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CHEMOSTERILANTS AND BIRD CONTROL

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JACKSON: We move then into the final phase of our program. I'll call on Dr. Woulfe of the Searle Company first. I heard of his work very briefly last spring; it sounded very intriguing, so I'm waiting to find out more of what happened in this area and the role of chemosterilants in population biology.

WOULFE: The total scope of chemosterilants is very wide so I will comment only on the pigeon chemosterilant developed by G.D. Searle & Co. and then briefly on the role of chemosterilants, generally, in bird control.

Searle's ORNITROL (SC-12937, azacosterol) is a chemosterilant which inhibits reproduction in the pigeon and is to be used as a means of controlling pigeon populations. It is fed as a treated whole corn bait (0.1%) for a period of ten days and inhibits reproduction for about six months. We recommend treatment in the early spring just before the onset of the peak reproduction season to be followed, if necessary, by a second treatment later in the year.

Azacosterol exerts its inhibitory effect through the blocking of the synthesis of cholesterol, thought to be a vital component in the formation of egg yolks. Interest initially arose in the possible use of cholesterol blockers to delay egg production in starter pullets several years ago. Among others tested was Searle's SC-11952. It was tested in hens, in 1961, at Iowa State University, to determine the effects on egg cholesterol levels and on egg production. This compound showed definite activity. Azacosterol is a more potent analog of SC-11952. Further work with SC-12937 in chickens proved the activity of this compound; and it attracted the attention of Dr. William H. Elder, Professor of Zoology, University of Missouri, who wanted to test the compound's activity in pigeons.

Using pigeons of known fertility, Dr. Elder set about establishing a dose level/duration of treatment-effect commensurate with efficacy in inhibiting ovulation on the one hand and absence of toxic symptoms on the other.

1. Pigeons given azacosterol at a level of 0.01% by weight of diet for 18 days show no signs of toxicity, neither did this level have an inhibitory effect on ovulation.

2. Ten pairs of pigeons were given a level of 0.1% azacosterol for 5 consecutive days. As a result of this treatment 8 out of 10 pairs were infertile for approximately 10 weeks. Thereafter, infertility diminished until at 14-16 weeks after treatment, 5 out of 10 pairs were laying normally, three pairs were laying infertile eggs, and 2 pairs were still anovolatory after 16 weeks. This level showed no signs of toxicity.

3. Ten pairs of pigeons were given 0.1% of drug by weight of diet for 14 days. This involved a total ingestion of 600 mg. After 15 months half were still anovulatory, the others laying intermittently and only partially fertile.

4. An attempt to induce inhibition by a large single dose was unsuccessful 1.0% SC-12937, representing 300 mg. of drug, or the total amount which would normally be ingested during a 10-day period at a bait level of 0.1%, was given in a pullet diet in one day to 10 birds. Only 2 birds stopped laying, the other 8 continued to lay fertile eggs. Further work indicated that the optimum dose/time relationship was at a drug level of 0.1% for a period of 10 consecutive days.

About this time in the development of the drug it became clear that some discrimination against treated wheat was being shown by pigeons. This appeared to take place about the 4th day of consumption and showed itself in the form of reduced intake during the subsequent days of treatment. Various methods were devised to determine whether this was a visual discrimination, a problem of smell, or a problem of taste. When treated and non-treated grain were placed side by side in a darkened environment the difference between treated and non-treated grain just about disappeared. This would indicate that visual differences between treated and non-treated were evident and the bird discriminated against the treated grain in the daylight.

In another trial, wheat was treated with azacosterol and labeled (radioactive iodine) and subsequently placed before pigeons side by side with untreated grain; the pigeons very definitely discriminated against the treated wheat. This trial was conducted in daylight. Subsequent field testing, as will be shown, has proved that ingestion of treated wheat, though subject to some discrimination, is adequate to insure a total intake of drug sufficient to bring about inhibition of reproduction.

Pigeons eat 30 to 45 gm. of food daily. Ingestion of treated bait at a level of 0.1% for 10 days therefore involves a total intake of about 300 mg. of azacosterol.

Pigeon eggs exhibit a normal fertility rate of 90 to 97%. Pigeons incubate their eggs normally for 17 days. They will sit on infertile eggs for up to 3 weeks.

After ingesting treated feed, pigeons will incubate empty nests for an indefinite time. This appears to be a maintenance of broodiness consequent to courting and mating. It is an important factor in depriving fertile birds of favorable nesting sites.

The following three field trials are written up in detail by the investigators Wofford and Elder in the Journal of Wildlife Management, Vol. 31, No. 3, July, 1967. I will touch on the important points of these trials which were very significant in that they involve the free feeding of free-flying pigeons.

1. Ashland Loft. Treated wheat was exposed to some 62 birds during June 21-28, 1964, and during August 7-14, 1964. Each bird consumed 281 mg. of azacosterol. Five months later only 8 squabs had been produced in the colony,

though the long, warm autumn of 1964 enabled wild pigeons to reproduce at a high rate well into December.

By April, 1965, the laying rate had risen to the normal spring peak, but the number of fertile eggs were still well below the level for June, 1964 when 53 out of 55 eggs laid were fertile. This loft was retreated with 270 mg. of azacosterol per bird in April, 1965. In the ensuing 7 months only 10 fertile eggs were laid.

2. Moberly Loft. 100 birds were exposed to azacosterol for 14 days, August 7-23, 1964. Egg laying diminished from 1.8 eggs per pair to 0.3 in September and remained at a low-level for 5 months. By May, 1965, egg laying rose again to normal levels; but fertility, 9 months after treatment, was only 73% as compared to a normal of about 95%. This loft was treated again in May, 1965, and birds layed only 0.2 fertile eggs per pair in June. During June, July, and August, 1965, only 23 fertile eggs were produced by some 47 pairs of pig eons, compared with 216 fertile eggs laid by a similar number in June, July and August, 1964. This loft had experienced some ingress of untreated pigeons during the observation period due to destruction of the colony pattern by shooting.

3. Another trial was conducted in New York City at the invitation of the ASPCA. It was known before starting that tabulation of results would be difficult; yet, in actuality, the trail represented the kind of situation likely to be encountered, if azacosterol were to be used on a practical basis.

Three discreet flocks, each of 150 to 200 birds, were chosen. Two were treated with the usual level of compound for ten days during the last week of April, 1965. The third flock served as control, being fed only untreated wheat. Reproductive success was evaluated by counting the number of fledged young in the treated flocks in proportion to the number of adults and comparing these with the ratio of adult to young in the control flock. Treated flocks showed a decrease in excess of 10% in the number of young, but interflock movement was quite an important factor in diluting the inhibition effect amongst the treated flocks. This experience added weight to the contention that the chemosterilant should be used over a wide area at a given treatment.

4. Another trial was initiated by and was entirely under the auspices of the Health Service Department: of the University of Illinois at Urbana. The purpose of the treatment was the reduction in numbers of an excessive population of pigeons on the Health Service building. Heretofore trials conducted by or under the direction of Dr. Elder used wheat as a bait. In Urbana whole kernel corn was used for the reason that this feed had been used in trapping pigeons over the years and pigeons were familiar with this type of bait. Azacosterol was mixed at the usual .1% level; and the treated corn was exposed for almost six weeks, beginning early April, 1966. Subsequently, 59 birds were trapped and permanently identified for future observation. As may be expected from such long exposure, the production of young was nil up to the end of September. Thirteen tagged birds on postmortem revealed degeneration of their reproductive systems. Twelve similar, but untreated, pigeons examined showed normal gonadal development.

5. Another field trial was initiated in Bangor, Maine in the month of February, 1967, at the invitation of the Department of Health for that city. The enthusiastic cooperation of Fish and Wildlife Services State Supervisor, Mr. Frank Gramlich, contributed enormously to the success of this, the first attempt to use a chemosterilant on a free-living pigeon population in a sizable city. This project got underway too late in the season to obtain much pre-treatment nesting and reproduction information. Accordingly, the total number of pigeons in the town was underestimated at 1,500 to 2,000 when, in reality, the pigeon population was probably in excess of 3,000. Two baiting sites were chosen—one the Maine Central Railroad yards in downtown Bangor, and the second, a feedmill some six miles north of town. For this trial it was decided to use baited poultry pellets inasmuch as this was the common form of feed available to pigeons in the Bangor area. (A subsequent acceptability trial was run on a small scale and showed that Bangor pigeons would in actuality eat whole kernel corn when presented only with that form of food.)

Baiting was begun after an initial pre-baiting period on February 6, 1967, and bait was available to the birds for ten days. Bait was distributed daily, and despite several light snow falls loss of bait was quite minimal. Some 1,500 birds fed at the railroad yards and perhaps 100 to 500 at the feedmill north of town. Acceptance of bait was adequate to inhibit reproduction at the railroad site. Competition from spillage and harassment by a hawk at the feedmill made difficult the accurate evaluation of the results at that site. We do know that nesting amongst birds identified with Rhodamine Red did not occur. Some 25 of these birds were subsequently seen in downtown Bangor.

Results of the baiting were very satisfactory. Some 257 birds (20% of the total) were identified with leg bands and tarsus tapes at the railroad yards. Only four of these were observed engaging in nesting activities in the following months. No eggs or young were found to have been produced by these four birds through July, 1967. Birds which normally fed at the railroad yards nested for the most part in the Bangor Brewer Bridge and nesting success was drastically reduced from a normal of about 100 nests to some ten nesting attempts. At the end of the summer the overall recruitment of young birds into the Bangor flock was greatly diminished with a concurrent marked reduction in the town's pigeon population. We did find, however, that many birds were feeding in the suburbs; and these birds, due to the localization of their feeding habits, were not affected by the baiting carried out at the two sites mentioned. These untreated areas had a normal recruitment quotient. This indicates that a very thorough evaluation of the concentrations and feeding locations of pigeons in any given city is necessary beforehand so that adequate baiting can be carried out.

During the months following, baiting observations were conducted at various times to determine the ratio of young birds to adults in various parts of Bangor. A ratio of about one young bird to ten adults (10%) was observed. Under normal conditions this percentage would be expected to be about 25% to 35%. No nesting was observed or reported in the Rhodamine Red dyed birds which fed at least irregularly on the treated feed at the mill site. Public interest in the red birds was high, and nesting, if it had occurred at all, would most likely

have been reported. The overall effect of the Bangor trail, in 1967, was very favorable.

At this time it was decided to carry out bait selectivity tests in various parts of the country. The most thorough and complex evaluation procedure was set up at the University of Illinois where the following choices were made available:

1. Untreated pellets and wheat and corn.
2. Untreated wheat and corn.
3. Untreated pellets.
4. Untreated wheat.
5. Untreated wheat and pellets.
6. Untreated corn.
7. Treated corn.

Similar work was conducted at Bangor and in Missouri. The result was definite proof that pigeons show first preference for the feed that they are accustomed to eating. This will, however, eat whatever is placed in front of them. The speed with which they adopt the new type of feed is dependent upon the degree of hunger and availability of food. We found, by and large, that corn was the most acceptable feed for pigeons.

6. A second trial at the behest of the Department of Health, Bangor, Maine was initiated early in 1968. This year we had adequate time and preparation to identify the locations and feeding areas of the entire city. We found a greatly diminished population of pigeons in Bangor in the spring of 1968. Failure to recruit young last summer, the apparently fast turnover, and apparent mortality amongst birds in any given flock was conducive to a marked reduction in the total number of birds available for tests early in 1968. Four baiting sites were selected within the City of Bangor. A fifth one, several miles out of town was located in the marshalling yards and cleanout tracks for the Maine Central Railroad.

This last was subsequently abandoned due to bait competition and the fact that pheasants were taking our bait. Baiting at the other sites began on March 7 and continued for ten days. One site in the downtown area was rendered useless by a pigeon lover feeding his birds in direct competition with our bait. This location later turned out to be an excellent control point for evaluating activity of untreated birds amongst treated pigeons within the total area being baited. The reduced number of birds in the downtown railroad yards—175-200 in 1968—as compared to 1200-1500 at the same site in February, 1967, resulted in less competition for feed with a resulting reduction in intake. However, observations over the next several months revealed that the birds did indeed get an adequate amount of the compound to effect inhibition.

A second baiting site—the roof of a building adjacent to the town park-attracted a large number of birds with a resulting keen competition for bait. Some 43 birds out of a total of about 100 were trapped and leg-banded at this site for subsequent observation during the nesting season. Of these 43 some 28 birds were further marked with Rhodamine Red dye under the wings for easier

identification at a distance. At the third baiting site 14 birds out of the total 50 were trapped and held in captivity for further observation.

RESULTS: Of the 23 birds captured and held in Mr. Gramlich's barn, during the period of March 22 through June 3, only two pairs of birds showed breeding activity. For the period, June 3 through August 13, a total of five pairs showed activity. Of these, two pair successfully produced young. A third pair was observed incubating. The last two pairs showed no reproductive activity. There is a diminishing drug effect with the passage of time, but at the fifth month post-treatment breeding success was still far below optimum.

In the town of Bangor, observations were conducted regularly during the months after treatment. During April and May observations (with binoculars) showed that reproductive capacity in heretofore heavy nesting areas was almost eliminated. In previous years, in this nesting area, some 13 houses had as many as 18 occupied nests. In 1968, this number was reduced to 3 observed occupied nests and only one of them had two young in it. On the Bangor Brewer Bridge, which in previous years supported some 100 nests, on May 21, a total of 5 nests were seen, but no young were in evidence at that time. No identified birds could be associated with the 5 nests.

On June 4, a thorough investigation of nesting sites with the aid of a fire brigade ladder was initiated. Amongst 12 known nesting sites observations revealed birds sitting on empty nests, birds sitting on infertile eggs or the nests abandoned. Three young were found or seen in 18 odd nests. Many broken or infertile eggs were found at the periphery of these various nests.

On the Bangor Brewer Bridge on August 13 a total of 7 nests were seen with pigeons incubating 5 of them. These were too high to reach so viability of the eggs, if any, remained unknown. A total of 4 young birds were seen at this observation. Railroad personnel who work in the area reported seeing two successful nests all season. Of course, their area of vision did not encompass the entire bridge.

The synagogue site where the pigeon lover had successfully competed with our treated bait provided a very interesting comparison to other areas. The flock based on adjacent buildings comprised 11 young and 31 adults. This ratio of young to adults is remarkably greater than seen in the treated areas.

CONCLUSIONS:

The reduction in pigeon population from somewhat more than 3,000 in February, 1967, to 500, or thereabouts, in late summer of 1968, is perfectly obvious even to casual observers. This reduction rate—faster than we had anticipated—can be explained when one considers the population dynamics and recruitment rate of pigeons in an average environment in an average year. A pair of pigeons can produce six to ten offspring—New York Health Department claims 10 to 14 offspring in sheltered conditions—and we know that a pigeon population does not increase, even under seemingly excellent environmental

conditions, at this rate. It seems reasonable to assume that a high rate of mortality or turnover—or other factor— in a given flock maintains a relatively stable total pigeon count. It would, therefore, appear safe to say that, in Bangor, the crippling interference with recruitment rate to the total flock will explain the drastic reduction in birds over a two-year period. One way of investigating the recruitment would be to omit treating Bangor population.

I have discussed, rather lengthily I fear, the oral administration of what we think is an effective chemosterilant in pigeons. Criteria can be summarized as follows:

1. Treatment must be effective for a reasonably long period of time-the longer the better.
2. It must be sufficiently non-toxic to avoid mortality and morbidity in the treated birds.
3. It must be available in a form of bait which will not constitute a threat to desirable birds and mammals or to children.
4. It must have a long "shelf-life."
5. It must be non-toxic to formulators and handlers.
6. It must be suitable for a stable, non-migratory bird population where, upon repeat use, an obvious and definite reduction in population is easily discernable and can be effectively maintained.
7. Cost must be within reasonable limits. It must be kept in mind, that unlike toxicants, the amount needed to do the job goes down each year as the population declines.

CONCLUSION: The use of an oral chemosterilant has proved highly effective in pigeons. It has gotten us away to a marked degree from the rebound effect-so detrimental to toxicant control. As to how chemosterilants might be used against migratory nuisance birds constitutes a major challenge to use in the immediate future.