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# **Development of Nicarbazin for Application as an Infertility Agent**

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### National Wildlife Research Center Scientists Explore Mechanisms to Reduce Canada Goose Fertility

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research facility devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and acceptable methods, tools, and techniques.

As goose populations and urban areas expand and overlap, Canada geese are often considered a nuisance and potential health problem (e.g., fouling land and water, colliding with aircraft). In addition, goose-related damage to crops and rangelands causes the loss of millions of dollars in agricultural production. Humane, non-lethal methods of managing the sizes of Canada goose flocks that reside near or on airports, golf courses, industrial parks, government sites, and city parks are urgently needed. The goal of this research project is to develop and field test nicarbazin as an economical and effective agent to control reproductive fertility in overabundant bird populations.

Nicarbazin has been approved by the U.S. Food and Drug Administration (FDA) for the treatment of the parasitic disease coccidiosis in broiler chickens. A side effect of nicarbazin when given to laying chickens is decreased egg hatching and, at higher doses, decreased egg production. It appears that one mechanism by which nicarbazin reduces the viability of eggs is by causing disruption of the vitelline (yolk) membrane, allowing the yolk and albumin to flow together, creating conditions under which the embryo cannot develop. Research to develop nicarbazin as a contraceptive agent has shown great promise in reducing the reproductive success of resident Canada geese.

### **Major Research Accomplishments:**

• WS demonstrated that the chemical nicarbazin is effective as a reproductive inhibitor for Canada geese.



## Applying Science and Expertise to Wildlife Challenges

**Nicarbazin**—NWRC has been studying the use of nicarbazin to control overabundant wild birds. In an initial study conducted in 1998, NWRC tested the effect of nicarbazin on Japanese quail reproduction in a laboratory setting. The study demonstrated that nicarbazin was effective in reducing the hatchability of eggs in species other than domestic chickens. In 1999, studies showed that the Canada goose successfully absorbed nicarbazin into the blood, although at a lower rate than was seen in the chicken. Subsequent studies in 2000 and 2001 showed that nicarbazin is effective in reducing the hatchability of eggs in waterfowl species including mallards and Canada geese. A multiple-year study in Colorado showed that use of nicarbazin in areas where Canada geese are nesting can effectively reduce the number of eggs that hatch under field conditions. Nicarbazin is therefore considered a highly promising avian infertility agent for use in controlling Canada goose populations.

**Palatability of Nicarbazin Bait**—Nicarbazin was shown to be absorbed less efficiently by Canada geese than chickens. Increasing the concentration of nicarbazin in bait for Canada geese resulted in poor palatability and not enough bait consumption to provide contraception. Cracked and whole corn coated with a mixture of nicarbazin, corn oil (to act as glue), and milk powder (to mask the taste) had high acceptance by Canada geese, but many non-target birds would also consume this bait. Experiments with captive Canada geese demonstrated that a product called OvoControl-G<sup>™</sup> (developed by Innolytics LLC) is a highly palatable bait. OvoControl-G<sup>™</sup> is a semisoft, wheat-based bread bait that contains 2500 ppm nicarbazin and resembles a kernel of corn in shape and color. Canada geese in pens at NWRC consumed enough OvoControl-G<sup>™</sup> bait to provide a contraceptive dose of nicarbazin. As a result, OvoControl-G<sup>™</sup> was

### Groups Affected by This Problem:

- Airports and patrons
- Municipalities
- Homeowners
- Homeowners' associations and property managers
- Citizens using urban recreational facilities
- Golf courses and patrons
- Farmers
- Livestock producers
- Natural resource managers

#### **Major Cooperators:**

- Innolytics, LLC
- Wildlife Services Operations

selected as a suitable bait for field efficacy studies that will be used to support registration of nicarbazin by the Environmental Protection Agency (EPA) as a reproductive control agent for Canada geese.

**The Field Efficacy Study**—A field study of the effectiveness of nicarbazin in reducing the hatchability of Canada goose eggs was conducted during spring 2004 in Oregon. After a period of acclimation, nicarbazin-treated bait was made available to free-ranging, resident Canada geese for 6 weeks. Nests were located and monitored until hatching or for at least 5 days beyond the expected hatching date to determine hatchability. Sixty-nine nests at treated sites and 46 nests at non-treated sites were monitored to determine the hatching success of Canada goose eggs. Hatchability at sites where nicarbazin-treated bait was consumed by geese was approximately 51% lower than hatchability at sites where non-treated bait was consumed. Data from this study are being submitted to support EPA registration of nicarbazin as a reproductive inhibitor for Canada geese.

#### **Selected Publications:**

- Stahl, R. S.; VerCauteren, K. C.; Buettgenbach, T. L.; Johnston, J. J. 2003. Determination of 4,4' dinitrocarbanalide (DNC), a component of nicarbazin, in Canada Goose (Branta canadensis) eggshells using high-performance liquid chromatography. Journal of Agriculture and Food Chemistry 51:1130-1135.
- VerCauteren, K. C.; Lavelle, M. J.; Shively, K. J. 2003. Characteristics of grit in Canada goose gizzards. Wildlife Society Bulletin 31: 265-269.
- VerCauteren, K. C.; Marks, D. R. 2003. Movements of urban Canada geese: implications for nicarbazin treatment programs. In: Moser, T. J., et al. eds. Proceedings of the International Canada Goose Symposium; 19-21 March 2003; Madison, Wisconsin.