting medium was fumigated by the incorporation of Basamid (Dazomet) at 6.5 oz / 100 ft^2 to a depth of 8 inches. After treatment, beds were adequately aerated and watered.

Bulb Treatment

Bulbs of *Tulipa* cultivars 'Oxford', 'Maureen', 'Negrita', and 'Queen of Bartigon' arrived from a commercial source on 28 September, 1990 and were immediately placed in 41°F dark storage for a period of thirteen weeks (DeHertogh 1985). Just prior to planting, bulb tunics were removed and bulbs were dipped for 30 minutes in a Benomyl 50% WP plus Truban 30% WP solution.

Growth Of Plants

Bulbs were planted on December 21, 1990, 1 inch deep on 2 inch centers in a row with a harvest target date of February 7th. Rows were 2 inches apart with 4 inches between cultivars within each treatment plot. After planting, all treatments were drenched with Truban 30% WP. Care was provided as needed and plants were fertilized twice weekly with 2 lbs $CaNO_3$ / 100 gal water. Side walls were raised when inside temperatures reached 70°F. Night temperature was maintained at 50°F.

Plants were harvested by cultivar when half of the flower buds showed 50% color. At harvest, entire plants, with bulb attached, were lifted from the media and various measurements taken. Plants were stored dry with bulbs attached at 41°F prior to subsequent post harvest evaluation.

A randomized complete block design with a split plot restriction was used with the following treatments: control, 30% shade cloth once bulbs emerged, and opaque covering until bulbs emerged to a height of 2 inches then removed. Treatments were

main plots with cultivars as sub-plots. There were 4 blocks with 27 bulbs/cultivar in each treatment.

Post Harvest Evaluation

After each cultivar had been harvested and conditioned at 41°F for 6 hours, 5 plants from each treatment were cut to a uniform stem length of 12 inches and placed in glass beakers containing 1/2 pint of deionized water and kept in a typical interior environment of 77°F with 30 μMoles sec^{-1}/ m^2 photosynthetically active radiation (170 foot candles) under cool white fluorescent lights. Plants were evaluated for shelf life and for stretching in the internode subtending the flower.

RESULTS AND DISCUSSION

The greenhouse was successfully modified to allow for cross ventilation via the rolled up side walls. As a result, no energy input was required for cooling purposes as air temperatures could be kept at or near ambient. Commercial sidewall modification kits are available, but are relatively expensive (approximately $2000) and require energy to operate. The system used in this study was inexpensive (approximately $100) to build and was manually operated. A major concern in this type of modification is gaining a tight seal along the sidewall/endwall interface because of the lack of a vertical sidewall. Further development along these lines is needed to reduce air leakage and improve heating efficiency.

Harvest dates for the cultivars were as follows: 'Oxford' February 14, 'Negrita' February 15, 'Maureen' February 25, and 'Queen of Bartigon' March 7. Unusually cool and cloudy weather during the experiment retarded growth and delayed flower bud development so that all cultivars flowered after the target date. An upward adjustment of the minimum night temperature would have sped up development. But, just as important was the variation in growth rates between cultivars. Cultivar selection and evaluation would be a crucial step to insure that a specific target date could be met.

All cultivars exhibited satisfactory stem length (> 14 inches) regardless of treatment, with Oxford having the shortest and Maureen having the longest average stem length (Table 1). Shading treatment had no effect on stem length. However, the forcing period was unusually cloudy. Shading treatment could help lengthen stems during a sunny forcing period which is possible during some years in east Texas.

Percent flower loss (Table 1) for each cultivar was within the 10% loss normally predicted for this type production system (DeHertogh 1985). Loss was mainly through bud abortion in which the flower bud failed to develop or was malformed. Post-harvest evaluation indicated that none of the treatments affected the shelf life of the cut flowers (data not shown). The average shelf life of the cut tulips was 7 days.

This study suggests that tulip cut flower production is possible in east Texas using modified Quonset greenhouses and minimum energy input. However, careful selection of cultivars would be necessary to insure that target dates can be met.

LITERATURE CITED

DeHertogh, August. 1985. Holland Bulb Forcer's Guide, Third Edition. International Flower Bulb Centre, Hillegom The Netherlands.

Table 1. Growth data for tulip cultivars. Average length (in centimeters) using three growth parameters for each of the three treatments, with percent loss of each cultivar.

Treatment	Foot[1]	Leaf[2]	Total[3]	% Loss[4]
Oxford				
Control	9.3	9.2	35.6	6.5
Opaque cover	9.8	9.8	37.3	6.5
30% Shade	9.8	8.6	35.4	13.9
Negrita				
Control	6.2	10.5	38.3	1.9
Opaque cover	6.2	9.9	37.2	5.5
30% Shade	6.2	10.1	37.4	2.7
Maureen				
Control	7.7	27.7	65.0	4.6
Opaque cover	7.7	26.2	63.0	6.4
30% Shade	9.1	24.3	63.9	9.2
Queen of Bartigon				
Control	8.4	15.9	42.7	6.4
Opaque cover	7.8	18.9	44.9	1.8
30% Shade	8.8	14.1	41.4	5.5

[1]Foot = Mean Length (cm) from first leaf node to top of bulb.
[2]Leaf = Mean Length (cm) from last leaf node to base of bud.
[3]Total= Mean Length (cm) from top of bulb to top of bud.
[4]Loss = Percent unmarketable plants.