Plant Genetic Resources Newsletter

Bulletin de Ressources Phytogénétiques

Noticiario de Recursos Fitogenéticos

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Cover:
Collection of seed of a pea landrace from harvested bundles in a farmer's field in Gonghe county, Qinghai province, China (discussed by Redden et al. on pp. 1–10).
Photo: Dirk Enneking.

Couverture :
Graines d'une variété locale de pois récoltées dans un champ du comté de Ganghe, province de Qinghai, Chine (article de Redden et. al., pp. 1-10).
Photo: Dirk Enneking.

Portada:
Colección de semillas de una variedad local de guisante obtenidas de manojos cosechados en un campo agrícola del condado de Gonghe, provincia de Qinghai, China (ver el artículo de Redden et al. en las pp. 1-10).
Fotografía: Dirk Enneking

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Plant Genetic Resources Newsletter

Aims and scope
The Plant Genetic Resources Newsletter publishes papers in English, French or Spanish, dealing with the genetic resources of useful plants, resulting from new work, historical study, review and criticism in genetic diversity, ethnobotanical and ecogeographical surveying, herbarium studies, collecting, characterization and evaluation, documentation, conservation, and genebank practice.

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An article will publish the results of new and original work that makes a significant contribution to the knowledge of the subject area that the article deals with. Articles, which should be of a reasonable length, will be considered by the Editorial Committee for scope and suitability, then assessed by an expert referee for scientific content and validity.

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On entend par brève communication un texte contenant, sous une forme abrégée, les résultats de travaux présentant un intêrêt pour tous ceux qui s'occupent de ressources phytogénétiques. Elle contient en particulier des comptes rendus des missions d'acquisition de matériel génétique.

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Le Bulletin des ressources phytogénétiques publie d'autres types de rapport tels que des documents de synthèse, des études critiques et des articles commentant des problèmes actuels concernant les ressources phytogénétiques. Le Bulletin publie une revue de livres ainsi qu'une section intitulée Nouvelles et Notes. Les auteurs sont invités à envoyer leurs suggestions pour les livres à passer en revue ainsi que des contributions aux Nouvelles et Notes.

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Boletín de Recursos Fitogenéticos

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El Noticiario de Recursos Fitogenéticos publica documentos en inglés, francés y español que tratan de los recursos genéticos de plantas útiles, fruto de nuevos trabajos, estudios históricos, revisiones y análisis críticos relacionados con la diversidad genética, investigaciones etnobotánicas y ecogeográficas, estudios de herbarios, actividades de colección, caracterización y evaluación, documentación, conservación, y prácticas en bancos de germoplasma.

Dirección
El Noticiario de Recursos Fitogenéticos se publica bajo los auspicios conjuntos del Bioversity International y la Dirección de Producción y Protección Vegetal de la Organización de las Naciones Unidas para la Agricultura y la Alimentación.

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El Noticiario de Recursos Fitogenéticos aparece como un volumen anual compuesto por cuatro números, que se publican en marzo, junio, septiembre y diciembre. Se distribuye gratuitamente a las bibliotecas de bancos de germoplasma, facultades universitarias y servicios gubernamentales, centros de investigación, etc. que se interesan en los recursos fitogenéticos. También pueden obtener este noticiario las personas que demuestren necesitar una copia personal.

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Los artículos divulgarán los resultados de trabajos nuevos y originales que contribuyan de modo importante al conocimiento del tema tratado. Dichos artículos, que deberán tener una longitud razonable, serán examinados por el Comité de Redacción en cuanto a su pertinencia e idoneidad y posteriormente un experto juzgará su contenido y validez científicos.

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Las comunicaciones breves informarán de modo conciso sobre los resultados de trabajos de interés para las personas que se ocupan de los recursos fitogenéticos. Las comunicaciones breves incluirán, en particular, resúmenes sobre las misiones de adquisición de germoplasma.

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El Noticiario de Recursos Fitogenéticos publicará otros tipos de informes, como documentos de trabajo, análisis críticos, y documentos que examinen cuestiones de actualidad relacionadas con los recursos fitogenéticos. El Noticiario publicará una reseña de libros así como una sección de Noticias y Notas. Las propuestas de libros para reseñar y las contribuciones a la sección de Noticias y Notas serán bien acogidas.

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Summary

Ecogeographic genetic erosion, seed systems and conservation of plant genetic resources in Kabale highlands, Uganda

The study examined the extent and underlying causes of genetic erosion, identified farmers' seed sources and exchange systems and documented conservation practices in the Kabale highlands of south-western Uganda. Data were collected using pre-tested structured questionnaires from a random sample of 120 farmers from six parishes. The analysis revealed substantial loss of traditional varieties of sweet potatoes (*Ipomea batatas*), potatoes (*Solanum tuberosum*), beans (*Phaseolus vulgaris*) and peas (*Pisum sativum*). More than 18, 7, 9, and 3 varieties, respectively were reported to have been lost completely. The most frequently mentioned underlying cause of genetic erosion (cited by 93.7% of the farmers) was introduction of new varieties. Other causes were lack of market (68.8%), diseases (45.6%), shortage of land (41.9%), pests (33.4%), shortage of labour (23.5%), change in weather (19.6%) and loss of soil fertility (15.8%). Farmers relied mainly on their own seed for traditional varieties (81.5% of farmers), while nearly half of farmers obtained seed of new or modern varieties by cash purchase from the market. The exchange of seeds of modern varieties between the farmers was common practice. This has resulted in rapid and wide spread of modern varieties and has contributed to the abandonment of the traditional cultivars. Farmers maintained field stocks of vegetatively propagated crop species. For seed-propagated crops farmers mainly stored dried seeds in gunny sacks in their houses. Very few farmers employed traditional seed storage methods. The loss of landraces is a threat to national food security. Without adequate reservoirs of diverse genetic resources, future genetic improvement programmes will be jeopardized. There is therefore an urgent need to collect, document, conserve and utilize the traditional varieties and formulate policies that will protect them from further genetic erosion. Farmers and policy-makers should be sensitized on the value of maintaining crop genetic diversity.

Key words: Genetic erosion, plant genetic resources, Uganda.

Résumé

Érosion génétique écogéographique, gestion des semences et conservation des ressources phytogénétiques dans les hautes terres de Kabale, Ouganda

L'étude concerne l'importance et les causes de l'érosion génétique, les sources et les systèmes d'échange de semences parmi les agriculteurs ainsi que les pratiques de conser-vation dans les hautes terres de Kabale, au sud-ouest de l'Ouganda. Les données ont été collectées en utilisant un questionnaire structuré pré-testé à partir d'un échantillon aléatoire de 120 agriculteurs de six paroisses. L'analyse révèle une perte sensible de varié-tés traditionnelles de patate douce (*Ipomea batatas*), pomme de terre (*Solanum tuberosum*), haricot (*Phaseolus vulgaris*) et pois (*Pisum sati-vum*). Plus de 18, 7, 9 et 3 variétés respective-ment sont définitivement perdues. La cause de la perte d'érosion génétique la plus fré-quemment mentionnée (citée par 93,7 % des agriculteurs) est l'introduction de nouvelles variétés. D'autres causes sont l'absence de débouchés (68,8 %), les maladies (45,6 %), le manque de surfaces cultivables (41,9 %), les ravageurs (33,4%), le manque de main d'œuvre (23,5 %), le changement des condi-tions météorologiques (19,6 %) et la perte de fertilité du sol (15,8 %). Les agriculteurs utili-sent principalement leurs propres semences pour les variétés traditionnelles (81,5 % des agriculteurs), tandis que près de la moitié d'entre eux achètent des semences de varié-tés nouvelles ou modernes sur le marché. L'échange de semences de variétés modernes entre agriculteurs est une pratique courante, ce qui a entraîné une extension rapide des variétés modernes et contribué à l'abandon des cultivars traditionnels. Les agriculteurs conservent des stocks en champs de plantes multipliées par voie végétative. Pour les plantes propagées sous forme de graines, les agriculteurs conservent principalement des graines séchées chez eux dans des sacs de jute. Très peu d'agriculteurs utilisent des mé-thodes traditionnelles de stockage de graines. La perte de variétés locales constitue une me-nace pour la sécurité alimentaire nationale. L'absence de systèmes appropriés de conser-vation de la diversité des ressources phyto-génétiques menace les futurs programmes d'amélioration génétique. Il est donc urgent de collecter, documenter, conserver et utiliser les variétés traditionnelles et d'élaborer des politiques qui les protègent contre la pour-suite de l'érosion génétique. Les agriculteurs et les décideurs doivent être sensibilisés à l'importance de la conservation de la diver-sité génétique des ressources agricoles.

Resumen

Erosión genética ecogeográfica, sistema de semillas y conservación de recursos fitogenéticos en Kabale Highlands, Uganda

Se examinó la amplitud y causas de la erosión genética, fuentes y sistemas de intercambio de semillas de los agricul-tores y prácticas documentadas de con-servación en Kabale Highlands, Uganda sudoccidental. Los datos se recogieron en cuestionarios ya comprobados sobre una muestra aleatoria de 120 agricultores de seis parroquias. El análisis reveló una pérdida sustancial de variedades tradi-cionales de batatas (*Ipomea batatas*), papas (*Solanum tuberosum*), guisantes (*Phaseolus vulgaris*) y frijoles (*Pisum sativum*). Se han perdido más de 18, 7, 9 y 3 variedades re-spectivamente. La causa de erosión gené-tica mencionada con más frecuencia fue la introducción de nuevas variedades (93,7 % de los agricultores). Otras fueron falta de mercados (68,8%) enfermedades (45,6%), escasez de tierras (41,9%), plagas (33,4%), escasez de jornaleros (23,5%), cambios climáticos (19,6%) y pérdida de fertili-dad del suelo (15,8%). Para las variedades tradicionales los agricultores confiaban en sus propias semillas (81,5%), mientras que la mitad compraba de contado semillas de variedades nuevas. El intercambio de semillas de variedades modernas, práctica común entre los agricultores, provocó una rápida y amplia difusión de variedades modernas a expensas de los cultivares tradicionales. Los agricultores mantenían en el campo reservas de especies de propa-gación vegetativa. Para las propagadas por semilla conservaban en sus hogares semillas secas en sacos de arpillera. Po-cos agricultores emplean métodos tradi-cionales de almacenamiento. La pérdida de variedades locales es una amenaza para la seguridad alimentaria nacional. Es urgente recoger, documentar, conser-var y utilizar variedades tradicionales y formular políticas que las protejan de una ulterior erosión genética.

Introduction

Plant genetic resources include all plant species that contribute to peoples' livelihoods by providing food, medicine, shelter, fibre, and energy (Mooney 1997; Evenson et al. 1998; Hammer et al. 1999), whether cultivated or found in natural habitats as wild plants or relatives of crops. They are crucial to attempts to feed and sustain the steadily increasing global population (Arunachalam 1999). The need to maintain genetic diversity in agricultural systems to ensure that genetic resources continue to be available to support food security is widely accepted (FAO 1999).

The Kabale highlands of south-western Uganda are part of an intensively cultivated ecoregion with unique, diverse plant genetic resources (Crawley 2000; Africare 2001). These genetic resources are a reservoir of genetic adaptability that acts as a buffer against harmful environmental changes and economic challenges (Hammer et al. 1999; FAO 1999). These resources are now seriously threatened by genetic erosion (Jean-Mark 1999; Crawley 2000; Africare 2001).

Few national programmes have given high priority to quantification of genetic erosion, as apparent from the paucity of information in FAO (1997). However, the accurate documentation of genetic erosion of major agricultural crops is important both scientifically and socio-economically (FAO 1995; Smale 1996; Swanson 1996; Karp et al. 1997).

The objectives of this study were to i) determine the extent and underlying causes of genetic erosion of important food crops in south-western Uganda, ii) document farmers' seed sources and exchange systems and iii) to identify and document conservation practices.

Description of the study area

The study was conducted in Kabale District between June and December 2003. The District lies in the south-west of the Republic of Uganda between latitudes 1°S and 1°30'S and longitudes 29°18'E and 30°9'E. Altitude ranges from 1400 to 2500 metres above sea level. The District is divided into three counties (Rukiga, Ndorwa and Rubanda) and one municipality. It borders with Kisoro District in the west, Rukungiri District in the north, Ntungamo District in the east and the Republic of Rwanda in the south. It has a montane-type climate with a bimodal rainfall pattern, the short rains in March–May and the long rains in September–November. The mean annual rainfall is 1200 mm and mean annual temperature is 18°C. The relative humidity ranges between 90% and 100% in the mornings and between 50% and 60% throughout the year.

The average land area for agriculture is 2.06 hectares per household. The District is mountainous and has undulating hills with steep convex slopes of 10–60° and gentle slopes of 5–10° nearer the swampy valleys formerly occupied by papyrus swamps (Lindblade et al. 1996). The main soil types are volcanic, ferralitic and peat. Ferralitic soils are the most widespread type. Volcanic soils are found mainly in Muko subcounty. Peat soils are mainly found in papyrus swamps and produce the rich organic soils for agriculture; they dominate the valleys of Kabale District.

Important crops grown include sorghum (*Sorghum bicolor* L.), beans (*Phaseolus vulgaris*), peas (*Pisum sativum*), potatoes (*Solanum tuberosum*), sweet potatoes (*Ipomea batatas*) and bananas and plantains (*Musa* spp.).

Materials and methods

Data were collected using pre-tested structured questionnaires (Appendix I) from a random sample of 120 farmers (20 farmers in each of the six parishes) (Table 1) and analyzed using SPSS for descriptive statistics. Percentages and cross tabulation techniques were used to examine the associations between factors investigated.

Results and discussion

Genetic erosion

Genetic erosion in bananas and plantains (*Musa* spp.)

There were no reports of banana and plantain cultivars being completely abandoned over the past 10–20 years. However, some cultivars were abandoned by some farmers but were still grown by others. For example, 'Gonja', 'Bogoya', 'Mabeere'/'Kitika', 'entundu' and 'engoote' were reported as still being grown by 7.7%, 20.4%, 33.3%, 19.5% and 29.9% of farmers while 46.4%, 31.7%, 24.3%, 19.6% and 17.4% of farmers reported abandoning them. The main reason given for abandoning cultivars was lack of a market. These cultivars were replaced with cooking types.

Genetic erosion in sorghum (*Sorghum bicolor* L.)

No sorghum variety was reported as being lost completely. However, some varieties are in danger of disappearing, mainly because of poor culinary quality and poor yields. These varieties include 'Mabeere' and 'Magune', which are still grown by 8.7% and 3.4%, respectively, of farmers interviewed but have been dropped by 43.8% and 72.5% of farmers.

Genetic erosion in peas (*Pisum sativum* L.)

Three pea varieties were reported as having been abandoned by all the farmers interviewed; varieties 'Kyambia', 'Rwantooro' and 'Nyakasaza' were lost completely and could not be traced from other farmers. A further two varieties, 'Misere' and

Table 1. Location of sample farmers, Uganda.

County/subcounty	Rukiga/Bukinda		Ndorwa/Buhara		Rubanda/Muko	
Parish	Nyakisiru	Karorwa	Bugarama	Rwene	Ikamiro	Butare

Table 2. Underlying causes of genetic erosion in south-western Uganda.

Cause	% of farmers interviewed
Introduction of new varieties	93.7
Lack of market	68.8
Diseases	45.6
Shortage of land	41.9
Pests	33.4
Shortage of labour	23.5
Change in weather	19.6
Loss of soil fertility	15.8
Others	10.6

'Amaharare', are still grown by a few farmers (7.0 and 2.4%, respectively) but were on the verge of extinction. This was mainly due to poor culinary quality and lack of market.

Genetic erosion in beans *(Phaseolus vulgaris* L.*)*

Nine bean varieties were reported as having been abandoned by all farmers interviewed: varieties 'Ntemeroruhanga', 'Kanyamunyu', 'Makara', 'Mugyerahansi', 'Kesharingwa', 'Kyinganente', 'Mirankwongyere', 'Murundi' and 'Kiribyonyami' were lost completely and could not be traced. A further five varieties were still grown by few farmers but are facing extinction: 'Ruhendamagari' (13.0%), 'Mwonyogwembeba' (8.5%), 'Kijunde' (5.6%), 'Rusavinyanza' (4.1%) and 'kikoti' (9.9%).

Genetic erosion in potatoes *(Solanum tuberosum* L.*)*

Seven potato varieties were reported as having been abandoned by all farmers interviewed: varieties 'Kashari', 'Magojo', 'Joseline', 'Ruranda', 'Kakwirwa', 'Rushwiga' and 'Kaposho' were lost completely and could not be traced. Five varieties were still grown by a few farmers but were at risk of extinction: 'Malierahinda' (5.8%), 'Katikamwe' (10.6%), 'Kisoro' (8.4%), 'Cruza' (44.4%) and 'Kabeera' (4.5%).

Genetic erosion in sweet potatoes *(Ipomea batatas* L.*)*

A lot of genetic erosion had occurred in sweet potatoes although there is still high diversity. Eighteen varieties were reported as having been abandoned: varieties 'Nyirasasi', 'Kakoba', 'Kikoyo', 'Magabari', 'Katere', 'Nshenhsera', 'Kashusha', 'Kahungyenzi', 'Kyitekamaju', 'Nkyiriza', 'Mukobwa', 'Nkijamundegye', 'Kyitambira', 'Kifefe', 'Nyinabusegyenyi', 'Kataikome', 'Nderera' and 'Ruranda' were lost completely and could not be traced from other farmers. A further eight varieties were still grown by some farmers but were on the verge of extinction: 'Kanyansi' (5.6%), 'Mulera' (6.7%), 'Sengamugabo' (5.3%), 'Rwampala' (4.8%), 'Ntegakatebe' (18.1%), 'Norah' (3.0%), 'Kyebandira' (45.5%) and 'Magumba' (3.5%).

Farmers' perceptions on causes of genetic erosion

The most frequently reported cause of genetic erosion, mentioned by 93.7% of farmers, was the introduction of new or modern varieties (Table 2). This is similar to findings reported by Zimmerer (1992), Charles and Weiss (1999), Kiambi (1998) and FAO (1999). Due to the superior qualities of modern varieties (especially higher yields and higher prices), farmers are increasingly replacing traditional varieties with modern varieties in many fields. The second most frequently cited cause of genetic erosion was lack of market (68.8%). Most of the farmers interviewed rely solely on agriculture for their entire livelihood and therefore give high priority to varieties that are in high demand and neglect or drop those with low demand. Diseases (45.6%) and pests (33.4%) were other major factors contributing to genetic erosion. The crop varieties that used to be resistant to most of the important diseases and pests in the District have lost resistance, resulting in decline in yield. Arunachalam (1999) also reported that natural disasters such as floods, droughts, diseases and pests contribute to genetic erosion.

Shortage of land (41.9%) and labour (23.5%) were other factors mentioned by farmers. As a result of high population pressure in the District, there is shortage of land and farmers have to utilize their meagre land holdings for the most productive and high-priced crop varieties. Lower-yielding varieties, which in most cases are traditional, are abandoned. The high rate of urban migration, especially among younger people, has reduced the labour force, resulting in the abandonment of crop varieties requiring high amounts of labour. This has also been reported by Charles and Weiss (1999) and Zimmerer (1992).

Changing climatic conditions have resulted in the loss of adaptation of some formerly high-yielding crop varieties, forcing farmers to shift to new, better-adapted varieties. The change in climate has also led to the introduction of new diseases and pests. A decline in soil fertility as a result of frequent cultivation of the land without furrowing was evident and some varieties have therefore been abandoned due to low productivity.

Other causes of genetic erosion (10.6%) included varieties dropped due to poor culinary qualities, undesirable seed colour (especially beans which were blue or black), seed size (small ones mostly dropped) and height (tall plants mostly dropped due to lodging).

Seed systems

Farmers' seed sources

The study revealed that farmers obtained seed from both informal and formal sources. This is in agreement with findings of others, including Pray and Ramasawmi (1991), Cromwell et al. (1992), Worede (1992), and Cromwell et al. (1993). Traditional varieties were mainly obtained through informal channels (especially own stock) while modern varieties were obtained from formal sources (Table 3). Informal seed supply is practised by farmers themselves in conservation and exchange of their landraces while the formal channel is used by non-governmental and research organizations to supply seed of modern varieties.

Table 3. Farmers' seed sources in south-western Uganda.

Seed source	Traditional varieties (%)	Modern varieties (%)
Own stock	81.5	31.3
Cash purchase from market	11.1	50.8
Cash purchase from shops	7.6	32.8
Cash purchase from other farmers	7.4	29.5
Exchange for other seeds	10.3	23.6
Free from other farmers	5.6	40.9
NGOs/CBOs/national/ international programmes	2.1	36.4

Table 4. Farmers' seed exchange systems in south-western Uganda.

	Traditional varieties (%)	Modern varieties (%)
Seeds given out to:		
None	41.7	3.1
One farmer	17.2	5.4
Two farmers	23.1	9.2
Three farmers	6.3	20.7
Four farmers	7.5	36.2
> four farmers	4.2	25.4
Seeds received from:		
None	46.1	5.3
One farmer	21.1	10.1
Two farmers	15.4	8.1
Three farmers	8.3	39.5
Four farmers	6.3	14.6
> four farmers	2.6	22.4

Seed exchange

As shown in Table 4, there was little exchange of seed of traditional varieties among the farmers in the District. In contrast, the exchange of seed of modern varieties among the farmers was more prevalent. This has resulted in a growing spread of the modern varieties, which has contributed to putting traditional varieties at risk of extinction. Widespread exchange of seed of new bean varieties among farmers in Kabale has also been reported by Mugisa-Mutetikka (1997), while David and Sperling (1997) reported similar behaviour elsewhere in eastern and central Africa.

Conservation practices

Farmers maintained field stocks of vegetatively propagated crop species such as bananas/plantains, sweet potatoes, pineapples (*Ananus comosus*), sugar-cane (*Saccharum officinarum*) and fruit trees. Potato seed tubers are kept in the dark, either on dry ground or raised platforms. For crop species propagated by seeds most farmers dried and stored seeds in their houses in gunny bags. Almost all farmers had abandoned traditional seed storage methods mainly because of theft of seed stocks.

When seeds are to be stored for long periods, they are treated with chemicals, especially Marathion, to control weevils. Some farmers were using wood ash but it was less effective.

Conclusions and recommendations

This study revealed that many traditional varieties or landraces have been lost and replaced with modern varieties. The most important cause of this erosion is the frequent introductions of modern varieties, which are now grown on a much larger area than are traditional varieties. There was also a lot of exchange of seed of modern varieties among the farmers, putting the traditional varieties at risk of extinction. The loss of these genetic resources is a threat to national food security. This results in reduction of the genetic base of the remaining varieties. Without adequate reservoirs of diverse genetic resources, future genetic improvement programmes will be jeopardized. There is therefore an urgent need to collect, document, conserve and utilize the traditional varieties and to formulate policies that will protect them from further genetic erosion. Farmers and policy-makers should be sensitized on the value of maintaining crop genetic diversity.

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Appendix I. Questionnaire on ecogeographic genetic erosion, seed systems and conservation of plant genetic resources in Kabale highlands, Uganda

1. Location

County……. Sub-county…… Parish…….. Village……..

Altitude…….. Longitude…… Latitude……. Date of interview……

2. Identification of person interviewed

Name…….

Sex	**Family size**	**Length of residence**
a) Male	a) 1–5	a) 1–10
b) Female	b) 6–10	b) 11–20
	c) >10	c) 21–30
		d) >30 years
Age	**Marital status**	**Education level**
a) 20–30	a) Married	a) None
b) 31–40	b) Single	b) Primary
c) 41–50	c) Widowed	c) Secondary
d) 51–60	d) Separated	d) Tertiary
e) >60 years		
Ethnic group		**Land tenure**
a) Bakiga		a) Customary
b) Bafumbira		b) Mailo
c) Banyarwanda		c) Lease
d) Banyankole		d) Freehold

3. On-farm diversity

Do you grow crops on your farm? If yes, which ones?

Crop	**Variety**

4. In the last 10–20 years, the number of local varieties has:

In your farm	**In your village**
a) Increased	a) Increased
b) Decreased	b) Decreased
c) Stayed the same	c) Stayed the same

5. If the number has decreased, which local varieties/cultivars did you drop in the last few years?

Which?	**When did it happen?**	**Why did it happen?**

6. What do you think are the causes of genetic erosion?

a) Shortage of land b) Change in weather

c) Diseases d) Lack of market

e) Pests f) Introduction of new varieties

g) Loss of soil fertility h) Shortage of labour

i) Others (specify)

7. What are your sources for:

Traditional seeds?	**Modern seeds?**
a) Cash purchase from market	a) Cash purchase from market
b) Cash purchase from shops	b) Cash purchase from shops
c) Cash purchase from other farmers	c) Cash purchase from other farmers
d) Own stock	d) Own stock
e) Free from other farmers	e) Free from other farmers
f) Exchange for other seeds	f) Exchange for other seeds
g) NGOs/National/International programmes	g) NGOs/National/International programmes

8. How many farmers did you give seeds to during the past year?

Traditional seeds?	**Modern seeds?**
a) None	a) None
b) 1	b) 1
c) 2	c) 2
d) 3	d) 3
e) 4	e) 4
f) >4	f) >4

9. How many farmers did you receive seeds from during the past year?

Traditional seeds?	**Modern seeds?**
a) None	a) None
b) 1	b) 1
c) 2	c) 2
d) 3	d) 3
e) 4	e) 4
f) >4	f) >4

10. What is the impact of introduction of modern varieties on traditional ones?

11. Do you think it is possible to trace the lost varieties?

12. Does it matter to you that these varieties are lost?

13. How do you conserve your seeds for next planting?

Crop	Conservation method

Thank you very much for your information and cooperation.