RESEARCH AND INDUSTRY NEWS

Beyond Pesticides: Research objectives in California
Sixty researchers from the University of California spent 18 months to develop a plan to help California's $18 billion agriculture industry deal with the possible loss of >150 synthetic chemicals (50% of active ingredients in current ag use). Research needs were divided in five categories:

1) Increased host plant resistance.
2) Improve use of natural enemies.
3) Better understanding of pest ecology, biocontrol agents, and plants.
4) Development of semiochemicals.
5) Related research studies such as scouting, and threshold determinations.

Insects Research needs at UC:
* 450 insects had resistance to insecticides by 1984
* 37 insect pests partially controlled with natural enemies in California.
* Based on research at UC some almond growers have reduced pesticide usage by 40%.
* Through use of biocontrols many tomato growers have been able to reduce pesticide applications from 22 to as few as three per season.
* Forty three insects are focus of current biocontrol research at UC, and 34 additional ones are potential candidates.

Nematode Research at UC
* Approx. 5,000 nematode species are parasites of humans, plants, and animals. Many are also beneficial.
* DBCP was banned in 1977, and 1,3- Dichloropropene (15 million pounds used annually in California) was banned in 1990.
* Promising research areas for nematode control include chemical ecology, biocontrols, host plant resistance, and cultural management.

Disease Research at UC
* Diseases cause an estimated 10% loss in yields annually.
* Research approaches should include rotations, quarantines, host-free periods and plant immunization.
* A drawback is the lack of state and federal research funds to conduct applied research (most research funds are targeted toward basic, conceptual-development type research)(UC Looks beyond pesticides, Agribusiness Fieldman, Nov. 1992).

Salinity Factoids
* 65 million irrigated acres in U.S. affected by Salinity
* Saline is defined as soils with > 1300 ppm total dissolved soils
* Over one third of the irrigated cropland is affected by salinity in California, Nevada, W. Utah, Colorado, Arizona, New Mexico and W. Texas.
* Salt deposits accumulation in drainage ponds of the San Joaquin Valley estimated at 630,000 tons per year (estimated to be 25% of annual salt accumulation in 56,000 Ac of ag land in the valley).
* Potential toxic chemicals in drainage waters of the San Joaquin Valley include selenium, boron, arsenic, molybdenum, uranium, and vanadium (D. Lee, J. Prod. Agric. 5,445(1992); California Agr. 46(6):18(1992)).
Florida Field Tomato Production Technology

Marketing - Background Information
* Main Production season October to June.
* Mexico and Florida account for >98% of the January to April fresh tomatoes market.
* Over the past 6 years Florida has held a market competitive advantage with Mexico (in terms of production costs and revenues).
* 200 growers in the regulated area of the Federal Marketing order
* 80 registered handlers for tomatoes (30 of those handle 97% of all the Florida tomato volume).

Problems of Production for Tomatoes in Florida
* Availability and quality of water
* Labor availability and regulations
* Land availability
* Increased regulatory restrictions including record-keeping and emergency planning guidelines.
* Sweetpotato whitefly and viruses

Production Factoids
* Suggested nitrate-N concentrations in fresh petiole sap for tomatoes is (ppm NO₃-N) 600-800 (transplant to 1 inch fruits); 400-600 (1 inch fruits to first harvest); 300-400 (main harvest).
* The greatest row middle weed problem for tomatoes in Florida is nightshade. Nightshade has developed resistance to some post-emergent herbicides. Best control with herbicide treatments are obtained when nightshade is 4-6 in tall, and rapidly growing. Best herbicide control occurs with two applications at 50 gallons per acre added with a surfactant.
* Most tomatoes are harvested at mature-green stage but vine-ripe fruit production is increasing.
* Most mature green tomatoes are picked 2-3 times.
* Packed in 25-lb (mature-green) and on 20-lb (vine-ripe tomatoes) containers.
* Main fruit quality traits for consideration are sugars, acids and texture.

Management of Tomato mottle virus (TMov, previously called the Florida tomato geminivirus).
* Symptoms include chlorotic mottling of the leaves, upward curling of middle and lower leaflets and a reduction in plant height. Early infections result in greater growth reductions.
* Evidence indicates the virus is not seed transmitted. Hosts include only species of the Solanaceae Family.
* Main source of infection for young plantings has been determined as tomato volunteers and the previous year’s tomato crop which was left on the field after harvest.
* Other important viruses detected in Florida include potato virus Y, tobacco etch virus, and tomato spotted wilt virus.
* Main TMov control strategies include:
  1) Remove volunteers and tomato plants from previous crops at least one month before planting.
  2) Use TMov-free transplants (from virus-free fields).
  3) Separate planting seasons by at least 4 weeks to allow for whiteflies from previous crops to die.
  4) Make timely application of insecticides for sweetpotato whitefly control.

Sweetpotato whitefly management and tomato IPM
* Surveys on weedy areas near tomato fields have indicated that parasitism and predation ranged from 0-100%, which indicate the ability of natural enemies to reduce whitefly numbers in weedy areas free from insecticides.
* An effective whitefly management program includes timely insecticide treatments along with a minimum 2 month crop-free period once a year or spacial separation of successive planting of host crops during the cropping season.
* To minimize resistance rotate chemicals with different modes of action (organophosphates, pyrethroids, chlorinated hydrocarbons, and soaps).
* Agrimek and Trigard are available in Florida for leafminer control. They can be rotated to avoid development of resistance.
* The use of pheromones (available from Scentry) to disrupt the mating process, along with Bt insecticides, has been shown to be an effective technique to control the tomato pinworm in Florida.
* Potential techniques to increase natural enemy activity for sweetpotato whitefly include release of natural enemies and also the planting of reservoir crops (such as cover crops, windbreaks, or border crops) to increase reproduction and survival of predators and parasites.
Insecticide treatments which have shown the most promising for sweetpotato whitefly control in Florida in 1990-1992 trials include: NTN-33893; Danitol and Monitor mixture; Karate and Monitor mixture; Thiodan; and, Brigade. Other chemicals which have shown successful include: Buprofzen; Amitraz; Margosan-O; Brigade and Monitor mixture; ICLA and monitor; SN 85292; Ambush and Monitor; Alette; Align; Enstar; and Monitor.

Management of Fusarium crown and Root Rot of Tomato
* This fungus, *F. oxysporum* f.sp. *radicis-lycopersici*, enters the plant through wounds and natural openings created by developing roots. Early symptoms include stunting, yellowing and loss of cotyledons and lower leaves. * Masses of white mycelium and yellow to orange spores in necrotic tissues are a characteristic of this fungus.
* Resistance has been bred in greenhouse tomatoes but not in field-grown cultivars.
* Possible controls include:
  1) Disinfest plug (transplant)-trays and stakes before re-use.
  2) Pre-plant fumigation.
  3) Do not drag plug-trays in the field before planting.
  4) Control weeds and plow in the tomato crop after harvest.
  5) Soil microorganisms in the rhizosphere may lower survival of fusarium crown and root rot of tomato especially the fungi Trichoderma and Glomus.
  6) Combination of soil solarization and biocontrol (beneficial soil microorganisms).
  7) Avoid ammoniacal-Nitrogen and maintain soil pH at 6-7.

Early blight control with processed sludge treatments
* Trials conducted in 1992 showed that early blight was suppressed in tomatoes where Florida Oranix processed sludge was applied at a rate of 7 tons per acre.
* The mechanism of action of processed sludge to control early blight is undetermined but in other work high inorganic nitrogen levels in the soil have reduced incidence of early blight in tomato.

Packing house dump-tank water treatments
* Main postharvest diseases detected in packing houses in Florida included Alternaria, Fusarium, Rhizopus, Stemphyllium, Colletotruchium, and Geotrichum.
* Adequate sanitation (no postharvest decay or disease development) was obtained by maintaining the tank water at >50 ppm chlorine, pH 7 and at 104°F (40°C).

Florida Tomato Cultivars
* Florida cultivars need resistance to Fusarium wilt race 1 and 2; Verticillium wilt; gray leaf spot; and tolerance to bacterial soft rot.
* Leading cultivar is Sunny (Asgrow). The bush is determinate vigorous with a jointed fruit attachment. Requires heavy pruning.
* Solar Set (Asgrow) was the second most important cultivar grown in Florida. A “hot-type” hybrid developed to set fruit during high temperatures (92/72°F, Night/Day). The bush is determinate compact with jointless fruit through the second and third pickings. Large-fruited. Requires light pruning of the first 3 or 4 suckers.
* Other cultivars which have performed well in Florida trials include: Agriset 761 (Agrisales-determinate, jointed); Bonita (Rogers NK-jointless hybrid); Colonial (Petoseed- jointless hybrid); Heatwave (Petoseed- early, large, jointed, uniform-green fruit hybrid); and, Olympic (Petoseed- early, determinate, jointed hybrid).

Other Ag factoids
◊ Typical discount store turns inventory 4 times per year.
◊ Typical supermarket turns inventory 25 times per year.
◊ Foreign inventors produced 47% of US patents in 1991, up from 36% in 1977.
◊ In 1990 about 182 million pounds (83,000 MT) of pesticides were used by licensed applicators in California.
◊ From rinsing application tanks approximately 100 million gallons (375,000 MT by weight) of "hazardous" rinsate was produced in California. Regulations in that state require all rinse water to be collected and treated as hazardous waste. (Business Week Jan. 18, 1993; Agribusiness Fieldman 21:9(1992)).
The Effect of alternative nematicides for the control of rootknot nematodes in edible ginger

Dwight Sato and Don Schmitt

Summary: Metham sodium appeared to be a good pre-plant soil fumigant in controlling the rootknot nematode. Mid-season control with Nemacur 3 (drip irrigated) minimized damage and increased marketable yield.

Table 1. Treatments for experiment on rootknot nematode control in edible ginger.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Method and Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>No nematicides</td>
</tr>
<tr>
<td>Manure</td>
<td>Pre-plant incorporation-10 T chicken manure/Ac</td>
</tr>
<tr>
<td>MeBr67</td>
<td>Pre-plant fumigation with 67% meth. bromide- 436 lbs/Ac</td>
</tr>
<tr>
<td>MeBr98 (375)</td>
<td>Pre-plant soil fumigation with 98% meth. brom -375 lb/Ac.</td>
</tr>
<tr>
<td>MeBr98 (436)</td>
<td>Pre-plant soil fumigation with 98% meth brom- 436 lb/Ac</td>
</tr>
<tr>
<td>MS</td>
<td>Pre-plant soil incorporation with 100 gal 32.7% metham sodium per acre and tarped</td>
</tr>
<tr>
<td>MS Clandosan</td>
<td>Same as MS plus post-plant treatment of Clandosan 618-total of 1.2 t/Acre</td>
</tr>
<tr>
<td>MS Manure</td>
<td>Same as MS plus post-plant treatment of chicken manure 2.4 t/Ac</td>
</tr>
<tr>
<td>MS Nemacur</td>
<td>Same as MS plus post-plant treatment of Nemacur 3- total 2 gal/Ac through drip system</td>
</tr>
</tbody>
</table>


Table 2. Effect of several nematode control treatments on yields of edible ginger.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grade #1</th>
<th>Grade #2</th>
<th>Offgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>672a</td>
<td>971a</td>
<td>1024a</td>
</tr>
<tr>
<td>Manure</td>
<td>3890ab</td>
<td>3767ab</td>
<td>2398ab</td>
</tr>
<tr>
<td>MeBr98 (436)</td>
<td>9204bc</td>
<td>4226b</td>
<td>3088abc</td>
</tr>
<tr>
<td>MeBr67</td>
<td>9272bc</td>
<td>3570ab</td>
<td>2377ab</td>
</tr>
<tr>
<td>MeBr98(375)</td>
<td>11180c</td>
<td>4720b</td>
<td>3705abc</td>
</tr>
<tr>
<td>MS Manure</td>
<td>11510c</td>
<td>4540b</td>
<td>1778ab</td>
</tr>
<tr>
<td>MS Clandosan</td>
<td>11937c</td>
<td>4982b</td>
<td>4361bc</td>
</tr>
<tr>
<td>MS</td>
<td>13873c</td>
<td>4065b</td>
<td>2960abc</td>
</tr>
<tr>
<td>MS Nemacur</td>
<td>14165c</td>
<td>5933b</td>
<td>5200c</td>
</tr>
</tbody>
</table>

Note: See Table 1. for treatment descriptions.
Column means followed by the same letter are not significantly different (P<0.05), Duncan's multiple range test.
Table 3. Effect of nematicide treatment on disease incidence for nematodes, tiprot, redrot, and fusarium in edible ginger.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Nematode</th>
<th>Tiprot</th>
<th>Redrot</th>
<th>Fusarium</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Clandosan</td>
<td>3559a</td>
<td>304abc</td>
<td>221a</td>
<td>6381c</td>
</tr>
<tr>
<td>MS</td>
<td>2978ab</td>
<td>546bcd</td>
<td>291a</td>
<td>7684c</td>
</tr>
<tr>
<td>MS Manure</td>
<td>2845ab</td>
<td>199ab</td>
<td>1054a</td>
<td>6697c</td>
</tr>
<tr>
<td>MeBr98 (375)</td>
<td>2452abc</td>
<td>918de</td>
<td>973a</td>
<td>6032abc</td>
</tr>
<tr>
<td>Manure</td>
<td>2372abc</td>
<td>43a</td>
<td>5000b</td>
<td>8459c</td>
</tr>
<tr>
<td>Control</td>
<td>1595abc</td>
<td>165ab</td>
<td>631a</td>
<td>3018a</td>
</tr>
<tr>
<td>MeBr67</td>
<td>1529abc</td>
<td>617cde</td>
<td>540a</td>
<td>8459c</td>
</tr>
<tr>
<td>MeBr98(436)</td>
<td>645bc</td>
<td>445abc</td>
<td>1010a</td>
<td>5886abc</td>
</tr>
<tr>
<td>MSNemacur</td>
<td>88c</td>
<td>968e</td>
<td>468a</td>
<td>5813abc</td>
</tr>
</tbody>
</table>

Note: See Table 1. for treatment descriptions.
Column means followed by the same letter are not significantly different (P<0.05), Duncan’s multiple range test.

The Effect of Shur-Crop Kelp based algae solution on yields of leafy Lettuce

Hector Valenzuela

Introduction and Materials and Methods
An experiment was conducted to determine the effect of weekly sprays of Kelp nutrient solution on yields of leafy lettuce. 'Anuene' lettuce was seeded June 16 and transplanted at the UH Waiamanalo Research Station (22° 56'0") on July 14, 1992. Plants were spaced 2 ft between rows and one feet in the row. Soil type was a Wailua silt clay (Vertic Haplustolls) at 70 feet elevation. Soil analysis before any fertilizers were applied on the experimental area determined an organic matter content of 1.12%, pH 5.6, and soil nutrient levels (ppm) of P= 52, K=480, Ca=2600, and Mg=800. On July 13 all experimental plots received a base application of P at 300 lbs/Ac and of K at 200 lbs/Acre. Treatments included 1) control= no nitrogen fertilizer, 2) nitrogen alone= 150 lbs/Acre of nitrogen fertilizer, and 3) nitrogen plus kelp spray applications= 150 lb/Ac N plus weekly sprays of 1% kelp nutrient solution (at rate of 2 lbs/Acre ai). N application was split with half banded 3 days after transplanting and the second half banded 15 days later. Each plot (treatment) consisted of four 10-ft rows. Each treatment was replicated four times arranged on a completely randomized design. Treatments were chosen in this manner because the objective of the experiment was to compare the effect of adding kelp to the fertilizer treatment that growers are already following. The plantings were irrigated as needed through drip irrigation. This experiment also evaluated the use of drip irrigation on leafy lettuce during the hottest part of the year. In general 'Anuene' lettuce growth suffered from heat stress and did not respond well to drip irrigation during the hot summer months. Transplant shock should in addition be minimized when transplanting leafy lettuce during the hot summer months. Biomass determinations were conducted at 25 days after transplanting and again at 45 days after transplanting. Tissue samples were collected at 45 days after transplanting for N content determinations.

Results
Even though weekly kelp spray applications tended to increase foliage fresh weight there was no statistical difference on fresh weight top yields between nitrogen alone and nitrogen plus kelp treatments (Table 1). The same pattern was observed on the two harvest dates. Both treatments (N alone and N plus Kelp spray) had significantly higher yields than the controls on both occasions. Root fresh weight was similar between N and N+Kelp treatments. Leaf N content was unexpectedly higher for N alone compared to N + Kelp treatment.

Discussion
Studies conducted so far with organic fertilizer applications on vegetable fruits and leafy vegetables have shown both positive and negative yield responses in several locations. It is likely that different crops will respond differently to organic fertilizer applications and that this response will be affected by location, time of planting, cultivar, and other cultural practices. Many growers have tried many types of organic fertilizers available in the market, many have experienced positive results and have continued to use these materials in their production programs. However, little research is still available on the effect of alternative organic sprays on crop yields, and again, this type of research is very location-specific. The results from this preliminary trial indicate that kelp did not increase yields of summer grown leafy lettuce compared with nitrogen fertilization alone. The results from this trial were similar to those obtained in a related trial with leafy 'Manoa' lettuce in East Oahu (unpublished data). Future experiments should include more replications per treatment to reduce the experimental error to determine if the trend toward increase yield with Kelp sprays is a real treatment effect or not. This experiment was not set to prove the contention that kelp solution may improve nitrogen use efficiency by the crop. This would be an interesting question but was not considered in these trials.
Table 1. The effect of nitrogen application and of nitrogen plus kelp spray applications on the biomass of ‘Anuene’ leaf lettuce grown

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Foliage fresh wt. (g) at 25 DAT</th>
<th>Foliage fresh wt. (g) at 45 DAT</th>
<th>Root fresh wt. (g) at 45 DAT</th>
<th>Leaf N Content (%) at 45 DAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>16.8a</td>
<td>62.5a</td>
<td>4.6a</td>
<td>2.9a</td>
</tr>
<tr>
<td>N alone</td>
<td>41.6b</td>
<td>181.2b</td>
<td>7.2b</td>
<td>4.2c</td>
</tr>
<tr>
<td>N + Kelp</td>
<td>45.9b</td>
<td>189.4b</td>
<td>6.5b</td>
<td>3.8b</td>
</tr>
</tbody>
</table>

1. DAT= days after transplanting

References

Industry Cooperators:
Certified Organic International, INC (kelp solution)
POB 1072
Aiea, HI 96701
Wisdom Industries Inc. (drip system)
Industrial rubber and plastics
719 Moowaa St.
Honolulu, HI 96817

Note: Mention of specific company or product does not constitute endorsement over other companies or equivalent products.
### 1991 Vegetable Crops Statistics for Hawaii

*(Compiled from DOA Statistics)*

<table>
<thead>
<tr>
<th>Major Vegetables</th>
<th>Local Farm Gate Value ($1,000)</th>
<th>Local plus imported farm gate value equivalent ($1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ginger</td>
<td>7,560</td>
<td>7,643</td>
</tr>
<tr>
<td>2. Tomato</td>
<td>3,120</td>
<td>10,658</td>
</tr>
<tr>
<td>3. Taro</td>
<td>3,010</td>
<td>3,336</td>
</tr>
<tr>
<td>4. Head Cabbage</td>
<td>2,935</td>
<td>3,123</td>
</tr>
<tr>
<td>5. Watermelon</td>
<td>2,030</td>
<td>2,345</td>
</tr>
<tr>
<td>6. Lettuces</td>
<td>1,928</td>
<td>12,102</td>
</tr>
<tr>
<td>7. Chinese cabbage</td>
<td>1,894</td>
<td>1,608</td>
</tr>
<tr>
<td>8. Cucumber</td>
<td>1,702</td>
<td>2,733</td>
</tr>
<tr>
<td>9. Watercress</td>
<td>1,610</td>
<td>1,612</td>
</tr>
<tr>
<td>10. Green Onion</td>
<td>1,552</td>
<td>1,805</td>
</tr>
<tr>
<td>11. Herbs</td>
<td>1,435</td>
<td>1,800</td>
</tr>
<tr>
<td>12. Bulb onion</td>
<td>1,365</td>
<td>19,397</td>
</tr>
<tr>
<td>13. Green pepper</td>
<td>1,219</td>
<td>2,835</td>
</tr>
<tr>
<td>14. Daikon</td>
<td>1,072</td>
<td>1,078</td>
</tr>
<tr>
<td>15. Sweet Corn</td>
<td>1,055</td>
<td>1,178</td>
</tr>
</tbody>
</table>

### Value of Vegetable Crops by Commodity Groupings

<table>
<thead>
<tr>
<th>Commodity grouping</th>
<th>Local Farm Gate Value ($1,000,000)</th>
<th>Percent of All Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Root Crops</td>
<td>13.59</td>
<td>35%</td>
</tr>
<tr>
<td>2. Leafy and Greens</td>
<td>6.64</td>
<td>17%</td>
</tr>
<tr>
<td>3. Cole Crops</td>
<td>5.83</td>
<td>15%</td>
</tr>
<tr>
<td>4. Solanaceous</td>
<td>5.16</td>
<td>13%</td>
</tr>
<tr>
<td>5. Cucurbits</td>
<td>4.33</td>
<td>11%</td>
</tr>
<tr>
<td>6. Onions (bulb and green)</td>
<td>2.91</td>
<td>7%</td>
</tr>
<tr>
<td>7. Sweet Corn</td>
<td>1.0</td>
<td>2%</td>
</tr>
</tbody>
</table>

Root Crops includes: ginger, taro, carrots, dasheen, burdock, lotus, and daikon.
Leafy/greens include vegetable legumes, and herbs.

**Hawaii Vegetable Statistics Factoids**

◊ Hawaii percent market share (by volume) of vegetable crops=55% (including ginger, taro for processing, and melons). Total volume of vegetables marketed in Hawaii annually= 259 million pounds (118,000 MT).
◊ Hawaii percent market share (by estimated equivalent farm gate price in Hawaii)= 40%.
◊ Estimated equivalent farm gate value of all vegetables marketed in Hawaii= $97.5 million.
◊ Number of vegetables with over 60% of local market share= 21 vegetables (out of 36 vegetables grown commercially in Hawaii). Volume-wise these vegetables represent 33% of all vegetables consumed and exported in Hawaii.
◊ Percent local market share of vegetables with annual market volume of over 5 million pounds = 48%. These vegetables include broccoli, chinese and head cabbage, carrots,
ginger root, lettuce, dry onions, potatoes, romaine, tomatoes, muskmelons, and watermelons.

◊ Percent local market share of vegetables with annual market volume over 15 million pounds (the so called "hi-volume" vegetables)= 42%. These vegetables include head cabbage, lettuce, dry onions, potatoes, tomatoes, and watermelons.

◊ The "high volume" vegetables which have an annual market volume of over 15 million pounds represent 50% of the volume of all the vegetables consumed and exported in Hawaii.

◊ Vegetables with potential for production in Hawaii based on economic returns and estimated yields based on data collected by the DOA include bittermelon, burdock, dasheen, eggplant, parsley, chinese peas, tomato, watercress, and ginger. Of these vegetables Hawaii has a low market share only for chinese peas and tomatoes.

UPCOMING EVENTS

First Hawaii Tissue Culture Conference, 22 March 1993, King Kamehameha Beach Hotel, Kailua-Kona. Registration= $25. For information contact HPTCA, POB 4072, Hilo, HI 96720, or call Rachel Keolanui at 808-959-0225


RESOURCES

Experimental Design on a Spreadsheet. Textbook on experimental design prepared by Dr. J. Brewbaker. Available for $10 in spiral bound from Ditto's on 2570 S. Beretania (tel. 943-0005).

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