

Beyond Threshold Dosing

A Process Control Approach to Sustainable Worm Management



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Traditional Worm Control Strategies

- Since the introduction of the first anthelmintic class in the 1960s, nematode control for equids in the western world has centred around interval dosing of all animals every 6 to 8 weeks
- This consistent exposure of the parasites to anthelmintics has introduced a strong selective pressure within parasite populations
- As a result, resistance to the Benzimidazoles developed in many cyathostomin populations by the late 1980's
- Resistance to all other available classes of anthelmintic has followed
- Indiscriminate interval dosing of all animals is no longer recommended



Cyathostomin species have demonstrated resistance to all anthelmintics available for use in equids



FWEC can be used to quantify the contribution of individuals to the total pasture contamination

Threshold Dosing Strategies

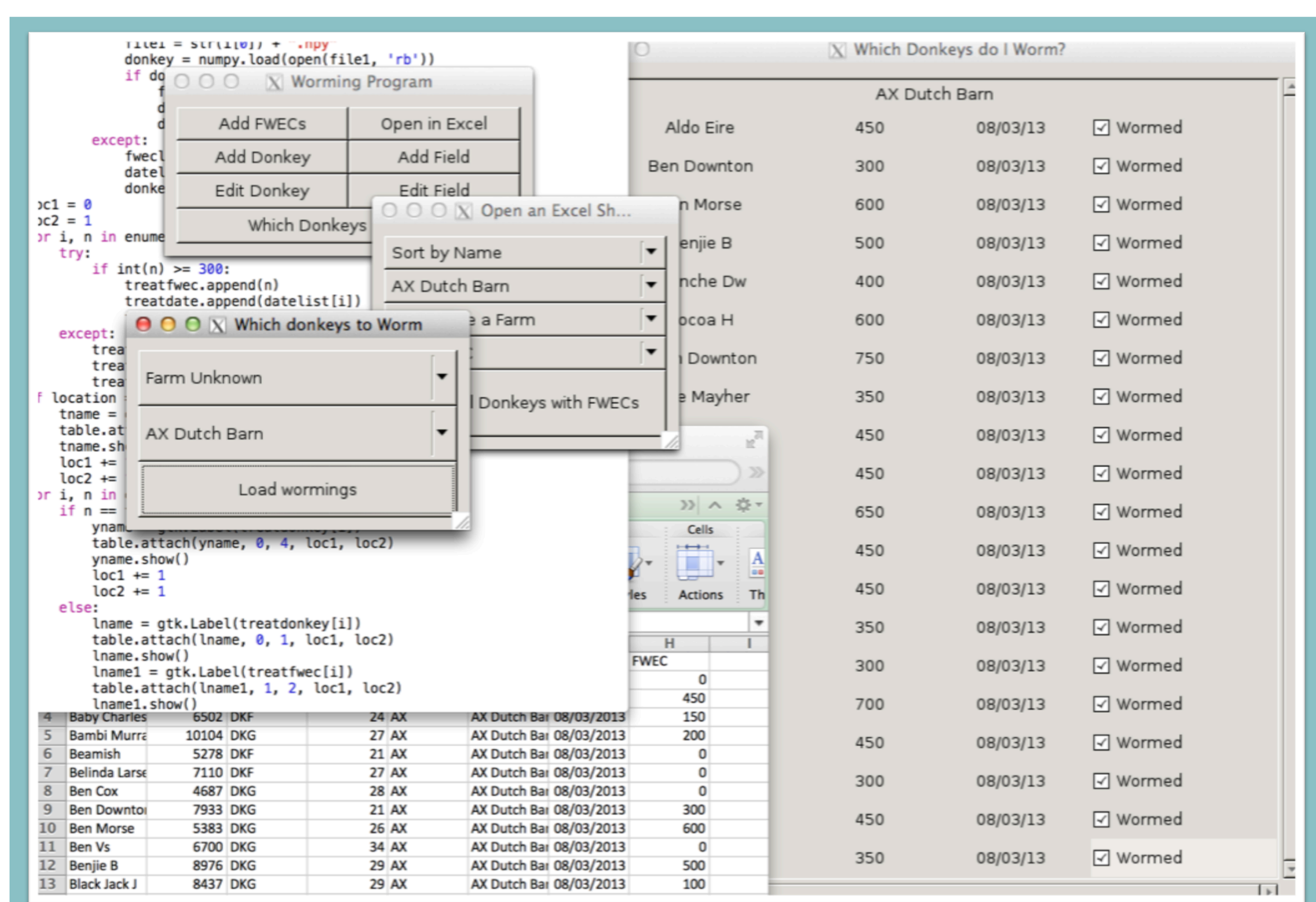
- Faecal Worm Egg Count (FWEC) from individual animals are highly over-dispersed, so the majority of pasture contamination originates from a small number of individuals
- Targeted selected therapy aims to treat only the highest shedders
- One strategy uses monthly FWEC on all animals, and treats those whose FWEC is above a given threshold
- However, variability in FWEC from the same animal means that a single observation does not reliably identify a high shedder
- The thresholds used are also typically quite arbitrary

Beyond Threshold Dosing

- More judicious use of anthelmintic dosing could be achieved by utilising the following information to select animals to be dosed:
 - Multiple historic FWEC from individuals (mitigates the effects of fluctuation and measurement error in individual FWEC)
 - Group mean FWEC (represents infective pressure from pasture)
 - Additional co-variants affecting future FWEC such as age, sex, weather, pasture hygiene management and season
- This control strategy, conceptually based on statistical process control, would be more useful in controlling cyathostomin populations whilst minimising the use of anthelmintic



The Donkey Sanctuary has a large population of equids with individual FWEC performed monthly



User interface of the statistical treatment program being developed

Implementation at the Donkey Sanctuary

- A statistical model is used to predict future FWEC of each individual of a group using the covariates mentioned previously
- If the prediction is for the group mean FWEC to become 'uncontrolled', anthelmintic dosing is implemented on a proportion of the group to prevent the predicted rise in pasture infectivity
- Selective dosing of animals based on their expected shedding and efficacy reduces repeated exposure of resistant worms
- A bespoke software interface (written in Python) is used to enter monthly FWEC, predict future FWEC, and instruct operators to dose individual animals with anthelmintic based on these rules