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Building and Using a Plastic Greenhouse
A portion of a Tuckcross V plant in the plastic greenhouse showing fruiting of the 7th, 8th and 9th clusters on February 26, 1958. Four fruits had been harvested from the lower cluster when this photograph was made. Leaves were removed from the plant to expose the fruit for photographing.
BUILDING AND USING A PLASTIC GREENHOUSE

E. L. MOORE and KERMIT R. RAY

The high cost of building materials has discouraged many farmers and hobbyists from constructing conventional type greenhouses for growing plants during the cool seasons of the year. Greenhouses may now be constructed at a relatively low initial cost. They are framed with wood and covered with plastic. The construction cost is about one-tenth that of a steel-framed glass house.

In January of 1957 an experimental plastic greenhouse was built 18 feet wide and 60 feet long at State College to explore problems of construction, design, and operation. The house, complete with 1 heating system and exhaust fan, cost slightly less than $700. In private construction this cost may be reduced in many ways. It is estimated that $200 per year will pay for replacing the plastic and provide fuel for heating the house after the first year.

The first part of this article deals with construction and design, and is a revision of Circular 210. It is intended to serve as a guide to those interested in building plastic greenhouses. The second part deals with the operation of the house, cultural practices and the results of two tomato crops.

Construction and Design

The house was 18 feet wide and 60 feet long. The length of the structure may be easily varied to suit individual requirements. Round posts 5 inches in diameter and 8 feet long were sunk 2 feet in the ground. They were spaced 12 feet apart along the two sides. Two half-round posts 4 inches in diameter and 6 feet long were equally spaced between the round posts. They were sunk 1½ feet in the ground. The placement of the round and half-round posts within one 12-foot section along one side and near a corner of the house is shown in Figure 1. At the ends of the house, two round posts were spaced 3½ feet apart for a door near the center. One half-round post was placed midway between a door and a corner post as shown in Figure 2. All posts were previously pressure treated with a preservative material ("Penta") and the underground portions were embedded in concrete.

The house framing was constructed of utility grade, dressed western fir. Other kinds of lumber can be used with equal satisfaction, and should be selected on the basis of price and durability. The plates, ventilator sills, studs, and door framings were made of 2 by 4 inch lumber. The plates were nailed flush with the outside and to the top of the round posts making the eaves 6 feet high. Eaves 5 feet high would be equally satisfactory and in some cases 4-foot eaves would be acceptable. The side ventilator sills were nailed on top of the half-round posts and to the sides of two round posts leaving 18-inch ventilators along each side of the building.

The rafters were 2 by 3 inch material 12 feet long and were cut on an 11 by 12 slope giving a roof pitch of 42.5 degrees and were spaced 24 inches apart on centers. They must be spaced to fit the width of the plastic, but spacings less than 21 inches or greater than 36 inches should be avoided. A 24-inch spacing was satisfactory for applying plastic sheets 54 inches wide. It allowed ample material for pulling wrinkles out of the sheets and for lapping at the edges.

1 Dr. Moore is associate horticulturist, Experiment Station, and Mr. Ray is architect for the Extension Service.
One end of the rafters was nailed directly to the plate at the eaves and the other to a 2 by 6 inch ridge board at the cap. They were attached to the lower edge of the ridge board so that ridge ventilators could be hinged near the upper edge.

The roof pitch of plastic greenhouses is important. A steep slope was employed to cause the water that condenses on the roof interior to roll down to the sides rather than fall upon the plants below. High moisture conditions on plants favor the development of leaf diseases and increase plant injury from excessive accumulation of gases. A second reason for a steep slope was to improve circulation of hot air uniformly throughout the house. With heating pipes located along the outer edges, the hot air rises, follows the roof to the ridge and then drops near the center of the house; thus, forming a circular air movement. When the ceilings are more nearly flat the air forms a temperature strata; near the ceiling it is hot, and near the ground it is cold. A steep roof also sheds ice well in the event of a sleet storm.

In contrast to glass greenhouses which require rigid roofs, no purlin is necessary in plastic greenhouses. One should keep in mind that excessive amounts of framing in the roof shade out light greatly needed in the house. If purlins are used, they should be of a small material (1 by 2 inches) and the number of pieces kept to a minimum. The State College house was braced with a 9-gauge wire attached near the top of each round post, run underneath and on a diagonal with the rafters, and fastened to the ridge board. Two wires crisscrossed each 12-foot section of the roof and were made tight by means of turnbuckles.

Frames for all ventilator shutters were constructed of 2 by 2 inch lumber, held together with corrugated fasteners and nails. Those for the sides were made small (18 by 45 inches) and a series of them extended the entire length of the building. They were made small so that the amount of ventilation supplied to this experimental house could be easily controlled and the amount needed more accurately determined. They were hinged to the plate. The ridge ventilator shutters were 1½ by 12 feet and were hinged to the top of the ridge board.

Props for the shutters were made of 3/4 by 3/4 inch lumber. The side shutter props were 24 inches long. Holes large enough for an eight penny common nail to slip through freely were drilled at 3-inch intervals from one end of the props to the other. An eyelet screw was then screwed into one end of the prop and another into the lower side of the shutter. The eyelet in the prop was then interlocked with the one in the shutter, forming a flexible joint. A hole was drilled into the ventilator sill adjacent

Figure 1. View of one side near a corner showing the placement of round posts, half-round posts, ventilator studs, sills and plates of a plastic greenhouse. Ventilators are 18 by 45 inches.
to the eyelet screw in the shutter. By placing a nail through the holes in the sill, the shutters could be raised to any desired height. These props hold the shutters rigidly in place even in moderately strong winds. The shutters were held in a closed position by screen hooks and eyes. Ventilator stops of 3/4 by 3/4 inch material sealed the cracks around the shutters.

Adequate ventilation is one key to the successful operation of plastic greenhouses. It has been found, however, that ridge ventilators were not necessary when sufficient side or end ventilators were provided. Elimination of the ridge ventilators simplifies construction and reduces the cost of the house.

In the construction of a commercial plastic greenhouse large ventilators along each side should be adequate. Since plastic houses are generally tighter than glass houses, consideration should be given to the construction of removable panels for the sides. They could be either hinged or completely removable.

Forced air ventilation should also be considered. This may be accomplished simply by the use of exhaust fans mounted in one end of the house, and ventilators in the other so that the air is pulled through the entire length of the building. If forced air ventilation is used, neither ridge nor side ventilators are necessary and the construction of the house is simplified.

A 36-inch exhaust fan was mounted in the north end of the house. It was adequate for satisfactory ventilation under most weather conditions. The difficulty has been that the volume of air displaced cannot be easily changed. Two smaller fans (18 or 24 inches) or a large fan with several speeds would be more desirable. Frequently only a small volume of air need be exhausted, but on the other hand, there are times when large volumes of air must be removed.

All lumber was treated with either Cuprinol or Cop-R-Tox. All wood preservatives injure plants, but the above two are relatively safe with certain precautions. First, treat as much of the lumber as possible away from the greenhouse site. Second, allow the treated lumber to dry for several days. And, third, avoid spilling any preservative on the house site.

Covering Material

Several companies make plastic for covering greenhouses, hotbeds and other plant growing structures. There are two general types of plastic available. One type, polyethylene plastic, lasts one season. The intense ultra-violet rays of the summer sun deteriorate it within six weeks. Rays of the fall and winter sun have no noticeable effect upon it. The polyethylene installed on the house at State College during January of 1957 began to break down about May 1, 1957. That installed on September 20, 1957, began to break down during late April of 1958.

This translucent material transmits enough light for satisfactory plant growth. It is available in a variety of widths up to 40 feet and the thicknesses most commonly used are 2, 3 or 4 mils (.002, .003 or .004 inches).

A second type, sold under a trade name, is supposed to last several years. Some of these “permanent” materials have been predicted to hold up for as long as 8 to 10 years, after which they dis- color slightly. This prediction was based on exposures to stepped-up artificial light rays equal to that of the sun for 8 to 10 years. None of the plastics have been exposed to natural weathering for that length of time, although such tests are currently being made.

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2 The polyethylene plastic used on the house at State College was supplied by the Bakelite Corporation, one of the larger manufacturers of polyethylene resins.
Preliminary reports from various sections of the United States as well as work of the Mississippi Agricultural Experiment Station, indicate that some of the “permanent” plastics are not holding up as well as laboratory reports indicated they would. On the other hand, others appear satisfactory after two or more years testing. Before testing these materials, the grower should investigate their durability by contacting his agricultural experiment station.

It is suggested that polyethylene be used as a covering for plastic greenhouses until the permanent types have been adequately tested under field conditions. Polyethylene is available at many local hardware and building supply houses. It is packed in rolls similar to wrapping paper.

Number of Layers

There are advantages and disadvantages in covering a house with two layers of plastic. One advantage is the conservation of heat. It is generally known that two layers of a material separated by a dead air space is a good insulator. In plastic greenhouses, two layers have been calculated to conserve up to 40 percent of the heat. In the State College house a second layer conserved less than 20 percent.

A second advantage of two layers is the reduction in moisture condensation on the ceiling and sides. Since the warm moist air in the greenhouse is in contact with a warmer surface than it would be when only one layer is used there is less condensation inside the house. In the State College house, as well as others ob-
served in Mississippi, moisture condensed between the two layers, and will be discussed in connection with the disadvantages.

A third advantage of the two layers is the protection provided if the outside layer is damaged. Damage may occur from hail, from strong winds, or as a result of faulty installation of the plastic. In general, plastics are reported to incur less damage in hail storms than glass.

One of the main disadvantages of two layers is the reduction of light transmission. The thickness of the film had little effect on the amount of light transmitted but the addition of a second layer reduced it considerably. Light intensity readings were made when the sun was almost obscured by clouds (5,000 foot candles) and when the sun was shining through a clear sky (12,000 foot candles). The percent of light transmitted through plastic varied very little under this range of conditions. When condensation was negligible, one layer of 2-mil polyethylene transmitted 80 to 85 percent of the light which compared favorably with glass. Two layers of the same material transmitted about 65 percent. Light transmission through two layers of 2-mil polyethylene was less than 50 percent when moisture condensation was present.

Two layers did not transmit adequate light for satisfactory plant growth or fruit set of tomatoes during prolonged periods of cloudy weather. When the outside light intensity dropped below 5,000 foot candles for as long as four days, tomato flowers began to drop from the plants. Experiments reported previously have shown that the average minimum light intensity required for fruit set of tomatoes is about 3,000 foot candles.

A second disadvantage is the difficulty of installing the inside layer. By using wide material the outside layer may be installed relatively easy with one sheet. In contrast the inside layer is not easily installed as one large sheet. In some cases plants should be established and growing in the house before the cover is applied and the danger of breaking them further complicates the installation of the inside layer.

A third disadvantage is the additional costs. Not only the cost of the plastic is involved but also the extra labor, batten strips, nails and scaffolding.

**Covering The House**

The house should be covered no earlier than September 15 to October 1, in central and north Mississippi. By this time of year the intensity of the sun has subduced, the air temperature has cooled and the plastic will stand up through the winter.

The ends of the house above the plate should be covered first. This allows the plastic to be pulled over the two end rafters and temporarily tacked to the inside of a rafter. When the roof is installed it overlaps the end covering, giving a tight seal. The plastic is readily rolled out near the building and the appropriate lengths cut to fit the ends of the structure. It is then fastened to the framing by means of batten strips and small nails. Stapling machines are available for stapling the strips down. Their main advantage is to speed the installation.

Although polyethylene is reasonably tough, certain precautions should be taken during installation. Avoid rolling the plastic over sharp objects such as rocks or puncturing it with sharp finger nails. In fact, crumpling the film in the hands or pulling it with the fingers in a rough manner weakens it and may cause subsequent damage. Also, avoid stretching the film too tight on the house. During warm weather the material should sag about an inch between rafters spaced two feet apart. It must be kept in mind that as the weather cools the plastic becomes tighter and will tear during cold weather as shown in Figure 3 if installed too tightly.

The plastic breaks first along the edges
of the rafters, and the size of the batten strips influence the severity of breakage. There was no breakage where the batten strips were 1/2 inch wider than the rafters. On the other hand, breakage occurred where the strips were narrower than the rafters. Apparently the wider strips shaded the plastic and the rafter, reduced the heat absorbed and reduced the amount of breakage. Batten strips 3/8 by 2 1/2 inches were satisfactory on 2 by 3 inch rafters. They may be of either rough or dressed lumber. The nails or staples should be spaced about 12 inches apart along the batten strips.

The film for the roof may be cut on the ground or rolled directly onto the roof. The latter method is most desirable if a strong wind is blowing. With either method an individual sheet should be used for each side rather than one large sheet to cover both sides at the same time.

The plastic should lap about 8 to 12 inches at the ridge. When the first side was being covered the upper two feet of the batten strips were not nailed fast. Then when the second side was covered the plastic was pulled over the ridge, placed under these batten strips and then nailed fast. A batten strip nailed to the ridge board and running lengthwise the house gave a tight seal at the ridge. The plastic was also battened to the eaves. The ventilator shutters may be covered at any time. They are conveniently covered at a work table before being attached to the house.

Heating

A satisfactory heating system is essential. Make-shift heaters lead to more trouble than any other item in a plastic greenhouse. Dry heat is highly desirable and should be circulated throughout the house. A central heating system with hot water or steam pipes leading through a house is the most satisfactory.

Figure 3. Polyethylene torn due to faulty installation. This film was pulled too tight when applied. As the weather cooled, it became tighter and broke at the rafters. An inch sag during warm weather between 2 foot rafter spacings is desirable.
but on a small scale operation may not be practical.

Electricity affords an excellent type of heat and should be considered where the cost is less than one cent per kilowatt hour. One disadvantage of electric heat is a power failure.

Small gas heaters are commonly used in plastic greenhouses. They may be either natural or LP gas types. With either type, vented heaters are preferred especially when fruiting crops such as tomatoes are to be grown. Vented heaters remove the fumes from the burning gas and also remove the large amounts of water released. When gas burns, carbon dioxide and water vapors are given off. Plants use both, but excessive amounts of either are harmful. Vented heaters also remove the non-burned gas. The average combustion efficiency of most gas heaters is 70 percent. If non-burned gases are not removed from the house, they injure plants, particularly tomatoes.

The amount of heat required during average winter conditions in Mississippi depends on the size of the house and its tightness. A well constructed house 12 by 18 feet requires roughly 32,000 B. T. U. of heat. The 18 by 60 foot house at State College was equipped with a thermostatically controlled 160,000 B. T. U. heater. It was located in the north end of the house which is usually the coldest part. Common stove pipes were attached to the heater vents and extended around the inside edges of the house. By means of a vacuum blower the fumes were exhausted from the pipes out of the south end of the house.

When the heater was first installed only a single run of pipe connected it to the exhaust blower. The north part of the house heated up too much and the south end remained too cool. In addition, too much heat was lost through the exhaust. It was found that about 350 linear feet of 6-inch stove pipe was necessary to adequately radiate the heat and distribute it uniformly with a minimum loss through the exhaust. The necessary amount of pipe was installed by placing a triple stack in the south half of the house. This arrangement kept a uniform temperature throughout the house. The variation in temperature from one end of the house to the other was never greater than four degrees. From either side to the center the greatest variation observed at a height of five feet was two degrees.

The main gas line from the meter (or tank) to the house must be large enough to accommodate the heaters in the house. Most gas company representatives will gladly assist in determining the correct pipe size.

**Greenhouse Operation for Tomato Production**

Successful production of any greenhouse crop depends on a proper control of the light, temperature, moisture and the nutrient supply best suited for the crop. Many diseases and insects attack tomatoes and may be a problem in the plastic greenhouse. Recommendations for their control may be found in Mississippi Agricultural Experiment Station Bulletin 453, “Vegetable Diseases and Their Control in Mississippi,” and in Extension Service Leaflet 167, “Kill Garden Bugs.”

In general, artificial light is not used in commercial tomato production. Every practical means should be employed to get as much sunlight as possible to the plants during the winter months. If the light intensity falls below 2,000 foot candles for four consecutive days, many of the flower buds drop regardless of how well other factors are controlled.

Greenhouse temperatures may be controlled by proper ventilation and adequate heat. While the crop is growing, the tem-
perature during the night and on cloudy days should be held between 60 and 68 degrees F. On clear days it should be held between 70 and 85 degrees. The flower buds develop normally and the fruit produced are smooth under these temperature conditions. The flowers drop and the fruit that develop are poorly shaped when the plants are grown at night temperature either below 58 or above 70. If adverse temperatures occasionally occur for only an hour or two during a day, little damage is done. Severe damage results after the plants are periodically exposed for three or four consecutive days to such temperature. Heaters equipped with thermostats are good for maintaining precise temperatures.

The greenhouse should be ventilated as often and as long as necessary to cool the house, remove moist air and bring in fresh air. No set rules for all weather conditions can be laid down. Generally, ventilators should be raised on clear days after temperature inside the house reaches 70 degrees. They may be closed when afternoon temperature in the house drops to 75. During cold, cloudy weather it is desirable to ventilate the house at least once each day to remove the moist air. Moisture evaporating from the soil and transpiring from the plants builds up the humidity in the house. Humidity must be kept as low as practical to reduce the development of fungus diseases on plants and prevent gas injuries.

The amount of water needed for growing plants in a plastic greenhouse and the frequency of applications depend on the soil structure and the amount of sunlight. Some soils are poorly drained and should be avoided where possible. Otherwise, they should be tile drained. Ditches 12 to 18 inches deep around the outside of the house may provide adequate drainage of soils that have moderately poor drainage. The plant beds must be watered often enough to maintain ideal soil moisture conditions. Under no condition should the plants be allowed to wilt, nor should the soil be “water-logged”. In general, weekly waterings are satisfactory, but in some cases more or less frequent applications are needed.

The nutrient supply must be ample for moderate vegetative growth, flower bud formation and fruit development. If the nutrients, particularly nitrogen, are in excess, the plants grow vegetatively and may not fruit well. On the other hand, if the nutrients are low, the plants make insufficient growth to support a satisfactory crop. Most Mississippi hill soils require a complete fertilizer. About 25 pounds of 5-10-5 or the equivalent are needed per 1,000 square feet of greenhouse bed. If the plant leaves lack a moderately green color or if the stems are not stocky, an application of nitrogen fertilizer may be needed. Frequent, light, nitrogen applications are preferred to a single heavy one. Two to four pounds of nitrogen fertilizer (ammonium nitrate or nitrate of soda) per 1,000 square feet are adequate. Barnyard manure improves the physical conditions of the soil and adds nutrients. It may be used if it is well rotted and thoroughly incorporated into the soil. A layer about two inches deep and worked well into the soil a few weeks before planting time is satisfactory.

**Tomato Pollination**

Pollination is necessary for proper fruit set. In the field or garden, the wind shakes the flowers and scatters the pollen over the stigmas. In greenhouse tomato production some artificial method of vibrating the flowers is necessary. One method is to gently strike the base of the flower clusters with a short piece of flexible tubing. It is very effective but time consuming. Another method is to strike each overhead wire with a stake. This vibrates several plants at one time and does a fair job of pollination. A third, and the most satisfactory method, is the
use of an electric vibrator that operates on an ordinary dry cell battery. It is simple to operate. A rubberized wire loop extending from the vibrator is held at the base of the flower cluster. When the electric switch is turned on, the loop vibrates the flowers causing the pollen grains to scatter over the stigmas.

Pollination must be done when the flowers are fully open. Since all the flowers of a cluster are not open at the same time each cluster should be vibrated on three to five successive days. The operation may be done at any time during the day that the flowers are dry enough for the pollen to scatter. The best time is usually between 9 A.M. and 3 P.M.

Fruit-Setting Chemicals

A good set of fruit is difficult to obtain by natural pollination methods during prolonged cold or cloudy weather. Fruit-setting chemicals known as hormone may be used to improve fruit set. Two chemical sprays that have been adequately tested by the Mississippi Agricultural Experiment Station and found to be satisfactory are Sure-Set (para-chlorophenoxyacetic acid) and Blossom-Set (betanaphthoxyacetic acid).

These materials are sprayed on the individual flower clusters when the flowers are open. Care must be taken not to direct the spray at the leaves as the chemicals injure the foliage. Under ideal tomato growing conditions there is no advantage to using them.

Results From Two Winter Tomato Crops

A preliminary test of tomatoes in a plastic greenhouse was conducted during the late winter and spring of 1957. Five varieties commonly grown as market garden tomatoes were tested. Seedlings with the first flower buds showing were transplanted from 3-inch cups into the plastic greenhouse on February 20. They were spaced 18 by 24 inches apart, pruned to a single stem, and trained to heavy twine suspended from an overhead wire. Nine

Table 1. The average marketable yield per plant of five tomato varieties grown in a plastic greenhouse, 1957.¹

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gulf States Market</td>
<td>6.6</td>
</tr>
<tr>
<td>Break O'Day</td>
<td>6.2</td>
</tr>
<tr>
<td>Manalucie</td>
<td>5.8</td>
</tr>
<tr>
<td>Southland</td>
<td>5.7</td>
</tr>
<tr>
<td>Rutgers</td>
<td>5.2</td>
</tr>
</tbody>
</table>

¹A house 18 x 60 feet provided space for 243 tomato plants.

plants of each variety were planted at random in each of four replicates. The varieties and their average marketable yields in pounds per plant are presented in Table 1. Although the differences in yields among varieties were small, Gulf States Market and Break O'Day produced the highest yields. The first fruit were harvested from these plants April 25. The last harvest was made about June 15, when locally grown field tomatoes began to reach the market.

A detailed test of nine greenhouse forcing tomato hybrids was conducted during the fall and winter of 1957-58. The seed were planted on August 21, 1957. Seedlings were transplanted into 3-inch cups on September 3, and into the plastic greenhouse on September 26. In the greenhouse each hybrid was placed at random in each of three replicates giving a total of 27 plot rows. Each plot contained nine plants making in all 243 plants in the house. They were spaced 18 by 24 inches apart, pruned to one stem and trained to heavy twine suspended from overhead wires.

A layer of well rotted barnyard manure two inches deep was spaded into the greenhouse soil on September 3, wet down and spaded again to a depth of about eight inches on September 10. On September 24, 50 pounds of hydrated lime and 25 pounds of 5-10-5 was broadcast over the 18 by 60 foot area and the soil spaded a third time. The plants were side-dressed with ammonium nitrate at a rate
of two pounds per 18 by 60 foot area on November 4, and again on January 27, 1958.

The roof of the house was covered with plastic September 20-25, and the sides on October 15. The heating system was installed on October 14, and the thermometer was set for operation the following day.

The hybrids, their marketable yields and other pertinent data are presented in Table 2. The data show that all hybrids tested which had Truckcross Forcing as a parent produced high yields. Truckcross V produced 7.3 pounds per plant, the highest average yield in the experiment (Figure 4.) Truckcross M yielded 6.9 pounds, and Truckcross O, 6.1 pounds. Waltham Hybrid yielded almost as well. The highest individual plant yield was 15.8 pounds and was produced by a Truckcross O plant.

The fruits of these high yielding hybrids were rated as very attractive. Those of Michigan Ohio Fl, Truckcross Forcing, Michigan State Forcing, Ohio W R Seven and Globelle were rated as moderately attractive. The fruit carpels of the moderately attractive hybrids tended to be prominent giving a slightly ridged appearance. Information on the average fruit weight, fruit color, dates of first flower and first harvest, and reaction to leaf mold of each hybrid are presented in Table 2.

The average yield per plant was not as large as may be obtained from greenhouse tomatoes. The winter of 1957-58 was much colder than the average at State College and on several days the heating system was inadequate. Several periods of cloudy weather also prevailed for a week or more. These conditions resulted in poor fruit set. In these experiments the only artificial means used to aid pollination was to strike the overhead wire daily with a stake. More effective pollination methods would undoubtedly improve fruit set and increase yields. The productivity of the plants diminished about May 1, due mainly to their age, length and crowded conditions. This indicates that greater yields may be obtained from two tomato crops during a winter season.

Table 2. The average marketable yield, fruit size, fruit color, earliness, and reaction to leaf mold of 9 forcing tomato hybrids grown in a plastic greenhouse, 1957-58.

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Yield per plant (Lbs.)</th>
<th>Fruit size (Oz.)</th>
<th>Fruit color</th>
<th>First flowers opened</th>
<th>First fruit harvested</th>
<th>Leaf mold reaction¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truckcross M</td>
<td>6.9</td>
<td>4.8</td>
<td>Red</td>
<td>Oct. 2</td>
<td>Dec. 25</td>
<td>Resist.</td>
</tr>
<tr>
<td>Waltham</td>
<td>6.0</td>
<td>4.0</td>
<td>Red</td>
<td>Oct. 27</td>
<td>Dec. 25</td>
<td>Resist.</td>
</tr>
<tr>
<td>Michigan-Ohio Fl</td>
<td>5.3</td>
<td>4.6</td>
<td>Pink</td>
<td>Oct. 27</td>
<td>Dec. 20</td>
<td>Resist.</td>
</tr>
<tr>
<td>Truckers Forcing</td>
<td>4.8</td>
<td>4.6</td>
<td>Red</td>
<td>Oct. 3</td>
<td>Dec. 20</td>
<td>Resist.</td>
</tr>
<tr>
<td>Ohio WR Seven</td>
<td>3.4</td>
<td>4.8</td>
<td>Pink</td>
<td>Oct. 26</td>
<td>Jan. 2</td>
<td>Resist.</td>
</tr>
<tr>
<td>Globelle</td>
<td>2.7</td>
<td>4.2</td>
<td>Pink</td>
<td>Oct. 21</td>
<td>Jan. 2</td>
<td>Resist.</td>
</tr>
</tbody>
</table>

Least difference required for significance among hybrid yields @ .05 is 1.1, @ .01 is 1.91 pounds.

¹As determined by Dr. W. W. Hare, Plant Pathology Department.