

Natural Resources International



**Livestock Production
Programme**

**OUTPUT TO PURPOSE
REVIEWS OF NINE PROJECTS
IN ZIMBABWE**

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1. INTRODUCTION

The Livestock Production Programme (LPP) is one of twelve research programmes funded by the United Kingdom Department for International Development (DFID) under their strategy for renewable natural resources research. Output to Purpose Reviews (OPRs) were undertaken in June/July 1999 for the cluster of ongoing LPP projects in Zimbabwe concerned with coping strategies for dry season feeding, drought and optimum milk production in a semi-arid environment. These are: reproductive performance of crossbred cattle developed for milk production (R6955); stovers in Zimbabwe (R6993); high quality silage from adapted forage (R7010); environmental variability and productivity of browse (R6984); and crop-livestock integration (R6781). Four completed projects on the same topic were also included: livestock-wildlife interactions (R6625); improving the productivity of DAP (R5926); effects of feed quality and time of access on behaviour (R6166); and evaluation of forages for smallholder milk production (R6138).

The OPRs had two main objectives:

- To investigate project progress towards achieving its outputs and purpose
- To consider the likely uptake and impact on poverty alleviation of project outputs and recommend any changes that could be made to increase this impact

As background information, each project leader was requested to complete two forms: a project review sheet (Annex 1) and a project output to purpose summary sheet (Annex 2). These desk-based reviews were followed by a field visit to the ongoing projects based at Matopos Research Station (MRS), during which informal discussions were conducted with project collaborators and beneficiaries around the following topics:

- The respondent's knowledge of and involvement with the project;
- Their expectations of the project and the extent to which these have been realised;
- Whether the project is tackling a real need in the livestock production sector;
- Whether the results of the project are significant and sustainable;
- The future options for research and development arising from the project;
- Forecast of the likely poverty impacts of the project.

An outline itinerary for the field visits is given in Annex 3 and a full list of stakeholders and resource persons contacted is given in Annex 4.

2. FINDINGS

All the projects included in the OPR exercise fall under either Purpose 1 or Purpose 2 of the LPP Semi-Arid Production System (see Annex 5). The findings are therefore presented under these headings, with the Purpose 1 projects being further subdivided under Outputs 2,3 and 5. Discussion of the relevance, achievements and uptake pathways of all projects is followed by consideration of the likely poverty impacts and future options for research and development (R&D) arising from ongoing projects.

2.1 Purpose 1, Output 2

2.1.1 RELEVANCE

Project R6955, reproductive performance of crossbred cattle developed for milk production, followed on from project R6138, evaluation of forages for smallholder milk production, which demonstrated the value of crossbred cattle for both milk and draught purposes. Farmers, extension and research workers are aware of the need to reduce calving intervals through increased conception rates if milk production is to be sustainable. Project R6138 also highlighted the importance of reproductive failure and, whilst not all reproductive failure is nutritional, a large proportion is probably due to inadequate feeding.

Project R6781, crop-livestock integration, arose from a need to understand the complex dynamics of crop-livestock change in different agro-ecological settings. The project has taken an institutional perspective and aims to highlight the different pathways of technological change under different social, economic and environmental conditions. An appreciation of these multiple pathways of change will allow researchers, planners and policy-makers to focus interventions more effectively in relation to poverty reduction and sustainable livelihoods objectives.

2.1.2 ACHIEVEMENTS

Project R6955 is collecting milk progesterone profiles for 37 indigenous cows and 45 crossbred cows, including nine backcrosses. A control group of each breed is fed a diet of grass and browse and a treatment group is fed this basal diet supplemented with dairy meal at 2kg per day for a minimum of 120 days post calving. The cows are milked daily and the yield recorded. Samples are collected three times per week and analysed for the concentration of progesterone. The profiles derived are then used to obtain the interval to the resumption of ovarian activity.

The preliminary results show that milk production is significantly higher in crossbred than indigenous cows. Diet did not have a significant effect on milk yield, but this may be because good grazing was available during the trial. Ovarian activity recommences earlier after calving in a significantly higher proportion of crossbred than indigenous cows. The time from calving to the start of the ovarian cycle was longer in backcrosses, indicating the possible detrimental effects of backcrossing crossbred cows intended for use in dry areas. Feed supplementation had a positive effect in enhancing the onset of ovarian activity, especially in indigenous cows.

Project R6781 has taken a historical and anthropological approach, focusing on livelihood systems, institutional arrangements and social factors as well as the technical elements of crop-livestock integration (manure application for soil fertility, draught power for cultivation and crop residues for fodder). This new approach allows policy makers and researchers to understand why some of their interventions fail. For the first time, they understand the interactions between different categories of resource users and the ways in which these are cemented through intricate agreements guaranteeing access to certain resources under different circumstances in different agro-ecological zones. It also became clear that targeting particular user groups who appear to be marginalised sometimes actually worsens their situation. As expected, farmers' responses to policy changes over time are complex and consequently it is important that researchers refrain from developing simple time-specific cause and

effect explanatory models when explaining rural phenomenon. Catastrophic events such as war and drought were found to have altered farmers' strategies in the short-term and pathways of change in the longer term. Work has been conducted in Ethiopia, Mali and four contrasting agro-ecological zones in Zimbabwe.

2.1.3 UPTAKE PATHWAYS

One of the collaborating researchers on project R6955 is registered for a PhD at the University of Zimbabwe. Farmers are receiving training and advice through the National Dairy Development Programme (NDDP) and the Department of Agricultural Technical and Extension Services (Agritex). Farmer-to-farmer extension could also play a part in disseminating the methods developed by the project, but in order for this to be successful, it is important that the proponents have a very clear idea of the principles and techniques involved. There was some confusion amongst the farmers as to why the milk samples were being taken and only one out of the four groups interviewed got it right. Other explanations included looking for diseases in the cattle or checking to see whether the milk is fit for consumption. Project dissemination is being effected through field days, at which it should be possible to deal with this issue through presentation of the preliminary results to farmers. One of the farmer groups remarked that the milk samples stay fresh for three weeks due to the preservative used and wondered whether they could adopt the same technology for conserving milk for sale. At present, farmers without refrigeration or transport sell sour milk, but fresh milk would fetch them a higher price. The project, therefore, needs to make it clear to farmers whether or not the preservative is safe for use in milk destined for human consumption.

The crop-livestock integration project is targeted at national and international research systems and policy makers. However, the research outputs are not easily amenable to direct forms of dissemination and uptake. The project has not produced a technology for adoption, or a set of ideas that easily fit into existing practices. Indeed, the results provide a critique of many current research, extension and donor support strategies. In order to encourage shifts in perspectives and priorities, the project added an additional research element focused on the nature of national policy processes and their interaction with international actors. This analytical work was designed to allow the project to tailor dissemination efforts in the light of the particular policy context. At the local level, University of Zimbabwe collaborators have received informal field training in research design and methodology. Discussion papers have been circulated in country and it is intended to produce a book for an international audience. Farmer workshops were also held, which were particularly rewarding since they allowed farmers to interact and learn about the results from different agro-ecological regions. In addition, the workshops highlighted the fact that the project results need to be contextualised, since there were many opinions on meanings and nuances that even the experienced local researchers had missed. Finally, the local project team in Zimbabwe participated in a FAO (Food and Agriculture Association of the United Nations) project on genetic resources, advising on methods of valuing animal genetic resources in rural areas in Southern African Development Community countries.

2.1.4 POVERTY IMPACTS AND SUSTAINABILITY

Although the preliminary results did not show any significant difference in milk yield between supplemented and unsupplemented cows, farmers involved with project R6955 claim to have noticed increases of up to three litres per day in supplemented animals. They also appreciate the fact that supplementary feeding will allow their cattle to produce more calves and thus lead to bigger herd sizes. The project aims to produce guidelines for effective reproductive management of cattle and farmers say that they now know how to detect when a cow is in heat. They would also know how to take care of dairy cattle, if they could obtain them. The problem is the non-availability of dairy bulls to cross with their indigenous cattle. One group of farmers have organised themselves into a dairy association and sent off an application to join the NDDP. They aim to club together to buy a dairy bull and build a milk collection centre to sell their milk.

Participating farmers are currently receiving the dairy meal for their supplemented cattle from the project. When the project finishes, many are not certain that they will be able to continue with feed supplementation due to the cost of the meal. One farmer said that it would take ten years before she would be able to afford to buy meal with the extra income from milk sales. Another thought that she might be able to cope, but only if she sold all the calves produced during the project to buy the meal.

The crop-livestock integration project has taken a retrospective look to try to provide policy makers with a prediction of what may happen in future. It is not possible to trace any direct impacts on policy and development interventions to date, although the project dissemination strategies are aimed in that direction. Broad interest in the results has been expressed by those who have attended in-country workshops and received workshop papers. Links to local Non-Governmental Organisations (NGOs) have been firmly established, but there is a need to develop further links to the broader sustainable livelihoods agenda.

2.1.5 FUTURE R&D

Due to the high cost of dairy meal, it is suggested that the crossbred cattle project should investigate cheaper alternatives, in particular, combining meal with other supplementary feed sources such as stover (project R6993) and silage (project R7010). Indeed, there is plenty of scope for collaboration with both these projects and the project leader of R6955 asserts that it was always the intention in the longer-term that supplementation should be with forage wherever possible. Farmers expressed an interest in information on planting forages for cattle, which the silage project could provide. Most farmers are also storing their stover in traditional sheds and the improved storage technology developed by the stover project, which some have already seen at a field demonstration, would be useful.

Agricultural extension in Zimbabwe follows the European model of mixed farming and is not always relevant to African smallholders. Research and development policy needs to take account of the diversity and complexity of livelihood strategies. Project R6781 is developing differentiated dissemination strategies to target specific in-country organisations and individuals, but as mentioned above more work is needed in order to link the broad conceptual findings to specific technical research.

2.2 Purpose 1, Output 3

2.2.1 RELEVANCE

Interest in milk production in smallholder dairy systems is increasing in the semi-arid zone of Zimbabwe. However, milk yields are constrained by the availability of feed, especially forage, and the genetic potential of the local cattle breeds. Project R6138, evaluation of forages for smallholder milk production, was designed to assess promising new hybrids of elephant grass (*Pennisetum purpureum*) and pearl millet (*Pennisetum glaucum*) for their agronomic characteristics and capacity to sustain milk production and to evaluate the potential of Jersey crossbred cows fed on these improved forages.

Project R7010, high quality silage from adapted forage, follows on from R6138. It aims to determine the feasibility of producing sufficient mixed cereal-legume silage on smallholders own fields to sustain a commercial level of milk production from a small dairy herd through the dry season. If dairying could provide a consistent income throughout the year, rather than seasonally as at present, it would become viable for smallholders to utilise part of their land for forage production instead of subsistence food crops.

Overstocking of rangeland leads to a shortage of grazing for cattle, exacerbated by the fact that goats tend to eat the most nutritious plants. Roughage deficiency then results in low productivity and high mortality of smallholder dairy cattle, which in many cases are the largest source of farm income.

Project R6993, stovers in Zimbabwe, follows on from earlier collaboration between the Natural Resources Institute (NRI) and MRS on mycotoxin formation in sorghum stover. It is looking at improved post-harvest storage methods to reduce on-farm losses and fungal contamination of maize and sorghum stovers.

2.2.2 ACHIEVEMENTS

The original forage project highlighted the seasonality of milk production resulting from a lack of cattle feed in the dry season. A forage garden was established to determine the best mixture of legumes and cereals, optimum cropping patterns and viability for ensilage. A dairy infrastructure for feeding and milking cattle was also constructed and operated by the project, using materials and technology available to smallholders.

The follow-up silage project showed that forage sorghums and *Pennisetum spp.* intercropped with legumes produce high yields and good quality silage when there is reasonable rainfall. However, under drought conditions forage sorghums exhibited moisture stress. Manual chopping and compression in plastic bags was found to be equally effective in producing acceptable quality silage as machine chopping and compression with a tobacco press. In the 1998-99 season, an average of 69 bags of silage weighing 10.8kg each was produced per farm. The silage is palatable to cattle and work is ongoing to assess the effect of supplementation with silage on milk production.

Following participatory studies, Bidi was chosen by project R6993 as a suitable area in which to operate, because of the availability of stover and the interest amongst farmers in improved storage methods. Traditional stores are open to the elements, so an improved roofed store design was developed. Ten of these improved stores, with asbestos roofs, were then constructed by the project for experimental and demonstration purposes and comparison made with traditional stores. In the second season, improved stores using lower cost roofing materials (thatch) were constructed by the farmers themselves and it was discovered that the slope of the thatch was the main factor in the effectiveness of waterproofing. Biochemical studies of stover quality were also conducted, analysing samples of 50 stovers from each store for composition, digestibility (gas production) and mycotoxins.

2.2.3 UPTAKE PATHWAYS

Project R6138 trained farmers in methods of managing forages and dairy cows and gave them bana grass cuttings to plant on their farms. It was instrumental in breaking down the barriers between researchers and the local community, encouraging farmers and schoolchildren to attend open days on-station as part of the relationship-building process. This paved the way for the establishment of other projects, especially R6955 and R7010, both of which were well received by the participating farmers due to their high level of confidence in the researchers. Papers were presented at a Danish International Development Agency workshop on smallholder dairying in Zimbabwe in 1993 and at the All Africa Animal Conference in Pretoria, South Africa in 1996.

Provided the silage project is successful, the NDDP intends to implement the new techniques of forage production and conservation with members of all 19 dairy co-operatives throughout Zimbabwe. They require all milk sold to the public to be produced in standard milking parlours, which the project farmers are building at their own expense. A new agricultural college being financed and built by the commercial farmers union will teach students the project methods as part of their diploma course. Although most of the beneficiaries will be students, the college will also offer training to commercial dairy farm supervisors and small-scale dairy farmers. Other dissemination vehicles include an article in a local farming magazine (Cattle World), a radio interview on a farming programme and field demonstrations to farmers, Agritex extension workers and NDDP staff.

The chief uptake pathway for the stover project will be via Agritex extension staff, but dissemination through demonstrations/open days will also be important. A student at MRS who is registered for a MPhil has received training through the project, thus increasing institutional capacity. Participating

farmers are aware that the project is trying to improve stover storage, but some do not seem to know what happens to the stover samples once they are taken from their farms. As already mentioned under section 2.1.3, in order for farmer-to-farmer dissemination to be successful it is important that participants know exactly what the project is trying to do and are able to explain it to their neighbours. Jealousies have been aroused locally, due to the perceived favouritism of the project in constructing improved stores on certain farms, but this should be seen as an opportunity for the technology to be disseminated and not as a threat.

2.2.4 POVERTY IMPACTS AND SUSTAINABILITY

Thirty-seven farmers are participating in the on-farm trials and all express satisfaction with the yield and quality of the silage and the ensilage technology. The use of bags instead of silage pits prevents silage effluents from entering the groundwater. It has also improved the quality of life for women farmers, who are largely responsible for feeding the cows. They claim that cattle fed on silage can be milked for 10 months, as opposed to the usual four-month period when supplementing only with stover, and that the calving interval is reduced. The cows produce less manure but also drink less water, due to the higher water content of silage compared to stover. This is an important benefit to cattle management in semi-arid areas, where water availability is limited. Incorporating legumes into the cropping system has a beneficial effect on soil fertility and inter-cropping reduces the labour required for weeding. Keeping at least part of the herd in zero or limited grazing systems would increase the availability of grazing for other types of livestock, but current production levels, although sufficient for supplementation, may not be high enough to support this.

The only negative factor in the ensilage technology is the price of plastic bags, which although cheap at present may become expensive in the near future due to soaring inflation in Zimbabwe. However, if there is evidence that milk supply will be reliable, there is the possibility of establishing a local co-operative and the NDDP would be able to buy bags in bulk and sell them at competitive prices to their members. The viability of the system would also be likely to improve if farmers were able to replace their indigenous cows with cross-breeds, thus giving greater returns on forage supplementation. Local demand for milk outstrips supply, but customers are resistant to price increases and the unit price of parlour milk is the same as kraal milk. Therefore, the returns to investment in the new technology will only be economical if milk yields per cow are increased, which is more likely with crossbred than with indigenous cows.

The stover project potentially has significant direct benefits for livestock owners in communal areas, who rely on stover as dry-season fodder. The original intention was to select contact farmers according to different wealth categories. In practice, however, it was not possible to work with the poorest farmers, because they tend both not to own livestock and not to produce enough stover to make it worthwhile building a store. Perceptions of wealth differed amongst the farmers encountered during the OPR field visit, but several commented that anyone with more than about five cows is considered rich. All agreed that the stover in the improved store, which is protected from the sun and rain, is of higher quality and has a longer storage life than stover stored in the traditional way.

The original improved store with the asbestos roof was expensive to construct, so farmers are happier with the second, thatched, model. The total cost of constructing a thatched store was estimated by Wood (1999) to be Z\$3000 (£50). For comparison, the asbestos roofed stores cost Z\$10,000 (£167) to build, excluding labour, which was provided by MRS. Although the improved design uses more wood than a traditional store, it lasts much longer and thus may result in reduced demand for timber in the long term. Most farmers are aware of environmental issues and use branches where possible, rather than felling whole trees. Another aspect of the technology is that it could lead to conflicts of interest within the household over whether stover should be used as field mulch for crops or as cattle feed. However, this would be lessened by using the cattle manure to improve soil fertility.

2.2.5 FUTURE R&D

A project funded by the Australian Centre for International Agricultural Research (ACIAR) is due to start in 2000, using the same ensilage technology as R7010 but also testing mixed rations-in-a-bag from forages and by-products ensiled together. The project will adopt a different farming system, namely a forage centre, where silage is produced under professional management and then sold in bags to the dairy farmers. The deterioration of the Zimbabwean economy may necessitate such centralisation of forage production, because bags, fertiliser and seeds are all cheaper when bought in bulk. A further season of participatory on-farm research for project R7010, looking into the socio-economics of silage making, would allow comparison of the costs and benefits of the two farming systems.

The issue of non-availability of crossbred cattle could be tackled either by linking farmers to commercial sales outlets or by the local farmers association approaching the NDDP to assist them with obtaining a dairy bull. However, further training in animal husbandry would be needed, since calf-rearing methods for crossbred cattle are not firmly established. Farmers involved with the silage project also expressed an interest in more information on the grass and tree species preferred by cattle, an obvious link to the LPP browse project R6984.

Project R6993, in collaboration with the crossbred cattle project (R6955), aims to make the information generated in Bidi available to farmers in Irivale and then observe whether they build their own stores without any physical inputs from the project. There is also scope for collaboration with the browse project (R6984), to determine when there is sufficient food for cattle on the rangelands and when it is necessary to supplement the feed with stored stover. In addition, a proposal has been submitted for a two-year extension, to promote and monitor adoption of the covered stover stores, identify reasons for non-adoption and provide information which could lead directly to wider extension activities in collaboration with Agritex. An extension leaflet is planned but there is more survey and laboratory work to complete and data to analyse before this is taken forward. Finally, the project leader suggests that conditions in Bangladesh may be even more favourable for this type of intervention than in Zimbabwe and the LPP should investigate the feasibility of this kind of technology transfer.

2.3 Purpose 1, Output 5

2.3.1 RELEVANCE

A shortage of draught animal power (DAP) is one of the principal constraints to crop production in communal areas of Zimbabwe and many other parts of sub-Saharan Africa. Project R5926, improving the productivity of DAP, investigated the scope for interventions both to increase the supply of DAP (donkeys and small breeds of cattle) and to reduce the demand. A rapid rural appraisal (RRA) of three contrasting semi-arid areas in Zimbabwe, completed in 1995, allowed the project research activities to be focused on farmers problems.

In addition to an absolute shortage of draught animals, there is often a lack of sufficient feed resources to sustain the required levels of work. This problem is exaggerated where access to feed is restricted, e.g. where part of the day is taken up by work or where land is intensively cropped and animals are tethered to prevent them causing damage. Project R6166, effects of feed quality and time of access on behaviour, investigated the need to maintain adequate intakes where access to grazing or feed is restricted and the need to use both animal and feed resources efficiently and sustainably whilst minimising environmental impacts.

2.3.2 ACHIEVEMENTS

The DAP project was successful in identifying optimum management practices for donkeys. A new lightweight plough developed as a result of the project is now in commercial production by

ZIMFLOW, formerly Bulawayo Steel Products (BSP), the major manufacturer of draught animal implements in Southern Africa. A prototype light cultivator and a lightweight toolbar are also available, manufactured by local artisans. Additionally, one of the project collaborators was able to complete a PhD at the University of Edinburgh.

The feed quality project conducted research in Ethiopia and Zimbabwe to describe seasonal changes in the foraging behaviour of cattle and donkeys. This information was used to develop recommendations on suitable feeding strategies. Restrictive grazing policies were found to have no effect on the productivity of cattle, but they had a profound effect on the productivity of donkeys. Therefore, separate management strategies are needed, which do not bring donkey owners into conflict with smallholder croppers.

2.3.3 UPTAKE PATHWAYS

Project R5926 worked closely with existing stakeholders, including Agritex, the University of Zimbabwe and BSP. The results have been incorporated into formal Agritex training programmes and other DFID-funded projects, e.g. on conservation tillage. Dissemination vehicles included project workshops and presentations at ATNESA (Animal Traction Network for Eastern and Southern Africa) conferences in Kenya and Ethiopia. A series of booklets entitled 'A guide for farmers on good land husbandry', produced through Agritex, the Zimbabwe Farmers Union and CARE International, includes one each on harnessing, tillage implements and weeding. Applications to the LPP and to DFID's Southern Africa Development Division to fund the production of further DAP extension messages for farmers were unsuccessful. The final project workshop identified several other areas requiring follow-up work, including the availability and management of communal grazing, the poor condition and use of DAP implements and the dissemination of existing knowledge on reduced tillage and weeding methods. A subsequent DAP project located at Fort Hare in South Africa looked at matching feed energy resources to requirements for work in draught cattle and verified feeding standards, but did not address any of the issues listed above.

Project R6166 trained a British PhD student in research methodology, two Ethiopian students in botanical surveying and both Ethiopian and Zimbabwean technicians in field observation methods. Further funding is required in order to prepare dissemination literature and decision software tools incorporating the project recommendations. A follow-up project will look at the effects of forage quality, herbage structure, season and rangeland species conservation on dry matter intake.

2.4 Purpose 2

2.4.1 RELEVANCE

Over 11 million square kilometres of Africa are infested with tsetse flies, the carriers of trypanosomes that cause disease in both cattle and humans. Project R6625, livestock-wildlife interactions, followed on from previous NRI work on the assessment of land-use change in relation to tsetse fly clearance in western Zimbabwe over a 20-year period. It extended the study area to include parts of northern Zimbabwe where tsetse has been eliminated more recently and investigated the effects of rural diversification management programmes on land-use change in areas with contrasting tsetse control backgrounds.

Climatic variability is the single largest cause of poverty in pastoral societies. This is because droughts, severe enough to cause livestock mortality, result in loss of wealth. Climatic variation also causes the long-term stocking rate to be lower than could be maintained under reliable conditions. Project R6984, environmental variability and productivity of browse, built on an earlier project (R6301: optimising utilisation of semi-arid rangelands), which conducted an analysis of semi-arid grazing systems and identified areas where knowledge was lacking. There was found to be a need for effective range assessment techniques and management strategies and Agritex staff confirmed that the production and utilisation of browse is the largest unknown factor in range assessment.

2.4.2 ACHIEVEMENTS

Satellite imagery for Guruve and Centenary Districts of northern Zimbabwe was checked in the field by the livestock-wildlife interactions project and the information integrated into a Geographical Information System (GIS) with seven land cover classes. Extensive Participatory Rural Appraisals (PRAs) helped the project to unravel the complex issues affecting land use by farmers in relation to community wildlife programmes and the threat of trypanosomosis. It was discovered that land under cultivation increased following the elimination of tsetse due to the greater availability of draught power. However, the increase stabilises once 50% of the available land area is in use. Cattle populations have grown, exponentially in some areas, and the populations of other livestock species have tended to increase, probably due to improved veterinary services. Conflicts between wildlife and livestock have increased, due to increased human settlement and greater wildlife populations, the major predators being lions, hyenas and crocodiles.

Project R6984 is looking at both the production and utilisation of browse. On the production side, three separate experiments are being conducted. The first is examining the effects of rainfall, soil and topography on browse production on-station. The second is a pot experiment, measuring water use in four browse tree species under controlled conditions. The third experiment concerns the management of browse resources in communal areas and involves lopping of the two most important tree species (identified during a PRA) at four different percentages on two soil types in Bidi. Preliminary results suggest that the greater the percentage of the tree crown lopped, the greater the subsequent growth, but further work is needed to determine the optimum level and frequency of cutting.

The browse utilisation work also involves three experiments. The first is considering the effects of browse availability on the diet selection of cattle and goats, in on-station field plots with three treatments: high grass/low browse, high grass/high browse and low grass/high browse. A standardised procedure has been developed to produce the low states of grass and browse in the experimental plots. The second experiment is evaluating the intake rate of eight browse species in cattle and goats and has demonstrated that the intake rate per unit metabolic body mass is much lower in cattle. This suggests that browse resources are more likely to be of benefit to goats and wildlife than to cattle. The final experiment is studying the activity pattern of cattle and goats in mixed species grazing on communal rangeland and the utilisation of browse. The results from all six experiments are being used to model the effects of climatic and spatial variation on livestock systems, in order to conduct policy analysis. The two experiments in the communal areas are additional to the original contract, having been initiated following discussions with local stakeholders.

2.4.3 UPTAKE PATHWAYS

Policy level managers have shown great interest in the results of project R6625 and pathways for uptake by local extension services were identified at the project completion workshop. However, the outputs need further dissemination to the target institutions and additional funding should be sought for this purpose. A new three-year project in Tanzania, jointly funded by the LPP and the Animal Health Programme (AHP), will concentrate on people-livestock-wildlife interactions and constraints to livestock development in agricultural and pastoral communities. This new project aims to develop improved livestock management strategies to achieve a stable balance between wildlife and domestic livestock and to identify the social and economic impact of disease where these animals coexist.

The main uptake pathway for the browse project is through Agritex and extension workers were involved in specifying the project goals. However, effort will be needed to convert the experimental findings into extension materials and additional socio-economic inputs may be required. The work on theoretical modelling of the effects of climatic and spatial variability on livestock systems is already making an impact on range ecologists and should contribute to an altered policy environment. The land-use planning section of Agritex is eager to use these results to help them match the available resources to stocking rates in resettlement areas, since current estimation systems are based purely on

In terms of poverty impacts, the stover and browse projects probably have the highest potential to benefit all livestock owners, not just dairy producers. However, the very poorest farmers do not tend to own any large livestock and therefore are unlikely to benefit from the research on cattle, although the results of the goat browsing experiments may be relevant. As for the silage and crossbred cattle projects, the high rate of inflation in Zimbabwe threatens the sustainability and viability of the technologies developed, because the cost of inputs (bags and dairy meal) to farmers may become prohibitively high. This problem would be reduced if farmers had greater access to crossbred cattle, or dairy bulls in order to breed their own crossbreeds, which yield larger quantities of milk and would make dairying a more economically viable activity for smallholders.

The silage, stover, crossbred cattle and browse projects should collaborate even more closely than they are presently doing, in order to give farmers the benefit of all the technologies and methods that are being developed. This would provide them with a 'basket' of technologies from which to choose when determining their livestock production strategies. None of the technologies will single-handedly solve the problem of dry season feeding. Pulling them all together (including the pod project and other MRS and National Agricultural Research Systems work) would allow farmers to make the best use of all the information that is available. Agritex are mentioned by all these projects as a potential uptake pathway and consequently there is a possibility that extension staff could become overloaded. Therefore, it would be useful to them, too, if the separate projects could co-ordinate their activities in order to develop clear extension messages incorporating the outputs of all the projects and the complementarities between them. The issue of technology transfer was raised by one project leader, but should be a possibility for all four projects, particularly if the results are packaged together as suggested above. The research is designed to be generic in nature and the impacts would evidently be much greater if the results could be applied in other regions or countries with similar agro-ecological conditions, for example, through the medium of a handbook.

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5. LIST OF ACRONYMS AND ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
Agritex	Department of Agricultural Technical and Extension Services
AHP	Animal Health Programme
ATNESA	Animal Traction Network for Eastern and Southern Africa
BSP	Bulawayo Steel Products
DAP	Draught Animal Power
DFID	Department for International Development
GIS	Geographical Information System
Logframe	Logical Framework
LPP	Livestock Production Programme
MRS	Matopos Research Station
NDDP	National Dairy Development Programme
NGO	Non-Governmental Organisation
NRI	Natural Resources Institute (University of Greenwich)
OPR	Output to Purpose Review
OVI	Objectively Verifiable Indicator
PRA	Participatory Rural Appraisal
R&D	Research and Development
RRA	Rapid Rural Appraisal
Z\$	Zimbabwe dollars
£	Pounds sterling

ANNEX 1: PROJECT REVIEW SHEET

Project Code and Title

R

Production System

RESEARCH DESIGN

Project Purpose

Target beneficiaries

Collaborating institutions

How was the project justified?

Who identified the research?

How did the project consider socio-economic issues?

How did the project consider environmental issues?

How did the project consider the policy/institutional environment?

RESEARCH IMPACT

At what stages were the target beneficiaries involved?

At what stages were collaborating institutions involved?

What training was provided?

What methods and extent of dissemination were reported?

What are the anticipated uptake pathways for project outputs?

How and by whom was uptake of project outputs reported?

What future follow-up was recommended?

CONCLUDING REMARKS

Completed by

Date

ANNEX 2: PROJECT OUTPUT TO PURPOSE SUMMARY SHEET¹

Project title:		Country:		Production System:	
Project code:		Project start date:		Project end date:	
Project Goal statement (from log frame):		OVI (from log frame):		Project cost (actual):	
1. Outputs (from log frame):		Progress & actual outputs: [Progress description against specified outputs and based on agreed indicators; commentary on unexpected/actual outputs. Free text.]	Recommendations: [Commentary focusing on decisions needed and actions to be considered. Include here assessment of stated risks and assumptions. Free text.]	Rating: [See rating system ²]	
2. Purpose (from log frame):		Progress: [Progress description against specified purpose and based on agreed indicators; overall contribution of project to purpose. Free text.]	Recommendations: [Commentary focusing on decisions needed and actions to be considered. Include here assessment of stated risks and assumptions. Free text.]	Rating: [See rating system ²]	
Key issues: [Give commentary on strategic issues, conditions and assumptions as specified in the log frame.]					
Action: [Give any remedial actions needed to reflect review findings; include a revised project framework where appropriate. Take into account the risks and assumptions given above.]					
Implications: [What are the implications? At:]					
1. Project level					
2. Production System level					
Completed by:				Date:	

¹ To be completed as far as possible by the Project Leader and then passed to the Production System Leader/Programme Manager

² Rating system: 1 = Likely to be completely achieved
 2 = Likely to be largely achieved
 3 = Likely to be partially achieved
 4 = Likely to be achieved only to a very limited extent
 5 = Unlikely to be achieved

ANNEX 3: ITINERARY FOR FIELD VISIT

DATE	CONTACT PERSON	LOCATION
17/06/99	Dr Titterton & Dr Mutisi	University of Zimbabwe
18-23/06/99	[Crop Post-Harvest Programme	meetings/field visits]
24/06/99	Mr Ncube, Mr Nyoni & Mrs Manda	Bidi Field Visit (stover project)
25/06/99	Ms Magadzire	On-station browse experiment
26-27/06/99	Ms Mhlanga	Matopos Research Station
28/06/99	Mrs Mukungurutse	Bidi Field Visit (browse project)
29/06/99	Mr Mhere & Mrs Manda	Gulathi Field Visit (silage project)
30/06/99	Various	Matopos Research Station
01/07/99	Ms Ntasi & Ms Munyoro	Irisvale Field Visit (crossbred cattle project)

ANNEX 4: STAKEHOLDERS AND RESOURCE PERSONS CONSULTED

Mr. Lone Chuma	Farmer, Village 3, Irisvale (Crossbred cattle project)
Mrs. Mabel Khumalo	Farmer, Village 8, Irisvale (Crossbred cattle project)
Ms. Zivayi Magadzire	Matopos Research Station
Mrs. Silisiwe Mathanda	Extension worker, Bidi
Mrs. T. Maphosa	Farmer, Tohwe area, Gulathi (Silage project)
Mr. Sergeant Mbuyazwe	Farmer, Village 4, Irisvale (Crossbred cattle project)
Mr. Owen Mhere	Matopos Research Station
Ms. Nolise Mhlanga	DFID Clerk, Matopos Research Station
Mrs. Joanne Manda	LPP/CPHP Country Co-ordinator
Mrs. Moyo	Farmer, Bidi (Browse project)
Mrs. Moyo	Farmer & Headman's wife, Nyumbane area, Gulathi (Silage Project)
Mrs. A. Moyo	Farmer, Bidi (Stover project)
Mr. Hezekiah Moyo	Farmer & DDP Vice-chairman, Village 1A, Irisvale (Crossbred cattle project)
Mrs. Margaret Moyo	Farmer, Village 4, Irisvale (Crossbred cattle project)
Mr. Mike Moyo	Farmer, Village 8, Irisvale (Crossbred cattle project)
Mr. P. Moyo	Farmer, Bidi (Stover project)
Mrs. Emilia Mukungurutse	Matopos Research Station
Ms. Evelyn Munyoro	University of Zimbabwe/Matopos Research Station
Dr. Charles Mutisi	University of Zimbabwe
Mrs. Ncube	Farmer, Bidi (Stover project)
Mrs. Christine Ncube	Farmer, Village 8, Irisvale (Crossbred cattle project)
Mr. J. Ncube	Farmer, Nyumbane area, Gulathi (Silage project)
Mrs. Pretty Ncube	Farmer, Village 3, Irisvale (Crossbred cattle project)
Mr. Shadreck Ncube	Matopos Research Station
Mr. Mthwakazi Ndebele	Farmer, Village 1A, Irisvale (Crossbred cattle project)
Mr. Ndlovu	Farmer, Bidi (Stover project)
Mr. Cleopus Ndlovu	Field Assistant, Silage project
Mr. Dick Ndlovu	Farmer, Village 1A, Irisvale (Crossbred cattle project)
Mr. Jephtha Ndlovu	Farmer, Village 3, Irisvale (Crossbred cattle project)
Mr. Luka Ndlovu	Farmer, Village 1A, Irisvale (Crossbred cattle project)
Mr. Sanderson Ndlovu	Farmer, Village 3, Irisvale (Crossbred cattle project)
Mrs. Sophia Ndlovu	Farmer, Village 3, Irisvale (Crossbred cattle project)
Mrs. J. Ngwabi	Farmer, Tohwe area, Gulathi (Silage project)
Mrs. Angeline Nhliziyo	Farmer, Village 3, Irisvale (Crossbred cattle project)
Ms. Mamello Ntasi	University of Zimbabwe/Matopos Research Station
Mrs. R. Nyathi	Farmer, Bidi (Stover project)
Mrs. Isa Nyerenda	Farmer, Village 1A, Irisvale (Crossbred cattle project)
Mr. Ndabezinhle Nyoni	Student, Matopos Research Station (Stover project)
Mr. Langton Panda	Field Assistant, Crossbred cattle project
Mrs. Phuthi	Farmer, Bidi (Browse project)
Mr. Joab Sibanda	Farmer, Village 4, Irisvale (Crossbred cattle project)
Mrs. N. Sibanda	Farmer, Tohwe area, Gulathi (Silage project)
Dr. Marion Titterton	University of Zimbabwe
Mr. Difficult Zololo	Farmer, Village 1A, Irisvale (Crossbred cattle project)

ANNEX 5: PROJECT DETAILS (based on LPP semi-arid production system logframes)

5.1: Purpose 1

Output 2

Purpose: Strategies to optimise livestock production and improve its contribution in the crop/livestock farming system through improved allocation and management of on-farm and locally available resources developed and promoted.

Project R6955: Reproductive performance of crossbred cattle developed for milk production in the semi-arid tropics and the effect of feed supplementation.

- Outputs:
1. The underlying causes of reproductive failure in cows in semi-arid systems investigated.
 2. Reproductive potential of indigenous and indigenous/exotic crossbreeds of cattle assessed and quantified.
 3. Ability of genetically different cattle types to respond to feed supplementation assessed and quantified.
 4. Possible reproductive management strategies identified.
 5. Results presented and strategies promoted by means of publications, field days and local workshops.

Project R6781: Crop-livestock integration: the dynamics of intensification of contrasting agro-ecological zones.

- Outputs:
1. Literature review produced of the historical dynamics of crop-livestock integration, including the role of manure transfers.
 2. Comparative study of crop-livestock integration conducted based on case study field research.
 3. Typology of crop-livestock integration dynamics developed with implications for policy and development.
 4. Collaborative research teams trained in 3 African countries.

Output 3

Purpose: Seasonal availability and utilisation of local feed resources for livestock production in semi-arid crop/livestock and livestock production systems improved and appropriate feed management strategy promoted.

Project R6138: Evaluation of forages for smallholder milk production in the semi-arid zone of Zimbabwe.

- Outputs:
1. New forages selected capable of producing high yields of digestible nutrients under semi-arid conditions.
 2. Recommendations produced on the utilisation of these forages for cross-bred Jersey cows in smallholder dairy systems for increasing milk production.
 3. The research capacity of NARS strengthened through the introduction of new forage evaluation methodology, a smallholder dairy research unit and on-farm linkages.

Project R6993: Effects of harvest and post-harvest practices on the production and nutritive value of maize and sorghum residues in Zimbabwe.

- Outputs:
1. Opportunities identified for improved harvest and storage practices.
 2. Improved harvest and storage practices developed and tested.
 3. Improved methods disseminated.

Project R7010: The production of high quality silage from adapted forage and legume crops for the maintenance of dairy cow productivity on smallholder farms through the dry season in the semi-arid region of Zimbabwe.

- Outputs:
1. Locally adapted high-yielding forage crops of satisfactory nutritive value identified for ensiling in smallholder dairy systems.
 2. Appropriate technology identified for harvesting and ensiling selected forage crops.
 3. Effects of feeding on-farm forage crop silages on the productivity of smallholder cross-bred dairy cattle measured.
 4. Economic viability and social acceptability of forage crop silages in smallholder dairy production systems determined.

Output 5

Purpose: The utilisation of draught animals in semi-arid livestock and crop/livestock systems assessed, the increased potential for on-farm activities identified and appraised, and improved feeding and management strategies developed and promoted.

Project R5926: Improving the productivity of draught animals in sub-Saharan Africa.

- Outputs:
1. Specific target groups of farmers identified and characterised relating to the management and output of DAP in Zimbabwe.
 2. A tested methodology developed for planning and extension of research methodologies relevant to DAP.
 3. Optimum management practices established for donkeys.
 4. Draught implements developed and identified that can be used by donkeys and lightweight cattle.
 5. DAP research capacity in Zimbabwe increased.

Project R6166: Effects of feed quality and time of access to feed on feeding behaviour and nutrient intake of tropical cattle and donkeys.

- Outputs:
1. Greater understanding developed of the feeding behaviour of cattle and donkeys.
 2. Information collected on the effect of limited feeding time, feed quality and pasture type on foraging behaviour and intake of cattle and donkeys.
 3. A remote monitoring method developed and tested for use with equids.
 4. Recommendations produced on feeding strategies for cattle and donkeys with limited access time to tropical pastures.

5.2 Purpose 2

Output 2

Purpose: Improved livestock management strategies to achieve stable balance between wildlife and domestic livestock developed and promoted.

Project R6625: Livestock/wildlife interactions in areas of tsetse fly elimination and areas of tsetse fly prevalence.

- Outputs:
1. Changes in land use since 1984 quantified in two areas of differing tsetse occurrence.
 2. Socio-economic interactions between tourism, farming practices and wildlife management identified and the effects on land use quantified.

3. Key indicators produced for evaluating the probable effects of tsetse clearance on dynamics of livestock/wildlife interaction over time.

Output 3

Purpose: Relationship between productive capacity of rangelands and climate and other environmental variability identified and incorporated into management strategies.

Project R6984: Environmental variability and productivity of semi-arid grazing systems.

- Outputs:
1. Techniques developed for assessing the productive capacity of rangeland.
 2. Prototype decision support system developed for analysing management options in the light of vegetation and livestock resources and environmental variability.
 3. Methodology produced for analysing management responses to climatic and spatial variability.

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