CHAIRS' SUMMARY PAPER: Constraints on Animal Production from Grasslands and Forages

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The theme of Session 11 was "Constraints on animal production from grasslands and forages". The two main topics reviewed in the session were:
- Parasites in pastures, and
- Plant secondary compounds

In this summary highlights of the invited papers and posters, and discussion are presented.

INVITED PAPERS

Parasites. Dr Bransby limited his presentation to internal parasites and their influence on grazing animals. Internal parasites are a part of grassland ecology, yet they are often ignored in managing pastures and grazing animals. There are also several widely held misconceptions about internal parasites:
- Rotational grazing reduces the need for deworming.
- Parasites hurt cattle more severely at high than low stocking rates.
- Parasites have greater adverse effects on animals whose nutrition is inadequate.
- Parasites stimulate appetite.
- One can judge visually the need for deworming.
- Faecal egg counts are an adequate measure of parasite burden in animals.

Measures for controlling internal parasites include:
- Chemotherapy can provide broad spectrum, season long parasite control. This may be achieved by treatments such as sustained release bolus technology.
- Grazing management can be beneficial but increased knowledge of plant / parasite ecology is essential.
- Biological control including the use of agroforestry in pasture programs is the preferred way. Exploitation of secondary compounds in plants and the role of endophytes in pasture plants offers alternate ways of control.
- Dung beetles may reduce parasites in pasture vegetation.
- Manipulation of pasture sward structure may retard the vertical migration of larvae.

The discussion on parasites highlighted the following points. There is a need to recognize and integrate local farmer practices and indigenous knowledge, especially in pastoral systems and communities, in parasite management. Possible adaptation of animals and differential tolerances of breeds and types of animals should receive attention in parasite control. There was considerable concern over the development of parasite resistance to antihelminthics. Strategic dosing coupled with grassland management were advocated as sustainable control measures. Indices advising on the use of dosing need to be improved to enable farmers to judge accurately on the strategic dosing of animals.

Ecological biochemistry of secondary plant compounds in herbivore nutrition. The second invited paper in this session dealt with secondary plant compounds and their role in herbivore nutrition. There is a large and diverse group of molecules that are involved in herbivore-plant interactions. There are two main groups that have been widely studied:
- Toxic/anti-nutritional compounds which include alkaloids, saponins, cyanogenic glucosides, isoflavonoids and other compounds.
- Non-toxic compounds that have nutritional limitations such as lignin, silica, cutin, tannins and terpenoids.

There are also secondary compounds in plants that can have both positive and negative effects on animal production and performance. Two compounds were given as examples, namely phenyl propenoids and condensed tannins. Red clover (*Trifolium pratense*) has phenyl propenoids that have a positive effect on protein digestion. Red clover also contains formononetin, an isoflavone, that is oestrogenic in nature and causes reproductive problems. *Sesbania sesban* accessions with a moderate content of condensed tannins (CT) resulted in higher growth rate and nitrogen retention in sheep than accessions with the lowest levels of condensed tannins. However, when fed to chicks, these accessions with low CT concentrations resulted in greater mortalities than accessions with moderate or high levels. Preliminary evidence suggests that saponins are responsible for the toxicity. It is possible that interactions between CT and saponins in accessions with higher content of CT reduce toxicity of saponins.

Given this multiplicity of secondary compounds and their function, what will be the impact of genetically lowering specific compounds on the agronomy and nutritional value of such plants? There is a need to manipulate vegetation so that dominant plants contain less inhibitory compounds and more beneficial compounds. Manipulating ruminal microflora could be used to reduce toxicity problems, such as mimosine, in *Leucaena* spp. This kind of research requires adequate funding to support interdisciplinary teams, focused team approach and highly trained personnel.

Discussion questioned also terminology, especially the use of the term 'anti-nutritional factors'. However, in the absence of detailed chemical studies, nomenclature was bound to remain generalized. The role of the nutritional environment of the plant on the production of secondary compounds was highlighted as was the need for precise qualitative and quantitative chemical and biological assays for secondary compounds.

POSTERS

Management and use of endophyte infected *Festuca* spp. and *Lolium* spp. were topics of several posters. There were also posters on endophytes in Sessions 13 and 22. Seed germination of *F. arundinacea* was not altered by the presence of *Acremonium* (Bush et al.). Thom et al. in New Zealand noted losses in milk production of cows grazing endophyte infected *L. perenne* pastures, compared with endophyte-free pasture, were small (<6%). Latch and Fletcher

reported that in *L. perenne*, endohytes exist which do not produce tremorgenic alkaloid loliterm B. Infecting plants with such a strain of *Acremonium* endophyte were effective against Argentine stem weevil but did not produce toxins harmful to grazing animals. This suggests that it should be possible to reduce or eliminate the deleterious effects that endophytes have on animals while preserving the beneficial effects they have on the grass host. Steer gains were slightly greater on mixtures of *A. coenophialum* infected (E+) and free (E-) *F. arundinacea* than on the E+ fescue pasture in Tennesee, USA (Fribourg and Waller). Average daily gains of and intake of *F. arundinacea* hay by dairy heifers were similar for E+ and E- hays in French studies (Emile et al.). Prolactin concentration in blood plasma was, however, lower in heifers fed E+ hay. Dihidroxipiridine excretion in urine of buffaloes fed *Leucaena leucocephala* at three levels occurred quickly after feeding which indicates rapid metabolization of mimosine (Alcântara et al.). Reports on new pasture species and cultivars were included in the session. In New Zealand, (Oppong et al.) hybrid willow *(Salix* spp.) had high yields with good nutritional quality in summer and could provide potentially valuable supplements to pasture production during summer drought. Steer performance on diploid and tetraploid *Agropyron cristatum* cultivars was similar in a grazing study in Saskatchewan, Canada (Bruynooghe et al.). Edwards et al. working on tagasaste (*Chamaecytisus proliferus)* in Australia suggest that the seasonal productivity of animals grazing tagasaste is largely due to changes in feed intake through the year, mediated by the concentration of phenolic compounds in its edible leaf and stem material.

Prof. Carl Hoveland reported on a closely related event, the 3rd International *Neotyphodium*/Grass Interactions Symposium, which was held just before the IGC at the University of Georgia in USA. The objectives of this symposium were to provide scientists with current reviews and latest research on the ecology and systematics of grass-endophyte associations, commercial uses of endophytes for livestock and turf industries, the pathophysiology of toxicosis in livestock, cellular and molecular techniques available for investigative research, and current farm practices for averting or ameliorating livestock toxicosis syndromes. Prof. Hoveland in his report indicated a need for continued collaboration. Perhaps the greatest challenge for researchers and end-users of technology is to appreciate, and be current on, the breadth of literature associated with mutualistic endophytes in grasses.

In conclusion, there was a great deal of interest in parasite control and management strategies of internal parasites in grazing systems. Discussion emphasized development of strategies for overcoming apparent difficulties in controlling internal parasites due to potential resistance to antihelminthics. Grass-endophyte associations are being studied extensively as was evident in posters and attendance in a separate symposium on *Neotyphodium/* grass interactions. In Session 39 of XVII IGC reference was made to designer endophytes. Such results were reported in this congress enabling insect control in grass without harmful effects to the grazing ruminants. Research on improving animal response and performance on a range of plant species containing potentially toxic or anti-nutritional compounds was promoted. Need for team effort in this type of research was advocated and limitations posed by resource requirements were recognized.