

1977

## Summer 1977

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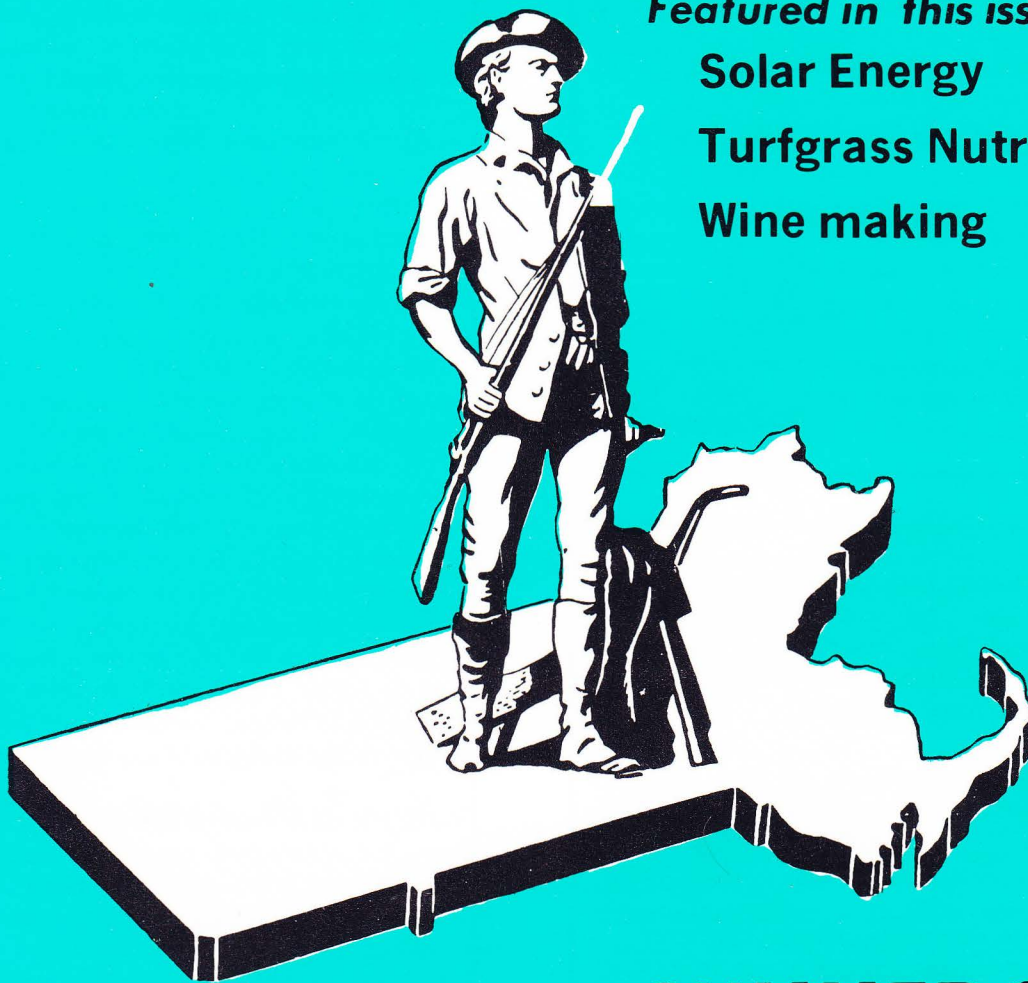
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# TURF BULLETIN

MASSACHUSETTS TURF  
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I N C O R P O R A T E D



*Featured in this issue:*

**Solar Energy**

**Turfgrass Nutrition**

**Wine making**

**SUMMER 1977**

**BETTER TURF THROUGH RESEARCH AND EDUCATION**

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## SOLAR ENERGY: Wave of the Future?

As an alternate source of energy, solar energy looks highly promising.

By Daniel I. Levy

The fuel crisis of 1973-1974 totally focussed the world's attention on the mammoth energy problems we face today. The shortages in energy came about simply because we were using more energy than we were producing. In other words, the demand exceeded the supply.

To make up for these shortages the United States started to import oil from foreign countries. Although importing this oil originally started decades ago in small quantities, today this has increased to millions of barrels of oil per year. If we continue with the present consumption we will double the amount of oil needed from foreign countries by the year 1985.

Even though we are now producing our own oil it is insufficient because much of it comes from old oil wells that have few years left of productivity. Our own oil wells cannot supply us with enough oil to keep our industries and economy running at a normal rate.

We have finally been brought to full understanding of the energy crisis because of the oil embargo. Since the oil embargo much discourse has been held on whether the shortages are imaginary or real. Even if some of the claims of the shortage are exaggerated, the fact still remains that shortages do exist and they will increase with our growing demand for this valuable fuel.

The oil embargo, therefore, created a need to find alternate sources of energy. Obviously, these sources of energy must come from within the continental United States so that foreign countries cannot control our destiny.

Our industries and commerce have been based on cheap, abundant energy sources. We consume well over 30 percent of all the oils produced throughout the world, while we only have 7 percent of the total world population. When looking within our borders for natural fuel such as oil and gas we quickly realize that the supply cannot possibly satisfy our demand. Even with a reduction in the amount of needed fuels, alternate sources of energy must be found. One of those sources of energy is solar energy.

### ALTERNATE ENERGY SOURCE: SOLAR ENERGY

Solar energy means the capturing of the sun's radiation in order to produce a transportable form of energy. The sun's radiation is captured by the means of solar devices and can be used for heating our hot water, our homes, and eventually cooling them. Utilization of the sun's ra-

diation is environmentally acceptable as compared to some alternate forms of energy sources which are not.

Solar energy is not a new science. In 212 BC, Archimedes utilized the sun's radiation to burn the sails of the Roman fleets thereby defeating them in a battle. In 1878, a solar steam engine was exhibited at the Paris fair. During the 1930's, Massachusetts Institute of Technology started experimenting with solar energy and much of the research that was conducted there is being utilized by manufacturers today.

In the past, the devices for capturing the sun's radiation were very simple and did not have the sophistication of today's devices. With the desire and determination on the part of our country to find alternate sources of energy, the field of solar technology has greatly improved.

### SOLAR COLLECTOR

A solar system is a relatively simple system to understand. It consists of three major component parts. The part that collects the sun is known as "The Solar Collector." The solar collector is generally mounted on the roof of a building and its primary purpose is to collect the sun's radiation. The collector generally three by seven feet in size and three to four inches thick contains a system of pipes carrying either water or air through it which is then heated by the sun's radiation. The collector is covered with one or two pieces of glass or plastic in order to retain the heat captured by the sun.

### STORAGE TANK

The second component within the system is a "Storage Tank." The storage tank is generally found in a basement or sub-basement of a building and contains the stored energy to be utilized at a future date when needed.

### DISTRIBUTION SYSTEM

The third component of the system is the "Distribution System," which takes the stored energy from the tank and transfers it to a point where it is needed.

To demonstrate how this system operates, let's assume we will be heating water by the solar system. The cold water is pumped into the solar collector mounted on the roof and the sun's radiation strikes the collector. As the cold water passes through the collector which contains a system of pipes, the water is heated to a temperature of between 120-180 degrees.

The heat generation depends on a number of factors

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*Daniel I. Levy is a professional planner who has had extensive experience with solar energy research and application of solar systems into buildings. He presently resides in Woodland Hills, California.*

(Continued on Page 4)



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such as flow rate and the availability of the sun's radiation. Once the water is heated it is then transferred by a system of pipes to the storage tank in the basement. This storage tank is insulated in order to retain the hot water that is collected. Finally, this hot water is then distributed in the building where needed. This hot water can either be used for domestic hot water or for the actual heating of the building. The distribution of the hot water is accomplished by a system of ducts, pipes, and appropriate valves in order to take the hot water away from the storage tank and into the building.

**COST OF INSTALLATION AND OPERATION**

The cost of installing a system depends on the ultimate use for this system. If a system were installed in a home for heating only domestic water the cost would be approximately \$1,000. Even with the solar installation a conventional backup system is needed in most parts of the country. However, a solar system can save approximately 70-80 percent of the fuel cost for heating our hot water.

Assume that it costs \$25.00 per month to heat our hot water. If we install a solar we will absorb 80 percent of the cost or \$20.00 per month savings and be paying \$5.00 per month to utilize our conventional backup system.

The cost is more for a solar system that heats our homes, because more collectors are needed and the equipment necessary for storage is much higher. The cost will be in the neighborhood of \$6,000 to \$8,000 depending on the size of the home and its location.

**A SOLAR SYSTEM FOR EVERY BUILDING OR HOME?**

In order to derive the maximum benefits from this system, the sun's rays must face in a south or southwest direction. Not every home, of course, has this exposure. The sun's radiation may also be lost if the building is blocked by trees or other buildings. Each home must be examined by an expert to determine whether a solar system is feasible.

**THE ART OF THE INDUSTRY**

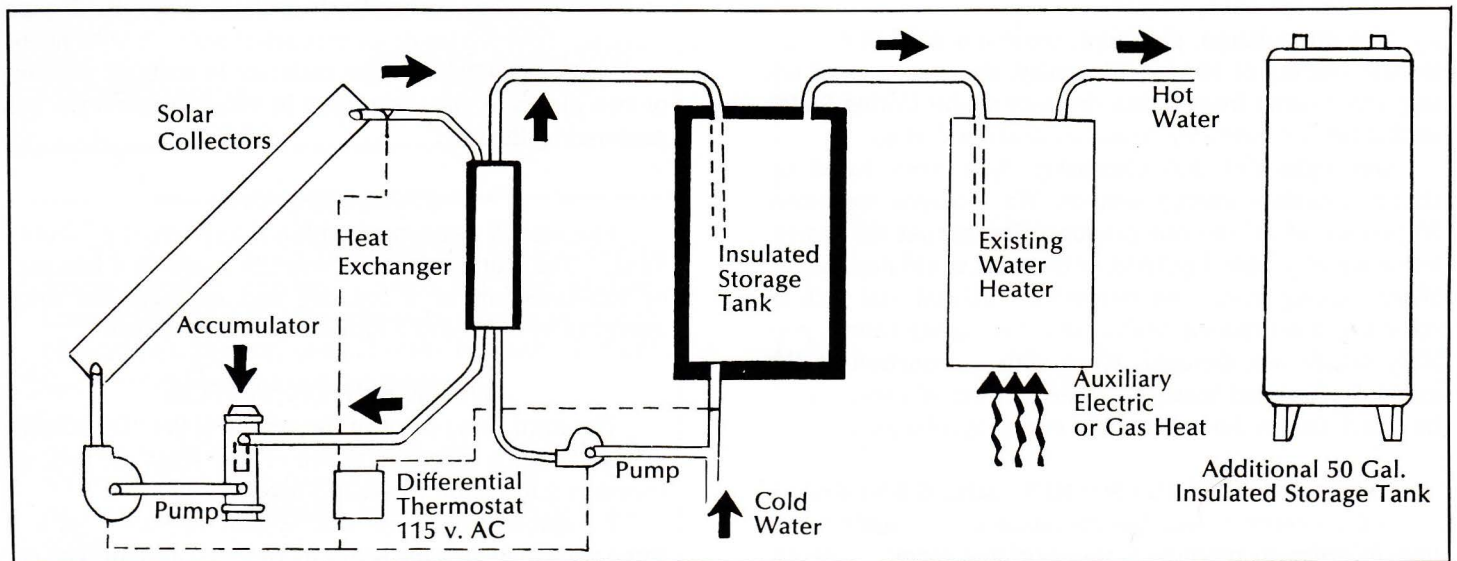
The industry in the last two years has grown considerably because of the demand to find alternate energy sources. Many manufacturers, distributors, and organizations are gearing up for mass production.

The most expensive item in the solar system is the solar collector. Originally these collectors were selling for between \$12.00 and \$15.00 per square foot, but because of the advancements in technology and the additional competition, the price per foot is down anywhere from \$4.00 to \$7.00 per square foot. The efficiency is also improving so that the number of collectors needed will be reduced in the future. Because of the demand on the part of the public to produce this alternate energy source, prices and efficiencies of the collectors will come down considerably more in a relatively short period of time.

**WASHINGTON INVOLVEMENT**

The federal government is involved with the development and experimentation of solar energy. In 1974 the Con-

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**HOW A SOLAR SYSTEM WORKS**

1. The collector absorbs the sun's rays and heats a liquid that is pumped through this collector.
2. The fluid within the collector (generally anti-freeze) captures heat and then transfers it to water by means of a heat exchanger.

3. The hot water is then stored for future use or can be used directly if needed.
4. Depending on location of the panels, and latitude of area, anywhere from 45 percent to 100 percent of the water can be heated by the sun.

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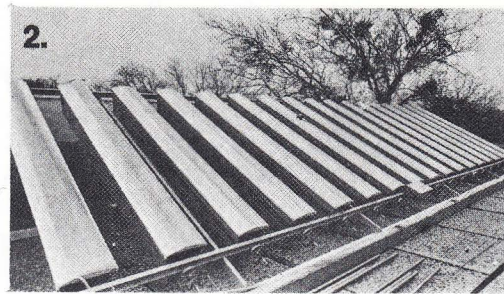
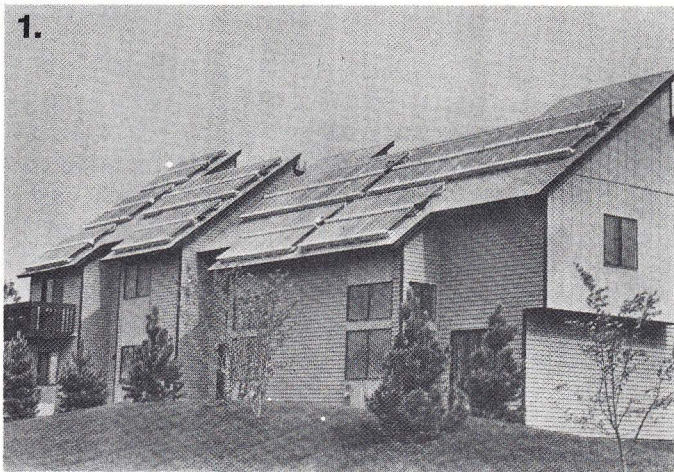
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**Banks of solar collectors (1) sit on the roofs of four recently completed solar powered townhomes at New Century Town, Vernon Hills, Ill. Concentrating solar energy collectors (2) are shown on the roof of the University of Texas at Arlington "Discovery 76" test house. These solar collectors (3) are round glass tubes designed to convert sunlight into heat energy.**

(Continued from Page 4)

gress passed the Heating and Cooling Demonstration Act which appropriated \$60 million to start experimenting and developing solar systems. A new agency known as ERDA (Energy Resource Development Administration) is in charge of overall coordination and development of the solar program. The Department of Housing and Urban Development is also involved with the solar program and has recently requested proposals to fund on an experimental basis.

#### **PRESENT INSTALLATIONS**

There are many experimental installations throughout the country at the present time. A number of schools recently installed systems on an experimental basis with gratifying results. A school in Tamonium, Maryland installed a heating system on the roof of one of its existing schools and it provided 91 percent of the heating needs during a 60-day period from March 11 to May 14, 1975. Another school in Minneapolis, Minnesota installed a system which provided 100 percent of the school's heating requirements in December from 11:00 a.m. to 4:00 p.m.

#### **NO SUNLIGHT?**

The solar system does have the capability of storing energy for a number of extended days. The exact duration depends on the size of the storage tank and the degree to which the hot water is originally heated. In any case, conventional backup systems are needed in case we have extended periods of sunless days and the conventional system must take over where the solar system cannot provide adequate heat for the building.

#### **FIELD LOOKS BRIGHT**

Even with the existing problems the field of solar energy looks bright. The solar system offers the ability to utilize a clean and efficient kind of energy always available to us and one that will not pollute the environment. With continued governmental support and experimentation the efficiency of solar systems will improve.

It is anticipated that the government will maintain a supportive role for solar energy and recently the Congress has been discussing tax credit and incentive programs for the owner to install a solar system.

Many of the existing problems that we face today might be resolved with the improvement of the solar collector. Experimentation is now being developed on what is known as tracking collectors that actually follow the sun in order to absorb the rays. Another collector now being developed is known as a concentrator collector. This means that the sun will be concentrated into a small area of the collector in order to produce higher water temperatures rather than over the entire surface of the flat plate collector that we are currently using.

#### **CONCLUSION**

The development of the solar system is well along the road. Significant gains have been made since the original energy crisis of 1973-1974 and the future promises to bring improved technology and lower costs so that many of us can install a system whereby the sun's radiation can be used. Many of our homes and buildings may not be able to receive in the future natural fuel sources because of our excessive demand and we may be forced to utilize a solar system to supplement these natural fuel sources.



# Turfgrass Nutrition: Current Thinking and Future Challenges

By John R. Hall, III

Extension Specialist, Turf

Virginia Polytechnic Institute and State University

Turfgrass nutrition has advanced considerably in the last sixty years, however, it still remains a combination of science and art. The science of turfgrass nutrition has resulted in soil testing, the development of slow release fertilizers, the trend toward late fall fertilization, and increased use of chelated iron, and other innovations. The art of turfgrass science is observed when professional turfgrass managers make decisions about utilizing specific forms of nitrogen, determine rate and timing of nitrogen applications, decide between slicing, coring, or verticutting, decide when to syringe greens, or make other important decisions based on past experience and current knowledge. Successful turfgrass management depends upon a complex mixture of SCIENCE and ART.

Our understanding of the effects of nitrogen, phosphorus, and potassium on the quality of turfgrass has expanded rapidly in the last 15 years. The introduction of slow release fertilizers significantly enhanced our ability to produce quality turf and reduced the labor cost associated with frequent applications. The benefits derived from use of supplemental iron and late fall fertilization are

considerable and have enhanced our ability to produce quality turf.

Research and practical observations have shown us that nitrogen is the most plant responsive element in turfgrass management. We know it increases general growth rate, shoot elongation, density, color, recuperative potential, and competitiveness. It can also have the effect of decreasing resistance to certain diseases as well as reducing heat, cold, and drought tolerance. Current soil tests for nitrogen are not reliable for determining the nitrogen needs of turfgrass. Our ability to rapidly and accurately interpret nitrogen soil tests leaves the decision of nitrogen need to the professional turfgrass manager who must make a decision based on a qualitative assessment.

The principles of phosphorus fertilization have not changed in recent years. Increasingly high phosphorus levels have been noted on greens and fairways in Virginia. There is concern about the influence this imbalance might have on nutrition. A survey conducted in Virginia in 1971 indicated that 49.6 percent of the greens tested were in the very high phosphorus range and 46.2 percent of the fairways tested were in the high range (Table 1).

Potassium soil test data in Virginia indicates that the majority of soil tests on greens and fairways are in the medium range (Table 1). Golf greens generally receive higher

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**Table 1. Summary of Phosphorus and Potassium Soil Tests on Greens and Fairways in Virginia in 1971 (1).**

Soil Test Level	GREENS		FAIRWAYS	
	Phosphorus %	Potassium %	Phosphorus %	Potassium %
Very High	49.6	1.2	21.7	8.8
High	27.8	13.7	46.2	41.2
Medium	19.3	53.5	28.3	41.8
Low	3.3	31.6	3.8	8.2

levels of potassium fertilization than fairways and yet 35% of the golf green samples are in the low and medium range. This suggests increased potassium soil mobility on greens and removal of potassium in clippings collected on greens. Research and field observations have led to an increased understanding of the importance of potassium in turfgrass management. Increased heat, cold, and drought tolerance, disease resistance, wear tolerance, water efficiency, and rooting have been noted with appropriate use

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of potassium. Literature reviews discussing the relationship between potassium and disease resistance suggest several possible mechanisms. The most likely possible roles of potassium in disease resistance are; 1) a reduction in soil fungi, 2) reduced pathogenicity of the organisms, 3) increased physical resistance of plant tissue, 4) promotion of more rapid healing, and 5) promotion of new crown buds to aid in recuperating from disease damage (2).

The principal fact emerging from research being conducted with nitrogen, phosphorus, and potassium is that balanced fertilizer programs are of major importance in improving turf quality. Nutritional imbalance is as serious a threat to turf quality as nutritional excess or deficiency.

Studies on soil PH indicate that on general soils, the availability of nitrogen, phosphorus, potassium, sulphur, calcium, magnesium, manganese, boron, copper, zinc, and molybdenum is increased as PH is increased from 4.5 to 6.5. Therefore, most efficient use of native soil fertility and applied nutrients is achieved by growing turfgrass in a soil PH in the range of 6.0 to 6.5. Recent studies also indicate the possibility of increased thatch decomposition brought about by frequent applications of small amounts (25 lb. per 1000 sq. ft.) of limestone to turfgrass (3). The conversion of ammonium ( $\text{NH}_4^+$ ) to nitrate ( $\text{NO}_3^-$ ) is important to the efficient utilization of applied nitrogen and this reaction does not occur rapidly when soil PH is below 5.5. Although the majority of reactions of turfgrass to lime are positive, we need to be aware of the fact that increased volatilization of nitrogen (conversion of applied nitrogen to gaseous nitrogen) does occur at PH's above 7.0.

The practical role of sulphur in turfgrass management has not been clearly understood, primarily due to the difficulty of measuring sulphur availability to plants. In the 1950's and early 1960's, low analysis superphosphate

(0-20-0) was commonly used as a phosphorus source and this material contained significant amounts of sulphur. Therefore, sulphur was seldom found to be a deficient element in turfgrass nutrition. Significant amounts of sulphur are applied to plants through rain fall. Measurements made in Virginia indicate that anywhere from 13 to 33 lbs. of sulphur per acre per year are provided through rainfall (4).

The development of slow release fertilizers began in the late 1940's and are very popular in turfgrass management today. The most popular materials being utilized today are isobutylidene diurea (IBDU) and Urea Formaldehyde (UF). A new slow release nitrogen, first developed by Tennessee Valley Authority, is a sulphur coated Urea and is becoming increasingly popular. It is important that progressive turfgrass managers be aware of the factors that influence the rate of nitrogen release of these slow release sources in order to use them most efficiently. The rate of release of IBDU nitrogen is dependent primarily upon particle size and soil moisture. Soil temperature and soil PH have a minor influence in the rate nitrogen release. However, various data available indicate that the rate of IBDU release can be significantly decreased if soil PH is above 7.0 (5). The primary factor influencing the rate of nitrogen release from Urea Formaldehyde is microbial population. The influence of temperature, moisture, and soil PH upon microbial populations will have a secondary effect upon the rate of nitrogen release from UF materials. However, the most important factor is microbial population. Therefore, in comparing the release rates of IBDU and Urea Formaldehyde, it is important to note that the IBDU release rate is more determined by microbial activity than any other factor. The rate of nitrogen release from sulphur coated Urea is primarily dependent upon the thickness of the sulphur particle coating. Soil moisture, temperature and microbial activity will

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have a secondary influence upon the rate of nitrogen release from sulphur coated Urea.

Studies were conducted at Columbia, Maryland on Obbitts Glen Golf Course. Penncross bentgrass greens comparing Urea Formaldehyde, IBDU, Milorganite, and sulphur coated Urea. Treatments had equal nitrogen applications and indicated that IBDU had faster initial rate of release than Urea Formaldehyde, however, as soil temperatures rose in the summer the rate of nitrogen release of Urea Formaldehyde exceeded that of IBDU. Spring green-up occurred faster with IBDU than with Urea Formaldehyde (6).

Studies conducted at Penn State University over a six year period compared IBDU and Urea Formaldehyde at 5 lb. per 1000 sq. ft. per year rates and showed that over a six year period where 129 observations of color were made, IBDU had unacceptable color ratings 29 times and Urea Formaldehyde had unacceptable color ratings 36 times (7). Interesting to note, however, was the fact that during the first two years of the six year study, when 46 color ratings were made, IBDU had 14 unacceptable color ratings and UF had 30. During the last four years of the study when 83 color ratings were made, UF had only 6 unacceptable color ratings while IBDU had 15. This data substantiates the field observation that continued use of constant rates of UF over extended periods of time can lead to annual release of higher rates of nitrogen. This build-up does not appear to be as great with IBDU.

Work by Richard E. Schmidt, at Virginia Polytechnic Institute and State University, with chleated iron has shown that there can be several favorable effects associated with the application of iron to turfgrass at the appropriate time. Iron deficiency can be initiated by several factors such as; overirrigation, poor aeration, high phosphorus levels, high concentrations of heavy metal in the soil, extremely low or high temperatures, high light intensity and high nitrate nitrogen concentrations in the soil. With all these conditions possibly creating iron deficiency, it does not seem shocking that iron applications can provide benefit to turfgrass. Benefits of iron fertilization which have been noted through research and practical observation are improved green color, increased top growth, increased root growth, increased carbohydrate levels, decreased respiration, and decreased winter dessication. The work at VPI&SU has expanded our understanding of the different performances provided by iron chelate and iron sulphate. It is now known that iron chelate has more plant mobility, does provide better results during stress periods and can cause growth inhibition in early spring. The iron sulphate form of iron is cheaper and does absorb more rapidly into the plant. Research does indicate that iron sulphate will perform better than iron chelate when applied with spring nitrogen programs (8).

One of the most important discoveries in recent years has been the finding that late fall fertilization provides several benefits to turfgrass. Advantages noted from late fall fertilization are increased density, increased root growth, decreased need for spring mowing, improved fall to spring color, decreased weed problems, increased drought tolerance, and decreased summer disease. The theory of late fall fertilization is primarily dependent upon differences which exist in the metabolic processes of photosynthesis and respiration. The process of photosynthesis utilizes carbon dioxide in the presence of sunlight, chlorophyll and water to produce carbohydrate. This carbohydrate serves as a food storage product. The process of photosynthesis is relatively temperature insensitive. It occurs almost as rapidly at 40 degrees as it does at 70 degrees. On the other hand, the process of respiration, which involves the utilization of photosynthetically produced food, is very temperature sensitive. The warmer the temperature, the higher the rate of food reserve use. This means that in most areas where summer temperatures exceed 75 degrees, Kentucky bluegrasses are in a state of "deficit spending" with regard to food in reserves. In other words, they are burning up more carbohydrates in respiratory processes when temperatures are warm than they are making in photosynthetic processes. Therefore, it is not wise to be forcing bluegrass into more rapidly respiratory rates with fertilization. Summer fertilization of Kentucky bluegrass in warmer regions of the United States results in excessive loss of stored food reserves. In many regions of the United States, fertilization of Kentucky bluegrass during periods when photosynthesis is maximum and respira-

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tion rates are minimum (late fall) can lead to maximum storage of food reserves. These food reserves are then utilized during the winter growing season for the production of roots. These same food reserves can be utilized to provide recuperative potential in July and August. Carbohydrate storage is maximum during the winter and early spring and root growth begins in the fall and peaks in early spring. The top growth rate is medium in the fall and minimum in the winter with a maximum peak appearing in the spring. During the spring period of rapid top growth considerable depletion of carbohydrate food reserves occurs. At the time of increase in top growth rate, root growth essentially stops. Current golf green recommendations for Virginia are slanted heavily toward late fall fertilization to provide the maximum benefit associated with late fall fertilization.

There are several areas in plant nutrition where challenging decisions will have to be made by professional turfgrass managers in the future. In 1967, approximately 19 percent of the world's nitrogen fertilizer was in the form of Urea and this amount increased to approximately 30 percent by 1974. As Urea becomes a more economically reasonable fertilizer to produce, it is obvious that professional turfgrass managers will be increasingly faced with Urea as the only available soluble nitrogen source. It is important that professional turfgrass managers have a good understanding of the nitrogen reactions that occur in the soil in order to improve the efficiency of nitrogen use. There is no doubt, that the volatility of applied nitrogen from Urea will significantly exceed that of ammonium nitrate under normal turfgrass situations (9). Professional turfgrass managers can increase the efficiency of applying Urea by being certain that it is not applied in conjunction

with liming operations and that irrigation immediately follow the application.

As the omni-present fertilizer/food crisis becomes increasingly threatening, it is highly likely that non-fertilizer use of fertilizers will come under increased scrutiny. We can be certain that there will be increased emphasis on the use of organic sources of nitrogen such as liquid and composted sewage sludge. Increased nitrogen fertilizer prices may eventually force a return to turfgrass varieties which respond better to low nitrogen fertilization programs. If nitrogen becomes extremely costly, we cannot preclude the possibility that we may be once again looking into the infusion of legumes into turfgrass stands to provide nitrogen. Ultra-high analysis fertilizers will be in vogue. In an attempt to reduce transportation and storage costs. Sulphur coated slow release potassium sources will be heavily investigated as will the possibility of utilizing expanded plant analysis for determining more efficient plant nutrition needs. Work currently being conducted on nitrogen fixation in grasses with the bacteria *Spirillum lipoferum* indicates that successful inoculation of *Digitaria*, *Paspalum*, *Cynodon*, and Pearl millet has been achieved. Optimum temperature for the *Spirillum* organism is from 86 degrees to 104 degrees F., which indicates that the current findings will have limited influence upon cool season grasses. This does not, however, preclude the possibility of finding other organisms capable of fixing nitrogen in grasses at lower temperatures.

Plant nutrition has advanced more in the direction of being a SCIENCE in the last thirty years, however, it still remains predominantly an ART which must be learned through experience by professional turfgrass managers. There is an increasing need for research in turfgrass nutrition in hopes of increasing our ability to reduce the cost of producing quality turf.

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## Make wine—not waste—with whey

By Tom Gentle  
Information Representative  
Extension Communication  
Oregon State University

Several years ago, a small cheese factory in Coos Bay on the southern Oregon coast, dismantled its vats and closed its doors. Poor management was not at fault. Nor could the economy be blamed.

The problem was whey, a watery by-product of cheesemaking. The cheese factory went out of business because it had too much whey to dispose of. The closing was not a unique phenomenon, but exemplified a nationwide problem confronting cheese manufacturers.

Now, thanks to a partnership involving the Oregon State University Extension Service, the OSU Agricultural Experiment Station, and private enterprise, one solution to the surplus whey situation has been found. After 3 years of research and testing, this partnership has shown that making wine from whey could be an answer.

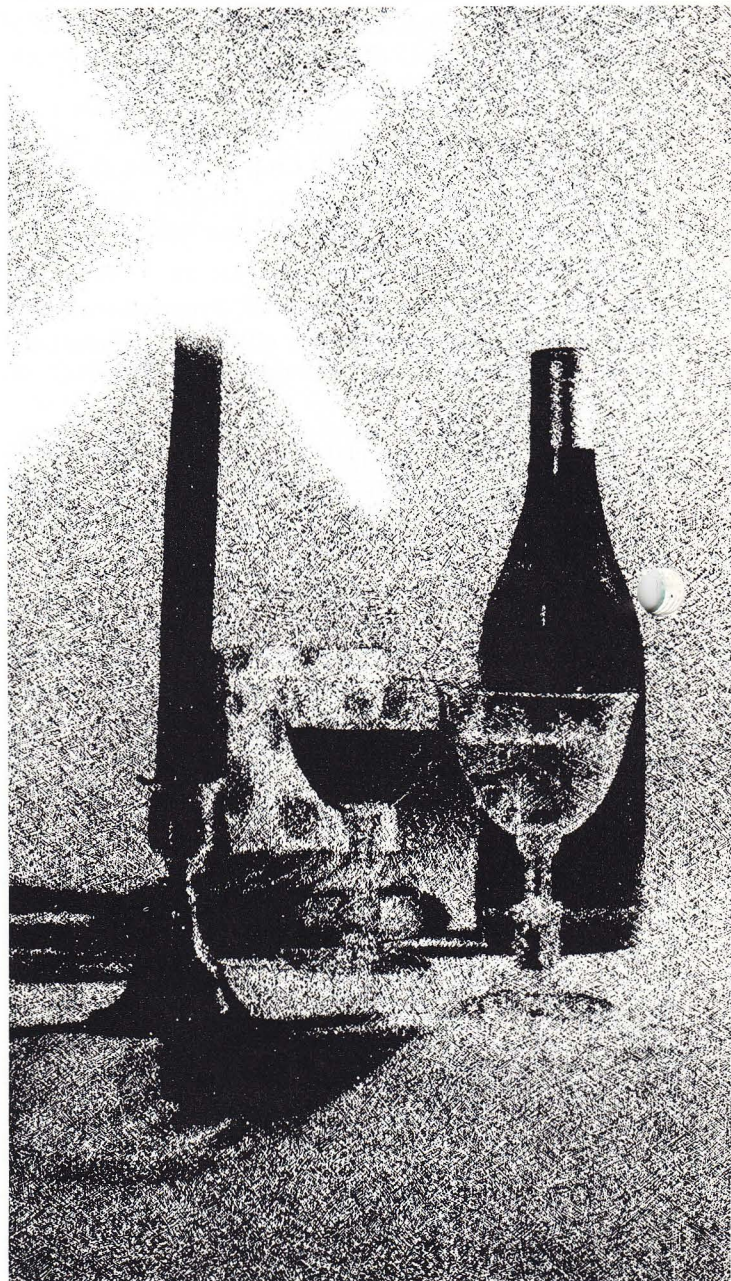
Why has whey been such a handicap to the cheese industry? For every 100 lbs. of milk used in cheesemaking, only 10 lbs. end up as cheese. The remaining 90 lbs. is whey. Some of this whey is utilized as a protein supplement, or as a component of dairy solids in ice cream, cake mixes, toppings and sauces. But, most of it goes to waste. Of the 30 billion lbs. of whey produced annually in the U.S., 13 billion lbs. become excess. The whey often ends up in streams and sewer systems where it promotes high bacterial growth and an unpleasant odor.

Whey pollution is so extensive that the Environmental Protection Agency (EPA) has issued strict regulations forcing cheese manufacturers to discontinue dumping whey into sewer systems by July 1977.

"The idea of converting whey into wine was sparked by Mayflower Farms, a Portland dairy cooperative," said Floyd Bodyfelt, the OSU Extension dairy processing specialist, who played a major role in the project.

An executive at the cooperative had read about a priest in Alaska, Father Emmet Engel, who had developed and marketed a wine made from whey. After dispatching a man to look at Father Engel's wine operation in Palmer, the cooperative contacted Bodyfelt in the spring of 1973. "They wanted OSU to conduct more research on making wine from whey," said Bodyfelt. He and Hoya Yang, an agricultural experiment station researcher with OSU's Department of Food Science and Technology, met with representatives of the cooperative where they agreed to explore the notion of whey wine.

"Extension had a part in uncovering the potential for research into whey wine," Bodyfelt pointed out. He describes his role as that of a catalyst bringing together the university, government, and industry for research sponsorship, industry pilot plant development, and marketing



trials. His contacts with the dairy industry and government agencies proved invaluable.

Credit for the technical breakthroughs achieved goes to Yang, chief investigator for the research project, and to Kay Berggren, the technician. Yang and Berggren worked through the summer, and by September they had several promising batches of wine—some from cottage cheese whey, some from cheddar whey.



Although impressed with the initial wine samples, the dairy cooperative could not fund additional research. Convinced their work on whey wine showed promise, Bodyfelt and Yang contacted EPA, which had previously funded research on whey utilization.

Bodyfelt and Yang submitted a proposal, which EPA quickly funded for \$39,000. Their subsequent research met with success. The whey produced a versatile wine that could be consumed straight or blended with berry wines. It also mixed well with a synthetic citrus flavoring, giving it a taste similar to "soda-pop" wines already on the market.

Most important, the wine-from-whey process has distinct advantages for the beleaguered cheese industry:

- The entire whey is utilized, eliminating the need to dry it.
- No energy is required for the fermentation process (unlike the production of protein supplements from whey, which requires large amounts of energy).
- The wine has a greater monetary value than other whey products. (Ninety lbs. of whey make 10 gallons of wine, which has an approximate market value of \$50.)
- The method can be readily utilized by small cheese factories because no elaborate or expensive equipment is necessary.

"Perhaps the greatest benefit is the one that makes this process feasible for the small cheese processor," Bodyfelt said, referring to the increasing closures of small cheese factories.

The second phase of the whey wine project involved testing for commercial production and consumer acceptance. Bodyfelt tried to persuade Oregon processors to carry out this phase, but was not successful.

A San Francisco-based foods company received approval to do the pilot plant investigations. The first commercial wine from whey should be ready for test market studies during the fall of 1977.

"Extension is too far removed from industry economics and testing problems. Its role now is to spread the word about the technology and merits of processing wine from whey," said Bodyfelt.

He is doing just that. Bodyfelt has demonstrations scheduled at Cornell University and the New York Cheese Manufacturers Association in September, and at The Ohio State University and the University of Arizona next February. Other states are also requesting his appearance.

The future holds promise for some cheese manufacturers, who now pay to dispose of whey, or who face closing down. They may be able to produce a profitable product and simultaneously eliminate a water-pollution problem.

"Wine-making can't solve the problem completely. There's too great a volume of waste whey for that. But we took a novel approach and may have come up with a partial answer," said Bodyfelt.

The story does not end here. The next step is to explore the possibility of brewing beer from whey.

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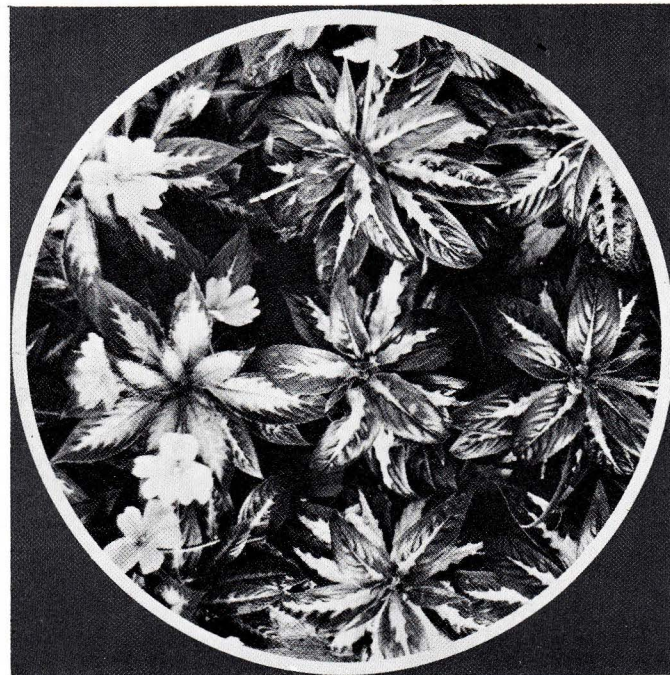


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## Potted Florist Crops for Everyday Use

### New Production Programs

By Carl F. Gortzig  
Department of Floriculture and  
Ornamental Horticulture, Ithaca



The past several years have seen a tremendous upsurge in the popularity of potted flowering and foliage plants for year-round, informal use in homes, offices, and business establishments. This new kind of "green revolution" has caused sales in retail florist shops, supermarkets, discount and regular department stores, and even flea markets to burgeon. Both stimulated by and stimulating the desire for an array of houseplants, a new phenomenon in retailing has appeared on the scene. This is the increasingly familiar plant store — a cash-and-carry, low-service shop located in an active retail area and devoted primarily to selling potted plants for everyday enjoyment.

However, the current enthusiasm is for plants in containers smaller than the usual 6-inch standard flowerpot. Therefore, to serve this market, commercial greenhouse growers need both to find new plants that grow well in small containers and to adapt present crops to this use. They must also develop production schedules and systems that will enable them to raise these crops economically and sell them profitably.

Recognizing that the producers who comprise New York State's nearly \$30 million florist-crop industry were presented with a new opportunity to serve consumer needs, researchers and extension faculty in the Department of Floriculture and Ornamental Horticulture of the New York State College of Agriculture and Life Sciences initiated an exploratory program in the fall of 1973. Our dual objectives were to identify the plants that could best be adapted to the new consumer requests and to develop efficient, year-round greenhouse production schedules for the growers. Our ultimate goal was to provide consumers

with a steady supply of quality plants at prices that would enable them to make frequent and regular purchases and to assure the grower his necessary return.

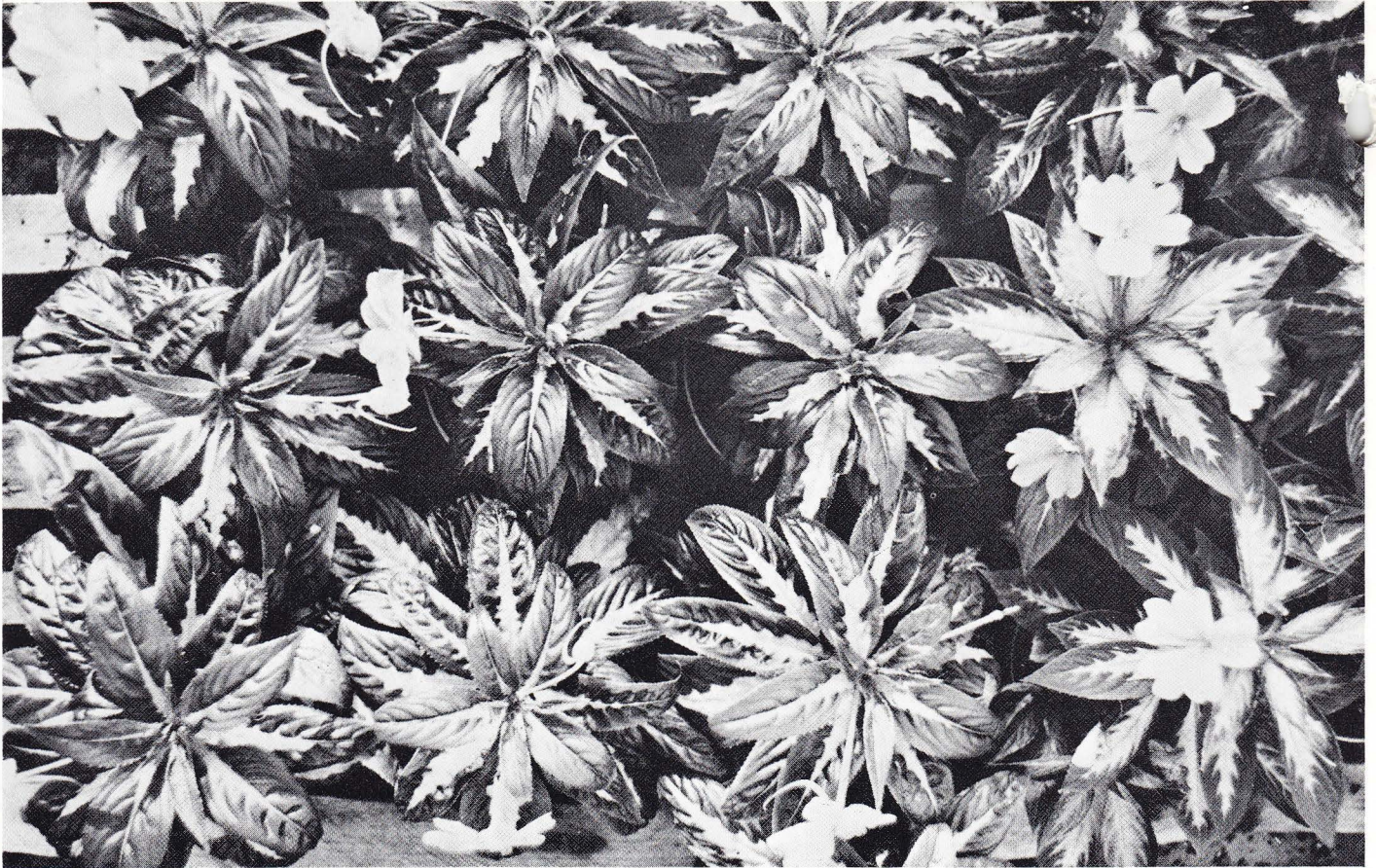
We identified several characteristics essential to suitable plants. The most desirable plants must have colorful flowers, foliage, or fruit. Further, they must be producible throughout the year under New York State greenhouse conditions and be ready for sale in a 4-inch plastic pot within 10 to 14 weeks or less. Also, a plant species should have minimal labor and other cultivation requirements. That is, acceptable crops must not involve such practice as pinching, disbudding, growth regulator treatments, changes in spacing, transfer from one temperature to another, and special lighting and shading. They should have a minimum of the insect and disease problems that call for expensive control action. Moreover, producers should be able to seed crops in the pot or to pot directly from purchased cuttings, bulbs, or other propagative material to avoid having to maintain stock plants. Also, high-cost hand irrigation should be replaced by a mechanical method such as the capillary bench.

In our first year of research, we selected the following crops for the program:

- Clerodendrum — Glorybower
- Coleus 'Carefree' series — 'Jade', 'Red', 'Pink', 'Flame', 'Scarlet'
- Marigold — 'American First Lady' (lemon yellow)
- New Guinea impatiens species

(Continued on Page 16)





New Guinea impatiens and other crops in this program spaced 6" x 6" throughout the production period.

(Continued from Page 15)

Primrose — 'Pacific Giants — Jewel Mixture'  
Zinnia — 'Peter Pan Orange' and 'Peter Pan Pink'

The 'Carefree' coleus and the New Guinea impatiens are very colorful foliage plants, spanning nearly all the color range except blue. Because some impatiens bloom freely and others only sporadically, they were selected

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Professor Carl F. Gortzig and technician Philip Ormsby serve development of New Guinea impatiens in Cornell greenhouses.

primarily for foliage color and pattern and for plant form; if the plant flowered at marketing time, it was simply considered a bonus.

On the other hand, a clerodendrum, marigold, primrose, and zinnia provide a wide range of clear, bright flower colors. Clerodendrum is also an attractive foliage vine after blooming, and primroses, being semi-hardy perennials, can be transferred to the garden, if purchased in late winter or early spring. Unfortunately, the latter two violate our basic requirements because clerodendrum requires growth-regulator treatments, and primroses require 5 to 6 months, instead of 10 to 14 weeks, to produce a saleable crop. However, they were included for evaluation because other attributes commend them for use in this program.

In addition, the plants selected could be supplemented with an assortment of already available colorful foliage plants and greenhouse chrysanthemums year-round and, for special-occasion purchases, garden mums from April through June, poinsettias for November and December, and pink and white poinsettia cultivars for Mother's Day. The production schedules and cultural practices for these crops are already available, however, none of them meets the requirements of our everyday crop program: mums need light and shade treatments, disbudding, and perhaps pinching and growth-regulator treatments. Poinsettias must be pinched, treated with a growth regulator, and perhaps given light and shade care.

Production programs are planned to be as economical as possible of greenhouse space and labor. Seeding is done and cuttings are rooted in the marketing container. The soil is standardized Cornell peat-lite mix A for potted crops, with enough slow-release fertilizer added to carry the crop 12 weeks. During the eighth through twelfth weeks, it may be necessary to add nitrogen and potassium

(Continued on Page 18)

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(Continued from Page 17)

to clerodendrum, 'Peter Pan' zinnias, and some species of New Guinea impatiens. This is especially true during the bright periods of the year.

Crops are grown at a spacing of six 4-inch plastic pots per square foot throughout the production period. This eliminates periodic respacing and provides ample room for quality plant production, provided the plants are sold just as soon as they reach saleable size or as soon as the blossoms of flowering plants are sufficiently developed. This is an important point in determining the profitability of this crop rotation. Growers who adopt the program must recognize that holding crops in the greenhouse beyond the stage of optimum salability only adds to the production costs and thereby reduces returns.

To provide information on crop scheduling and performance under the various geographical and climatic situations in New York State, the plots were run concurrently at Ithaca, Farmingdale, Mattituck on Long Island, Cobleskill, and Alfred. Ralph N. Freeman, Cooperative Extension agent in Suffolk County, Long Island, conducted the work there. Irvin A. Gillow, Erie County Cooperative Extension agent, and floriculture faculty and students at S.U.N.Y. Agricultural and Technical at Alfred worked in the western New York area; and William H. McEvoy, Cooperative Extension specialist in the Capital

District, with the floriculture faculty and students at S.U.N.Y. Agricultural and Technical College at Cobleskill, ran the plots there. The writer, with technician E. Ormsby, conducted the Ithaca research. In most seasons of the year, the plots at Alfred, Cobleskill, and Ithaca performed similarly and could be produced with essentially the same schedules. The Long Island plots tended to mature 7 to 10 days earlier than those grown at the three up-state sites.

Production budgets were developed for each of the crops grown in the experimental program. Wholesale market prices ranging from \$0.65 to \$0.90 were assumed. At these prices, the retailer could probably sell the product at \$0.99 to \$1.79 and obtain the mark-up necessary to cover his costs and profit. All crops showed the potential for yielding net returns per square foot of greenhouse area that were equal to, or in most cases greater than, those from plants grown in the traditionally larger container.

Further test applications of the everyday, florist-crop production programs by Cooperative Extension field staff, University workers, and industry men confirm that, with the approach described here, New York State greenhouse men can provide crops of the popular small plants. Moreover, this kind of production is not incompatible with the commercial flower grower's continuing to produce larger plants for the customary, important specialty and gift market served by the retail florist.

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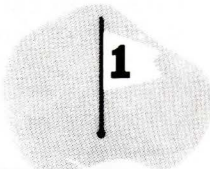
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