CROP PROTECTION PROGRAMME

Promoting improved crop establishment and weed management in semi-arid areas of sub-Saharan Africa.

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FINAL TECHNICAL REPORT

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Project Leader: Professor Ostin Chivinge
University of Zimbabwe

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Research team

Zimbabwe

University of Zimbabwe
Ostin Chivinge (Project leader)
Edward Chuma
Peter Jowah
Arnold Mashingaidze

Department of Agricultural Engineering
Tiri Koza
Sipho Sibanda

United Kingdom

Silsoe Research Institute
Jim Ellis-Jones
Nicola Harford

Natural Resources Institute
Charlie Riches

Acronyms

AgEng	Department of Agricultural Engineering (Zimbabwe)
AREX	Department of Agricultural Research and Extension (Zimbabwe)
CPP	Crop Protection Programme (of DFID)
COTTCO	Cotton Company of Zimbabwe
DFID	Department for International Development (UK Government)
EA	Extension agent (Government or NGO)
FFS	Farmer field school
LF	Lead farmer
NGO	Non Government Organisation
NRI	Natural Resources Institute
PEA	Participatory extension approach
PREA	Participatory research and extension approach
PTD	Participatory technology development
SRI	Silsoe Research Institute
UZ	University of Zimbabwe

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EXECUTIVE SUMMARY

A very brief summary of the purpose of the project, the research activities, the outputs of the project, and the contribution of the project towards DFID's development goals. (Up to 500 words).

Project Purpose:
Promotion of strategies to reduce the impact of pests and stabilise yields in semi-arid cotton-based and cereal based cropping systems or the benefit of poor people.

Specific project objectives in support of this Programme Output included improving livelihoods options of farmers improving food security and reducing poverty through sustainable and enhanced crop production, dissemination of knowledge and technologies through on-farm demonstration and testing plots, promoting strategies to reduce impact of weeds to stabilize yields, training both farmers and extension staff on appropriate technologies and developing dissemination materials for use by both farmers and extension staff.

Outputs:
Key outputs were:

i) Information knowledge and technology sources were identified and developed with extension workers and farmers on options for improving crop productivity in cotton and maize systems with training materials being delivered to extension staff. Key technologies included weed management **for** seasonally inundated land (vleis) and cotton based systems in semi-arid areas.

ii) A process approach was developed and tested for farmer testing of alternative crop establishment and weed management practices including widespread testing and adoption of new rice varieties introduced from West Africa. This involved farmers, agricultural extension or field staff in Government, NGO and the private sector, with work programmes being part of their on-going extension and development activities.

iii) The capability of participating organisations has been strengthened through use of participatory approaches, training in technologies developed as well as improvements to research-extension-farmer-private sector linkages.

These Outputs were interlinked in a participatory approach designed to identify adoptable technologies and promote scaling-up in two areas of Zimbabwe, firstly in parts of Masvingo Province, south-east Zimbabwe where the priority was placed by farmers on improved utilisation of wetland (vlei) areas, and secondly where priority was given to maize-cotton systems in the Zambezi Valley in Northern Zimbabwe. Farmer groups formed in Masvingo are already disseminating technologies to other farmers on their own.

Contribution of Outputs to Project Goal:
This project has promoted research outputs from a number of CPP funded projects undertaken in Zimbabwe from 1996-2002, through communicating the knowledge and technologies gained to stakeholders, including extension workers and farmers. The project has been an enabling one led by the University of Zimbabwe, which involved Agricultural Research and Extension Services (AREX), a number of NGOs and commercial companies in developing a process for demonstration and further testing of a range of crop establishment and weed management technologies, targeted at poor farmers in the small-scale sector. It incorporated a process for scaling-up aiming to improve the capabilities of participating organisations though improved research-extension-farmer-private sector linkages. The project has demonstrated an enhanced dissemination process providing farmers with improved access to information about production increasing technologies, which given normal weather conditions have potential to increase income generation, improve livelihoods and reduce poverty. Training kits, incorporating a trainer's manual, posters and farmer leaflets have been developed for use by extension service. Electronic versions are being provided to institutional stakeholders for further dissemination of the process and technologies. Two main concerns, firstly the extremely dry conditions in the first and now the third season of the project and secondly, the deteriorating economic conditions in the country have severely impacted on stakeholders abilities to support project activities from their own budgets due to the rise in input costs (over 1000% in two years). In addition redeployment of collaborator staff (both Government and NGO) initially involved in the project into other activities also adversely affected outcomes.

BACKGROUND

Information should include a description of the importance of the researchable constraint(s) that the project sought to address and a summary of any significant research previously carried out. Also, some reference to how the demand for the project was identified.

Importance of the researchable constraints

Communal, resettlement and small-scale commercial farming areas of Zimbabwe are home to mostly smallholder, subsistence farming households of which over 80% live below the "basic needs" poverty line. Both Masvingo Province and the Zambezi Valley are in the driest regions of the country (Agro-ecological regions IV and V), which are particularly vulnerable to drought, as average annual rainfall is less than 650 mm. Recent CPP supported initiatives to enhancing agricultural productivity, and particularly that of cotton and maize, central to household livelihoods in the region, have focused on tillage, planting and weeding systems, across the soil catena from toplands to wetlands (vleis).

Crop and livestock production are increasingly central to people's livelihood strategies, although due to the drought experienced in early 2002, people are increasingly diversifying into unsustainable, riskier and sometimes illegal coping strategies such as gold panning, poaching, sale of fuel wood and thatching grass, piece work, illegal cross-border trade and prostitution. At the same time new vulnerable groups are emerging including the elderly, children caring for HIV affected people. The number of orphans is increasing with responsibility for raising them falling on grandparents. Traditional safety nets are breaking down under pressure, notably the extended family under pressure of rising burdens of AIDS and the rising cost of living.

Unfortunately rural people are increasingly distanced from input and output markets. Communities are interacting less with the outside due to rising transport costs. Rather than the usual picture of urban to rural migration the reverse is now true. People are moving back to the rural areas due to urban unemployment, retirement or resignation, as they cannot survive in urban areas. The devastating drought of 1992 left many households depleted of livestock, which still have not been replaced. The re-occurrence of serious drought in 2002, especially in the southern parts of Zimbabwe (including Masvingo Province) led to increasing concern over the food security situation and over exploitation of natural resources. It should be noted that the only areas where a crop was harvested on dryland agriculture in Masvingo came from the wetlands (*vleis*).

The project is effectively targeting the 80% of small-scale farmers who are living below the poverty line. Within this group, four categories have been identified ranging from relatively well resourced to very poorly resourced, distinguished by access to physical (draught animals, implements), natural assets (land), financial assets (especially non-farm income, which is rapidly declining). Women headed households, especially where the head is widowed, separated or abandoned are amongst the poorest. Differing access to resources make it particularly important that a range of technology options is available from no cost (such as seed priming) to higher cost (such as herbicides).

Previous research

Low cost, labour efficient options for soil and weed management in seasonally inundated land (vleis) in maize-rice production systems and in cotton-maize systems in the Zambezi valley had been the subject of a number of previously funded CPP research over the period 1996-2002. Vleis are used by many people in Zimbabwe, especially in the Masvingo Province where vlei production is widely practised and farmers are not obtaining full benefits due to primarily waterlogging and a failure to control weeds. A similar situation was also observed in the Zambezi valley where weed management had been identified as a major constraint to cotton production. Outputs from earlier CPP-funded projects had been identified as potentially playing an important role in improving productivity of resource poor farmers. These included**:**

R7473 Weed management options for cotton-based systems of the Zambezi valley
- Use of herbicides
- Soil and water management using draught animal power
- Reduced tillage plus herbicides
- Use of DAP for weed control

R7474 Weed management options for seasonally inundated land (vleis) in semi-arid Zimbabwe.
- Use of herbicides
- Soil and water management options
- Use of hoe weeding plus herbicides

R6655 Moisture conservation through improved weed management in conservation tillage systems
- Improved crop establishment (ripper planting)
- Alternatives for weed control

R7189 and R7440 Seed priming and weed reduction
- Seed soaking techniques

R5742 Management of Cynodon dactylon in animal draft farming systems
- Integration of tillage and herbicide use for the control of this widespread perennial grass weed

This Research developed technologies which were appropriate, applicable and improved crop production, which could increase income generation, reduce poverty, improve health and nutrition, improve food security, reduce labour demand, especially for women and children and increase livelihood options for the poor people in these two areas.

Demand for the project

Many of the technologies are aimed at the poorest, whose livelihoods were identified as becoming increasingly more vulnerable, as a result of AIDS and a worsening macro-political and economic environment in Zimbabwe. In Masvingo Province 76% of households were classified as poor of whom 52% are very poor[1]. Life expectancy of Zimbabweans has declined dramatically from 62 to 36 years for women and from 58 to 39 years for men as a result of the HIV/AIDS epidemic[2]. The deteriorating macro-economic situation and HIV/AIDS impacts more heavily on women, who have also traditionally been more involved in labour intensive weeding activities. There was therefore a need to ensure that farmers have technologies, which are labour saving and are efficient to improve crop production. Masvingo Province has a high percentage of acute malnourished children less than 5 years. Improved food security, resulting from adoption of innovative crop production practices will contribute to improved health through better nutrition as well reducing the labour input and drudgery experienced by women.

Beneficiaries from previous projects were largely confined to participating farmers and other stakeholders with limited scaling-up occurring. For the benefits to be more widely disseminated, a need was identified to engage with a wider group of stakeholders, who had been consulted during preparation of the proposal and had agreed in principle to increased participation and contribution of resources to the project activities (Table 1). Development agencies had requested that as the research projects were completed, opportunity be given for them to work alongside researchers and other farmers in ensuring further adaptation and dissemination of technologies. Such requests had been made by AREX, CARE, COTTCO, ZFU and other farmer organisations.

[1] Central Statistics Office, 1998. Poverty in Zimbabwe

[2] WHO, 2001. Basic health indicators as reported by WHO member states

Table 1: Stakeholders and their interests

Research	Development	Commercial	Farmer representation
University of Zimbabwe (UZ) ➢ *Ongoing research activities*	CARE-Zimbabwe ➢ *Agent programme for retailer support* ➢ *Rural livelihoods (small dams)*	Cotton Company of Zimbabwe (COTTCO) ➢ *Input supply, loans and marketing*	Zimbabwe Farmers' Union (ZFU) ➢ *Farmer price support* ➢ *Training*
Department of Agricultural ***Research*** and Extension (AREX) ➢ *Ongoing research activities* ➢ *Past partner in CPP funded research*	Department of Agricultural Research and ***Extension*** (AREX) ➢ *Ongoing extension activities* ➢ *Demonstrations* ➢ *Training* ➢ *Dissemination*	Wholesalers ➢ *Input supplies*	Existing local farmer groups and networks ➢ *Loans groups* ➢ *Commodity groups* ➢ *Women's groups* ➢ *ZFU groups* ➢ *Research groups* ➢ *CARE-Agronomy/ conservation groups*
Agricultural Research Council (ARC) ➢ *Funding research*	Cotton Training Centre (CTC) ➢ *Training on cotton*	Retailers ➢ *Rural agents*	
Silsoe Research Institute (SRI) and Natural Resources Institute (NRI) ➢ *Involvement in CPP funded research*			

For more farmers to benefit from new knowledge there was need to avail the information and technologies to many more farmers in partnership with AREX extension staff, ZFU, the private sector such as COTTCO, Agricura and NGOs including CARE, Africare, among others working with these communities. Hence there was need to establish a process working with partners so that many more farming communities could test, adopt and modify the technologies.

PROJECT PURPOSE

The purpose of the project and how it addressed the identified development opportunity or identified constraint to development.

The project purpose as indicated in the Project Logframe (

Annex 3) was defined as, *"Promotion of strategies to reduce the impact of pests and stabilise yields in semi-arid cotton-based and cereal based cropping systems or the benefit of poor people".*

More specific project objectives (in support of this CPP Output) included improving livelihoods options of farmers**,** improving food security and reducing poverty through sustainable and enhanced crop production, dissemination of knowledge and technologies through on-farm demonstration and testing plots, promoting strategies to reduce impact of weeds to stabilize yields, training both farmers and extension staff on appropriate technologies and developing dissemination materials for use by both farmers and extension staff.

RESEARCH ACTIVITIES

This section should include detailed descriptions of all the research activities (research studies, surveys etc.) conducted to achieve the outputs of the project. Information on any facilities, expertise and special resources used to implement the project should also be included. Indicate any modification to the proposed research activities, and whether planned inputs were achieved.

Information sources developed

Initial stakeholder meetings

Initial stakeholder meetings were held to finalise detailed project planning and agree a work plan for identification of existing farmer groups and technologies to be tested by farmers. This re-introduced the project to partners, explained how it had been developed and developed a work plan that would be taken forward and to seek a commitment from government, NGO and private sector organisations that they would become involved and commit resources to the work. The purpose, expected outputs, activities and targets for the new project, as well as how the project was to be organised and managed were agreed. As such this comprised the start of a new enabling project led by the University of Zimbabwe that involved AREX, ZFU and a number of commercial companies in developing a process for further testing and demonstration of a range of crop management technologies, targeted at farmers in communal, small scale commercial and resettlement areas. The fact that previous work had been undertaken in close collaboration with farmers, using participatory extension methods meant that the project had a strong base on which to build and each organisation had much to offer and gain by collaboration.

The project was given high priority by UZ as the Project Leader was keen that all partner organisations worked together in harmony over the two year project period.

Production and dissemination of suitable training materials.

Appropriate extension material building on that which was already available from previous projects was reviewed, further developed and tested with extension staff, farmers, ZFU, the private sector and NGOs involved in the project.

Initial drafts were distributed at the start of the project, tested during 2003 and 2004 and finalised by October 2004 when it was distributed to partner organisations at two end-of-project workshops held in February 2005.

Establishment of farmer study groups

From project outset it was the intention to work with existing organisations and farmer groups identified largely by partner organisations. Focus group discussion meetings between researchers and extension staff led to establishment of farmer study groups in each area, selection of lead farmers for each and identification of technologies to be tested by each group for both Masvingo (Table 2) and the Zambezi Valley components of the project.

Table 2: Masvingo and Zambezi Valley, extension agent, farmer group and farmer participation

Area	Extension agents	Study groups	Farmers ±
Masvingo			
Mshagashe ssca	3	6	120
Zimuto ca	2	4	80
Chatsworth rsa	4	6	120
Mukaro ca	1	4	80
Sub total	*10*	*20*	*400*
Zambezi Valley			
Mshumbi Pools ca	4	5	125
Muhuwe ca	5	5	25
Muzarabani ca	2	3	75
Machaya ca	3	5	125
Hoya ca	1	2	50
Sub total	*15*	*20*	*400*
Total (both areas)	***25***	***40***	***800***

ssca=small-scale commercial, ca=communal area, rsa=resettlement area

The number of study groups is less than that originally envisaged largely as a result of the reduction of the number of extension agents participating in the programme, changes in personnel and changing priorities of partner organisations. For instance the serious drought conditions in 2003 led to a focus by NGOs in particular often in close association with AREX staff on food distribution to destitute households rather than development orientated activities. The fast track land resettlement meant that AREX extension staff were often assigned new duties and became temporarily unavailable to the project. In addition funds for travel and subsistence within AREX had been cut by Government and had to be supplemented by the project.

Each extension agent was expected to develop his/her own activity schedule that reflected the participatory research and extension approach (PREA) being utilised (Table 3).

Table 3: Typical extension agent PREA activity schedule

Activity	J	J	A	S	O	N	D	J	F	M	A	M	J	Responsibility
SOCIAL MOBILISATION														
Ensure farmer groups are aware of activities	X				X									EA/LF
Facilitate LF reports to farmer groups	X	X	X	X	X									EA/LF
Discuss alternative technologies					X									EA/LF/Group
Facilitate training of LFs	X	X	X	X										EA/AREX/UZ
Distribute extension leaflets to LFs					X	X								EA
JOINT (PARTICIPATORY) ACTION PLANNING														
Agree on trials to be established			X	X										Group/LF/EA
Farmers to confirm plots to be used					X	X								Group/LF/EA
Plan resource requirements			X	X										Group/LF/EA
Access resource needs					X	X								Group/LF/EA/UZ
IMPLEMENTATION														
Obtain inputs					X	X								EA/UZ
Mark pots					X	X								EA/LF
Plant trials						X	X							EA/LF
Harvest trials											X	X	X	EA/LF
Use existing LF plots for training other farmers							X	X	X	X	X	X	X	EA/LF
Encourage LFs to visit/assist others							X	X	X	X	X	X	X	LF
SHARING EXPERIENCES-														
Mid season evaluations by each community								X	X	X				EA/LF
Visit plot, ensure LF explains detail to group								X	X	X				Group/LF/EA
Facilitate discussions on (dis) and advantages								x	x	X				EA/LF
End of season participatory evaluations											X	X		
Facilitate partial budgets		X									X	X		EA/LF
Submit reports	**X**		**X**		**X**	**X**			**X**		**X**		**X**	

Processes developed

Input supply mechanisms put in place.

It had been recognized that for wider adoption to occur ready availability of inputs was critically important. It was the intention that inputs would be purchased as far as possible from local suppliers. Some success in the Zambezi valley was achieved as COTTCO (as result of earlier work) now included herbicides within its loan package to farmer groups and stocked herbicides at its main depots in the Valley. However the political and economic problems facing the country led to a huge increase in costs, non availability of many items and withdrawal by many suppliers from rural areas. For instance parts for animal drawn implements, knapsack sprayers, seed fertilizer and chemicals increased in cost by over 1000% during the two years of the project. As a result inputs became increasingly unaffordable and existing suppliers in fact closed depots in more remote areas. This has meant that the project has had to supply inputs in many cases, especially in Masvingo.

Farmer technology testing

The establishment by lead farmers of test and demonstrations plots was facilitated by AREX, COTTCO, CARE, Africare and ZFU over three years, the last with reduced support from UZ. These test plots involved various technologies chosen by the different farmer groups depending on their resources available and environment. These included

In vlei utilization (Masvingo)

- Alternative maize-rice planting systems
- Seed priming
- Soil and water management including flat, bed and ridge systems
- Improved use of ploughs and cultivators in crop establishment and weed management
- Weed management using herbicides

In cotton production (Zambezi valley)

- Soil and water management options, including reduced tillage
- Improved use of ploughs and cultivators in crop establishment and weed management
- Use of herbicides for weed management in combination with hand and draught animal weeding equipment.

In all cases lead farmers from each group provided facilities for testing the new technologies, with others within the same group encouraged to learn from and try the technologies on their own farms. In Mshagashe for instance there has been a steady increase in the number of farmers adopting the technologies (Table 4)

Table 4: Number of farmer using different practices in vleis.

Technology	**Farmers in groups**			**Other adopters**
	2002-03	**2003-04**	**2004-05**	**2004-05**
Sole rice in rows	12	25	25	15
Broad beds for maize and rice	17	13	13	10
Pre-plant ridges for maize and rice	16	15	15	13
Post-plant ridges for maize	5	12	10	11
Maize and rice planted in same row	23	11	19	35
Maize and rice alternate rows	6	23	6	23
Herbicides	0	3	1	2
Seed production of new rice varieties	6	5	6	-
Water conservation pits on contours	13	18	18	35

Source: Extension agent reports (Masvingo workshop 2005)

In addition CARE reported that the following technologies were being tested and promoted within their activities in 5 districts in the Province

- Production of rice including new varieties with 12 groups being involved
- Seed priming was operating with 10 lead farmers
- Weeding with a light cultivator with 10 lead farmers
- Tied ridges occurring with 10 lead farmers.

Adoption of these technologies varied from low to high depending on the district.

Increasing numbers of farmers have started practising the technologies which have been tested over the last two years. This has resulted in increased crop production especially in rice as introduced varieties which have proved popular and are yielding more than the local variety. Cultivation of new rice varieties is persisting and spreading to new farmers particularly in Mshagashe, Zimuto and the Gutu-Chatsworth resettlement areas.

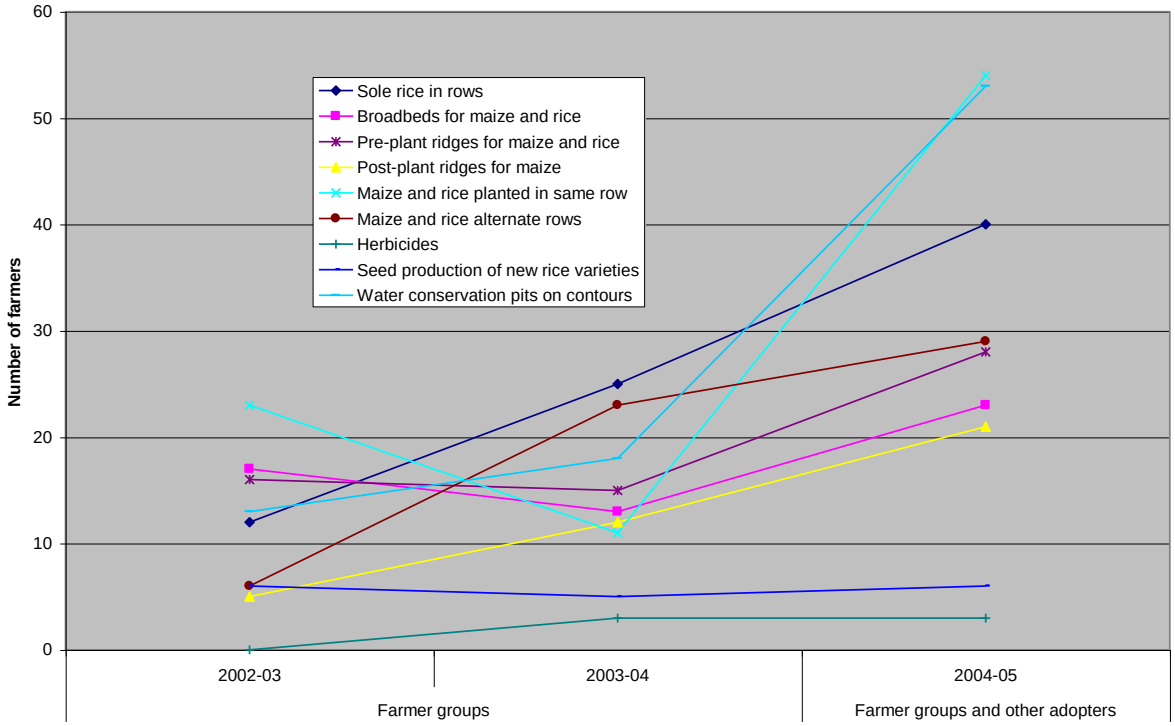

Figure 1: Technology adoption, Mshagasge (2002/3-2004/5)

Interestingly farmers are making modifications to practices. These included: i) planting maize seed behind the plough when making beds to ensure good emergence. Wider spacing results so that a cultivator can be used on the bed, ii) extending infiltration pits along contours, iii) using of post-plant ridges on wetland. This is very encouraging as its shows that farmers are able to improve some of the technologies to fit their conditions.

In the Zambezi valley, fourteen farmer groups successfully implemented at least two weed management practices (Table 5).

Table 5: Farmer Groups successfully implementing at least two weed management options

	Weed Management Options Selected							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Farmer Group	**HH+OC**	**HH+OP+D**	**HH+OP-D**	**Hca+OC**	**Hca+OP+D**	**Hca+OP-D**	**FA**	**Hca+HH**
Kupinduraivhu	√			√			√	
Tineshungu	√			`√				*
Mukombero	√			√			√	
Karikoga	√			√			√	
Tabudirira			√			√	√	
Mutomba		√			√		*	
Kutenderana	√			*			√	
Kumboyedza	√			√			√	
Utete	√			√			√	
Mutumhe	√			√			√	
Gombera			√			√		
Ruvimbo	√			*			√	
Hamaivhu	√			√			√	
Simudziranayi	√			√			√	
Total	**11**	**1**	**2**	**9**	**1**	**2**	**11**	**0**

HH=Hand hoe, OC=Ox cultivator, OP+D=Ox plough with dish, OP-D=Ox plough less dish, Hca=Herbicide, FA=Full application of herbicide

Mid season monitoring

Mid-season evaluations were facilitated by extension staff through field days for each group. At such occasions farmers who were implementing the technologies explained to others how they implemented the technologies providing opportunities for others to visually examine the results. Extension staff were expected to facilitate at least one such mid season evaluation for each farmers group during the season. However, due to the drought experienced some of the test/demonstration plots did not succeed and field days were combined. During both 2002/3 and 2003/4 some 20 field days took place in each season. An example of a mid season evaluation is shown in Annex 1.

Stakeholder workshops for end of season evaluations

A typical example of an end of season evaluation is shown in Annex 1 for Masvingo and

Annex 2 for the Zambezi valley, where the crops were harvested by farmers allowing a full farmer evaluation of the technology using participatory budgeting.. This built on the mid season evaluation and in some cases where a mid season evaluation was not possible replaced it.

In addition end of season workshops were conducted during the 2002/2003 in the Zambezi Valley and in 2002/3 and 2003/4 in Masvingo where both farmers and extension staff expressed their views on both the process and technologies being tested allowing adjustments to be made for the next seasons planned activities.

Capabilities strengthened

Training

Training was provided to AREX, CARE, COTTCO, Africare, AFRICA 2000 and ZFU in farmer participatory research and extension methodologies in both 2002/2003 and 2003/2004. Lead farmers and farmers were also trained in the use of the various technologies developed and how to apply them and methods of evaluating the technologies being tested. During these training sessions a presentation on the need for good communication and faciliatation at all levels was given.

Knapsack spraying and safety use of herbicides were also taught to farmers and other stakeholders to ensure human safety. During these training all stakeholders were given opportunities to practically apply some of the issues such as knapsack sprayer calibration.

Promotion and development of findings

End of project workshops for discussing the overall approach, technologies tested dissemination materials were held for both the Zambezi valley (30 participants) and Masvingo (42 participants) components of the project in February 2005. Training and extension material were distributed to AREX, lead farmers, farmers, ZFU, NGOs and private sector companies. Participants included lead farmers, AREX extension staff, CARE, Africare, ZFU, the private sector and other interested organizations interested in agriculture. The major issue was how to facilitate further scaling up of information and technologies to other suitable areas.

Proposals on the way forward for continued dissemination of materials and demonstration of technologies were agreed. This required UZ and AREX to play critical roles while farmers will be spearheading the activities,

The University of Zimbabwe would meet with various policy makers in government for them to play critical roles in promoting dissemination of technologies for the benefit of poor people who disparately need the technologies to improve their livelihoods. The University of Zimbabwe made a commitment to source for funds to assist with the dissemination of technologies in other areas where the information and technologies were applicable.

It was agreed to have discussions with policy makers to ensure that all other farmers outside the research areas benefit from the technologies developed. The private sector companies also agreed to partner with AREX for promotion of these technologies, especially those related to use of herbicides for weed management. They also promised to supply inputs where there were problems for inputs to ensure that demonstration plots functioned well and were well implemented.

The dissemination materials have been distributed to farmers, extension staff, partners, other institutions and other relevant stakeholders in order to improve crop production, improve income generation, improve food security, reduce labour demand and reduce poverty. Dissemination materials were given to various organisations and individuals, as shearing research findings with other people is critical for effective dissemination of information and technologies countrywide. It was announced that the University of Zimbabwe had electronic copies of all dissemination materials are available at UZ and Silsoe Research Institute for those who need to print copies.

RESEARCH OUTPUTS

The research results and products achieved by the project. Were all the anticipated outputs achieved and if not what were the reasons? Research results should be presented as tables, graphs or sketches rather than lengthy writing, and provided in as quantitative a form as far as is possible.

Information and knowledge resources developed

Information knowledge and technology sources were identified and developed with extension workers and farmers on options for improving crop productivity in cotton and maize systems with training materials being delivered to extension staff.

For each component of the project seven interrelated training modules had been developed together with a trainers' guide (Box 1). These have been provided as a training kit, which incorporates a series of visual aids that can be used with farmers in discussion groups as well as a series of farmer leaflets (15) on each topic area in both English and Shona.

Box 1: Group extension and training guide using pictures

This training guide is an extension tool for use by extension workers with groups of 10-15 farmers. Active participation of farmers in the discussion is required. Good communication and facilitation skills are essential for this.

Extension workers should use key questions, combined with their own ideas and should act as facilitators rather than teachers using appropriate communication and facilitation skills. Enough time should be given to allow farmers to reflect and answer. In this way, farmers will be encouraged to exchange their experiences to enable them to find their own ways of managing their vleis.

The training method uses a series of pictures and illustrations that can be used with farmers in discussion groups. The visual aid is attractive, relatively low cost, transportable, easy to copy and adapted to local needs. In addition a series of leaflets on each topic area is available in Shona.

The training uses a number of modules (topic areas) and pictures with twelve farmer guidelines or leaflets produced in English and Shona for each topic area (Table 6).

Table 6: Training module and topic areas

Module and topic areas	Picture Nos.	Total pictures	Farmer guideline Nos.
Masvingo			
Module 1			
Problems in vleis Cropping options	C1-C6	6	UZ/05/V1
Module 2: Soil and water management	SWM1-SWM5	5	UZ/05/V2-5
Module 3: Crop establishment	CE1-CE4	4	UZ/05/5
Module 4: Weed management	WM1-WM8	8	UZ/05/V6
Module 5: Weed management using herbicides	H1-H11	7	UZ/05/V10-12
Module 6: Testing alternatives	TA1-TA3	3	
Module 7: Evaluating alternatives	EA1-EA2	2	
Zambezi Valley			
Module 1:			
The importance of good tillage	LP1-5	4	UZ/05/2-3
Land preparation options	LP6-10	5	UZ/05/4
Module 2: Soil conservation	SC1-5	5	UZ/05/4
Module 3: Crop establishment	CE1-4	4	UZ/05/5
Module 4: Weed management	WM1-8	8	UZ/05/6-9
Module 5: Weed management using herbicides	H1-12	12	UZ/05/10-12
Module 6: Testing alternatives	TA1-3	3	
Module 7: Evaluating alternatives	EA-1-2	2	

In addition a series of five posters on safe use of pesticides, storage and disposal of chemicals in English and Shona have been produced. 5 000 copies have been produced and are being distributed.

The use of both English and Shona has ensured that different users including farmers have access to appropriate information. All the dissemination materials is available in electronic form from UZ ensuring that different organisations, institutions and individuals who are the potential users or promoters can gain access.

Processes developed for demonstration and testing

A process approach (PREA) was developed and tested for farmer testing of alternative crop establishment and weed management practices (Figure 2). Widespread testing and adoption of new rice varieties introduced from West Africa by R7473 continued. This process involved farmers, agricultural extension or field staff in Government, NGO and the private sector, with work programmes being part of their on-going extension and development activities.

The process used was based on a PEA approach developed in Zimbabwe (Hagmann *et al*., 1998), which now gives greater emphasis on linking research into the approach. This also drew on the approach used in Tanzania (R8215) and in Nigeria (Ellis-Jones *et al*., 2004)

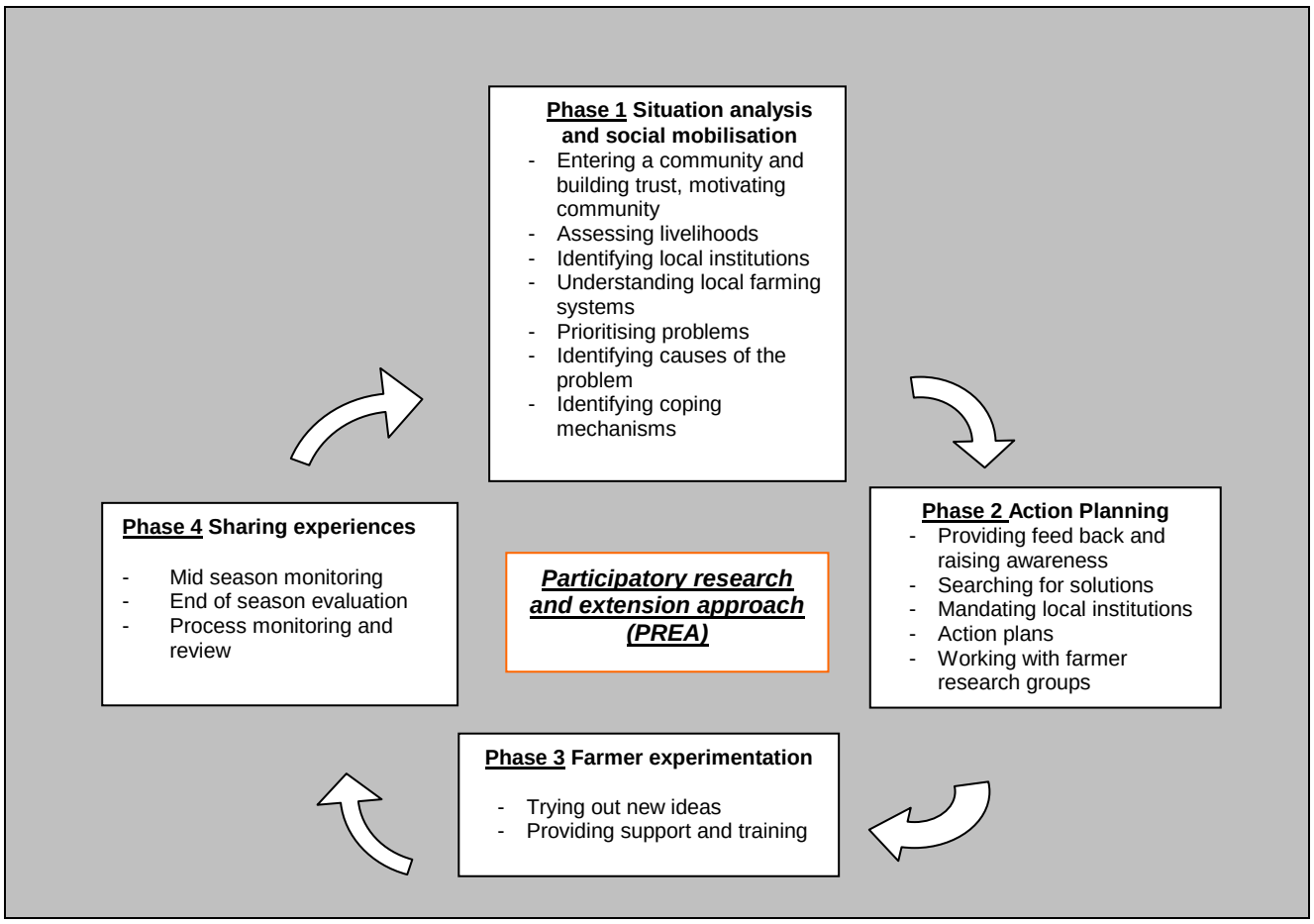

Figure 2: Participatory research and development approach used during the project

Capability of participating organisations strengthened

The capability of participating organisations has been strengthened through use of participatory approaches, training in technologies developed as well as improvements to research-extension-farmer-private sector linkages.

In Masvingo the main extension agent was AREX, but also involved CARE, Africare and ZFU. In the Zambezi valley the main extension agent was COTTCO, but also involved AREX and Farmers World. Training provided has included:

- Use of PREA
- The importance of good tillage
- Land preparation options
- Soil conservation
- Crop establishment
- Weed management
- Weed management using herbicides
- Testing alternatives
- Evaluating alternatives

The main problem in ongoing use of PREA in promotion of these technologies is the issue that NGOs remain with a food distribution and emergency focus, AREX is short of resources in providing an effective extension service and input availability remains restricted due to affordability and increasing scarcity of supply agents in remote areas.

CONTRIBUTION OF OUTPUTS TO DEVELOPMENTAL IMPACT

Describe the potential long-term impacts of the research; the identified promotion pathways to target institutions and beneficiaries; follow up action/research is necessary to promote the findings for development benefit This should include a list of publications, plans for further dissemination, as appropriate. Identify any lessons from the project which may be replicable to other projects. For projects aimed at developing a device, material or process specify: a) what further market studies need to be done; b) how the outputs will be made available to intended users; c) what further stages will be needed to develop, test and establish manufacture of a product; and d) how and by whom, will the further stages be carried out and paid for?

Potential long term impact

This project promoting research outputs from a number of CPP funded was an enabling project led by the University of Zimbabwe, that involved AREX, farmers, the private sector, NGOs and commercial companies, in developing a process for demonstration plots and further testing of a range of crop establishment and weed management technologies which were targeted at resource poor farmers in the small-scale sector. It incorporated a process for scaling-up aiming to improve the capabilities of participating organisations though improved research-extension-farmer-private sector linkages. UZ and its partners in the private sector and NGOS have played a key role in the further promotion and scaling-up of technologies. However, the potential impact will remain limited until political and economic circumstances in Zimbabwe allow the redevelopment of an effective extension service with efficient input supply network. Notwithstanding UZ will use its new outreach initiative to ensure effective communication with service providers and farmers.

The project has delivered a process and technologies which will increase crop production, improve food security, reduce poverty, increase income generation and conserve the environment. It has also demonstrated a scaling-up process that has provided farmers with access to information, increasing technology use, and given normal weather conditions has potential to improve food security, increase income, reduce poverty, and improve health and nutrition. Technologies applied have reduced seasonal land abandonment by farmers due to failure to control weeds and therefore loss on inputs (such as seed, fertilizer and labour). This has now been achieved through use of integrated weed management techniques, including both mechanical and non-mechanical methods hand weeding, use of draught animal equipment and herbicides. Poor emergence and stands of crops due to poor seedbed preparation, variable moisture resulting in low crop yield has been eliminated under the vlei due to seed priming, rip planting, bed and ridge systems which were demonstrated and are now being applied by many farmers after appreciating the benefits. There is also a reduction in weeding burden through more productive use of existing labour, use of draught power animals and herbicides. Reduced drudgery of working for long hours in either hot sun or waterlogged conditions has been achieved using alternative labour saving technologies. Relieving these constraints has help in improving increased food production and food security and allowing surpluses to be sold for income generation.

Three main factors have meant that project outputs have been limited, firstly extremely dry conditions in the first and third seasons of the project, secondly the deteriorating economic conditions of the country have severely impacted on stakeholders abilities to support project activities from their own budgets and the rise in input costs of the project of over 1000%. Thirdly transfers of staff from AREX and NGOs into other programmes has also negatively affected some of the activities, especially in the Zambezi valley.

Promotion pathways

Promotion pathways remain with partner institutions (Government, NGOs and the private sector companies) as well as farmer representative bodies (Figure 3).

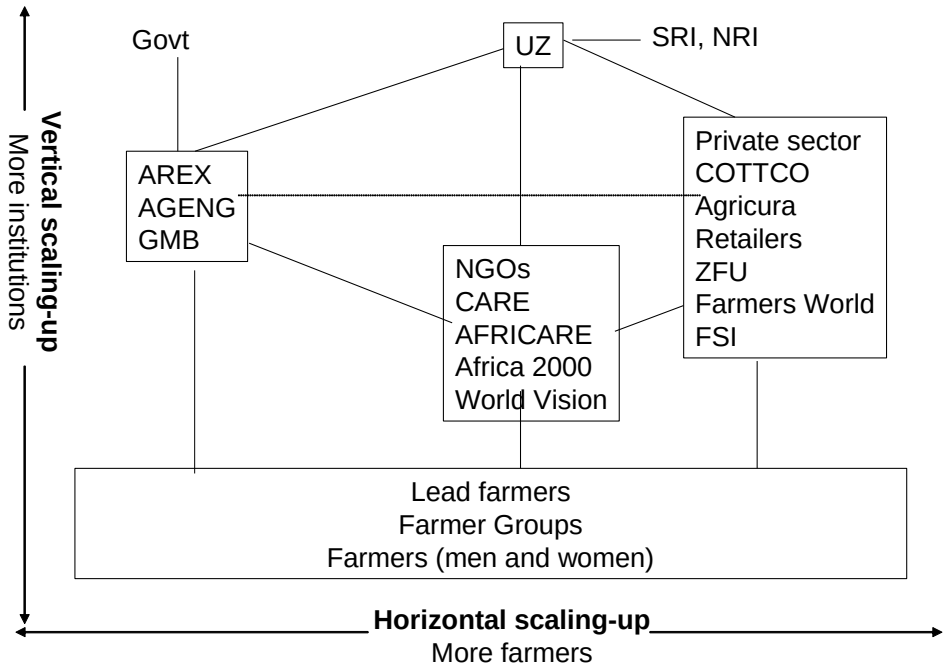

Figure 3: Scaling up and promotion pathways

Despite the proposals made for further scaling-up of technologies there are challenges which need attention and ensure that the agreed issues are implemented. The knowledge developed by the project currently rests with participating extension agents, farmers and their respective institutions. There is therefore need to ensure that PREA and the training materials relevant to other users outside the research areas reach more farmers in areas where vlei and cotton cultivation is important. There is therefore need to for resources for training in PREA and use of the training material. There is need for resources to undertake training workshops on PREA and the various technologies. We also need to share ideas including policy issues on the best approach to ensure that others farmers and stakeholders get the dissemination materials. In addition some of the information is relevant to other countries in the region.

Further activities

Within Zimbabwe the following actions are planned

i) Briefing Governors and Provincial Administrators in Masvingo and Mashonaland East on project outputs (to be undertaken by UZ). This will include District Administrators, Council chairmen and representative of Chiefs.

ii) Raising awareness of AREX senior management at provincial and district level of the potential gains from rolling out farmer training. A short meeting led by AgEng supported by UZ, Crop Science is proposed. Staff would include:
   - Chief Agricultural Extension Officer and Crop Specialist (Masvingo Province)
   - District Agricultural Extension Officers
   - CAEO and DAE from Midlands (vleis in some districts)
   - Representatives of NGOs

iii) Training of trainers at Provincial and District level. This should be led by AgEng with support from UZ, and involve AREX Crops Specialist and Training Officers. Farmer testing/demonstration sites would be used for training. The need is to make Districts self-sufficient in their ability to train extension staff. .

iv) Training of extension staff and subsequent farmer training incorporated into village level programmes.

Publications

List, only those published and in press, i.e. accepted for publication.

Journal publications and refereed papers

CHIVINGE O. A. 2004. Fight against weeds. The Harvester Volume 1 (5): 2004. (A Quarterly Publication of the Crop Post-Harvest Programme Southern Africa).

Internal reports

List reports and working papers with dates and addresses where copies can be obtained.

HARFORD N., 2003. Evaluating communications materials for the CPP dissemination project

HARFORD N. 2003. Checklists for monitoring and evaluating dissemination materials.

KHOZA T., 2003. Report on the visit to access progress on technologies being demonstrated and farmer to farmer exchange visits under the vlei programme. 17-28 November 2003.

KHOZA T., 2003. Report on the comments from farmers and extension staff on the dissemination materials drafts developed. 2 September 2003.

KHOZA T., 2003 Workshop training on communication skills. 10-12 December 2003.

KOZA T AND JIRI L, 2003. Draught Animal Power Implements and Weed Management Training for Lead farmers. *Training report 0n* Operation, repair and maintenance of animal drawn implements-ploughs and cultivators and weeding techniques and cropping systems in vleis. *27-30 May 2003.* Mshagashe, Zimuto and Chatsworth

MASHINGAIDZE AB, 2003. Stakeholder meeting on selecting technologies to be applied on cotton and selection of lead farmers. 23 October 2003.

UNIVERSITY OF ZIMBABWE, 2003. Workshop on improving crop management held at Alvord Training Centre, Makoholi, 17-19 June 2003.

UNIVERSITY OF ZIMBABWE, 2002. Workshop report and action plan on improving weed management in the Zambezi Valley held at the Howard Training Institute, Chiweshe, 12 September 2002.

UNIVERSITY OF ZIMBABWE, 2002. Workshop report and action plan on improving crop management in vleis held at Alvord Training Centre, Makoholi, 30 August 2002.

UNIVERSITY OF ZIMBABWE, 2003. Workshop on improving weed management in the Zambezi Valley held at the Mushumbi Pools Development Centre, Mushumbi Pools, 23-26 June 2003.

Copies can be obtained from the project Leader Professor O. A. Chivinge, University of Zimbabwe, P O Box MP 167 Mt Pleasant, Harare, Zimbabwe. Phone/fax: +253 333406. E-mail: chivinge@admin.uz.ac.zw

Other dissemination of results

A group extension training guide using pictures for land preparation, crop establishment, soil conservation, and weed management for cotton and maize.

A group extension training guide using pictures for soil, water and weed management for maize and rice in vleis

Each comprises a training kit, which incorporates a series of visual aids that can be used with farmers in discussion groups as well as a series of farmer leaflets (15) on each topic area in both English and Shona.

To support training modules on weed management using herbicides a series of five posters on the safe use of pesticides (in English and Shona) have been distributed to stakeholders.

Annex 1: A PARTICIAPTORY EVALUATION OF FARMER VLEI TRIALS

SOIL, WEED AND CROP MANAGEMENT

9 February 2004

MSHAGASHE EAST SMALL SCALE COMMERCIAL FARMING AREA, FARM 70, MASVINGO PROVINCE

Farmer: Mrs Chitapa, Lead Farmer (Wedhza Group), Farm 70, Mshagashe East, and six farmers of her group of 11

Also present
AREX-Mshagashe: Messrs, Mashingaidze, (Extension Supervisor), Mkondo, Muzondo and Ziyenge
AREX-Zimuto: Messrs Bakuri (Extension Supervisor), Mhaka, and Mrs Muzvozviona
AREX-Masvingp: Mr Chiewu
AREX/UZ-Harare: Messrs Koza and Ellis-Jones
CARE: Mr Phikelele

Trial inspections
Participants all visited the trial site, where Mrs Chitapa explained the trials. Crops had been harvested and place in bags next to each plot.

Trial details were:

Plot 10 x 20 m^2	**Treatment**	**Estimated yields**
1	Maize and Rice planted in the same row on the flat	Maize: 1 x 50 kg bag Rice: 1 cup (50 g)
2	Maize and rice planted in alternate rows on the flat	Maize: 1½ x 50 kg bag Rice: 2 kg
3	Maize and rice planted in alternate rows on ridges made at planting time	Maize: 1¼ x 50 kg bag Rice: 5 kg
4	Maize and rice planted on beds**.** Two rows of maize planted on the bed and one row of rice planted in the furrow	Maize: 1¼ x 50 kg bag Rice: 3 kg

All plots (measuring 20 x 10 metres) were planted on 15 August 2004. Maize variety was SC 501. On plots 1 and Muchecheni, the main local rice variety had been planted. On plot 3, a white rice (from Jiri, TRT) had been planted and on plot 4 another Jiri supplied rice variety. All plots had been planted at the same time as ploughing with primed seed planted behind the plough. 3kg "D" fertiliser was applied at planting and 1 kg "AN" at knee height. A herbicide (servian) was applied to all plots in October to kill *Mfende* (knutsedge). Thiodan was applied to all plots to control stalkborer. Weeding on all plots was undertaken with a cultivator and hand weeding where required.

The different criteria being evaluated were

Plot	Soil management			Crop management		Weed management		
	Flat	Ridge	Bed	Rice in row	Rice between rows	Cultivator	Herbicide	Hoe
1	X	X		X		X	X	X
2					X	X	X	X
3		X			X	X	X	X
4			X		X	X	X	X

An explanation of the trials was very clear and after ensuring that everyone new what the treatments were the advantages and disadvantages of each treatment were identified.

Treatment	Advantages	Disadvantages
Plot 1	- Less labour required - Cultivator can be more easily used	- Poor germination due to deep ploughing - Rice shatters as maize is harvested - Lower yields
Plot 2	- Less labour needed than plots 3 and 4 - Cultivator can still be used - No competition between maize and rice - Rice can be more easily harvested	- Water logging problems in a wet season
Plot 3	- Good for soil and moisture conservation - Good drainage when wet - Better crop nutrition as ridge is topsoil	- More labour required - 2 large oxen needed to make ridges
Plot 4	- Fast to cultivate on the beds - Good yields - Less waterlogging	- More labour than plots 1 and 2 - Animals must be well trained

These advantages and disadvantages of each treatment provided opportunity to identify farmer evaluation criteria, which was used to discuss each point.

Participatory evaluation using farmers' criteria

Process

1. The different treatments were confirmed.
2. The main evaluation criteria had been identified from the discussions on advantages and disadvantages
3. Each treatment was scored 1, 2 or 3 (1=worst, 2=average, 3=Best) against the agreed criteria. This helped to compare treatments according to each criterion. The scores were added and the treatments ranked.

Treatment	Labour for planting	Ease of construction	Soil conservation	Moisture conservation	Waterlogging	Seed germination	Soil fertility	Ease of weeding	Maize yields	Rice yields	Score	Rank
Plot 1 Flat maize and rice in same row	3	3	1	1	1	1	2	2	2	1	17	4
Plot 2 Flat, maize and rice in alternate rows	2	2	2	2	1	3	2	2	3	1.5	20.5	3
Plot 3 Maize on ridge, rice in furrow	2	2	3	3	3	3	3	3	3	3	28	1
Plot 4 Maize on bed, rice in furrow	2	2	3	3	3	2	3	2	3	2	25	2

3=Best, 1=Worst

Comments

The effect of the herbicide could not be measured as all plots had servian applied. The Lead farmer had previously regarded the beds as the best system. It was agreed that there was little difference between Plots 3 and 4 but these were substantially better than plots 1 and 2

End-of-season evaluation

Once the trial crops have been harvested and the yields are known, conclusions can be reached about the alternative management treatments. Results from the mid season evaluation, namely, the advantages and disadvantages and ranking can be referred to and modified in light of any subsequent information during an end-of-season evaluation.

Plot	Treatment	Yields	Crop value (Z$)	Rank
1	Maize and Rice planted in the same row on the **flat**	Maize: 1 x 50 kg bag Rice: 1 cup (50 g)	Maize 65000 Rice 1650 **Total 66650**	4
2	Maize and rice planted in alternate rows on the **flat**	Maize: 1½ x 50 kg bag Rice: 2 kg	Maize 97500 Rice 6600 **Total 104100**	3
3	Maize and rice planted in alternate rows on **ridges**	Maize: 1½ x 50 kg bag Rice: 5 kg	Maize 97500 Rice 16500 **Total 114000**	2
4	Maize and rice planted on **beds.**	Maize: 2 x 50 kg bag Rice: 3 kg	Maize 130000 Rice 9900 **Total 139900**	1

In this example farmers indicated that the price of maize was Z$20,000 per 15kg tin and that of rice was Z$ 50,000 per 15 kg tin. This equates to Z$ 1300 per kg and Z$3300 per kg for maize and rice respectively.

This example shows a different ranking from the mid season evaluation with the highest yields/crop values being obtained from beds and ridges. However yield may not be the only criteria that farmers want to consider. Other resources and their costs, in this case the costs of making the beds and ridges and weeding will need to be considered before drawing a final conclusion. This is best achieved by developing a participatory budget with farmers that compares each of the technologies being tested. A partial budget can be used for this purpose. This only considers the costs that differ between treatments and not all the costs. An example is shown for the same treatments.

This shows that after the costs of labour and draft animals have been considered, the best treatment is ridges with maize on the ridge and rice in the furrow. Next best is the flat system with maize and rice in alternate rows. The worst is a flat system with maize and rice in the same row.

Remember these results are only for one year, a dry year in which the maize did well and the rice did badly and for one soil type. It is therefore important that farmers repeat the evaluations in other years, for those treatments that they believe suits their circumstances. Results in a wet year may be different.

Example of a partial budget comparing four treatments (each treatment is on a plot of 20m x 20m)

	Units	Value	Flat Maize-rice Same rows		Flat Maize-rice Alternate rows		Ridges Maize-rice Alternate rows		Beds Maize-rice Alternate rows	
Crop yields and values		Z$ per kg	Yield (kg)	Value (Z$)	Yield (kg)	Value (Z$)	Yield (kg)	Value (Z$)	Yield (kg)	Value (Z$)
Maize	kg	1300	50	65000	75	97500	75	97500	75	97500
Rice	kg	3300	0.5	1650	2	6600	5	16500	5	16500
A Total crop value				**66650**		**104100**		**114000**		**114000**
Costs that vary		**Cost per hour**	**Hours**	**Total**	**Hours**	**Total**	**Hours**	**Total**	**Hours**	**Total**
B Labour	hours									
Making structures		1000	0	0	0	0	1	1000	1.5	1500
Ist weeding		1000	1	1000	1	1000	1	1000	1	1000
2nd weeding		1000	0.5	500	0.5	500	0.5	500	0.5	500
3rd weeding		1000	0.5	500	0.5	500	0.5	500	0.5	500
4th weeding		1000	0.5	500	0.5	500	0.5	500	0.5	500
Sub-total A				*2500*		*2500*		*3500*		*4000*
C Draft animals	hours									
Making structures		5000	0	0	0	0	1	5000	1.5	7500
Ist weeding		5000	1	5000	0	0	0	0	1	5000
2nd weeding		5000	0.5	2500	0.5	2500	0.5	2500	0.5	2500
Sub-total B				*7500*		*2500*		*7500*		*15000*
Total costs that vary B+C				***10000***		***5000***		***11000***		***19000***
Margin over construction and weeding costs A-(B+C)				**51650**		**99100**		**99000**		**84000**
Rank				**4**		**1**		**2**		**3**

No other costs were considered, as these were the same for all the treatments.

Annex 2: A weeding evaluation in cotton from the Zambezi valley.

Plot	Treatment
1	Using a pre-emergent herbicide applied over the whole plot with hand hoeing as required
2	Using a pre-emergent herbicide applied in bands over the planting row using an ox-drawn cultivator and hand hoe as required
3	Using an ox-drawn cultivator and hand hoe

In this trial, all the plots were fairly large (40 x 30 metres) and were planted on the same day. All plots were planted using third furrow plough planting. The same fertiliser was applied to each plot at planting and again when the cotton was knee height. A herbicide (Bladex or cynazine) was applied to Plots 1 and 2 just after planting. The herbicide was applied over the whole of Plot 1, and band applied over the planting rows in Plot 2 just after planting when the soil was still moist. This was followed by weeding either by hand or ox-cultivator as required later in the season. On Plot 3, weeding was undertaken using an ox-drawn cultivator followed by hand weeding as required. Insect pest management was the same on all plots.

Establishing advantages and disadvantages of alternative treatments
After ensuring that everyone knows what the treatments are, the advantages and disadvantages of each treatment can be identified. Here is an example from the same trial.

Plot	Advantages	Disadvantages
1	Least labour and no draft animals required. Least crop damage. It is not so expensive if a knapsack sprayer is already owned.	Herbicide had to be purchased, mixed and applied, requiring the skills for this. Worst for moisture conservation
2	Less labour and draft animals are needed than Plot 3. The cultivator can be used between the crop rows. Less crop damage results than Plot 3.	Herbicide had to be purchased, mixed and applied, requiring the skills for this. Use of draft animals allows some moisture conservation.
3	No herbicide has to be purchased. If labour and draft animals are available this can be the best method. Best for moisture conservation.	Most draft animals and labour required. Animals have to be well trained. Most expensive if labour and draft animals have to be hired Some damage was done to the crop by the animals.

Participatory evaluation using farmers' criteria

Using these advantages and disadvantages, it is possible to identify farmers' criteria for assessing weed control methods. Matrix ranking can then be used to evaluate the performance of the technologies in relation to these criteria.

This is an example of matrix ranking of the same treatments shown earlier, based on a list of criteria previously agreed with participants.

Treatment	Cost of herbicide and application	Skills for application	DAP for weeding	Labour for weeding	Need for trained animals	Moisture conservation	Cotton yields and grades	Score	Rank
Plot 1 Full herbicide application	1	1	3	3	3	1	3	15	**1**
Plot 2 *Banded herbicide application*	2	2	2	2	2	2	2	14	**2**
Plot 3 Ox cultivator and hand weed	3	3	1	1	1	3	1	13	**3**

Scoring (3=Best, 2=Average, 1=Worst).
Ranking (highest overall score has been ranked the best treatment).

Summary of discussions

It was agreed that there was little difference between Plots 1and 2 but these were substantially better than Plots 3, but that a final evaluation could only be made only when the crop is harvested.

End of season evaluation

Once the trial crops have been harvested and the yields are known, conclusions can be reached on the alternative management treatments. Results from the mid-season evaluation, namely, the advantages and disadvantages and ranking can be referred to and modified in light of any subsequent information during an end-of-season evaluation.

Plot	Yields	Crop value (Z$)	Rank
1 Full herbicide application	48 kg grade A 5 kg Grade B	21,150	**1**
2 Banded herbicide application	45 kg grade A 6 kg Grade B	20,340	**2**
3 Ox-cultivator and hand hoe	0 kg grade A 36 kg Grade B	14.040	**3**

In this example farmers indicated that the price of cotton was Z$400 per kg for Grade A and Z$390 per kg for Grade B.

This example shows the same ranking from the mid season evaluation with the highest yields, best grades and crop values being obtained from the herbicide application. However yield may not be the only criteria that farmers want to consider. Other resources and their costs, in this case the costs of alternative weeding methods will need to be considered before drawing a final conclusion. This is best achieved by developing a participatory budget with farmers, which compares each of the technologies being tested.

A partial budget can be used for this purpose. This only considers the costs that differ between treatments and not all the costs. An example is shown for the same treatments which show the margin over weeding costs. This shows that after the weeding costs have been considered, the best treatments are full and banded applications of herbicide. There is however only a slight difference between the two.

Farmers were able to draw the following conclusions:

1 If no draft animals are owned it would be best to use a full application of herbicide.

2 If draft animals are owned a banded application of herbicide would be the best option.

Remember these results are only for one year, a dry year. It is therefore important that farmers repeat the evaluations in other years, especially for those treatments that they believe suit their circumstances.

Example of a partial budget comparing margins over weeding costs for three weeding treatments

Each treatment is 40 metres x 30 metres or 0.12ha

Cotton Output		**Overall herbicide application**			**Banded Herbicide + Ox-cultivator**			**Ox-cultivator and hand hoe**		
	Units	***Amount***	***Price***	***Total***	***Amount***	***Price***	***Total***	***Amount***	***Price***	***Total***
Grade A	Kg	48	400	19200	45	400	18000	0	400	0
Grade B	Kg	5	390	1950	6	390	2340	36	390	14040
Total Output		**53**		**21150**	**51**		**20340**	**36**		**14040**
Inputs	**Units**	**Amount**	**Price**	**Total**	**Amount**	**Price**	**Total**	**Amount**	**Price**	**Total**
Chemical and application										
Herbicides	Knapsacks	6	167	1002	3	167	501	0	0	0
Labour	Knapsacks	6	100	600	3	100	300	0	0	0
Sub-total				***1602***			***801***			***0***
Draft animals	0.12ha									
1st Weeding				0			480			480
2nd Weeding				480			480			480
3rd Weeding				0			0			480
4th Weeding				0			0			0
5th Weeding				0			0			0
Sub-total				***480***			***960***			***1440***
Labour	No of rows									
1st Weeding		0	0	0	8	50	400	8	50	400
2nd Weeding		8	50	400	8	50	400	8	50	400
3rd Weeding		8	50	400	0	50	0	8	50	400
Sub-total				***800***			***800***			***1200***
Total inputs				2882			2561			2640
Output less inputs				**18268**			**17779**			**11400**
Margin over OC-HH				***6868***			***6379***			***0***

No other costs were considered, as these were the same for all the treatments.

Annex 3: Project logframe

Narrative Summary	**Indicators of Achievement**	**Means of Verification**	**Risks and Assumptions**
Goal			
Livelihoods of poor people improved through sustainably enhanced production and productivity of RNR systems.	*To be left blank*	*To be left blank*	
Purpose			
Promotion of strategies to reduce the impact of pests and stabilise yields in semi-arid cotton-based and cereal-based cropping systems, for the benefit of poor people.	By June 2005, knowledge sources and dissemination processes developed and capabilities of key stakeholders improved By December 2005, 1500 households/farmers are using and benefiting from technology changes and stakeholders have adopted the approach to technology development	Stakeholder reports	Political and economic stability
Outputs			
1. Information and knowledge resources developed with extension workers and farmers on options for improving crop productivity	By June 2003, initial knowledge sources developed for improving crop establishment, weed management and crop yield in maize and cotton systems. By June 2004, knowledge sources refined and in use by stakeholders and participating farmers	Project reports	Stakeholders involvement from the initial design of the project, through implementation will facilitate achievement of this Output
2. Processes developed for demonstration and testing of alternative crop establishment and weeding practices by farmers. This will involve farmers, agricultural extension staff and CARE field staff, making these part of their on-going extension and development activities.	By June 2003, a process for farmer testing and demonstration established. By June 2004, the process improved and refined	Project reports	
3. Capability of participating organisations strengthened through improved research-extension-farmer-private sector linkages.	By June 2003, four stakeholders (NGOs, extension and private sector) actively participating in the programme By June 2004, stakeholders are promoting the processes and management systems.	Project reports	

Activities			
Information sources developed *1.1* Initial stakeholder meetings/workshops to finalise detailed project planning.	Stakeholder roles agreed at workshops held before the end of Q1 of the project.	Workshop proceedings	Key stakeholders are willing and able to actively participate in the project contributing their own resources in key areas.
1.2 Production and dissemination of suitable training materials in English and Shona aimed at farmers and extension workers	Leaflets, posters, booklets distributed to farmer groups and input suppliers - Initial drafts by October 2002 - Testing by October 2002 - Final versions by October 2004	Dissemination material	
1.3 Establishment of farmer study groups in target areas to consider options	28 lead farmers receiving training in 2002/3, and 56 in 2003/4 50 study groups operational during 2002/2003 and 100 during 2003/4	Training courses for development professionals and farmer mobilisers Project reports	
Processes developed *2.1* Input supply mechanisms put in place. This will include rippers for crop establishment, knapsack sprayers and herbicides for weed control	Local traders stocking key input items from Sept 2002. Credit facilities in place through COTTCO where required from Sept 2002.	Project reports Reports from individual stakeholders	Political and economic stability in the country
2.2 Farmer testing and demonstrations facilitated by AREX, CARE and ZFU over two seasons.	50 farmers testing new technologies in 2002/3 and 100 in 2003/4		
2.3 Mid-season monitoring through field days and focus group discussion	20 field days and focus group discussions held in 2002/3 and 30 in 2003/4		Normal weather conditions prevail during the two seasons of the project
2.4 Stakeholder workshops for end of season evaluations and assessment of the approach adopted for future use by extension agencies.	Monitoring and evaluation workshops held at the end of the 2002/3 and 2003/4 seasons	Workshop proceedings and stakeholder planning reports	
Capabilities strengthened *3.1* Training provided to AREX, CARE, COTTCO and ZFU in farmer participatory research and extension methodologies.	10 training sessions provided to key extension stakeholders (AREX, CARE-field officers and agents, COTTCO, ZFU) in September 2002/3, 20 in 2003/4	Training course materials	
3.2 Promotion and development of findings	Documentation/Publication of the process over two growing seasons by June 2004.	Publications	