Diversionary Plantings and Fixed Land Honey Production

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Inspired by the work of Dr. George S. Ayers
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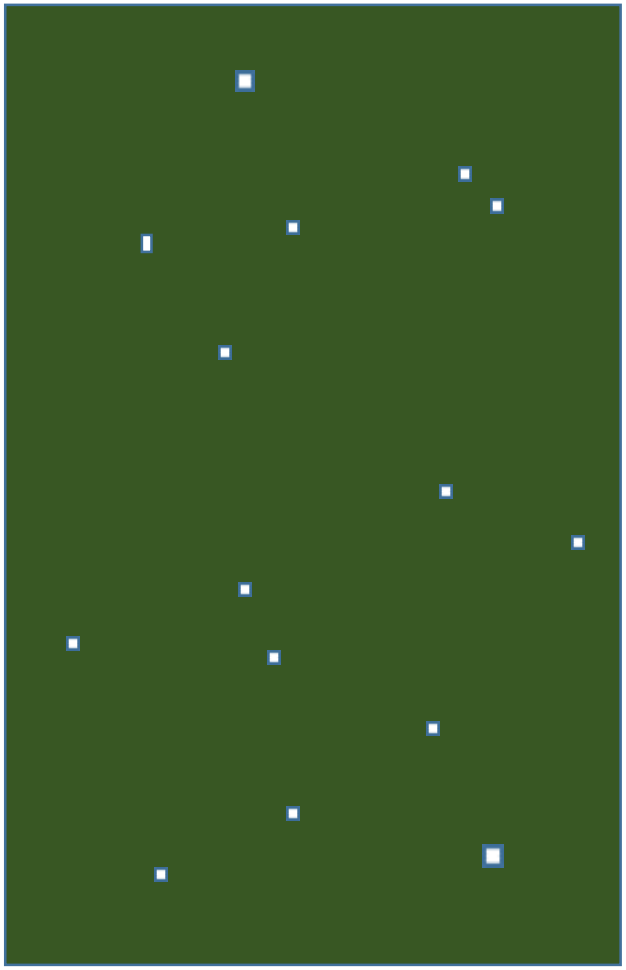
Work published in American Bee Journal, data used with permission.

Full citations are given at the end of this presentation.

Flowering plants in orchards attract bees, which then may be

poisoned if bee-toxic pesticides are applied.



Orchard

Diversionary planting (D.P.)

Small area,
Very highly attractive,
Bees prefer D.P. over orchard

Proof of principle

Planted buckwheat, borage, rapeseed

Results

	Number of bees		
	June 23, 1983	July 18	Area
Combined orchard	900	150	40 ac
Diversionary planting	1,500	2,200	0.7 ac
Ratio (D.P. : orchard)	1.7 : 1	14.7 : 1	

Ideal characteristics

Bloom cannot overlap the crop
Crop area must not be too large (cotton)
D.P. must be much more attractive
D.P. bloom must overlap “offending” bloom
Must not allow forage dearth
Maximum yield for space used
Ecologically stable community …

… sounds like a “designed bee meadow”

Challenge:

No standardized method for comparing plants

Response:

Develop replicated choice test plantings
Count flower per unit area
Measure yield per unit area from solid stand
Relate attractiveness to yield

Scrophularia nodosa – Simpson's honey plant

1877 Letter from James A. Simpson to A. I. Root resulted in the nickname and flurry of interest

S. marylandica = carpenter's square or eastern figwort

S. nodosa = common figwort wood figwort

both are native

www.wikiwand.com/en/Echinops_sphaerocephalus

Echinops sphaerocephalus
great globe-thistle

Eastern Europe

"2,135 bee visits to a single flower head over the course of one day."

REPORT OF THE COMMITTEE ON THE

CHAPMAN HONEY-PLANT

Gleanings in Bee Culture, 1887

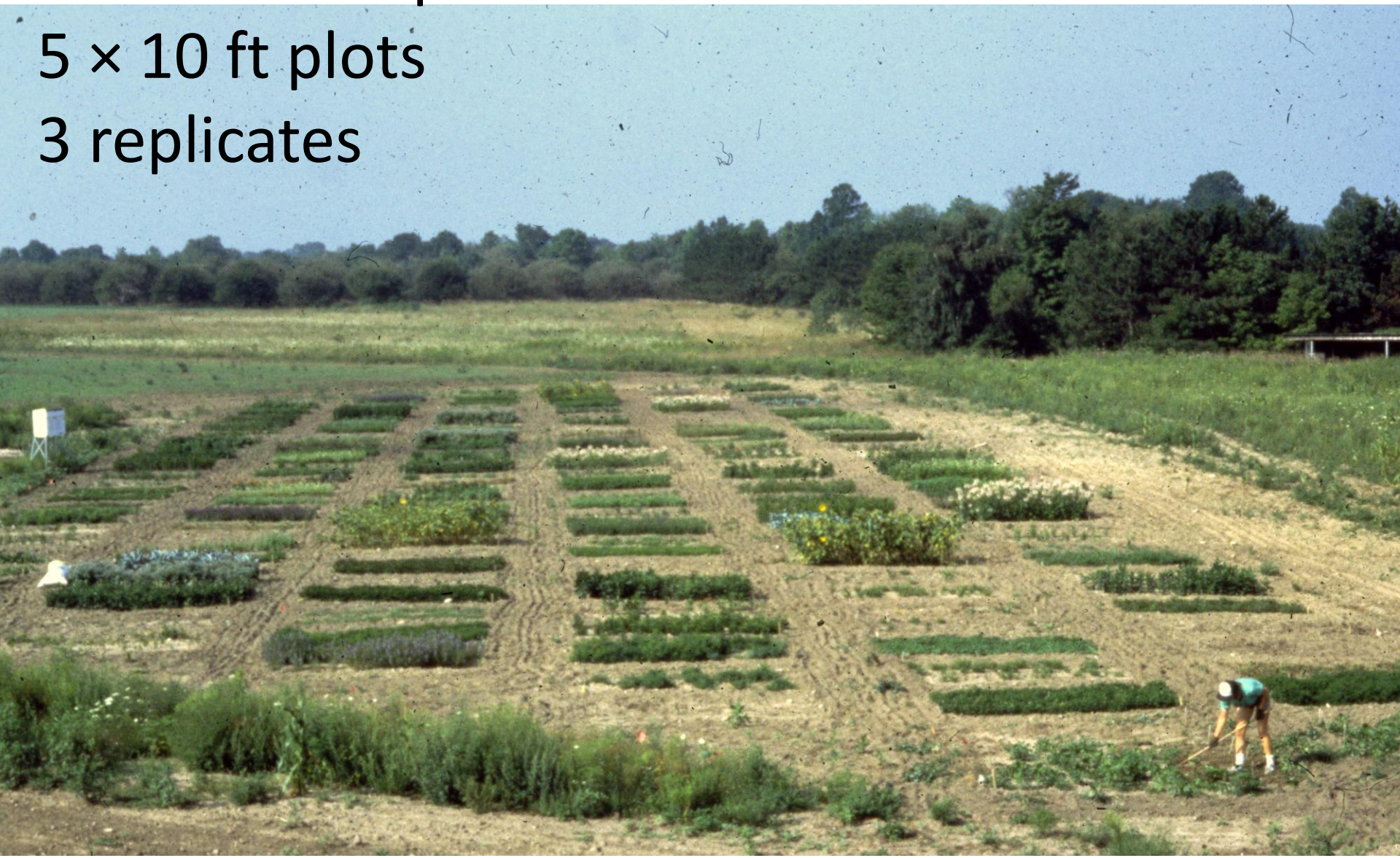
WRITTEN OUT BY PROF. McLAIN

Choice test to compare attractiveness

70 different species

5 × 10 ft plots

3 replicates



Family	No. species	Family	No. species
Asclepiadaceae	3	Labiatae	25
Boraginaceae	1	Leguminosae	20
Capparidaceae	1	Liliaceae	1
Compositae	10	Nyssaceae	1
Crassulaceae	1	Polygonaceae	1
Cruciferae	2	Scrophulariaceae	2
Euphorbiaceae	1	Verbenaceae	1
Hydrophyllaceae	1		


DAD

Methods to quantify value of bloom

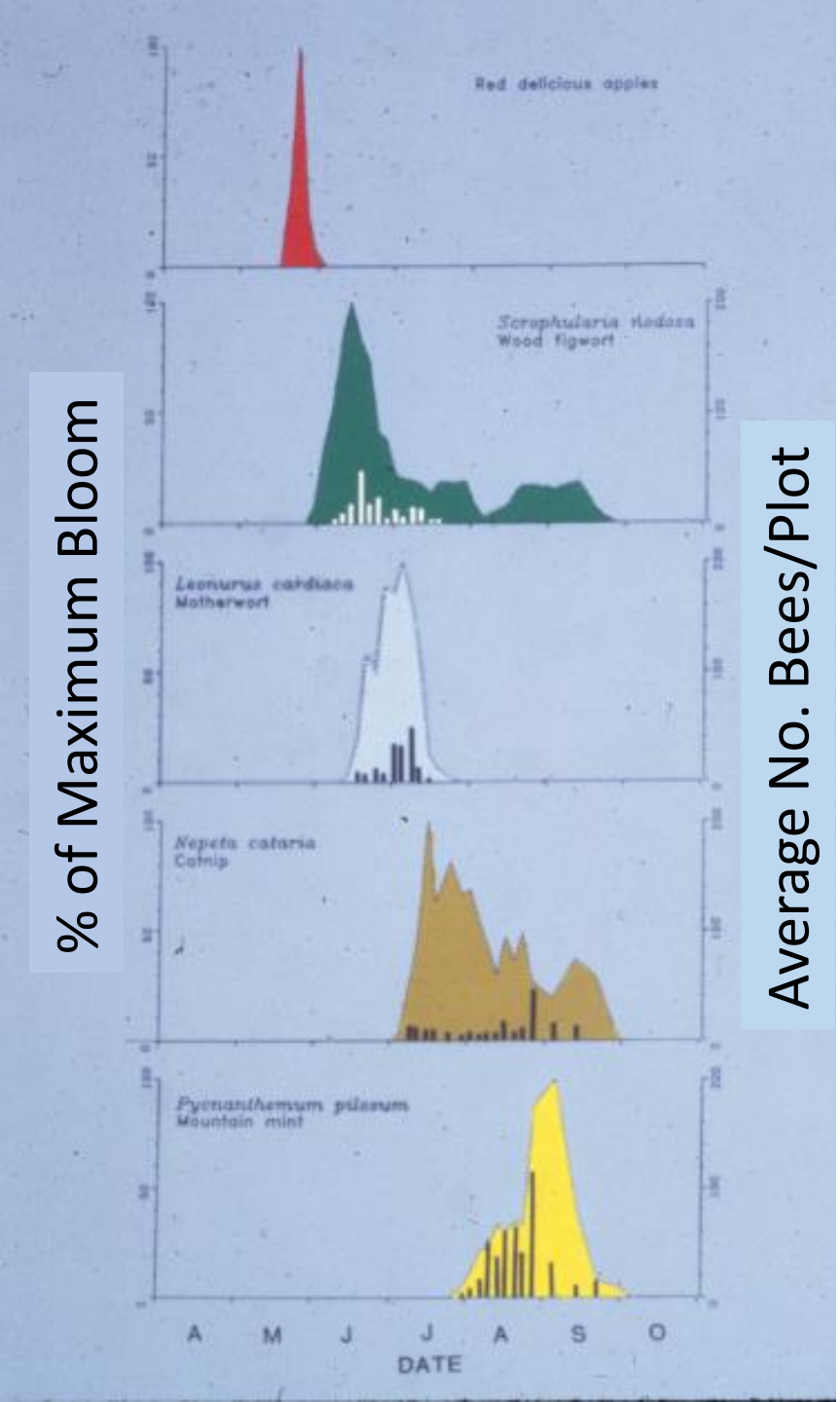
For each sampling date:
Measure number of flowers per sq. yard
Measure foraging bees per sq. yard

Cover some blossoms with screen
Sample blossoms under screen vs open

Extract nectar from both samples
Analyze sugar concentration
Difference is the amount collected by pollinators

Species with at least one bee census statistically indistinguishable from the most attractive plant

Species	No. occurrences	Total bees
Mountain mint	10	1403
Wood figwort	5	517
Chapman honey plant	4	471
Swamp milkweed	3	1094
Motherwort	3	512
New England aster	3	214
Anise hyssop	2	393
Catnip	1	610
Butterfly weed	1	575
Purple loosestrife	1	299



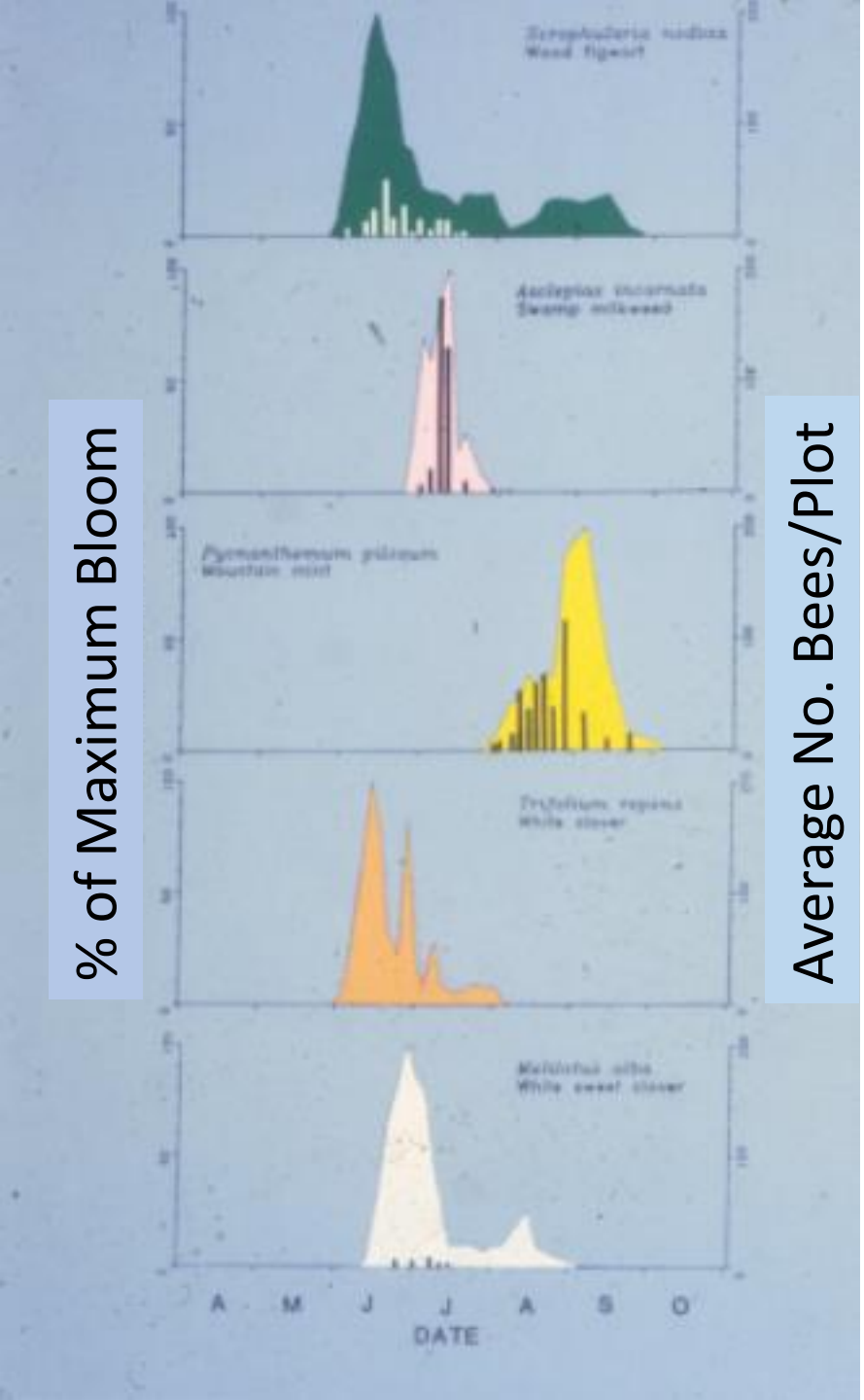
Red Delicious apple

Scrophularia nodosa
wood figwort

Leonurus cardiaca
motherwort

Nepeta cataria
catnip

Pycnanthemum pilosum
mountain mint



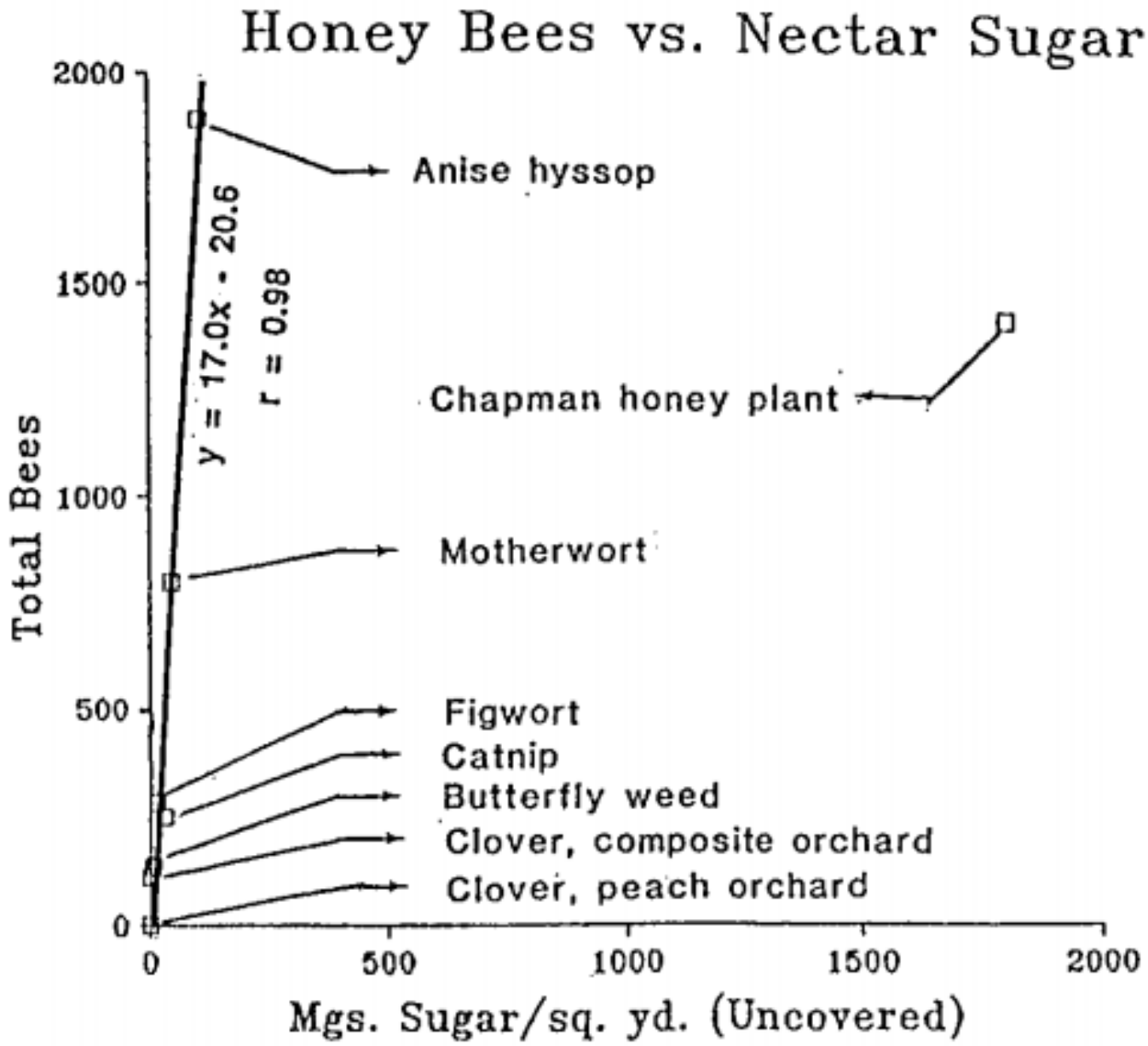
Scrophularia nodosa
wood figwort

Asclepias incarnata
swamp milkweed

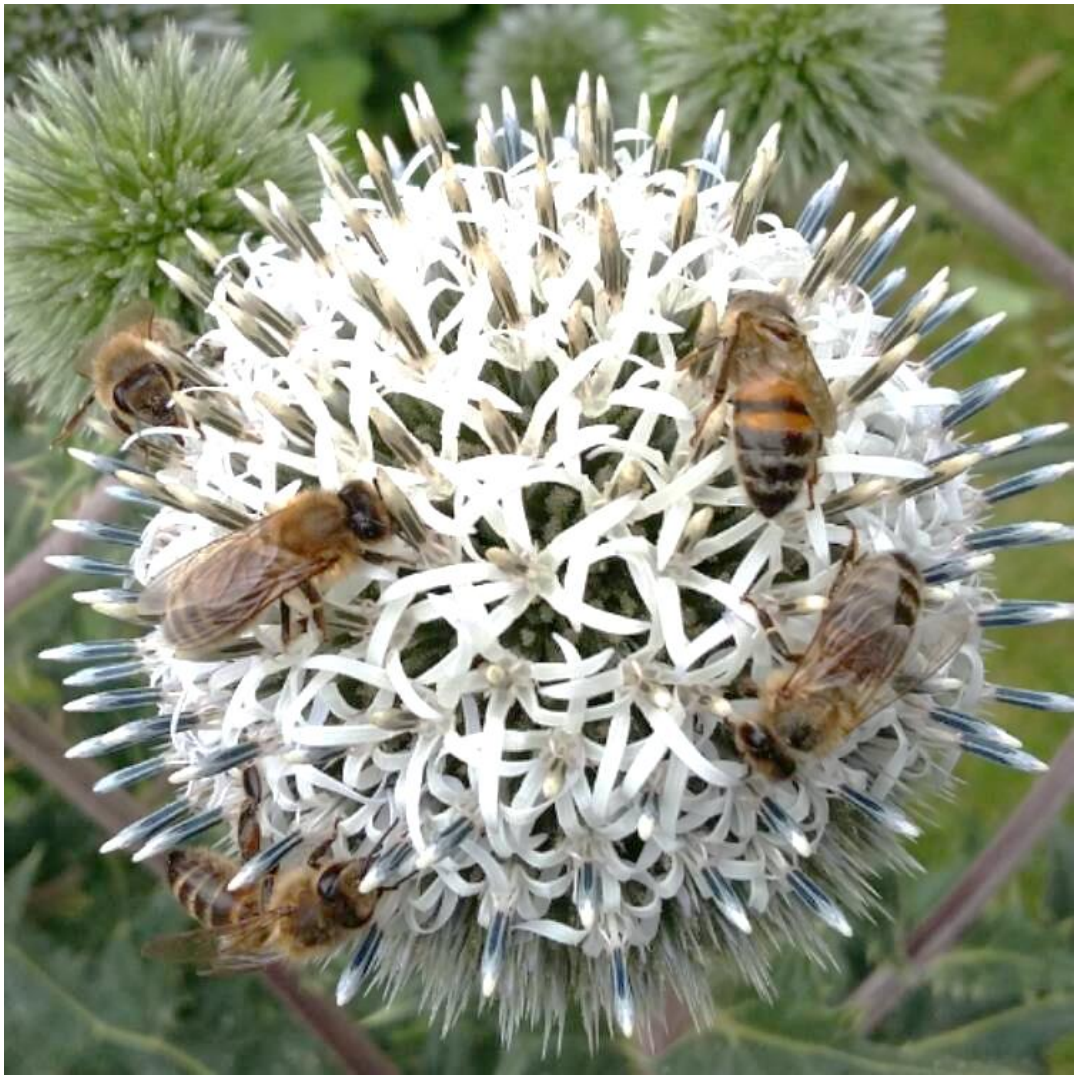
Pycnanthemum pilosum
mountain mint

Trifolium repens
white clover

Melilotus alba
white sweet clover

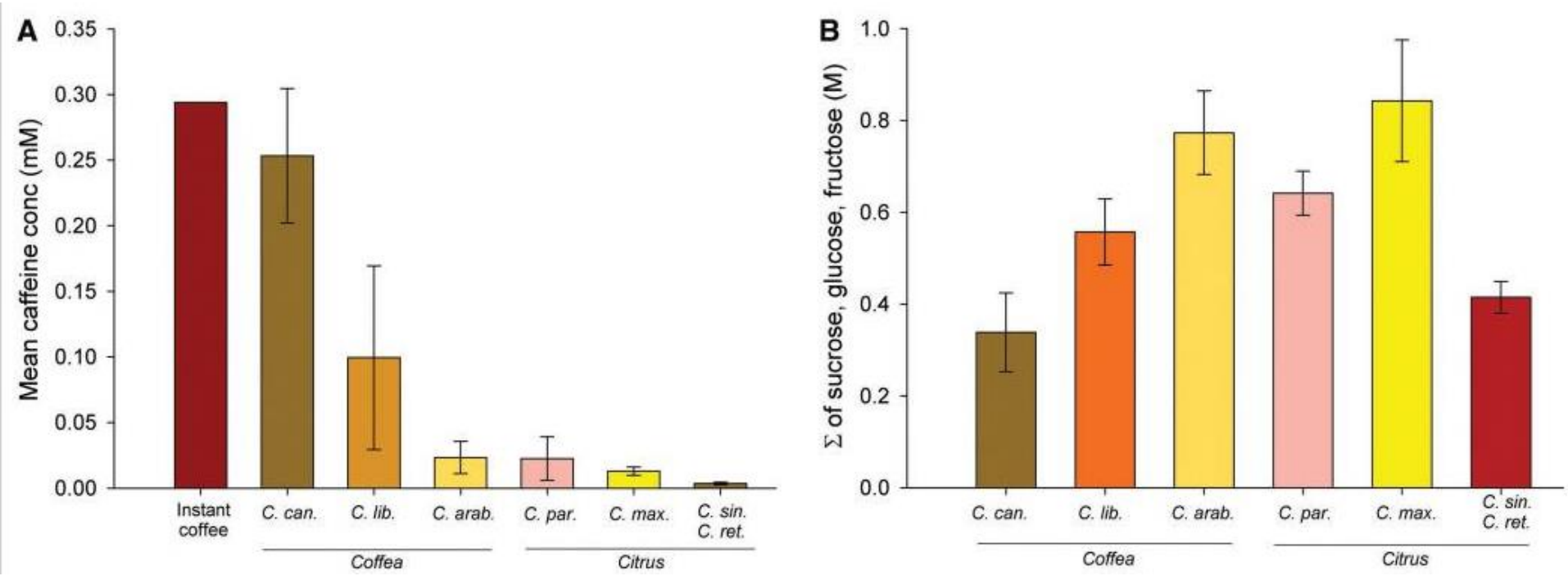

Honey Bees vs. Nectar Sugar
2000
1500
1000
500
0
Total Bees
y = 17.0x - 20.6
r = 0.98
Anise hyssop
Chapman honey plant
Motherwort
Figwort
Catnip
Butterfly weed
Clover, composite orchard
Clover, peach orchard
0
500
1000
1500
2000
Mgs. Sugar/sq. yd. (Uncovered)

Why is Chapman honey plant an outlier?



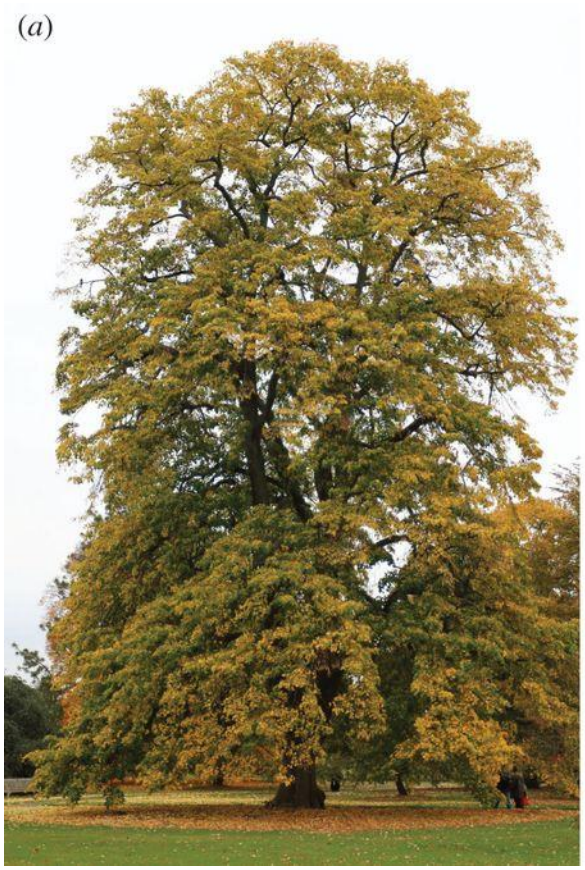
The awards are too extreme to accommodate the “expected” number of bees:
~29,000 total bees!

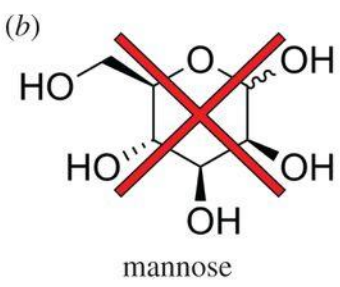
Other plants may manipulate relationship with bees

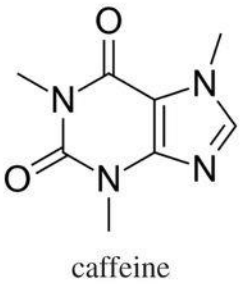


G. A. Wright, et al., 2015. Science https://dx.doi.org/10.1126%2Fscience.1228806

(a) Silver linden (T. tomentosa 'Petiolaris') at the Royal Botanic Gardens, Kew, UK; (b) chemicals implied in bee deaths; (c) buff-tailed bumblebee (B. terrestris) worker foraging on T. tomentosa; (d) dead bees (B. terrestris, B. hypnorum, B. lucorum, Apis mellifera) collected during 1 day (29 July 2016) under flowering T. tomentosa.







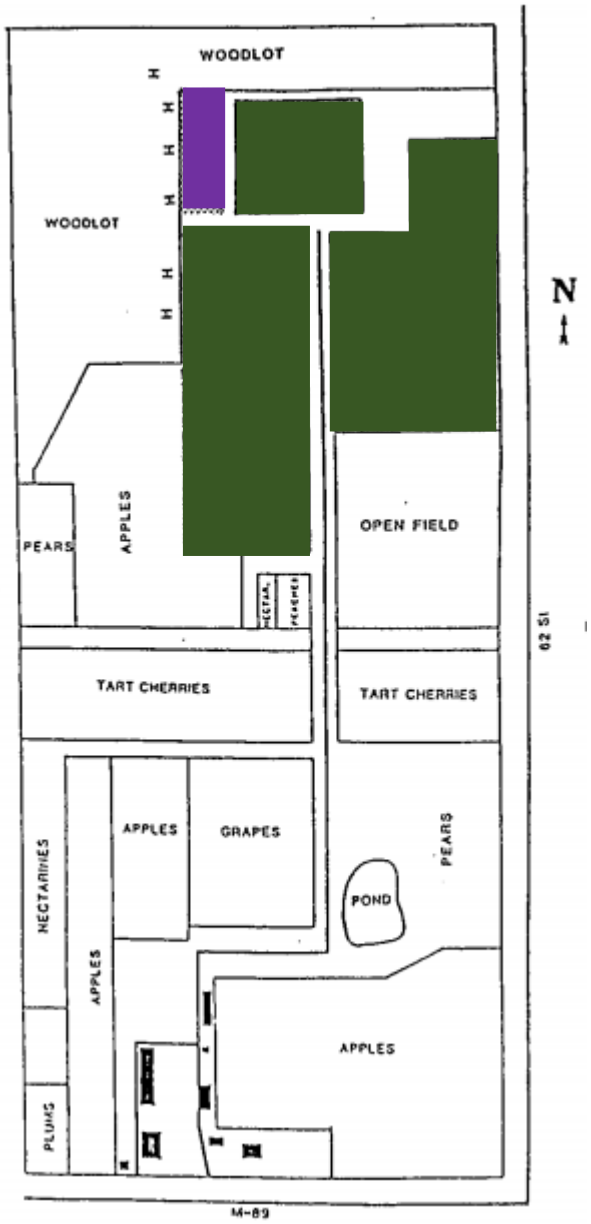
Hauke Koch, and Philip C. Stevenson Biol. Lett. 2017;13:20170484

biology letters

Diversionary planting: Version 2.0

Orchards	13.5 acres
Diversionary planting	0.33 acre

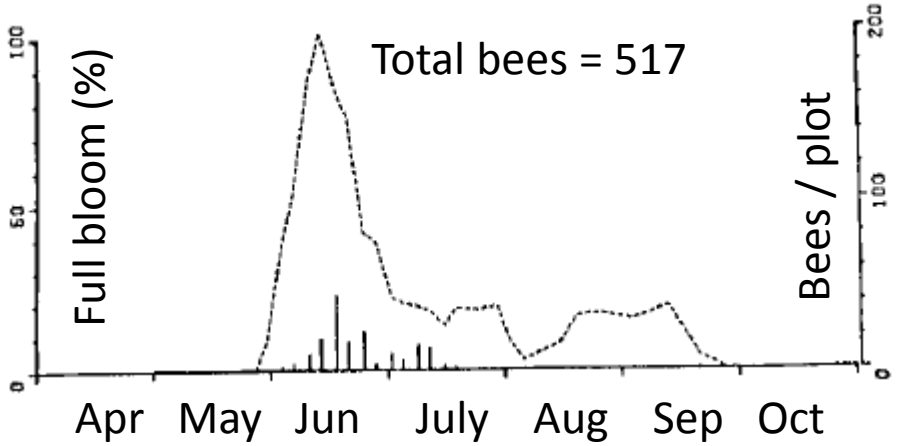
5 ft × 105 ft plots, 3 replicates per species, 9 species



Plants in diversionary planting

Scrophularia nodosa – wood figwort
Leonurus cardiaca - motherwort
Asclepias tuberosa - Butterfly plant
A. syriaca – common milkweed
Agastache foeniculum - anise hyssop
Echinops sphaerocephalus –
Chapman honey plant
Nepeta cataria - catnip
Echinops ritro – blue globe thistle
Pycnanthemum pilosum –
mountain mint

Scrophularia nodosa
wood figwort

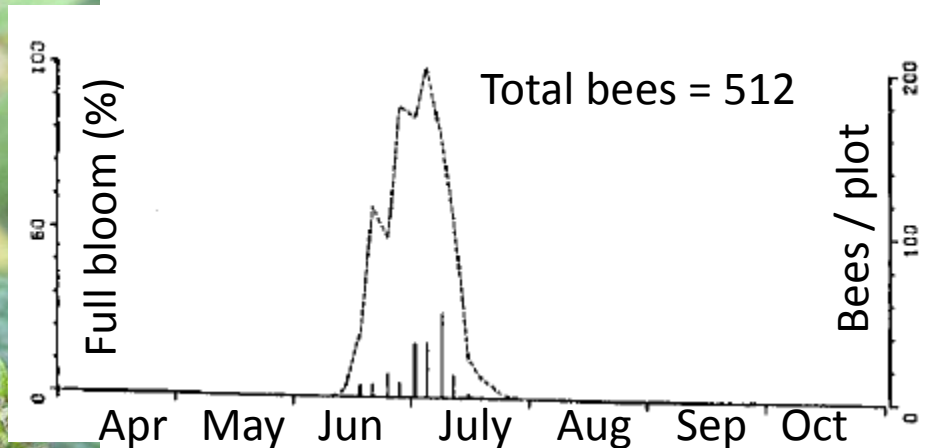


Compare total bees with alsike clover (6)

Native plant, other *Scrophularia* species are available, too

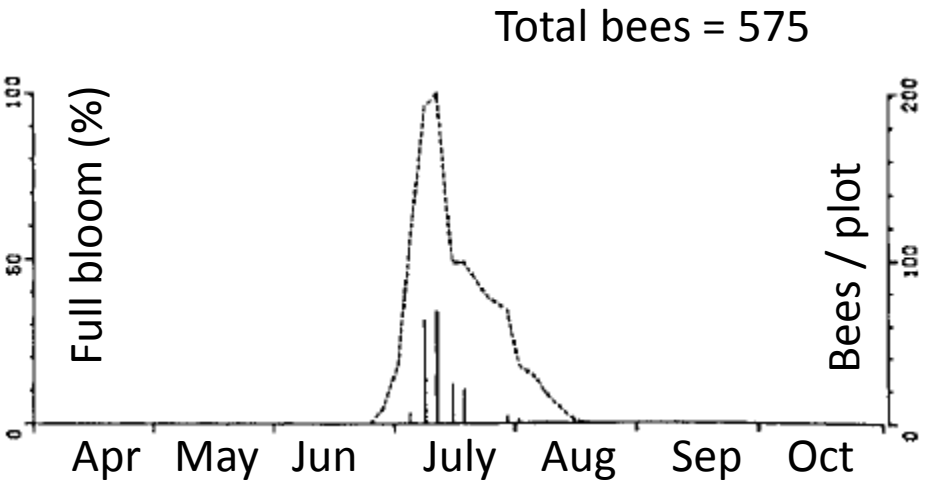
Leonurus cardiaca
Motherwort

S.E. Europe, central Asia
widely naturalized in N.A.



Asclepias tuberosa
Butterfly weed

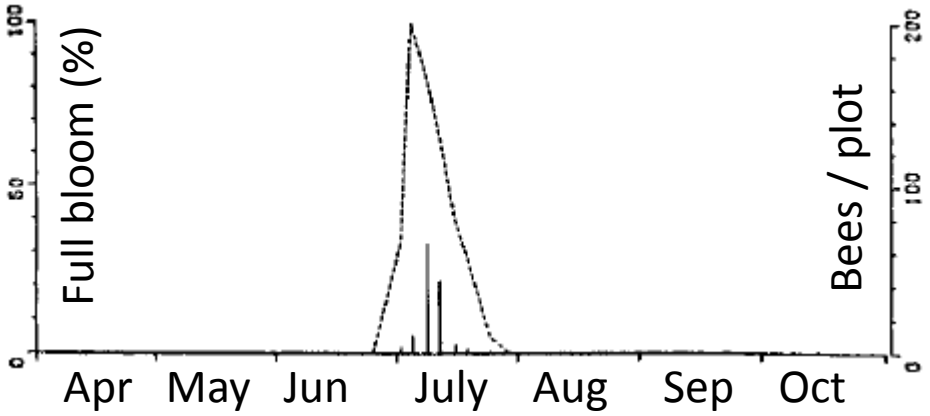
Native, eastern and central North America



Asclepias syriaca
Common milkweed

Native, eastern and central North America

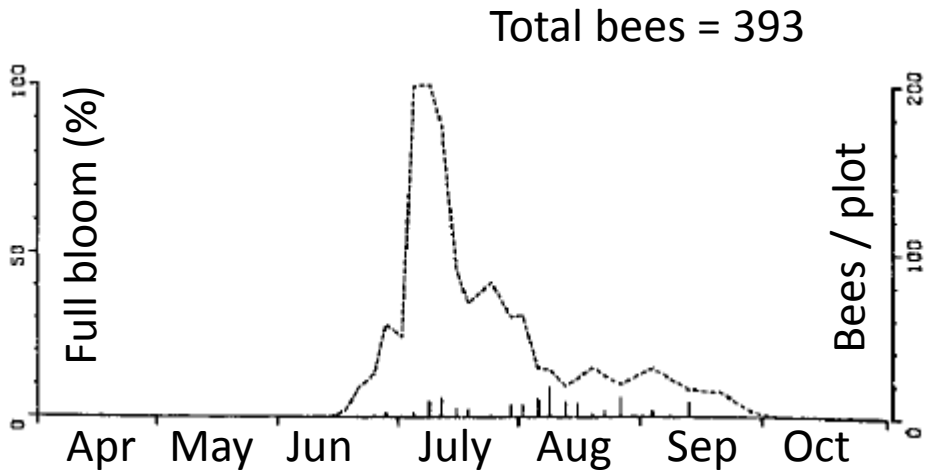
Total bees = 408



Note: Total bees on *A. incarnata* = 1,094

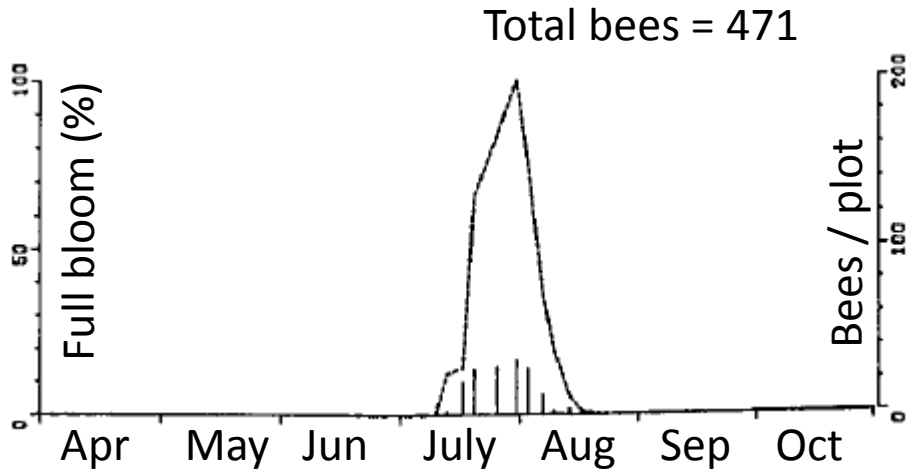
Agastache foeniculum
Anise hyssop

Native, northern N.A.



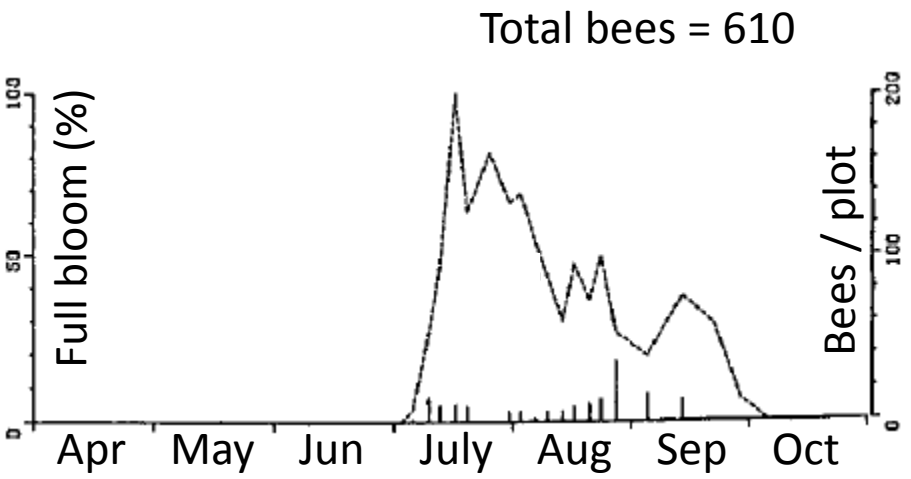
Echinops sphaerocephalus
great globe-thistle

Eastern Europe



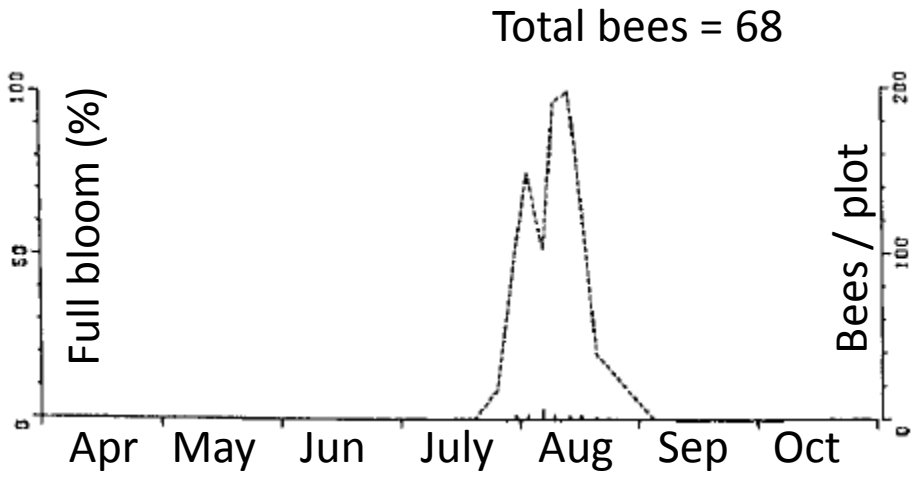
Nepeta cataria
Catmint

Europe, Asia, N. Africa



Echinops ritro
southern globe-thistle

European

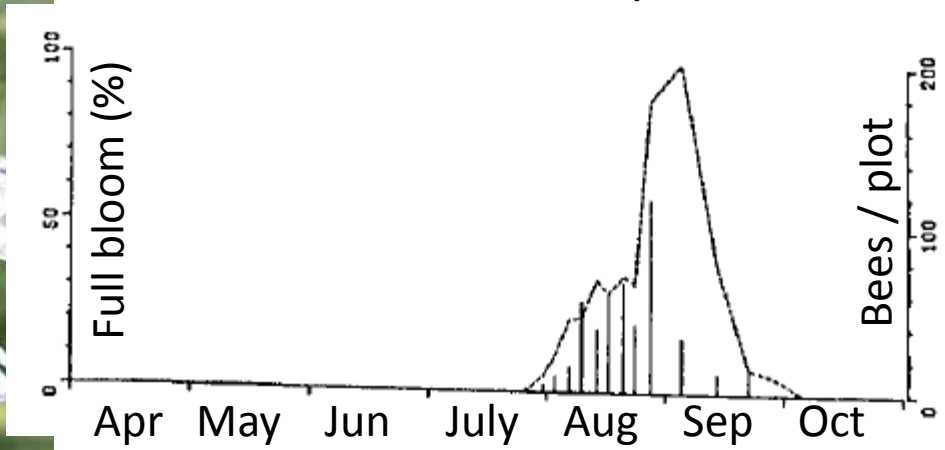


Pycnanthemum tenuifolium
Slender mountain mint

Native to North America

Pycnanthemum pilosum
Hairy mountain mint

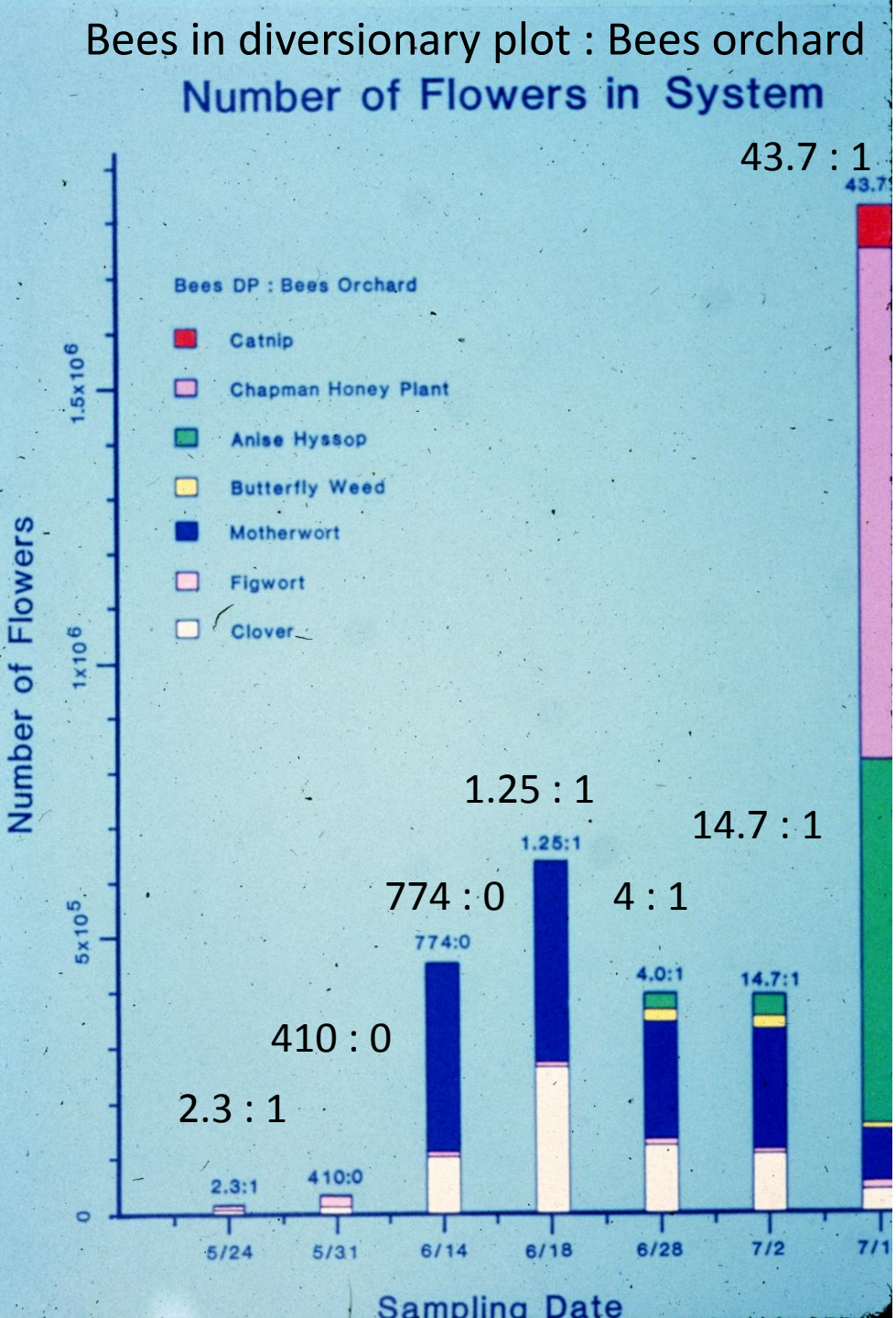
Total bees = 1,403



Carbohydrate removed by bees*

	Total	Per Acre
Orchards	67.1 g	5 g/Ac
Diversionary planting	1032.5 g	3129 g/Ac

*Total of four sample dates from June 14 – July 18, 1986



Functionality would have improved with larger area planted to motherwort.

Diversionary planting worked.

Only 2.5% of the area planted, but always contained more bees than the orchard.

Bees remained healthy until the diversionary plants stopped blooming, then bee mortality was severe.

Why not plant bee forage as an economic crop?

Late 1800's - a few enterprising beekeepers

Currently, common practice in Eastern Europe

Phacelia tanacetifolia
native plant

Causes of insufficient forage

Modern landscape practices

- herbicide-tolerant crops
- herbicides in lawns
- roadside vegetation control
- destruction of hedgerows


Robert McGuoey (All Canada Photos/Corbis)

Purple loosestrife
Lythrum salicaria

Other invasives, such as Japanese knotweed, have become important bee forage plants.

These stands should be replaced with high-value nectar plants.

Fixed-land honey production

Could honey fields be economically justified?

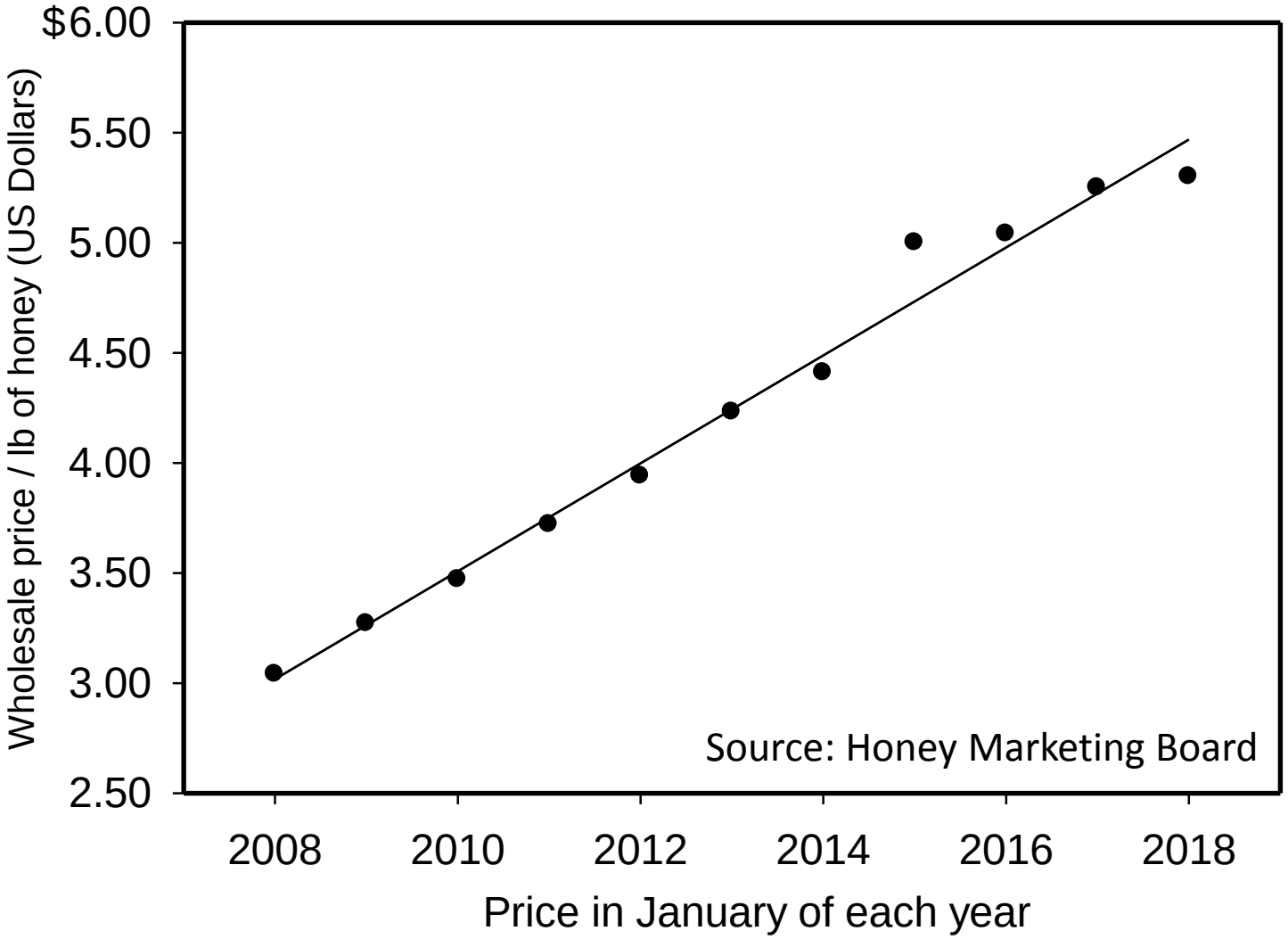
Current value of hay crop ~ $800 / acre

Assuming alfalfa; 5 tons at $160 per ton

Agastache foeniculum
Anise hyssop

Native, northern N.A.

Surplus of 2,000 – 3,100 lb of honey per acre
Assume we can only plant 40% of area to this plant
Other complementary plants have yield of 400 lb/acre
Reasonable estimate of ~ 1,000 lb per acre



Gross return of ~ $5,000 per acre is possible

Potential “super” plants for fixed-land honey production

Linden trees (*Tilia americana*)

Perennial plants

- *Ilex* spp., *Scrophularia* spp.
- *Pycnanthemum* spp.
- *Agastache foeniculum*

Annual

- *Phacelia tanacetifolia*

REVIEW ARTICLE
https://doi.org/10.1038/s41559-017-0412-3
nature ecology & evolution

Risks to pollinators and pollination from invasive alien species

Adam J. Vanbergen[1]*, Anahí Espíndola[2] and Marcelo A. Aizen[3]

Conservation Letters
A journal of the Society for Conservation Biology
Open Access

LETTER

Gauging the Effect of Honey Bee Pollen Collection on Native Bee Communities

James H. Cane[1] & Vincent J. Tepedino[2]

[1] USDA-ARS Pollinating Insect Research Unit (PIRU), Utah State University, Logan, UT 84322–5310, USA
[2] Department of Biology, Utah State University, Logan, UT 84322–5305, USA

ECOLOGY

Conserving honey bees does not help wildlife

High densities of managed honey bees can harm populations of wild pollinators

By **Jonas Geldmann** *and* **Juan P. González-Varo**

There is widespread concern about the global decline in pollinators and the associated loss of pollination service an environmental feat persists in the media (*2*) and among the public (*6*). This lack of distinction between the declines of wild pollinators and the plight of a heavily managed, agricultural species may even reduce efforts to conserve wild pollinator species, with honey bees for nest sites in rock cavities. The western honey bee thus unequivocally fits Geslin and colleagues' concept of a "massively introduced managed species," which, regardless of whether they are native or not, can negatively affect their envi-

Journal of Animal Ecology

View issue TOC
Volume 84, Issue 3
May 2015
Pages 615–624

Standard Paper

A sting in the spit: widespread cross-infection of multiple RNA viruses across wild and managed bees

Dino P. McMahon, Matthias A. Fürst, Jesicca Caspar, Panagiotis Theodorou, Mark J. F. Brown, Robert J. Paxton

First published: 3 March 2015 Full publication history

DOI: 10.1111/1365-2656.12345 View/save citation

As generalist patch exploiters, perhaps we can focus honey bee foraging to fields we provide, and limit the interactions leading to transmission of viruses to native bees.

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Photos: Jillian Cowles