Beekeeping
Department of Entomology Insect Note

Note 1.04
(Previously Note #2)

HONEY PLANTS OF NORTH CAROLINA

Knowledge of the plants honey bees use is important to every beekeeper. Plants provide the nectar for honey production and pollen for brood production. Coincidently, the bees pollinate the plants allowing seed and fruit to develop.

The type and availability of nectar sources in an area determines, not only the potential honey production for that locality, but also the flavor, color and quality of the honey crop. Pollen is collected by bees and provides the essential protein for brood development. For these reasons, a beekeeper who knows his local flora will be better able to develop a management system which fully utilizes those potential honey and pollen plants.

North Carolina is a large state and exhibits considerable variety in honey plants as one travels from the sea to the mountains. This note lists the average blooming dates of some of the important nectar sources in the state's three main geographical areas. The figure in parenthesis following each blooming date indicates the average number of days flowering may be expected. There are others which you should learn.

Some good references are:

Honey Plants Manual by H.B. Lovell. 1966. A. I. Root Company, Medina, OH 44256.

American Honey Plants by F.C. Pellett. 1947. Orange Judd. N.Y.

Manual of the Vascular Flora of the Carolinas by Radford, Ahles and Bell. 1968. UNC Press, Chapel Hill, NC

Calendar of Beekeeping. N.C. State Beekeepers Assn. 1403 Varsity Drive, Raleigh, NC 27606.

Plant	Average bloom date (duration)		
	Mountains	Piedmont	Coastal Plain
Alsike Clover (*Trifolium hybridum*)	–	Apr 4 (102)	–
Aster (*Aster* spp.)	Aug 30 (40)	Sep 25 (35)	Sep 30 (40)
Basswood, Linden (*Tilia* spp.)	Jun 20 (23)	--	--
Black Gum (*Nyssa sylvatica*)	May 5 (10)	Apr 26 (14)	Apr 27 (24)
Black Locust (*Robinia pseudoacacia*)	May 15 (14)	Apr 27 (10)	--
Blackberry (*Rubus* spp.)	--	Apr 10 (20)	Mar 1 (46)
Crimson Clover (*Trifolium incarnatum*)	--	Apr 10 (25)	--
Dandelion (*Taraxacum officinale*)	May 1 (50)	Mar 15 (60)	Mar 5 (55)
Gallberry (*Ilex glabra & coriacea*)	--	--	May 12 (28)
Goldenrod (*Solidago* spp.)	--	Aug 8 (67)	Aug 1 (85)
Heartsease, Smartweed (*Polygonum* spp.)	--	Jul 4 (126)	--
Holly (*Ilex* spp.)	May 8 (15)	Apr 30 (15)	Apr 24 (16)
Huckleberry (*Gaylussacia* spp.)	--	--	Apr 5 (32)
Ladino Clover, White Clover (*Trifolium repens*)	May 29 (51)	Apr 14 (102)	--
Pepperbush (*Clethra alnifolia*)	--	--	Aug 1 (20)
Persimmon (*Diospyros virginiana*)	May 22 (15)	May 20 (13)	--
Privet (*Ligustrum* spp.)	--	May 8 (23)	--
Raspberry (*Rubus* spp.)	May 17 (17)	Apr 30 (20)	Apr 20 (40)
Red Maple (*Acer rubrum*)	Mar 5 (35)	Feb 1 (40)	Jan 20 (45)
Sourwood (*Oxydendrum arboreum*)	Jun 25 (25)	Jun 10 (20)	Jun 1 (20)
Sugar Maple (*Acer saccharum*)	--	Mar 5 (25)	Feb 25 (25)
Sumac (*Rhus* spp.)	Apr 8 (146)	Apr 3 (151)	Apr 1 (153)
Sweet Clover (*Melilotus* spp.)	Jun 8 (53)	May 28 (37)	--
Tulip Poplar (*Liriodendron tulipifera*)	May 25 (23)	Apr 25 (29)	Apr 17 (30)
Tupelo Gum (*Nyssa aquatica*)	--	--	Apr 20 (30)
Vetch (*Vicia* spp.)	--	Apr 28 (46)	--

Prepared by J. Ambrose; revised by S. Bambara 6/21/95

"Pollinator Paradise" Garden at Chatham Marketplace

Created by Debbie Roos, North Carolina Cooperative Extension

More info at www.protectpollinators.org

Common Name	Scientific Name	Origin
Perennial Flowers		
Yarrow	*Achillea* x 'Moonshine'	naturalized
Yarrow	*Achillea* x 'Paprika'	naturalized
Anise hyssop	*Agastache* x 'Blue Fortune'	hybrid of U.S. native
Licorice hyssop	*Agastache rupestris*	southwest U.S.
Giant bugle weed	*Ajuga reptans* 'Caitlin's Giant'	exotic
Nodding onion	*Allium cerneum*	NC
Arkansas bluestar	*Amsonia hubrechtii*	NC
Eastern wild columbine	*Aquilegia canadensis*	NC
Golden columbine	*Aquilegia chrysantha*	southwest U.S.
Butterfly weed	*Asclepias tuberosa*	NC
Wild indigo	*Baptisia* x 'Carolina Moonlight'	NC
Wild indigo	*Baptisia* x 'Purple Smoke'	NC
White wild indigo	*Baptisia alba*	NC
Dwarf wild indigo	*Baptisia minor*	NC
Yellow wild indigo	*Baptisia tinctoria*	NC
Gray-leaved conradina	*Conradina canescens*	NC
Lobed tickseed	*Coreopsis auriculata*	NC
Tickseed	*Coreopsis pubescens* 'Sunshine Superman'	NC
Tall tickseed	*Coreopsis tripteris*	NC

Common Name	Scientific Name	Origin
Moonbeam coreopsis	*Coreopsis verticillata*	NC
Purple coneflower	*Echinacea purpurea*	NC
Purple coneflower	*Echinacea purpurea* 'Fragrant Angel'	NC
Purple coneflower	*Echinacea purpurea* 'Harvest Moon'	NC
Purple coneflower	*Echinacea purpurea* 'Kim's Knee High'	NC
Purple coneflower	*Echinacea purpurea* 'Tiki Torch'	NC
Purple coneflower	*Echinacea purpurea* 'Twilight'	NC
White coneflower	*Echinacea purpurea* 'White Swan'	NC
Joe-pye weed	*Eupatorium dubium*	NC
Wild ageratum	*Eupatorium coelestinum*	NC
Boneset	*Eupatorium perfoliatum*	NC
White wood aster	*Eurybia divaricatus*	NC
Lanceleaf blanketflower	*Gaillardia* 'Oranges and Lemons'	NC
Lanceleaf blanketflower	*Gaillardia* 'Burgundy'	NC
Lanceleaf blanketflower	*Gaillardia* 'Torchlight'	NC
Hardy geranium	*Geranium* 'Dilys'	exotic
Hardy geranium	*Geranium* 'Rozanne'	exotic
Swamp sunflower	*Helianthus angustifolius* 'Gold Lace'	NC
Swamp sunflower	*Helianthus angustifolius* 'Mellow Yellow'	NC
Purple-head sneezeweed	*Helenium autumnale* 'Red Shades'	NC
Purple-head sneezeweed	*Helenium flexuosum*	NC
Oxeye daisy	*Heliopsis helianthoides* 'Summer Nights'	NC
Velvet mallow	*Hibiscus grandiflora*	NC
Seashore mallow	*Kosteletzkya virginica*	NC
Blazing star	*Liatris ligulistylis*	mid-west U.S.
Small head blazing star	*Liatris microcephala*	NC
Gayfeather	*Liatris spicata*	NC
Bee balm	*Monarda fistulosa* 'Claire Grace'	NC
Spotted beebalm	*Monarda fruticulosa*	Texas
Eastern horsemint	*Monarda punctata*	NC
Wild quinine	*Parthenium integrifolium*	NC

Common Name	Scientific Name	Origin
Beard tongue	*Penstemon* 'Husker Red'	NC
Small's beard tongue	*Penstemon smallii*	NC
White moss phlox	*Phlox nivalis* 'Snowdrift'	NC
Obedient plant	*Physostegia virginiana*	NC
Prairie coneflower	*Ratibida columnifera*	NC
Orange coneflower	*Rudbeckia fulgida*	NC
Brown-eyed susan	*Rudbeckia triloba*	NC
Lyreleaf salvia	*Salvia lyrata*	NC
Hoary skullcap	*Scutellaria incana*	NC
Sedum	*Sedum spurium* 'Dragon's Blood'	exotic
Tall sedum	*Sedum* x 'Matrona'	exotic
Bluestem goldenrod	*Solidago caesia*	NC
Sweet goldenrod	*Solidago odora*	NC
Rough-leaf goldenrod	*Solidago rugosa* 'Fireworks'	NC
Showy goldenrod	*Solidago speciosa*	NC
Stokes' aster	*Stokesia laevis* 'Mary Gregory'	NC
Stokes' aster	*Stokesia laevis* 'Peachie's Pick'	NC
Eastern silvery aster	*Symphyotrichum concolor*	NC
Smooth aster	*S. laeve* 'Bluebird'	NC
Aromatic aster	*S. oblongifolium* 'Fanny's Aster'	NC
Aromatic aster	*S. oblongifolium* 'October Skies'	NC
Aromatic aster	*S. oblongifolium* 'Raydon's Favorite'	NC
Foamflower	*Tiarella cordifolia* 'Running Tapestry'	NC
Verbena	*Verbena canadensis* 'Homestead Purple'	NC
Threadleaf ironweed	*Vernonia lettermanii*	southern U.S.
Ironweed	*Vernonia noveboracensis*	NC
Adam's needle	*Yucca filamentosa* ' Golden Sword'	NC

Common Name	Scientific Name	Origin
Perennial Herbs		
Bronze fennel	*Foeniculum rubrum*	exotic
Lavender	*Lavendula* spp.	exotic
Catmint	*Nepeta* 'Walker's Low'	exotic
Oregano	*Origanum* 'Herrenhausen'	exotic
Oregano	*Origanum* 'Rosenkuppel'	exotic
Mountain mint	*Pycnanthemum incanum*	NC
Virginia mountain mint	*Pycnanthemum virginianum*	NC
Rosemary	*Rosmarinus officinalis*	exotic
Thyme	*Thymus* spp.	exotic
Vines		
Climbing aster	*Ampelaster carolinianus*	NC
Honeysuckle	*Lonicera sempervirens* 'Cedar Lane'	NC
Honeysuckle	*Lonicera sempervirens* 'John Clayton'	NC
Honeysuckle	*Lonicera sempervirens* 'Major Wheeler'	NC
Passionflower	*Passiflora incarnata*	NC
Trees and Shrubs		
Abelia	*Abelia* x *grandiflora* 'Rose Creek'	exotic
Pepperbush	*Clethra alnifolia*	NC
Dwarf Fothergilla	*Fothergilla* 'Mount Airy'	NC
Witchhazel	*Hamamelis virginiana*	NC
Oak-leaf hydrangea	*Hydrangea quercifolia*	NC
Shrubby St. John's Wort	*Hypericum frondosum* 'Sunburst'	NC
Possumhaw	*Ilex decidua*	NC
Inkberry/Winterberry	*Ilex glabra*	NC

Common Name	Scientific Name	Origin
Virginia sweetspire	*Itea virginica*	NC
Sourwood	*Oxydendrum arboreum*	NC
Eastern ninebark	*Physocarpus opulifolius* 'Diablo'	NC
Fragrant sumac	*Rhus aromatica*	NC
Staghorn sumac	*Rhus typhina*	NC
Sassafras	*Sassafras officinale*	NC
Blueberry	*Vaccinium corymbosum*	NC
Viburnum	*Viburnum nudum*	NC
Blackhaw viburnum	*Viburnum prunifolium*	NC
Grasses		
Splitbeard bluestem	*Andropogon ternarius*	NC
Switchgrass	*Panicum virgatum* 'Heavy Metal'	NC
Switchgrass	*Panicum virgatum* 'Northwind'	NC
Switchgrass	*Panicum virgatum* 'Shenandoah'	NC
Little bluestem	*Schizachyrium scoparium* 'The Blues'	NC

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Beekeeping Insect Note 2B

Landscape Planting for Bees

Prepared by:
S. Bambara, Extension Specialist

Dated 1/93
Placed on the Web 3/95 by the Center for Integrated Pest Management

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Increased urbanization of our rural areas has destroyed native forage vegetation in many places. In addition, many of our hobby beekeepers living in the suburbs enjoy watching bees work the flowers. With this in mind and because honey bees are so important for pollinating agricultural, horticultural, and wild plants, there is at least one small thing we can do to support our state insect.

Most houses and yards are landscaped, so by merely making certain choices, nectar or pollen producing plants can be used with little or no additional cost. Though they have only a tiny effect on a single hive, every little bit contributes and the more people use these plants, the more significant will be the total benefit. Below are listed some plant material which can be used around homes, parks or city streets. All are highly attractive to bees except where noted. Attractiveness may vary in different regions. Most of the berry and seed bearing plants also produce good forage for birds.

This list is not complete and all plants may not thrive in all parts of the state. Consult any reference on landscape plants or your Cooperative Extension agent for further information about how to use some of these. You may also want to visit local gardens or plantings for ideas.

Ground Covers

- Ladino clover - blooms late spring-summer
- Crimson clover - blooms late spring
- Ajuga - blooms spring
- Graph Hyacinth - blooms spring
- Strawberry - blooms spring
- *Ampelopsis brevipedunculosa* - blooms late spring

Shrubs

- Barberry (*Berberis* sp.) - blooms spring: evergreen*
- Vitex - blooms most of summer: deciduous
- Privet (*Ligustrum*) - blooms late spring: may produce bitter nectar

- Abelia - blooms summer/fall; evergreen; mildly attractive
- Quince (*Chaenomeles*) - blooms spring
- Blueberry (*Vaccinium*) - blooms spring
- Silverberry (*Eleagnus*) - blooms late spring; deciduous; fragrant*
- Nandina - blooms summer; mildly attractive
- Pieris (*Pieris japonica* - blooms spring; evergreen
- Holly (*Ilex*) especially *I. burfordi, I. cornuta, I. rotunda*; blooms spring; almost all species excellent nectar source; may require pruning*
- Euonymous - blooms summer; variable attractiveness among species
- Silverling (*Baccharis halimifolia*) - blooms fall; native aster shrub in coastal plain and piedmont
- Pepperbush (*Clethra alnifolia*) - blooms late spring; native coastal plain shrub, survives piedmont; evergreen*

Small Trees

- Red Bud (*Cercis*) - blooms early spring; native or cultivated varieties
- Apple, Crabapple (*Malus*) - blooms early spring; usually requires pruning*
- Pussy Willow (*Salix*) - blooms early spring; most *Salix* spp. good
- Golden Rain Tree (*Koelreuteria paniculata*)_ - blooms summer
- Sourwood (*Oxydendron arboreum*) - blooms midsummer; irregular nectar production
- Sumac (*Rhus*) - blooms summer/fall; shrub or small tree; deciduous*
- Holly (*Ilex*) - blooms spring; many species achieve tree status if unpruned*
- Beebee Tree (*Evodia danielli*) - blooms late summer
- Hercules Club (*Aralia spinossa*) - blooms late summer

Large Trees

Maple (*Acer* spp.), especially *A. rubrum, A. ginnala* - blooms early spring; good nectar production

- Linden, Basswood (*Tilia* - blooms in spring; excellent nectar production
- Black Locust (*Robinia pseudoacacia*) - blooms spring; inconsistent nectar production
- Tulip, Yellow Poplar (*Liriodendron tulipifera*) - blooms spring; fast growing; excellent nectar production
- Black Gum, Tupelo (*Nyssa*) - blooms spring; Tupelo requires moist soil
- Persimmon (*Diospyros*) - blooms late spring

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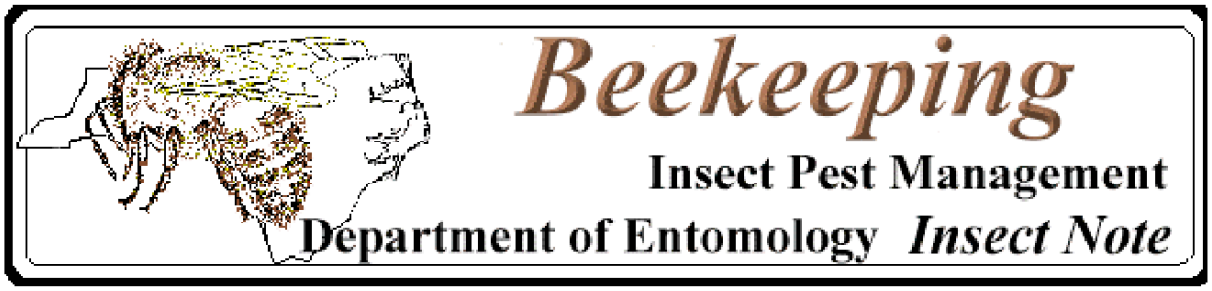
*Also provides food/cover for birds.

Suggested References

Honey Plants Manual. H.B. Lovell. 1966. A.I. Root Co., Medina, OH 44256.

American Honey Plants. F.C. Pellett. 1947. Orange Judd, NY.

"Bee Forage of North America." Ayers & Harman, in *Hive and Honey Bee*. 1922. Dadant & Sons, Hamilton, IL.



Note 1.05
(Previously Note #2A)

AN HERB GARDEN FOR THE BEES

In addition to "merely" keeping bees, the successful beekeeper must often branch out into many other areas of expertise, such as botany, carpentry, wholesale/retail marketing mechanics, accounting, etc. All of these related areas are important but a working knowledge of botany is probably one of the most important. As beekeepers, we are intrinsically botanists, for bees and plants are interdependent and the nature and productivity of the plant population plays a major role in the success or failure of any beekeeping operation.

One frequently stated need of many beekeepers is how to increase nectar availability in an area. Herbs provide a direct means for the beekeeper to improve and expand the honey flow in this area. An herb is defined as any nonwoody plant that dies down to the ground after flowering. More commonly, herbs are defined as plants that are used for such purposes as medicinal treatment, nutritional value, food seasoning, coloring or dying. Herbs are extremely versatile plants and, unlike trees and shrubs, most will bloom the same year that they are planted. With sufficient variety, an herb garden can have plants in bloom for 10 months of the year.

With a little planning, herbs can provide both excellent nectar and pollen sources for honey bees. These plants can supply valuable bee pasture during periods of dearth, but careful planning must precede planting. Most herbs will grow anywhere, and most will bloom profusely, but not all will attract honey bees. Strict attention must be paid to varieties, ecotypes, soils, climate, fertilization, and watering.

Varietal selection is most important. Some plants, such as feverfew, simply will not attract honey bees. Ecotypes are an even more subtle difference that play an equally important role. Ecotypes are species of plants that are adapted to a particular environment. This is to say that a

catnip plant native to Iowa may not grow, or bloom, or produce nectar the same if it were transplanted to a location in North Carolina. Thus, the herb gardener with an eye towards nectar production should be very careful in ordering plants from areas with different climates, for the plants will
look the same, but their systems may well be altered due to the change in environment,and they may perform differently. To add a tempering note, plants touted as honey plants in other parts of the country may fail miserably in North Carolina, but other "unknowns" can fill the niche and perform very well under North Carolina conditions. Fertilization, water, and soils are things the herb gardener can control, and normal gardening practices would be followed in these areas.

Designing an Herb Garden

An herb garden can be as simple or complex as the gardener desires. Herbs can be grown in established borders, among low growing shrubbery, or in a vegetable garden. The simplest way, in terms of organization and care, is to designate a certain space for herbs and herbs only. The design one chooses can range from formal gardens to simple displays. Care should be taken to segregate tall growing herbs such as the bee balms from low spreading herbs like the mints and thymes to minimize unwanted shading. Planting herbs of the same family (i.e. the mints) in groups also eases care and identification.

The authors recommend planting herbs in a raised bed bordered with railroad cross ties, or similar materials, to keep the herbs in and the weeds out. After filling the bed with soil (preferably a light soil to promote early growth and provide good drainage), have a soil test run to insure a pH of 6.5-7, and add organic matter in whatever form is convenient. Soil fertility should be kept at a low to moderate level, as heavy fertilization will extend the vegetative portion of a plant's life cycle, causing a later reproductive, or flowering phase.

The next step is to apply a mulch. Black plastic provides an excellent mulch for herbs. It serves to warm the soil in the spring, prevent evaporative moisture loss from the soil, completely control weeds, and if the herbs are planted in pot sized holes in the plastic, control the spread of those herbs which would other wise take over the herb garden. Water can be applied to the base of the plants when needed, and holes can be punched in the plastic with a nail to facilitate drainage of rain water. An additional "cosmetic" mulch of pine bark, or sawdust can be spread on the plastic if desired.

The beekeeping herb gardener usually has more than enough things to do, so the herb garden should be designed for minimal maintenance. Congruent with the concepts of a raised bed, moisture saving mulch, and "container-sized" planting holes, is the use of perennial herbs wherever possible. Perennials die back each fall but return the following spring and will last for many years, if properly cared for. Herbs can be propagated from seeds, cuttings, or layering. Layering is generally easiest, the procedure being to cover a portion of the plant stem with a mound of soil, and roots will shortly

form on the portion covered by the soil. This new plant can be cut off from the mother plant and planted in a new location. Any plants started from seed should be planted indoors or in a cold frame early in the spring and transplanted to a permanent site with the onset of warm weather.

The following list of herbs is based upon the results of a two year research project conducted by the authors at N. C. State University. The listed herbs were selected primarily on their attractiveness to honey bees, but ease of growing and long term maintenance were also contributory factors.

Herb	Growth Habit	Propagation	Use	Attractiveness to Bees
Basil	annual, 12"	seed	culinary herb	moderate
Bee Balm	perennial, 24"	seed, division	mint teas	high
Borage	annual, 10"	seed	garnish foods	high
Catnip *Musini*	perennial, 20"	seed	sedative teas	high
Catnip *Catara*	perennial, 20"	seed	sedative teas	high
Chives	perennial, 12"	seed, bulbs	culinary herb	slight
Comfrey	perennial, 36"	division	medicinal herb	slight
Hyssop (Anise)	perennial, 36"	seed	teas	high
Lavender	perennial, 24"	seed	sachets	slight
Marjoram	perennial, 12"	seed	culinary herb	moderate
Mints	perennial, 10"	cuttings, division	mint teas	high
Sage	perennial, 12"	seed, division	culinary herb	moderate
Salvia, blue	annual, 24"	seed	ornamental	high
Salvia, white	annual, 24"	seed	ornamental	high
Spider Plant	annual, 24"	seed	ornamental	high
Teasel	perennial, 36"	seed, division	ornamental	moderate
Thistle, Globe	perennial, 48"	seed	ornamental	moderate
Thymes	perennial, 6"	seed, cuttings	culinary herb	high
Yarrow	perennial, 24"	seed	tea	slight

Notes: 1. Some of the herbs such as the mints may impart a very distinctive flavor to the honey that the bees produce.

2. The above "uses" of the herbs are listed for informational purposes only and is not meant to be an endorsement of any particular use.

References:

Clarkson, Rosetta E. 1970. Herbs, Their Culture and Uses. MacMillian Publishing Company, New York, N.Y.

Foley, Daniel F. 1971. Herbs for Use and Delight. Dover Publications, Inc. New York. N.Y.

Lust, John. 1974. The Herb Book. Bantam Books, New York, N.Y.

Meyer, Joseph E. 1960. The Herbalist. Meyerbooks, Glenwood, Ill.

Stary, Franfised and Valclav Jirasek. 1973. Herbs, A Concise Guide in Color. Hamlyn Publish Group Ltd., New York, N.Y.

Seed Sources: The following list is for informational purposes only and the inclusion of a firm does not constitute endorsement nor does the exclusion of a firm suggest non-endorsement.

Pellet Gardens Catalog of Honey Plants, Atlantic, Iowa 50022.
Nichols Herb and Rare Seeds, 1190 N. Pacific Hwy., Albany, Oregon 97321.
Parks Seeds, Greenwood, South Carolina 29647.
A World Seed Service, J. L. Hudson, P.O. Box 1058, Redwood, California 94064.

Prepared by: W. G. Lord, Research Technician

Honey Plants of the Triangle Checklist

trees:

- ☐ Red Maple
- ☐ Prunus family: apples, pears, cherry etc..
- ☐ Crabapple
- ☐ Redbud
- ☐ Holly
- ☐ Tulip Poplar
- ☐ Locust
- ☐ Sourwood
- ☐ Chaste Tree

shrubs:

- ☐ Oregon Grape
- ☐ Flowering Quince
- ☐ Trifoliate Orange
- ☐ Blueberry
- ☐ Winter Honeysuckle
- ☐ Abelia
- ☐ Hydrangea
- ☐ Butterfly Bush
- ☐ Caryopteris
- ☐ Sumac

herbs:

- ☐ Lavender
- ☐ Rosemary
- ☐ Chives, Allium
- ☐ Borage
- ☐ Horehound
- ☐ Oregano
- ☐ Mint
- ☐ Heal-All
- ☐ Mountain Mint
- ☐ Catmint

annuals:

- ☐ Soybean
- ☐ Cotton
- ☐ Smartweed
- ☐ Poppies
- ☐ Cosmos
- ☐ Cleome
- ☐ Clovers
- ☐ Buckwheat
- ☐ Sunflowers

perennials:

- ☐ Winter Aconite
- ☐ Lamium family: Henbit, Red Dead Nettle
- ☐ Blackberry, Raspberry
- ☐ Jo Pye Weed
- ☐ Verbena
- ☐ Echinacea
- ☐ Salvias
- ☐ Asters
- ☐ Goldenrod

Bees forage on different flowers at different locations and different times of year. The flavor of the nectar of a particular flower can determine the flavor of the honey if the bees are working one type of flower or mostly one type at a single time. This honey is often stored all together in a frame so it can be extracted separately from other types. These are called Artisan Honeys.

Some of the common types of honey found in North Carolina are:

Early blooming Fruit Trees: Apple, Cherry, Prunus family: Light early spring honey with a slight fruit taste, not as distinctive as Blueberry.

Blueberry: Light golden honey with a fruity finish like blueberries, very distinctive.

Clover: Light honey with very sweet finish.

Tulip Poplar: Mid colored honey with good rich even flavor.

Sourwood: Very pale honey with great almost citrus flavor.

Wildflower: Usually darker honey with rich flavor but varies with mix of blooms.

Buckwheat: Very dark honey tastes almost like molasses, acquired taste.

Goldenrod: Very yellow honey tends to crystallize so usually used to overwinter bees.

Plants for Bees Resource Listing

Books

The Hive and the Honey Bee - Dadant & Sons, available at www.dadant.com
The latest edition of the classic book on beekeeping. Completely rewritten, revised and enlarged. The best reference book on honey bees and beekeeping. 22 chapters, 33 world-famous authors, hundreds of photos and drawings, clothbound with attractive gold stamped cover and spine, and many special features: new 52-page U.S. and Canadian honey plants table, updated Africanized honey bee information, parasitic bee mites management, business practices, marketing, hive products, bee behavior, pesticides, and more.

Honey Plants of North America - John H. Lovell, ISBN: 0936028203
Root Publishing has issued this reprint of a beekeeping standard. Written in 1926, the comprehensive and detailed information about nectar and pollen sources as well as the intricacies and intimacies of the honey bee/plant relationship is still wonderfully pertinent and timely. The only book of its kind still in print.

Online Resources

http://www.thedailygreen.com/going-green/tips/bee-friendly-plants

http://nature.berkeley.edu/urbanbeegardens/

Apiculture Program at NCSU • http://www.cals.ncsu.edu/entomology/apiculture/

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ENY152

UF UNIVERSITY of FLORIDA
IFAS Extension

The Benefits of Pollen to Honey Bees[1]

Amanda Ellis, Jamie Ellis, Michael O'Malley and Catherine Zettel Nalen[2]

The honey bee's basic nutritional requirements are similar to those of humans; namely, they need proteins (amino acids), carbohydrates (sugars), minerals, fats/lipids (fatty acids), vitamins, and water. In order to meet their nutritional requirements, honey bees collect nectar, pollen, and water.

Bees forage for water at almost any source close to their colonies. These sources include ponds, streams, leaky taps, the neighbor's pool, dog dishes, or bird baths. During hot weather, honey bees use water to cool the colony by fanning and evaporating water droplets inside the hive. Water may also provide essential minerals in addition to hydration.

Honey bees consume processed nectar (honey) and pollen (bee bread), both of which are provided by flowers (Figure 1). Nectar, which bees convert to honey, serves as the primary source of carbohydrates for the bees. It provides energy for flight, colony maintenance, and general daily activities. Without a source or surplus of carbohydrates, bees will perish within a few days. This is why it is important to make sure that colonies have sufficient honey stores during the winter months. Colonies can starve quickly! Nectar also is a source of various minerals, such as calcium, copper, potassium, magnesium, and sodium, but the presence and concentration of minerals in nectar varies by floral source.

Figure 1. Honey bee on an orange blossom. Photo Credit: Honey Bee Research and Extension Laboratory, University of Florida.

Pollen Content

Pollen, in the form of bee bread, is the honey bee's main source of protein and it also provides fats/lipids, minerals, and vitamins. The protein that pollen provides is vital to brood production and the

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development of young bees. Pollen is the most nutritionally variable food source that honey bees use and typically is composed of the following: water (7-16 %); crude protein (6-30 %); ether extract (1-14 %); carbohydrates including reducing sugars (19-41 %), non-reducing sugars (0-9 %), starch (0-11 %); lipids (5 %); ash (1-6 %); and unknown (22-36 %). Pollen from different floral sources has different quantities of each component: all pollens are NOT equally nutritious to the bees.

The protein pollen provides is essential for hive growth, but the amount of crude protein available in pollen is highly variable among different pollens, ranging from 6-30% of the total dry weight of the pollen. Protein is composed of amino acids, 10 of which have been identified as essential to honey bees. These include threonine, valine, methionine, isoleucine, leucine, phenylalanine, histidine, lysine, arginine, and tryptophan. The quantity and type of amino acids present in pollen varies by the floral source from which the pollen was collected.

Where is Pollen Produced?

Pollen is produced by the stamen, which is the male reproductive portion of a flower (Figure 2). Honey bees play an important role as pollinators as they transfer pollen from the stamen of a flower to the stigma (female part) of the same or different flowers. Sometimes the pollen only needs to be transferred to a stigma on the same flower or another flower on the same plant, but often the pollen must reach a different plant altogether. Consequently, a very intricate relationship has developed between plants and their pollinators, as both parties rely on one another for survival.

In terms of pollen production, plant species differ in the quantity and quality of pollen produced. Some plants may produce an abundance of pollen, but the pollen may be of poor quality, whereas others may produce very little but high quality pollen. Plants that are closely related (within the same genus) tend to have similar amounts of crude protein available in their pollens. Plants with relatively high crude protein values include canola (*Brassica napus* – 23%) and almond (*Prunus dulcis* – 26%), while plants with lower crude protein levels include raspberry/blackberry (*Rubus* spp. – 19%), willow (*Salix* spp. – 17%), sunflower (*Helianthus annuus* – 16%), and pine (*Pinus* spp. – 7%). It is important to note that there are several different methods used to analyze protein content in pollen which, in turn, can yield different results. Consequently, one must use published protein levels in various pollens as a general guideline and not a definitive value.

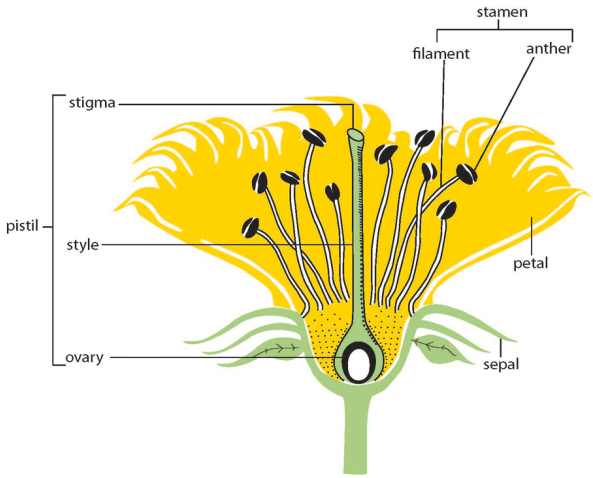

Figure 2. Anatomical diagram of a flower. Photo Credit: Entomology and Nematology Department, University of Florida.

Pollen Collection by Honey Bees

It has been observed that honey bee workers choose pollen based on the odor and physical configuration of the pollen grains rather than based on nutritive value. A typical size honey bee colony (approximately 20,000 bees) collects about 57 kg of pollen per year. On average, 15-30% of a colony's foragers are collecting pollen. A single bee can bring back a pollen load that weighs about 35% of the bee's body weight. Bees carry this pollen on their hind legs, on specialized structures commonly called "pollen baskets" or corbicula (Figure 3).

Once pollen is brought back to the colony, the workers condition it by adding glandular secretions containing enzymes and acids that prevent harmful bacterial activity and prepare the pollen for long-term storage (Figure 4). Stored pollen often is called "bee bread". Bees also add beneficial microbes to the pollen and they produce enzymes that help the pollen release nutrients and amino acids. Bee bread is consumed by a colony relatively quickly and only stored for a couple of months if there is a surplus. A

colony's annual requirement for pollen has been estimated to range from 15 to 55 kg.

Figure 3. Worker bee carrying pollen in her pollen baskets. Photo Credit: Honey Bee Research and Extension Lab, Trevor Schleuter, University of Florida.

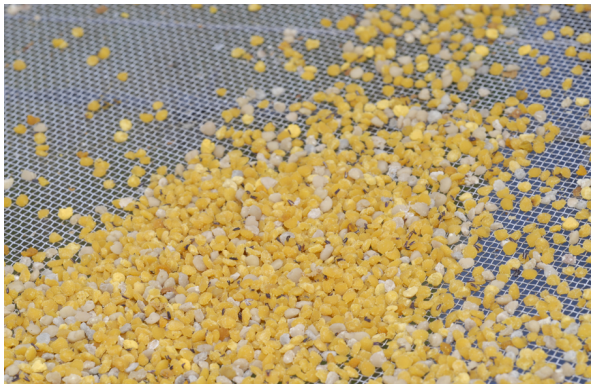

Figure 4. Pollen that has been collected from a pollen trap placed on the bottom board of a bee hive. Photo Credit: Honey Bee Research and Extension Lab, C.M. Zettel Nalen, University of Florida.

Bees require pollen for growth and development. Immature (larval) bees are fed a mixture of brood food and bee bread. Newly emerged bees consume bee bread so that their bodies can complete development. The amount of pollen required to rear a single worker larva has been estimated at 124-145 mg, this containing about 30 mg of protein. The minimum level of protein required for honey bees has been estimated to be between 20-25% crude protein. Pollens with protein levels in this range are more useful to colonies and allow them to meet their protein requirements readily. A diet of high protein pollen increases worker bee longevity, while brood rearing is reduced when supported by pollens low in protein.

Protein content is very important and is the most studied component of pollen, but little is known about the importance of other trace nutrients available in pollen to bees. The chemical analysis of the composition of pollen is complex and only a relatively few pollens have been investigated well. A good publication to review for pollen contents of many common plants is "*Fat Bees Skinny Bees* – a manual on honey bee nutrition for beekeepers" (http://www.rirdc.gov.au/reports/HBE/05-054.pdf). The authors of this manual include a list of pollen compositions from some common Australian plants. When reviewing the list, remember that plants within the same genus often have similar protein contents. This list can serve as a guideline for predicting protein content of pollen from similar plants in the U.S.

Ensuring Colony Nutrition

What can a beekeeper do to ensure that the nutritional requirements of the colony are met? A beekeeper should make certain that plants in the area actually provide pollen. For example, bees do not forage on many ornamental plants, so all blooming flowers are not attractive to bees. Also, the volume of pollen produced by a plant is not correlated necessarily to a bee's use of that plant's pollen. Pine trees, for example, produce copious amounts of protein-poor pollen but typically are not visited by honey bees. Additionally, plants that produce large amounts of nectar do not always also provide pollen for bees. When considering the nutritional requirements of honey bees, it is important to remember "variety, variety, variety". No single pollen meets all the nutritional needs of a colony so a variety of pollens from different plant sources will help ensure that these needs are met. Just like humans, bees need well-rounded diets. When inspecting a honey bee colony, one should see frames with a rainbow of pollen colors (orange, yellow, red, white, green, etc.) present in the cells. Additionally, pollen quality is more important than quantity.

A beekeeper should be familiar with both nectar and pollen producing plants in their area. Also, a colony's requirements change depending on season, brood production, and the beekeeper's goals. If there is a lack of pollen, or a suspicion that the pollen available is of poor quality, a pollen substitute or supplement may be provided to the colony.

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