SNAILS AS QUARantine PestS OF ORNAMENTALS

The garden snail, *Bradybaena similaris* (Ferus-sac) has become a frequent quarantine pest of potted-foliage plants. Local nurserymen have reported finding this pest on *Dracaena marginata* and sometimes on other *Dracaena* species. It is a small snail and may easily be overlooked. *B. similaris* is a native of Asia and is found wherever coffee is cultivated. It is established in Louisiana, Florida and Hawaii and is a pest of vegetable and ornamental crops. The garden snail climbs on plants and feeds on tender shoots and buds. It is known to feed on plant roots that are exposed on the surface.

*Bradybaena similaris* belongs to the Phylum Mollusca, Class Gastropoda and Family Bradybaenidae (=Eulotidae). In the mouth is rasping organ (radula) which is a structure unique to mollusks. It is tongue-like organ with rows of minute chitinous teeth used in rasping food. Each snail has both male and female reproductive organs, or they are hermaphroditic. Snails are generally nocturnal and during the day may be found resting under objects such as rocks, old boards and logs, pots, under plants, and among damp debris.

The most important factor affecting the seasonal activity of snails is humidity. They become inactive when dry conditions prevail and active in humid conditions.

Since *B. similaris* is a quarantine pest of exported foliage plants, control measures must ensure 100% kill or removal from the plant material. Basically, there are two methods of controlling snails. They are molluscicides and bait molluscicides. Molluscicides such as methiocarb 75% WP (Mesurol) and mexacarbate 2EC (Zectran) are sprayed as a liquid and snails must come in contact with the toxic residue for kill. Both molluscicides have a general ornamentals label, however, mexacarbate may be phytotoxic to certain ornamentals because of its emulsifiable concentrate formulation. Both methiocarb and mexacarbate are molluscicides belonging to a group of chemicals called carbamates. Therefore, carbamate insecticides such as carbaryl (Sevin) may have some molluscicidal properties.

The bait molluscicides are more commonly available, and these incorporate an attractant to ensure consumption of a lethal dosage of molluscicide. Common bait molluscicides are formulated as granules or pellets which are broadcast on the ground. Moistened bait attracts the mollusks, but watering bait after application reduces its effectiveness. Methaldehyde paralyzes the mollusks and causes them to lose large amounts of water. During warm weather they die of dessication, but in rainy weather they may recover.

Recently, a report from California stated that insecticidal soap when used as a dip was 88% effective in dislodging snails from plant material. In quarantine situations, this degree of effectiveness is not acceptable since 100% of snails must be dislodged or killed.

Research on the control of garden snail, *Bradybaena similaris* which ensures 100% control is needed. Control measures may involve a combination of the above methods.

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**SNAILS AS QUARantine PestS OF ORNAMENTALS**

The most important factor affecting the seasonal activity of snails is humidity. They become inactive when dry conditions prevail and active in humid conditions.
PRECAUTIONARY STATEMENT
Use pesticides safely. Follow the label. Consult your Cooperative Extension Service or the Hawaii Department of Agriculture personnel for authorized special local need registrations or additional information. The user is responsible for proper use and application of pesticides as well as storage and disposal.

Prepared by:
Arnold H. Hara, Entomologist
Ruth Y. Iwata, Horticulture Specialist

REFERENCES
Williams, F. X. 1931. Handbook of the Insectsing For Farm and Ranch Management, Sprayer Boom for Construction of a Two and Three Nozzle

AVAILABLE PUBLICATIONS

Instant Information
Two new publications are available in the Instant Information, General Home Garden Series. These are:
No. 36. Care for Your Garden—Water Properly by W. W. McCall.

Financial Calculating
A very useful publication, Financial Calculating For Farm and Ranch Management, provides information on some of the more complex business financial calculations using some of the newer financial calculators. This publication is available as U.H. Information Text Series 026 by R. W. Wall and L. J. Cox.

Sprayer Boom
This publication, HITAHOR Brief No. 055, describes the construction of two and three nozzle spray booms used with a backpack sprayer. It was prepared by Joe DeFrank, Weed Science Specialist and titled, Instruction and Parts List for Construction of a Two and Three Nozzle Boom for a Backpack Sprayer.

HELICONIA PRODUCTION IN HAWAII
Interest has expanded rapidly in the 1980's in tropical cut flower production in Hawaii. The wholesale value of red ginger has increased since 1981 by 70% and bird-of-paradise by 140%. No comparable figures are available for heliconia, but the increase will also have been very marked. It is estimated that Hawaii has 60-75 part-time growers of heliconias on perhaps 150 acres of land. More persons are seeking to get into growing tropical cut flowers, particularly heliconia, because of the appearance of a lucrative market. Heliconias are a top priority because their fast growth promises earlier returns than for gingers and bird-of-paradise. Rates for given species are not generally available, and there is considerable seasonality among the different species.

Heliconias are grown in Hawaii on soils ranging from lava rock to fertile valley soils. Spacing depends on how rapidly the species spreads. Most plantings are in the open in full sun. Few plantings are artificially irrigated, and most rely on rainfall, particularly on Maui and Hawaii. No standards exist for fertilization and the most common practice is to throw a handful of 16-16-16 fertilizer around the base of the plant every few months. Weed control is an important cultural problem, and most growers are still experimenting to see what is suitable to their situation. Insect problems include earwigs and ants on the inflorescences and the Chinese rose beetle and spider mites on the foliage; stinkbugs favor some species, too.

More than 75 species and selected clones are being produced with about 2 dozen comprising the bulk of the exported crop. Many more are used locally because they are not amenable to shipping. Quality, which is enhanced by proper handling, will be one key to retailer and consumer acceptance of the heliconia in U.S. and foreign markets. Much is yet to be learned about which ones ship best and have good vase-life.

Richard A. Criley, Horticulturist, UH Manoa
(Reprinted from HSI Bulletin No. 1, 1985)

NURSERY NOTES

Condo Growth Spurring Industry
Condo dwellers want—and will receive—better quality landscape plantings and maintenance. This represents an additional market for the nursery and landscape industries. Reports a select committee of the American Association of Nurserymen.
“New plant material introductions emphasizing small garden, high-intensity planting concepts must occur,” says the committee, which meets annually to prepare a list of trends. "Like the single-family home dweller, there will be an increasing need to enhance property value and provide the psychological benefits of a beautiful environment."

Some developers, committee members feel, will operate their own nurseries and maintain landscape crews for the planting and maintenance demanding by tenants of multi-family units.

Weeds Trees & Turf
September, 1986

It Pays to be in Hort.
A recent study of former students of California Polytechnic State University's Ornamental Horticulture Department in San Luis Obispo found that of the 80% still in horticulture, 20% earn a salary of over $40,000 a year. In the survey, which polled a random sample of 532 former students, 15% reported a salary of less than $15,000; 65% reported making between $15,000 and $35,000; and 26% said they earn a salary between $25,000 to $35,000. About 16% of the respondents work in floriculture, 26% with nurseries and 33% in landscaping.

Market Letter
Vol. 1 No. 35, 1986

Gardening Still #1
Gardening was the number one outdoor leisure activity in 1985. Eighty-four percent (17 of every 20) of all U.S. households, or about 74 million households, participated in one or more forms of indoor or outdoor lawn and garden activities. Comparisons over the last five years of gardening showed an important increase in the number of U.S. households which, of course, increases the customer base for lawn and garden sales. As the total number of U.S. households increased from 80.5 million in 1981 to 87.9 million in 1985, the percent of those involved in gardening was the same (84%) in both 1981 and 1985; gardening dipped in '83 but strengthened thereafter.

Flower Marketing Information
June 1986

Costlier Homes, Landscape on Upswing
Demand for new luxury homes in the United States has soared, according to recent real estate reports. One report said that eight out of 10 builders will be catering to upscale buyers by 1990, compared to last year's 66 percent.

Part of the reason for this new demand is that baby-boomers are no longer first-time buyers. They are now becoming what are termed "move-up buyers."

Because more emphasis is being placed on luxury homes, the trend is expected to carry over into the landscaping market. It would be natural for homeowners to also place more emphasis on luxury landscapes, too.

And that could be a big boom to the landscape contracting industry.

Weeds Trees & Turf
May 1986

Nursery Business Consultants
Opens California Office
Nursery Business Consultants, a British firm owned by Ian Baldwin and John Stanley, has opened a U.S. office in Elk Grove, CA. Nursery Business Consultants company is based in Avon, England. It was formed in 1978 to provide consulting services to wholesale nurseries and garden centers and now serves clients in Europe, North America, Australia and New Zealand. Baldwin will operate the California office, and Stanley will serve customers from the England office.

American Nurseryman, 1986

National Flower
The rose is now the national flower! Roses Inc. was instrumental in getting the passage of the bill by Congress on September 23. This is a good example of the influence the floral industry has on Capitol Hill.

NYSFI
Number 187, Oct/Nov 1986

HOUSE PLANT AS HEALTH
SAFEGUARD—NASA
Experimental work at the NASA laboratories has thrown new light on the way in which plants can purify the air in household and other environments.

NASA is interested in removing pollution in space capsules by using plants.

Many modern houses are deprived of natural ventilation but subject to various forms of pollution. Wooden panels and furniture, carpet adhesives and cavity wall insulation can all give off formaldehyde, which is a known carcinogen and can, in quite low concentrations, make people's
eyes water and induce drowsiness and headaches. Other pollutants include cigarette smoke, which contains carbon monoxide, and the natural radioactive gas radon, which seeps upward from the ground everywhere in small quantities. Many aerosols and insecticides also add to pollution.

The NASA researchers found that 70 spider plants (Chlorophyllum comosum)—or the equivalent in other plants, more or less efficient—would provide adequate air cleansing in an average modern home. Plants in a conservatory which is part of the internal air system are, of course, equally effective.

There is, therefore, an excellent case for selling house plants as health safeguards as well as for other reasons. Perhaps every time a house is renovated, or a new house is purchased, the wise occupier should make his next call at the local garden centre, not only for decorative plants but also for free health insurance!

Australian Nurseryman
Vol. 9, No. 9, August 1985

Landscape Survey

According to a recent nationwide survey of realtors, improving the home lawn and landscaping could add $6,400 to its selling price, according to the O.M. Scott & Sons Company.

The selling price of a suburban home in the $40,000–90,000 range could go up an average of $3,100 in price simply by improving the lawn's appearance. Landscaping with trees, shrubs and flowers adds to the selling price of a home an average of $3,300 in the same price range. In addition to adding value to the selling price, a well landscaped property will shorten its time on the market.

O.M. Scott & Sons, Marysville, Ohio

OPTIMUM FERTILIZER APPLICATION INTERVAL FOR GINGER ROOT PRODUCTION

The excellent quality of Hawaiian ginger root (Zingiber officinale) is known internationally and is a function of intense management, ideal climate and high rates of fertilizer applied. Total application of nutrients at rates up to 1,000; 2,040; 2,725; 1,600; and 1,130 pounds per acre per crop of nitrogen (N), phosphorus (P₂O₅), potassium (K₂O), calcium (CaO), and magnesium (MgO), respectively is not uncommon. Typical fertilization programs utilize 500 to 1,000 pounds of a complete fertilizer at intervals from 7 to 30 days with the lower rates used at shorter intervals. The optimum timing of fertilizer application has not been experimentally demonstrated for Hawaiian conditions.

Since tissue analysis has been shown to be an effective tool in reflecting the nutritional status of plants, a test was installed in May 1986 to observe the uptake rate of ginger root plants in response to a fertilizer application. The objective was to determine optimum application interval by measuring the time interval in which the tissue nutrient levels were maintained at a high level.

Materials and Method

A field planted on March 1, 1986 was selected for the test. It had received 615 pounds of nitrogen (N), 1335 pounds of phosphorus (P₂O₅), 615 pounds of potassium (K₂O), 1,517 pounds of calcium (CaO), 945 pounds of magnesium (MgO), and 2,500 pounds of chicken manure per acre. To insure a low nutrient baseline in the plant tissues, the first fertilizer application was delayed for 3 months after planting until May 31, 1986. The rates of fertilizers applied were 183, 96 and 225 pounds per acre of nitrogen (N), phosphorus (P₂O₅), and potassium (K₂O), respectively. The field was monitored by tissue sampling as described by Lee, Edwards and Asher (1) of Australia. The third leaf from the growing tips of first order stems was collected and analyzed by x-ray fluorescent quantum at the Agriculture Diagnostic Service Center, University of Hawaii—Manoa. Each sample collected during the forty-five day sample period was composed of a total of twenty randomly selected leaves.

Results and Discussion

The rainfall during the test period was normal in comparison to similar periods in previous production years. The tissue analysis results are included in Table 1 and show increases in both tissue nitrogen and potassium levels.

Tissue nitrogen approached the 3.89% average established for August by Nishina and Okazaki (2) at about 10 days after application (6–11). This level was maintained for 20 days or 30 days after initial fertilizer application (6–30). Potassium tissue levels did not approach the 4.27% average for August (2) but showed an increase to 4.00% at 23 days after application. This level was maintained until the test was terminated on July 14, 21 days later. Tissue magnesium showed
Table 1. Response of Ginger Root Elemental Tissue Levels during a 6-week period following fertilizer application.

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
<th>Mn</th>
<th>Fe</th>
<th>Cu</th>
<th>Zn</th>
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<tr>
<td>5-31-86</td>
<td>3.05</td>
<td>0.27</td>
<td>2.26</td>
<td>0.62</td>
<td>1.12</td>
<td>200</td>
<td>90</td>
<td>13</td>
<td>24</td>
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<tr>
<td>6-2</td>
<td>3.09</td>
<td>0.23</td>
<td>2.22</td>
<td>0.57</td>
<td>1.06</td>
<td>159</td>
<td>76</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>6-4</td>
<td>3.38</td>
<td>0.26</td>
<td>2.63</td>
<td>0.68</td>
<td>1.35</td>
<td>172</td>
<td>82</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>6-6</td>
<td>3.48</td>
<td>0.26</td>
<td>2.44</td>
<td>0.69</td>
<td>1.30</td>
<td>168</td>
<td>83</td>
<td>10</td>
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<tr>
<td>6-9</td>
<td>3.64</td>
<td>0.24</td>
<td>2.54</td>
<td>0.65</td>
<td>1.40</td>
<td>109</td>
<td>72</td>
<td>14</td>
<td>29</td>
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<tr>
<td>6-11</td>
<td>4.02</td>
<td>0.21</td>
<td>2.54</td>
<td>0.52</td>
<td>1.12</td>
<td>140</td>
<td>80</td>
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<td>6-13</td>
<td>3.99</td>
<td>0.26</td>
<td>3.26</td>
<td>0.57</td>
<td>1.16</td>
<td>215</td>
<td>89</td>
<td>8</td>
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<td>6-16</td>
<td>3.98</td>
<td>0.25</td>
<td>3.30</td>
<td>0.57</td>
<td>1.26</td>
<td>248</td>
<td>79</td>
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<tr>
<td>6-18</td>
<td>3.99</td>
<td>0.27</td>
<td>3.32</td>
<td>0.72</td>
<td>1.36</td>
<td>332</td>
<td>89</td>
<td>4</td>
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<tr>
<td>6-20</td>
<td>4.03</td>
<td>0.26</td>
<td>3.96</td>
<td>0.64</td>
<td>1.13</td>
<td>335</td>
<td>100</td>
<td>17</td>
<td>30</td>
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<tr>
<td>6-23</td>
<td>3.88</td>
<td>0.25</td>
<td>4.00</td>
<td>0.77</td>
<td>1.14</td>
<td>415</td>
<td>90</td>
<td>16</td>
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<tr>
<td>6-25</td>
<td>3.93</td>
<td>0.21</td>
<td>3.20</td>
<td>0.57</td>
<td>0.93</td>
<td>399</td>
<td>78</td>
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<tr>
<td>6-27</td>
<td>3.93</td>
<td>0.23</td>
<td>4.90</td>
<td>0.57</td>
<td>0.88</td>
<td>393</td>
<td>78</td>
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<td>6-30</td>
<td>3.87</td>
<td>0.20</td>
<td>3.96</td>
<td>0.59</td>
<td>0.92</td>
<td>329</td>
<td>69</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>7-2</td>
<td>3.76</td>
<td>0.21</td>
<td>4.35</td>
<td>0.60</td>
<td>0.85</td>
<td>427</td>
<td>76</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>7-4</td>
<td>3.78</td>
<td>0.21</td>
<td>4.13</td>
<td>0.58</td>
<td>0.85</td>
<td>407</td>
<td>71</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>7-7</td>
<td>(no sample taken)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
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<td>---</td>
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<tr>
<td>7-9</td>
<td>3.72</td>
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<td>4.05</td>
<td>0.58</td>
<td>0.84</td>
<td>415</td>
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<tr>
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<td>0.20</td>
<td>4.03</td>
<td>0.49</td>
<td>0.71</td>
<td>313</td>
<td>64</td>
<td>0</td>
<td>24</td>
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<tr>
<td>7-14</td>
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<td>0.20</td>
<td>4.23</td>
<td>0.46</td>
<td>0.64</td>
<td>265</td>
<td>59</td>
<td>1</td>
<td>23</td>
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</table>

A constant decrease throughout the test period but was greater than the August average of 0.57% (2). The other nutrients did not show substantial changes during the sampling period.

Although the tissue potassium response lagged behind tissue nitrogen by 12 days, the plant retained a high nutrient level for about three weeks after the tissue level reached established optimum. The data indicate that fertilization of ginger root on a three week interval schedule will insure adequate nutrient availability for optimum growth.

Summary
The rainfall during the test period was similar to previous production years. The field selected for the test was not fertilized for 3 months prior to the test installation to ensure low initial tissue nutrient levels. The plant uptake rate for nitrogen was about 12 days faster than potassium, however, both nutrients were maintained at adequate levels for 3 weeks after initial response. The data indicate that a three week fertilization schedule is adequate to maintain tissue nutrients at a level necessary to produce a successful crop of ginger root.

References
COMING EVENTS

Heliconia Conference

The 1987 annual conference of the Heliconia Society International will be at the Ala Moana Hotel in Honolulu, June 24-27, 1987. The Harold L. Lyon Arboretum and Lyon Arboretum Association will host the three day conference, which begins on Wednesday evening with a welcome reception followed on Thursday with a full day of talks and a banquet. Friday morning will consist of a workshop, the rest of Friday and Saturday will be devoted to tours of botanic gardens and commercial producers.

For the main program on Thursday, June 25, the following is a list of the subjects to be covered: Propagation methods for Heliconias and Gingers; Diversity in Gingers; Native Heliconias of the South Pacific; Heliconias of Costa Rica; New Research In Cut Flower Production; Post Harvest Handling of Heliconias and Gingers; The Scitamineae of Pacific Tropical Botanical Gardens—an H.S.I. plant collection center; Heliconias in Hawaii—Past, Present and Future; a panel discussion on marketing cut Scitamineae flowers; and a workshop on Growing and Identifying—all you need to know about the Scitamineae—is also being planned.

Contact the Lyon Arboretum Association, 3860 Manoa Road, Honolulu, HI 96822 (988-3177) for registration information.

PLANT GROWTH REGULATOR MEETING

The annual meeting of the Plant Growth Regulator Society of America will be held at the Princess Kaiulani Hotel in Honolulu August 2-6, 1987. This will be a joint meeting with the Japanese Society for the Chemical Regulation of Plants.

The technical content of the meeting encompasses two major areas of research. A symposium on Tropical and Sub-tropical Agriculture, with emphasis on the plant growth regulators used therein, and a symposium on Biologically Active Natural Products, with an emphasis on their role as agricultural chemicals.

TURF CONFERENCE

The "Pan Pacific Turf Conference" is scheduled for the Hawaiian Regent Hotel in Honolulu on September 24-25, 1987. Commitments from internationally known turf specialist, Dr. James Beard, Texas A & M, Dr. Duich, Penn State, Dr. Couch, Virginia Polytech Institute, Dr. Hammel, Cornell University, Robert Trent Jones or a company representative, Elliot Roberts, American Lawn Institute, Dr. Watson, Toro Company and John Van Dam, University of California at Davis, promise to make this conference an exciting learning experience.

The Golf Course Superintendent's Association (GCSAA) has also arranged a 2-day seminar the two days prior to the conference. This seminar will provide golf course superintendents the opportunity to accrue CEUs towards their certification. Site of seminars, in Honolulu, to be announced.

Turf managers and specialists from Japan, Korea, China, the Philippines and Australia have been asked to participate and the arrangements are currently being finalized. Their anticipated participation will indeed enhance this event. For further information contact Wayen Ogasawara, General Chairman, at 677-8779 or Dr. Charles Murdoch at 948-7958.

HAN Annual Conference

The Hawaii Association of Nurserymen's Annual Conference and Trade Show will be held at the Ala Moana Americana Hotel in Honolulu, November 2-4, 1987. Contact: HAN, P.O. Box 293, Honolulu, HI 96809 (833-3369).

HAN Plant Show

The annual HAN Plant Show and Sale is scheduled for the Blaisdell Center, March 25-27, 1988.

Food For Thought

Some people always seem to win, while others never do. According to the Association of Graphic Arts' newsletter, "Successful people have formed the habit of doing things that failures do not like to do."

Turf Accounting? . . . American visitors to London might be puzzled by shop fronts with a single out front announcing "Turf Accountant". Bring money. A turf accountant is a bookie.

One of Murphy's laws clearly says everything will take longer than expected. For elected leaders running board and committee meetings, and
other facing deadline, the question always has been: Exactly how much longer?

Exactly 2.71828 times longer than expected, says Philip Musgrove, describing his algebraic analysis of job efficiency in the American Economic Review. Remember his calculation when figuring out how much time something will take.

NOTE: The use of trade names is for the convenience of readers only and does not constitute an endorsement of these products by the University of Hawaii, the College of Tropical Agriculture and Human Resources, the Hawaii Cooperative Extension Service, and their employees.

Fred D. Rauch
Extension Specialist in Horticulture