Computer-planned Gardens[1]

Julie F. Bernstein,[2], John A. Wott,[3] and Judy Santini[4]
Department of Horticulture, Purdue University, West Lafayette, IN 47907

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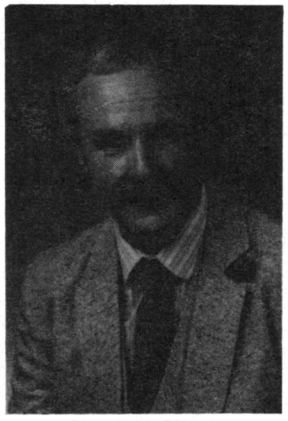
The Fast Agricultural Communications Terminal System (FACTS) is a computer-based communications system with intelligent terminals in each Indiana County Extension office, departmental offices at Purdue, and linkage to a central computer. A program was developed to plan a home vegetable garden which included 27 vegetables, data on crop placement, planting dates, general cultural information and yield data. The program was based on input and predetermined yield data. It has been widely accepted by neophyte as well as experienced gardeners and is a prototype for additional programs in home horticulture.

Julie F. Bernstein



John A. Wott

Judy Santini

The computer is rapidly becoming an effective tool in daily management of industrial, educational, and even personal affairs. The Cooperative Extension Service (CES) is entering the computer age by using computer technology as an effective extension tool.

In 1977, Purdue University initiated a computer-based communications system, FACTS, funded initially by a $1.2 million grant from the W.K. Kellogg Foundation, Battlecreek, Mich., with matching funds from Purdue University, the State of Indiana, and its 92 counties (4).

FACTS was unique, as the principal hardware component of its distributed systems was the intelligent terminal. In these systems, the campus and county terminals were "intelligent," meaning they were capable of doing more than just transmitting and receiving data. Each terminal was a small computer which was capable of independent operation of applications and program development. Presently, there are 127 of the systems in Indiana; 91 in county offices, 10 in each of the area extension offices, and 26 in the campus departments in agriculture and consumer and family sciences.

Equipment

The standard hardware configuration was a 56K byte memory, central processor with hardware floating point, 2 single-density, single-side diskette drives, cathode ray tube (CRT) console, 180 characters/second printer, and a 120 characters/second communication modem. The specific hardware was a Digital Equipment Corporation PDP 11V03, Vadic 3455 modem, FX Floppy Disc System, DECscope Video Terminal VT 52, and LA 180 DECprinter (Fig. 1). The software was MU-BASIC, which meant that up to eight video terminals could be used with one central processing unit.

These terminals were linked by telephone lines to a front-end processor (PDP 11/70) at Purdue University. If there was a message to be sent between counties or between county terminals and campus, this computer acted as the message-switcher. In addition, when a problem was handled by the university's central computer (a CDC 6500), the front-end processor acted as the intermediary between the county and the university computer system.

Development

Subject matter specialists in each campus department selected topics and, with the aid of computer programmers, prepared application programs. The Purdue Department of Horticulture designed its initial application in the area of home horticulture, since an increasing number of questions and problems relating to this area had arisen (3). A survey initiated in 1971 by the Cooperative Extension Services of Minnesota and Wisconsin and USDA explored various extension approaches to communicating home garden information (9, 10). The use of computer technology was listed as a high priority in helping to meet the demand for home gardening information.

From 1971 and 1975, interest in vegetable gardening increased steadily, according to a survey prepared for Gardens for All by the

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[2]Graduate research assistant in horticulture. Present address: 690 Ocean Parkway, 6F, Brooklyn, NY 11230.

[3]Professor. Present address: Center for Urban Horticulture, AR-10, University of Washington, Seattle, WA 98195.

[4]Computer programmer. Present address: Department of Agronomy, Purdue University, West Lafayette, IN 47907.

Gallup Organization. A peak was reached in 1975 with 49% of the surveyed households gardening (5). In 1980, the incidence was 43%, but gardens were larger and a larger variety of vegetables were being grown. In addition, the Midwest has consistently had the highest percentage of gardeners (6).

Because of increasing interest in vegetable gardening, the Purdue specialists developed a garden program to aid in planning a garden known as the Vegetable Garden Planning Program (VGPP). The VGPP diagramatically planned a vegetable garden based upon predetermined parameters and user input.

Input

The program was designed so that the user answered a series of simple screen queries (Fig. 2). Each screen contained one question and a minimum amount of explanation. However, the entire FACTS system was developed so that if the user required an additional explanation, a "Help" key would bring up more information.

In order to use the program at meetings not held at a county office or to answer telephone inquiries, a simple questionnaire was developed as a separate program (Fig. 3). Both the "Help" explanations and the questionnaire could be run in quantity for ease of later use.

The program was designed to be run in the county office by either an extension agent or a secretary. In actual practice, it is so easy to input data, the user can also enter it without assistance. At flower shows and open houses where the system has been displayed, persons line up to run garden plans.

Questions

The questions which the user answers are as follows:

Name. Each sheet of the program is headed by a statement which indicates the plan has been "designed especially for *Mr. Home Gardener* on *date*." This individualizes the plan for each person.

Garden size in width and length. Square or rectangular gardens were planned with dimensions ranging from 1 × 1 ft to 900 × 900 ft.

Orientation. The user selects 1 of 6 possible garden orientation having sides or corners aligned to the points of the compass.

Minimum row width. The user selects 1 of 4 minimum row widths based upon preferred method of cultivation. Hand cultivation had a minimum row width of 1 ft. Cultivation by large rototillers or small garden tractors had a minimum row width of 4 ft.

Vegetable choice list. In the initial program, a choice of 11 vegetables was available from which the user entered the number of adults to be supplied with each vegetable for fresh and/or processed use. The vegetable selections offered were based on their popularity according to a 1975 national survey (7). Amounts to be grown per adult for fresh and/or processed use were obtained from various extension and commercial publications (1, 8, 11, 12). In addition, vegetables were chosen as representative of groups (double cropped, high space/low yielding, full season) to allow for future expansion of the selection of vegetables. High-space requiring vegetables like corn or cantaloupe (muskmelon) were excluded from gardens under 625 sq ft.

In 1978, the program was expanded to include 27 vegetable selections. Gardeners desiring to plant a species not available on the list could consult the *User's Guide*. The *Guide* explained how certain species could be substituted for others (2).

Fig. 1 The intelligent terminal included (top right) key input and video screen, (bottom right) processor, (left) printer.

Storage and calculations

After inputting the data, 3 to 5 minutes were required while calculations were prepared. Calculations were based on user input data and additional data stored within the program matrix. Data stored for each species included whether a vegetable was a full-season or double-cropped vegetable. Also, recommended row width, height, yield, and amount to be grown per adult, both fresh and processed use, were available. These data were used in the algorithm, a series of mathematical equations.

The algorithm first calculated the area required by the user's choice of vegetables. If this area exceeded the actual area of the garden space available, the amount of each vegetable was reduced proportionally.

The garden was then divided into two sections: one for full-season vegetables and one for double-cropped vegetables. The full-season vegetables were subsequently allocated according to row width and were ranked by height within each row width grouping. In this way, tall crops were kept to the north to minimize shading of lower-growing crops. Corn was allocated separately from other full season vegetables as it should be blocked or planted across the entire row. Finally, double-cropped vegetables were allocated in a similar manner.

Output

The user received an 8-page print out composed of the following sections:

Page 1. *User Input*. This page summarized the data input by the user.

Page 2. *Garden Plan Summary*. For each vegetable, the summary listed three items: (a) total linear ft and number of transplants and/or hills to be planted, (b) the expected yields, and (c) the number of adults to be fed by each crop.

Page 3. *The Garden Plan*. Two types of plans could be printed. For gardens under 30 ft in width, a combination of single-row symbols and individual symbols characteristic for each crop were used (Fig. 4). Gardens over 30 ft used a line of upper and lower case type for vegetable symbols. Individual plants were not represented (Fig. 5). Garden width and length were marked as were the points of the compass.

Page 4. *Row Placement and Symbol Key*. These two items facilitated reading the plan. The placement of each row was indicated by the actual number of ft, starting from the northwest corner of the garden. The rows extended down the left side of the print out sheet. For each row, the number of ft of each vegetable to be planted in the row was indicated. The symbol key indicated the appropriate symbol for each vegetable.

Page 5. *Vegetable Planting Guide*. This

HOME VEGETABLE GARDEN PLANNING PROGRAM

This program will design a vegetable garden. The Client is asked for the vegetables to be grown for summer consumption and processing. The program will calculate and print a garden plan, expected yields, and planting information.

This instruction and the corresponding answer sheet allow an individual to obtain a garden plan, even if time or the inaccessability of a FACTS terminal make running the program in person an impossibility.

The answers to the following questions should be written on the answer sheet, while this document attempts to explain what information the computer needs, and the allowable answers.

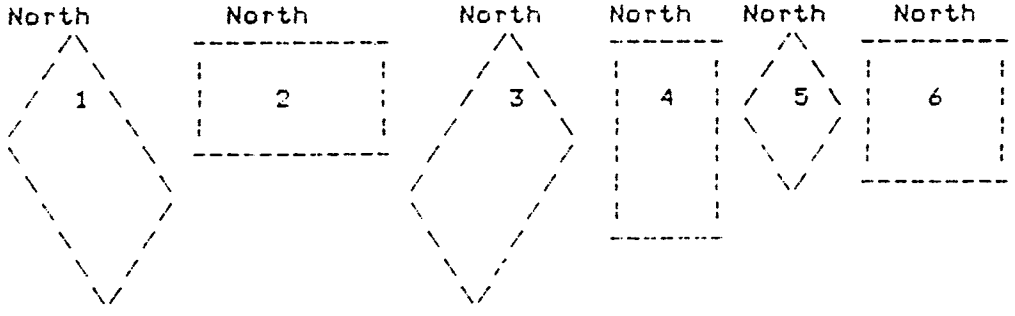
QUESTION 1: WHAT IS THE CLIENTS NAME? XXXXXXXXXXXXXXXXXXXXX

The printed plan will be specifically designed for each Client.

QUESTION 2: WHAT IS THE SIZE OF YOUR GARDEN? WIDTH IN FEET? XXXX
LENGTH IN FEET? XXXX

If your garden shape is unusual, you may designate a garden width and length that approximates your square footage. Do not plan for more than you can handle. It can take one person two weekends to turn the soil of a 25 by 30 foot garden by hand, and two hours a week to care for it. This does not include planting and harvesting.

QUESTION 3: THESE ARE THE POSSIBLE PLOT SHAPES AND ORIENTATIONS TO THE SUN:



PLEASE ENTER THE NUMBER OF THE GARDEN PLOT SHOWN ABOVE WHICH IS MOST NEARLY LIKE YOURS (1-6)? XXXX

QUESTION 4: YOU CAN CHOOSE THE MINIMUM ROW WIDTH TO FIT YOUR GARDEN EQUIPMENT.

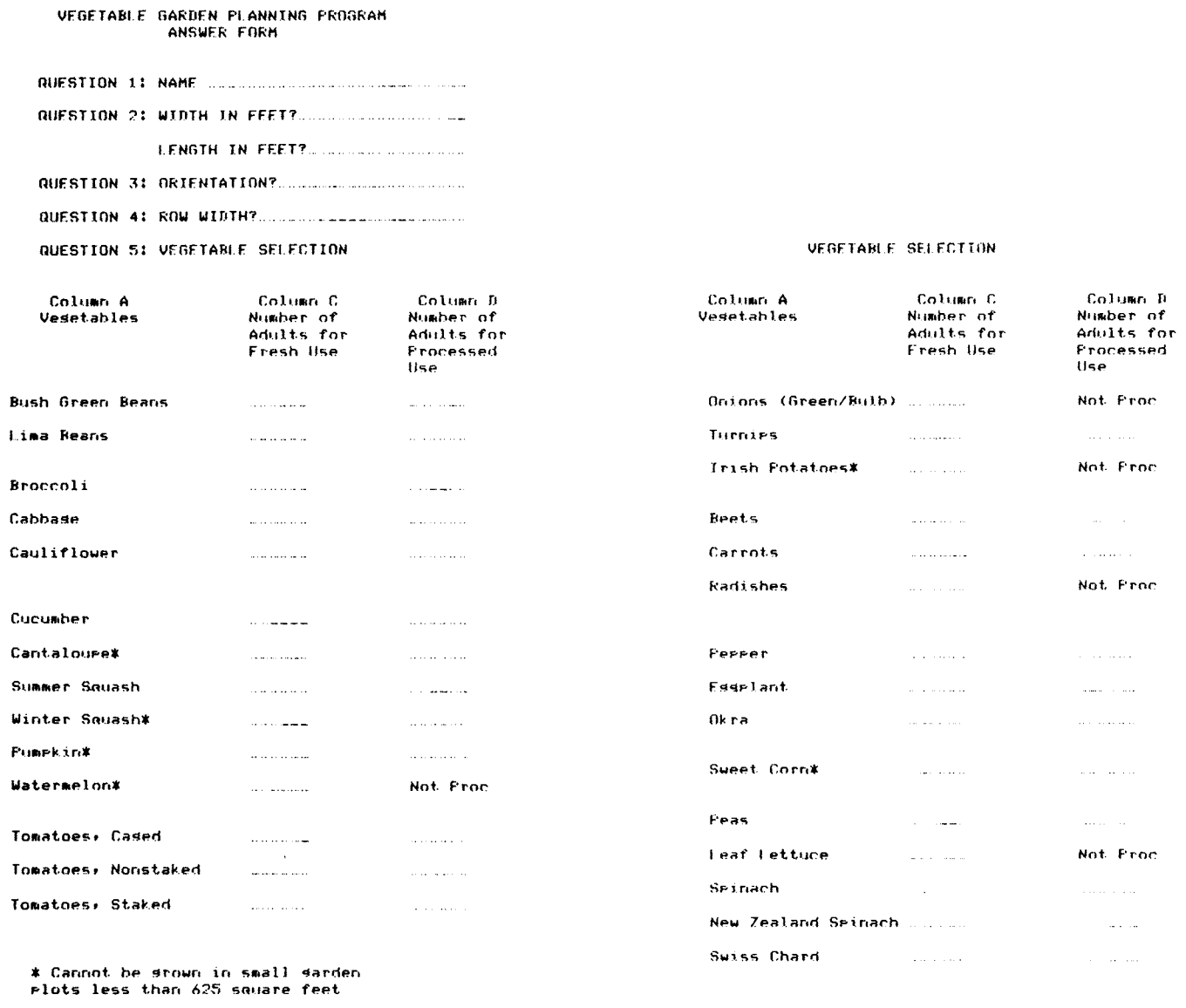
MINIMUM ROW WIDTHS:

HAND WEEDING	- 1 FOOT
SMALL ROTOTILLER	- 2 FEET
MEDIUM ROTOTILLER	- 3 FEET
LARGE ROTOTILLER OR SMALL GARDEN TRACTOR	- 4 FEET

WHAT IS YOUR MINIMUM ROW WIDTH IN FEET (1-4)? XXXX

The program will not plant rows closer than the width you choose.

Fig. 2. The input screens and "help" messages are summarized as they appeared on the video.



VEGETABLE GARDEN PLANNING PROGRAM
ANSWER FORM

QUESTION 1: NAME .....

QUESTION 2: WIDTH IN FEET? ..

LENGTH IN FEET? .....

QUESTION 3: ORIENTATION? .....

QUESTION 4: ROW WIDTH? .....

QUESTION 5: VEGETABLE SELECTION

VEGETABLE SELECTION

Column A Vegetables	Column C Number of Adults for Fresh Use	Column D Number of Adults for Processed Use
Bush Green Beans	.....	.....
Lima Beans	.....	.....
Broccoli	.....	.....
Cabbage	.....	.....
Cauliflower	.....	.....
Cucumber	.....	.....
Cantaloupe*	.....	.....
Summer Squash	.....	.....
Winter Squash*	.....	.....
Pumpkin*	.....	.....
Watermelon*	.....	Not Proc
Tomatoes, Cased	.....	.....
Tomatoes, Nonstaked	.....	.....
Tomatoes, Staked	.....	.....

Column A Vegetables	Column C Number of Adults for Fresh Use	Column D Number of Adults for Processed Use
Onions (Green/Bulb)	.....	Not Proc
Turnips	.....	.....
Irish Potatoes*	.....	Not Proc
Beets	.....	.....
Carrots	.....	.....
Radishes	.....	Not Proc
Pepper	.....	.....
Eggplant	.....	.....
Okra	.....	.....
Sweet Corn*	.....	.....
Peas	.....	.....
Leaf Lettuce	.....	Not Proc
Spinach	.....	.....
New Zealand Spinach	.....	.....
Swiss Chard	.....	.....

* Cannot be grown in small garden plots less than 625 square feet

Fig. 3. A simple questionnaire is completed by the user.

chart was developed so that planting information was readily available to the user without further research. Information included the planting method (drill, hill, or transplant), number of weeks to grow to transplant size, thinning distance, early and late spring planting dates, succession planting, fall planting dates, and reference bulletins from Purdue University.

Page 6. *Everything you wanted to know about the planting guide but were afraid to ask.* The title of the 6th page was chosen to intrigue the user and inspire further reading. Each column of the vegetable planting guide (5th page) was explained and/or examples given for additional explanation.

Page 7. *Cultural Notes.* Information and tips on planting, growing, and/or harvesting for each vegetable were given on this page.

Page 8. *Ten Rules of Good Gardening.* Advice on soil preparation, site location, seed purchase, fertilization, cultivation, irrigation, row orientation, and crop rotation were briefly outlined.

Results

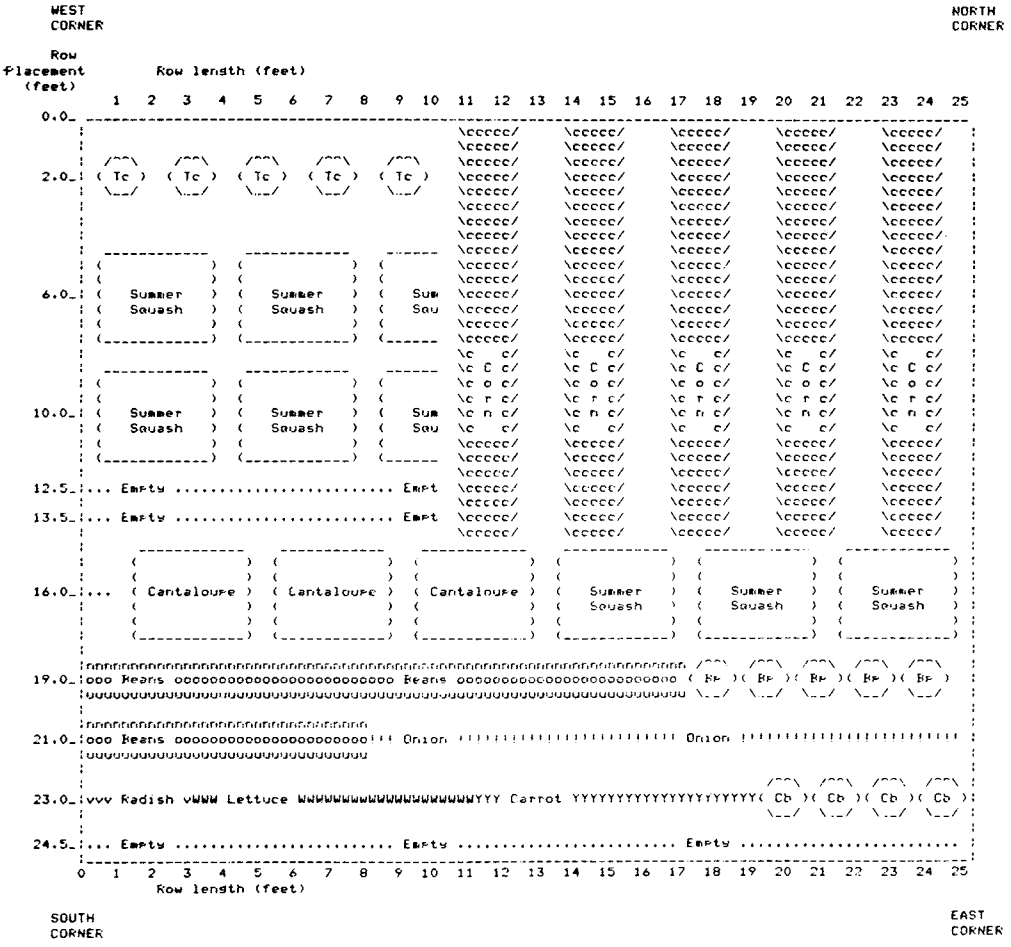
The program was tested in selected Indiana counties in 1978 and 1979. Since 1980, it has been available to all Indiana residents free of charge, simply by stopping at or calling their county Cooperative Education Office. At one flower show, 1,000 requests for programs were received.

The program was copyrighted by the Purdue Research Foundation and has since been released to a national seed company. They are using it in their spring 1981 sales campaign.

The program also has been licensed for educational use through the following agencies: the Cooperative Extension Services of Utah, Mississippi, Missouri, Ohio, Idaho, Oregon, and Wisconsin, and the Maryland National Capital Parks Commission.

The VGPP has been used by beginning gardeners, community gardening groups, and experienced gardeners alike. All have found the program easy to run either alone or with the aid of extension personnel. Experienced gardeners have found their computer garden to be similar to previous unplanned gardens. Sometimes it indicated their already perceived mistakes such as planting too much. The VGPP has helped agents in disseminating home vegetable garden information and in teaching good cultural practices for vegetable gardens.

This program is a model for other home horticulture programs such as small fruit gardening, home landscaping, and flower gardening. It introduces the user to the capability and diversity of small computers, which are becoming commonplace in daily living and will become increasingly prevalent in the home in the future (7).



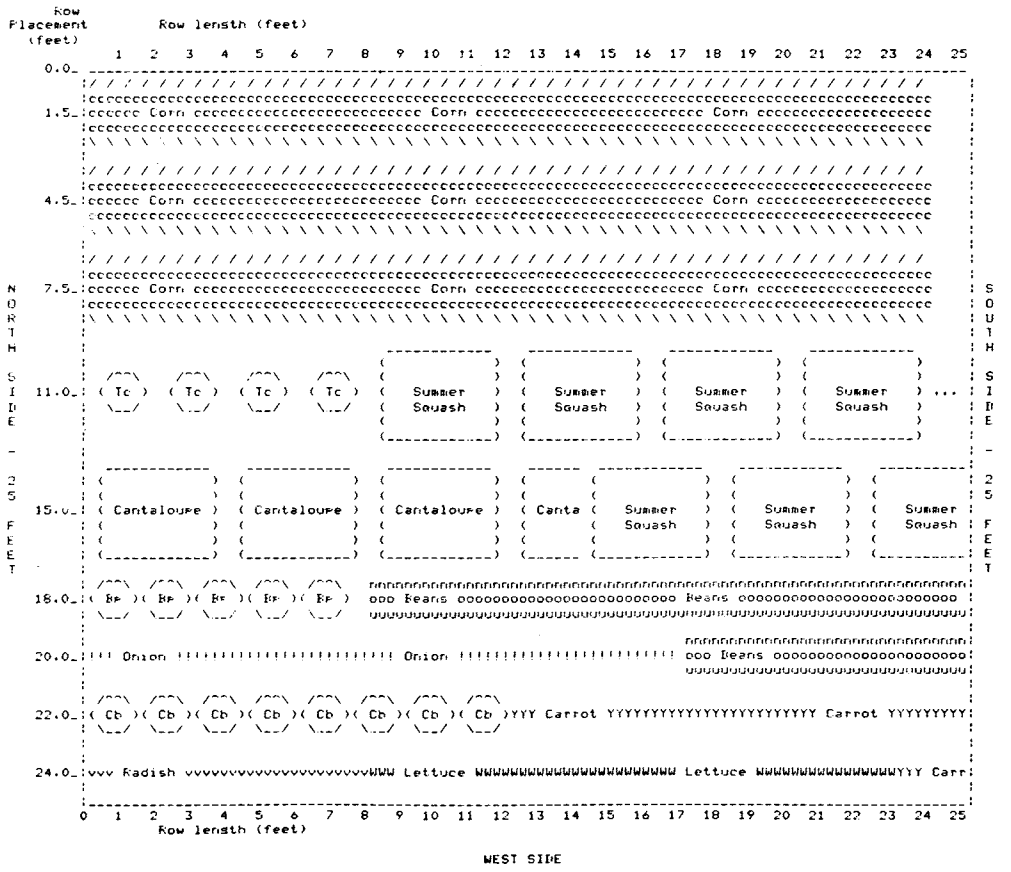


Fig. 4. Plans for small gardens showing a) block corn and b) row corn.

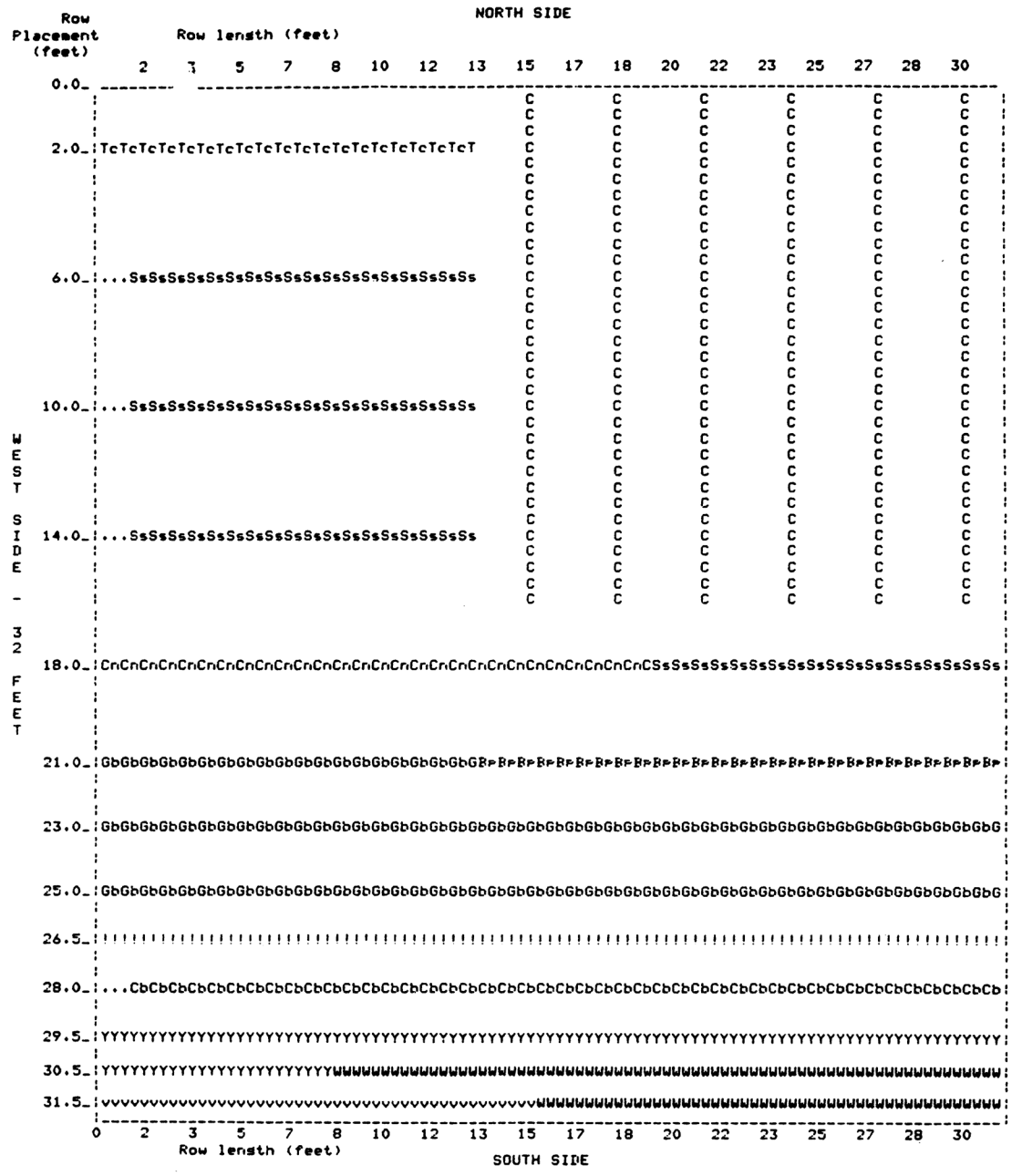


Fig. 5. Plans for a large garden using single line symbols.

Fig. 6 A large garden which was planned by a computer.

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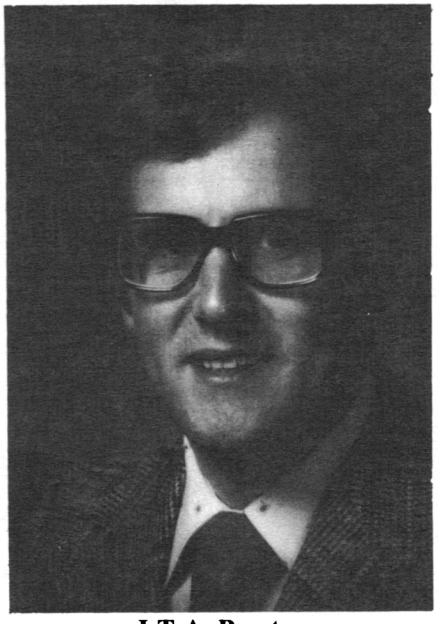
The Apple Industry in Korea[1,2]

J.T.A. Proctor[3,4]

Department of Horticultural Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1

Jae Chang Lee[4]

Department of Horticulture, Chungnam National University, Daejeon, 300-01, Korea



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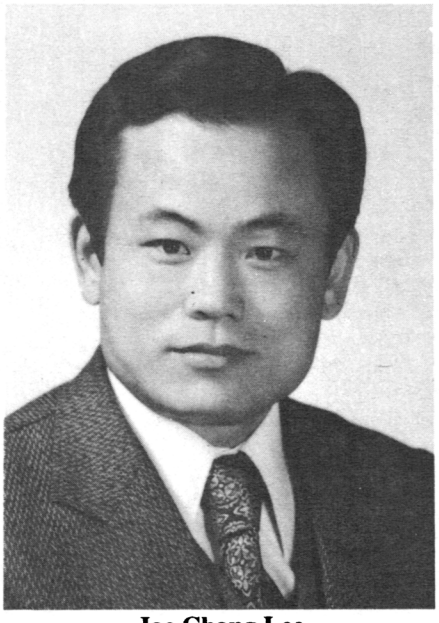

Jae Chang Lee

The word "apple" was first recorded in Korean literature in 1103 BC. After that, and up to the end of the 14th century, an apple cultivar Numgkeum (*Malus asiatica* Nakai) was grown in Gaeseong, the capital city. Today, Korea has an apple industry of some 46,088 ha with a production of about 444,000 MT. The spectacular increase in the Korean apple industry since the Korean War (1950–53) has paralleled the unprecedented growth rate of a newly industrialized nation. Few westerners realize this. A study of the apple industry reveals a fascinating growth story with many aspects of interest to pomologists around the world.

South Korea is a relatively small country (98,477 km^2); it is slightly larger than Indiana (93,994 km^2) and slightly smaller than Ohio (106,765 km^2). In 1979, the population of South Korea was 37,605,000, with 31% of the people living on farms. With a population density of 382 people per km^2 it ranks as one of the most densely populated countries in the world. Effective family planning campaigns in the last decade have restricted population increases.

Geomorphologically, South Korea is characterized by abundant hills and mountains which occupy about 70% of the land. Because of this, cultivated land is restricted and used primarily for the production of food grains, especially rice and barley (Table 1). While almost half of the apples are grown on the plains next to the paddy fields, an increasing amount of apple production is on sloping land. Presently, 17% of the apples are grown on slopes greater than 15°.

On a world basis, South Korea apple production has risen from 27th (217,000 MT) in the period 1969-71, to 17th (444,000 MT) in 1979 (6). This increase in production and demand parallels that of vegetables as the coun-

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[2]Statistical data reported here were extracted from numerous sources provided by the Korean Office of Rural Development.

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