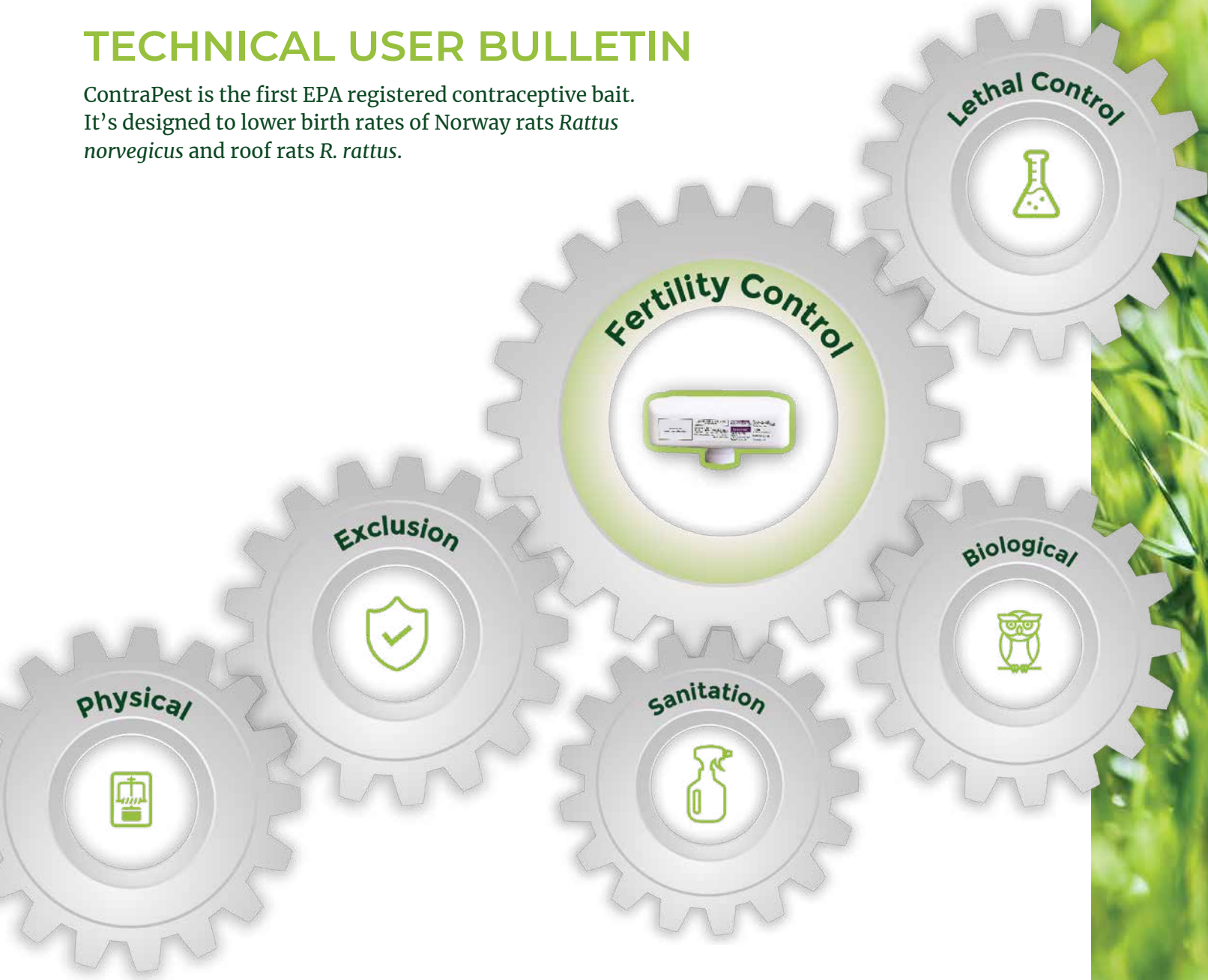


CONTRAPEST

TECHNICAL USER BULLETIN

ContraPest is the first EPA registered contraceptive bait. It's designed to lower birth rates of Norway rats *Rattus norvegicus* and roof rats *R. rattus*.



SENESTECH



contrapest

WHAT IS CONTRAPEST

ContraPest is the first EPA registered contraceptive bait designed to lower birth rates of Norway rats *Rattus norvegicus* and roof rats *R. rattus*. ContraPest provides complementary benefits to existing integrated pest management (IPM) practices, without effects on non-target populations such as predators, pets and humans.

FEATURES & BENEFITS



FEATURES

- Liquid bait with high fat content and sweet taste
- Quickly impacts fertility upon consumption
- Proprietary tank delivery system. Dispensed inside tamper resistant bait stations
- Not a sterilant, effects of ContraPest reversible over time
- Active ingredients are metabolized upon ingestion
- Recommend strategic placement at foraging locations, not standard spacing

BENEFITS

- Repeated consumption leads to reduced fertility
- Sustained rat population reduction
- Minimizes risks to non-target species populations
- Reduced risk to predators
- Deployment flexibility to meet your program objectives

HISTORY

The founders of SenesTech, developed a model for inducing menopause in mice. This work was licensed for women's health research and became known as Mouseopause. Using the underlining ideas of Mouseopause, the founders realized the technology to induce menopause in rodents could become a useful tool for pest rodent management. This commercial product, ContraPest, has the potential to be an effective means of pest control for other small mammalian species.

WHY RODENTS LIKE IT

ContraPest is a liquid formulation that is high in fat and tastes sweet, which is a preferred flavor profile for rodents, particularly rats. The liquid formulation was developed in part based on rodents' significant daily water requirement. Rats consume ~10% of their body weight in water each day. In early testing, ContraPest was consumed in the presence of other food and water sources.

With a finalized formulation, SenesTech registered ContraPest with the EPA in 2016 as a non-lethal rodenticide for Norway and roof rats.

THE KEY INGREDIENTS IN CONTRAPEST

ContraPest affects the reproductive system of both male and female rodents. The two active ingredients are 4-vinylcyclohexene diepoxide (VCD) and triptolide. Triptolide, derived from the thunder god vine, *Tripterygium wilfordii* Hook, has been used in ancient Chinese medicine and some over the counter supplements. Triptolide has long been known to affect spermatogenesis and the growing follicles in females. VCD is a standard industrial chemical that depletes primary and primordial follicles in the ovary.

MODE OF ACTION

The concentration of ContraPest's active ingredients, 4-vinylcyclohexene diepoxide (VCD) and triptolide, is 0.09604% and 0.00118%, respectively. These concentrations are much less than those used in research literature. By putting these active ingredients together, ContraPest effectively targets the fertility mechanisms of both male and female rats, reducing their ability to reproduce.

Purified triptolide is a diterpene triepoxide that has attracted research attention for its effects on mammalian fertility¹⁰. Triptolide affects the reproductive systems of female and male mammals, with males more sensitive to its effects than females. Epididymal sperm are most sensitive to triptolide effects which reduces the number and motility of these gametes⁴⁻⁹. In female rats, triptolide causes significantly prolonged estrous cycles, or few to no ovulations, and depletion of secondary follicles in the ovary¹¹.

VCD is a byproduct of mammalian liver catabolism of the industrial chemical 4-vinylcyclohexene (VCH). When ingested, VCD causes depletion of primordial and primary ovarian follicles in mammals¹⁻³. Although VCD interferes with ovarian function, it does not affect endocrine function and therefore is not an endocrine disruptor.

ContraPest is a long-term solution which decreases rodent populations by mitigating reproduction. Continual uptake of ContraPest is required to suppress fertility and keep rat populations down.

LOW-RISK & INTRINSIC BENEFITS

Bioaccumulation and Biomagnification

Studies with ¹⁴-C labelled VCD show that VCD is quickly absorbed and metabolized by ovarian tissue, which is the source of its ovotoxic effects. The plasma half-life of VCD is 14.2 minutes; the average plasma residence time is 15.0 minutes¹⁴.

Triptolide is rapidly metabolized in male Sprague Dawley rats^{17,18}. The plasma half-life of triptolide in male rats, when injected intravenously at 0.6 mg/kg body weight, is 15.10 ± 4.44 minutes. When 0.6 mg/kg triptolide is given as an oral dose the plasma half-life is 21.70 ± 3.00 minutes¹⁷. Triptolide oral clearance (CL/F) was 16 times faster in males than in females. Triptolide is inactivated by liver enzymes that hydrolyze, hydroxylate, and conjugate it with sulfate, glucuronide and glutathione^{19,18}. Specifically, the biotransformation via C2-H hydroxylation,^{12,13} epoxyethane hydrolysis and C14-OH conjugate reaction inactivates triptolide¹⁹.

The speed with which VCD is metabolized makes it an ideal fertility control agent² and makes its tendency to bioaccumulate negligible^{15,16,12,13}. Triptolide is extensively metabolized. And there is no triptolide accumulation in heart, liver, spleen, lung and kidney of rats¹⁷.

APPLICATION

ContraPest is available in 400mL plastic tanks. Tanks are inserted in Universal Feeder trays and placed within PROTECTA EVO EXPRESS® bait station, a registered trademark of Bell Laboratories, Inc.

ContraPest bait stations should be strategically deployed near rat foraging locations to effectively treat the population. Rat populations are concentrated in habitats near a stable food supply with limited risk of exposure to predators. Standard spacing used for many other rodenticides is not recommended for ContraPest. ContraPest baited stations should be checked monthly to determine rat feeding behavior and re-deploy the bait stations to the areas with the highest level of rat activity. Reduce the number of bait stations deployed as the rat populations decline to levels that meet your control objectives. Avoid placing bait stations in direct sunlight to reduce ContraPest evaporation. Use two ContraPest tanks per bait station in areas with high activity as needed.

For best results, we recommend ContraPest be used as part of an integrated pest management (IPM) program.

In new programs without a history of rodent control, we recommend the use of monitoring tools to determine rat activity/foraging behavior prior to the deployment of ContraPest or other rodenticides such as non-toxic chew cards or SenesTech Pre-Bait. SenesTech Pre-Bait is the same formulation as ContraPest without the active ingredients.



1

PLACE STATIONS

- Best baiting locations are where rats are known to be feeding on site (ex: dumpsters, animal feed, loose trash, etc.)
- In addition, utilize areas where previous baiting has been successful (keep bait stations at least 30 feet away from lethal methods).



2

DEPLOY CONTRAPEST

- Place one (1) ContraPest tank and tray in the station(s) in either the left or right side.



3

MONITOR

- To ensure a constant supply is available to the rats, add a second ContraPest tank and tray to stations when 50% or more of the tank has been consumed in between monthly tank replacements.
- If consumption is repeatedly low or ceases, try relocating the bait station to a different location as rats may migrate.



4

MAINTAIN

- Replace ContraPest trays monthly, or as often as needed to retain optimum flow of bait.

STORAGE

Store only in original, tightly secured, bait tank in a room temperature environment, inaccessible to children, pets, livestock and other non-target animals. Do not contaminate water, food or feed by storage or disposal. Do not expose tank to direct sunlight.

DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Do not dispose of product down any drains, waterways or sewers. Tanks are non-refillable. Dispose of partly filled tanks by recapping and placing in trash can or may be disposed of by an approved waste disposal facility. Do not re-use empty tanks. If the tank is empty, place empty tank in trash or offer for recycling.

RESULTS OF CONTRAPEST FIELD DEPLOYMENT

A number of large-scale field trials demonstrate that ContraPest deployed within existing IPM programs provide significant and sustained reduction in rat populations.

1. Washington D.C - Summary

Washington D.C. implemented ContraPest as part of an ongoing IPM program.

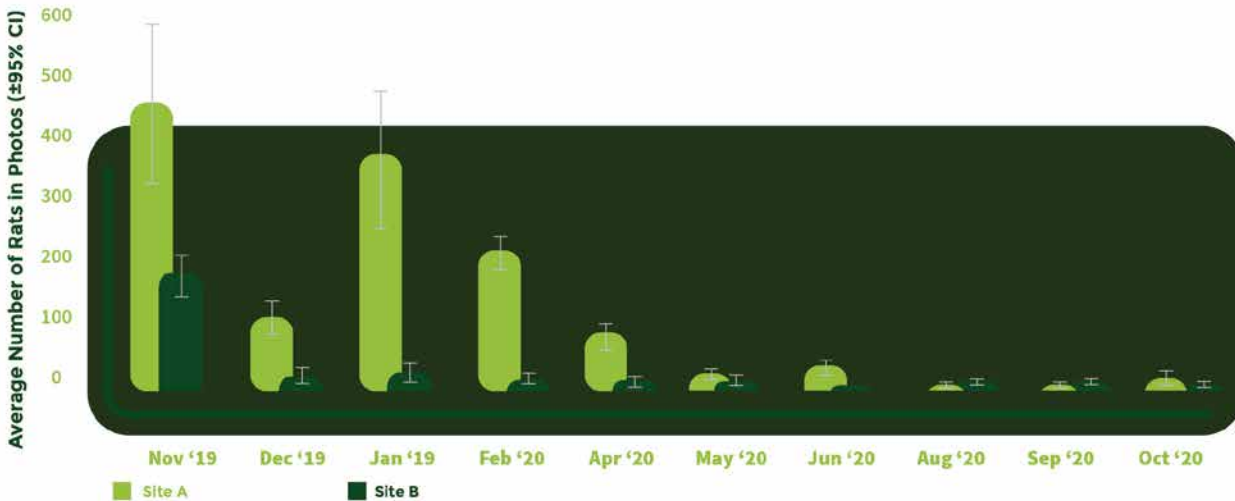


Figure 1. Rats activity reduced over 90% at 2 sites following ContraPest deployment.

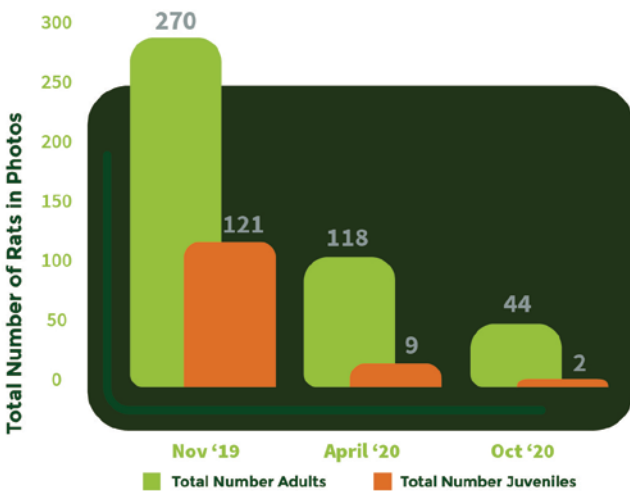


Figure 2. Juvenile rat populations declined 98% at Site A, Washington, D.C.

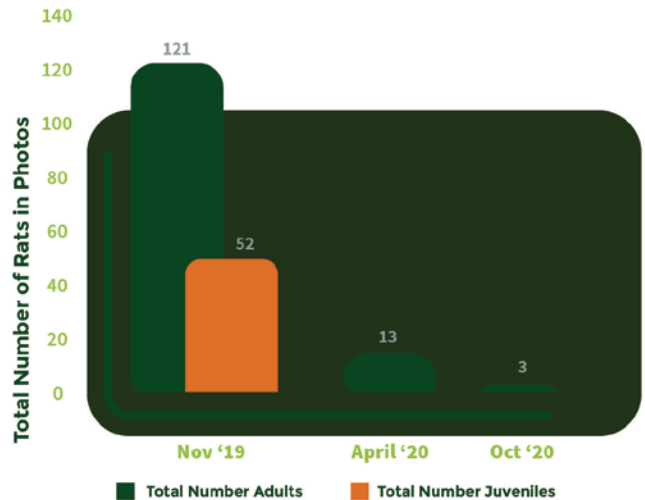


Figure 3. Juvenile rat populations declined 100% at Site B, Washington, D.C.

2. San Francisco Case Study

San Francisco Recreation and Park personnel implemented ContraPest within an ongoing IPM program and monitored burrow counts.



Figure 4. Burrow counts reduced 65% following ContraPest deployment within San Francisco Recreation and Park Department's ongoing IPM program.

3. Agribusiness

ContraPest was deployed within an ongoing IPM program at a poultry hen egg farm.

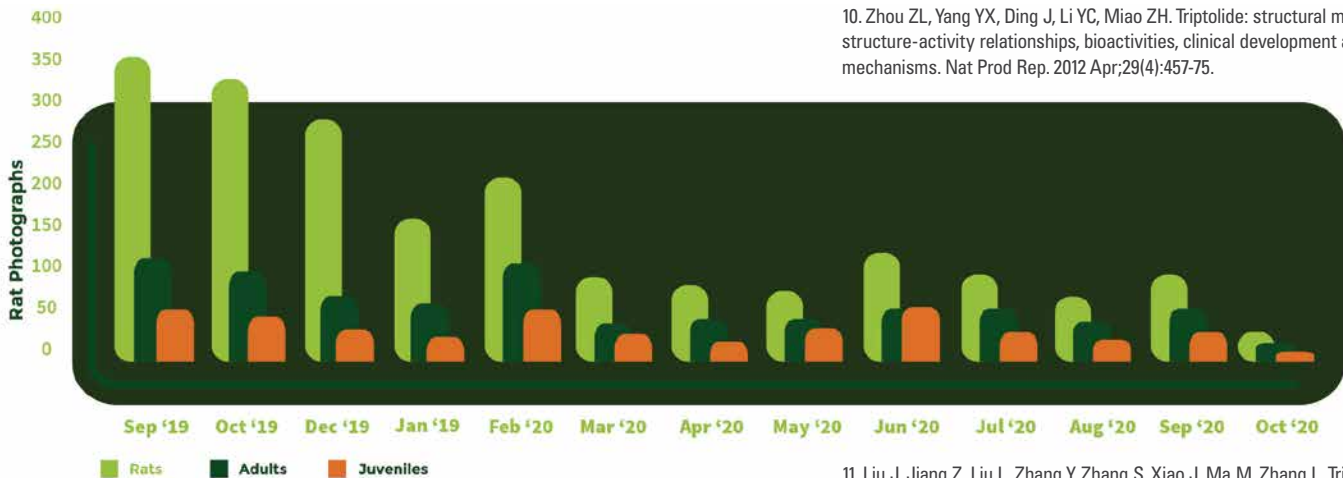


Figure 5. Total rat activity declined rapidly and remained low during the ContraPest deployment.

ContraPest saved over \$600,000 when deployed within an ongoing IPM program at a poultry hen egg farm.

	Yearly Minimum losses*	
	No ContraPest	ContraPest
Loss Egg Revenue	\$400,000	\$60,000
Grain Loss	\$250,000	\$120,000
Equipment Loss	\$42,000	\$20,160
IPM materials (bait, traps..)	\$65,784	\$65,784
ContraPest	\$0	\$5,040
Wages for Rodent Control	\$162,228	\$44,916
Total	\$920,012	\$315,900

*Data provided by an egg farm manager

Table 1. ContraPest increased (egg) revenue over \$300,000 with improved rodent control.

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AGRIBUSINESS



COMMERCIAL



MUNICIPALITIES



RESIDENTIAL

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SenesTech is always here to answer any questions and support our customers. If you have any questions about ContraPest, how to deploy or how to implement into your current rodent control program, please do not hesitate to reach out.

**For more information,
contact us today.**

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