

Current State of Strychnine for Gopher Control

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Richardson's Ground Squirrel

Damage in western, central and southern Saskatchewan



RGS Control

- Integrated approach (IPM)
 - Chemical control
 - Chlorophacinone (Rozol, Ground Force, Gopher Doom)
 - Diphacinone (Ramik)
 - Aluminum phosphide (Gastoxin)
 - Zinc phosphide (Burrow Oat Bait, ZP Rodent Oat Bait AG)
 - White Mustard Seed Powder + Sodium Alpha-olefin sulfonate (RoCon)
 - Tolerance and promotion of predators
 - Badgers, coyotes, foxes, raptors, weasels...
 - Shooting, trapping, drowning
 - Vegetation >15 cm



Photos: Jen Kranabetter



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Saskatchewan Gopher Control Program

- Sustainable Canadian Agricultural Partnership
- Administered by SARM
- Rebate program for accepted control practices
 - Up to 50% registered gopher control products
 - Non-chemical means to increase predation
 - Raptor platforms and nest boxes eligible for 50 per cent to a maximum rebate of \$125
 - Offered to rural municipalities and First Nations and through RMs and FNs to other stakeholders

Northern Harrier



Photo: Cornell lab of Ornithology

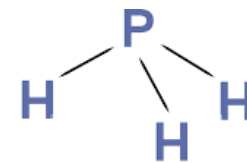
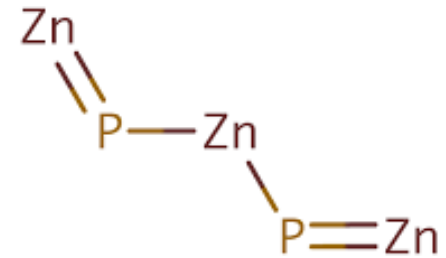
Ferruginous Hawk



Zinc Phosphide



- Use for rats, mice, burrowing rodents
- Synthesized in 1740
 - First used as a rodenticide in 1911 in Italy
 - First Canadian registration 1961
- Stable under dry, acid-free conditions up to 40°C
 - Bait life on wet soil 20 days
 - At pH < 4, hydrolyzes to release phosphine gas
- Phosphine gas
 - Inhibits mitochondrial oxidative phosphorylation and causes cell necrosis in heart, brain, kidneys, and liver
 - May inactivate acetylcholinesterase
 - Escapes cadaver



Aluminum phosphide

- Canadian registration 1978
- Fumigant
 - Primarily for stored products insects
- Hydrolyzes to phosphine gas
 - Under neutral conditions
 - Highly reactive
- Restricted use
 - License
 - Detailed fumigation management plan
 - Plan must be written prior to actual treatment



First generation anticoagulants

- Used for rats, mice, burrowing rodents

- Chlorophacinone

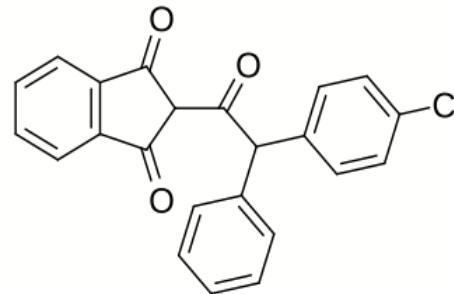
- Liphatech 1961: Rozol
- Registered in Canada 1972

- Diphacinone

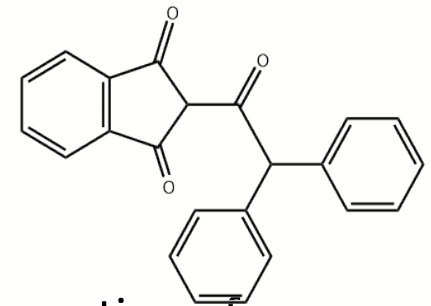
- Described 1952
- Registered in Canada 1968
- Products include Ramik

- Both

- Inhibit clotting protein synthesis by preventing regeneration of vitamin K1
- Multiple feedings required
- Residues



Chlorophacinone



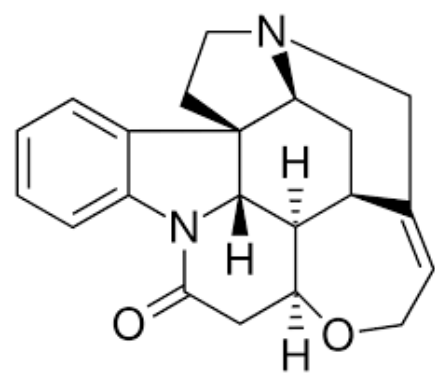
Diphacinone

Rocon

- White Mustard Seed Powder (*Brassica hirta*) + Sodium Alpha-olefin sulfonate sodium
 - Foam pumped into burrowing rodent burrows
 - Rats and Richardson's ground squirrel
 - Suffocant
 - Significant irritant
 - Causes irreversible eye damage



Strychnine



- Alkaloid
- Toxic, intensely bitter
- From seeds of the venom orange, *Strychnos nux-vomica*, native to South Asia
- Neurotoxin
 - High affinity, low specificity antagonist of acetylcholine receptors and glycine
 - Symptoms include spastic muscle contraction
 - Death by respiratory arrest



Strychnine (a recent history)

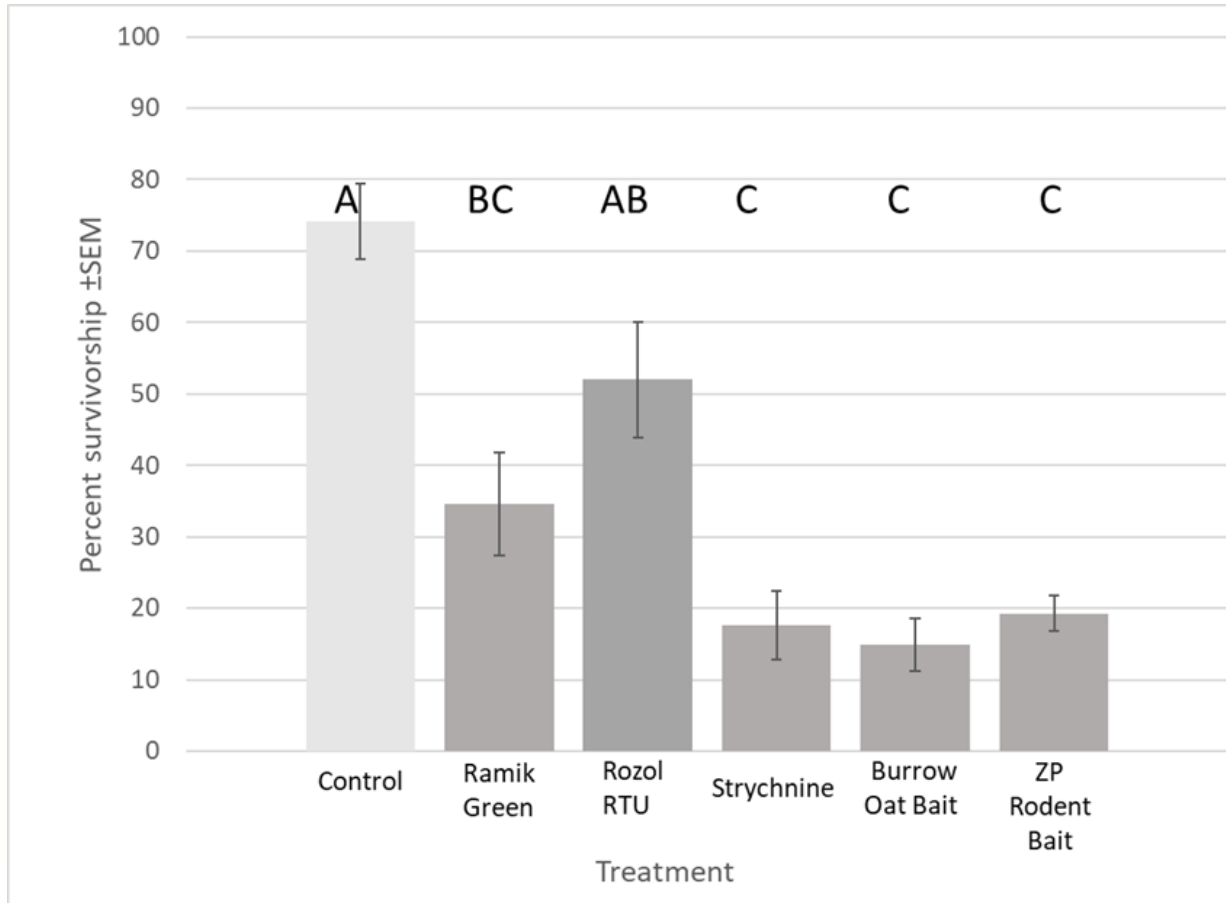
- PMRA final decision to de-register March 2020
 - Last use March 2023
 - Reviews do not consider value
 - Reviews take worst case scenario approach
- SK and AB submitted letters of objection to final decision
 - April 2020
 - Concerns with interpretation of studies used to inform decision
- Agromax experienced supply chain issues
 - Shortage reduced availability during the phase-out
 - SK and AB requested delay of deadlines

Invertebrate scavengers



Strychnine alternatives

- Saskatchewan and Alberta 2022 and 2023



No significant differences among like-lettered groups (Tukey HSD, $\alpha = 0.05$)
(Tansey, Wickerson, et al 2023)

March 15 to April 30 is the best time to manage RGS

Activity by sex and stage

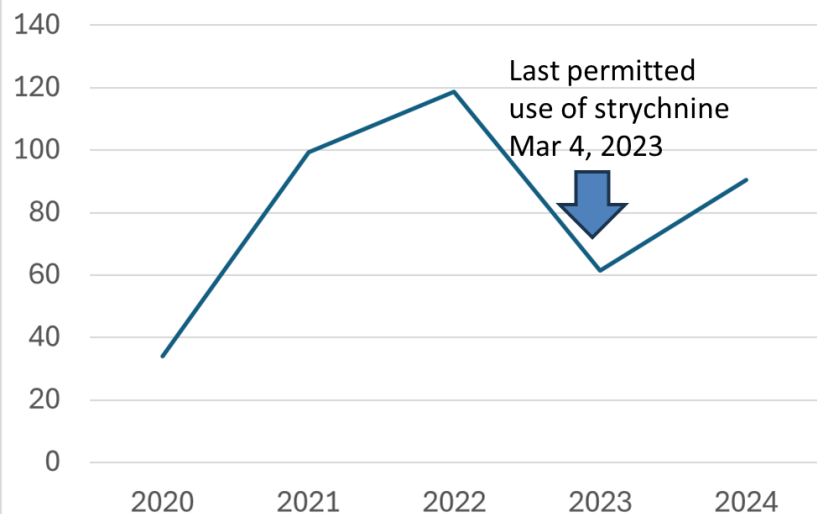
RGS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Males												
Adult Females												
Juvenile Males												
Juvenile Females												



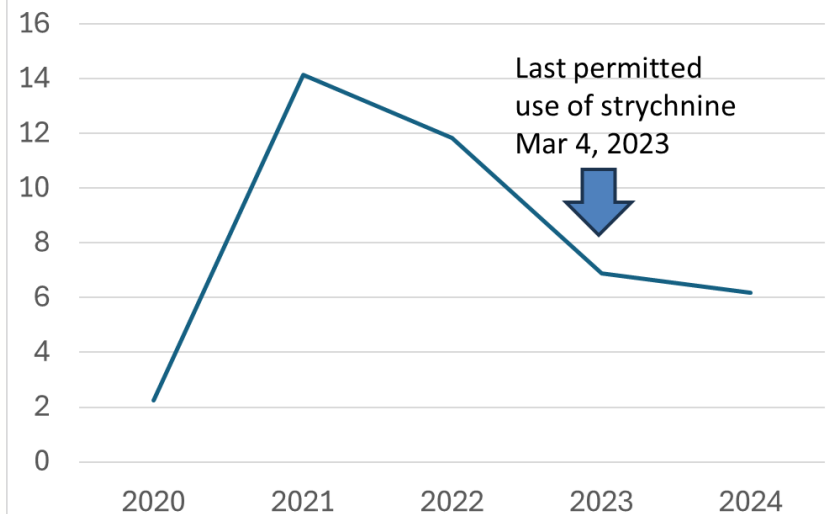
SCIC claims

- Data do not support provincial increase in RGS populations
- Ground squirrels are not the only cause of loss in all cases

Acres (thousands)



Total Indemnity (million \$)



Coming challenges

- PMRA Cyclical (15-year) review: Rodenticide Cluster
 - Q2 2026-27
 - First generation anticoagulants
 - Warfarin (present in free form or as sodium salt)
 - Chlorophacinone (Rozol)
 - Diphacinone (present in free form or as sodium salt) (Ramik)
 - Second generation anticoagulants
 - Brodifacoum
 - Bromadiolone
 - Difethialone
 - Mitochondrial activity
 - Zinc phosphide
 - Bromethalin