North Carolina
Crop Profile
Poultry

PRODUCTION FACTS
- Poultry production accounts for 26.6 percent ($2.2 billion) of all agricultural income in North Carolina.
- North Carolina ranks first in the U.S. in the number of turkeys (53.5 million) produced.
- North Carolina ranks fourth in the U.S. in the number of broilers (665 million) produced.
- North Carolina ranks ninth and tenth, respectively, in the U.S. in the number of non-broiler chickens (17.2 million) and eggs (2.8 billion) produced.

PRODUCTION REGIONS
Chicken production (layers, broiler breeders, and broilers) essentially extends from Gates, Pitt, Craven, and Pender counties in the east to Cleveland, Burke, Caldwell, and Ashe counties in the west. North Carolina’s turkey production region follows a similar east-west distribution but extends no farther north than Pitt, Chatham, and Iredell counties. There are two distinct areas of concentrated turkey production within this region: an eastern area centered around Sampson, Duplin, and Wayne counties and a western area centered around Union, Anson, and Stanly counties.

PRODUCTION PRACTICES
Commercial poultry production is predominantly a vertically integrated system in North Carolina. Production companies (integrators) contract with growers to produce birds or eggs. In general, the integrator supplies birds, feed, and often supplemental materials (medications, pesticides, etc.). The integrator is also responsible for hatchery management, transport, slaughter, and marketing. The grower builds and maintains the houses, installs and maintains equipment, handles daily flock management, and disposes of dead birds and waste.

Birds are housed in large structures with floor areas ranging from 12,000 square feet to more than 20,000 square feet. Buildings have automated feeders and either bell-type, nipple, or cup watering systems. Broilers and turkeys are raised on deep litter (wood shavings) in open-floor environments where birds can move freely throughout the house. A production cycle for broilers generally lasts six weeks, after which birds are removed to market. A new flock of day-old broilers is placed in the broiler house within two to four weeks, allowing time for the grower to clean and disinfect the building. Turkey production schedules and methods are somewhat different. Young turkeys are most often placed in brooder houses for the first six weeks of their lives, after which they are moved to growout houses until they are sold to market after another 12 to 18 weeks of growth. A two- to four-week period is allowed before a new flock is placed in either turkey brooder or growout houses to allow for cleaning and disinfection. Wastes (manure mixed with litter) are generally removed from broiler and turkey growout houses once a year. Old litter is generally replaced after each flock is removed from turkey brooder houses.

Broiler-breeder hens are first housed in open-floor environments or pens where they are reared to 20 to 22 weeks of age. The arrangement and management of these houses are similar to that described for broilers. Roosters are similarly housed until breeding age. The breeding flock (hens and roosters) is then transferred to production houses where hens begin to lay fertile eggs at about 24 weeks of age. The birds are held in production for an additional 56 to 44 weeks, at which time they are sold to the market. Production broiler-breeder flocks are confined in modified open-floor housing, where two thirds of the space (along walls) consists of a raised,
slatted floor. Most of the manure collects beneath these slats. The remaining central portion of the floor (scratch area) consists of deep litter. Water and feed lines are located over the slatted area of the house. Automated nest boxes are positioned down the length of the house along the raised slats on both sides of the scratch area. Once the broiler-breeder flock is removed, nest boxes and slats are taken from the building to allow a thorough cleanout. Manure and litter are removed, the building and equipment are washed and disinfected, and the system of slats and nest boxes is reinstalled for a new flock of birds. Several months often elapse between flocks.

Layer pullets are first placed in cages or open-floor environments for six to eight weeks. Floor-reared birds are transferred to rearing cages until ready for production. All layer pullets are then reared in cages until they are 18 to 20 weeks of age, after which they are transferred to production housing. Laying flocks are held in production until about 75 weeks of age. Commercial layers are confined to cages (three to four birds per cage) within buildings. Rows of cages are most often tiered three to four cages high, each tier slightly offset from the one below to prevent droppings from contaminating the birds in lower cages. Four to eight rows of tiered cages extend the length of the house. Rows are arranged back to back so that three to five walkways can be used for inspection and maintenance. Automated feeders and cup or nipple drinkers provide food and water to each cage. An automated egg-handling system collects eggs as they are laid. Manure may be allowed to collect in a deep pit beneath cages, or it may be flushed into a lagoon. Manure collected in deep-pit designs (high-rise housing) accumulates until the layer flock is removed; liquid waste-handling systems are flushed daily. The cleanout interval between flocks is similar to that for broiler breeders, although the cages and equipment are generally left in place while the building is cleaned and disinfected.

**PESTS AND MANAGEMENT**

Two broad categories of pests affect poultry: ectoparasites—mites and insects living and/or feeding on poultry (mites, lice, bed bugs); and structural or environmental pests—flies, mosquitoes, litter beetles, dermestid beetles, cockroaches, spiders, and red imported fire ants. This latter category of pests, associated with the environment of modern confinement poultry production, directly damages poultry structures, is a potential or documented vector of disease and avian parasites, or is a source of nuisance, as reported by producers in a 1993 survey.

**Ectoparasites**

These pest infestations are infrequent and typically limited to breeding flocks or layers. Broilers and market turkeys are seldom if ever affected. Management of ectoparasites largely consists of whole flock treatments whenever infestations are detected by scouting birds and/or inspection of the structure and equipment (nest boxes, curtains, slats, cages). Other effective management techniques are not available. It is estimated that slightly more than 4 percent of breeder birds and layers are treated for ectoparasites each year. Pesticides are applied directly to the birds for control of northern fowl mites and poultry lice. The average number of treatments applied directly to birds ranges from 1.2 to 5.5. Premise treatments are most often applied to control red chicken mites, bed bugs, and poultry lice. Permethrin, pyrethrins, carbaryl, tetrachlorvinphos, and RaVap (dichlorvos + tetrachlorvinphos) are applied to the birds as well as the premises. Dichlorvos is occasionally used as a flushing agent/toxicant space spray for bed bugs. Malathion is labeled for bird application for mite and louse control but is seldom, if ever, used for this purpose by commercial producers. Cyfluthrin may also be used as a premise treatment to control bed bugs as long as birds are not present.

Although pyrethroid resistance in fowl mites, lice, and bed bugs appears to be minimal, the availability of carbaryl, tetrachlorvinphos, and dichlorvos is believed to be essential to minimize resistance potential unless new classes of compounds become available.

**Structural / environmental pests**

This category of pests is widespread and affects every stage of poultry production to a greater or lesser extent. The house fly (Musca domestica) and other fly species with similar biology and habits can generally be managed with minimal use of pesticides where appropriate cultural and biological control practices are most effective (broiler breeders and layers). Manure management to reduce moisture reduces fly-breeding potential and enhances the effectiveness of naturally occurring fly parasites and predators. Releases of beneficial insects (primarily parasitic wasps) can also be effective in the control of flies in broiler-breeder and layer operations. Trapping is useful where fly populations are relatively low. However, manure moisture and biological control are difficult to manage throughout an entire flock cycle. Traps are difficult to maintain and are quickly overwhelmed when other elements of the management system fail. Failures occur frequently and require the use of insecticides to reduce fly populations. More than half (54 percent) of producers are estimated to use insecticides to control a variety of dipteran pests.

Other pests such as the darkling beetle (Alphitobius diaperinus) and the dermestid beetle (Dermestes maculatus) are also prevalent in poultry houses. Darkling beetles are by far the most serious problem, prompting approximately 81 percent of producers to apply pesticides for beetle control. The red imported fire ant, spiders, mosquitoes, and cockroaches may also infest poultry houses and account for a little more than 10 percent of the pesticides applied. Cultural and biological control practices are largely ineffective for these pests, requiring between-flock application of insecticides to control their populations.

Insecticides used to control some or all of these structural/environmental pests include those already mentioned (carbaryl, tetrachlorvinphos, dichlorvos, permethrin, pyrethrin, and cyfluthrin), as well as chlorpyrifos, lambda-cyhalothrin, orthoboric acid, dimethoate, malathion, methoxyi, trichlorfon, cyromazine, and nithazine.

Pyrethroid resistance in house flies is well documented. However, the extent to which it occurs in North Carolina poultry production has not been quantified recently. Pyrethroid resistance among other structural/environmental pests is not believed to be substantial at present, but as in the case of flies, it has not been quantified for North Carolina. The availability of carbaryl, tetrachlorvinphos, dichlorvos, malathion, and other organophosphates/carbamates is believed to be essential to minimize resistance potential at present. The introduction of new classes of compounds into
the poultry industry is minimal; and for pests where no effective management alternatives other than pesticides exist, the outlook for new and economical options for managing resistance is not promising.

**Chemical Options.**

**Chlorpyrifos (Duratrol)**

This newly introduced product is available as a microencapsulated concentrate. Use patterns have not been established for premise treatments to control flies, beetles, and other pests. A new pesticide survey of the poultry industry was conducted in April 1999, and results were available that fall. Treatment is applied as a premise fog or spray at a rate of 1 gallon (0.04 lb active ingredient) spray per 1,000 square feet of surface.

**Dichlorvos (Vapona)**

This material is available as an emulsifiable concentrate. Treatments are rarely applied to control ectoparasites during cleanup routines following the sale of an infested breeder or layer flock; more often, it is used for fly control. Dichlorvos is applied as either a space spray (0.001 lb active ingredient/1,000 cubic feet) or as a premise spray (0.01 lb active ingredient/1,000 square feet of surface area). It is occasionally used as a spot larvicide treatment for fly control at a rate of 0.002 to 0.02 pound active ingredient per 100 square feet of manure beneath slats, cages, and drinkers. An estimated 800,000 square feet (0.4 percent) of premise area are treated with dichlorvos.

**Dimethoate (Cygon)**

Available as an emulsifiable concentrate, Dimethoate is used at an estimated 1 percent or a little more (2 million square feet) of premise area. The compound is used primarily as a premise treatment for fly control (0.08 to 0.2 lb active ingredient/1,000 square feet of surface area). It is occasionally used as a spot larvicide treatment (0.02 lb active ingredient/100 square feet of manure) beneath slats, cages, and drinkers.

**Malathion**

Available primarily as an emulsifiable concentrate and dust, Malathion is used as a premise treatment on approximately 6 percent (12 million square feet) of poultry house area by North Carolina producers. Premise treatments are applied for fly and beetle control at a rate of 0.08 to 0.2 pound active ingredient per 1,000 square feet of surface area. Dust formulations are applied at about 0.3 pound active ingredient per 1,000 square feet.

**Tetrachlorvinphos (Raban)**

Available as a dust and wettable powder, Tetrachlorvinphos is applied to about 18 percent of the birds treated for ectoparasites and 10 percent of premise area (20 million square feet) to control various pests. Treatments are generally applied as high-pressure sprays at a rate of 1 gallon (0.04 lb active ingredient) spray per 100 birds. Premise applications for a variety of pests are made at a rate of 0.05 to 0.8 pound of active ingredient per 1,000 square feet of surface area. Dust formulations are applied to birds (dust boxes) at a rate of 0.01 to 0.2 pound of active ingredient per 100 birds, and to premises for ectoparasites and beetles at a rate of 0.05 to 0.2 pound active ingredient per 1,000 square feet of surface area. Rabon is occasionally used as a spot larvicide treatment for fly control at a rate of 0.08 pound active ingredient per 100 square feet of manure beneath slats, cages, and drinkers.

**Tetrachlorvinphos + dichlorvos (RaVap)**

Available as an emulsifiable concentrate, RaVap is applied to approximately 10 percent of the birds treated for ectoparasites and 7 percent of premise area (14 million square feet) for a variety of pests. Treatments are applied as high-pressure sprays at a rate of 0.04 pound tetrachlorvinphos + 0.01 pound dichlorvos per 100 birds. Premise applications are made at a rate of 0.04 + 0.01 pound to 0.08 + 0.02 pound of active ingredient per 1,000 square feet of surface area for a variety of pests in poultry houses. RaVap is occasionally used as a spot larvicide treatment for fly control at a rate of 0.08 + 0.02 pound active ingredient per 100 square feet of manure beneath slats, cages, and drinkers.

**Trichlorfon (Dipterex)**

Available as soluble powder, Trichlorfon use was not reported by poultry producers in the 1993 survey. The material has seen limited use within the past two to four years. A mail survey of North Carolina poultry producers was conducted by the North Carolina Cooperative Extension Service in 1999 and should establish an accurate estimate of its use during 1996. The material is applied at a rate of 0.2 pound active ingredient per 1,000 square feet of surface area for fly control.

**Carbaryl (Sevin)**

Dust, flowable, wettable powder, and bait formulations are available. Carbaryl is applied to an estimated 42 percent of layer and broiler-breeder birds treated for ectoparasites. Treatment is generally applied with high pressure sprays at a rate of 1 gallon (0.04 lb active ingredient) spray per 100 birds. Premise applications are made at a rate of 0.05 to 1 pound active ingredient per 1,000 square feet of surface area for a variety of common pests. Dusts are used to treat individual birds (dust boxes) and premises (litter) at a rate of 0.05 pound active ingredient of dust per 100 birds or 1.25 pounds active ingredient per 1,000 square feet of surface area. Bait formulations (0.15 lb active ingredient/1,000 square feet) are used to control darkling beetles. Each year, 23 percent (46 million square feet) of surfaces in poultry houses are estimated to be treated with carbaryl.

**Methomyl (Apache, Golden Malrin)**

Available as a bait for fly control, Methomyl is used as a scatter bait or in fly traps at a rate of 0.005 pound active ingredient per 1,000 square feet. An estimated 360,000 square feet are treated with methomyl each year.

**Cyfluthrin (Tempo, CountDown)**

This relatively new material is available as dust, wettable powder, and flowable. Its use patterns for poultry have not been established. A 1999 mail survey of North Carolina poultry producers by the North Carolina Cooperative Extension Service is likely to show that cyfluthrin has largely replaced many insecticides previously used for darkling beetle control. Premise treatments are applied at a rate of 0.004 to 0.008 pound active ingredient per 1,000 square feet of surface area. Dust formulations (0.1 percent) are applied at 0.02 and 0.05 pound active ingredient per 1,000 square feet of surface area.

**Lambda-cyhalothrin (Grenade, Commodore)**

Use patterns for this relatively new material for poultry have not been established. It is available as a wettable powder and microencapsulated concentrate. A mail survey
of North Carolina poultry producers was conducted by the North Carolina Cooperative Extension Service in 1999. Used primarily for fly control in poultry houses, cyhalothrin is applied as a premise spray at a rate of 0.001 to 0.01 pound active ingredient per 1,000 square feet of surface area.

**Permethrin (various trade names)**
Available as a dust, wettable powder, and emulsifiable concentrate, Permethrin is used on more than 10 percent of the birds (layers, breeders, pullets) treated for ectoparasites. Treatment is most often applied to birds at a rate of 1 gallon (0.004 lb active ingredient) spray per 100 birds. Premise application at the same concentration is made at a rate of 1 to 2 gallons spray per 1,000 square feet of surface area. Dust formulations (0.25 percent) are applied to birds (dust boxes) and premises (litter) at a rate of 1 pound (0.003 lb active ingredient) per 100 birds or 10 pounds (0.03 lb active ingredient) per 1,000 square feet of litter surface, respectively. Premise treatments for fly and beetle control are applied at a rate of 0.01 to 0.05 pound active ingredient per 1,000 square feet of surface area. Space sprays for fly control are applied at approximately 0.001 to 0.006 pound active ingredient per 1,000 cubic feet of volume.

Permethrin is applied to approximately 17 percent (34.1 million square feet) of area in North Carolina poultry houses to control a variety of pests.

**Pyrethrin (various trade names)**
Available primarily as an emulsifiable concentrate, these materials are used mainly as space sprays for fly control. About 6 million square feet of the area in N.C. poultry houses (3 percent) are treated with pyrethrins. The insecticide (synergized with PBO) is generally applied at a rate of 0.0002 to 0.001 pound active ingredient per 1,000 cubic feet of volume. It is used to treat 6 percent of breeders and layers for mites and lice at a rate of approximately 0.01 pound active ingredient per 100 birds.

**Orthoboric acid (SafeCide)**
Available primarily in dust and bait formulations and used for the control of darkling beetles, boric acid is applied at a rate of approximately 10 to 20 pounds active ingredient per 1,000 square feet of floor area. The material may also be applied as a spray at the same rate. The bait is applied at a rate of approximately 3 to 6 pounds active ingredient per 1,000 square feet of floor area. About 600,000 square feet of premise area are treated with boric acid each year.

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**Cyromazine (Larvadex, CyFly)**
Available as a feed additive and soluble liquid, cyromazine is used for the control of flies in broiler breeders, layers, and pullets. The feed additive is administered at 0.01 pound active ingredient per ton of feed for a period of 4 to 6 weeks per treatment cycle. The liquid formulation is applied to manure beneath slats or cages at a rate of approximately 0.01 pound of active ingredient per 100 square feet. Cyromazine is used for fly control in slightly more than 76 percent of breeders and layers each year. The material was used for only about 8 weeks per flock cycle of 44 to 72 weeks.

**Nithiazine (QuikStrike)**
Formulated as an insecticidal strip and used for fly control, nithiazine strips (1 percent) are hung in poultry buildings at 1 strip per 100 to 500 square feet. The product is new to the market, and estimates of use will be established with the mail survey of North Carolina poultry producers conducted by the North Carolina Cooperative Extension Service in late 1999.

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**REFERENCES**

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