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SCHOOL OF FORESTRY AND NATURAL RESOURCES
THE UNIVERSITY OF GEORGIA

Deer-Tolerant Ornamental Plants

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Deer like nutrition-rich plants, especially in spring and summer when does are pregnant or nursing, when young deer are growing and when bucks are growing antlers. Fertilized plants, such as those in home landscapes, provide protein, energy-rich carbohydrates, minerals and salts. Deer also get about one-third of their water from the moisture in irrigated plants and young, succulent vegetation on expanding leaves, buds and green stems.

Nuisance deer that feast on home gardens and bucks that damage young trees by rubbing them with their antlers during the rutting season are difficult and expensive to control in residential communities. Although there are a number of commercially available deer repellents on the market, none of them are 100 percent effective. Most "home remedy" repellents, such as soap, human hair and animal dung, are unreliable. Shooting deer or using noise guns is prohibited in most residential neighborhoods, and many citizens are opposed to this method of control. Fencing whole communities or individual properties is often not practical, and may be against local ordinances or community covenants. Trapping and relocating deer is costly and often harmful or fatal to deer.

If deer are overabundant in your neighborhood, and deer herd reduction or management is not feasible, a good way to prevent deer browsing in landscapes is to plant ornamental plants that deer do not like to eat.

There is no such thing as a deer-resistant plant, and when deer populations are high and food becomes scarce, deer may feed on plants that are thought to be deer-tolerant. However, deer generally do not like plants with pungent aromas. Some gardeners have reported success with planting strong-scented plants like lantana, catmint, chives, mint, sage or thyme adjacent to plants that deer frequently browse. Deer also shy away from plants with prickly or rough leaves and plants with a bitter taste. Sometimes, deer browse new plantings or established plants with tender new growth, then avoid those same plants when their leaves are mature.

Over the years, wildlife organizations, universities, botanical gardens and garden writers have constructed many lists of deer-tolerant and deer-susceptible ornamental plants. Because most of these lists are constructed from observational trial-and-error data instead of controlled scientific studies, they are open for criticism. Furthermore, many variables influence deer feeding preferences.

The list below is a compilation of ornamental plants for Georgia hardiness zones that appear in published literature (see [References](#)) as well as observations by the authors. It is intended to be a guide for selecting ornamental plants for landscapes where deer browsing is a problem. Plants known to be invasive and a serious problem in natural areas, regardless of their level of deer tolerance, were excluded from the list.

**Plants Deer Occasionally or Frequently Browse
(Protection is recommended)**

Common Name	Botanical Name
American Arborvitae	<i>Thuja occidentalis</i>
American Beautyberry	<i>Callicarpa acmericana</i>
American Elder	<i>Sambucus canadensis</i>
American Sycamore	<i>Platanus occidentalis</i>
Arrow-wood	<i>Viburnum dentatum</i>
Asiatic Lilies	<i>Lilium</i> spp.
Beech (low branches)	<i>Fagus</i> spp.
Bittersweet	<i>Celastrus scandens</i>
Black-Eyed Susan	<i>Rudbeckia</i> spp.
Blackgum	<i>Nyssa sylvatica</i>
Blanket Flower	<i>Gaillardia</i> spp.
Buttonbush	<i>Cephalanthus occidentalis</i>
Carolina Ash	<i>Fraxinus caroliniana</i>
Carolina Buckthorn	<i>Frangula caroliniana</i>
Carolina Yellow Jessamine	<i>Gelsemium sempervirens</i>
Chrysanthemum (fall mums)	<i>Chrysanthemum</i> spp.
Coleus	<i>Coleus</i> spp.
Cosmos	<i>Cosmos</i> spp.
Crossvine	<i>Bignonia capreolata</i>
Daylily (prefer flowers and flower buds)	<i>Hemerocallis</i> spp.
Eastern Redbud	<i>Cercis canadensis</i>
Flowering Crabapple (small trees and low branches)	<i>Malus</i> spp.
Flowering Dogwood	<i>Cornus florida</i>
Fothergilla (flowers and new growth)	<i>Fothergilla</i> spp.
Fringetree	<i>Chionanthus virginicus</i>
Gerbera Daisy	<i>Gerbera jamesonii</i>
Grape Hyacinth	<i>Muscari</i> spp.
Green Ash (tender new growth)	<i>Fraxinus pennsylvanica</i>
Greenbriar	<i>Smilax</i> spp.
Hawthorn	<i>Crataegus</i> spp.
Hibiscus	<i>Hibiscus</i> spp.

Some Hollies (some, such as Lusterleaf, Mary Nell, Nellie R. Stevens, Blue)	<i>Ilex</i> spp.
Hollyhock	<i>Alcea</i> spp.
Honey Locust	<i>Gleditsia triacanthos</i>
Hop Hornbeam	<i>Ostrya virginiana</i>
Hosta	<i>Hosta</i> spp.
Hydrangea (bigleaf, oakleaf, climbing)	<i>Hydrangea</i> spp.
Impatiens	<i>Impatiens walleriana</i>
Indian Hawthorn	<i>Rhaphiolepis indica</i>
Japanese Maple (tender new growth)	<i>Acer palmatum</i>
Morning Glory	<i>Ipomea</i> spp.
Trumpet Honeysuckle	<i>Lonicera sempervirens</i>
Pansy	<i>Viola</i> spp.
Petunia	<i>Petunia</i> spp.
Redbay	<i>Persea borbonia</i>
Red Maple	<i>Acer rubrum</i>
Rhododendron	<i>Rhododendron</i> spp.
Rose Balsam	<i>Impatiens balsamina</i>
Roses	<i>Rosa</i> spp.
Sedum 'Autumn Joy'	<i>Sedum 'Autumn Joy'</i>
Serviceberry	<i>Amelanchier arborea</i>
Soloman's Seal,	<i>Polygonatum</i> spp.
Sourwood (tender new growth)	<i>Oxydendron aroreum</i>
Strawberry Bush	<i>Euonymus ameicanus</i>
Summersweet Clethra	<i>Cletra alnifolia</i>
Swamp Cyrilla	<i>Cyrilla racemiflora</i>
Sweetbay Magnolia	<i>Magnolia virginiana</i>
Sweetshrub	<i>Calycanthus floridus</i>
Titi	<i>Cliftonia monophylla</i>
Trumpet Creeper	<i>Campsis radicans</i>
Tulips	<i>Tulip</i> spp.
Violas	<i>Viola</i> spp.
Virginia Sweetspire	<i>Itea virginica</i>
Yew (English and Japanese)	<i>Taxus</i> spp.

Trees Deer Rarely Browse

Common Name	Botanical Name
Bald Cypress	<i>Taxodium distichum</i>
Carolina Silverbell	<i>Halesia carolina</i>
Cherry Laurel	<i>Prunus laurocerasus</i>
Crape Myrtle	<i>Lagerstroemia indica</i>
Dawn Redwood	<i>Metasequoia glyptostroboides</i>
Deodar Cedar	<i>Cedrus deodara</i>
Eastern Redcedar	<i>Juniperus virginiana L.</i>
Falsecypress	<i>Chamaecyparis spp.</i>
Fir	<i>Abies spp.</i>
Ginkgo	<i>Ginko biloba</i>
Goldenraintree	<i>Koelreuteria paniculata</i>
Gordonia	<i>Gordonia lasianthus</i>
Japanese Cedar	<i>Cryptomeria japonica</i>
Katsura Tree	<i>Cercidiphyllum japonicum</i>
Kousa Dogwood	<i>Cornus kousa</i>
Pawpaw	<i>Asimina triloba</i>
Palm	<i>Many genera and species</i>
Pine	<i>Pinus spp.</i>
Saucer Magnolia, Japanese Magnolia	<i>Magnolia x soulangiana</i>
Southern Magnolia	<i>Magnolia grandiflora</i>
Smoketree	<i>Cotinus obovatus</i>
Spruce	<i>Picea spp.</i>
Sugar Maple	<i>Acer saccharum</i>
Sweetgum	<i>Liquidambar styraciflua</i>
Tuliptree, Tulip Poplar	<i>Liriodendron tulipifera</i>

Shrubs Deer Rarely Browse

Common Name	Botanical Name
Banana Shrub	<i>Michelia figo</i>
Barberry	<i>Berberis</i> spp.
Beautybush	<i>Kolkwitzia amabilis</i>
Bottlebrush Buckeye	<i>Aesculus parviflora</i>
Boxwood	<i>Buxus</i> spp.
Butterfly Bush	<i>Buddleia</i> spp.
Common Witchhazel	<i>Hamamelis virginiana</i>
Cotoneaster	<i>Cotoneaster</i> spp.
Deutzia	<i>Deutzia</i> spp.
Drooping Leucothoe	<i>Leucothoe fontanesiana</i>
European Fan Palm	<i>Chamaerops humilis</i>
Firethorn (<i>Pyracantha</i>)	<i>Pyracantha coccinea</i>
Flowering Quince	<i>Chaenomeles speciosa</i>
Gardenia	<i>Gardenia</i> spp.
Glossy Abelia	<i>Abelia</i> spp.
Some Hollies (yaupon, inkberry, Chinese and Japanese) See occasionally browsed list.	<i>Ilex</i> spp.
Japanese Andromeda	<i>Pieris japonica</i>
Japanese Plum Yew	<i>Cephalotaxus harringtonia</i>
Japanese Rose	<i>Kerria japonica</i>
Junipers	<i>Juniperus</i> spp.
Needle Palm	<i>Rhapidophyllum hystrix</i>
Oleander	<i>Nerium oleander</i>
Osmanthus	<i>Osmanthus</i> spp.
Pineapple Guava	<i>Feijoa sellowiana</i>
Pomegranate	<i>Punica granatum</i>
Primrose Jasmine	<i>Jasminum mesnyi</i>
Sotol	<i>Dasyilirion wheeleri</i>
Spiraea	<i>Spiraea</i> spp.
Sweet Box	<i>Sarcococca hookeriana</i>
Viburnum	<i>Viburnum</i> spp.
Wax Myrtle	<i>Myrica cerifera</i>

Weigela	<i>Weigela florida</i>
Winter Daphne	<i>Daphne odora</i>
Yucca	<i>Yucca filimentosa</i>

Ornamental Grasses Deer Rarely Browse	
Common Name	Botanical Name
Fountaingrass	<i>Pennisetum alopecuroides</i>
Feather Reed Grass	<i>Calamagrostis</i> spp.
Hakone Grass	<i>Hakonechloa macra</i>
Lemongrass	<i>Cymbopogon citratus</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Northern Sea Oats	<i>Chasmanthium latifolium</i>
Pampas Grass	<i>Cortaderia selloana</i>
Pink Muhly Grass	<i>Muhlenbergia capillaris</i>
Purple Moor Grass	<i>Molinia caerulea</i>
Ravenna Grass	<i>Erianthus ravennae</i>
Sedge	<i>Carex</i> spp.
Sweet Flag	<i>Acorus</i> spp.
Switch Grass	<i>Panicum virgatum</i>

Vines and Groundcovers Deer Rarely Browse	
Common Name	Botanical Name
Bugleweed (<i>Ajuga</i>)	<i>Ajuga reptans</i>
Columbine	<i>Aquilegia</i> spp.
Confederate Jasmine	<i>Trachelospermum jasminoides</i>
Creeping Raspberry	<i>Rubus calycinoides</i>
Creeping Lantana	<i>Lantana montevidensis</i>
Dwarf Mondo grass	<i>Ophiopogon japonicus</i>
Japanese Pachysandra	<i>Pachysandra terminalis</i>
Junipers	<i>Juniperus</i> spp.
Liriope	<i>Liriope spicata</i>

Plumbago	<i>Ceratostigma plumbaginoides</i>
Prostrate Rosemary	<i>Rosemarinus officinalis</i> 'Prostratus'
Sweet Woodruff	<i>Galium odoratum</i> (<i>Asperula odorata</i>)
Thyme	<i>Thymus</i> spp.

Herbaceous Perennials and Bulbs Deer Rarely Browse	
Common Name	Botanical Name
Allium	<i>Allium</i> spp.
African Lily	<i>Agapanthus</i> spp.
Amaryllis	<i>Hippeastrum</i> spp.
Anise Hyssop	<i>Agastache</i> spp.
Aster	<i>Aster</i> spp.
Astilbe	<i>Astilbe</i> spp.
Balloon Flower	<i>Platycodon grandiflorus</i>
Beebalm	<i>Monarda didyma</i>
Boltonia	<i>Boltonia</i> spp.
Bush Cinquefoil	<i>Potentilla fruticosa</i>
Butterfly Weed	<i>Asclepias tuberosa</i>
Candytuft	<i>Iberis</i> spp.
Cardinal Flower	<i>Lobelia</i> spp.
Catmint	<i>Nepeta</i> spp.
Christmas Fern	<i>Polystichum arcostichooides</i>
Cinnamon Fern	<i>Osmunda cinnamomea</i>
Columbine	<i>Aquilegia</i> spp.
Crinum Lily	<i>Crinum</i> spp.
Crocosmia	<i>Crocosmia</i> spp.
Crocus	<i>Crocus</i> spp.
Daffodils	<i>Narcissus</i> spp.
Dahlia	<i>Dahlia</i> spp.
Delphinium	<i>Delphinium</i> spp.
Elephant Ears	<i>Alocasia</i> spp. / <i>Colocasia</i> spp.
False Indigo	<i>Baptisia australis</i>

Foamflower	<i>Tiarella cordifolia</i>
Forget-Me-Not	<i>Myosotis</i> spp.
Four O'Clock	<i>Mirabilis jalapa</i>
Foxglove	<i>Digitalis</i> spp.
Gay-feather (Liatris)	<i>Liatris</i> spp.
Globe Thistle	<i>Echinops</i> spp.
Goldenrod	<i>Solidago</i> spp.
Green Jerusalem Sage	<i>Phlomis</i> spp.
Hens and Chickens	<i>Sempervivum</i> spp.
Iris	<i>Iris</i> spp.
Jack-in-the-pulpit	<i>Arisaema triphylum</i>
Lamb's Ear	<i>Stachys byzantine</i>
Lantana	<i>Lantana</i> spp.
Larkspur	<i>Consolida ambigua</i>
Lavender	<i>Lavandula</i> spp.
Lavender-cotton	<i>Santolina chamaecyparissus</i>
Lenten Rose	<i>Helleborus</i> spp.
Lily-of-the-Nile	<i>Agapanthus africanus</i>
Lupine	<i>Lupinus</i> spp.
Marjoram	<u>Origanum</u> <i>marjorana</i>
May Apple	<i>Podophyllum peltatum</i>
Meadow Rue	<i>Thalictrum aquilegifolium</i>
Mint	<i>Mentha</i> spp.
Money Plant	<i>Lunaria annua</i>
Oregano	<i>Oreganum vulgare</i>
Peony	<i>Paeonia</i> spp.
Perennial Sunflower	<i>Helianthus</i> spp.
Pinks	<i>Dianthus</i> spp.
Poppy	<i>Papaver</i> spp.
Primrose	<i>Primula</i> spp.
Purple Coneflower	<i>Echinacea purpurea</i>
Rose Campion	<i>Lychnis coronaria</i>
Rosemary	<i>Rosmarinus officinalis</i>
Royal Fern	<i>Osmunda regalis</i>

Russian Sage	<i>Perovskia atriplicifolia</i>
Snowdrop	<i>Galanthus nivalis</i>
Society Garlic	<i>Tulbaghia violacea</i>
Speedwell	<i>Veronica</i> spp.
Sweet Woodruff	<i>Galium odoratum (Asperula odorata)</i>
Statice	<i>Limonium latifolium</i>
Tansy	<i>Tanacetum vulgare</i>
Tarragon	<i>Artemisia dracunculus</i>
Threadleaf Coreopsis	<i>Coreopsis verticillata</i>
Toad Lily	<i>Tricyrtis hirta</i>
Texas Sage	<i>Salvia greggii</i>
Wallflower	<i>Cheiranthus</i> spp.
Wild Indigo	<i>Baptisia</i> spp.
Wormwood	<i>Artemesia</i> spp.
Yarrow	<i>Achillea filipendulina</i>

Annuals Deer Rarely Browse	
Common Name	Botanical Name
Ageratum	<i>Ageratum houstonianum</i>
Alyssum	<i>Lobularia</i> spp.
Annual Periwinkle	<i>Catharanthus</i> spp.
Annual Salvia	<i>Salvia</i> spp.
Baby's Breath	<i>Gypsophila</i> spp.
Bachelor's Buttons	<i>Centaurea cyanus</i>
Basil	<i>Ocimum basilicum</i>
Calendula, Pot Marigold	<i>Calendula officinalis</i>
California Poppy	<i>Eschscholzia californica</i>
Cock's Comb	<i>Celosia</i> spp.
Dusty Miller	<i>Centaurea cineraria</i>
Flowering Tobacco	<i>Nicotiana</i> spp.
Lantana	<i>Lantana</i> spp.
Marigold	<i>Tagetes</i> spp.

Parsley	<i>Petroselinum crispum</i>
Scarlet Sage	<i>Salvia coccinea</i>
Swedish Ivy	<i>Plectranthus</i> spp.
Snapdragon	<i>Antirrhinum majus</i>
Spiderflower	<i>Cleome</i> spp.
Strawflower	<i>Bracteantha bracteata</i>
Stock	<i>Matthiola incana</i>
Sweet Pea	<i>Lathyrus odoratus</i>
Verbena	<i>Verbena x hybrida</i>

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Nine-Banded Armadillo

(*Dasypus novemcinctus*)

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[PDF](#)

Introduction

Scientists classify armadillos with anteaters and sloths. This tells us that they have poorly developed teeth and limited mobility. In fact, armadillos have small, peg-like teeth that are useful for grinding their food but of little value for capturing prey. No other mammal in Georgia has bony skin plates or a “shell,” which makes the armadillo easy to identify. Just like a turtle, the shell is called a *carapace*. Armadillos are common in central and southern Georgia and are moving northward. Only one species of armadillo lives in Georgia and the southeastern United States, but 20 recognized species are found throughout Central and South America. These include the giant armadillo, which can weigh up to 130 pounds, and the pink fairy armadillo, which weighs less than 4 ounces. About two million years ago a relative of the armadillo as large as a rhinoceros lived in South America, and small cousins lived as far north as Canada. These disappeared in the ice ages long before humans inhabited North America.



Taxonomy

Order Xenarthra – Armadillos, Anteaters, and Sloths

Family Dasypodidae – Armadillo

Nine-banded Armadillo – *Dasypus novemcinctus*

The genus name, *Dasypus*, is thought to be derived from a Greek word for hare or rabbit. The armadillo is so named because the Aztec word for armadillo meant turtle-rabbit. The species name, *novemcinctus*, refers to the nine movable bands on the middle portion of their shell or carapace. Their common name, armadillo, is derived from a Spanish word meaning “little armored one.”

Status

Armadillos are considered both an exotic species and a pest. Georgia law prohibits keeping armadillos in captivity, however. Because they are not protected in Georgia, they can be hunted or trapped throughout the year. There are no specific threats to their survival. Armadillos have few natural predators. Many are killed while trying to cross roads or highways or when feeding along roadsides.

Description

The nine-banded armadillo is about the size of an opossum or large house cat. They are 24 to 32 inches long of which 9½ to 14½ inches is tail. The larger adult males weigh between 12 and 17 pounds whereas the smaller females weigh between 8 and 13 pounds. They are brown to yellow-brown and have a few sparse hairs on their bellies. Long claws make them proficient diggers.

They have 4 toes on each front foot and 5 on each back foot. The toes are spread so that a walking track looks somewhat like an opossum or raccoon. The ears are about an 1½ inches long and the snout is pig-like.

Distribution

About two million years ago, a relative of the armadillo as large as a rhinoceros lived in South America. Smaller cousins lived as far north as Canada. All of these forms disappeared in the ice ages long before humans inhabited North America. At the start of the 20th century, the nine-banded armadillo was present in Texas. By the 1930s, they were in Louisiana and by 1954 they had crossed the Mississippi River heading east. In the 1950s, they were introduced into Florida and began heading north. Today, some maps (Georgia Wildlife Web: <http://museum.nhm.uga.edu/gawildlife/gaww.html>) show them to be restricted to South Georgia but, in fact, they are present as far north as Athens and Rome, Georgia. They occur throughout the South from Texas, Oklahoma and Kansas through Missouri, eastern Tennessee and into South Carolina. They are currently absent from North Carolina but are likely to continue to move northward along the coast and into the Piedmont. Because they do not tolerate cold temperatures (below about 36 degrees F), several studies suggest that farther northward migration into the Appalachian Mountains will be limited.

The Armadillo Trap, 820 Oloh Rd, Sumrall, MS 39482, Phone: 601-408-1070

Form and Function

The armadillo's appearance is unique among Georgia's mammals. The shell (carapace) is made up of scutes or bony plates attached to a tough epidermal skin layer. Since each scute overlaps

slightly with the one before it, the entire shell appears to move like a telescope or accordion. The ears, underbelly and parts of the head and limbs are not covered by the shell.

The head is relatively small. The skull is tubular; the lower jaw is long and slender. There are 7 or 8 teeth in each jawbone or 14-16 teeth in the lower jaw and the same number in the upper jaw. The teeth are small pegs with a single root.

Armadillos can have 7-10 bands on the shell even though their name indicates nine. Males are about 25 percent heavier than females on average. Though males lack a scrotum and external testes, the sexes are easy to distinguish by the presence of four teats in females. Both sexes possess anal glands that protrude when the animal is excited. The anal glands produce a strong odor but, unlike a skunk, they do not spray.

Ecology

Armadillos dig their own burrows or use the burrow of another armadillo, tortoises or natural holes. They do not hibernate but neither can they tolerate high temperature (above about 85 degrees F). During the winter months they often are active during the warmer part of the day. During the hot summer, activity shifts to the cooler night hours. While they can remain in their burrows for several days, they do not store food or accumulate large stores of body fat, so they must eventually emerge to forage. In bad weather, they can freeze to death or starve if they are unable to locate food. Armadillos rely on a good sense of smell to locate food but have poor eyesight. They eat insects and surrounding soil and plant litter while foraging, so their droppings consist of undigested insect parts, soil and litter fragments. Droppings are about the size and shape of marbles.

Reproduction

Armadillos reach sexual maturity at about one year of age. They breed between June and August. They have delayed implantation (a step in development when the fetus attaches to the wall of the uterus), which can last for up to four months. Implantation occurs around November and gestation lasts about four months. Generally, the female produces only one litter per year. A single fertilized egg gives rise to four separate embryos. Thus each litter consists of four identical quadruplets.

Fully formed young are born with their eyes open in March or April. They weigh 3-4 ounces at birth and can walk within a few hours but remain in the nest or burrow for 2-3 weeks. Then the young follow their mother while foraging. The young leave the nest at 20-22 days (around the first or second week of June in south Georgia), drink water at 21-25 days, eat solid food at 35-42 days, eat insects at 71-74 days, and are weaned at 90-140 days. The armor plates on the young are soft and flexible at birth — not hardening to the typical adult form until July in south Georgia. The male plays no role in raising or caring for the young.

Feeding

Armadillos are largely insectivores but may consume fruit when available. Their skull, jaw and teeth are adapted to a specialized diet. Their tongue is sticky with rear facing hooks giving the tongue a rough texture. The armadillo's diet consists mainly of invertebrates including insects (beetles, wasps, moth larvae) and also ants, millipedes, centipedes, snails, leeches, and earthworms. The exact composition varies by season, availability and geographic locations. Studies show they also consume fruit, seeds and other vegetable matter. They have been reported to consume newborn rabbits and at least one robin. It is unknown if they merely found these animals dead or not. Other items known to be consumed by armadillo include salamanders, toads, frogs, lizards, skinks, and small snakes.



University of Georgia researchers studying armadillos on Cumberland Island found that, although their diets varied seasonally, 99 percent of their diet consisted of beetle (Coleoptera) larvae, and ant and wasp (Hymenoptera) eggs, pupae and adults. White grubs and wireworms were the most frequently consumed larvae throughout the year. Armadillos were also found to consume earthworms, crabs, crayfish, butterfly and moth larvae, fruits and vertebrates. In addition, 60 out of 171 armadillo (35%) in the sample ate fruit. Grapes, saw palmetto, greenbrier and Carolina laurel cherry were most common in the diet. Armadillos also occasionally consumed spadefoot toad, five-lined skink, green anole, eastern fence lizard, rough green snake, and various snake and lizard eggs. Using remote cameras to study nest predation, several studies have shown that armadillos consume quail eggs. Other observers report that sea turtle eggs are eaten.

Feeding activity, such as digging, is often considered a nuisance, although consumption of ants, including fire ants, and white grubs may be beneficial in other ways. Small invertebrates are swallowed whole while large items are chewed. They will hold and tear apart larger food items with their claws and feet. In one study in Alabama, nearly every fire ant mound on the study site showed evidence of disturbance by armadillo. They seem undeterred by the bite of the fire ant.

Armadillos have been observed tearing the bark from fallen trees, presumably to feed on the insects (beetles and termites) in the decaying wood. They move slowly while feeding and locate food items by smell. The diet shifts to fruits in the summer and fall as these items are often abundant in southern U.S. forests.

Behavior

Armadillos spend most of their active time outside the burrow feeding. They move slowly – traveling between 0.15 and 0.65 miles per hour — often in an erratic, wandering pattern. Often grunting like pigs and with their snouts to the ground, they forage by smell and possibly sound. They often use their sticky tongue to probe holes searching for food, but they are also powerful diggers.

Foraging pits are up to 5 inches deep and are often found in moist soil. Periodically they will stop foraging, stand upright on their hind legs balancing with their tails, and sniff the air. They also take low hanging fruits from this posture.

Armadillos mark their territory with secretions from the anal gland. Individuals may be able to recognize others through scent marking. When alarmed they can run quickly. They have a habit of leaping vertically like a bucking horse before running away in a surprising burst of speed. The anal gland's strong odor and the sudden leaping motion may momentarily startle a predator, possibly allowing the armadillo to escape. Contrary to popular folklore, the nine-banded armadillo cannot curl into a ball to protect itself.

Armadillos are good climbers and readily climb fences although they are not known to climb trees. They often use fallen and leaning logs and trees to escape rising water along streams and rivers. Armadillos can cross water by either swimming in a typical, dog-paddle motion or walking on the bottom while holding their breath. Buoyancy is increased by ingesting air into the stomach and intestines. Armadillos can cross small water bodies by holding their breath and walking underwater for short distances. One armadillo swam across a river 140 yards wide. Having a specific gravity of 1.06 helps, since it makes them heavier than water. Armadillos are known to take mud baths on hot days, perhaps to remove parasites or to coat themselves in cooling mud.

They make a variety of low grunting sounds when feeding or to call young to mother. Other sounds are described as “wheezy grunt,” “pig-like sound,” “buzzing noise” and a “weak purring” made by very young armadillo while attempting to nurse. They are capable of learning simple tasks in a laboratory, such as recognizing patterns in a Y-maze. They are primarily solitary animals except during brief periods for mating and mother-young groups.

Habitat

Armadillos prefer habitat near streams but avoid excessively wet or dry extremes. Soil type is important due to their burrowing. They prefer sandy or clay soils. Armadillos can be found in pine forests, hardwood woodlands, grass prairies, salt marsh and coastal dunes. Human created habitats such as pasture, cemeteries, parks, golf courses, plant nurseries and crop lands also provide suitable habitat. They also forage along roadsides.

While foraging, armadillos always seem to know where they are and, if alarmed, often take a direct route to the safety of a nearby burrow or tangle of roots and briars. They usually dig their

own burrows. Burrow entrances will be 8 to 10 inches across and range from 2 to 24 feet long averaging 3 to 4 feet. The burrow entrance is often concealed among clumps of vegetation, fallen logs or under buildings. Each armadillo may have 5 to 10 burrows. The average number of different burrows used per individual armadillo was 10.9. Other animals will use armadillo burrows including rabbits, opossums, mink, cotton rats, striped skunks, burrowing owls, and the eastern indigo snake. Occasionally, armadillos will cohabit with other animals.

Armadillo do not always dig a burrow; some will build nests out of dry grass. These nests resemble small haystacks and are often used in areas of wet soil. On Cumberland Island, University of Georgia researchers found that 75 percent of all dens were under saw palmetto plants.

An individual's home range varies from 1.5 to 22.5 acres. The home range size is smaller for the armadillo than for similar sized animals. Researchers at the University of Georgia found that armadillos on Cumberland Island had a home range of 13 acres in summer and only 4 acres in winter. Armadillos spent 65 percent of their time in burrows in winter compared to only 29 percent in summer.

Enemies

Armadillos have few wild predators, but coyotes, dogs, black bears, bobcats, cougars, foxes and raccoons are reported to catch and kill armadillos in places where these predators occur. Hawks, owls and feral pigs may prey on armadillo young. One study noted a decline in armadillo numbers as feral pig populations increased. Humans and highways are significant sources of mortality in many areas. One study in Florida, however, found no juveniles in a road-killed sample.

Populations

The sex ratio by litter is 1 male litter (= 4 identical quadruplets) per 0.78 female litters in Florida. Armadillos probably live 6 to 7 years in the wild. Population density is about one animal per 4 acres but could range as high as two animals per acre.

General

Their flesh is tasty and often eaten by people. Weather, especially cold winters, may be the most effective barrier to northern range expansion. Their normal body temperature is 92-95 degrees F.

Disease

Armadillos may carry diseases transmissible to humans, but reports are rare. Armadillos can acquire leprosy and are used in medical research to study this disease. Only two cases are known

in which a human contracted leprosy from wild armadillos. Both cases are from Texas, and the transmission occurred by consuming raw or undercooked armadillo meat. There are no reported positive cases in Georgia, Alabama or Florida.

One wild armadillo in Texas was reported to have rabies but no known transmission to humans has occurred. Armadillos on Cumberland Island, Georgia, had between 0 and 3 species of parasitic worms per individual. The average was 14 worms per individual armadillo but the impact of these parasites on the health of the animal is unknown.

Economic Value

One study in Texas from 1975-1979 put the total amount of damage at \$20,000 for a limited area but did not specify the type of damage. In Georgia, 78 percent of county agents reported receiving requests for information regarding armadillos, and that armadillo complaints accounted for nearly 11 percent of all animal complaints they received each year. No dollar value was attached to the damage complaints, however. Furthermore, the monetary value of damage done to vehicles is not known.

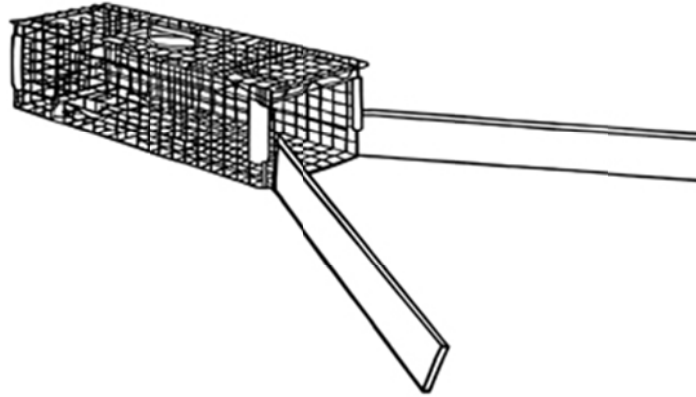
Damage occurs to lawns and landscape due to digging for insects and other food items. Shallow holes 1 to 3 inches deep and 3 to 5 inches wide, usually shaped like an inverted cone, are the most common landowner complaints. Armadillos can uproot flowers and other plantings through their foraging. Damage is generally local and of a nuisance variety more than a large scale economic loss.

Legal Aspects

Armadillos are not protected in Georgia. There are no season or harvest restrictions.

Control to Reduce

Armadillo can be controlled by trapping. Wire cage live traps measuring at least 10 x 12 x 32 inches are recommended. Use of wings, constructed of 1 x 6 inch lumber in various lengths and placed in a V-arrangement in front of the trap can help to “funnel” the armadillo into the trap. Setting traps along natural barriers like logs or the side of a building increases capture success. Placing the trap in front of a burrow entrance is better than random placement in the environment. No bait, lure or attractant has been shown to be effective in increasing capture success, although there are numerous report of baits used with varying success.



No repellents are registered for use with armadillo. No toxicants (poisons) are registered for use. Pesticide use to reduce insect populations in landscape settings may be effective. No fumigants are registered for use to control armadillo.

Shooting is an effective control technique. Use a .22 caliber rifle in a safe and legal manner. Check city and county ordinances before discharging weapons. Always practice safe gun handling procedures.

Management to Enhance

Management activities are usually directed at control and elimination rather than enhancement.

Human Use

Native American Use – None. Armadillos are widely used (and considered a delicacy) by many cultures in Central and South America.

Colonists View – None.

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Ten Questions and Answers About Liberty-Link7 Soybeans in Georgia

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The increasing threat of herbicide-resistant weeds, particularly glyphosate- and ALS-resistant Palmer amaranth (*Amaranthus palmeri*), has caused soybean growers in Georgia to consider weed management strategies other than Roundup-Ready7. In 2009, Liberty-Link soybeans were made commercially available to aid this effort. This publication provides growers with current information about the use of the Liberty-Link soybean system in Georgia.

1) What are Liberty-Link soybeans?

Liberty-Link soybeans are genetically modified soybeans that have resistance to topical applications of glufosinate. Glufosinate is the active ingredient in Ignite7 herbicide. The use of Ignite on conventional or Roundup-Ready7 soybeans will result in severe crop injury or plant death (Figure 1). The resistance gene for glufosinate was obtained from soil bacterium (*Streptomyces* species.)



Figure 1. Ignite injury on conventional or RR soybean varieties.

2) Are there Liberty-Link soybean varieties adapted for production in Georgia?

In 2009, the commercial availability of Liberty-Link soybeans was limited. It is anticipated that this will rapidly change as the desire to plant Liberty-Link soybeans in the Southeast increases. However, the agronomic performance of the available Liberty-Link soybean varieties has not yet been adequately documented in Georgia. Refer to the latest edition of the UGA Soybean Variety Performance Tests for current information about Liberty-Link soybean varieties. UGA variety test results can be obtained online at www.swvt.uga.edu. In 2009, the following Liberty-Link soybean varieties were included in these tests: SS LL511N, SS LL595N, Halo 4:65, Halo 4:94, Halo 5:25, and Halo 5:65. Liberty-Link soybean varieties should be sold in seed bags that contain the appropriate identification label (Figure 2).



Figure 2. Liberty-Link soybean varieties resistant to Ignite should be contained in seed bags identified with this logo.

3) How does Ignite compare to Roundup?

Based upon the chart below, Ignite is not necessarily a direct substitute or replacement for Roundup.

	Roundup	Ignite
Mode of Action	EPSP synthase inhibitor	Glutamine synthetase inhibitor
Speed of Action	slow	Intermediate-fast
Translocated in plant	yes	limited
Broadleaf Weed Control		
annual morningglory (<i>Ipomoea</i> species)	F ^a	G-E
Florida beggarweed	G-E	G
Florida pusley	F	P-F
horseweed (marestail)	G	G
ALS-resistant	G	G
glyphosate-resistant	P	G
Palmer amaranth	E	F-G
ALS-resistant	E	F-G
glyphosate-resistant	P	F-G
sicklepod	G-E	G-E
smallflower morningglory	G	G-E
tropical spiderwort (Benghal dayflower)	F	P-F
Grass/Sedge Weed Control		
broadleaf signalgrass	E	G
crabgrass species	E	F-G
crowfootgrass	E	G
fall panicum	E	G
goosegrass	E	P
johnsongrass	E	G

(seedling) johnsongrass (rhizome)	G-E	P-F
nutsedge (purple) nutsedge (yellow)	F-G F	P P
Texas millet (panicum)	E	G
^a Abbreviations: E = excellent ($\geq 90\%$ control); G = good (80-89% control); F = fair (70-79% control); P = poor ($\leq 69\%$ control).		

4) Can the Liberty-Link soybean system be used to help manage the ALS- and glyphosate-resistant Palmer amaranth (Figure 3) problems in Georgia?

Yes, but application timing will be critical! Ignite is most effective on Palmer amaranth when applied before plants reach 3 inches in height. Applications made in warm temperatures ($>70^{\circ}$ F), high humidity and bright sunlight will improve the performance of Ignite. Ignite does not provide residual weed control. Ignite is rain-fast in four hours.



Figure 3. Glyphosate-resistant Palmer amaranth in soybeans, Macon County, Georgia.

5) Is a residual herbicide needed with the Liberty-Link system?

YES! The Liberty-Link weed control system must be used following or in combination with a residual herbicide (Figure 4). The use of residual herbicides in the Liberty-Link system will improve the control of herbicide-resistant weeds and help delay the development of resistance to Ignite. Residual soybean herbicides used at planting, prior to soybean emergence, include: Authority MTZ*, Boundary*, Canopy*, Dual Magnum, Envide, Intrro, Metribuzin*, Prefix, Prowl, Pursuit, Scepter, Treflan, TriCor*, and Valor.

Residual herbicides that can be tank-mixed with Ignite and applied postemergence in soybean include Dual Magnum and Reflex.





Figure 4. Palmer amaranth control in Georgia with the Liberty-Link soybean system (2009). Left: non-treated check; Right: Boundary 6.5EC @ 1.5 pt/A (PRE) followed by Ignite 280 2.34SL @ 22.0 oz/A (POST). Pictures taken 54 days after planting.

**Caution: Authority MTZ*, Boundary, Canopy, and TriCor contain the active ingredient metribuzin. In the past, certain soybean varieties were sensitive to this active ingredient. Contact your local county Extension agent or seed dealer before using these products on Liberty-Link soybean varieties.*

6) What are the optimum spray volumes and nozzle tips for use with Ignite?

Since Ignite is a contact herbicide (non-translocated), optimum coverage is critical for success. Avoid the use of nozzle tips and spray pressures that will produce fine (<250 microns) or coarse (>350 microns) sprays. Optimum coverage with Ignite can be obtained using a minimum spray volume of 15 GPA and flat fan nozzle tips.

7) Does time of application influence Ignite performance?

Yes, Ignite performance can be greatly influenced by the time of application. Ignite should not be applied near twilight or dusk. The optimum time of application for Ignite is between 9:00 a.m. and 6:00 p.m.

8) When can Ignite safely be applied to Liberty-Link soybeans?

Ignite 280 2.34SL can be applied from soybean emergence or VE up to -- but not including -- the bloom stage of growth or R1 (Figure 5).



Figure 5. R1 soybean growth stage.

Source: Dr. Palle Pedersen, Iowa State University.

9) What rates of Ignite can be used on Liberty-Link soybeans?

Ignite 280 2.34SL can be applied in Liberty-Link soybeans as follows:

Use Pattern	1st Application	2nd Application ^a	Season Maximum
Option 1	22 oz/A	22 oz/A	44 oz/A
Option 2	29-36 oz/A ^b	none	36 oz/A

^aSequential applications should be made 10-14 days apart.

^bDo not apply Ignite 280 2.34SL at rates greater than 22 oz/A past the V3-V4 stage of soybean growth.

*Refer to the latest edition of the UGA Pest Management Handbook for the most current rate recommendations.

10) Are there any rotational crop concerns related to the use of Ignite on Liberty-Link soybeans?

Ignite has limited soil activity; thus, rotation restrictions are very favorable. Labeled rotational crop restrictions for Ignite 280 2.34SL are as follows:

Rotational Crop	Plant-Back Interval (days)
Canola, corn, cotton, rice, soybean, sugarbeets	0
Root and tuber vegetables, leafy vegetables, Brassica leafy vegetables, and small grains (barley, buckwheat, oats, rye, triticale, wheat)	70
All other crops	180

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Cooperative Extension

College of Agricultural and Environmental Sciences

July 1, 2010

COTTON PEST MANAGEMENT NEWSLETTER #2

COTTON SITUATION: The Georgia Weekly Crop Progress and Condition Report for the week ending June 27th listed the crop as 54 percent squaring and 9 percent setting bolls which is ahead of the 5-year averages of 47 and 6 percent. The acreage report released by USDA on June 30, 2010 indicated that Georgia producers planted 1.25 million acres of cotton (find online at:

http://www.nass.usda.gov/Publications/Reports_By_Date/2010/June_2010.asp). During recent days scattered thunderstorms have been common and have provided relief from hot and dry conditions in some areas. The crop is rated 30% fair, 52% good, and 13% excellent.

INSECT SITUATION: Tarnished plant bug adult migration to cotton has tapered off in the past week to 10 days. Aphid populations have been slow to build, but expect numbers to increase in the coming weeks. Spider mites have been reported in some fields; the presence of spider mites in a field should influence management decisions for other pests. Threshold levels of stink bug damage have been reported on early planted cotton.

Tarnished Plant Bugs: Adult tarnished plant bugs (TPB) were common in squaring cotton during mid-June. Square retention was below the threshold level of 80% in a higher percentage of fields than normal. If you were not scouting squaring cotton when plant bugs were active, you may have an unpleasant surprise when you do look. Fortunately it appears that the heavy migration of adult TPBs from wild host plants has declined. However, we still encourage producers and scouts to monitor retention and be observant for TPBs. In fields which were infested with adults TPBs, scouts should be observant for immature TPBs (see images below). 2 Photo by Barry Freeman, ipmimages.org

Photo by Russ Ottens, ipmimages.org Immature TPBs are very mobile and are most frequently detected using a drop cloth. You may also observe immature TPBs feeding in squares and/or in blooms. Medium and large squares damaged by tarnished plant bugs may not be shed by the plant. However, when these damaged fruiting positions bloom the flower petals and/or anthers may be misshapen or have areas of localized discoloration. Such damaged blooms are often referred to as "dirty blooms" (see image below). Although we do not have an established threshold for dirty blooms, we would be concerned if the dirty bloom percentage is in excess of 15 percent and treatment should be considered. In fields where dirty blooms are common, we would recommend the use of a drop cloth to assess plant bug populations. Drop cloth thresholds for TPBs used in the Mid-South (where TPBs are a consistent and major pest) are:

Prior to Bloom: 1 per 6 row feet After First Bloom: 3 per 6 row feet

Cotton Aphids: Aphid populations have been slow to build to date, but during recent days we have had reports of areas of fields becoming more heavily infested. Most likely aphid numbers will build in the coming days and weeks. It is rare that we treat aphids with insecticide on a widespread basis in Georgia as we typically can wait on the naturally occurring fungus which causes populations to crash.

Boll Weevil Eradication Assessment (65 cents per bale): BWEP assessment fees will now be calculated and collected on a per bale assessment. The assessment for 2010 is 65 cents per bale and will be deducted in the same manner as the Cotton Board and Georgia Cotton Commission fees.

Stink Bugs: A small percentage of cotton is setting bolls, however we have received several reports of threshold levels of internal boll damage. In most years we tend to see higher damage initially in early and late planted fields. Most stink bugs observed in the field are brown stink bugs. Once cotton begins setting bolls, begin monitoring for stink bugs and damage. Bolls about the diameter of a quarter should be examined for internal damage (callous growths or warts on the inner surface of the boll wall and/or stained lint). During the first week to 10 days of bloom when bolls the diameter of a quarter are not present, sample the largest bolls available. Stink bugs prefer to feed on medium sized bolls but will feed on smaller bolls. Feeding damage 3 on small bolls may cause the bolls to shed. Small bolls which are damaged will often have jelly-like areas in locules. Below find an example of field template developed by southeastern cotton entomologist to assist with stink bug scouting and decision making. Field templates will be sent to county extension offices by mid-July. 4
Acephate (acephate)Pyrethroid (several)Centric (thiamethoxam)Trimax Pro (imidacloprid)Cruiser (thiamethoxam)Gaucho Grande (imidacloprid)Aeris (imidacloprid)Bidrin (dictophos)Avicta (thiamethoxam)Intruder (acetamiprid)Vydate (oxamyl)Acephate (In-furrow) (acephate)Dimethoate (dimethoate)Acephate (seed) (acephate)Temik (aldicarb)Spider Mite Flaring0 = None, 1 = Slight, 2 = Moderate, 3 = Severe
Mean Rating18 ResponsesN = 16N = 10N = 6N = 10N = 11N = 11N = 12N = 10N = 7N = 13N = 14N = 13N = 13N = 18N = 18

Spider Mites: During recent years we have observed an increased incidence in the presence of spider mites in Georgia cotton fields. To date we have received reports of the presence of spider mites in cotton from several areas. The presence of spider mites in a field should influence insect pest management decisions for other pests. Insecticides should only be used on an as needed basis and when possible insecticides which are least likely to flare spider mites should be used. It is important we do everything possible to avoid having problems with spider mites. Miticides used for control of spider mites are expensive. For the past three years we have consistently flared mites on the Experiment Station in Tifton. Recently 22 cotton entomologist representing 14 states across the cotton belt responded to a survey on insecticide performance in cotton. In addition to rating efficacy on of insecticides on individual pests, entomologists were asked to rate the risk of flaring spider mites.

Spider Mites (*Tetranychus urticae*)

Description: Spider mites are very small and wingless; barely visible without magnification. Spider mites are not insects and include the following developmental stages: egg, 6 legged larvae, 8 legged nymphs, and adults. Color of immatures and adults varies from yellowish to greenish to red. Although several spider mite species may infest cotton, the most common is the two spotted spider mite which is so named because of two dark areas on the sides of the 5 Photo by David Cappaert, ipmimages.org abdomen. Eggs are round and cream colored and are only visible with the aid of a hand lens for magnification.

Early mite damage on folds of leaf (bottom left). Underside of leaf, notice discoloration in folds of leaf that correspond with leaf symptoms on top of leaf (bottom right). Magnified view of spider mites and eggs (top).

Life History: Spider mites are typically considered a dry weather pest; however mites may be problematic in any environment. Initial mite infestations are often spotty and localized arising near field margins, weed clumps, telephone poles, or other sources of populations. Mites disperse locally by crawling; widespread mite infestations can be a result of mechanical dispersal by farm machinery, scouts walking fields, and windy conditions. The complete life cycle requires as few as 2 weeks and females may lay up to 100 eggs. Thus populations can increase rapidly. Mites are very susceptible to predation and disruption of beneficial insects with broad spectrum insecticides increases the likelihood of population explosion.

Damage: Mites feed by sucking plant juices from the underside of leaves. Early symptoms of mite infestation and damage include small chlorotic or yellowish to red spots near folds in the leaf and along the main leaf veins. As infestations and damage become more severe, leaf mottling and reddening become more obvious and in severe cases may cause premature defoliation.

Scouting and Reporting: Be observant for mite damage as you walk and scout the field for other pests. If suspected mite damage is observed, examine the underside of affected leaves with a hand lens to confirm the presence of mites. If mites are observed, indicate "spider mites observed" in the comments section; it is important that mite problems are detected early. Mite infestations are often localized in fields initially and may spread in time. If mites are observed in numerous areas of a field, examine the 5th leaf below the terminal of randomly selected plants (or plants being examined for corn earworm) for the presence of mites and report as the percentage of plants infested.

Mite Damage Symptomology: The series of photos below shows progressively more severe mite injury symptoms on leaves. It is important to recognize mites early! Immature TPBs are very mobile and are most frequently detected using a drop cloth. You may also observe immature TPBs feeding in squares and/or in blooms. Medium and large squares damaged by tarnished plant bugs may not be shed by the plant. However, when these damaged fruiting positions bloom the flower petals and/or anthers may be misshapen or have areas of localized discoloration. Such damaged blooms are often referred to as "dirty blooms" (see image below). Although we do not have an established threshold for dirty blooms, we would be concerned if the dirty bloom percentage is in excess of 15 percent and treatment should be considered. In fields where dirty blooms are common, we would recommend the use of a drop cloth to assess plant bug populations. Drop cloth thresholds for TPBs used in the Mid-South (where TPBs are a consistent and major pest) are: Prior to Bloom: 1 per 6 row feet After First Bloom: 3 per 6 row feet

INSECT UPDATES: Check the **Cotton Insect Hotline (1-800-851-2847)** for updates on current insect conditions. The Cotton Pest Management Newsletter and additional cotton production information is also posted on the UGA Cotton Homepage at:

<http://www.ugacotton.com>

Sincerely,
Phillip Roberts

Extension Entomologist

Putting knowledge to work

COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES, COLLEGE OF FAMILY AND CONSUMER SCIENCES, WARNELL SCHOOL OF FOREST RESOURCES, COLLEGE OF VETERINARY SCIENCES

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