CHAIRS' SUMMARY PAPER: Technology Transfer

D.G. Smith[1] and G.D. Lacefield[2]
[1]Agriculture & Agri-Food Canada, PFRA, Swift Current, Canada S9H 3X3
[2]Department of Agronomy, University of Kentucky, Princeton, KY, USA 42445

Invited papers from D.B. Hannaway (USA) and I. Scoones (UK) were presented at the Technology Transfer session of the International Grassland Congress. Summaries of these papers and a synopsis of the twenty-five poster papers, grouped into five themes, are presented.

David Hannaway presented a multimedia version of his paper which reviews technological developments over the past 100 years that have transformed our ability to communicate electronically. Recent developments in the area of multimedia information systems on the world wide web present new opportunities for forage scientists, educators, farmers and ranchers, and agribusiness personnel. The challenge remains to fully utilize current capabilities for electronic communications and to apply these capabilities to meet our needs now and in the future.

Ian Scoones paper, presented by Ann Waters-Bayer, examines the argument that conventional linear models of research and extension, based on simplistic assumptions of diffusion, adoption and technology transfer, are deficient under complex and diverse agroecological settings such as grasslands. In these settings, where sustainability and integrated resource management are key issues, researchers' and extensionists' perspectives on carrying capacity, grazing rotation and ecological dynamics are contrasted with those expressed by farmers. Based on a case study from communal areas of Zimbabwe, the paper discusses future challenges and highlites the need to move beyond the linear model of technology transfer and implement participatory, co-learning approaches for extension systems which recognize multiple sources of knowledge, technological innovation and requirements for new skills, attitudes, behaviors and organizational forms for research and extension.

EDUCATION AND LEARNING PROGRAMS

Training of agricultural workers is essential to delivery of technology transfer programs. A new Bachelor of Applied Science degree, introduced at Massey University, New Zealand is designed to meet the changing needs of primary sector industries. The Agriculture endorsement is broad-based in concept and requires students to complete at least one paper from each of six main disciplines.

Pasture Management is a computer assisted, problem based, multimedia educational program developed in Australia to complement field exercises in pasture assessment and management. Students learn from traditional teaching methods and from new computer technology. The software offers students simulated exercises to explore the outcomes of alternative management decisions using case studies.

Producers require educational programs to successfully implement changes in grassland management. In 1994, the Michigan Hay and Grazing Council contracted a co-ordinator to assist in establishing local grazier and forage groups, publish a quarterly newsletter and assist in evaluation of the Michigan Grazier Network educational program.

USING COMPUTER TECHNOLOGY

Scientists, extension staff and producers around the world require reliable sources of new information about forages. The Forage Information System on the world wide web (WWW) is a pioneering effort in the provision of decision support. Information on the WWW is dynamic and is not confined by the time, space and geographical constraints of books and CD-ROMs. The Forage Information System (http://www.forages.css.orst.edu) is creating a template for "International Forage Fact Sheets" and linkages to resource information, seed vendors, education materials, and forage organizations. Computer communications systems allow networking of beef/forage advisory groups by using E-mail and the world wide web.

Today's computer technology is also used for managing spatial data in land use systems. Geographic Information Systems (GIS) and Remote Sensing are used to assess hazards of soil erosion and to prevent land degradation. One case study looks at the potentially hazardous zone of land degradation related to river networks in Pakistan. The USDA's Natural Resource Conservation Service (NRCS) recently drafted a new National Range and Pasture Handbook that prescribes use of ecological site descriptions, rating of rangeland trend, rangeland health and determination of a rangeland similarity index. In support of this effort, four strategic databases are maintained: soil, climate, plant and ecological site information.

The Australian Rainman computer package is a tool used to help manage climatic risks associated with the El Nino southern oscillation phenomenon and delivers benefits to farm managers and others. The software provides an array of meteorological information and permits users to enter their own data and receive monthly updates. Australian farm managers are using Rainman to manage climatic risks and opportunities through adjustment of stocking rates in response to projected feed supplies and management of herd structure.

STAKEHOLDER INVOLVEMENT IN RESEARCH AND EXTENSION

The decline of ecologically valuable perennial grasses in the high rainfall zone of southern Australia occurs when producers concentrate more on management of their stock rather than management of their pastures and soils. In response, a producer planning group has established a business plan which describes what producers need to adopt improved grazing management systems. Under the plan, local steering committees identify critical issues and decide on relevant activities. The skill development program is designed to involve producer groups as opposed to individual producers.

In southwestern Australia, the extension approach is considered to be more effective when primary producers take an active role in the implementation of research and development. Technology transfer of successful research activities requires marketing and exposure to attain adoption of the promoted practices. In turn, involvement of grower groups helps to facilitate development of research and extension ideas such as newsletters, field days and road side demonstrations.

A comparative analysis of technology transfer in the USA and Australia suggests producers require more information to address increasingly complex and diverse ecological and social issues. A review of strategies to increase forage production in India and identification of the specific areas requiring research and extension activities now and in the future is provided by Singh and Mal. Participatory research, involving farmers as equal partners with researchers in the Phillippines, is aimed at developing appropriate forage technologies. The process advances the understanding of farming systems, and improves identification of technologies with

strong extension potential.

A development project in China, supported by New Zealand scientists, is considered a success because local ownership and responsibility was established from the beginning of the project with the goal of providing long term sustainable development. An important feature of the project is the retention of project management at the local level with interactive training conducted in New Zealand and research completed in China. This process enabled local management and technical staff to identify and evaluate appropriate technology, then transfer it to small holder farmers through demonstration projects.

USE OF LEGUMES IN GRASSLAND PRODUCTION SYSTEMS

Experience of researchers and farmers demonstrates the addition of legumes to grass dominant pastures in the Southeast USA improves environmental, agronomic and animal parameters. The most important advantages identified, include: improved forage quality, biological nitrogen fixation, extended growing season, increased forage yields and offsetting of certain forage-related disorders. A renewed emphasis on use of legumes will assist livestock producers under pressure to minimize expenses, improve animal performance, and develop more sustainable operations.

Agronomists provide technical information to forage and livestock producers about problems (perceived or real) using clovers. They also help identify additional research and educational needs. A questionnaire about clovers was sent to state or area agronomists in the USA and results indicate producers have a limited understanding of clover benefits and perceive clover as having poor persistence. Agronomists ranked clover management issues as less important for the adoption of clover and ranked demonstrations as highly important. Magazine articles and producer meetings are considered important to help producers realize the benefits growing clovers.

An on-farm pilot project was initiated in the Andean Piedmont in Caquetá, Columbia to determine the contribution of forage peanut, *Arachis pintoi*, in degraded pastures dominated by low nutritive value grasses. Daily milk production per cow has been low and unsustainable, however, early results of the project indicate that milk yield can be increased by 20% in well established pastures. The project also suggests that for the use of forage peanut to be adopted, farmers need a close working relationship with technology transfer workers and an assured supply of good quality *A. pintoi* seed.

In southern China, livestock are traditionally grazed during the day and penned indoors at night. A study to evaluate the impact of stock pressure and nutrient return to pastures by sheep on the rate of pasture improvement was initiated by penning sheep on small areas of pasture at night. Jiang et.al. conclude that pasture development by on-paddock night penning was successful, easy to implement and low cost, however, the procedure will be more beneficial as a tool for pasture improvement.

TECHNOLOGY TRANSFER AND EXTENSION METHODOLOGIES

The use of different technology transfer and extension methods is determined by local experiences, social and economic situations and consideration for stakeholders. An example of an integrated planning process implemented in the USA helps farmers make decisions as they face increasing demands and costs of environmental protection. The process contributed to improved production of a higher quality product (beef steers and bred heifers), reduced potential for negative environmental impacts, better management of the farm and satisfaction of the farm family knowing they are making their farm a better place to live. Case studies from Australia indicate that adoption of research and development findings could be enhanced with insight into the socio-economic context in which the information might be used.

MacLeod et al. advise that performance problems exist with technology transfer even though the valuation of the worth of research and development is changing from outputs to outcomes. They suggest the research and development process assumes stakeholders are empowered to share or negotiate objectives but commitment to a given outcome is not necessarily guaranteed. The interactions between research and development teams and stakeholders are like the sphere of action of an arena and composition, predisposition and relative power of stakeholders will ultimately determine the outcome of the process.

In Canada, forage and livestock producers are involved in the identification of research priorities and participate in research and demonstration projects. Stewart et.al. identify four methods of technology transfer which are targeted at different information categories. They suggest that central demonstration sites are used for a systems approach, on-farm demonstrations are used for specific technology, producer meetings, field days, short courses and satellite technology are used for producers' groups to share information, and other printed and electronic media will reach larger general audiences. A Canadian example of technology transfer is presented by Joosse. Extension staff encourage earlier cutting of forages to improve hay quality. The technology transfer is done by monitoring forage quality and examining cost of forage production.

The methods used to develop farm policy and to deliver information to producers continually evolves in the United States. The American Society of Agronomy (ASA) believes the adoption of farm advising as a profession will change agricultural policy and methods of delivering information to farmers. The Certified Crop Adviser program, developed by public and private sectors in response to concerns that legislated standards were imminent, enhanced the view that farm advisors are now considered part of the regulatory delivery system. Information transfer by private farm advisors has increased with a corresponding shift away from extension activities being carried out by public sector. The ASA suggests extension staff in the public sector must involve farm advisors in their programs. The significance of this cooperation will increase as advisors acquire large databases from precision farming services. The ASA also indicates that agricultural College programs must base their curriculum on competency standards used for farm advisors. Professional societies, educators, extension staff and researchers must partner with farm advisors to identify problems, formulate solutions and evaluate progress.

Professor, L.R. Humphreys' paper presents a discussion of ten (10) disciplinary themes used to group papers from past International Grassland Congresses. The analysis of these groupings reveals a homeostasis of disciplinary content over 56 years, although the subject matter within each discipline has changed. The science of grassland improvement has relied on an interest in the plant genetic base and provided the largest share of papers. Plant genetics, plant physiology, plant ecology and soil science contributed 52 to 57 percent of the subject matter at five Congresses from 1937 to 1993. In more recent years, aspects of the environment such as reduction of off-farm effects of agricultural development (i.e. stream pollution) have drawn considerable attention because the earlier focus on increasing production from grassland has been modified by the need for "sustainable development."