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The Importance of Acaricide and Anthelmintic Resistance Management in Livestock Productivity and Farmer Profitability

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Introduction

In the sector of livestock rearing, productivity of the animals has a direct relationship to the profitability of the farmer and the sustainability of the farm. It is often considered as a key performance indicator in the animal husbandry sector which is why various efforts and innovations are aimed at improvement of livestock productivity. The threat of parasites like worms and ticks is one of the biggest risks affecting the health and productivity of animals. Due to decreased production of meat, milk, and wool, higher mortality, and the expense of treatments, these parasites not only lower animal output but also directly result in financial losses. Two major classes of drugs – acaricides for ectoparasites and anthelmintics for endoparasites – are generally involved in the management and control of these parasites. However, the widespread overuse or improper use of these chemical agents have led to manifestation of resistance in the organisms thereby leading to reduced efficacy of the treatments. Hence, acaricide and anthelmintic resistance pose a serious challenge to farmer's profitability and livestock health necessitating immediate intervention.

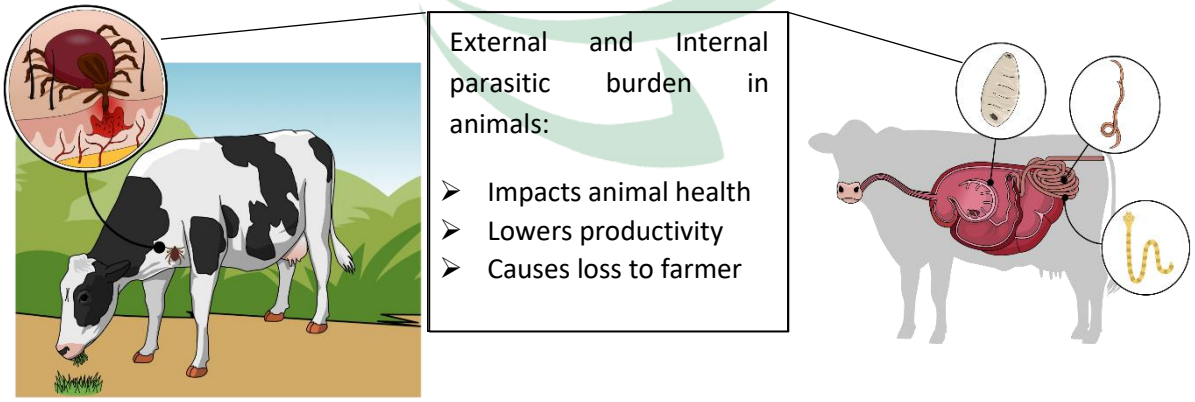

Fig.1 Impact of acaricidal and anthelmintic resistance in animals

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This article intends to cover the mechanism behind the emergence of resistance, its impact on the health and productivity of livestock, the threat to profitability of livestock rearing, and the ways to counter this threat.

Understanding the acaricide and anthelmintic resistance

Chemicals known as acaricides are used to eradicate ticks and other ectoparasites that spread illnesses like theileriosis, anaplasmosis, babesiosis etc. Whereas, the anthelmintics are used to treat livestock diseases caused by parasitic worms, or helminths. Reduced weight increase, poor feed conversion, decreased milk supply, and fertility issues are some of the major losses brought on by these infections. The practices such as underdosing of these medications, treating animals without a correct diagnosis, or repeatedly utilising the same class of drugs may lead to development of resistance among the parasites against these drugs. Resistance, is termed as the phenomenon where an organism becomes less sensitive to a drug that usually kills it, thereby limiting the therapeutic potential of the drug. The emergence of resistance to various class of drugs is being perceived as a global threat as it limits the longevity of drugs leaving veterinarians with less options to treat a particular disease.

While the resistance to other classes of drugs such as antibiotics, antifungals etc., is of concern, the resistance to acaricides and anthelmintics in particular is more important since these drugs are routinely used in the management of livestock, and there are less available alternatives in the market. Thus, the acaricidal and anthelminthic resistance has a direct impact on the farm productivity, economics, and the health of animals.

As we investigate the cause of resistance, several important mechanisms are believed to induce the emergence, and contribute in the spread of this phenomenon. The popular mechanisms that contribute to the emergence of resistance in parasites include:

- **Natural selection:** In the nature, some mutants appear randomly, which are resistant to certain classes of these drugs mostly due to modification in the target at the site of action of these chemicals. When these parasites reproduce, they pass on their resistant traits which lead to development of resistant. This is very rare and does not majorly contribute to the menace of resistance.
- **Artificial selection:** This is the most common reason for emergence of resistance. In this case, the selection pressure is man-made, wherein the factors such as incorrect

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dilution of drugs, incorrect dosing of animals, inappropriate selection of agents, overdosing of the agents, use of same class of drugs for extended periods etc., induce adaptation mechanisms such as modification of target site, development of pathways to metabolise the chemical agents, efflux mechanisms that reduce penetration or absorption of the drugs, etc., these traits are then carried over to the next generation by the surviving individuals thereby leading to emergence of resistance against a particular class of drugs.

Furthermore, "cross resistance" has also been observed among the parasitic population. Wherein, resistance against a particular agent may facilitate resistance against other chemical agents with similar mode of action, to which the parasite may not have been exposed yet. One parasite may even be resistant to multiple classes of agents leading to emergence of "multi-drug-resistant parasites".

Consequences of the emerging resistance

Livestock health and productivity is significantly impacted by anthelmintic and acaricide resistance, both directly and indirectly. Some of the consequences include:

- **Decreased health and growth Rates:** Compromised immune system of the animal, anaemia, loss of appetite, and poor growth are all consequences of the persistent infestation of resistant parasites. Reduced weight gain, delayed maturity, and poorer reproductive success are the results of this.
- **Increased mortality of animals**: In extreme situations, untreated or inadequately managed parasite diseases result in increased mortality rates, particularly in young or vulnerable animals, which directly costs farmers money.
- **Increased disease transmission:** Ticks in particular, act as vectors for diseases like babesiosis and theileriosis etc. This issue is made worse by acaricide resistance, since poor treatments make it easier for tick populations to infect livestock with these diseases thereby causing widespread disease among the animal herds.

All of these contribute to compromised animal health, increased animal suffering due to diseases, decreased productivity of animals, increased expenses in the form of veterinary care and an overall increased economic loss to the farmer.

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Fig.2 Image depicting parasitic load on farm animal

Fig.3 Poor body condition of animal as a result of parasitic burden

Strategies for management of resistance

Maintaining animal productivity and ensuring the effectiveness of anthelmintics and acaricides depends on development of an effective resistance management strategy. The following methods can be adopted for the same:

- **Rotation of chemical agents:** By alternating between different classes of chemical agents on a regular basis, parasites are less likely to be selected to become resistant to a particular class of pharmaceuticals.
- **Targeted Selective Treatment (TST):** Instead of treating the entire herd, treat the animals that are exhibiting symptoms of parasite infection. This lowers the use of agents and slows the development of resistance by maintaining vulnerable parasite populations in untreated animals.
- **Non-chemical Control**: In addition to chemical treatments, biological controls such as predatory fungi that prey on worm eggs or dung beetles that decompose manure and lower worm larvae can be used. Rotation of pastures is one example of environmental management that lowers parasite exposure and lessens the need for chemical treatments. Ethnoveterinary practices are also being explored as effective alternative methods to the current chemical agents.
- **Appropriate Dosage and Timing**: To prevent emergence of resistance due to underdosing, acaricides and anthelmintics must be administered as per proper dose. The right dosage of medication is to be given taking account of accurate animal weights and suitable dosing tools. Additionally, pharmacological efficacy is maximised when treatment is administered at the optimal period, that is when parasite burden is at peak.

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Combination of different classes of drugs can be used with caution to increase the spectrum of coverage and maximized impact of therapy.

- **Integrated Parasite Management (IPM):** IPM involves control of parasites by combining environmental, biological, and chemical methods. Farmers can lessen their dependence on drugs and can delay the emergence of resistance by combining various techniques.
- **Increasing awareness among farmers:** Though often overlooked, educating farmers on the proper usage of chemical agents and creating awareness about emerging resistance is one of the vital components of any strategy designed to combat resistance.

Conclusion:

Livestock productivity and farmer profitability are severely hampered by anthelmintic and acaricide resistance. Nonetheless, farmers may lessen the consequences of resistance, preserve the well-being and output of their herds, and enhance their overall financial output by putting smart resistance management techniques into place. Farmers may protect their revenue and advance sustainable livestock farming by using integrated parasite management, education, and close observation of treatment procedures.

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