Integrated Management of Poinsettia Pests: Fungus Gnats

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INTRODUCTION

Fungus gnats and poinsettias, like sauerkraut and pork, seem to be a natural pair. Fungus gnats are among the most common insects found on poinsettias, especially during propagation and shortly after potting the fall crop. Why the fuss over fungus gnats? There are several reasons: 1. Fungus gnat larvae can damage healthy roots, stunting or killing young seedlings and cuttings during propagation and after potting. 2. Fungus gnat adults and larvae can carry several pathogens that cause root rot diseases, so there is potential for increased disease problems when fungus gnats are around. 3. Fungus gnat adults, because they can fly around, are nuisances in homes, offices, and retail shops. Therefore, fungus gnats can affect plant development and value both directly and indirectly.

SUMMARY OF GENERAL BIOLOGY, DETECTION, AND IDENTIFICATION

Fungus gnats have four developmental stages: egg, larva, pupa, and adult. Fungus gnat adults are about 1/8-inch long with long antennae. There is a distinct "Y" vein on each wing. Adults often can be seen flying near the potting mix surface or walking over the surface. Sometimes adults can be found well away from any potting mix or soil. Females can produce 100 to 200 oval, white eggs that are laid within protected areas of the growing media surface. Larvae feed on fungi, decaying organic matter, and/or plant roots and stems. Larvae pass through four stages (instars), and they are about .5-inch long when fully grown. Fungus gnat larvae are translucent white with shiny black heads. Late-stage fungus gnat larvae are nearly pure white and can often be seen on the potting mix surface. After 10 to 14 days, the pupal stage is formed, usually just beneath the potting mix surface. Adults normally appear three or four days later. The egg-to-adult cycle is completed in three to four weeks, depending on moisture and temperatures. Adults can be detected by using yellow sticky traps, placed either horizontally (sticky side up) on the potting mix surface or vertically within the plant canopy. Horizontal traps may be more effective, based on data shown in Figure 1. This figure shows far greater numbers of fungus gnat adults on horizontal sticky traps compared to vertical traps in the plant canopy. If traps are used, they must be checked (and possibly replaced, depending on fungus gnat numbers) at least weekly. It is not necessary to count the trapped fungus gnat adults. The important thing is to note whether numbers are increasing or decreasing from week to week.

Larvae can be detected by placing potato pieces on or slightly in the potting mix surface. Leave the potato pieces in place for 72 hours to attract larvae. When the potato pieces are lifted, larvae can be seen on them as well as on the potting mix surface adjacent to the pieces. Because fungus gnat larvae are not evenly distributed among all pots or flats, there is a good chance that larvae will not be in the area of the potato slices.

PLANT INJURY POTENTIAL

As mentioned earlier, fungus gnat larvae can injure plants during and after propagation. Figure 2 shows results of an experiment comparing fungus gnat larval sampling (using potato wedges - one is almost tempted to call this the "wedgie method") and poinsettia health. The plant health index was a visual assessment of root and foliage appearance, and might be better called a plant quality rating. This was developed by Millie Casey and Terry Moore, research technicians in my laboratory. It should probably be called Millie and Terry's Plant Health Index.

The data show that higher numbers of fungus gnat larvae are associated with lower plant health ratings. Plant disease *(Pythium or Rhizoctonia)* did not appear to be a factor in these ratings, based on the use of test kits during the experiment, as well as application of fungicide drenches. So, if these data are correct and the plant health differences are due to fungus gnat larval feeding, it shows the importance of keeping fungus gnat numbers low to improve plant quality.

INTEGRATED FUNGUS GNAT MANAGEMENT

Three management categories can be used to manage fungus gnats: cultural, chemical, and biological. There are possibilities in all the categories to reduce problems with fungus gnats, but the best results will occur when two or more approaches are used.

Cultural Management. Greenhouses with wet and/or weedy areas may have more problems with fungus gnats. Keep these areas weed-free, clean up spilled potting mix and tipped pots, and keep problem areas as dry as possible. Some growers apply hydrated lime under benches, using a slurry of 1 to 2 pounds per gallon of water in a sprayer. Limestone F, from W.A. Cleary, is said to be effective as well. Limestone F is a flowable formulation and is therefore much easier to apply than dry hydrated lime. Chuck Powell, Plant Health Advisory Services, Worthington, Ohio, suggests using 10 gallons of Limestone F per acre in enough water to produce a heavy spray. This should also help reduce numbers of shore flies and western flower thrips.

It is well known that there are differences in the number of fungus gnats produced by different potting mixes. These

differences may be due to attractiveness of a mix, variation in fungus gnat survival, or both. Coir-based (coconut fiber) potting mixes have been mentioned as having fewer problems with fungus gnats. This may be because the surface of coir mixes dries faster and is less attractive to egg-laying adults. Figure 3 shows fungus gnat survival in different potting mixes, using "choice". The graph bars and numbers represent fungus gnat larvae in different potting mixes when adults were allowed to select among mixes. Similar results were obtained when larvae were actually placed in the different mixes, in a non-choice test.

Coir alone (100% coir) did not reduce fungus gnat numbers in either experiment, compared with two other commercial mixes; but a mixture of coir and MetroMix 366, as well as a mixture of coir and perlite, did reduce fungus gnat numbers. The reasons for all of this have not been determined, but as they say, we're working on it.

Chemical Control. Some excellent products are registered for fungus gnat control in greenhouses. Conventional insecticides registered for fungus gnat larval control are Knox Out GH, and DuraGuard. Both are micro-encapsulated formulations, of diazinon and chlorpyrifos, respectively. Nonconventional, or biorational products for larval control include: Adept (diflubenzuron), Azatin (azadirachtin), Citation (cyromazine), Enstar 11 (kinporene), Gnatrol *(Bacillus thuringiensis israelensis),* and Precision (fenoxycarb).

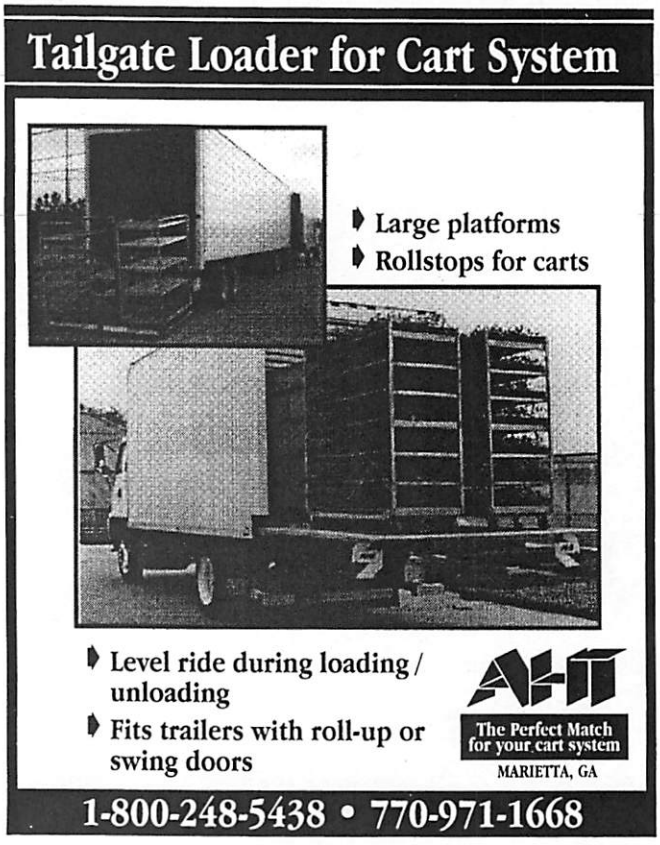
Results of an experiment using a single application of some conventional and nonconventional products for fungus gnat control are shown in Figure 4. The treatments were applied 14 days after plants were removed from mist propagation. The bars in the figure represent the average total number of fungus gnat larvae observed on potato wedges over a five-week period after applications. This trial also included Marathon 1% G, which is not registered for fungus gnat control. It should be emphasized that Marathon is not registered for this use, and it was applied at approximately double the suggested rate for the pot size used. All pots received a Subdue drench in addition to the pesticides. As the figure shows, control was good with all of the products included in the experiment, compared to Subdue only and untreated pots.

For adult control, several products are registered, including Astro (permethrin), Decathlon (cyfluthrin), resmethrin (Resmethrin EC26, PT 1200), pyrethrum (PT 1600A, PT 170), and Taistar (bifenthrin). A combination program involving larval and adult control will probably be necessary, if adults are present in significant numbers when you begin a control program.

Biological Control. There are two options for biological control using beneficial organisms: entomopathogenic nematodes and predatory mites *(Hypoaspis).* Both are commercially available for fungus gnat control. Nematodes are tiny, wormlike creatures that usually live in the soil. Entomopathogenic nematodes are specialized for attacking the larvae of certain insect species. The nematodes do not kill the larvae directly, but enter the body through openings and release bacteria, which multiply rapidly and kill the insects. Worldwide, several nematode species and isolates within species are now available for fungus gnat control. In the United States, *Steinernema feltiae* strains are commonly used and are available under several trade names, including Entonem, Scanmask, and X-Gnat (although the production of X-Gnat is temporarily on hold).

Predatory mites in the genus *Hypoaspis* are also used in place of, or along with, nematodes. They are available commercially from several insectaries. These tiny mites are general predators that live in the soil or potting mix. They can survive without prey, so they can be introduced into the potting mix before planting. Nematodes and mites can be used together.

Results of an experiment using nematodes and predators for fungus gnat control over an 11-week period are shown in Figure 5. Nematodes were applied three times at weekly intervals beginning in the second week after planting. Each nematode application was one billion nematodes per acre (three billion total). *Hypoaspis* predators were introduced



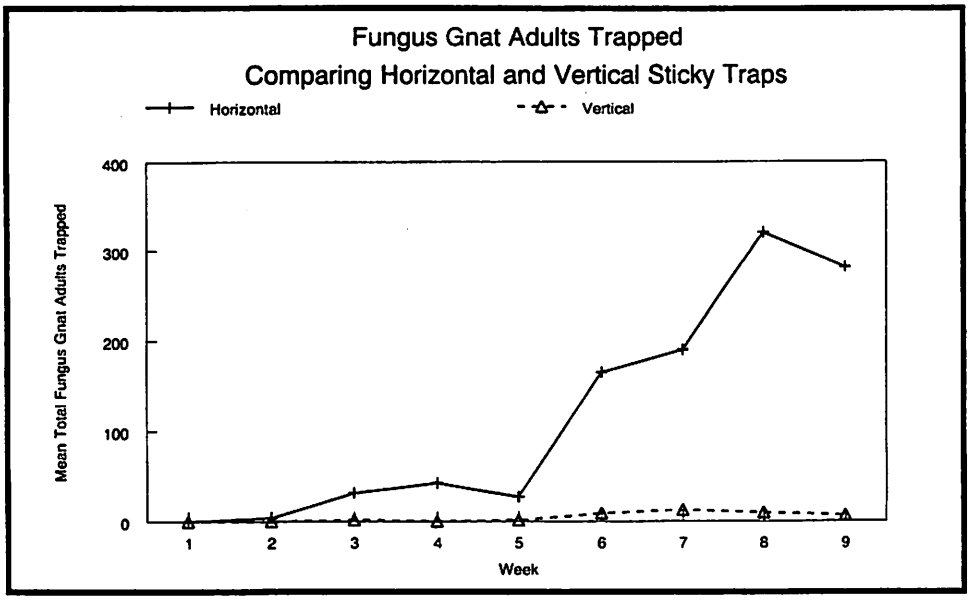


Figure 1. Fungus gnat adults trapped on horizontal and vertical sticky tapes over a nine-week period.

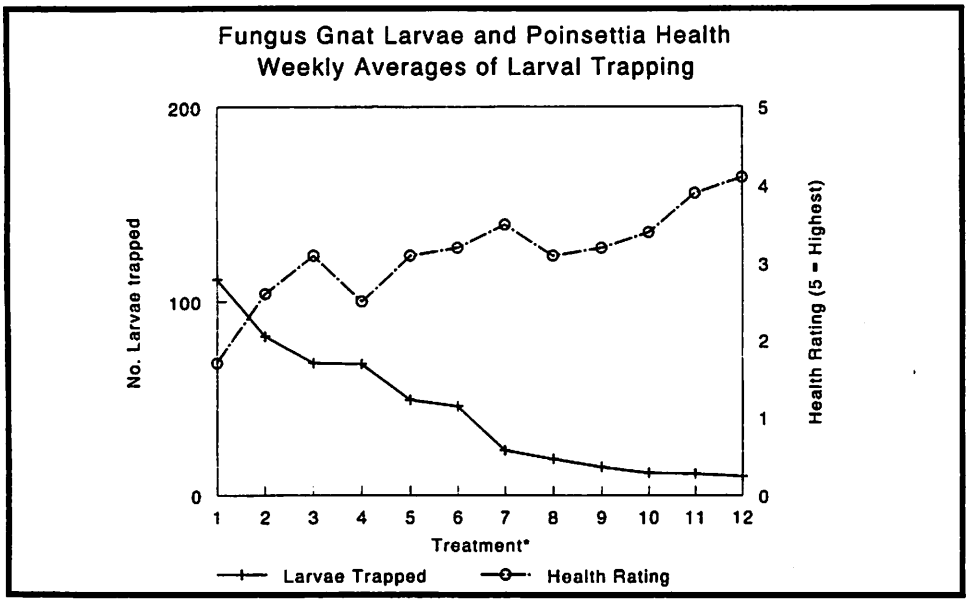


Figure 2. Comparing poinsettia plant health (R) with fungus gnat larval numbers (L). *There were 10 insecticide treatments, with and and without Subdue drenches, plus two control treatments.

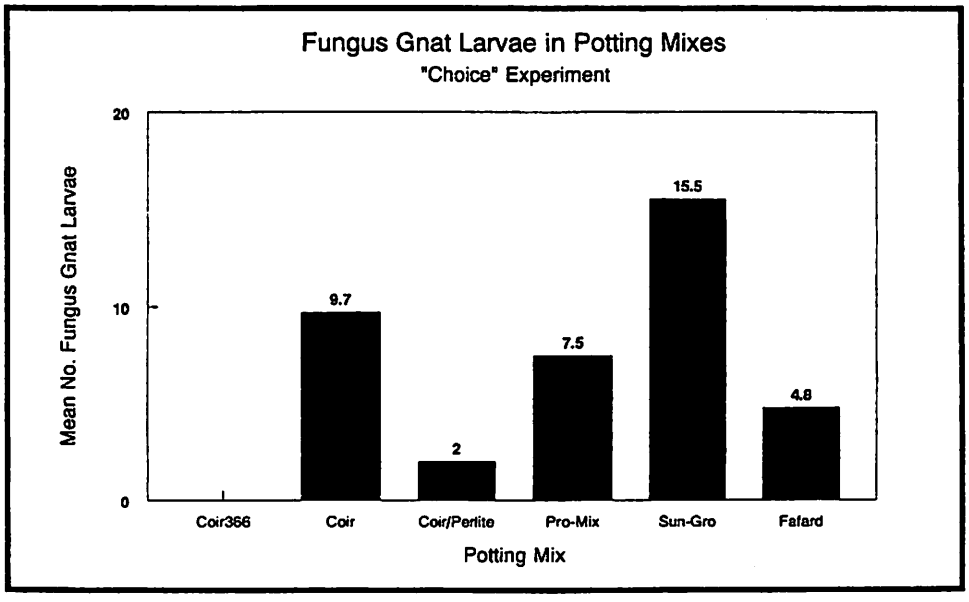
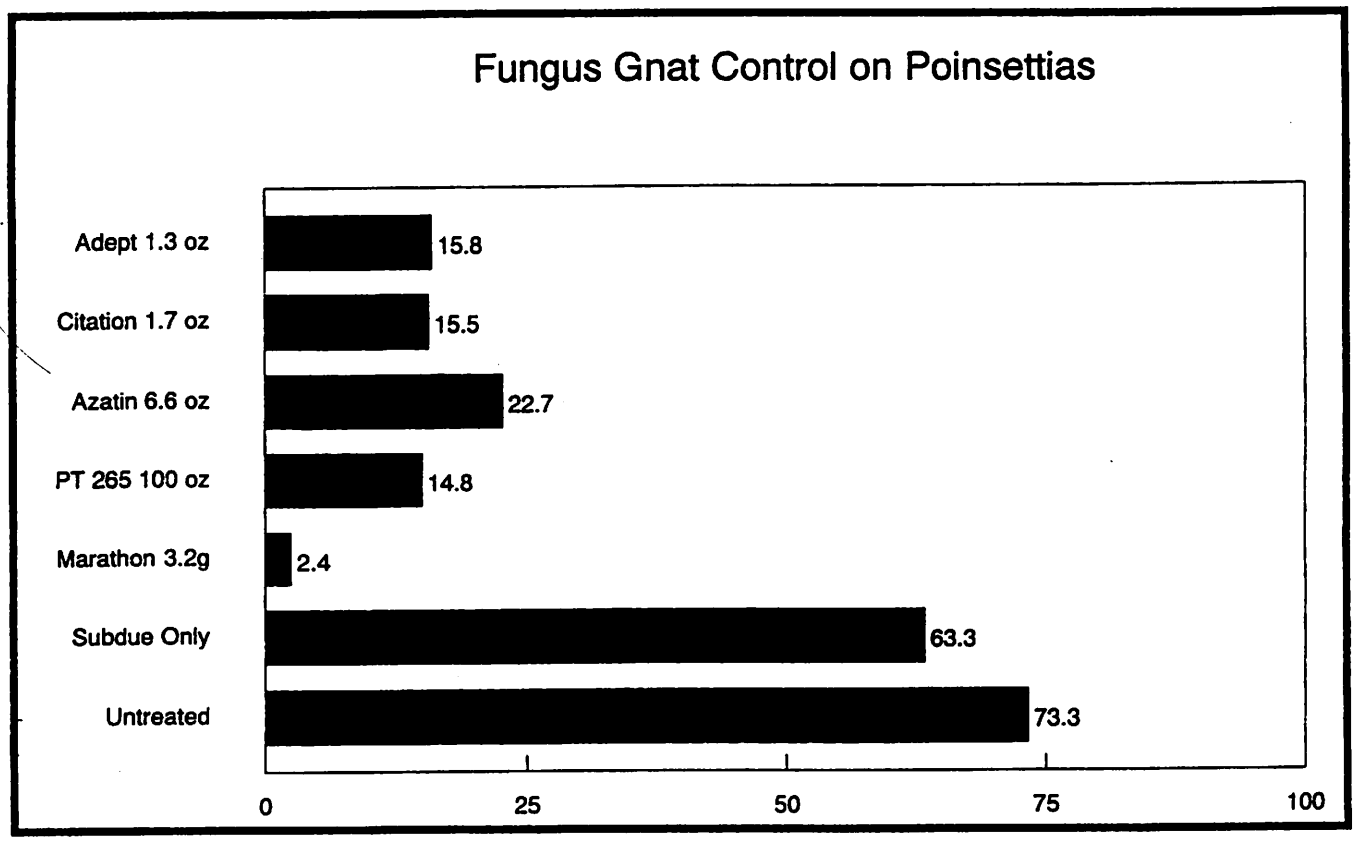
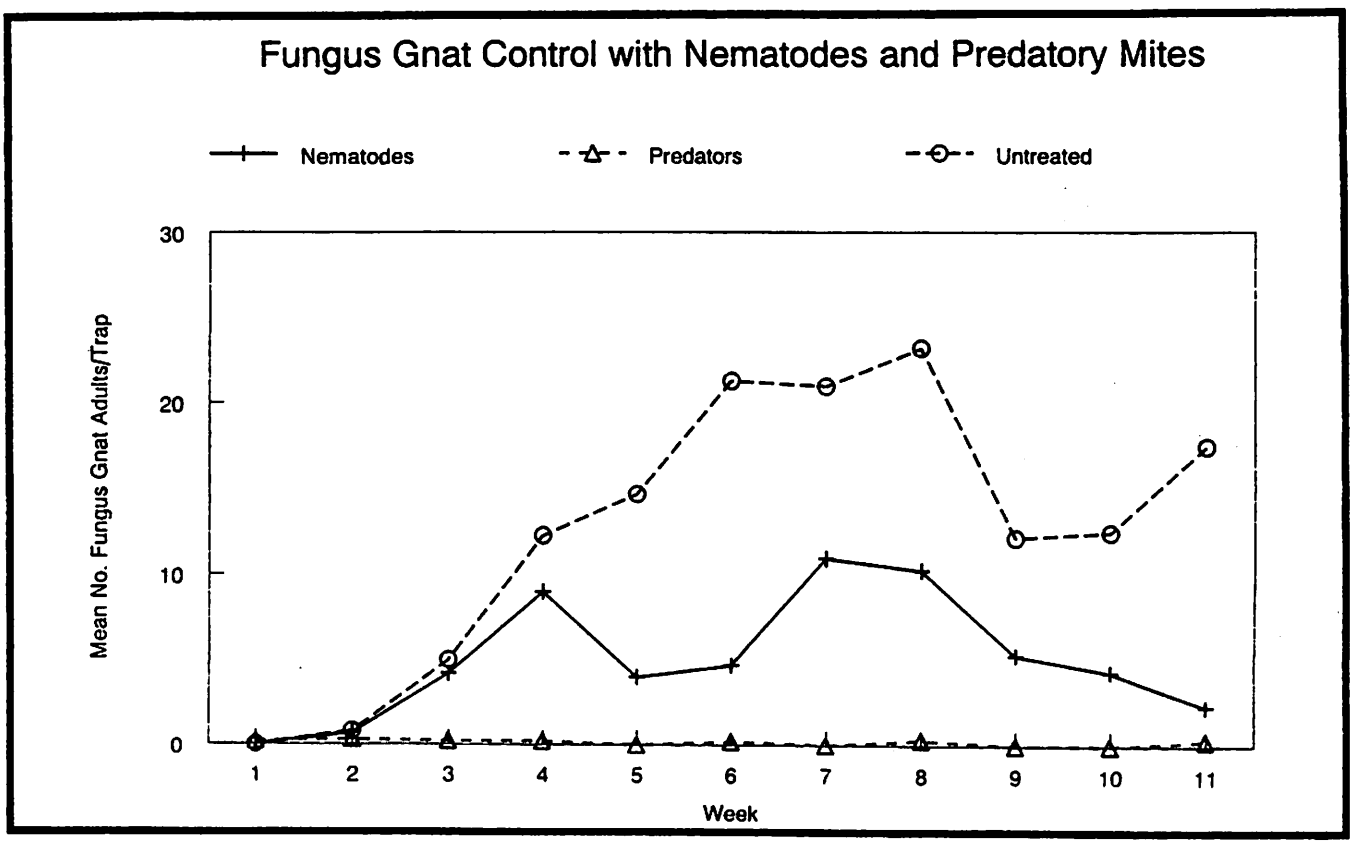


Figure 3. Fungus gnat larvae in different potting mixes after adults were allowed to "choose" among them for egg laying.


Fungus Gnat Control on Poinsettias
Adept 1.3 oz
15.8
Citation 1.7 oz
15.5
Azatin 6.6 oz
22.7
PT 265 100 oz
14.8
Marathon 3.2g
2.4
Subdue Only
63.3
Untreated
73.3
0
25
50
75
100


Fungus Gnat Control with Nematodes and Predatory Mites
Nematodes
Predators
Untreated
Mean No. Fungus Gnat Adults/Trap
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
Week

once, immediately after planting. Predatory mites were introduced at the very high rate of 25 per 4.5-inch diameter pot (200/square foot). This is 10 to 20 times the rate now suggested by some commercial insectaries for these mites. Obviously, the mites are more effective than we first thought. Both beneficial organisms reduced fungus gnat adult emergence, compared to emergence from untreated pots.

To summarize, fungus gnats can be controlled with a combination of cultural, chemical, and biological approaches. It is important to realize that the first few weeks of the crop are when fungus gnats probably will cause the most trouble, and therefore are the most important times for fungus gnat control. If past experience has shown that fungus gnats are likely to cause problems, use a preventive approach. To help monitor the control level, remember that yellow sticky traps will indicate fungus gnat adult activity, and potato pieces placed on the potting mix surface will help detect larvae. ***OFA, Bulletin No. 813.***

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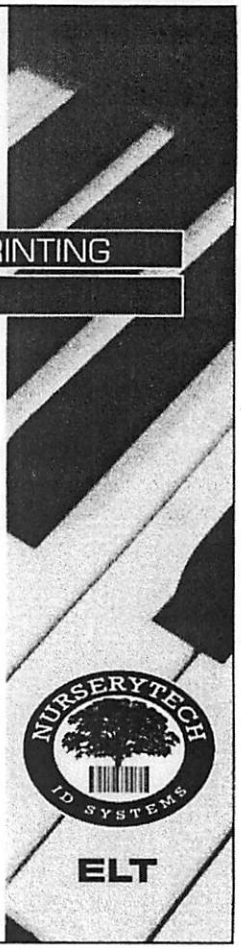

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