More work for oxen, less work for women and children

RIU

Validated RNRRS Output.

New locally-produced equipment means that oxen are now more productive. In Uganda, hiring oxen is cheaper than hiring labour. But, although oxen always plough the fields, they are rarely put to other work such as sowing, ridging or lifting root crops because farmers don't have the right tackle. Over 2000 households now put oxen to work using inexpensive new tools. This reduces their costs and improves returns. Putting oxen to work also frees women from the drudgery of tasks such as weeding, and releases children so they can go to school. Small companies already manufacture the equipment locally and it has major potential in other areas of sub-Saharan Africa where draught animals are traditionally used to prepare land.

Project Ref: **CPP65:**
Topic: **2. Better Lives for Livestock Keepers: Improved Livestock & Fodder**
Lead Organisation: **SAARI, Uganda**
Source: **Crop Protection Programme**

Document Contents:

Research into Use
NR International
Park House
Bradbourne Lane
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ME20 6SN
UK

Geographical regions included:

Uganda,

Target Audiences for this content:

Crop farmers, Livestock farmers,

Description

CPP65

A. Description of the research output(s)

1. Working title of output or cluster of outputs.
In addition, you are free to suggest a shorter more imaginative working title/acronym of 20 words or less.

Reducing drudgery and improving returns to annual crop production in Uganda through the promotion of draught animal technologies

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.

Crop Protection Programme
Livestock Production Programme
DFID bi-lateral funds for Uganda (COARD Project) (www.coard.co.uk)

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities. As with the question above, this is primarily to allow for the legacy of the RNRRS to be acknowledged during the RIUP activities.

R7401
SAARI-NARO J.E.P. Obuo
D Barton (UK) Ltd D. Barton

*4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? **(max. 400 words)**. This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.*

The main objective of Project R7401 “Improving production in the Teso Farming System (TFS) through the development of **sustainable draught animal technologies**” was to investigate ways of **alleviating labour constraints and drudgery** associated with weeding annual crops in the TFS, NE Uganda and to reduce costs and improve returns to these enterprises. Teso is an area where the presence of HIV is reducing the numbers of economically active people available for agricultural labour, placing great pressure on family labour and in particular on women and children. The original research took place in1999-2002 and the project was extended to facilitate promotion and extension of successful technologies, 2003-2005.

There was a shortage of draught animals in the TFS following civil war and insurgency during the 1980s and 1990s. This constraint has been addressed by a number of ‘restocking’ projects and many households are now able to open up land (plough) with oxen. The benefits of using draught animal power (DAP) however, are not fully realised until animals are used for weeding and other crop production tasks (planting or line sowing, groundnut lifting and sweet potato ridging). Although only 50% of households own oxen, 90% use them for ploughing, including some of the poorest households as it is cheaper to hire oxen than to employ manual labour. **Hand weeding** is mainly undertaken by **women and children** resulting in drudgery, withdrawal of children from school during the weeding seasons. Alternatively, there are high costs if labour is hired to undertake the task and

poor returns (gross margins), especially as poorly weeded fields can result in reduced yields. This problem has been exacerbated by the reintroduction of draught animals as larger areas of land are ploughed and sown than previously.
Project R7401 designed animal drawn tools for cultivation (line marking, weeding, ridging) and harvesting (e.g. lifting groundnuts) and worked in conjunction with a private sector manufacturer to develop a sustainable supply of tools and equipment. Farmer-to-farmer extension methods and training of trainers (partner NGOs) were used to promote the technology in 5 Districts. Adoption rates have been good with around 45% of trained farmers using the technologies (2,000 households adopting the technology by the end of 2005). **Increases in land and labour productivity** have been realised but further development is constrained by limited access to other new technology such as high yielding, disease resistant varieties and to output markets.

There is scope to promote project outputs into other areas of Uganda and more widely in sub-Saharan Africa in locations which traditionally use draught animals for land preparation. For example, in Uganda, Arua, Tororo, Lira, Sironko and Kamuli Districts.

5. What is the type of output(s) being described here?
Please tick one or more of the following options.

Product	***Technology***	***Service***	***Process or Methodology***	***Policy***	***Other Please specify***
	X	*X*			

6. What is the main commodity (ies) upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment

Annual crops. Any annual crop where field operations can be mechanised and/or labour shortages exist, or the use of herbicides is not a realistic option.

7. What production system(s) does/could the output(s) focus upon?
Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	***High potential***	***Hillsides***	***Forest-Agriculture***	***Peri-urban***	***Land water***	***Tropical moist forest***	***Cross-cutting***
X		*X*					

8. What farming system(s) does the output(s) focus upon?
Please tick one or more of the following options (see Annex B for definitions).
Leave blank if not applicable

Smallholder rainfed humid	***Irrigated***	***Wetland rice based***	***Smallholder rainfed highland***	***Smallholder rainfed dry/cold***	***Dualistic***	***Coastal artisanal fishing***
			X	*X*		

*9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (**max. 300 words**).*
Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.

Outputs from R7401 address only one major constraint faced by farmers in NE Uganda. As labour constraints are overcome and labour productivity increases this allows many farmers to expand their area of cultivation and increase production. Further development is constrained by limited access to high yielding varieties, crop pests and diseases and poor marketing strategies. Buyers and traders of agricultural products are constrained by the high transaction costs associated with collecting produce from a large number of small producers and small-scale processors. Producers are poorly organized and rarely store, add value (even simple cleaning and grading of produce is rare) or market their goods collectively. Most farmers market produce immediately after harvest when prices are low. There is a need therefore for further promotion of labour saving technology to be complemented by improved access to both input and output markets. Household livelihoods can therefore be further enhanced by combining the outputs of R7401 with the outputs from other RNRRS projects particularly those providing IPM, information and marketing opportunities e.g:

- IPM for smallholder cotton farmers in Uganda, R8403, R8197
- Linking demand with supply of agricultural information project, R8429, R8281
- Farmer Access to Markets R8274. R8498
- Gross Margin Analysis, R8421
- Sweet potato varieties for food security, health, local and export markets R8273
- Inventory Credit Schemes are also relevant given that many farmers are forced by household cashflows to market produce immediately after harvest when prices are at their lowest, R8114

Validation

B. Validation of the research output(s)

*10**. How** were the output(s) validated and **who** validated them?*
*Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the "who" component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation **(max. 500 words)**.*

Three validation exercises were undertaken with end users of technology:

- Participatory assessment of technology, 2002
- Impact assessment, 2004

- A rapid survey to gauge uptake of technology, 2005

Participatory assessment

This was undertaken with 56 male and female smallholder farmers who had been using DAP weeders (4 designs were tested) for 3 seasons (Annex 1). The methodology used was a participatory exercise - matrix scoring. This allowed farmers to indicate their preferred tool and the reasons for their preference. Following this exercise their chosen tool was further developed by a private sector manufacturer (during the project extension, 2003-2005) with a view to developing an affordable and saleable product. By 2004 batch production of a weeder had begun and in excess of 200 units had been sold to private buyers (as a complete implement or attachment to a plough beam).

Impact assessment

This was undertaken by an independent consultant/researcher using participatory budget (PB) techniques with 77 male and female smallholder farmers (end users) in 4 Districts. PBs allow farmers to cost all inputs and outputs and to produce a simple budget and a gross margin for a single enterprise. The results of this exercise are summarised in the Table below. Both family labour and DAP costs (hire charges) were included in the budgets. For each PB and each site cash balances are higher for enterprises where DAP is used for weeding. Participants attributed this to the lower costs associated with DAP weeding (when compared with hand weeding), and higher yields [1]. The study demonstrated that investment in DAP equipment and adoption of the recommended techniques increase gross margins, contribute to increased yields and reduce drudgery. This last outcome is of particular importance to women and children who were previously responsible for providing most of the weeding labour.

[1] DAP weeding increases infiltration of rainwater but also allows more timely and efficient weeding which also improves yields (when compared with poorly weeded fields)

Summary of the Participatory Budgets completed during the Impact Assessment

Site / Village	Apapai	Akotodao (Abalang)	Kachede	Amuria (Pingire)	Obule	Kibale	Kaler
Type of enterprise	Maize	Groundnuts	Sunflower	Groundnuts	Groundnuts	Cotton	Cow peas
Estimated size of enterprise (acres)	1	1	1	1	1	1	.75
Cash balance with DAP (Ug. Shs)							
Direct Cash Expenditure	48,000	433,000	63,400	184,800	184,000	84,000	11,250
Family labour	62,000	51,000	9,400	50,000	31,000	3,000	13,000
DAP	40,000	162,000	40,000	79,000	62,000	91,000	8,000
Total Expenditure	150,000	646,000	112,000	313,000	277,000	178,000	33,000
Value of output	400,000	1,600,000	341,000	800,000	540,000	300,000	50,400
Cash balance	**250,000**	**954,000**	**228,000**	**487,000**	**263,000**	**122,000**	**17,150**
Cash balance without DAP (Ug. Shs)							
Total Expenditure	200,000	743,000	76,000	458,000	241,000	220,000	39,500
Value of output	300,000	1,000,000	210,000	600,000	360,000	240,000	360,000
Cash balance	**100,000**	**257,000**	**134,000**	**142, 000**	**119,000**	**20,000**	**8,700**
% increase with DAP	250%	370%	70%	340%	220%	600%	200%

Rapid survey
A rapid survey was carried out during November/December 2005 of a sample of trained farmers to establish how many of those trained during the period 2003 -2005 were using DAP technologies. This survey estimated that approximately 45% (805 out of 1770 trainees) of those trained had adopted these technologies. The promotion of ridging as a labour saving technique in sweet potatoes has been a resounding success along with the use of DAP weeders in other annual crops. Information collected during the survey indicated that DAP technology is appropriate for a wide range of annual crops. Adopting farmers were able to apply weeding technology to most of their crops.

*11. **Where and when** have the output(s) been validated?*
*Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above **(max 300 words)**.*

Five Districts of NE Uganda (Teso farming system) with both male and female smallholder farmers (mostly moderate poor) between 2002 and 2005.
Semi-arid production system.
Smallholder rainfed dry cold farming system.

Current Situation

C. Current situation

*12. **How and by whom** are the outputs currently being used? Please give a brief description **(max. 250 words**).*

A rapid appraisal and survey of a randomly selected sample of 86 farmers and 18 partner organisations in 5 Districts (57 men and 29 women) that had received training from project R7401 was completed during September 2006. All 86 farmers had adopted DAP technologies with 72% using weeders and 58% ridging potatoes in the most recent season. In turn these 86 farmers had trained a further 604 farmers with more than one third of these trainees adopting DAP technology (some or all of weeding, ridging and harvesting). Partners including NAADS service providers [2], local government organisations and NGOs (those that had been trained during the project extension) were also visited to ascertain the degree to which they had used their DAP training skills. Of the 18 organisations contacted 11 had trained farmers in the last 6 months. In total 764 farmers (468 men and 296 women) had been trained and field demonstrations established in 7 locations. All organisations that had completed training were promoting the DAP tools designed by the project in association with the local manufacturer. Future planned activities include further training and demonstration and credit provision for implement purchase.

[2] NAADS is the National Agriculture Advisory and Development Service

*13. **Where** are the outputs currently being used? As with Question 11 please indicate place(s) and countries where*

the outputs are being used ***(max. 250 words).***

The following Districts of Uganda:
Amuria, Soroti, Kumi, Pallisa, Kaberamaido, Katakwi, Kamuli, Tororo, Arua

14. What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading ***(max 250 words).***

Farmer-to-farmer extension began on a small scale in 7 locations throughout Teso during 2002 and has continued to the present, undertaken by the most enterprising of the 63 farmers who participated in the original research (1999-2002). Backstopping support was provided to these farmers during the project extension (2003-05). It is estimated that these farmers have trained a further 1,100 farmers. In addition 900 trainers (partner NGOs, NAADS contractors) were trained between 2003-05 who have in turn trained farmers. Recent contact with a sample of these groups revealed that on average these organisations had trained 70 farmers. Based on the recent appraisal (2006) and the validation exercises described earlier (question 10) it is estimated that DAP technologies designed and promoted by R7401 are being used by approximately 2000 smallholder farmers in Teso for a range of crops, including groundnuts, cassava, sweet potatoes, sesame, maize, cotton, sunflower, soya, beans and cowpeas. Reasons for non-adoption include a shortage of oxen, implements, training materials and inadequate skills.

Although significant progress has been made in promoting outputs only 1% of potential beneficiaries in the Teso region are currently benefiting from the advantages provided by DAP technology. Labour shortages and drudgery are estimated to affect in excess of 250,000 households, or over one million people.

15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? ***(max 350 words).***

The Plan for the Modernisation of Agriculture (PMA) (www.pma.go.ug) seeks to shift Ugandan agriculture away from its subsistence orientation towards commercialisation. R7401 outputs are entirely consistent with this Plan enabling farmers to increase production for the market at a lower cost. RNRRS funding and NAADS and NGO partners have been instrumental in facilitating the spread of DAP technology.

Despite promotion in local and national media (mostly local radio broadcasts in the Teso region) spread of the technology has been limited to those farmers who have received training either directly from the project or from partners (NAADS service providers, local government organisations and NGOs). Radio broadcasts have stimulated demand and led to requests for support from listeners including local government, parishes, NGOs, CBOs and farmer groups. Given the resources available it was not possible for the project or partners to service all these demands. Scaling up of these efforts both within and beyond Teso (other Districts in Uganda) would appear to be the best method of ensuring that the benefits of project outputs are spread more widely.

The model used to promote this technology which included field demonstration plots (similar to farmer field schools), training of trainers and farmers in tandem (in the field) and the provision of printed extension materials has been demonstrated to be both appropriate and successful. The required skills for training trainers and

farmers are available both within NARO and among NGOs and NAADS partners but these are considered to be in short supply given the numbers of farming households who could potentially benefit from DAP technology. Resources for capacity strengthening and upscaling are currently very limited. There is a need therefore for further development of training capacity (NAADS service providers and NGOs) to respond to the demand for technology from farmers. It is estimated that a further 250,000 households could benefit from DAP technology in Teso alone (i.e. excluding other areas of Uganda).

Current Promotion

D. Current promotion/uptake pathways

*16. **Where** is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion **(max 200 words).***

Promotion is currently limited to those organisations and individual farmers that have received training and backstopping support from the original project. Thus promotion is limited to the 5 Teso Districts (Soroti, Kumi, Kaberamiado, Katakwi and Palissa) and to only a few locations within these Districts, with small pockets of promotion in Tororo and Arua Districts following training that was undertaken in association with Project R8429. The project extension trained the trainers of 25 different organisations. Recent contact with a sample of these organisations suggested that 60% continue to train farmers.

*17. What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional issues, those relating to policy, marketing, infrastructure, social exclusion etc. **(max 200 words)**.*

The main barrier in Teso and elsewhere in Uganda is institutional – that there is inadequate capacity [capability] and understanding of the labour saving benefits of DAP technology and therefore weak commitment to its promotion. Promotional activities such as radio programmes and agricultural shows raise awareness but until now farmers have few reliable sources of information and training. Barriers to adoption therefore relate mostly to a shortage of available resources and skills to train farmers. Poorer households may also find it more difficult to access relevant information in comparison with the larger more commercial producers. There is a need for investment to generate a critical mass of users of technology i.e. to a level at which adoption and adaptation become spontaneous, and to target poorer farming households.

National extension policy is conducive to promotion and adoption as NAADS responds to the expressed demands for information from farmer groups. However, there is insufficient capacity (skills and knowledge) to promote R7401 outputs more widely, both within the Teso Region and nationally.

Recent surveys indicate the following barriers to adoption (survey of 86 farmers in 2006):

- Technical issues surrounding row planting (55%) when compared with the traditional practice of broadcasting
- A shortage of appropriate implements (45%) and oxen (40%)
- Continuing skills and knowledge shortages (27%)

18. What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify perceived capacity related issues ***(max 200 words).***

Farmers do not adopt technology without some form of training from development organisations such as NAADS service providers, NGOs or from neighbouring farmers (farmer-to-farmer extension). Although there are expectations that farmer-to-farmer extension will continue post project this is by no means certain. Farmers providing extension services did continue to receive backstopping support from the project (2003-05) in the form of printed extension materials, transport (bicycles) and resources to hold demonstrations and field days etc. Without this support will they may not continue to train others.

Commitment from donors to develop the capacity of organisations providing agricultural extension and training services (NAADS service providers and NGOs) to facilitate further promotion and upscaling may therefore be essential if the majority of smallholder farmers in Teso are to benefit from this labour saving technology. Extension efforts should be combined with improved access to input and output markets (new varieties, bulking, adding value etc) and the use of draught animals for transport.

A recent survey of 86 farmers (2006) proposed the following solutions to these barriers to adoption:

- More field demonstrations and field days (71%)
- Further provision of training materials (for extension) (60%)
- Access to credit (60%)
- Further radio broadcasts (50%)

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? ***(max 300 words).***

Key factors contributing to success include:

- Allow rural communities to prioritise their problems before embarking on research and/or extension. A Needs Assessment for Agricultural Research was undertaken before the project was designed and funding sought [3]. This assessment identified labour constraints as one of the most important issues affecting communities in Teso. Thus this research was truly **demand-led** with researchers responding to needs articulated by farmers.
- Provide a range of technology options (different tools) and allow farmers to determine which best meets their needs and why.
- Develop links with the private sector for sustainability (post-project) (technology production and promotion). DAP equipment is being manufactured by a private sector company based in Soroti.
- Encourage exchange of information between farmers (farmer-to-farmer extension).
- Develop partnerships and train trainers (those organisations that are likely to continue to be active for the foreseeable future).

Demonstration plots (farmer field schools), printed extension materials, local agricultural shows and training of trainers in the field alongside their client farmers, along with promotion in local media have all been demonstrated to be effective ways of promoting technology. Agricultural shows and radio programme stimulate interest and demand for technology and lead to requests for training. The resources currently available to provide training

services are insufficient to meet this demand.

Farmer-to-farmer extension may be one of the more effective means of effecting rapid adoption of technology; as most farmers in rural Uganda have little, if any, contact with formal extension services. Their main source of information and knowledge – which they trust – and the results, which they can easily observe, are the activities of neighbouring farmers. It is anticipated that in the longer-term even the poorest of economically active households will benefit from mechanisation as hire markets develop for DAP services (weeding, groundnut lifting and potato ridging) – they already exist for ploughing and to a limited extent weeding.

[3] Akwang, Agnes, Dan Kisauzi, Charlotte Boyd, and Joseph Oryokot 1998 Needs Assessment for Agricultural Research in the Teso Farming System. NARO/DFID, Kampala

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Impacts On Poverty

E. Impacts on poverty to date

20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place? This should include any formal poverty impact studies (and it is appreciated that these will not be commonplace) and any less formal studies including any poverty mapping-type or monitoring work which allow for some analysis on impact on poverty to be made. Details of any cost-benefit analyses may also be detailed at this point. Please list studies here.

No formal poverty impact studies have been undertaken. However, end users who are poor smallholder farmers (mostly moderate poor) were able to reflect upon the usefulness and impact of the technology during the following studies:

- Participatory assessment of technology, 2002
- Impact assessment, 2004
- Rapid survey to gauge uptake of technology, 2005

21. Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) ***(max. 500 words):***

- *What positive impacts on livelihoods have been recorded and over what time period have these impacts been observed? These impacts should be recorded against the capital assets (human, social, natural, physical and, financial) of the livelihoods framework;*
- *For whom i.e. which type of person (gender, poverty group (see glossary for definitions) has there been a positive impact;*
- *Indicate the number of people who have realised a positive impact on their livelihood;*
- *Using whatever appropriate indicator was used detail what was the average percentage increase recorded*

The studies described in question 10 and listed above; indicate a positive impact on the livelihoods of those households who have adopted the technology. Increases in area cultivated, yields (per unit area and gross) and incomes are widely reported along with improved food security. The greatest impact has been on women and

children who have traditionally been responsible for weeding annual crops. The introduction of DAP weeding has made women feel less oppressed and men have become involved in this task as it is mechanised and a great reduction in drudgery is reported. Women of adopting households are now able to pursue more rewarding activities and are experiencing a better quality of life. Children are no longer withdrawn from school during the weeding seasons (April-May and October-November) which represents an improvement in human capital.

Ridging of sweet potatoes and groundnut lifting have been particularly well received by farmers and widely adopted in those communities receiving training. The mechanisation of potato ridging reduces labour costs from 123,000/- to 24,000/- per hectare and the drudgery associated with this operation. In some communities this has allowed area expansion (as labour availability and costs formerly restricted the area cultivated), improved food security and incomes.

Weeder evaluation (4 designs) by farmers on their own fields took place during 2000 and 2001 in sorghum and groundnut crops. For sorghum DAP weeding made little impact on yield but reduced the time needed for hand weeding from 157 hours to 34 hours per hectare. Hand weeding costs were reduced from 47,000/- to 10,000/- per hectare. For groundnuts DAP weeding gave higher yields and reduced the time needed for hand weeding from 73 hours to 31 hours per hectare. Hand weeding costs were reduced from 30,700 Ush to 13,700 Ush per hectare.

Project R7401 has had the following livelihood impacts:
Human capital has been enhanced for those farmers (both men and women) who have received training - 75 farmers received intensive training over a period of 18 months and a further 1700 farmers were trained during the project extension. A further 2000 attended field days and demonstrations. Benefits in terms of **social capital** accrue mostly to women and children of households adopting technology. Adoption of DAP technology frees women to undertake other tasks (household and income generation). The **social capital** of farmers who are experts/pioneer users of technology has also been enhanced. Agricultural mechanisation facilitates crop rotation (as opposed to the continuous cultivation of a single plot) thereby enhancing **natural capital** (sustainability of crop production and yields). DAP technology has made significant contributions to **financial capital** as (net) incomes have increased. The Impact Assessment indicated that additional income resulting from adoption of this technology is mainly used for improving household nutrition, school fees (human capital), clothing, medical expenses and purchase of livestock including oxen (asset accumulation). These indicators suggest a major impact on household livelihoods.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? ***(max 300 words)***

Some benefits regarding the sustainability of farming systems given that DAP technologies facilitate crop rotations.

This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? ***(max 100 words)***

None observed or anticipated in the short-term.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? ***(max 200 words)***

Yes, inasmuch as they contribute generally to improved livelihoods. i.e. increased incomes and asset accumulation along with better access to education and health services. Beneficiary livelihoods are therefore more robust and able to better deal with external shocks. If rainfall becomes more erratic, farmers with DAP technology will be better able to undertake the necessary crop production operations if the time available becomes more limited.

Annex

Related information

Click below to view the related information ....

PF_CPP65_Annex.pdf
