

A toolkit for responsible anthelmintics use in equine populations

This toolkit is focused on preventative principles rather than treatment of clinical cases

- (p) ractice policy**
- (r) isk assess**
- (o) ther methods of control**
- (t) arget treatment to high egg shedders**
- (e) nvironmental sustainability**
- (c) heck for drug efficacy**
- (t) est for tapeworms**
- (M) onitor the herd**
- (E) ducate**
- (too) protect anthelmintics as well as antibiotics**

(p) ractice policy

- Develop practice guidance based on current best evidence.

 [BEVA primary care clinical guidelines: Equine parasite control](#)

(r) isk assess

- Use risk assessment to develop tailored parasite control programmes for equestrian properties which reduce indiscriminate use of dewormers.

Other methods of control

Reduce need for treatment in each population by encouraging:

- Improved pasture hygiene.
- Co-grazing with ruminants.
- Reduced stocking density.
- Resting pastures.
- Rotation of grazing.
- Avoiding harrowing.

Target treatment to high egg shedders

- Carry out faecal egg counts (FECs) to help identify those individuals which are shedding high numbers of eggs, and treat accordingly, as these are the main source of parasites.
- Where risk is low and management systems allow, consider using >500 epg as the threshold for treatment.

Environmental sustainability

- Consider and educate on the toxic effects of anthelmintics, particularly ivermectin.

 [Environmental impacts of equine parasiticide treatment: The UK perspective](#)

- Remove faeces from pasture for 1 week after ivermectin or moxidectin treatment and take measures to avoid contamination or run-off into water courses.

Check for drug efficacy

- Perform **faecal egg count reduction tests** (and **egg reappearance tests** following treatment with avermectins) annually to understand the resistance pattern on each property.
- Use a FEC method that has a low multiplication factor.

 [BEVA primary care clinical guidelines: Equine parasite control](#)

 [World association for the advancement of veterinary parasitology \(WAAVP\): Third edition of guideline for evaluating the efficacy of equine anthelmintics](#)

Test for tapeworms

- High tapeworm antibody titres indicate exposure, and possible infection.
- Testing before treatment will help identify those who do not require treatment.

Monitor the herd

- Testing one is better than none; but testing the group together is best of all.

Educate

- To protect the viability of equine businesses.
- To delay the onset of resistance and extend the lifespan of currently available anthelmintics.
- To prevent unnecessary illness and death from endoparasitism.
- To reduce the negative impacts of ecotoxic drugs on the local environment.

Protect anthelmintics as well as antibiotics

- Anthelmintics should be afforded the same respect as antimicrobials.
- We have fewer options to turn to and we have resistance to all of them.

Endoparasite control practice toolkit

LOGO HERE

PRACTICE NAME HERE

This BEVA **protectMEtoo** practice toolkit is intended to provide guidance rather than set protocol.

The role of the vet

- There is widespread agreement across the equine industry that anthelmintics should be used in accordance with an annual programme of **diagnostic-testing led parasite control**, which is overseen by a vet and revised as necessary.
- Vets are uniquely placed to tailor and adapt the parasite control advice we give to our clients based on knowledge of a range of factors, including the horse's risk profile, the results of diagnostic tests, husbandry and management practices, and those relating to the environment.

Using the toolkit

- This toolkit has been developed to promote responsible use of dewormers in equine populations and focuses on **preventative principles** rather than treatment of clinical cases.
- This toolkit is intended for use in **mature horses**.
- Guidance for **foals and other youngstock** can be found separately in the [“Foals and youngstock fact sheet”](#).
- Before using this toolkit, read the [“Protecting anthelmintics fact sheet”](#) which summarises our current understanding of the issues we face, highlights advice that is now outdated, and busts common myths about parasite control.

 More detailed information on parasite control is available in the

[BEVA primary care clinical guidelines: Equine parasite control](#)

 More information on the ecotoxic effects of antiparasiticides can be found in the article

[Environmental impacts of equine parasiticide treatment: The UK perspective](#)

- The anthelmintics choices recommended in this document should be amended based on drug **resistance** issues, where known or anticipated on the premises.

Responsible use of anthelmintics in mature horses: Four steps to success

Step 1: Assess the parasite risk profile

Step 2: Diagnostic testing - deciding what to do and when to do it

Step 3: To deworm or not to deworm? Interpreting diagnostic tests

Step 4: Appropriate selection of anthelmintics

Step 1: Assess the parasite risk profile

Classifying horses as low, medium, or high risk can help decide on frequency of diagnostic testing and choice of treatment (see [Risk table for endoparasite control](#)).

Step 2: Diagnostic testing - deciding what to do and when to do it

For most premises with adult horses which are under good, consistent management, it is sufficient to start with the following **basic strategy**:

- Regular worm egg counts throughout the year when horses are grazing
- Testing for tapeworm once a year.
- This can be **modified according to risk**. It may be possible to reduce the frequency of testing if risk remains low year on year.

The table below is a suggested starting point which may be modified as appropriate:

Risk profile	FECs (per year)	Tapeworm ELISA (per year)	FECRT (testing for resistance)
Low	x 2-3	x 1 (Autumn)	Re-test 10-14 days after deworming (for all drugs).
Medium	x 3	x 1-2	When treating with ivermectin or moxidectin , even if FECRT does not indicate resistance a further re-test 6 weeks after deworming is recommended to detect ' early egg reappearance '.
High	x 3-4	x 2 (Spring & Autumn)	

Step 3: To deworm or not to deworm? Interpreting diagnostic tests

This toolkit is focused on preventative principles rather than treatment of clinical cases, but how do we decide when it is appropriate to treat mature horses without signs of clinical disease?

- Remember our aim is to **reduce egg shedding, prevent clinical disease and minimise resistance**. This is not the same as eradication of all worms, which is an unnecessary and futile endeavour.

Faecal egg count (FEC)

- FECs are a reliable and sensitive way to detect strongyle eggs.
- FECs will also tell you if ascarid eggs are being shed in foals and yearlings.
- The 'threshold to treat' for mature horses without clinical signs of disease is often set at **>200-500 epg** of faeces.
- The upper threshold of **500 epg** should be encouraged where adult horses are kept in a low-medium risk environment.
- The FEC 'threshold to treat' should be determined with consideration of signalment, risk of clinical disease in the population, and management on the property.
- Testing of individual horses is better than no testing, but testing groups of **co-grazing horses** is best of all.

Tapeworm ELISA

- Tapeworms are present in approximately 50% of the population, so nearly half of all horses **do not** have a tapeworm burden.
- Blood and saliva ELISA tests measure the horse's antibodies against tapeworm, and therefore indicate **exposure** to tapeworm and not necessarily a current infection.
- Antibodies persist for approximately **3-6 months**, and therefore may indicate historical infection.
- Both tests have been validated to show that **high levels of antibodies correlate to higher numbers of tapeworm**.
- It should be noted (as with FECs) that this test is most valuable when groups of **co-grazing horses** are tested at the same time.

Small redworm ELISA

- There are **differing opinions** regarding where, or if, this test is beneficial in determining whether to administer anthelmintics.
- This test should **not** be used routinely and/or in isolation.
- A **positive** test result cannot be used to confirm that there is a clinically relevant mucosal redworm burden present, therefore cannot predict risk of clinical disease.
- Where there is insufficient history to carry out a satisfactory risk assessment, and a FEC test demonstrates low or no egg shedding, a **negative** small redworm ELISA test result may support a conclusion that there is no indication for administering an anthelmintic.
- Where the test is used, the result should only be interpreted **alongside** the results of a **FEC** and a **risk assessment** (accepting that any history may be limited or non-existent).

Step 4: Appropriate selection of anthelmintics

- When prescribing anthelmintics, the **Summary of Product Characteristics (SPC)** often conflicts with current best evidence.
- The **Veterinary Medicines Directorate** has been clear that 'off-label' product use should not be promoted by organisations such as BEVA.
- We note, however, that practitioners regularly make their anthelmintic prescribing decisions based on current best evidence alongside the results of **risk analysis (including FECs)** rather than following historic SPCs.
- We also note that practitioners are aware of the **risk of resistance** associated with the unnecessary use of a registered combination product and that some may instead choose to prescribe an unregistered extemporaneous preparation.

Strongyles: treatment of adult horses in response to a high FEC (also read encysted small redworm section below when considering options)

Pyrantel	A first choice where there is susceptibility, but perform FECRT as resistance is believed to be increasingly common .
Fenbendazole	A first choice if there is susceptibility, but a FECRT is essential as resistance is present on most properties .
Ivermectin Moxidectin	Effective drugs that treat both adult worms and larval stages, but there is concern over the detrimental impact they have on the environment . Recent emergence of resistance so FECRT recommended.

Encysted Small Redworm: to Treat or Not to Treat in the Autumn?

- Larval cyathostomiasis is rare in mature horses.
- Horses 5 years and under, and possibly geriatric horses, may have lower immunity and higher risk of disease.
- Clinical disease is typically seen in young horses with inadequate deworming history or, increasingly, where there is anthelmintic resistance in a high-risk environment.
- The decision whether to use moxidectin should be considered in line with the level of risk and the need to preserve the effectiveness of larvicidal dewormers.
- **Routine larvicidal treatment is discouraged and should be avoided in horses that have repeated low FECs and are managed in such a way that the risk of disease is low.**

Tapeworms: Treatment Where ELISA Result Indicates Significant Exposure

Praziquantel	Currently, there is no authorised product that facilitates monotherapy control using praziquantel. Veterinary surgeons have access to products under the prescribing cascade that are not available to SQPs.
Double dose Pyrantel	Not tapeworm specific but can be helpful when concurrent cyathostomin infection warrants treatment.

Risk table for endoparasite control

Risk factor	Factors supporting low risk	Factors supporting medium risk	Factors supporting high risk
Exposure based on individual horse test results*	Low exposure for the individual horse: defined by repeated negative or low egg shedding from FEC/low tapeworm ELISA titres over at least one year	Moderate exposure for the individual horse: defined by mixed moderate egg shedding from FEC/ borderline tapeworm ELISA titres in the past year	Highest exposure risk for the individual horse: defined by high egg shedding from FEC/moderate to high tapeworm ELISA titres in the past year
Exposure based on herd test results*	Low exposure for co-grazing group defined by repeated negative or low egg shedding from FEC/low tapeworm ELISA titres over at least one year	Moderate exposure for co-grazing group defined by repeated mixed moderate egg shedding from FEC/ borderline tapeworm ELISA titres over at least one year	High exposure risk for co-grazing group defined by repeated high egg shedding from FEC/moderate or high tapeworm ELISA titres over at least one year
Age profile	5-20 years old (although younger/ older individuals may be considered low risk based on other factors in this column)	>20 years of age (although older individuals may be considered low risk based on other factors in this table)	<5 years of age
Removal of faeces from pastures**	≥2 times per week**	Sporadic**	No faecal removal from pasture
Horse movements	Stable population	Some individual horse movement in/ out of grazing group	Transient population of horses co-grazing together
Stock density	Low	Medium	High
Presence of youngstock	No youngstock (although see above under 'age profile')	N/A	Grazing with youngstock
Quarantine protocol	High level of quarantine: - FECRT (or FEC 2 weeks post-treatment) prior to co-grazing with resident population - Known histories of new entrants, demonstrated by FEC results indicating low shedding for >12 months prior to arrival on yard	Moderate quarantine: 1 or more FEC results prior to arrival on yard	No quarantine of new entrants

History of clinical disease caused by parasitism	No history	N/A	History of clinical disease caused by parasitism, e.g.: - Larval cyathostominosis - Parascaris jejunal obstruction - Infarctive colic (strongylus vulgaris)
History of colic	No history	N/A	History of colic
History of anthelmintic resistance	No history	N/A	Anthelmintic resistance documented on premises by way of: - FECRT - Parasitic-related clinical disease confirmed in spite of definite appropriate deworming

Key	
ELISA	Enzyme-linked immunosorbent assay
FEC	Faecal egg count
FECRT	Faecal egg count reduction test

*Strongyle egg shedding categories:	
Low egg shedding	0-200 epg
Moderate egg shedding	200-500 epg
Higher egg shedding	>500 epg

*Tapeworm ELISA test scores			
Tapeworm diagnosis	Low	Borderline	Moderate/High
Tapeworm treatment recommended	No	Yes	Yes

**Removal of faeces from pastures

Please note moving faeces to another part of the grazing area (e.g. heaping in corner of paddock) is not considered adequate 'removal' to reduce risk of exposure to cyathostomins.

Protecting anthelmintics: Fact sheet

Why is it so critical we act now?

- Resistance has already been reported for **all** anthelmintics currently available in the UK.
- There are no new classes of anthelmintics being developed for horses – when these drugs stop working, there will be **no alternatives**.
- Unnecessary use of anthelmintics, giving them too often, or repeated use of the same class of drug, **increases the rate of resistance development**.
- There is accumulating evidence demonstrating the serious risk anthelmintics (particularly ivermectin and the other parasiticides) pose to the environment, including insects and aquatic animals.

Key principles

- Preventative deworming should be based on a **diagnostic-testing led deworming programme** that is applied to the whole property and its equid population and is revised at least annually (more often if there is a known endoparasite problem).
- The programme should aim to **limit exposure** to worms, and limit the need for anthelmintics, whilst preventing clinical disease.
- **The aim is not to eradicate all worms**. Maintaining a population of worms that are sensitive to anthelmintics in **refugia** (not exposed to treatment, i.e. worms on pasture or in untreated horses) reduces selection pressure and the propagation of resistant genes.
- **Interval deworming** (giving horses anthelmintics at set intervals in the year) is no longer an acceptable way to deworm mature horses and is at odds with current professional standards.
- Anthelmintics should only be one aspect of worm control in mature horses – **appropriate management** should be the mainstay of reducing the risk of worm associated disease, e.g. poo picking, avoiding harrowing, keeping low stocking densities, co-grazing or rotating with ruminants, considering different groups of horses, etc.
- Foals and other youngstock (**<5 years of age**) require special consideration as they have lower immunity and wider susceptibility to worms.

Diagnostic testing - what do I need to know?

- When performing diagnostic tests remember that testing one horse is better than none, but **testing groups** of horses at the same time is best of all.

Faecal egg counts (FECs)

- **FECs reflect shedding status**, of a horse and its potential for contaminating pasture. It does not reflect the horse's worm burden or its risk of clinical disease. FECs are a reliable and sensitive way to **quantitate roundworm eggs** (cyathostomins, ascarids and ***Strongyloides westeri***). However, FEC are not helpful in determining *Parascaris* in young foals, due to the long pre-patent period (see "[What about foals and youngstock?](#)").
- FECs can be used to detect tapeworm eggs after treatment ([see Tapeworm ELISA test below](#)).
- FECs are not a reliable means of identifying the presence of pinworms or other endoparasites.
- Consideration should be given to the **FEC method** that is used; FECRTs should be performed using those methods with a low multiplication factor (i.e. the correction factor applied to raw egg count data). See the following publications for more information:

 [BEVA primary care clinical guidelines: Equine parasite control](#)

 [World association for the advancement of veterinary parasitology \(WAAVP\): Third edition of guideline for evaluating the efficacy of equine anthelmintics](#)

Faecal egg count reduction tests (FECRTs)

- FECRTs should be performed **annually** where there are horses that require treatment.
- FECRT can be used to assess the efficacy of anthelmintics in individual animals, but groups of horses (at least 6 where possible) are better for detecting resistance.
- FECRT involve performing a second FEC **10-14 days** after treatment has been administered.
- When using ivermectin or moxidectin, even if the FECRT does not indicate resistance a further re-test 6 weeks after deworming is recommended to detect 'early egg reappearance'.

Tapeworm ELISA test

- A **low** result indicates low levels of antibody and that treatment is not required.
- Blood and saliva ELISA tests for tapeworm indicate **exposure** to tapeworm but not necessarily current infection.
- Tests may remain 'positive' for **3-6 months** after infection has been cleared.
- Both tests have been validated to show that antibody levels **correlate well** with the degree of infestation (number of tapeworms) in the horse.
- Sometimes horses will repeatedly demonstrate high tapeworm ELISA titres despite appropriate management and dewormer treatment. In these cases, a **FEC** for tapeworm eggs performed **48 hours after treatment** can be a helpful means to detect current (patent) infection.

 [BEVA primary care clinical guidelines: Equine parasite control](#)

Small redworm ELISA (enzyme-linked immunosorbent assay) test

BEVA considers that the test should **not** be used routinely and/or in isolation. It should only be used following consideration of the following points:

- There are **differing opinions** regarding where, or if, this test is beneficial in determining whether to administer anthelmintics.
- BEVA will **review** the evidence on an annual basis and may revise its guidance accordingly.
- At this time, it is not known what level of redworm burden should be considered **pathogenic** and this will vary between individual animals.
- The test is **not specific for larval stages** of small redworm; it detects exposure to late larval and adult stages.
- **Antibodies** may persist for many months. This test, like the tapeworm ELISA test, does not distinguish between **current and historical exposure**.
- There is consensus that a result **below the threshold** indicates that a redworm burden is unlikely (although false negatives can occur).
- There is also consensus that a result **above the threshold** does not necessarily indicate a current redworm burden or, given current evidence, reflect an increased risk of clinical disease.
- Use of the test in **hypoproteinaemic horses** may result in artificially low results (false negatives).

Strongylus vulgaris

- This large strongyle, is a very rare cause of disease in the UK at this time. This is presumed to be due to the high frequency of routine treatment which has taken place historically. It is possible that clinical disease associated with larval migration (such as infarctive, non-strangulating colic) **may start to reappear** as routine treatment ceases to be used, but the overall risk will probably remain very low in horses on well managed premises with good non-pharmaceutical practices in place.

What about foals and youngstock?

The role of the vet: Why is it so critical we act now?

- **Young horses (under 5 years of age)** are most at risk of endoparasitic disease.
- They have a lower immunity and are more likely to **excrete high numbers of eggs** onto pastures.
- Strategic anthelmintic use is sometimes utilised to reduce the risk of disease in youngstock **up to 18 months old**.
- A **diagnostic led approach** should be employed where possible, and particularly once over 18 months old.
- Advice for **foals** will vary with level of risk: number of horses/foals on the stud, previous history of disease, management practices, etc.
- **FEC/FECRT** testing should be utilised to monitor for efficacy and resistance, particularly as **ascarids** and **cyathostomins** are increasingly resistant to all classes of anthelmintics.

Foals and weanlings (< 12 months)

- ***Parascaris equorum*** is an important cause of disease, and resistance to macrocyclic lactones (both ivermectin and moxidectin) is common in the UK. Egg-shedding peaks at around 4 months old, and **FEC** to monitor for ascarid eggs should be performed **from 3 months old**.
- ***Strongyloides westeri*** is a **rare** cause of disease, and preventive treatment is not warranted unless there is a history of associated clinical disease in foals on the property. Routine treatment of mares prior to (or at the time of) foaling is not warranted. **FEC** should be performed from **3 months old** to monitor for eggs.
- **Tapeworm saliva tests should not be used in foals before weaning**, due to the possibility of interference of maternally derived antibodies. In any case, young foals are unlikely to require treatment for tapeworms unless there is a particularly high level of exposure on the property.
- **Moxidectin** use in foals may be justified in **autumn/winter** if there is a **significant risk** of accumulating a high cyathostomin larval burden. Precise timing will depend on level of risk and age of the foal. Moxidectin is not authorised for use in foals less than **4 months** of age, but foals of this age would not usually be expected to be at risk of larval cyathostomiasis. **Late foals** (e.g. those born in August) will not have time to develop a significant cyathostome burden by the autumn.

Example worm control strategy for foals

The following is a suggested example for a worm control strategy in foals on a commercial stud. Smaller enterprises or individual breeders may be able to adapt this based on their individual risk assessment:

Age	Relevant parasites	Test
3 months (2 months if history of disease on property)	Ascarids	FEC not recommended in foals up to 3 months old because this parasite has a long prepatent period. Foals should be treated at 2-3 months old.
4-5 months	Ascarids Cyathostomins	FEC to determine the need for treatment against ascarids, cyathostomins, or both (which type of eggs are present in sample).
7-8 months	Ascarids Cyathostomins	FEC to determine the need for treatment against ascarids, cyathostomins, or both (which type of eggs are present in sample).
**Strategic autumn/winter treatment (may replace the treatment at 7-8 months old)	Cyathostomins	Moxidectin (not licensed in foals <4 months of age). <i>Note: Combined products containing praziquantel are not usually required and are licensed from 6.5 months old only.</i>
Autumn	Tapeworms	ELISA

** If there is suspicion of a concurrent ascarid burden after strategic autumn/winter deworming (moxidectin treatment), then perform a FEC to determine whether additional treatment is necessary to treat the ascarid burden, as resistance to moxidectin is common amongst ascarids.

In **late foals** (e.g. those born in August), the focus remains on ascarids.

Youngstock (1-5 years old)

- Worm control strategies should be based on **risk assessment** and **diagnostic testing**.
- Perform **FEC** every 2-3 months whilst at grazing (may be all year round), recording type of eggs seen, and ideally perform **FECRT**.
- Perform **tapeworm ELISA** tests (usually in spring and autumn), ideally on the whole (or a portion of) the co-grazing youngstock group simultaneously. Treat accordingly.
- **Larvicidal treatment** (usually moxidectin) in the late autumn/winter is recommended in this age group, as they are most at risk of larval cyathostominosis. Due to the levels of resistance reported, the effectiveness of deworming cannot be relied upon, and close monitoring of this age group (such as checking serum **albumin** concentrations) is crucial, especially where non-pharmaceutical prevention methods are not being undertaken.

Toolkit for donkeys and hybrids

Introduction

As equid species, donkeys and hybrids require equal consideration in helminth and pasture management programmes, yet can often be forgotten or neglected when it comes to preventative care. The principles of the main toolkit are applicable to donkeys, but this addendum acknowledges known areas of donkey/hybrid-specific advice.

Important to know:

- **There are few anthelmintics authorised for use in donkeys.**
- **There are no authorised products for hybrid species.**
- **If no suitable authorised product, prescription can only be made by following the [cascade guidelines](#).**

The same four steps of the toolkit are followed here. As there is minimal donkey specific information compared with horses, information for **all age groups** is included together, rather than a separate section for foals and youngstock.

Step 1: Assess the parasite risk profile

Donkeys may be classed as low, medium or high risk, as for horses. Helminth specific information is given below the table, as the behaviour of these parasites in donkeys and hybrids is relevant when carrying out risk assessment.

Risk factor	Low	Medium	High
Clinical history of disease associated with endoparasitism	No history in the herd or associated with the pasture	Indication of disease in the herd or associated with the pasture	Clear indication of disease in multiple members of the herd or associated with the pasture
Age profile	Healthy adults (5-20 years old)	Healthy geriatrics (>20 years old) and/or Adults (5-20 years old) with concurrent disease (e.g. PPID)	Youngstock (<5 years old) and/or Geriatrics (>20 years old) with concurrent disease (e.g. PPID)

Strongyle results on FEC	Pair/group consistently <10% high shedders (>500 epg) or individual/pairs of animals are consistently low shedders (<500 epg)	Group has 10-30% high shedders (>500epg) or individual/pairs sometimes high shedders (>500 epg)	Group has 30-50% high shedders (>500 epg) or individual/pairs consistently high shedders (>500 epg)
Lungworm results on FEC	Consistently negative	One or more positives from new animals but housed, treated and re-sampled prior to turnout onto pasture	One or more positives within the herd whilst out grazing pasture
Liver fluke results on FEC	Consistently negative	One or more positive results but low risk grazing (i.e. pasture not wet and marshy, and not co-grazed with ruminants)	Repeated positive results and high-risk grazing (i.e. wet marshy land and/or co-grazing with ruminants)
FECRT results	Demonstrated efficacy of some/all anthelmintics by FECRT	Demonstrated efficacy of some anthelmintics by FECRT	Demonstrated lack of efficacy of some/all anthelmintics by FECRT
Herd stability	Closed group or individuals/pairs that have restricted time at grazing (e.g., those kept on yarded/non-grass areas or housed for a majority of the time)	Occasional newcomers into the group	Frequent movements in and out of group
Removal of faeces from pasture	Dung removal at least twice a week	Inconsistent dung removal	No dung removal
Pasture rotation	Regular rotation and resting of pastures	Rotation of pastures but with minimal resting	No rotation or resting of pastures
Co-grazing of pastures	Pasture regularly co-grazed or rotationally grazed with livestock. *Note that co-grazing with livestock reduces risk for strongyles but may increase risk for liver fluke	Grazing used by one equid species and occasionally rotational grazing with livestock	Mixed equid species grazed together with no rotational grazing with livestock
Soil drainage	Well drained land that is unlikely to support the intermediate host of liver fluke	Some wet/marshy areas which could support the intermediate host of liver fluke, but mainly fenced off from grazing animals	Extensive areas of poorly drained wet/marshy grazing known to, or highly likely to support the intermediate host of liver fluke
Quarantine	Effective quarantine procedures e.g. obtaining worm control history and testing of new arrivals before allowing access to pasture	Quarantine procedures inconsistent e.g. no history of previous worm control but testing of new arrivals before allowing access to pasture	Quarantine procedures non existent e.g. no worm control history available and no testing of new arrivals before allowing access to pasture

***Dictyocaulus arnfieldi* (lungworm)**

- **Usual reservoir:** Donkeys.
- **Pasture contamination:** Donkeys and hybrids (as both are permissive of the whole lifecycle).
- **Co-grazing:** Donkeys/hybrids could act as a source of infection for horses.
- **Clinical disease in donkeys:** Rarely reported, possibly due to low athletic demand, meaning low-grade lung disease can remain undetected.

***Fasciola hepatica* (liver fluke)**

- **Lifecycle:** Can complete lifecycle in both ruminants and grazing equids.
- **Donkeys/hybrids:** Appear to be more permissive hosts than horses.
- **Pathogenicity:** Poorly understood in equids.
- **Hepatopathy:** Clinical and subclinical hepatopathy, indicated by elevations in serum levels of gamma-glutamyl transferase (GGT) and glutamate dehydrogenase (GDH), have been identified in donkeys with fluke. However, donkeys with known fluke burdens may also have normal blood biochemistry, therefore, the significance of liver fluke in hepatopathy in donkeys is uncertain.
- **Wet pastures:** The intermediate snail host, *Galba (Lymnaea) truncatula*, requires wet conditions, therefore wet pastures increase the risk of liver fluke.
- **Co-grazing with ruminants:** Increases the risk of liver fluke.
- **Treatment:** It is advisable to administer treatment to donkeys with liver fluke burdens because of the potential risk of liver disease.

***Parascaris* (ascarids)**

- **Adult donkeys/hybrids:** Can harbour patent infections and contaminate pastures (unlike horses, where patent infections are usually only seen in foals).
- **Compromised adults:** Risk of disease is increased where compromised through work, ill health or poor nutrition.
- **Pathogenicity:** Clinical disease tends to be associated with large burdens in foals/youngstock (as per horses).

***Anocephala perfoliata* (tapeworm)**

- **Prevalence:** Postmortem studies indicate prevalence, and therefore risk of disease, is low in donkeys.

Step 2: Diagnostic testing - deciding what to do and when to do it

Worm egg count (WEC)

- ✓ **Strongyle egg shedding**
 - **Routine FECs throughout grazing periods:** Key component of parasite control for donkeys/hybrids.
 - **Test together:** All individuals should ideally be tested at the same time to identify high shedding donkeys/hybrids, which require treatment.
 - **Frequency of testing:** Depends on the risk of strongyle transmission.
 - **High pasture contamination:** More frequent testing is advised.
- ✓ **Ascarid egg shedding**
 - **Foals and youngstock:** Should be the primary focus when monitoring ascarid egg shedding.
 - **Foals should be >4 months of age:** WEC are less accurate before this age.
 - **Monitor for longer:** Donkeys/hybrids need close monitoring for longer than horses, as they do not tend to develop age-related immunity in the same way as horses.

- × **Tapeworm eggs**
 - **Unreliable:** Standard FECs are unhelpful in diagnosing tapeworm in donkeys and hybrids.
- × **Lungworm eggs**
 - **Unreliable:** Standard FECs are unhelpful in diagnosing tapeworm in donkeys and hybrids, as eggs contain a living embryo which hatches very quickly into first stage larvae (in as little as a few hours), before analysis is possible.
- × **Liver fluke eggs**
 - **Unreliable:** Standard FECs are unhelpful in diagnosing liver fluke in donkeys and hybrids.

Sedimentation tests

- ✓ **Lungworm L1 larvae**
 - L1 larvae can be detected using sedimentation tests, such as Baermann's technique.
- ✓ **Liver Fluke**
 - Only give an indication of adult (egg laying) fluke being present, therefore regular testing is warranted where animals graze higher risk pastures.
 - Consideration should also be given to testing any co-grazing livestock and treating as required.

Tapeworm ELISA Test

- × **Unvalidated:** The test commercially available for use in horses has not been validated for use in donkeys or hybrids.

Liver Fluke ELISA Test

- × **Unvalidated:** The test commercially available for use in livestock has not been validated for use in donkeys or hybrids.

Small Redworm ELISA Test

- × **Unvalidated:** The test commercially available for use in horses, for detection of antibodies to adult and larval stages of cyathostomins, has not been validated for use in donkeys or hybrids.

Step 3: To deworm or not to deworm? Interpreting your diagnostic tests

When deciding when to administer treatment consider the following:

- **Reliability of tests:** The only reliable tests available for use in donkeys/hybrids are FECs (including sedimentation tests).
- **Frequency of testing:** It is recommended that all donkeys/hybrids on a premises undergo faecal sampling 3-4 times per year, including checking for lungworm and liver fluke as outlined above.
- **Sampling all individuals:** Allows a more accurate picture of the level of pasture contamination and risk of clinical disease.
- **FEC threshold to treat:** In mature donkeys/hybrids with no clinical disease, a threshold of >500 epg is suggested.

Step 4: Appropriate selection of anthelmintics

- **Dose rates:** Dose rates for most deworming products (with the exception of flukicides) is the same mg/kg bodyweight as for horses.
- **Bodyweight:** A common lack of familiarity with estimating donkey bodyweight can sometimes lead to owners using inappropriate estimation tools that result in inadequate dosages being given.
- **FECRTs:** Recommended to monitor efficacy of selected products (as per horses).

Table 1. Active ingredients where there are products with specific authorisation for donkeys (note that the SPC of individual products should be checked carefully).

	FBZ	PYR	IVM	MOX	PRAZ
Adult small strongyles	✓	✓	✓	✗	✗
Encysted small strongyles	✓ (5d)	✗	✗	✗	✗
Large strongyles (adults)	✓	✓	✓	✗	✗
Large strongyles (larvae)	✓ (5d)	✗	✓	✗	✗
Large roundworms (ascarids)	✓	✓	✓	✗	✗
Tapeworm	✗	✓ Double dose	✗	✗	✗
Pinworm	✓	✓	✓	✗	✗
Lungworm	✗	✗	✓	✗	✗
Liver fluke	✗	✗	✗	✗	✗
Threadworm	✓	✗	✓	✗	✗
Bots	✗	✗	✓	✗	✗

Cyathostomins

- **Authorised products:** FBZ, PYR and IVM are authorised for the treatment of cyathostomins in donkeys.
- **Avermectins:** Donkeys and hybrids may be more likely to develop signs of neurotoxicity and care must be taken to dose accurately.
- **Resistance:** Whilst the efficacy remains reasonable for some products within certain populations, suspected or confirmed cases of resistance have been reported.
- **Acute larval cyathostominosis:** Can be challenging to detect in the typically stoical donkey before the animal is too sick to recover, not least because acute diarrhoea is rarely a presenting sign.
- **Annual moxidectin treatment:** As for horses, deciding whether to give an annual moxidectin treatment with the aim of reducing encysted cyathostomes is a challenging consideration and requires individual assessment of each case. Note: Not licensed for use in donkeys/hybrids.

Large strongyles

- **As per horses:** See general advice on treating large strongyles in horses.
- **Resistance:** To date there has been no evidence published to suggest any concerns of resistance in donkeys.

Ascarids

- **Always treat:** Where ascarid infections are identified, treatment should always be administered. Both to reduce the risk of clinical disease in the individual donkey, and to prevent further pasture contamination.

Lungworm

- **Clinical disease:** Rare.
- **Treatment:** Advised where tests are positive to prevent re-infection, particularly where donkeys or hybrids co-graze with horses.
- **Ivermectin:** Only licensed lungworm treatment in equids (including donkeys).
- **Resistance:** Suspected resistance to ivermectin has been observed within certain donkey populations in the UK, so follow-up FECRTs are advisable to check treatment efficacy.

Liver fluke

- **Treatment:** Decision should be based on risk and only considered alongside test results.
- **Authorised flukicides:** There are currently no authorised flukicides for liver fluke in equids.
- **Triclabendazole:** Has been used as a first line flukicide in donkeys and hybrids at 18 mg/kg bodyweight.
- **Closantel:** If triclabendazole resistance is identified, closantel at 20 mg/kg bodyweight can be used, with a repeat dose after 8-10 weeks as the drug does not kill juvenile fluke.

Tapeworm

- **Double dose pyrantel:** The only authorised tapeworm treatment for use in donkeys.
- **Treatment:** Given that the prevalence in known donkey populations is low, and the incidence of associated clinical disease is also low, treatment may be considered unnecessary.
- **Resistance:** Resistance to pyrantel has not been studied within UK donkey populations, and without an accurate means of diagnosing infections in live animals this remains difficult.