Epidemiological Intelligence for Grazing Management in Strategic Control of Parasitic Gastroenteritis in Small Ruminants in India – A Review

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Abstract

Because of the environmental and consumer concerns arising out of exponential growth in human population the world over, a term Sustainable Development has become an integral international concept, which is defined as one which meets the needs of the present without compromising the ability of future generations to meet their own needs. Ruminant animals appear sustainable as they do not compete with man for food, play a crucial role in the conversion of low quality plant material and crop residues to high quality human food as well as return valuable plant nutrients to the soil. Parasite control in ruminant livestock is a first-order input in any sustainable animal production system. As sustainable development is a compromise between reducing environmental degradation and positive economic growth, sustainable parasite control should aim towards less intensive, lower input, lesser risk of parasite induced losses with greater opportunities for integration of all available control resources. The compound scenario of rising anthelmintic resistance, food and environmental security and apathy of the pharmaceutical industry to go for the invention of new anthelmintic compounds has triggered the need for optimising the use of available anthelmintics with integration of all other alternative means for sustainable worm control. The “Sustainable Control of Parasitic Gastroenteritis in Ruminants” is thus encompasses a multidisciplinary approach involving integration of chemotherapy, grazing management, biological control, worm vaccines, genetic resistance of hosts, mathematical model based decision support and other strategies, if any. There is no single requirement more crucial to the rational and sustainable control of helminth parasites in grazing animals than a comprehensive knowledge of the epidemiology of the parasite as it interacts with the host in a specific climatic, management and production environment. In its absence, anthelmintic treatment is either given suppressively which provokes resistance or therapeutically which risks clinical disease and production losses. Sustainable parasite-control programmes require knowledge of seasonal larval availability, origin of larvae contributing to any peaks and climatic requirements for worm egg hatching, larval development and survival. Control measures based on this knowledge include strategic anthelmintic treatments and various forms of grazing management. While these measures can reduce the frequency of anthelmintic treatment required, their effect on selection for drench resistance is more problematical, unless they can be combined with other forms of control to reduce our current dependence on anthelmintics. The present article deals with sustainable nematode parasite control in small ruminants in India through grazing management using epidemiological intelligence.

Key words : Epidemiology, Grazing Management, Strategic control, Parasitic gastroenteritis, Small ruminants.

Introduction

Small ruminants' are widely distributed and are of great importance as a major source of income for small scale and the landless in rural communities of developing countries .Sheep & goat with large genetic diversity accounts for about 0.5 to 5% of total output of livestock sector in India. (Singh, 1995). Depending upon availability of grazing material & changes in the season, the flocks are reared either in sedentary (organized farm) or in migratory system (farmers flock).

The general management of small ruminants is either extensive grazing (natural range lands, waste lands, community grazing land during monsoon, stubble grazing on kharif harvested field in winter; stubble grazing on rabi harvested field, top feed &forests in summer) or semi intensive grazing (Singh et al ., 2005).

Gastrointestinal nematodosis is well known to induce important economic losses in small ruminants production. (Fabiyi,1987). The usual mode of control of this menace upto now was based upon repeated use of anthelmintics.However,the higher prevalance of anthelmintic resistance & presence of chemical residues in animal products made it mandatory to look for some alternative solutions (Hoste et al ., 2002) so as to control of nematode menace and manage emergence of anthelmintic resistance. Several options (Sanyal, 1998; 2005) are currently explored to improve hosts resistance (genetically; nutritionally; immunologically by vaccination) or avoiding contamination (grazing management, biological control).

Epidemiology of Ovine Gastrointestinal Nematodosis

Thorough knowledge of epidemiology including the seasonal variation in pattern of larval development and availability on pasture can form basis for control of gastrointestinal nematodosis through pasture management. The epidemiology of gastrointestinal nematodes is governed by weather conditions and management practices that regulate the development & survival of exogenous stages of parasites (Bali,1973, Mishra et al., 1974; Dhar et al., 1982; Gupta et al., 1987; Ahmed and Ansari, 1987; Singh et al., 1997; Bandyopadhya, 1999; Anon, 2004). The epidemiological picture of ovine GIN in India can be described under 4 major agroclimatic zones:

Northern Plains:

Predominant parasites : *Haemonchus contortus, Oesophagostomum spp., Trichostrongylus spp., Bunostomum spp.*

The usual monsoon period in this region remained from june to October causing high rise of GIN in small ruminants during monsoon and post monsoon period.(Ahmed and Ansari, 1987; Mishra et al., 1974; Bali and Singh, 1977).The incidence of Haemonchus contortus was maximum during July to October and minimum during March to June. The climatic conditions favourable for development of trichostrongyle larvae on pasture during February to April lead to occurrence of peri-parturient rise (PPR) in faecal egg counts (Gupta et al., 1986). However, hypobiosis was reported to be absent. Recently as per the studies conducted at Pantnagar revealed higher incidence of gastrointestinal nematodes in flocks of Tarai region as compared to plains throughout the year. The occurrence of *Haemonchus contortus* and *Trichostrongylus spp*. was throughout the year while prevalence of *Oesophagostomum spp*. was restricted mainly from August to November and *Ostertagia spp*. was recorded in the month of May (Anon, 2008).

Semi Arid Western Region

Predominant parasites : *Haemonchus contortus, Trichostrongylus spp.,Oesophagostomum spp.*

Most of precipitation occurs from July to September. Suitable conditions for exogenous stages of parasites were from July to October. Peak intensity of infection in host was recorded from July to early September and in young from august to early November (Singh et al., 1997; Khan et al., 1999). Maximum survival period of infective larva on pasture was 9 weeks in September and 2 months resting period was required to sterilize the contaminated pasture. Intensity of infection started rising with onset of monsoon and persisted upto September, followed by decline in succeeding months. Comparatively higher prevalence of Trichostrongylus spp. was recorded in arid region of Rajasthan than semiarid region. (Swarnkar,et.al.,1997). Incidence of gastro-intestinal nematodes was higher during monsoon in all climatic zones of Rajasthan. Higher incidence in organized farm flocks was recorded compared to farmers flock. PPR was recorded to be absent and non significant variation in faecal egg counts in different breeds of sheep of semiarid western region was noticed (Singh et al., 1997).

Sub-temperate Southern Humid Region:

Predominant parasites : *Haemonchus contortus, Trichostrongylus spp., Oesophagostomum spp.*

The studies conducted at an organized farm in Kodai hills of Tamil Nadu revealed that rainy and autumn season (June to November) were best suited for survival and migration of exogenous stages of nematodes (Sanyal, 1989a) and a higher incidence of GIN in sheep was recorded during South-west and North-east monsoon (Anon, 2004). The in depth study conducted in different zones of Tamil Nadu revealed higher incidence of GIN in rainfall area followed by Cauvery delta and North-eastern zone. Sanyal and Gour (1984) observed prevalence of H. contortus (70%), T. colubriformis (20%), O. venulosum (20%) and occasional Strongyloides in sheep from Tamil Nadu. The migration of infective larvae on grass blades was more in autumn, while all the pre-parasitic activities were low in winter due to scanty rainfall. The lowest pasture contamination was observed in the month of December and attributed it to harsh climate as a result of low temperature and sparse rainfall. The survivability of infective larvae was more than 11 weeks in rainy season. In face of sufficient rainfall, larvae were found to migrate vertically up to 15 cm and laterally up to 50 cm compared to only 5 cm and 20 cm, respectively during non rainy season (Sanyal, 1989b). The pasture contamination by grazing ewes from January to March took 4 months to become parasitologically barren following preventing the grazing in April. In spite of low herbage larval burden and low FEC in February the sudden rise in eggs and worm count in March were attributed to hypobiotic behaviour of H. contortus at Kodai hills in Tamil Nadu, which may become the potential source of pasture contamination in spring coinciding with the lambing (Sanyal 1988, 1989c).

Temperate and Sub Temperate Himalayan Region:

Predominant parasites : *Haemonchus contortus, Trichostrongylus spp, Bunostomum spp,*

The monsoon period started by middle of June and exists upto early September. The moderate temperature makes the environment favourable for development and survival of pre parasitic stages leading to availability of larvae of pasture .Peak intensity of infection in host occurred from july to September with maximum incidence from march to November. (Dhar and Das, 1982). Hypobiosis remained not known and PPR was present (Makhdoomi et el., 1995).

Management of Gastrointestinal Nematodosis by Grazing Management

Arthru le Feuvre's Principle states that “if one cannot or do not measure something, one cannot manage it and if one do not manage it, one cannot control it.” The management of gastrointestinal nematodes through a system should incorporate :

* Measurement of worm level
* Measure the efficacy of available anthelmintics.
* Application of efficacious drench
* Ensure reduction in pasture contamination
* Use of worm hostile climate
* Use of non-chemical strategies.

Our goal is not the creation of parasite free animals but prevention of clinical disease and production losses (Sanyal, 1998).

The aim of grazing management is :

* To provide low risk pastures (those with the fewest worm larvae) for the most susceptible sheep (weaner and lactating ewes)
* To have vulnerable sheep exposed to fewer larvae on pasture which not only supposed to reduce drench frequency but also provides better nutrition at the same time thus, allowing sheep to deal with parasites better (Barger, 1998, 1999).

Types of Pasture

Clean Pasture: It is the pasture free from infection in the sense that susceptible animals grazing on it will not become a source of contamination & if worm free animals are put on such pasture it will remain safe for the rest of the season (Waller, 1997; Barger, 1998). The clean pasture can be prepared by:

* Cultivation of new pasture
* Pasture not grazed by small ruminants for past 6 to 12 months
* Pasture grazed by cattle/buffalo in the previous year.
* Grassland used for conservation in previous year.
* Burnt pasture

Safe Pasture: It is not sufficiently heavily infested to effect the production of susceptible animals grazing on it but such animals will become a source of contamination. The safe pasture are those which are grazed only by young animals during summer.Pasture that has been grazed by other species for a grazing season or longer period are also considered safe ,because only a small amount of cross infection between species occur (Waller, 1997; Barger, 1998).

Dangerous Pasture: These are liable to carry an infestation sufficient to impair the production of susceptible animals (Waller, 1997; Barger, 1998).

Basic Strategies to Reduce Pasture Contamination

Preventive Strategy: The animals are prevented from contaminating the pasture. It is achieved by turning out clean animals on clean pasture.It is flexible to manage as timing of turn out, weaning and housing is not critical (Waller, 1997; Barger, 1998).

Evasive Strategy: This relies on the removal of a moderate existing infection by anthelmintic treatment,allied with a movement of treated animals to a safe pasture. Shifting of animals to other safe pasture before PLB rises to dangerous level. Though it does not require clean pasture but timing of turning out is critical (Waller,1997; Barger,1998).

Diluting Strategy: It involves grazing of susceptible animals (source of contamination) with resistant adult animals in order to dilute the faeces of susceptible animals which is rich in worm eggs (Waller, 1997; Barger, 1998).

Practices of Pasture Management

Pasture Rotation System: It is a grazing management technique involving sub divisions of pasture in which each paddock is grazed for a short time & then rested for a relatively much longer time.The resting time should be framed in such a way to cause death of larvae. It has better applicability in tropical climate (Singh and Swarnkar, 2005).

Advantages

· Continous reduction in PLB
· Reduced use of anthelminthtics & risk of AR

- Better pasture productivity & it's utilization

Limitations

- Initial higher capital investment (fencing etc)
- Require larger pasture area, Labour intensive.

Safe Pasture System: It is suitable in combined crop & livestock production system.The number of larvae in the pasture are reduced overtime by resting the pasture during the period when they are normally being re-contaminated or through growing & harvesting of crop of hay/silage (Cabaret et al., 2002).

Advantage

- Reduced PLB, Reduced use of anthelmintics
- Better pasture utilization

Limitation

- If combined with the use of anthelmintics,it may increase the selection pressure for AR
- Poor performance of animals if turned out was not in time

Alternate Grazing System: Two or more host species in any given environment do not share common parasite species, alteration between species can be a successful tool of improving worm management. It is less efficient in temperate climates (prolonged survival of larvae). It involves grazing between different age group of different species taking advantage of higher resistance in older animals & between different animal species ,where cattle and buffalo act as vacuum cleaner to the pasture if grazed before or after sheep & goat. In area where *T. axei* is not a major concern alteration between small ruminants & cattle would be successful. In *H. placei* predominant areas, alternate grazing with sheep/cattle would not work as this infects both the species (Barger et al., 1994). Best example is low intensity of gastrointestinal nematodes in field flocks because of grazing of different animal species on same pasture and higher intensity in farm flocks because of monospecific grazing in organized farms.

Pasture Resting: This requires preventing of animals from grazing in the same paddock for longer time. The resting period varied from 2 months (Semi-arid) to 6 months (Cool Moist Climate). The studies conducted in semi arid regions of Rajasthan revealed that sheep grazed during monsoon on spring contaminated, summer ungrazed pasture had very low faecal egg counts, pasture larval burden and worm counts compared to those on continuously grazed contaminated pasture.(Singh et al., 1997).

Other Strategies Involved In Grazing Management

Dose & Move: This strategy involves moving of animals from pasture to pasture after deworming. It requires a clean pasture but is highly selective for anthelmintic resistance (Abbot et al., 2004).

Stocking Rate: High stocking density on pasture increases pasture larval burden. On lowering the stocking density there occurs reduction in amount of manure in given area and higher height of residual grazing forage (Morley and Donald, 1980).

Herbage Height

- 80% of parasite larvae live in first 5cm of vegetation.
- In older pasture, animals should be grazed on longer (10cm) grasses.
- New pasture should be grazed closely so that sun rays can dry the faeces & diminishes the chances of larval survival (Jones, 1993).

Grazing Time

- Larva move to the top of herbage when intensity of light is low.
- Limit grazing time to when the sun is strong, diminishes the risk of infection.
- Limit the grazing in highly contaminated pasture during summer months.
- Put the animals on new pasture during monsoon.

Destocking and Fodder Conservation

- Majority of larvae are removed with fodder to be conserved.
- Remaining larvae on the top 2cm of pasture are exposed to sunlight & drying.
- Now new eggs have been deposited due to destocking of paddock.
- Provides better opportunity for pasture growth with minimum infectivity.

Zero Grazing: This system is practiced for fat lamb production and animals are raised in confinement on dry lot (with no grass) without any problem of gastrointestinal nematodes (Singh and Swarnkar, 2005).

Conclusion

1. Regional worm management programme should be developed for effective control of gastro-intestinal nematodes.
2. Integration of different approaches will be sustainable in face of emerging anthelmintic resistance in future.
3. Success of pasture management depends on ability of farmers/associated agencies to understand and implement them.
4. The worm control through pasture management could be better implemented in organized farms than traditionally extensive system of sheep farming in field (Sanyal, 1998).

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