

Precision Crop Pollination Management Guide

Decide if you are managing for focal crop bee species or for all species

All bee species

Crop specific bee species

Assess or plant flower species on **borders** of orchards/fields: **across** season (3-5 sp/time)

Assess or plant flower species on **borders** of orchards/fields: **before & after** bloom of crop

Create, protect, manage nesting habitat:

- Mud
- Bare soil - sandy loam soil
- Pebbles
- dead twigs and stems
- fresh clean water

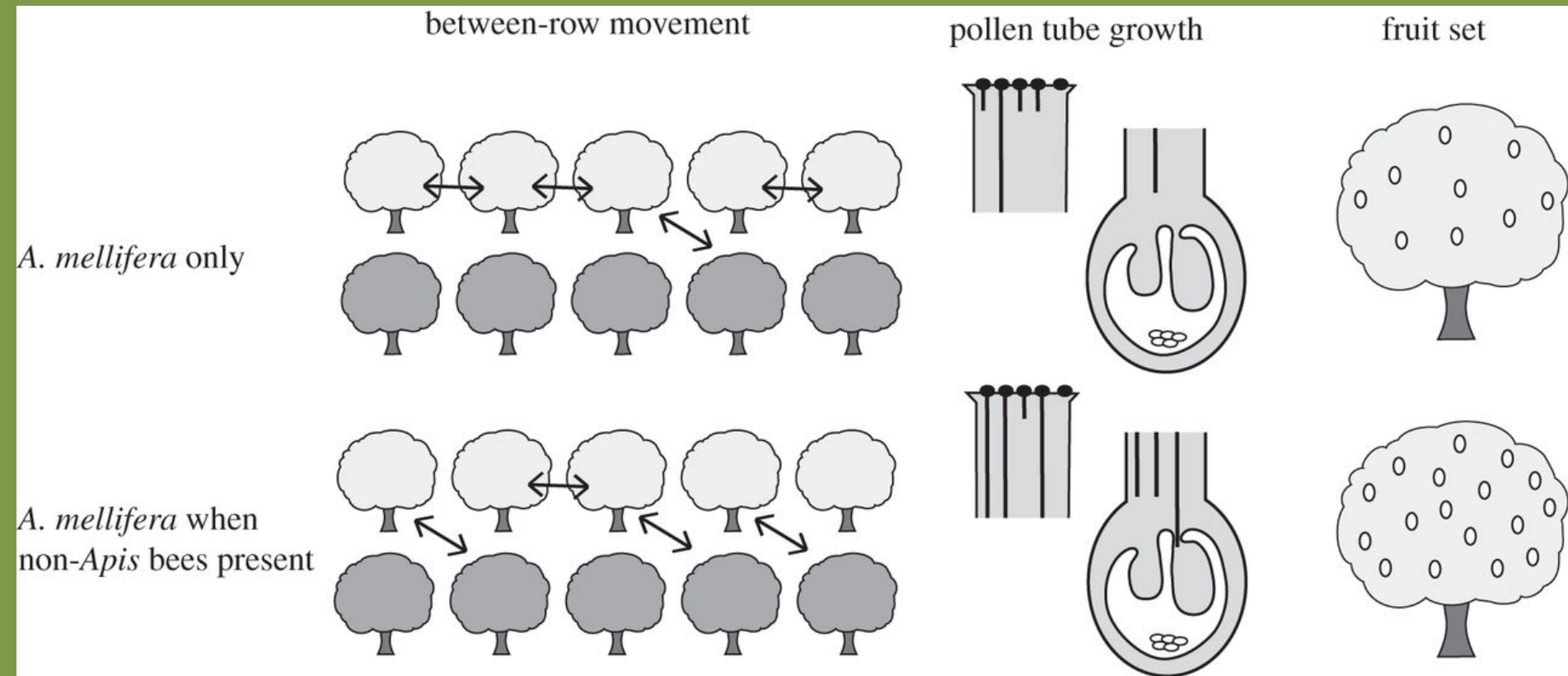
- Scout often
- Spray late PM early AM
- Use low toxicity pesticides
- Call local beekeepers

Both wild native bees and honey bees are crucial to agricultural production

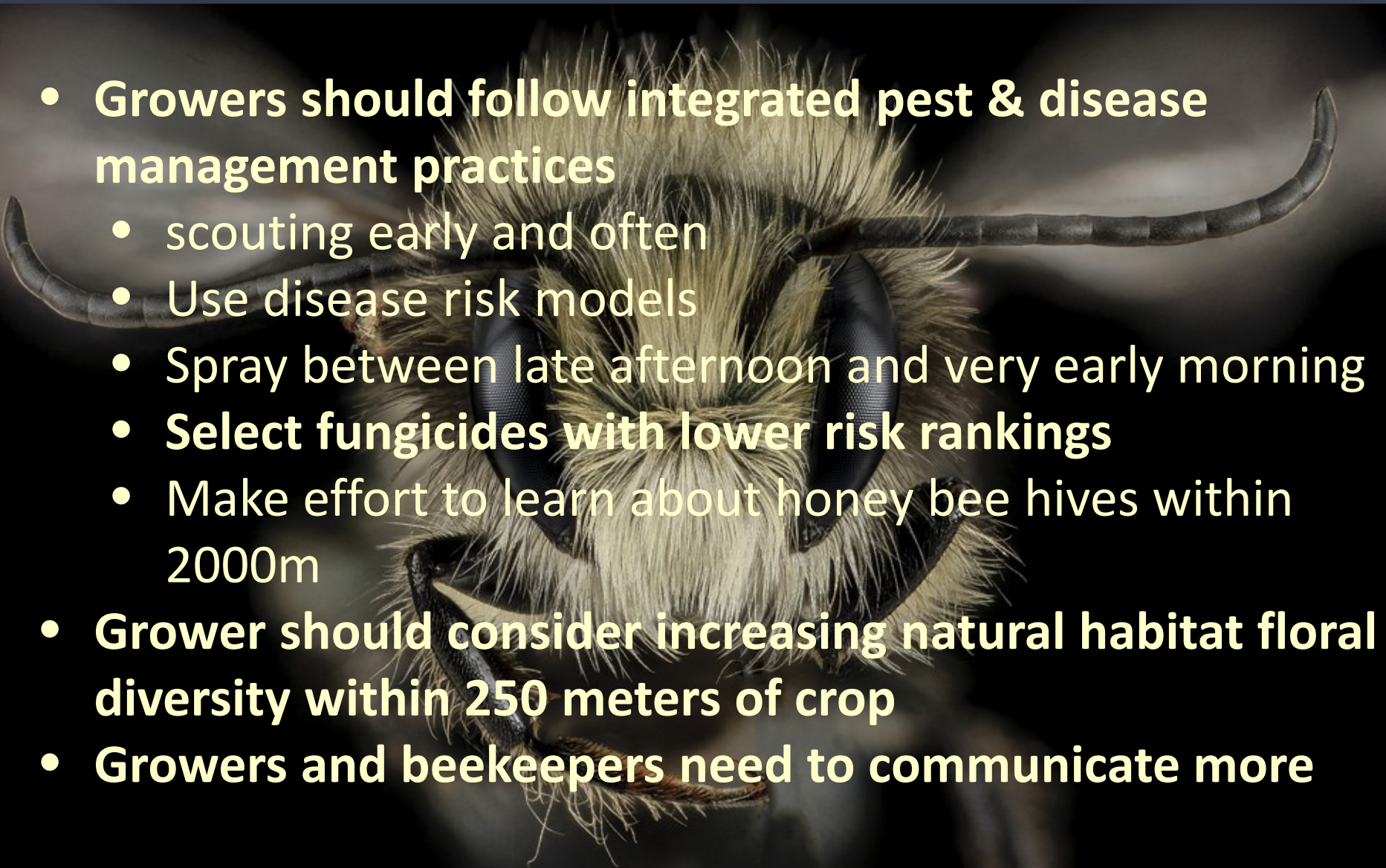
□ Wild bee ■ Honey bee



Wild native bees increase the effectiveness of honey bee pollination



Pesticide Management

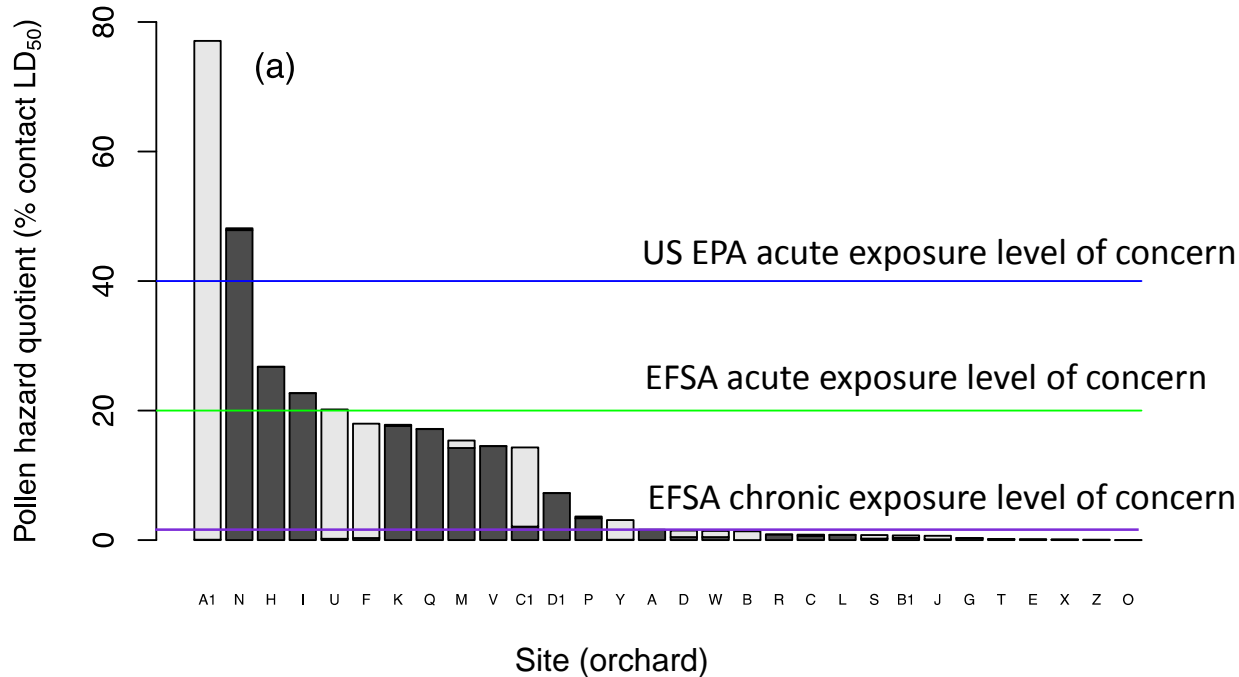
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- **Growers should follow integrated pest & disease management practices**
 - scouting early and often
 - Use disease risk models
 - Spray between late afternoon and very early morning
 - **Select fungicides with lower risk rankings**
 - Make effort to learn about honey bee hives within 2000m
 - **Grower should consider increasing natural habitat floral diversity within 250 meters of crop**
 - **Growers and beekeepers need to communicate more**

Top 13 Pesticide residues in pollen: during apple bloom



Chemical	Brand name(s)	Compound Type	Mean residue (ppb)1	Positive detection	Limit of detection (ppb)2	Contact LD50(ug /bee)3	Oral LD50(ug/bee)3	Mean Contact PHO4	Mean Oral PHO4
Indoxacarb	Avaunt	Insecticide	557.1	2	35.5	0.118	0.26	4721.2	2142.7
Cyfluthrin	Leverage, Defcon, Tombston, Aztec, Baythroid	Insecticide	93.3	6	35.5	0.037	0.051	2522.8	1830.3
Thiamethoxam	Actara, Cruiser, Durivo, Platinum, Voliam	Insecticide	21.5	5	3.6	0.024	0.005	895.3	4297.2
Carbaryl	Sevin	Insecticide	69.9	11	3.6	0.84	0.15	83.2	466
Acetamiprid	Assail	Insecticide	160.5	11	1.4	7.9	14	20.3	11.5
Cyprodinil	InspireSuper, Vanguard	Fungicide	1216.4	24	0.4	100	100	12.2	12.2
Iprodione	Rovral 4	Fungicide	929.3	4	355.3	400	25	9.3	148.7
Thiophanate-methyl	Evolve, Topsin-M70 WSP	Fungicide	570	1	1.4	100	100	5.7	5.7
Fluxapyroxad	Priaxor	Fungicide	353.6	12	3.6	100	110.9	3.5	3.2
Difenoconazole	Aprovia Top, Inspire Super, QuadrisTop, RevusTop	Fungicide	327.1	22	1.4	101	177	3.2	1.9
Penthiopyrad	Fontelis	Fungicide	119.2	8	1.4	312	385	3.1	2.5
Trifloxystrobin	Flint, Gem, Luna, Sensation	Fungicide	14.1	18	0.4	200	200	1.3	1.3
Myclobutanil	Rally 40 SWP	Fungicide	49.5	1	35.5	39.6	34	1.2	1.5

Pesticide risk: During apple bloom



- █ Pesticides sprayed during bloom (**37% of risk**)
- █ Pesticides *not* sprayed during bloom (**63% of risk**)



- Pollen from hives in 22/30 orchards above regulatory agency level of concern for acute or chronic exposure
- **63% pesticide risk from pesticides not sprayed during bloom**

Top 10 most toxic pesticides in Osmia pollen: during apple bloom

Brand name(s)	Pesticide	Pesticide class	% Samples	Max ppb	% HQ
Cobalt, Hatchet, Lorsban	<i>Chlorpyrifos</i>	ORGANOPHOSPHATE	13.5%	143.0	243.10%
Avaunt	<i>Indoxacarb</i>	OXADIAZINE	9.6%	690.0	167.57%
Somonic, Somonil, Supracide, Suprathion and Entrust, Seduce, Tracer, Blackhawk	<i>Methidathion</i>	ORGANOPHOSPHATE	3.8%	400.0	52.31%
Sevin	<i>Spinosad</i>	SPINOSYN	1.9%	11.0	51.94%
Actara, Cruiser, Durivo, Voliam, Phosmet	<i>Carbaryl</i>	THINNER	50.0%	2289.0	35.38%
	<i>Thiamethoxam</i>	NEONICOTINOID	21.2%	34.0	24.08%
	<i>Phosmet</i>	ORGANOPHOSPHATE	3.8%	261.0	4.11%
Diazinon	<i>Diazinon</i>	ORGANOPHOSPHATE	65.4%	20.0	2.62%
Couraze, Macho, Admire, Brigadier	<i>Imidacloprid</i>	NEONICOTINOID	3.8%	6.6	2.56%
Belay	<i>Clothianidin</i>	NEONICOTINOID	5.8%	4.8	1.86%

Organophosphates

Other Insecticides

Neonicotinoids



Top pesticides found in Bumble bee wax

Compound	Type	Product	# positive detections	Mean residue (ppb)	Mean contact WHQ	Mean oral WHQ
Imidacloprid	Insecticide	Couraze, Macho, Admire*, Brigadier*	1	2.76	0.009202118	0.0138031770
Indoxacarb	Insecticide	Avaunt	6	31.65	0.033669958	0.0121722985
Carbaryl	Insecticide	Sevin	20	12.46	0.001482784	0.0069196600
Spinetoram J	Insecticide	Radiant	17	1.59	0.006640809	0.0011384240
Spinetoram L	Insecticide	Radiant?	9	0.25	0.001039851	0.0001782600
Acetamiprid	Insecticide	Assail	5	10.36	0.000127890	0.0000714420
★ Piperonyl butox	Synergist	Pyrethrum TR, Pyronyl Crop Spray	93	0.16	0.000000632	0.000000632
Propiconazole	Fungicide	Bumper, Propimax EG, Quilt(2)	10	1.54	0.000162624	0.0007356790
Azoxystrobin	Fungicide	Custodia, Quadris, Quilt	93	43.02	0.000021511	0.0001720850
Trifloxystrobin	Fungicide	Flint, Gem, Luna Sensation	86	25.41	0.000012706	0.0000127059
★ Cyprodinil	Fungicide	Inspire Super, Switch 62.5 WG, Vanguard	19	9.21	0.000009210	0.0000092096
Propamocarb	Fungicide	Previcur Flex	4	7.51	0.000007513	0.0000089439
Thiophanate-Me	Fungicide	Evolve, Topsin-M 70 WSP	13	7.86	0.000003932	0.0000039323
Difenoconazole	Fungicide	Aprovia Top, Inspire Super, Quadris Top, Revus Top	30	6.9	0.000006902	0.0000036909
★ Pyraclostrobin	Fungicide	Pristine, Merivon, Headline, Priaxor,	77	1.63	0.000001629	0.0000022289
Cyflufenamid	Fungicide	Miltrex, Cyflufenamid	3	1.12	0.000001121	0.0000011211

Habitat Management

A close-up photograph of a bee's head, showing its large compound eyes, antennae, and the fuzzy texture of its thorax. The bee is positioned centrally, with its head facing forward. The background is dark and out of focus.

- 1. Provide a diversity of wild foraging plants species**
- 2. Push for 3-5 species blooming at all times across season**
 - At least before and after crop bloom
 - At least 30-100 meters from crop margin
- 3. Provide safe nesting sites for native bees 30-100 meters from crop margin (away from drift)**
- 4. Mow small areas on margins to provide bareground for the ground-nesting species – Manage 1/3 area each year.**

Habitat Assessment Framework

1. Habitat within ½ mile of site (not including lawn or overgrazed fields)
 - Dominant vegetation type (% native to % non-native to % invasive)
2. Site habitat features
 - % cover of natural or semi-natural habitat on site
 - Dominant vegetation type (% native to % non-native to % invasive)
 - Water, dead wood, forest, grassland, shrub land, etc.
3. Foraging Habitat
 - Percent of non-crop foraging habitat on site
 - Number of pollinator friendly flowering plant species that bloom in, 1) Spring, 2) Summer, 3) Fall
4. Nesting sites for ground-nesting bees
5. Nesting sites for cavity-nesting bees
6. Site Management Practices
 - Use of pesticides
 - Land management techniques

Floral Resources

Woody Plants

- Willows
- Maples
- Plum
- Serviceberry
- Apple
- Redbud
- Hawthorn
- Blueberry
- Raspberry
- New Jersey Tea

Native

- Baptisia
- Penstemon
- Milkweed
- Blue Lobelia
- Partridge Pea
- Hyssop
- Beebalm
- Joe Pye Weed
- Mountain Mint
- Boneset
- Goldenrod
- Asters

Non-Native

- Red Clover
- White Clover
- Alfalfa
- Buckwheat
- Basil
- Lavender
- Catmint
- Hairy vetch
- Annual Sunflower
- Oregano

Important Native Forage Species

20 Native Plants that support Bees and Butterflies - Early to Late Season

BEST Native Plants for BEES and BUTTERFLIES

Early Season to Late Season

Early season

Asclepias tuberosa (Butterfly Milkweed)

Rudbeckia hirta (Black-eyed Susan)

Mid-season

Lobelia siphilitica (Great Blue Lobelia)

Agastache scrophulariifolia (Giant Hyssop)

Pycnanthemum tenuifolium (Mountain Mint)

Asclepias incarnata (Swamp Milkweed)

Late-season

Eupatoriadelphus maculatus (Joe Pye Weed)

Oligoneuron rigidum (Goldenrod)

Common name	Scientific name	Bloom period
Purple giant hyssop	<i>Agastache scrophulariifolia</i>	Mid
Swamp milkweed	<i>Asclepias incarnata</i>	Mid
Butterfly milkweed	<i>Asclepias tuberosa</i>	Early
Spotted Joe Pye Weed	<i>Eupatoriadelphus maculatus</i>	Late
Flat-top goldentop	<i>Euthamia graminifolia</i>	Late
Common St. Johnswort	<i>Hypericum perforatum</i>	Early
Great blue lobelia	<i>Lobelia siphilitica</i>	Mid
Stiff goldenrod	<i>Oligoneuron rigidum</i>	Late
Hairy beardtongue	<i>Penstemon hirsutus</i>	Early
Narrowleaf mtn mint	<i>Pycnanthemum tenuifolium</i>	Mid
Blackeyed Susan	<i>Rudbeckia hirta</i>	Early
Cutleaf coneflower	<i>Rudbeckia laciniata</i>	Late
Wrinkleleaf goldenrod	<i>Solidago rugosa</i>	Late
New England aster	<i>Symphotrichum novae-angliae</i>	Late
New York aster	<i>Symphotrichum novi-belgii</i>	Late
Hairy wht oldfield aster	<i>Symphotrichum pilosum</i>	Late
Swamp verbena	<i>Verbena hastata</i>	Early
New York ironweed	<i>Vernonia noveboracensis</i>	Late
Culver's root	<i>Veronicastrum virginicum</i>	Early
Golden zizea	<i>Zizia aurea</i>	Early

Bee Habitat Management Framework

Restoration & Management

- Planting additional bee forage
- Building cavity nests
- Establishing ground nesting sites
- Develop & Implement Pesticide Management Plans.
 - Timing of spraying
 - Types of chemicals
 - Integrated Pest Management
- Develop & Implement Mechanical Management Schedules on 1/3 of habitat each year (rotate)
 - Fire
 - Mowing
 - Grazing
 - Cutting

Make an effort to meet local beekeepers

- Make pollination contracts
- Grower communicates with beekeeper when intending to spray
- Beekeeper lets growers know when they put their hives nearby (1-2 miles radius).
- Beekeeper educates grower
- Grower educates beekeeper



Get to know the 'wild' bees on the crop



- Count the # of wild bees vs honey bees at early and peak bloom in a 5 minute period
- Try to identify the wild ones
- Learn how:
(www.northeastpollinatorpartnership.org)



Solutions Quick Guide

Problems

1. Low Plant Diversity & Abundance
2. Low Plant Flowering Times
3. Lack Ground nesting sites
4. Lack Cavity nesting sites
5. Site lacks of Natural Habitat and/or Structure & Composition
6. Lack of habitat within ½ mile
7. Disturbance of landscape (+/-)

Solutions

1. Add more bee forage plant species
2. Plant forage for each season
3. Create bare ground, plant bunch grasses
4. Build cavity nests, dead wood, bramble, grass
5. Create structure with snags, trees, meadows and moist areas
6. Add habitat-partner with neighboring landowners to create corridors.
7. Manage pests and weeds via fire, mowing, grazing, cutting or spraying at times of low bee activity (late fall, very early spring, dawn and dusk)