2022 FLYSTRIKE RD&E

TECHNICAL FORUM

Nanotechnology for flystrike control

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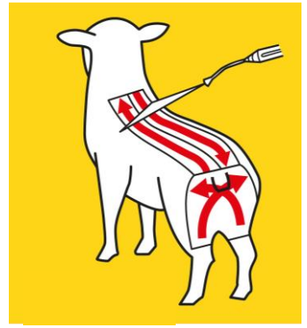
Insecticidal control of flystrike

- Mainstay of integrated flystrike control program
- Practical requirement for prolonged periods of protection
- Effective long term protection required to reduce reliance on mulesing

- Reduced development of new chemistries for flystrike control
- Resistance - cyromazine and dicylanil
- Range of chemistries required for resistance management

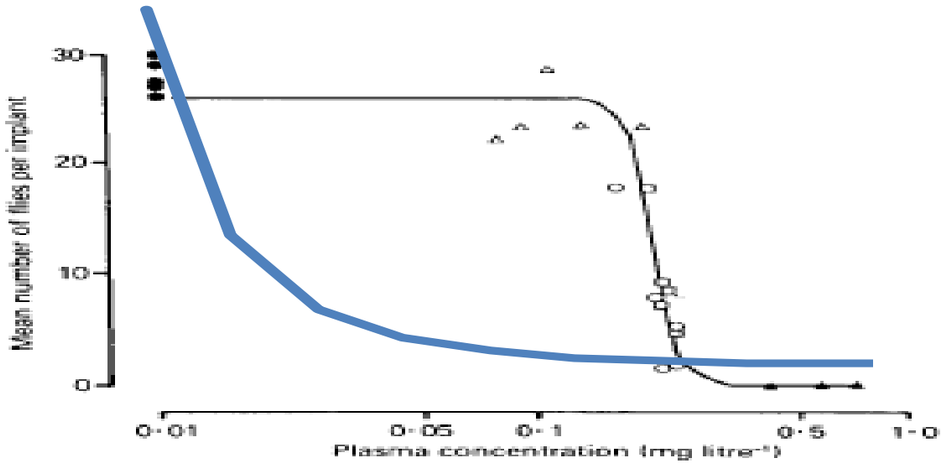


Increasing use of controlled release technology to give extended period of protection against parasites

- Long acting injectable formulations
- Polymer matrix dog collars
- Insecticidal ear tags
- Rumen capsules

Controlled release or strategic release for flystrike control?

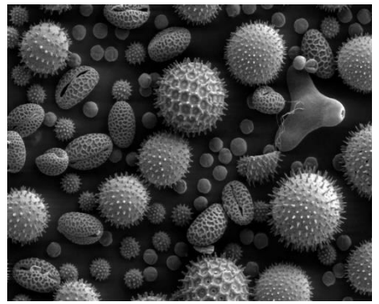
- Cyromazine ‘square release curve’ from capsule (Anderson et al. (1989) *Res.Vet. Sci.* 46: 131)
- Ivermectin capsules (Rugg et al. (1998) *Aust. Vet. J.* 76:350)
- Polymer tags for poll strike control
- Starch xanthate (particulate starch xanthate strategic release for flystrike control (James et al. (1994) *Vet Parasitol*. 52:113 /WRDC DAS11)

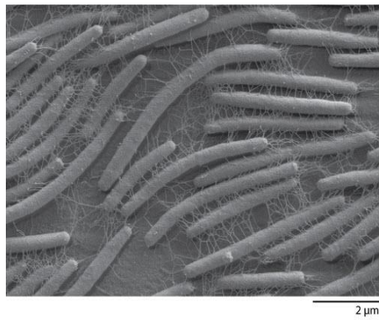


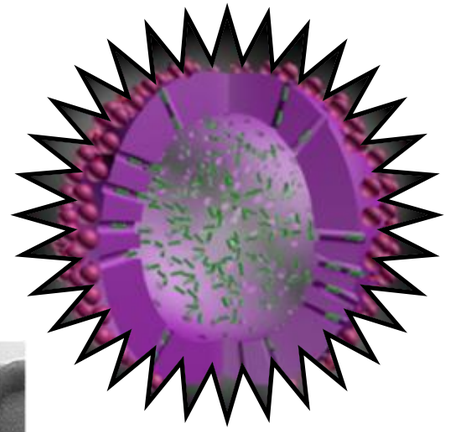
UQ Nanoparticles

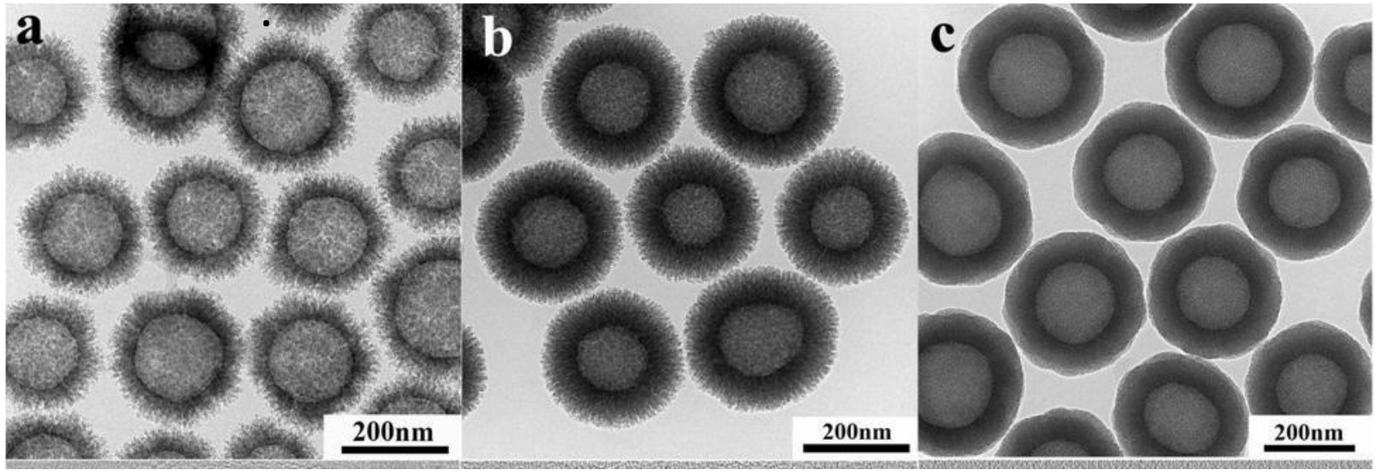
A solution learnt from nature:
Particles with rough surface enhance adhesion and delivery

- 100 % pure silica (SiO_2, silicon dioxide)
- Hollow, porous shell to carry active (AI) inside
- Surface whiskers adhere to various surfaces
- NP here were 180-800 nm
  (1 nanometre = 1 millionth of a mm,
  1 thousandth of a micron)
- ‘Tunable’ construction



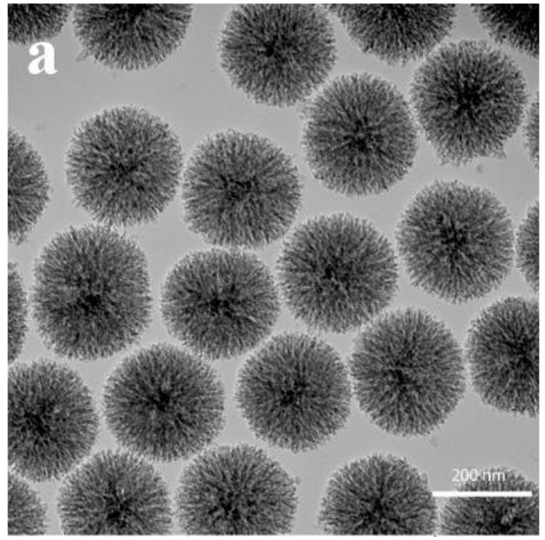






Rough nanoparticles

Smooth nanoparticles



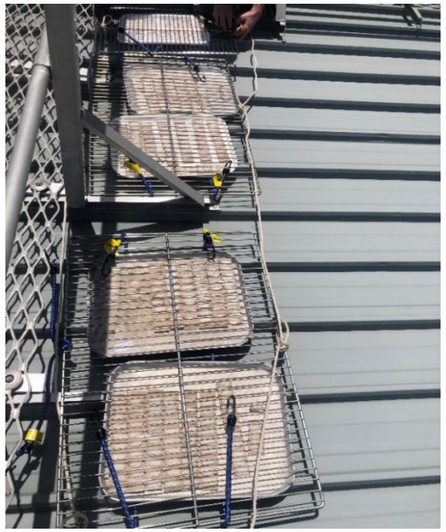
FSN nanoparticles

Nanoparticle studies

- Prolonged protection
- Strategic release

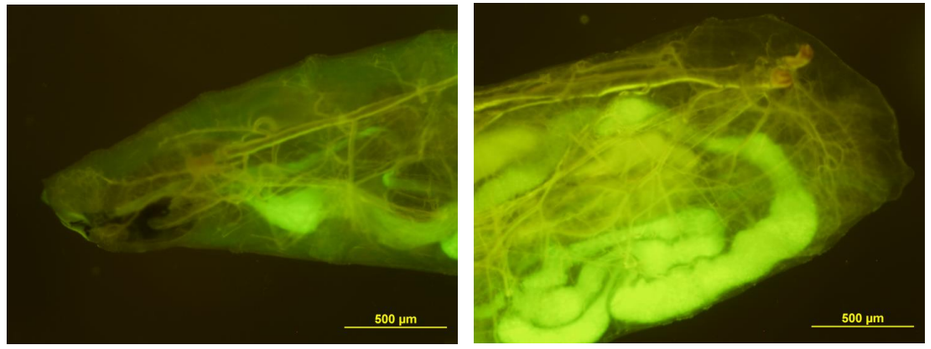
Methods

- Different types of particles, compared with ‘traditional’ commercial formulations
- Applied to wool
- Tested UV breakdown, water leaching
- Artificial and natural weathering tests
- Weathering on sheep
- Efficacy tested with laboratory assays against sheep blowfly maggots



Artificial weathering

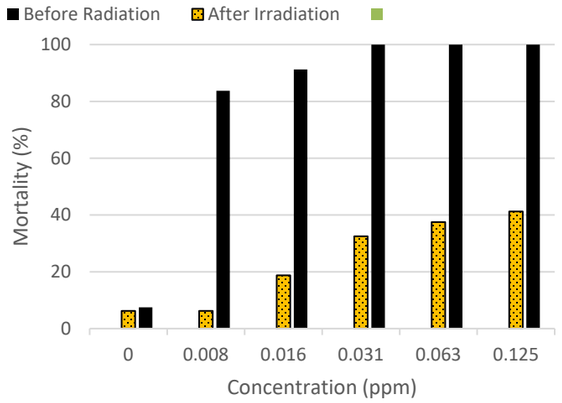
Weathering on sheep



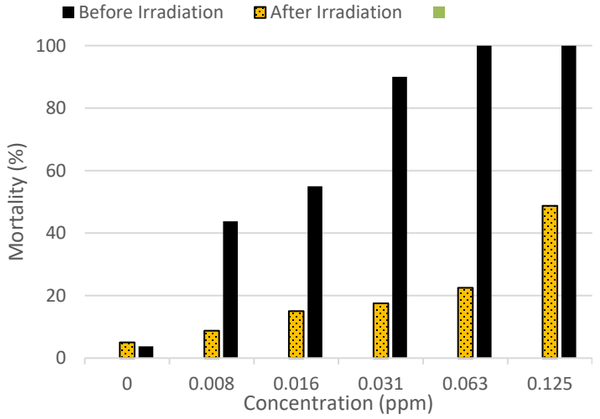
Fluorescent nanoparticles in the gut of blowfly maggots and lice

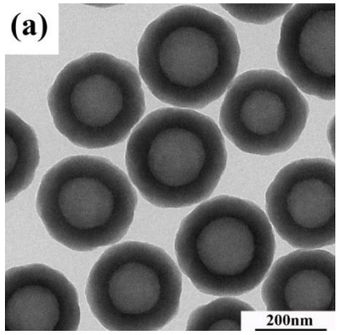
UV weathering, ivermectin nanoparticles – larval bioassays

Ivermectin (100%)



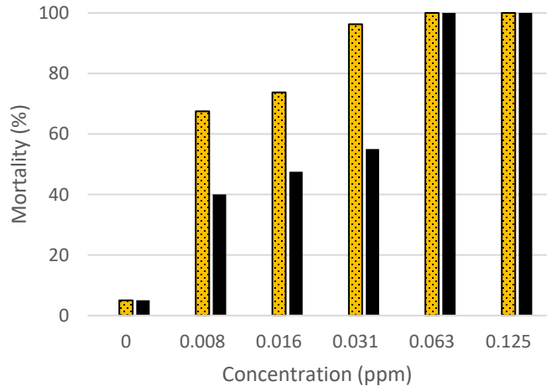
Smooth Nanoparticles (SNP)



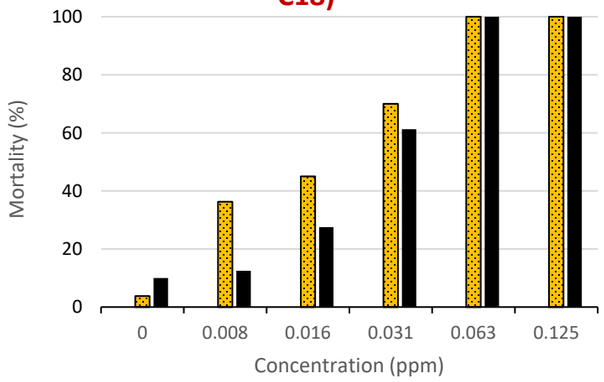


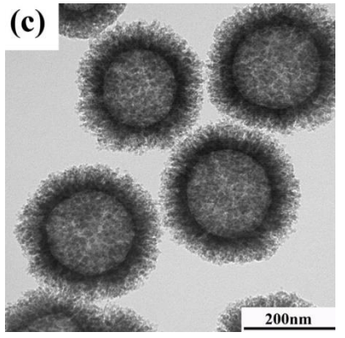
Smooth

Rough Nanoparticles (RNP)



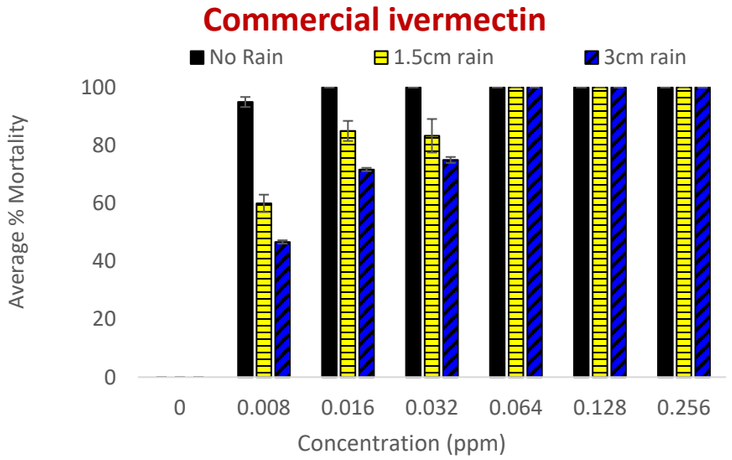
Rough Silica C18 Nanoparticles (RNP-C18)

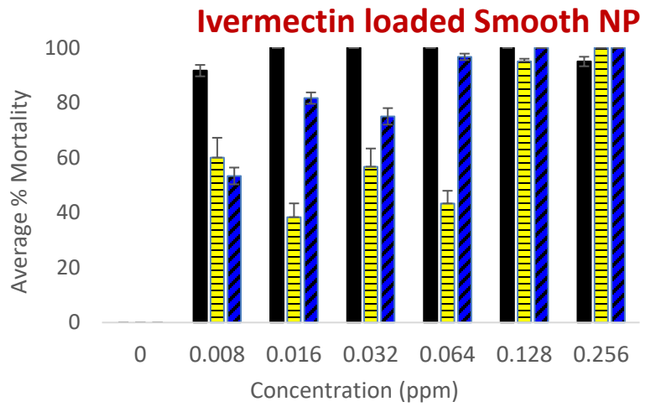


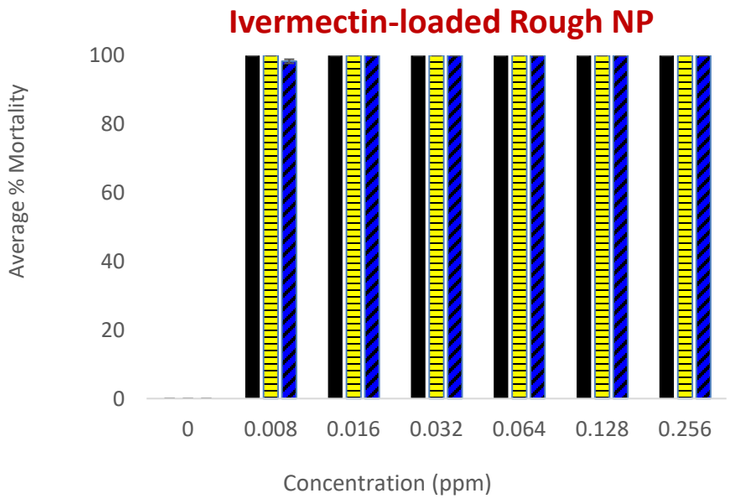


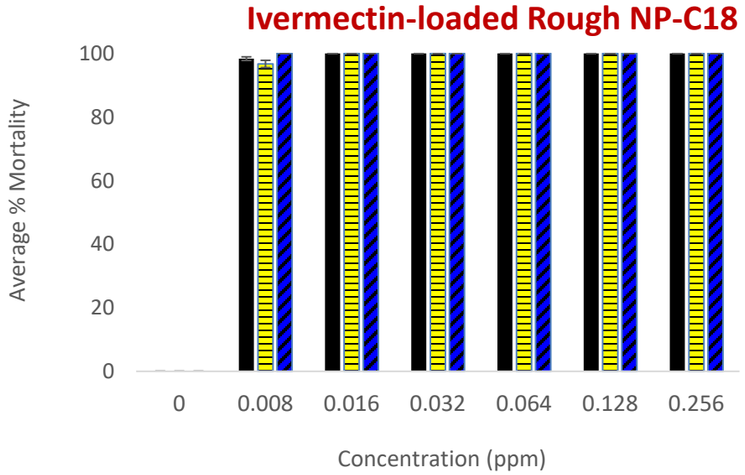
Rough

Water fastness of ivermectin under artificial rainfall

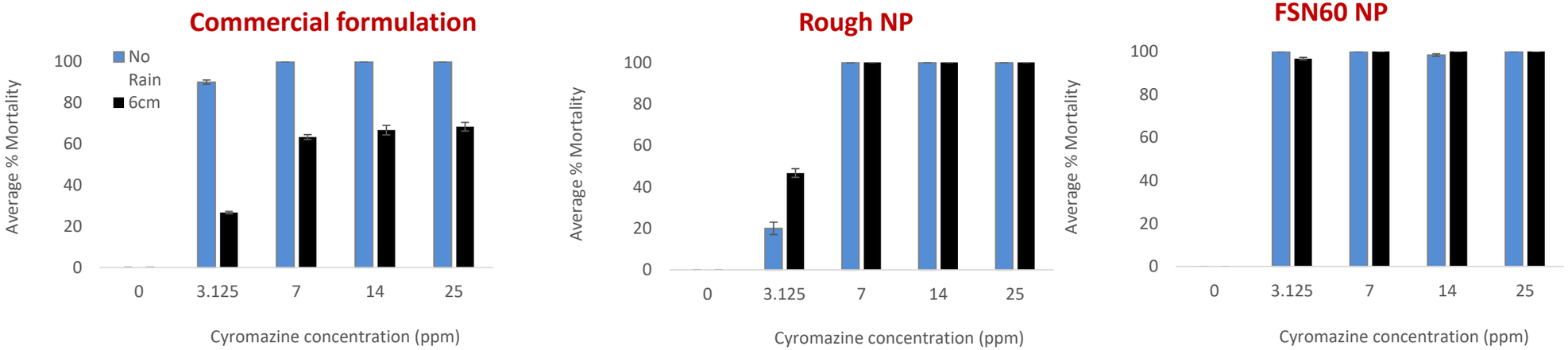






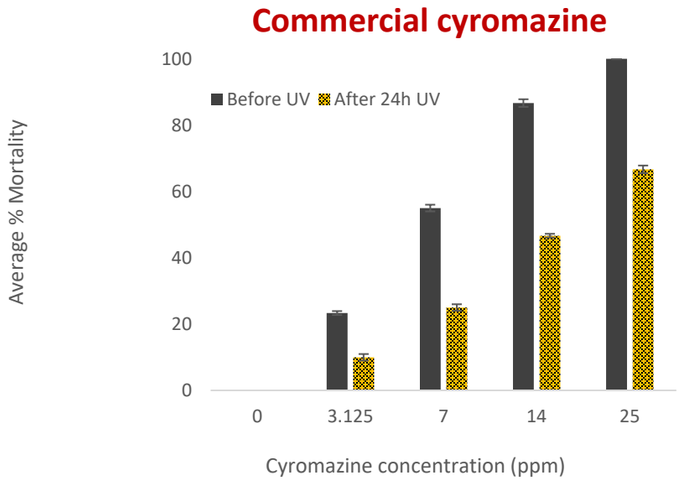


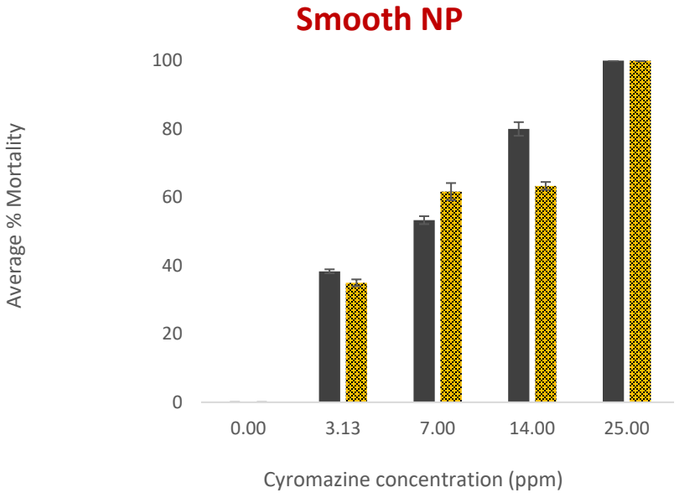
Cyromazine nanoparticles – Artificial rain on two occasions

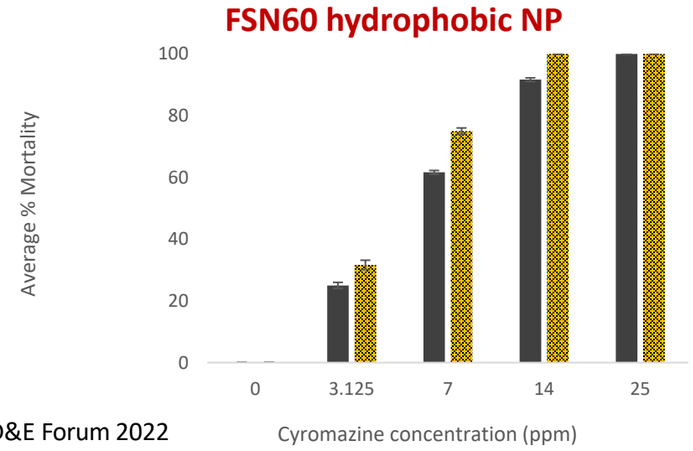


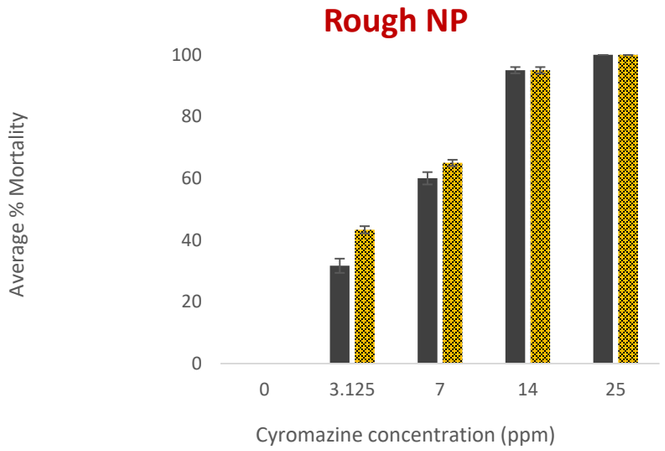
*** Larval toxicity in assays for rain fastness with wool treated with different formulations of cyromazine, then exposed to simulated rainfall on two occasions**

Effect of exposure to ultra-violet radiation on efficacy of nanoparticle and commercial formulations of cyromazine in larval assays

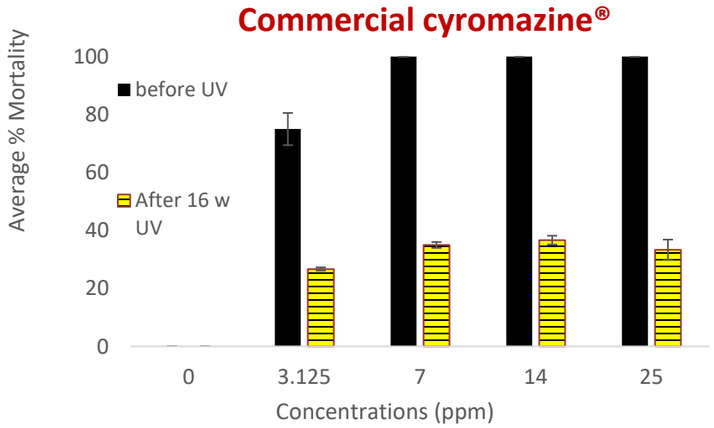


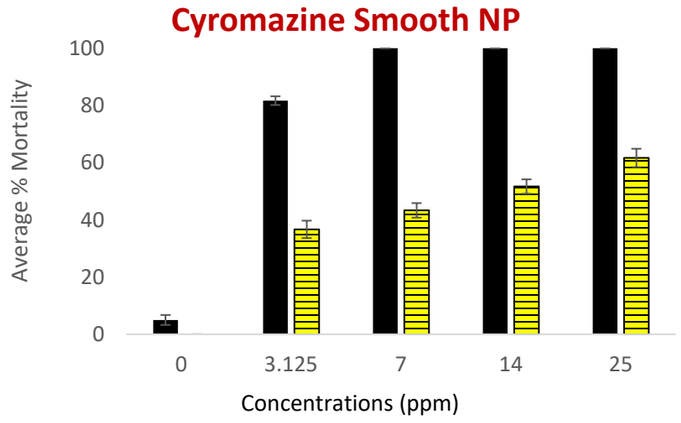


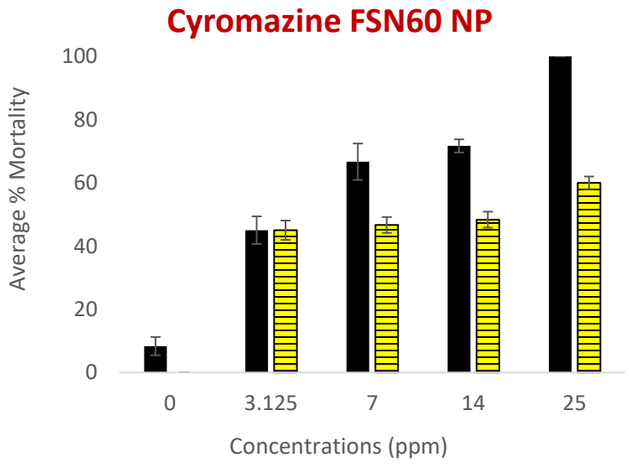


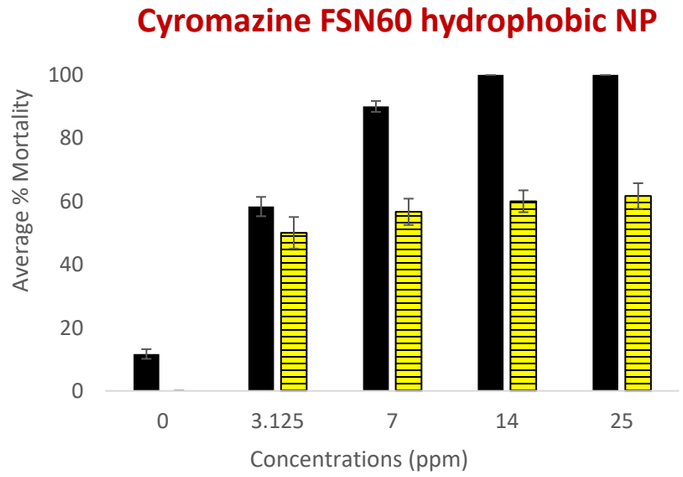


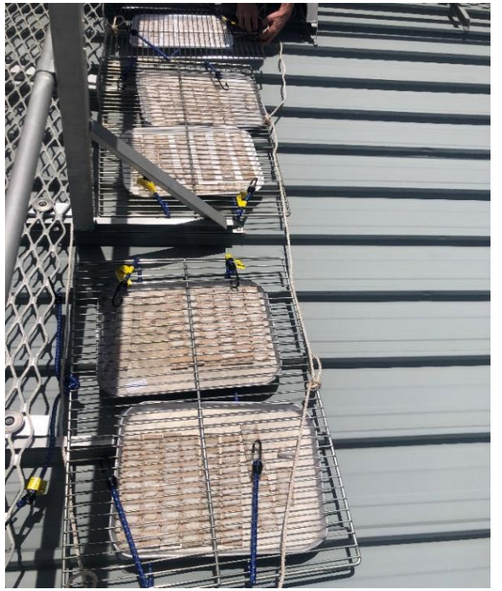
Larval toxicity: cyromazine formulations following 16 weeks exposure to outdoor weathering



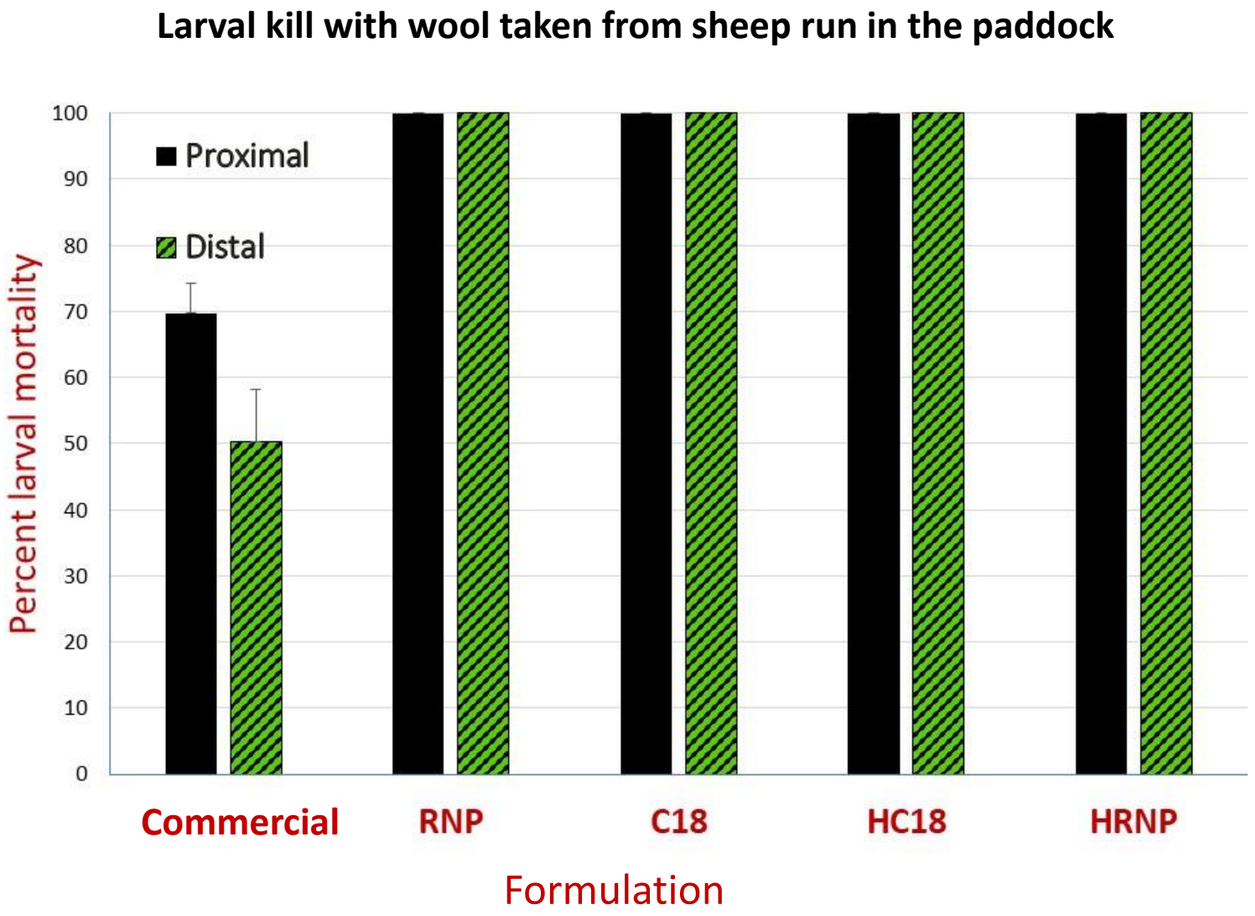




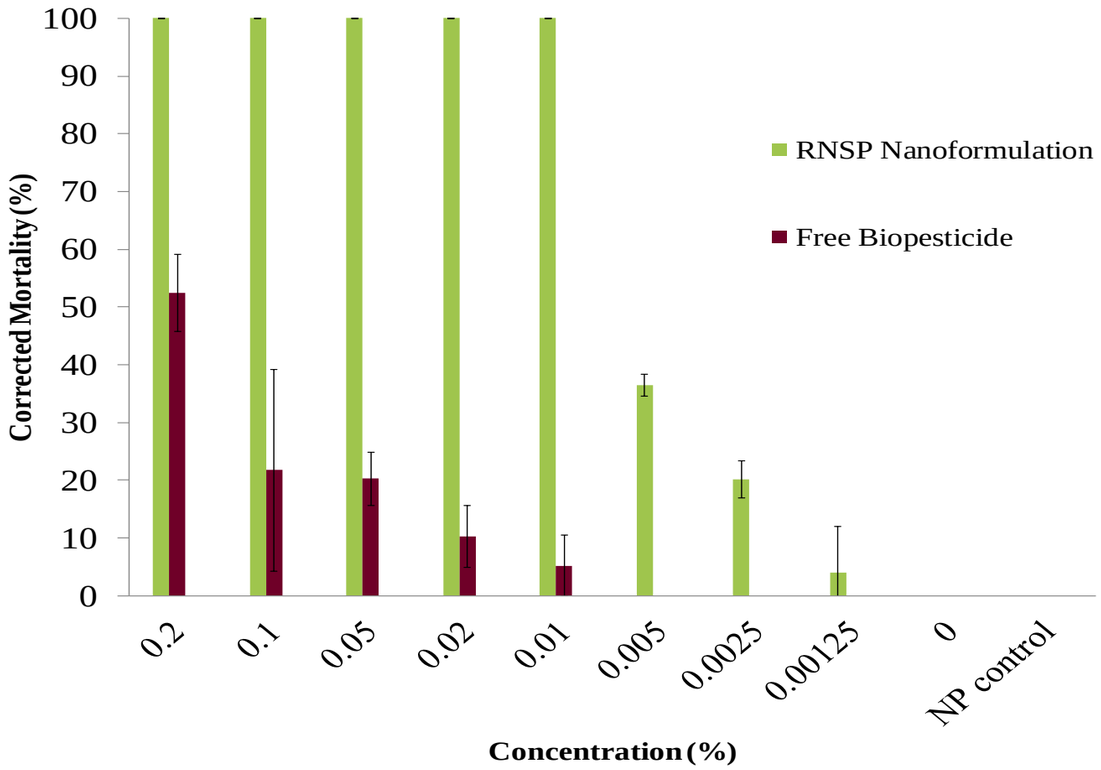




Weathering effects on sheep run under paddock conditions



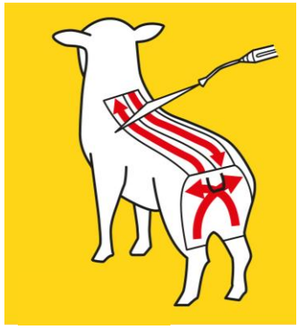
Encapsulation of plant extract (biopesticide) in nanoparticles



Summary

- Increased longevity of effect
- Applicable to a range of chemical actives (hydrophobic and hydrophilic)
- Tunable/targeted design to suit purpose
- Design to reduce chance of tissue absorption/meat residues
- Potential to reduce selection for resistance
- Make less persistent chemicals feasible
- Amenable to application with existing equipment

- More sheep studies needed



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