New varieties and methods boost maize production in Tanzania

RIU

Validated RNRRS Output.

New strategies are improving the quality and yield of maize to benefit poor people in the southern highlands of Tanzania. Two new varieties—which are highly resistant to important maize diseases, among other attractive attributes—were tested and validated by farmers and other stakeholders. Improved management approaches were developed and promoted through leaflets in English and in Kiswahili. To ensure regular supply of quality seed, a public–private partnership for certified seed production and distribution was put in place. Farmers, scientists, extension services, seed companies, NGOs and stockists in at least 60 villages in Tanzania's southern highlands are using the new strategies and materials.

Project Ref: **CPP01:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **Uyole Agricultural Research Institute (ARI-Uyole), Tanzania**
Source: **Crop Protection Programme**

Document Contents:

Description

CPP01

A. Description of the research output(s)

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

Geographical regions included:

Tanzania, Uganda,

Target Audiences for this content:

Crop farmers,

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.

Working title: Improved maize seed systems to meet farmers' needs in the Southern Highlands of Tanzania and similar high potential areas

Original title: Improving farmers' access to and management of disease-resistant maize cultivars in the Southern Highlands of Tanzania

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

Crop Protection Programme

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.

R. Numbers:
R8220 (2002-2005) – Improving farmers' access to and management of disease resistant maize cultivars in the Southern Highlands of Tanzania Phase 1
R8406 (2005-2006) - Improving farmers' access to and management of maize seed in the Southern Highlands of Tanzania Phase 2

Closely associated projects:
R8422 (2005-2006) Improving farmers' and others stakeholders' access to quality information and products for pre and post harvest maize systems management in the Southern Highlands of Tanzania.
R7429, R6642 (1996-2000) Maize Streak Virus management

Institutional Partners:

(i) Agricultural Research Institute(ARI) , Uyole Mbeya (Lead Institution)
Address: P.O. Box 400, Mbeya; E. mail

Lead contact Name: Dr. N.G. Lyimo
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(ii) District Agricultural Extension Service
District Extension Officers in the following districts in phases 1 and 2:
Mbozi Mr. G.T. Hoza, Mbozi District Agricultural Extension Office, P.O. Box 94, Mbozi
Mbarali Mr Geofrey Mwamengo, Mbarali District Agricultural Extension Office, P.O. Box 186, Rujewa,
Iringa Mr F.B. Mpwehwe, Iringa District Agricultural Extension Office, P.O. Box 290, Iringa
Njombe Mr Sylvester J. Mhoka, Njombe District Agricultural Extension Office, P.O. Box 76 Njombe, Email:

kombanila@yahoo.com
- and in phase 2
- Mbeya Rural; Mbeya Municipality; Sumbawanga; Nkasi; Mufindi; Kilolo; Mbinga; Songea

(iii) NRI (UK)
Richard Lamboll: Email: r.i.lamboll@gre.ac.uk
Richard Gibson: Email: r.w.gibson@gre.ac.uk
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(iv) ADP Mbozi Trust Fund Email: adpmbozi@atma.co.tz

(v) ASPS-DANIDA
Munga Z. Lumbadia: Email: seed.asps@cats-net.com

(vi) Tanzania Official Seed Certification Institute(TOSCI)
D.S. Shayo:

(vii) Highland Seed Growers Ltd, Mbeya
J.A.B. Mwiga Email: hsglimited@yahoo.co.uk

(viii) Mbegu Technologies (Moshi)
Prof. H.O. Mongi: Email: mbegutech@yahoo.com

(ix) FICA (Uganda)
G.L. Minja: Email: fica@habari.co.tz

(x) INADES-FORMATION Tanzania, Mbeya
Iddi Baruani Email: inadesfo@yahoo.com

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.*

Maize is a key crop in Tanzania as in much of Africa. However, unavailability, lack of confidence in and high price of seed of quality disease-resistant varieties hinder smallholders in maize-based cropping systems. Project outputs include strategies to reduce the impact of disease and improve quality and yield of maize in high potential cropping systems for the benefit of poor people validated in the Southern Highlands (SH) of Tanzania:

(1) Disease resistant maize varieties validated by farmers and other stakeholders
Two new **maize hybrids, UH615, UH6303**, and associated **agronomic management** options (2001-2006), were validated by various stakeholders, while value was added to UH6303 by breeding in resistance to ***Maize streak virus*** (**MSV**). The two maize hybrids are highly **resistant** to **Grey Leaf Spot**, one of the most serious foliar

diseases of maize worldwide. In addition, they are tolerant of **rust** and **turcicum blight**, two other foliar diseases which can severely limit maize grain yield. Other desirable attributes include a fast rate of dry matter accumulation and a **semi-flint** grain as preferred by farmers and other consumers in **Tanzania**. These hybrids are **earlier maturing** (160-165 days at 1800 m.a.s.l.) than many other cultivars. Tanzania and **East Africa** as a whole, is experiencing a significantly altered rainfall pattern, often having a shorter rainfall period, hence the need for earlier maturing cultivars. These two hybrids have a high grain yield potential [8-9 t/ha and 9-10 t/ha for UH615 and UH6303, respectively], and yield well in localities ranging from 1000 – 2000 m.a.s.l. UH6303 is one of the few MSV-resistant, high altitude maize cultivars.

(2) Improved management approaches for maize cultivars validated and promoted
Maize production and disease management leaflets in English and in **Kiswahili**, the latter serving as a quick reference for farmers, were developed, tested and promoted. Training materials for management of open-pollinated varieties were developed.

(3) Sustainable systems for quality seed supply
Improvements to certified seed, quality declared seed and farmer-saved/locally-traded seed systems were identified by a range of stakeholders. A **public-private partnership** between ARI-Uyole and private sector seed companies was established so as to improve certified seed production and distribution for the SH. District and zonal **maize promotional strategies** were developed by key stakeholders.

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

Main commodity: Maize

Lessons learnt could be applied to working with farmers and other stakeholders on seed systems of a wide range of field and horticultural crops. However, the crop-based technical information and outputs provided here are specific to maize and to medium and high altitude areas of Tanzania.

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			

*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 limitation which proformas are currently being prepared.

(i) Outputs of R8422 added value to R8220 through improving farmers' and other stakeholders' access to information, training and products in maize systems in the S. Highlands. Further added value may be gained from R8428/R8349 on improving communications strategies in Tanzania
(ii) Outputs of maize production projects offer added value to: maize grey leaf spot management (R8453/ R7588), MSV management (R7429, R6642), promoting integrated pest and soil management for lowland maize systems in Tanzania (R8452/R8215) and the Lake Victoria basin (R8449/R8212) as well as projects R7034/ R8179 on post-harvest protection of grain.
(iii) Outputs of R8415 add value to R8220, through experience sharing, given the importance of beans under mixed, inter-and mono-cropping systems in high potential production systems of the Southern Highlands.
(iv) Smallholders have limited resources to buy inputs, so the experience of projects R8219, R7405 (mini-packs of fertilizers and seeds and learning protocols) is valuable; joint activities have already been initiated in the S. Highlands.
(v) Links have already been established with the Good Seed Initiative (R8480) and there would be added value to mutually improving farmer seed management.
(vi) Increase in yield arising from adopting better varieties and husbandry will generate surplus maize for sale requiring the outputs on market information tools generated by projects R8250 and R7494.
(vii) The two varieties UH615 and UH6303 are "stay green", the stover remaining succulent even after crop harvest. Succulent stover fed to dairy cattle benefits milk production so outputs of R8220 add value to those of project R5188 addressing straw quality for smallholder milk production.

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)****.*

Project outputs were validated through the core team engaging with key stakeholders at all stages of the projects, including the following:

(i) A situation analysis by trans-disciplinary teams (public sector researchers and extensionists, NGO trainers) informed project partners about farmers' knowledge, perceptions and practices regarding maize, with particular emphasis on access to and management of quality seed/cultivars in the target area. This provided an entry point to identify farmers interested in participating in project activities, ensuring relevance of maize cultivars and accompanying agronomic options.
(ii) Validation of new cultivars focused on collaborative (farmer-researcher-extension) on-farm maize variety demonstrations/trials. These were done in 16 villages in each of 4 districts. In collaboration with researchers (ARI Uyole leading) and village extension officers, 5 farmers (all belonging to a farmer group) in each of the 16 villages planted demonstration trials. Each demonstration/trial consisted of up to 6 new cultivars undergoing validation, a local check and a standard commercial hybrid or OPV variety. Trials were done for 3 seasons, for a total of 240 trial/demonstration sites. The farmer groups generally had a 3:2 male:female ratio .
(iii) Farmer group strengthening to improve capacity to influence the research process, including validation, was facilitated primarily by the NGO INADES Formation Tanzania (IFTz).
(iv) A collaborative monitoring and evaluation approach (involving farmer groups, researchers, NGOs and later the private seed sector) assessed the maize cultivars during the 3 seasons of field demonstrations. In addition, field days were carried out at selected sites, attracting further farmers, as well as political leaders and administrators from village to regional level.
(v) Collaborative public-private partnership trials between ARI-Uyole and private sector seed companies in Mbeya, Moshi (Northern Tanzania) and FICA-Seeds (Uganda) validated private sector demand for the new hybrids.
(vi) Training tools, largely in the form of leaflets were developed through an iterative process involving farmer groups as well as individual farmers in selected villages within the four target districts. Farmers scrutinized the first drafts. Tools were further revised and validated during farmer seminars and subsequent project workshops in which researchers, village and district extension officers, NGOs and other stakeholders participated.
(vii) Options for improving certified seed, quality declared seed and farmer-saved/locally-traded seed systems were identified and partially validated through the situation analysis, collaborative M and E, a consultation survey of non-farmer stakeholders interested in maize in the SH and various workshops with public and private sector stakeholders.

Validation of the outputs involved male and female farmers who largely were low income, moderate-poor members of farming communities in the SH of Tanzania. Increase in maize grain yield during the validation phase varied, with some farmers harvesting up to thirty 100 kg-bags of maize grain per acre from their own fields, using the improved cultivars plus the recommended management package, in comparison with 7-10 100kg-bags from unimproved local maize cultivars.

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)****.*

Validation was done in the Southern Highlands (SH) of Tanzania (a zone made up of 22 districts) by stakeholders in 8 districts (Mbeya Urban, Mbeya Rural, Mbozi, Mbarali, Njombe, Iringa Rural, Kilolo and Rungwe), from March 2003 to June 2006. These areas are in the high potential production system of the SH. The predominant farming system in this area is smallholder, rain-fed highland, characterized by small maize fields (0.5-1.5ha of maize per household), under monocropped, intercropped or mixed cropping systems. Beans, rice, potatoes, wheat, bananas are other food crops; however, maize is the staple food. Most maize is planted from mid December to early January under monomodal rainfall. In some high altitude areas, maize is planted between June and August using residual moisture such that anthesis coincides with the start of the main rains in November-December.

The project identified improvements in seed systems ranging from certified seed to quality declared seed to farmer-saved/locally-traded, thereby addressing the needs of a wide range of social groups growing and consuming maize. The hybrids are primarily directly targeting smallholders that may be described as moderately poor with potential indirect benefits to consumers and the wider economy. The learning tools were developed for a wider target group potentially including any maize producers or intermediaries who are able make use of written materials (currently in Kiswahili and English) directly or indirectly.

In Northern Tanzania (Kilimanjaro region), an emerging local seed company (Mbegu Technologies Inc) validated the new hybrids in the Moshi rural district during the 2005/06 season.

In Uganda, the two hybrids were validated through village demonstrations organized by FICA, a Ugandan company, in Kapchorwa, Kasese, Kabarole and Kabale districts between February and July, 2006. All the aforementioned districts represent high potential smallholder rain-fed intermediate to highland environments.

Current Situation

C. Current situation

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

Who	How
Farmers in groups in 16 villages	- Improved farmer group leadership, planning and working skills - Through applying improved knowledge and skills for crop management - Applying knowledge of seed management to produce MSV tolerant OPVs (eg Staha ST) in Mbarali district.

Farmers in SH and elsewhere	– Maize varieties UH615, UH6303 in widespread use - Several thousand of the various leaflets/ posters have been disseminated to farmers in Mbozi, Iringa, Njombe, Mbarali and Mbeya, through field days, district extension offices, and agricultural shows (where leaflets have been bought).
Researchers/ scientists in SH	- Enhanced understanding about farmers' situations - Village-based maize screening site established in MSV hotspot in Mbarali district
District extension services in 6 districts of SH	- Through improved knowledge of various aspects of maize management eg varieties, diseases; - Working with farmer groups established by the projects.
Seed companies	- The private seed sector(eg Highland Seed Co) is distributing inputs, including certified seed, in order to address the increased demand for the two maize hybrids across the SH zone. - A local seed company based in the SH, Highland Seed Growers Ltd has installed new seed processing facilities in the zone, with the objective of increasing seed production and distribution across the zone. - In Northern Tanzania, , a local seed company Mbegu Technologies Inc, is producing UH6303 certified seed through an agreement with FICA Seeds-Uganda to initially address demand for this cultivar in Uganda -
NGOs in SHZ	-Through increased knowledge of seed development, increased awareness of seed policy and seed security. - Better knowledge of seed systems and the participatory seed development process
Stockists in 5 districts of SHZ	- Leaflets/posters are being used as a quick reference for maize production information.
Students/ tutors.	- Leaflets/posters are being used in agricultural training schools

*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).***

Varieties UH615 and UH6303

(i) In 6 districts in the SH of Tanzania (Mbeya Urban, Mbozi, Mbarali, Njombe, Iringa Rural, Kilolo), areas where the varieties were tested, validated and promoted.

(ii) Songwe Prison and Uyole Training Institute Farms in Mbeya; District Development Trust Farm at Matanana, Njombe, Laela Agricultural School Farm at Laela (Rukwa Region).

(iii) **In Ruvuma region where UH615 seed is sold through the Songea District Extension Office (10 tonnes in 2004/5), and in Mbinga District (5 tonnes sold in the 2004/05 season).

(iv) **In Sumbwanga district (Rukwa region) (12 tonnes of seed sold through the district extension office during the 2004/05 season).

(v) In Northern Tanzania (Arusha/Mbulu/Moshi) where Mbegu Technologies Inc. in 2005 and 2006 made a few farmers aware through collaborative testing and validation.

(vi) In Uganda, FICA seed company has raised interest with farmers to plant the two hybrids,

especially UH6303, if seed is available for the 2007 cropping season.
(vii) Unconfirmed reports say the seed has crossed borders (unofficially) to Zambia and Malawi.

** Despite high demand from farmers, it was not possible to supply these two regions with any seed during the 2004/05 season due to limited seed supply. For Ruvuma region, some limited quantities of UH6303 were made available during the 2005/06 season; however, none was supplied to Rukwa region, again due to limited seed supply.

Training tools are mainly being used in the SH of Tanzania.

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

At local level, outputs are being used in at least 60 villages in 8 districts in the SH. Interest in hybrids UH615 and UH6303 is rising for both main and off-season planting. Production of UH615 certified seed (tonnes) was 112 in 2002, 202 in 2003 but only 133 in 2004 due to production problems and due to unavailability of foundation seed and bad weather, production of UH615 fell to 15 tonnes in 2005. Only 32 tonnes of UH6303 were available to the farming community in 2005. All seed produced has so far been sold to farmers and demand is estimated to be much greater. 110 tonnes of UH6303 and 125 tonnes of UH615 will be available by early November, 2006, to coincide with the 2006/07 season. However, this quantity is expected to be sold quickly, with demand estimated at over 600 tonnes for the SH zone alone.

Regionally, the varieties have been released in Uganda, No seed was made available to farmers in 2006, however, at least 70 tonnes should be available for the highlands of Uganda in 2007. Demand for UH6303 is expected to be significantly higher from 2008, according to FICA Seed company in Uganda.

Learning tools: the 6,500 units of leaflets/ posters produced in the past 3 years have been distributed to farmers and intermediaries (eg extensionists, stockists) primarily in the SH of Tanzania. Many more are in demand, perhaps an indication that usage of these outputs is also spreading.

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).***

Programmes The projects were primarily funded by CPP, working alongside a CPHP project in the final year.

Platforms Within the SH, the lead organization ARI Uyole is strategically placed as the Southern Highlands Zonal Agricultural Research Centre. It hosts the office of the Zonal Research and Extension Liaison Officer (ZRELO), linking with district agricultural extension services (in Mbozi, Mbarali, Njombe and Iringa) and NGOs which provide a promotional platform in the zone. Working with farmer groups provided greater opportunities for farmers to influence the research and promotion process. ARI Uyole also links with input stockists, distributors and seed supply companies in the SH (Highland Seed Growers) and beyond, in the Northern Zone (Mbegu Technologies) and Uganda (FICA Seed Company).

Policy The policy environment has created opportunities and challenges. Liberalisation of input and output markets (since late 1980s/ early 1990s) has resulted in a wide range of players entering the market, but input use by farmers has declined following the removal of input price subsidies, declining real grain prices and a loss of confidence in seed from seed suppliers. Decentralisation has made it easier for various actors in the zone to form linkages and partnerships with minimal bureaucracy. Seed policy has been recently reviewed, breeder's rights are now recognised which has had an impact on hybrid seed development. Production of Quality Declared Seed (QDS) of open pollinated varieties by trained village based farmers is formally recognised, and financially supported by DANIDA ASPS, enhancing local ownership & management of seed and improving access to seed for farmers in remote areas. Regional harmonization of seed regulation amongst East African countries facilitated the release of varieties in Uganda. Public-private sector partnerships are being encouraged by the Tanzania government and donors and loans are available to support the initial stages of these partnerships eg between breeders and seed companies. Subsidising transport costs for basic inputs, (in particular seed and fertilizers) has been re-introduced recently; this needs to be monitored to assess who is benefiting and how.

Infrastructure: ICTs eg mobile phones and internet were crucial in making easy and fast communication between the various actors.

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).***

In Tanzania, promotion is taking place in 60 villages in 8 districts (Iringa, Kilolo, Mufindi, Njombe, Mbarali, Mbozi, Mbeya Rural and Songea) in collaboration with the district extension services. Some NGOs, including ADP-Mbozi Trust Fund, INADES Formation, Njombe District Development Trust Fund and Ileje Rural Development Corporation are promoting these outputs. Two field days were organized this year in Iringa (Ihemi village, June 22nd); and Mbeya (Inyala village, 4th May) attracting 385 farmers (202 women). Additionally, farmer group representatives from 4 neighboring districts (Mbeya Rural, Kyela, Mbarali, Mbozi) participated. Training tools (leaflets and charts) were distributed to each participant after a plenary session. Zonal and district maize promotion strategies have been prepared by district/zonal stakeholders.

The two hybrids are being promoted in Tanzania by Highland Seed Growers and by Mbegu Technologies and, in Uganda, by FICA Seeds Ltd. In Uganda, promotion started in 2005 in Kapchorwa district, followed by Kapchorwa, Kasese, Kabarole and Kabale districts between February and July, 2006, In addition to demonstrations, farmers were provided with seed samples of UH615 and UH6303. According to FICA, this strategy has created a high demand and they have made seed production plans in collaboration with Highland Seed Growers in Tanzania.

*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)**.*

a. Farmers' situation and perceptions
Many SH farmers have lost confidence in the formal seed system through experiences of inappropriate varieties, 'fake' seed and relatively high input prices. R8220/R8406 addressed these issues and outputs were accepted by many of those farmers reached. However, most in the zone are still unaware of these outputs.

b. Low certified seed production capacity
Quantities of seed produced have been far below demand.

c. Poor seed distribution network.
Most input stockists are clustered in urban areas, making farmers' access to inputs including seed difficult.

d. Weak infrastructure.
The feeder road system is poor, particularly during the rainy season, making input delivery difficult and input prices frequently higher than farmers can afford.

e. Low crop prices.
In many rural communities, particularly those with poor roads/ inadequate transport, farmers get unattractive prices from the sale of surplus.

f. Social exclusion
Farmers reached were generally middle wealth rank and the extremely vulnerable may have been excluded from the process. Most staff were male, which impacted on female participation at all levels.

g. Institutional issues
Incentives are emerging for stakeholders to improve the formal seed sector, but less so for the informal.

h. Capacity of stakeholders and systems.

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).***

Barrier	**Change needed**
a. Farmers' situation and perceptions	Strengthen farmer organizations Implement strategies with stakeholders improving farmers' access to maize information, training and products
b. Seed production capacity	Strengthen private/public partnership strategies in production distribution and promotion. Government support to private sector eg ensuring financial systems in place to support appropriately located seed processing facilities.

c. Input distribution network.	Strengthen capacity of stockists / distributors making input supply chains more efficient and equitable through: reducing transaction / marketing costs (eg ICTs), securing a better policy environment (eg Improving roads and incentives eg tax relief), improving access to credit (eg through supply chain / inventory credit) and improving coordination. FIPS Africa approach– 'honest broker' negotiating with farmers, stockists and suppliers to provide quality inputs in appropriate size packaging, promotion and training to improve efficiency at farm level.
d. Infrastructure.	Encourage wider, more efficient use of ICTs eg mobile phones and internet
e. Crop prices.	Improve access to agricultural market information; including use of ICTs up to the village level.
f. Social exclusion	Targeting socially excluded groups
g. Institutional issues	Promote the importance and links with informal sector
h. Capacity of stakeholders	Capacity strengthening needs have been identified Strong capacity strengthening component to future inventions

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).***

- Awareness of the outputs among end users (through seminars, field shows, leaflets, brochures, exchange visits etc)
- Demonstration of the effectiveness of the output: “seeing is believing concept”
- Availability of the output (seed) within or close to the village, timeliness in delivery, affordable price, true seed (not fake)
- Convenient packing of seed e.g. in 0.5, 1.0, 2.0 kg packs of seed
- Availability of other agro-inputs inputs (fertilizers, insecticides)
- Ready market for the surplus at fair but profitable price
- Link with agricultural extension who work very closely with farmers in the villages
- Work with NGOs to a) build capacity of farmers to and b)assist in the dissemination of the outputs in their target areas
- Provide leaflets, brochures, posters (at no cost initially) in the local language to create awareness and understanding about the technology.

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 impact studies on poverty have been undertaken with respect to this project. The following reports provide some indications of potential implications for impact on poverty:

ARI Uyole/ NRI (2003) Situation analysis of maize growers in the Southern Highlands of Tanzania with particular emphasis on access to and management of seed. ARI-Uyole, Mbeya, Tanzania.

Stathers, T., Lyimo, N., Lamboll, R., Temu, A. and Gibson, R. (2004). Improving Maize Seed Systems to Meet Farmers' Needs in the Southern Highlands of Tanzania: Report of a Stakeholder Workshop on 29th -31st July in Iringa, Tanzania. Working Paper for DFID project R8220. ARI-Uyole, Mbeya, Tanzania.

Lamboll, R., Nsemwa, L.T.H. and Stathers, T. (2006) Survey of service providers to get feedback on influence of DIFID CPP/CPHP on improved capacity, effectiveness and morale. ARI Uyole, Mbeya, Tanzania.

Stathers, T., Nsemwa, L.T.H., Gondwe, B., and Lamboll, R. (2006) A survey of farmers and stockists' access to and demand for maize information, training and products in the Southern Highlands of Tanzania. ARI Uyole, Mbeya, Tanzania. pp 150 + ix.

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*

Product

At local level, outputs are being used in at least 60 villages in 8 districts in the SH. Total production of UH615 certified seed since 2002 has been 462 tonnes together with 32 tonnes of UH6303 in 2005. All seed produced has so far been sold. Assuming: 400 tonnes were purchased by smallholders; each smallholder planted 1 hectare of hybrid seed; and a planting rate of 20 kg / hectare then up to 20,000 smallholders may have benefited. The incremental net benefit will depend on a range of factors including: individual farmer's previous practice, the changes in costs of production, the actual changes in yields, and use of maize outputs. Increase in maize grain yield during the validation phase varied, with some farmers harvesting up to three tonnes of maize grain per acre (7 tonnes/ hectare) from their own fields, using the improved cultivars plus the recommended management package, in comparison with 700 kg-1 tonne (1.7 -2.4 tonnes/ hectare) from unimproved local maize cultivars.

Process

A small number of farmers ie those in farmer research groups and others who participated in various learning activities have benefited directly through improved capacity to manage their maize systems. Those in the research groups also benefited indirectly through an enhanced capacity to influence the maize research and

development process. One group from Mbarali district were trained in open pollinated variety seed production and are planning to produce QDS seed to sell to their neighbours.

Key indicators which needs to be measured include: productivity (labour and capital, as well as land), farmer incomes and food security, equity (who is benefiting?) and sustainability [1].

Impact on poverty to date

Poverty grouping	**Capital assets Human, Social, Natural, Physical. Financial**	**Addressing vulnerability**	**Outcomes**	**Estimated number of people**
Moderate poor	**Product** Improved access to appropriate maize germplasm **Process** Farmer groups formation & development Enhanced capacity to influence systems providing agricultural information and products Improved capacity to manage maize systems and lower unit costs of production	*Trends* Increasing population pressure Pest /disease pressure Increasing price and declining use of external inputs on maize Declining real price of grain Rainfall becoming less reliable	Increase yields from 1.75 t to 5 t/ hectare Contributing to: Food security Improved income	Ten thousand 200 300 700-1000

[1] Based on Melinda Smale and Thom Jayne (2003) Maize in eastern and southern Africa@ seeds of success in retrospect. EPTD Discussion paper No. 97 IRPRI Washington DC, USA.

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)***
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.

Improving farmers' capacity to manage maize may have positive or negative implications for the environment.

Increased use of external inputs may have negative consequences on eg biodiversity of farming landscapes. Alternatively improving knowledge may result in a reduction in use of inputs. More intensive farming should result in less pressure to expand into previously uncultivated areas.

The use of disease resistant maize varieties eliminates the need for chemicals for disease control, therefore contributing to a healthy environment

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

Improving farmers' capacity to manage maize may have positive or negative implications for the environment. Increased use of external inputs may have negative consequences on eg biodiversity of farming landscapes.

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)***

The outputs can contribute as follows:

- Widespread use of these disease resistant maize varieties reduces the risks of loss of crop due to fungal disease outbreaks (by over 90%), such as the GLS outbreak in the Southern Highlands of Tanzania in 1995, which are often exacerbated by unusually heavy and prolonged rainfall.
- There is a likelihood, already apparent in some areas, that climate change [warming] is enabling cold intolerant insects such as the leafhoppers that spread maize streak to flourish at higher altitudes. Medium and high altitude adapted MSV-resistant varieties are required to combat this problem. Another likely outcome of climate change is increased irrigation. This also exacerbates MSV, again requiring the MSV-resistant cultivars the project has achieved.
- Early-maturing, but high yielding maize varieties, can mitigate the effects of changing rainfall patterns which result in shorter growing seasons
- Lessons learnt about approaches to improving farmers' capacity to manage maize crops, including for seed, and to access inputs including seed of superior varieties, can also mitigate effects of climate change by improving the overall management and hence robustness of cropping systems.

Annex

Acronyms and Abbreviations

ADP Mbozi	Agricultural Development Programme Mbozi Trust Fund
ARI	Agricultural Research Institute
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASDP	Agricultural Sector Development Programme
ASPS	Agricultural Sector Programme Support
ASSP	Agricultural Sector Support Programme
CABI ARC	Commonwealth Agricultural Bureau International Africa Regional Centre

CIMMYT	International Maize and Wheat Improvement Centre
CPHP	Crop Post Harvest Programme
CPP	Crop Protection Programme
DADPs	District Agricultural Development Plans
DADS	District Agricultural Development Strategy
DANIDA	Danish International Development Assistance
DFID	Department for International Development
ECAMAW	East and Central African Maize and Wheat Network
EPTD	Environment and Production Technology Division
FFS	Farmer Field School
FIPS Africa	Farm Inputs Promotions Africa
FRG	Farmer Research Groups
GSI	Good Seed Initiative
ICT	Information Communication Technologies
IFAD	International Fund for Agricultural Development
INADES Tz	Institut Africain pour le Developpment Economique et Social, Tanzania
IITA	International Institute for Tropical Agriculture
KARI	Kenyan Agricultural Research Institute
MDGs	Millennium Development Goals
M&E	Monitoring and Evaluation
NGO	Non Governmental Organisation
NRI	Natural Resources Institute, UK
NSIMA	New Seed Initiative for Maize in Africa
OPV	Open Pollinated Varieties
PADEP	Participatory Agricultural Development and Empowerment Programme
QDS	Quality Declared Seed
RIUP	Research Into Use Programme
RNRRS	Renewable Natural Resources Research Strategy
SADC	Southern African Development Community
SH	Southern Highlands, Tanzania
SHZ	Southern Highlands Zone
SSA	Sub Saharan Africa
ST	Streak Tolerant
UH	Uyole Hybrid
UK	United Kingdom
ZRELO	Zonal Research and Extension Liaison Officer