environment, can theoretically be used to either automatically set optimal conditions or to inform the operator of the optimal levels.

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THE USE OF COMPUTERS IN NURSERY CROP PRODUCTION

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Computers at Oki Nursery are not a new sight. We obtained an IBM 403 Card Sorting System about 1960. Programming the machine required actual rewiring of a program board. Later, we graduated to an IBM System 3 and in 1980 to our current computer, an IBM System 38. With this computer, we have linked our Portland branch to our main office in Sacramento. There are more than 12 terminals distributed through the main office in Sacramento and between 20 to 30 people a day use the computer to utilize its processing capabilities or to access information which is held in its memory. Lately we have been networking personal computers to the System 38 to increase our capabilities. Our major applications are order entry, order picking, inventory, truck dispatching, accounting, payroll, credit, and accounts receivable, accounts payable, crop planning, and a variety of management reports.

Now, let me tell you about my personal experiences with a computer because I am not an expert with it. I want to assure you that it does not take a genius to figure out how to use them—because I am not one. A computer is just a machine—a tool. Just like you use a forklift to help move material or a soil machine to fill flats, you can use a computer to help with your business. But as with all tools, you can utilize a computer to its maximum potential or you can waste it if you are afraid to use it or do not learn to use it properly. You cannot be afraid of it and you have to make a commitment to yourself that it will work.

If you've decided that a computer can be part of your business, the next decision to make is not what kind of computer to buy, but what do you want to do. Do you want to use it to do accounting? Do

you want to use it to help with your production? After you answer these questions, then you will need help. Tell the person who is helping you what you want to do—be as specific as possible. He can then help you with the software that is available. When you have a list of software to use—then you decide on the hardware—the computer to run the software and any peripherals you'll need (probably at least a printer).

The one thing that all businesses have in common is accounting. And since there are so many businesses, it follows that there is a lot of software to help with accounting—general ledger, accounts payable, accounts receivable, payroll, inventory. A nursery is a business, so if you've decided that this is where you want to use a computer, there will be a large selection of "canned" or ready-to-use programs available. A nursery can also use crop scheduling, space allocation programs, and other production aids. But since nurseries constitute a relatively small percentage of all business there are few "canned" programs available that are applicable. But the uses for a computer in nursery production are still limitless. You can have seed sowing schedules, purchasing, transplanting schedules, labor requirements, space requirements, and on and on.

I started using a computer for production about two years ago and I want to share with you some of the uses that I have developed and to tell you a little about how I came up with them. The system that I am using is an IBM-PC, using Lotus 1-2-3. One of the reasons I decided on this system is simply because I do not know how to use the mainframe computer at our office and Lotus is easy to use on the P.C. I had no experience with this system but I did manage to begin writing programs the first day I started using it. The reason it was so easy is because of the tutorials that are included with both the machine and the software. There are classes that are available, too, should you decide to take advantage of them.

Lotus is what is called a spreadsheet program. A spreadsheet can be thought of as a ruled paper with each entry you make in a "cell". Each cell has an "address". Columns are labeled at the top alphabetically, rows are numbered at the right. The upper left-most cell is "A1".

Math operations are straightforward. Formulas are pretty much written as a regular math formula but they can get complicated. I will be giving you examples of simple formulas and show you more advanced ones. My purpose is not to teach you how to program but to show you what spreadsheets are capable of doing.

Let us start with a simple spreadsheet so that you can become familiar with terms and some procedures. Let us say that the cells in column "A" are the number of flats of a certain plant you want to produce. The next cell in column "B" is the number of labels you will need. We will write the formula and the results will appear in

column "C". The formulas should be: +A6*B6 (Figure 1). Since the number of labels per flats should be constant, let's say 15, you can also write: +A6*15.

C6: +A6*B6

	A	B	C
1			
2		QTY LABELS	TOTAL
3	QTY FLATS	NEEDED	QTY LABELS
4	PRODUCED	PER FLAT	REQUIRED
5	---	---	---
6	100	15	1500
7			
8			
9			
10			
11			
12			

Figure 1. Portion of a simple spreadsheet showing total quantity of labels required.

This is a specific example (Figure 2). At our company, cp's (or cell packs) require 15 labels per flat, pp's (or pot packs) (or jumbo packs) need 6 per flat, p4's (or 4 inch pots) need 16 per flat. The information that needs to be provided are the amounts of each size that we expect to produce. The formula for the "quantity of labels required" would be the number of cp's times 15 plus the number of pp's times 6 plus the number of p4's times 16. The answer will be the amount of labels that you will need. The formula will look something like:

+B6*15+C6*6+D6*16

E6: [W12] +B6*15+C6*6+D6*16

	A	B	C	D	E
1					
2		# FLATS TO PRODUCE			TOTAL
3		---			QTY LABELS
4	VARIETY	CP	PP	P4	REQUIRED
5	---	---	---	---	---
6	AGERATUM	100	50	75	3000
7					
8					
9					
10					
11					
12					

Figure 2. Specific example of a spreadsheet portion showing total labels required for ageratum.

After we take the inventory out then we will get the quantity that we will actually need to order (Figure 3). The formula will be:

+E6–F6

E6: [W12] +B6*13+C6*6+D6*16

	A	B	C	D	E	F	G
1							
2		# FLATS TO PRODUCE			TOTAL		
3		---	---	---	QTY LABELS	INVENTORY	QTY LABELS
4	VARIETY	CP	PP	P4	REQUIRED	ON HAND	TO ORDER
5	---	---	---	---	---	---	---
6	AGERATUM	100	50	75	3000	750	2250
7							
8							
9							
10							
11							
12							

Figure 3. Spreadsheet showing quantity of labels that need to be ordered.

Now, let us say you produce 250 cultivars of plants. You can put together a label order in the amount of time it takes to enter the numbers.

It used to take me about 2 weeks to produce our seed order by hand. The process included doing a sales analysis of the previous season, developing a projection of the next season and then finally producing the seed order. Using sales information from our mainframe computer, it only takes about 2 hours to develop the projections for our annuals product line of the spring. After I enter the projection into the computer along with our seed inventory, a seed order is produced. Now it is very easy to produce an order well within a day. Of course, there are always changes in projections after everyone in sales and production finishes making their analysis but changes are easy to make.

The spreadsheet can also help produce production schedules. Here is an example of a portion of a sowing schedule. This program may not be the most efficient. There is probably an easier way to do it—but it works this way. Using *Ageratum* 'Blue Blazer' as an example, the way the spreadsheet works is like this (Figures 4–6):

The dates on the right are the sowing dates by week. On April 7, the program calculates the date (June 9) that would be 9 weeks ("No. wks sow to sale") later and looks for a quantity. If there is no amount to be produced on the date that has been calculated, then it simply puts a zero—nothing to sow at this date. On April 14, it does the same thing—9 weeks from April 14, on June 16, we would like to have 25 flats ready. A calculation is made to determine the number of trays (11) to sow and is indicated to sow on April 14.

C9: (F0) [W7] 25

	A	B	C	D	E	F	G	H	I	J
1										
2					SOWING SCHEDULE FOR 1986 (CP) SUMMER CROP					
3										
4					QTY TO SELL 1986					
5										
6										
7	VARIETY	I02-Jun		09-Jun	16-Jun	23-Jun	30-Jun	07-Jul	14-Jul	21-Jul
8	----------	I----------								
9	Ageratum Blue	I 25			25		20		20	
10										
11										
12										

Figure 4. Spreadsheet showing sowing schedule for 1986 summer crop of *Ageratum* 'Blue Blazer'.

Q9: (F0) [W7] @HLOOKUP(Q$7+$L9*7,C7..J9,$N9)*90/200

	L	M	N	OP	Q	R	S	T	U	V	W
1											
2											
3											
4	# WKS										
5											
6	SOW TO	IOFF-I									
7	SALE	ISET	I	I	31-Mar	07-Apr	14-Apr	21-Apr	28-Apr	05-May	12-May
8	----------	I----		I----------							
9		9	I	2 I	11	0	11	0	9	0	9
10											
11											
12											

Figure 5. Continuation of spreadsheet in Figure 4 (see text for explanation).

T9: (F0) [W7] @HLOOKUP(T$7+$L9*7,C7..J9,$N9)*90/200

	A	B	C	D	E	Q	RS	T	U	V
1										
2					SOWING SCHEDULE					
3										
4					QTY TO SELL 1986					
5										
6										
7	VARIETY	I02-Jun		09-Jun	16-Jun			31-Mar	07-Apr	14-Apr
8	----------	I----------						----------		
9	Ageratum Blue	I 25			25			11	0	11
10										
11										
12										

Figure 6. Continuation of spreadsheet in Figure 4 (see text for explanation).

We also use the computer to track our production during the season by using what we call a "crop status" (Figure 7). We will look at our crop weekly and take a physical inventory and note the amount that will be ready to sell in 1 week, 2 weeks, 3 weeks, 4 weeks, and the quantity that has just been planted. By knowing what you have projected to sell, you can determine if you are maintaining the proper quantities of pots or flats by cultivar.

E8: +D8-C8

	A	B	C	D	E	F	G	H	I
1			P4 CROP STATUS FLOWERING						
2									
3									
4		I	1st TWO WEEK PERIOD			I	2nd TWO WEEK PERIOD		
5		I				I			
6	VARIETY	I	EXPECTED	ACTUAL	+/-	I	EXPECTED	ACTUAL	+/-
7									
8	Ageratum	I	2100	5200	3100	I	2100	0	-2100
9									
10	Alyssum	I	1950	600	-1350	I	1950	3200	1250
11									
12	Begonia	I	938	0	-938	I	938	3200	2263

Figure 7. Crop status spreadsheet used to track production during the season.

The examples that I have given are all designed for bedding plants because that is where I have the most experience. But scheduling is the same no matter what the crop. What I wanted to do today was to introduce you to spreadsheets, to show you that they are easy to use, and since you start out with essentially a blank sheet of paper, the possibilities are endless.

RALPH SHUGERT: A question for Mike Dunnett. Is your plant, scabious butterfly blue, available in the U.S.

MIKE DUNNETT: A simple answer is—no, but we are always interested in considering any offers.

VOICE: Could you say something about the flowering of your scabious butterfly blue?

MIKE DUNNETT: It is an herbaceous perennial. It flowers well the first year and for a number of years after that. It could be used as a perennial bedding plant. It shows color from April until October in England. It does not require a winter-chilling period. In a warmer climate it would probably flower continuously.

VOICE: What did your promotional efforts cost you in bringing out this plant?

MIKE DUNNETT: It cost in the first year 27 pence (30 or 40 cents) per plant. This, times 70,000 plants gives about $24,500, not

including my time and that of the other directors of the firm.

KIRK CLARK: This is to Loren Oki. Have you put into your spreadsheet a "fudge factor"?

LOREN OKI: Yes, the calculations are very precise, but we also use a "production factor" of 10%, which indicates more transplantable plants than we calculate.

JAPANESE MAPLE PROPAGATION AT MONROVIA NURSERY

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The numerous cultivars of Japanese maples, *Acer palmatum*, comprise an interesting group of desirable landscape plants. Their variations in leaf form, color, and habit, merit special placement in the landscape. To preserve these characteristics, Japanese maples are traditionally grafted on to seedlings of *Acer palmatum*.

At Monrovia Nursery Company, we are propagating the cultivars by grafting and budding. The propagation method used is determined by the time of year and the size of the scion and rootstock. During late winter, stick budding and side cleft grafts are utilized. In the late summer, chip budding is used.

Stick-Budding. Stick-budding uses a small stick with several sets of buds as a scion. The rootstock must be actively growing and in the bark slip stage for a successful union. This method is particularly useful if there is a caliper difference between scion and rootstock.

In late winter, dormant seedling *Acer palmatum* rootstocks of approximately pencil thickness are brought into a greenhouse held at 72°F. Kept thoroughly watered in this warm environment, the seedlings quickly resume growth and enter the bark slip stage, usually in about three weeks. A color change or "greening" of the stems is a good indication. As the upper buds swell and begin to break it is time to stick-bud.

Dormant leafless scions are collected from container-grown stock. The scions can be held in cold storage for several days if wrapped in damp newspaper.

The grafter cuts a 1 in. T-bud cut near the base of the rootstock. This bark is opened by slipping the budding blade under the bark. The scion is formed using a shallow 1 in. cut on one side and a short basal nick on the opposite side. The scion is slipped into the open T-bud matching the long shallow cut. Clear plastic chip bud tape