

VEGETABLE CROPS UPDATE

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Insectaries

The Use of Insectary plants as a Reservoir for Beneficials in Vegetable Agroecosystems

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On our last issue we covered the area of habitat manipulation, in the form of living mulches, for improved management of soil erosion, nutrient cycling, and weed control in the farm. Another important area of habitat manipulation is the encouragement of beneficial populations in the farm through an increased diversity of plants in the agroecosystem. Experimental evidence, in fact¹, indicates that agroecosystems that have a greater diversity of plant species (which mimic secondary or later successional stages in natural ecosystems) will tend to have less insect outbreaks compared to less diversified systems. Perhaps this partly explains why traditional farming systems throughout the world evolved into complex polycultural systems, involving a mix of edible species planted concurrently in the same field, or in other formats of planting schedules with several space and time combinations.

Simplified agroecosystems. On the other hand, modern agriculture consist of very simplified agroecosystems in which one crop is grown over extensive areas year-round, and year after year. As it would be expected this has lead to ecological instability and to the development of frequent pest outbreaks in the field. To solve this, pesticides are applied which often further disrupt the internal ecological interactions by altering arthropod life-cycles, affecting plant physiology and growth, and by destroying populations of beneficials both above and below the ground level. For example, in New York, parasitism of the diamondback moth was 25% greater in fields that received Bt treatments, compared to those that received pesticide sprays toxic to the beneficials². In another example sprayed globe artichoke fields in California, had 8 fewer predatory mite species than unsprayed fields. In addition, in the California trials, secondary outbreaks of the two spotted spider mite occurred in the sprayed fields³. In Florida 90% parasitism of silerleaf whitefly has been determined in some unsprayed fields⁴.

Trial and error. The question from the commercial production standpoint is how to incorporate field diversity, without disrupting the already hectic, and labor intensive, farm operations. And secondly, little data is yet available to make sound recommendations. Local organic farmers, do try to use weeds that may have attractive floral nectaries, or that may provide a refuge for beneficials. In our experiments we also often find high levels (40-90%) of parasitism of important pests such as thrips, leafminers or silverleaf whitefly in unsprayed plots, or in unsprayed weedy patches along field borders⁵. However, due to the lack of baseline data, the approach of increasing species diversity in the farm, today, is still based on a trial and error basis but it always helps to have a good understanding of the life cycles of both pests and beneficials, and their interactions with both commercial crop and weedy habitats in areas close to the farm.

Local Work

Local insectaries. In Hawaii we are working with Dr. Greg Luther, and Dr. Joe DeFrank on the use of mustards as insectaries or reservoirs of beneficials for control of caterpillars in cabbage. Locally Dr. Ron Mau, and Randy Hamasaki are working on the use of sweet alyssum, as a reservoir for beneficials for control of the melon aphid in wet-land taro. In addition, living mulches and no-till practices may also provide a refuge for beneficials, or act as barriers for insect movement. With that on mind, Cerruti Hooks, a Ph.D student in our lab, will evaluate 12 living mulch species and their effects on beneficial and pest populations in zucchini. The accompanying tables (page 2-6) provide a list of "biological" resources available, which have been reported to act as potential insectaries. Quick starter tips include: learn what beneficials species you want to attract, what plant species may attract that species (what works in one location does not necessarily work in another), learn as much as possible about the biology of your pest and beneficials, keep an open mind, and when possible, use a mix of plant species as an insectary, rather than using a single species.

Notes

¹ See References (page 7) No. 8, 12, and 16.

² Shelton, A.M. 1993 NY State Vegetable Conference, pg. 53-55.

³ Goh, K.S. and W.H. Lange. J. Econ. Entomol. 82:621(1989).

⁴ Schuster, D.J. et al. 1993 Proc. Fl. Tomato Institute. pg. 77-106.

⁵ Dianne Ullman (pers. comm.) and Schuster, 1993, idem.

Table 1. List of plants reported to be useful as insectaries for attraction of beneficials in agroecosystems.

Insectary plant	Sci. name	Beneficials attracted	Comments	Ref
alysium sweet	Lobularia maritima	tachinid flies, hoverflies	long bloom period	1,4
alysium sweet	Lobularia maritima	chalcids	easy to grow, annual	1,
angelica	Angelica sp.	ladybugs, lacewings, sandwasps	attractive foliage	4,
angelica	Angelica sp.	potter, mud-dauber	biennial	
anthesis	Anthesis tinctoria	wasps, flies		2,
barley wild	Hordeum leporinum	parasitic mites	provides wind-blown pollen	5,
bean, bell	Vicia faba	parasitic wasps	cover crop in orchards	5,
black locust		lady beetles, lady bugs		1,
buckwheat flowering	Fagopyrum esculentum	hoverflies, minute pirate bugs,	soil improver	1,4
buckwheat flowering	Fagopyrum esculentum	predatory wasps, tachinid flies	till after peak bloom	1,5
buckwheat flowering	Fagopyrum esculentum	lacewings, lady beetles, syrphids	quick to flower, annual	1,
buckwheat wild	Eriogonum spp.	hoverflies, minute pirate bugs		1,
clover bur	Medicago polymorpha	lady beetles but harbors lygus bugs	winter annual	5,
California liliac	Ceanothus spp.	hoverflies		1,
candytuft	Iberis umbellata	syrphid flies	small shrub ground cover	4,
candytuft	Iberis umbellata		long bloom, perennial	
caraway	Carum cavi L.	lacewings, hoverflies, spiders		1,
caraway	Carum cavi L.	insidious flower bugs,		1,
caraway	Carum cavi L.	parasitic wasps		1,
carrot	Daucus carota	big-eye bugs, assassin bugs,	biennial, requires cold	4,5
carrot	Daucus carota	lacewings, parasitic wasps	exposure	
chickweed flowers	Stellaria media	tachinid, hoverflies, wasps, ants		3,5
clover, berseem	Trifolium alexandrinum	big-eyed bugs, Geocoris punctipes		1,8
clover, arrowleaf	Trifolium vesiculosum	big-eyed bugs, Geocoris punctipes		8
clover, crimson		minute pirate bugs, lady beetle		1,6
clover, crimson		big-eyed bugs, Geocoris punctipes		1,6
clover, subterranean	Trifolium subterraneum	big-eyed bugs, Geocoris punctipes		1,6, 8
clover, white	Trifolium repens	parasitic wasps of aphids, whiteflies	nitrogen fixer, perennial	4,
clover, white sweet	Melilotus alba	tachinid flies, mud-dauber, sand,	nitrogen fixer, excellent	4,
clover, white sweet		hornet, yellow jacket wasps, bienn	green manure, biennial	
coriander	Coriandrum sativum	tachinid flies	decorative foliage, annual	4,
cowpea		predatory wasps		1,
dill	Anethum graveolens	ladybugs, syrphids, wasps, spiders		2,
evening primroses	Oenothera lacinata or	ground beetles	attractive yellow flowers	4,
evening primroses	Oenothera biennis		perennial, biennial	
evergreen eunonymus	Euonymus japonica	lacewings, ladybugs	used as hedge plant, perennial	4,
fennel sweet	Foeniculum vulgare	parasitic wasps, predatory wasps	warning: invasive plant	1,4,5
fennel sweet	Foeniculum vulgare	syrphids, spider, ladybeetles	perennial weed	2,
indigo hairy	Indigofera hirsuta	aphid predators		5,
ivy	Hedera sp.	flower and tachinid flies, braconid	mature vine with bloom	4,
ivy	Hedera sp.	potter, mud-dauber, sand hornet	drought tolerant, perennial	
knotweed common	Polygonum aviculare	big-eye bugs, hoverflies,	summer annual weed	1,5
knotweed common	Polygonum aviculare	parasitic wasps, pirate bugs		1,
knotweed common	Polygonum aviculare	soft winged flower beetles		1,
lettuce wild	Lactuca canadensis	soldier beetles, lacewings, earwigs	easy to control, annual	4,
lettuce wild	Lactuca canadensis	syrphid flies		
marigold 'Lemon gem'	Tagetes tenuifolia	small wasps, spiders		2,

Table 1. Continues. List of plants reported to be useful as insectaries for attraction of beneficials in agroecosystems

Insectary plant	Scientific name	Beneficials	Comments	Ref
may weed	<i>Anthemis cotula</i>	general predators	annual weed, Asteraceae	5,
Mexican tea	<i>Chenopodium amrosioides</i>	stink bugs, ladybugs, assassin bugs	epazote, edible leaves, annual	4,
morning glory	<i>Convolvulus arvensis</i>	syrphid flies, lady bugs	Invasive plant; perennial	4,
mustard, white	<i>Brassica hirta</i>	braconid and ichneumon wasps	fast-growing, annual	4,
oat wild	<i>Avena fatua</i>	predatory mites	provides wind-blown pollen	5,
oat slender wild	<i>Avena barbata</i>	predatory mites	provides wind-blown pollen	5,
pigweed	<i>Amaranthus</i> sp.	ground beetles	edible weed, annual	4,
pinneapple weed	<i>Matricaria matricarioides</i>	general predators	annual weed, Asteraceae	5,
queen anne's lace		lacewings, predatory wasps,		1,
queen anne's lace		minute pirate bugs, tachinid flies		1,
rattail fescue	<i>Vulpia myuros</i>	predatory mites	provides windblown pollen	5,
ripgut brome	<i>Bromus rigidus</i>	predatory mites	provides windblown pollen	5,
rue	<i>Ruta graveolens</i>	potter wasps	deer resistant, perennial	4,6
rye	<i>Secale cereale</i>	lady beetles		6,
ryegrass, annual	<i>Lolium multiflorum</i>	predatory mites	provides windblown pollen	5,
saltbrush	<i>Atriplex</i> sp.	potter, sand, and mud-dauber wasps	brackish water tolerant, per	4,
Sesbania	<i>Sesbania exaltata</i>	lady bug beetles, syrphid flies		5,
showy patridge pea	<i>Cassia fasciculata</i>	entomophagous wasps, ants	Trichogramma parasitaton	5,7
silver lace vine	<i>Polygonum aubert</i>	tachinid and syrphid flies	attractive blooming white vine	4,
silver lace vine	<i>Polygonum aubert</i>		4-6" tendrils are edible, per	
snowberry	<i>Symphoricarpos</i> sp.	flower and tachinid flies	decidous shrub, perennial	4,
soap-bark tree		hoverflies, green lacewings,		1,
soap-bark tree		brown lacewings		1,
sowthistle	<i>Sonchus oleraceus</i>	lady beetles	annual weed	3,5
spearmint	<i>Mentha spicata</i>	predatory wasps, flies, spiders		1,
stitchwort	<i>Stellaria graminea</i>	tachinid, hoverflies, wasps, ants		5,
tansy	<i>Tanaceum vulgare</i>	parasitic wasps, lady beetles, flies		1,
tansy	<i>Tanaceum vulgare</i>	insidious flower bugs, lacewings		1,
toothpick ammi	<i>Ammi visnaga</i>	hoverflies, minute pirate bugs,	warm season annual	1,5
toothpick ammi	<i>Ammi visnaga</i>	soft-winged flower beetles,		1,
toothpick ammi	<i>Ammi visnaga</i>	tachinid flies		1,
tree of heaven	<i>Allanthus altissima</i>	syrphid, chloropid flies, braconid,	Warning: invasive plant	4,
tree of heaven	<i>Allanthus altissima</i>	potter wasps, lacewings	stress tolerant, perennial	4,
vetch, hairy	<i>Vicia sativa</i>	lady beetles, minute pirate bugs		1,5
vetch, hairy	<i>Vicia sativa</i>	predatory and parasitic wasps		1,
vetch, hybrid	<i>V. sativa</i> x <i>V. cordata</i>	big-eyed bug	cvr. Vantage	8
wheat, spring	<i>Triticum aestivum</i>	generalist predators	cover crop in orchards	5,
white sweetclover		tachinid flies, bees, predatory wasps		1,
Cosmos 'White sensation'	<i>Cosmos bipinnatus</i>	insidious flower bugs		2,
Cosmos 'White sensation'	<i>Cosmos bipinnatus</i>	lacewings, ladybugs, spiders		2,
yarrow	<i>Achillea</i> sp.	lady beetles, parasitic wasps, bees	drought resistant, perennial	1,4
yarrow	<i>Achillea</i> sp.	tachinid flies, scales, whiteflies	spread by underground roots	

References:

1= Karen Cicero, 1993. The New Farm. 15(2):28-33.

2= Joanna Poncavage, 1991. Organic Gardening. May/June 1991.

3= Parry Klassen, 1994. Fruit Grower. Vineyards in the Clover

4= Robert Kourik, 1992. Garbage. May/June 1992

5= Bugg & Waddington. Ag. Ecos. Environ. 50:11(1994)

6=Cecil Yancy, 1994, The New Farm, Feb. pg. 20-23.

7= Altieri 88;

8=Bugg et 91

big eyed bugs= *Geocoris punctipes*

hover flies= syrphids

Table 2. List of beneficial arthropods and plants used to attract them in agroecosystems

Beneficial arthropod	Scientific name	How to Attract
Aphid midge Aphid parasites	Aphidoletes aphidimyza Aphidius matricariae	dill, mustard, thyme, sweet clover, anise, caraway, dill, parsley, mustard family, white clover, lemon balm, corn spurry, wild carrot, stinging nettle, yarrow.
Assassin bugs Big-eyed bugs Braconid wasps	Reduviidae family Geocoris spp. Braconidae family eg. Apanteles glomeratus	Provide shelter alfalfa, potatoes, beets, subterranean clover
Damsel bugs	Nabidae family	dill, parsley, wild carrot, corn spurry, mustard, white clover, lemon balm, stinging nettle, yarrow
Ground beetles Lacewings	eg. Nabis americoferus Carabidae family Chrysoperla & Chrysopa spp.	alfalfa perennial plantings/sods, amaranth, white clover dill, angelica, corn, sunflowers, and weeds: dandelion, goldendrod
Lady beetles (bugs)	Hippodamia, Adalia spp. etc.	Plants with nectar and pollen flowers: angelica, dill, and weeds: dandelion, wild carrot, yarrow.
Mealybug destroyer Minute pirate bugs	Cryptolaemus montrouzieri Ortus sp.	NA Alfalfa, goldenrod, daisies, yarrow, corn (silken varieties), stinging nettles, clover, vetch, willows, and other shrubs
Praying mantis Predatory mite Predatory thrips	Mantis religiosa (European) Phytoseiulus persimilis Thripidae family, others.	native species NA, live mites must be available. Prefer insect prey but will feed on sap and pollen for survival. Plant flowers and corn.
Rove beetles	Staphylinidae family	Plant permanent beds, or interplant strips of rye or other grains or cover crops.
Spidermite destroyer Spined soldier bug Syrphid flies (hover or flower flies)	Stethorus spp. Podisus maculiventris Syrphidae family	Pollen and nectar from carrot and mustard family. Maintain permanent perennial beds
Tachinid flies goldenrod, wild carrot, amaranth Tiger beetles Trichogramma wasps	Tachinidae family Cicindellidae family Trichogramma minutum	Pollen and nectar from dill, fennel, marigold, and parsley, weeds eg wild carrot or yarrow. Pollen and nectar plants, dill, parsley, sweet clover, Phacelia sp., fennel, buckwheat, and herbs. Weeds.
Whitely parasite Western predatory mite	Encarsia formosa Metaseiulus (=Typhlodromus)	Maintain permanent beds. maintain several species: dill, anise, caraway, fennel, and mixture of clover and flowering weeds. NA

Table adapted from: Linda Gilkeson and J. Grossman. 1991. Organic Gardening. May/June 1991 pg. 46-56.

Table 3. List of weedy or crop species which have been reported as hosts of beneficial populations in agroecosystems.

Weed species	Beneficials attracted	Main crop	Comments	Reference
<i>Amaranthus hybridus</i> (pigweed)	big-eyed bug, ground beetle	soybean	generalist predator	Naranjo 87; Altieri & Let 86
<i>Amaranthus artemisiifolia</i> (ragweed)	big-eyed bug, other predators, parasites	soybean, cotton	generalist predator	Naranjo 87; Alt & Let 86, Alt 88
<i>Baccharis pilularis</i> (coyote brush)	hover fly	NA	aphid predators	Bugg 93
<i>Bidens alba</i> (Spanish needles)	big-eyed bug	soybean	generalist predator	Naranjo, Stimac 87
<i>Brassica juncea</i>	general predators	head cabbage	border crops	Luther, Valenzuela 94.
<i>Brassica napus</i> (canola)	hover fly (syrphid)	NA	with buckwheat	Bugg 93
<i>Chenopodium ambrosioides</i> (Mexican tea)	big-eyed bug, 34 predators	soybean, NA	generalist predator	Naranjo 87; Altieri & Whit 79b
<i>Dactylis glomerata</i>	general predators, spider	cereal crops	linear island habitats	Thomas 89; Chiverton 89
<i>Desmodium</i> spp. and <i>Croton</i> spp.	<i>Trichogramma</i> parasitation	soybean	with corn polyculture	Altieri 88
<i>Festuca pratensis</i>	general predators, spider	cereal crops	aphid predators	Chiverton 89
Grasses/broadleaves general	general beneficials	almond orchard	California BIOS program	Klassen 94b
<i>Heterotheca subaxillaris</i> (camphorweed)	big-eyed bug, 30 predators	soybean, corn	generalist predator	Naranjo 87; Altieri & Whit 80
<i>Holcus lanatus</i>	general predators, spider	cereal crops	linear island habitats	Thomas 89
<i>Lactuca canadensis</i> (wild lettuce)	6 general predator species	NA	general predators	Altieri & Let 86
<i>Monochoria vaginalis</i>	spider, <i>Pardosa ramulosa</i>	paddy rice	leafhopper control	Oraze & Grigarik 89
<i>Oenothera laciniata</i>	ground beetle	(early evening primrose)	leaf beetle control	Altieri & Let, 86
<i>Oenothera biennis</i>	ground beetle	(evening primrose)	leaf beetle	Altieri & Let 86
<i>Panicum maximum</i>	predaceous earwig, <i>Doru taeniatum</i>	cassava, Nicaragua	control fall armyworm	Jones et al 87
<i>Paulownia tomentosa</i>	predaceous mites	NA, Korea	extrafloral nectar	Pemberton, 93
<i>Pennisetum purpureum</i>	predaceous earwig, <i>D. taeniatum</i>	cassava, Nicaragua	control fall armyworm	Jones et al 87
<i>Phacelia tanacetifolia</i> (Tansy)	hover fly	NA	aphid predators	Bugg 93
<i>Phleum pratense</i>	general predators, spider	cereal crops	Chiverton 89	
<i>Prunus ilicifolia</i> (holly l. cherry)	hover fly (syrphid)	NA	aphid predators	Bugg 93
<i>Quillaja saponaria</i> (soapbark tree)	hover fly	NA	aphid predators	Bugg 93
<i>Richardia scabra</i> (Florida pusley)	big-eyed bug	soybean	generalist predator	Naranjo, Stimac 87
<i>Solidago fistulosa</i> (goldenrod)	big-eyed bug, 58 predators	soybean, NA	generalist predator	Naranjo 87; Altieri & Let 86
<i>Sorghum halapense</i>	predaceous earwig, predatory mites	cassava, grape	control fall armyworm	Jones et al 87; Flaherty 69
<i>Sorghum bicolor</i>	predaceous earwig	cassava, Nicaragua	control fall armyworm	Jones et al 87
<i>Spergula arvensis</i> (corn spurry)	hover fly	NA	control fall armyworm	Bugg 93
Various (54) weed species	sugar cane borer, <i>Diatraea saccharalis</i>	sugarcane	aphid predators	see: Ali, Reagan 85; Showler 91
Various, closed canopy ¹	Predators and parasitoids	soybean, collards	weedy habitats	Alston et al 91; Horn 81
Various (32) species, 15 families ²	ladybird beetles, lacewing	NA	weedy habitat, aphids	see: Pemberton 93
Various ³	below-ground predators, predators	peanut, various	extra floral nectar	Brust 90, Altieri et al 77
Various wildflowers	parasitoids	apple orchard	corn rootworm, others	Leius 67

¹ Weed species in the soybean study included large crabgrass (*Digitaria sanguinalis*, broadleaf signalgrass (*Brachiaria platyphylla*), fall panicum (*Panicum dichotomiflorum*), common lambsquarter (*Chenopodium album*), redroot pigweed (*Amaranthus retroflexus*), and morning glory (*Ipomoea* spp)); Beneficials included: the predators *Orius insidiosus*, *Geocoris punctipes*, *Coleomegila maculata*, and *Hippodamia convergens*, and the parasitoids from the groups Tachinids (Diptera) and ichneumonids (Hymenoptera). Major weeds in the collar study were pigweed (*Amaranthus retroflexus*, goosefoot (*Chenopodium album*), cocklebur (*Xanthium strumarium*), smartweed (*Polygonum* spp), purslane (*Portulaca oleracea*), thistles (*Cirsium* spp), ragweed (*Ambrosia artemisiifolia*), and several grass spp.. Beneficials in the collar study included lacewings, beetles, and syrphids (Horn 81).

² Also see: Lanza 1993; Agnew et al., 1982; Yokoyama, 1978; Stone et al., 1984; Treacy et al., 1987, for a review see: Koptur, 1992. For an overview of the attraction of several insect groups to floral volatiles see: Dobson, 1994.

³ Weeds and reported beneficials increases as reported by Altieri et al (1977) were: increased predators in cotton with *Rumex crispus* for control of *Heliothis* sp.; Increased predators and parasites in cabbage for aphid control in a weed complex consisting of *Barbarea vulgaris*, *Armoracia rusticana*, *Cardamine pennsylvanica*, *Lepidium campestre*, and *Brassica nigra*; and increased predators and parasites in brussel sprouts for caterpillar control in a weed complex consisting of *Avena fatua*, *Polygonum persicaria*, *P. aviculare*, *Chenopodium album*, *Sinapsis arvensis*, and *S. nigrum*.

Table 4. List of insectary mixes sold in California

Seed Co. Common Name Scientific Name

'Border Patrol' Mix

Clyde Robin Seed Co. Hayward, CA	Angelica Baby blue eyes Bishop's flower Black-eyed Susan California buckwheat Candytuft Evening primrose Nasturtiums Strawflowers Yarrow	Angelica sp. Nemophila menziesii Ammi majus Rudbeckia hirta Eriogonum fasciculatum Iberis imbelatum Oenothera argillicola Nasturtium sp. Helichrysum sp. Achillea millefolium
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'Fall-sown' Insectary Mix

Lohse Mill Inc. Artois, CA	Alfalfa Baby blue eyes Brown mustard Carrot Celery Common vetch Coriander Crimson clover Rye Subterranean clover (3-4 varieties) Sweet alyssum Sweet fennel Tidy tips White mustard White sweetclover Yarrow Yellow sweetclover	Medicago sativa Nemophila menziesii Brassica juncea Daucus carota L. Apium graveolens Vicia sativa L. Coriandrum sativum Trifolium subterraneum Secale cereale Trifolium subterraneum Lobularia maritima Foeniculum vulgare var dulce Layia platyglossa Sinapsis alba Melilotus alba cv. 'Hubam' Nemophila menziessi Melilotus officinalis
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'Spring-sown' Insectary Mix

Lohse Mill Inc., Artois, CA	Buckwheat Cowpea Sesbania Sorghum	Fagopyrum esculentum Vigna unguiculata Sesbania exaltata Sorghum bicolor
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'Germain's' Insectary Mix

Germain's Inc. Fresno, CA	Baby blue eyes Birdsfoot trefoil Buckwheat Crimson clover Little burnet Poppy Sweet alyssum Yarrow	Nemophila menziesii Lotus corniculatus Fagopyrum esculentum Trifolium incarnatum Sanguisorba minor Eschscholzia californica Lobularia maritima Achillea millefolium
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'Pacific Coast' Insectary Mix

Pacific Coast Seed Pleasanton, CA	Annu. white sw. clover Annual baby's breath Caraway Coriander Cosmos, white Dwarf white sweet alyssum Fennel Parsley Tall white sw. alyssum Tidy tips White yarrow Yellow sweet clover	Melilotus alba cv. Hubam Gypsophila muralis Carum carvi Coriandrum sativum Cosmos bipinnatus Lobularia maritima Foeniculum vulgare var. dulce Petroselinum crispum Lobularia maritima Layia platyglossa Achillea millefolium Melilotus officinalis
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(Table adapted from Bugg and Waddington 1994)

Resources

Insectary propagation materials (Plants and Seed)

W. Atlee Burpee & Co.
300 Park Ave.
Warminster, PA 18974

Gardens Alive!
Highway 48
POB 149
Sunman, IN 47041

Thompson & Morgan Inc.
POB 1308
Jackson, NJ 08527

Well Sweet Herb Farm
317 Mt. Bethel Rd.
Port Murray, NJ 07865

Whayes End Nursery
POB 310
Burgess, VA 22432

Seed Sources of Insectary Plants

Peaceful Valley Farm
POB 2209
Grass Valley, CA 95945
916-272-4796

Goog bug blend of clovers, flowers, and herbs

Harmony Farm Supply
POB 460
Graton, CA 95444
707-823-9125

Insectary blend of sweetclovers, herbs, and flowers

Super Weeds!!

Studies conducted by Norman Ellstrand indicate that genetically engineered crops that cross-pollinate with wild relatives may result in "super weeds" with herbicide resistance or other superior traits not available in "natural" weed populations. In California weedy species exist as relatives to such crops as asparagus, carrot, and celery.

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Local Extension Activities

Second Annual TeleConference for Commercial Vegetable Growers

Over 55 people attended the first two sessions of the 2nd TeleConference for Commercial Vegetable Growers, which has been conducted through the HITS interactive television system in the state. Participants have attended the several sites in the state to learn about 1) Virus cross-protection and a Primer on Nematode Management, on the first session, and 2) Alternative Pest Control Practices for the second session. Time for the presentations, only 1 hour long each, leaves little room for discussions, but the interaction from different sites in the state is really invaluable. Don't miss the next two sessions:

Nov. 16, 1994, 9-10 AM:

Weed Control in Vegetable Crops by Dr. Joe DeFrank

Nov. 23, 9-10 AM

**Fertilizer Recommendations for Vegetable Crops
by Dr. Joe Tamimi**

Sites are in Hilo CC, Kona-Ch. 7, Molokai, Maui CC, Oahu Leeward CC, Kauai CC.

Waimanalo Field Day. Over 40 people attended the Vegetable Composting Field day in Waimanalo in late June. Short lectures were given on composting, nitrogen fixation, the new soybean rust disease, an update on weed control, and an ono taste panel of basil dishes. The attendants visited the nature farming (organic) demonstration plots, and the ongoing basil composting experiment.

Poamoho Field Day. About 30 people showed up for the vegetable field day held at Poamoho in early September. Growers received an update on mosaic virus control, and cross-protection from Dr. Steve Ferreira, and visited the zucchini and daikon variety trials. Daikon growers were especially impressed with 'High Snow' from Know-you seed and have asked about sources of seed (contact Kaigo Inc. at 396-1028 Attn. Ms. Joyce Luh). Know-you seed is sending me a large seed sample of 'High Snow' so let me or Steve Fukuda know if you would like to conduct some on-farm collaborative trials with us. The zucchini varieties showed a range of damage from low to high, from feeding by leafminers and the silver leaf whitefly. Hope to see you at our next field day!

ACTION GROUP UPDATE

The Vegetable Action Group met on Oct. 18 in Oahu for the third time this year. The committee received an update from several research projects and updates from DOA on the soybean rust, and other issues. In addition to the normal business items, the several vegetable extension agents that attended presented an overview of what are their views are in terms of future extension needs. Dr. P.Y. Lai and K. Rohrbach, CTAHR Assistant Directors also attended the meetings. Kert Hamamoto, Wendell Koga, and the representatives from the different production areas did an excellent job by providing an opportunity for this dialogue.

UPCOMING EVENTS

Liquid Manure Application Systems Design, Management and Environmental Assessment, 1-2 Dec. 1994, Rochester Marriott Thruway Hotel, Rochester, New York, For information contact Cooperative Extension, 152 Riley-Robb Hall, Ithaca, NY 14853-5701, Tel. 607-255-7654.

California Farm Conference, 26-28 Feb., 1995, Radisson Hotel, Sacramento. Family farming, direct marketing, and ag sustainability. For information contact the Small Farm Center, UC, Davis, CA 95616.

Western Nutrient Management Conf., Salt Lake City, Utah. 9-10 March 1995. Contact: Terry Tindall, Univ. Idaho, Twin Falls, ID 83341, tel. 208-736-3600.

4th National Symposium on Stand Establishment of Hort. Crops, 23-26 Apr. 1995, Doubletree Hotel, Monterey, CA. Tim Hartz, Dept. Veg. Crops, UC, Davis, CA 95616-8746, tel. 916-752-7049.

Workshop: Mineral Nutrition of Root Crops in The Pacific. Nuku'alofa, Tonga, April 17-20, 1995. For information contact: Prof. Colin Asher, The Univ. Queensland, Brisbane, O'ld, 4072, Queensland, Australia. Tel. 617-365-2067; FAX 617-365-1188.

An International Training Program in New Crops: Aromatic and Medicinal Plants. 19-30 June 1995, Purdue Univ. Cost is \$1,800. Mr. Tom Robertson, Continuing Educ., Purdue Univ. 1586 Stewart Ctr., West Lafayette, IN 47907-1586. Tel. 317-494-7220, Fax. 317-494-0567.

92nd ASHS Annual Meeting. Montreal Convention Center, 30 July-3 Aug. 1995. R.L. Granger, Res. Station AC, CP-457, 430 Blvd. Gouin St. Jean-sur Richelieu, P..Q., Canada, J3B 6Z8; tel. 514-346-4494.

STATEMENT OF PURPOSE

The purpose of this newsletter is to update the Vegetable County Extension Agents and Industry Leaders with recent developments in the area of Vegetable Crops Production. Contributions, news bits, and comments are welcomed. Anyone is free to use the information in this newsletter. Whenever possible, please give credit to the authors. The purpose of trade names in this publication is solely for the purpose of providing information and does not necessarily constitute a recommendation of the product.

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