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REPORT
ON

PLANT BREEDING AND BIOTECHNOLOGY CAPACITY SURVEY

MOZAMBIQUE

by

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2004

Acknowledgements

Firstly, I would like would to express my deep gratitude to the FAO for providing financial support which enabled me to carry out this survey.

My deep appreciation is extended to Dr Elcio Guimarães (Senior FAO Officer, Cereals/Crops Breeding) for the useful overall supervision during the undertaking of survey this survey.

Special gratitude Mr. Pedro Fato (Maize Breeder, INIA) for revising the text and to all contacted plant breeders, individuals and institutions listed in the Annex 6 for assisting me to conduct this survey.

List of acronyms

DINA- Direcção Nacional de Agricultura (National Directorate of Agriculture)
FAEF- Faculdade de Agronomia e Engenharia Florestal (Faculty of Agronomy and Forest Engineering)
FAO- Food and Agriculture Organization of the United Nations
INIA- Instituto Nacional de Investigação Agronómica (National Institute of Agriculture Research
ITPGRFA- International Treaty on Plant Genetic Resources for Food and Agriculture
MADER- Ministério de Agricultura e Desenvolvimento Rural (Ministry of Agriculture and Rural Development
MESCT- Ministério do Ensino Superior, Ciências & Tecnologia (Ministry of High Education, Science and Technology)
PROAGRI- Programa de Investimento no Sector Público Agrário (Programme for Investiment in Agriculture Public Sector)
SADC- Southern Africa Development Community
SEMOC- Sementes de Moçambique (Mozambique Seeds Company)
UEM- Universidade Eduardo Mondlane (Eduardo Mondlane University)
UNDP-United Nations Development Programme
USAID- United States Agency for International Development

I. Introduction

The FAO is involved in a global survey with the aim of developing plant breeding country profile worldwide. It is expected that these country capacity assessments and their recommendations will form the basis for establishment of country needs and priorities in the area of plant breeding. The results will be also useful in the development and implementation of country driven capacity building programmes related to sustainable use of plant genetic resources for food and agriculture.

This report intends to present the results from Mozambique of the survey commissioned by FAO in the scope of its work on cereals/crops breeding towards assessing and strengthening sustainable use of plant genetic resources (PGR). The work was carried out under the supervision of the Senior Officer for Cereal/Breeding, Crop and Grassland Service, Plant Production and Protection Division.

II. Objective

To assess Mozambique's plant breeding and biotechnology capacity with the aim of assisting the development and implementation of country driven capacity building programmes related to sustainable use of plant genetic resources for food and agriculture in Mozambique.

III. Methodology

The work consisted of desktop surveys and interviews conducted to key plant breeders and policy makers in the country.

The information on resources allocation for plant breeding and biotechnology from the public and private sector in Mozambique was collected using the survey form previously prepared by the FAO (Annex 1).

This questionnaire was applied to all public and private plant breeding programmes in the country (one questionnaire for each institution/organization); interviews were also conducted to key plant breeders and policy makers in the country. Additional information was collected from relevant reports on crop improvement in Mozambique
A description and interpretation for each questionnaire (organization) was made. Further more, all data were aggregated and interpreted as whole to provide national plant breeding and biotechnology capacity;

Lastly a short document advising police makers on strategies to strength national plant breeding capacity was written.

IV. Results

This report contains results of the 3 organisations which have or have had active plant improvement programme namely: INIA (annex 2), FAEF (Annex 3) and SEMOC (Annex 4). The aggregated data are in the annex 5.

IV.1. Description and interpretation of survey results: INIA

IV.1.1. Question 1.

The National Institute of Agriculture Research INIA is a public research institute under the Ministry of Agriculture and Rural Development. Funding is from PROAGRI (Programme for investment in public agriculture sector) which is a pool of both the government and multi-donors funds.

IV.1.2. Question 2.

Crop improvement programme started in 1967 at IIAM (the predecessor name of INIA) pioneered by the hybrid development in Maize.

Biotechnology research has never been seriously undertaken at INIA due the lack of functional laboratory facilities and trained personnel. There was a tissue culture laboratory in 1990's at Umbeluzi Research Station (about 30 Km from INIA headquarters). This laboratory was designed for production of diseases-free plant material and micro-propagation. However, this laboratory has faced problems related to the supply of clean water and fluctuation of electricity supply which limited its regular functioning. Moreover, floods in 1994 caused severe damage to both the laboratory infra-structure and equipment. For this reason, it is still closed up to now.

Provisions have been made to establish a new laboratory at INIA headquarters to be completed by end of the 2003 with the technical assistance of IITA and financial of USAID.

IV.1.3. Question 3.

The global crop research staff data set from INIA is indicated in the completed survey form 2. Table 1 indicates the research staff distribution among different crop research programmes at INIA.

Table 1. Research staff distribution among different crop research programmes at INIA.

	1985			1990			1995			2001		
	BSc	MSc	PhD	BSc	MSc	PhD	BSc	MSc	PhD	BSc	MSc	PhD
Trigo	0	0	0	0	0	0	0	0	0	0	0	0
Arroz	0	0	1	0	0	1	0	1	0	2	0	0
Milho	2	0	1	2	0	1	2	1	0	3	2	2
Sorgo e milheto	0	0	0	0	0	0	2	0	0	1	0	0
Outos cereais	0	0	0	0	0	0	0	0	0	0	0	0
Proteaginosas	0	0	0	0	0	0	0	0	0	0	0	0
Fibras (algodão)	0	0	0	0	0	0	1	1	0	1	1	0
Raizes e tubérculos	2	0	0	3	0	1	2	0	1	2	1	1
Forrageiras	0	0	0	0	0	0	0	0	0	0	0	0
Outras leguminosas (feijões)	2	0	0	1	0	2	2	0	0	2	1	1
Fruteiras e hortícolas	1	0	0	1	0	0	0	0	0	2	0	0
Outras culturas (Cajú)	0	0	0	0	0	0	1	0	1	2	1	0
Total	7	0	2	7	0	5	10	3	2	15	6	4

The shortage and quality of the staff have been a major constraint for all crop programmes. This has been exacerbated by continuous change of staff in all programmes. It should be noted that the continuity of staff is an important factor for any successful plant breeding programme.

In the period 1983-94, the crop improvement programmes were run mainly by expatriates staff contracted under FAO projects (FAO/UNDP DP/MOZ/81/014 and FAO/UNDP/ MOZ/86/009). In the late 1980's and early 1990's, there were also expatriates staff contracted by SADC Cowpea Improvement Programme 1990's. Virtually, all expatriates left INIA when both SADC Cowpea Improvement Programme and FAO projects were discontinued in 1993 and 1994, respectively.

In the period 1994-2001, there were major changes in staff composition; from there onwards, there were increasing of national staff.

Both the maize and roots and tubers programmes had more and qualified staff over all period 1985-2001. These programmes have also had some staff all over the period.

There has never been allocated staff specifically for wheat, groundnuts (groundnuts improvement programme was carried out by the University Eduardo Mondlane) and soya bean.

There was very limited staff allocated to improvement of sorghum and millets, cotton, cashew nuts and fruits and horticulture crops.

Lastly, there was no staff involved in crop biotechnology apart from short-term tissue culture work done in 1990's. The staff mentioned in the completed survey form 2 is doing conventional cassava breeding waiting for the installation of biotechnology laboratory later this year.

IV.1.4. Question 4.

There is very limited data on financial resources allocated to crop improvement. Many documents on government financial resources allocated to crop improvement prior to 1998 have been lost or do not provide accurate information. The available external project reports do not provide organised and accurate information on expenditures.

Broadly speaking, there has been very limited investment in agriculture research and, in particular, crop improvement. The government budget allocation for crop improvement covered only salaries for national staff. The actual cost for crop improvement came from external sources.

In the Period 1983-1994 funding for crop improvement was granted by FAO/UNDP projects and/or SADC Cowpea Improvement Programme. There was dramatic decline in funding in 1994 after these programmes have been discontinued.

New funding came from a transitional Pre-Programme in 1995 (funds allocated from previous FAO projects).

There was slight increase in investment on crop improvement when the Rockfeller Foundation started funding maize and root and tuber crops programmes in 1996. To date the Rockfeller Foundation is the major contributor for crop improvement programme at INIA.

From 1998, the PROAGRI – a pool of the both government and multi-donors funds-started to provide some funds to agriculture research on yearly basis. However, funding to agriculture research is limited and, in many case, it is not done in a timely manner.

IV1.5. Question 5

There was more investment in maize, root and tubers and grain legumes all over the period. The budget for maize was the highest except in 1995 when lost ground to cassava and in 2001 when it was equal to cassava. These facts reflect the importance of maize, root and tubers and grain legumes as the main food crops in Mozambique. It should be noted that the research policy gives higher priority to the main food crops.

Some investment was made in sorghum and millets in 1995 as result of SADC ICRISAT Sorghum and Millets Programme input. However, was a dramatic decline in 2001 after this project has ended.

Very little investment has been done in crop improvement of fruits and vegetables, cotton and cashew nuts. This picture will change in near future since the government has started to consider seriously the promotion of research addressing the need of the private sector hence will increasing importance given to the cashew nut, coconut, sugarcane and cotton.

IV.1.6. Question

The active development of germplasm and production of lines were almost exclusively carried in maize and root and tubers. The other crop improvement programmes were mainly carrying out evaluation work of both local and exotic germplam for selection of better performing material.

IV.1.7. Question 7

Overall, INIA was mainly carrying out evaluation work of both local and exotic germplam for selection of better performing material except maize and cassava where there were active breeding programmes.

The development of maize germplasm was interrupted in 1995 due to the fact that the experienced staff left INIA in 1994. This activity was resumed in 1998 to full recover its performance in 2001 onwards.

No significant investment has been done in plant biotech except tissue culture work done in early 1990's

IV.1.8. Question 8.

Biotechnology research has never been seriously undertaken at INIA due the lack of functional laboratory facilities and trained personnel. There was a tissue culture laboratory in 1990's at Umbeluzi Research Station (about 30 Km from INIA headquarters). This laboratory was designed for production of diseases-free plant material and micro-propagation. However, this laboratory has faced problems related to the supply of clean water and fluctuation of electricity supply which limited its regular functioning. Moreover, floods in 1994 caused severe damage to both the laboratory infra-structure and equipment. For this reason, it is still closed up to now.

Provisions have been made to establish a new laboratory at INIA headquarters to be completed by end of the 2003 with the technical assistance of IITA and financial of USAID.

IV.1.9. Question 9.

The data shown are only for maize and roots and tubers crops where there have been very active crop breeding programme.

The other crop improvement programme are mainly carrying out evaluation work of both local and exotic germplam for selection of better performing material.

IV.1.10. Question 10.

The main source of germplasm for food crops (rice, maize, sorghum and millets, groundnuts, roots and tubers and grain legumes) are, in descending order, CGIAR genebanks, evaluating networks as well as local and national genebanks.

For the cash crops (cotton and cashew nuts) the main germplam sources are the private sector and acquisition through bi-lateral agreement. Local and local genebanks play an important role as sources for cashew nuts.

For fruits and vegetables the main source is the private sector and acquisition through bi-lateral agreements. CGIAR genebanks play some role as sources of germplasm for vegetables.

IV.1.11. Question 11.

Overall, for the majority of food crops (maize, sorghum and millets roots and tubers and grain legumes), high or medium importance was given to biotic and abiotic stress in 1980. In 2001, high importance was given to both biotic and abiotic stress in all these crops.

Favourable conditions were given high importance in both in 1980 and 2001 for the rice crop.

In cotton, high importance was given to favourable conditions and medium importance to biotic stress both in 1980 and 2001.

In fruits and vegetables high importance was given to favourable conditions with medium or medium importance given to biotic stress.

Some food crops included medium and high importance in 2001, due shift in agriculture policy which now equally promotes the private sector.

IV.1.12. Question 12.

Capacity building (training in conventional breeding and biotechnology, infra-development (biotech laboratory), equipment) and the access to germplasm and new biotechnological tools are the main priority areas of investment that can make significant contribution for development of the national crop improvement programmes at INIA.

IV.1.13. Question 13.

In 1995, there were more varieties released as this is the year where there was an update of national variety list after some a long period of stagnation. Most of these varieties have been produced in previous years but not registered.

IV.1.14. Question 14.

The most important limiting factors are, in descending order:
Lack of financial resources to carry out field and lab experiments, shortage of staff, updated literature, and lack of expertise in marker assisted breeding and molecular characterisation of germplasm.

IV.2. Description and interpretation of Survey results: FAEF

IV.2.1. Question 1.

The Faculty of Agronomy and Forest Engineering belongs to the University Eduardo Mondlane which is a public higher education institution. Funding is from both the government and external sources.

IV.2.2. Question 2.

Crop improvement programme started in the mid early 1980

There was no plant biotechnology research in the period 1985-2001 except some tissue culture work for plant physiology purposes.

From 2002, the FAEF is involved in plant biotechnology research namely in molecular characterization of local cowpea

IV.2.3. Question 3.

Due to the shortage of the staff, the FAEF has only been involved in crop improvement of 3 crops- cowpeas, groundnuts and sunflower. This has been exacerbated by the fact that the staff has to combine both teaching and research responsibilities in the department.

There was no plant biotechnology research staff in the period 1985-2001. Even now that the FAEF is involved in molecular characterization of local cowpea, there is no full-time staff allocation for plant biotechnology research.

IV.2.4. Question 4.

There is very limited data on financial resources allocated to crop improvement.

Broadly speaking, there is a very limited investment in crop improvement. The government budget allocation for crop improvement covered only salaries for national staff. The actual cost for crop improvement came from external sources.

Taking into account that the core business of FAEF is teaching, perhaps less than 5 percent of total FAEF budget has been allocated to crop improvement. Funding for this has come only from external sources (the Italian and Dutch funded projects).

IV.2.5. Question 5

Investment in crop improvement at FAEF was concentrated only in cowpeas, groundnuts and sunflower.

Although investment in sunflower started later, in mid 1990's, it is now consuming the majority of funds allocated to crop improvement. This is due to the fact that Italian financial support is directed to sunflower.

IV.2.6. Question 6

The active development of germplasm and production of lines were exclusively carried in groundnuts and sunflower. In the cowpeas, improvement programme was directed to the evaluation of the both local and exotic germplam for selection of better performing material.

IV.2.7. Question 7

Overall, the FAEF has been involved in evaluation of both local and exotic germplam for selection of better performing material. However, some work on the development of germplasm has been done in ground nuts and sunflower.

There was no plant biotechnology research in the period 1985-95 except some tissue culture work for plant physiology purposes

From 2002, the FAEF is involved in plant biotechnology research namely in molecular characterization of local cowpea

IV.2.8. Question 8.

There was no plant biotechnology research in the period 1985-2001 except some tissue culture work for plant physiology purposes.

From 2002, the FAEF is involved in plant biotechnology research namely in molecular characterization of local cowpea

IV.2.9. Question 9.

Data summary still to be provided.

IV.2.10. Question 10.

The main source of germplasm for groundnuts and cowpea are, in descending order, CGIAR genebanks, evaluating networks as well as local and national genebanks.

For the sunflower, the main source of germplasm was the public research institutions in developed countries and acquisition through bi-lateral agreement.

IV.2.11. Question 11.

For groundnuts and cowpeas, high importance was given to biotic and abiotic stress both in 1980 and 2001.

For sunflower, favourable conditions were given high importance while biotic stress and abiotic stress are given medium importance, respectively, in 2001.

IV.1.13. Question 13.

In 1995, there were more varieties released as this is the year where there was an update of national variety list after some a long period of stagnation. Most of these varieties have been produced in previous years but not registered.

IV.1.14. Question 14.

The most important limiting factors are, in descending order:
Lack of financial resources to carry out field and lab experiments, shortage of staff, updated literature, and lack of expertise in marker assisted breeding and molecular characterisation of germplasm.

IV.3. Description and interpretation of Survey results: SEMOC

IV.3.1. Question 1.

The Mozambique Seeds Company (SEMOC) is now a private seed production company. When SEMOC was created it was a para-state company with some shares from the state but it has now evolved to a private status.

IV.3.2 Question 2.

It was not the mandate of SEMOC to carry out crop improvement since the company's business was seed production. In the period 1998-2000, SEMOC was eventually involved in crop improvement due the demand and existence of well trained breeders in both maize and rice programmes. These programmes have made considerable contribution for crop improvement in the country. When SIDA funding was stopped and after complete privatization of the company, the crop improvement programmes were discontinued and the company is now concentrated its core business - the seed production.

Biotechnology has never been SEMOC business.

IV3.3. Question 3.

Very few staff was allocated to crop improvement in maize and rice since this activity was not the priority business of SEMOC.

No staff was involved in crop biotechnology.

IV.3.4. Question 4.

Data on company expenditures were not made available perhaps because they confidential.

However, taking into account that the core business of SEMOC was seed production, the staff interviewed thinks that less than 5% of the budget was allocated to crop improvement.

There was no budget allocated to crop improvement in 2001 since this activity has been stopped.

IV.3.5. Question 5

Investment on crop improvement was made in maize and rice only. The majority of financial resources were allocated to maize.

This investment was discontinued following withdrawal of SIDA support and complete privatization of the company.

IV.3.6. Question 6

At SEMOC, there was no crop improvement in 2001. However, available show that there was active crop improvement programmes in the period 1988-2000 in maize and rice concentrated in variety testing and selection for better performing material.

IV.3.7. Question 7

In the period 1988-2000, crop improvement programme included both germplam development and evaluation work in maize and rice. However, more effort was directed to variety testing and selection for better performing material.

No biotechnology research work was carried out.

IV.3.8. Question 8.

No biotech work was carried out.

IV.3.9. Question 9.

The was no crop improvement work in 2001. However, available data show, for example, when the rice improvement programme was full functional, they used to make 70 crosses, produce 300 segregants, with 300 experimental plots in two sites.

IV.3.10. Question 10.

In 2001, SEMOC did not have crop improvement programme but when maize and rice programme were active the main sources of germplasm were CGIAR genebanks, evaluation network as well as local and national genebank

IV.3.11. Question 11.

The SEMOC was created after 1985 and there had no crop improvement programme in 2001. When crop improvement programme was active, SEMOC used to give high priority to favourable conditions. However, medium importance was given also to biotic stress.

IV.3.12. Question 12.

Not applicable

IV.3.13. Question 13.

In 1995, there were more varieties released as this is the year where there was an update of national variety list after some a long period of stagnation. Most of these varieties have been produced in previous years but not registered.

IV.3.14. Question 14.

Not applicable.

IV.4. Description and interpretation of Survey results: Aggregated data

IV.4.1. Question 1.

In the period 1985-2001, only 3 institutions have been actively involved in crop improvement namely, the National Institute of Agriculture Research (a public research institute under the Ministry of Agriculture and Rural Development), the Faculty of Agronomy and Forest Engineering (public higher education institution under the University Eduardo Mondlane) and Mozambique Seeds Company (a private seed production company).

IV.4.2. Question 2.

Crop improvement programme started 36 years ago at IIAM (predecessor name of INIA), 24 years ago at FAEF and 16 years ago at SEMOC. At IIAM crop improvement was pioneered by the hybrid development in maize.

In the period 1985-2001 none of these institutions have been involved in plant biotechnology research except tissue culture work that was done at INIA (Umbeluzi Research Station) in early 1990's.

IV.4.3. Question 3.

The shortage and quality of the staff have been a major constraint for all crop programmes. This has been exacerbated by continuous change of staff in all programmes. More ever, the staff from FAEF combined both teaching and research responsibilities in this the institution.

It should be noted that the continuity of staff is an important factor for any successful crop improvement programme.

In the period 1983-94, the crop programmes were mainly run by expatriate staff contracted under UNDP/FAO projects and SADC Cowpea Improvement Project (at

INIA), SIDA (at SEMOC) and Dutch and Italian funded projects (at FAEF). Virtually, all experienced expatriates left INIA when both the SADC Cowpea Improvement Programme and FAO/UNDP projects were discontinued in 1993 and 1994, respectively.

In the period 1994-2001, there were major changes in staff composition; from there onwards, there was an increase of national staff running the crop improvement programmes. To date, the crop improvement are virtually run by national staff.

During the period 1985-2001, there was no staff involved in crop biotechnology apart from short-term tissue culture work done in 1990's at INIA. Even now that the FAEF is involved molecular in characterization of local germplasm, there is no full-time staff allocation for plant biotechnology research.

IV.4.4. Question 4.

There is very limited data on financial resources allocated to crop improvement. Many documents on government financial resources allocated to crop improvement are not readily available. The available project reports do not provide organised and accurate information on expenditures.

The figures given are guest estimates agreed upon by plant breeders and some administrators that where interviewed during the survey.

Broadly speaking, there was very limited investment in agriculture research and, in particular, crop improvement. The government budget allocation for crop improvement covered only salaries for national staff. The actual cost for crop improvement came from external sources.

In the Period 1983-1994 funding for crop improvement at INIA was granted by FAO/UNDP projects and/or SADC Cowpea Improvement Programme. When these programmes were discontinued, there was a dramatic decline in funding in 1994. New funding came from a transitional Pre-Programme in 1995 (funds allocated from previous FAO projects).

There was slight increase in investment on crop improvement when the Rockfeller Foundation started funding maize and root and tuber crops programmes in 1996. To date the Rockfeller Foundation is the major contributor for crop improvement programme at INIA.

From 1998, the PROAGRI – a pool of the both government and multi-donors funds- started to provide some funds to agriculture research on yearly basis. However, funding to agriculture research is limited and, in many case, it is not done in a timely manner.

It was not the mandate of SEMOC to carry out crop improvement since the company's business was seed production. In the period 1998-2000, SEMOC was eventually involved in crop improvement due the demand and existence of well trained breeders in both maize and rice programmes. These programmes have made considerable contribution for crop improvement in the country. When SIDA funding was stopped and

after complete privatization of the company, the crop improvement programmes were discontinued and the company is now concentrated its core business - the seed production

IV.4.5. Question 5

There was more investment in maize, root and tubers and grain legumes all over the period. The budget for maize was the highest except in 1995 when lost ground to cassava and in 2001 when it was equal to cassava. These facts reflect the importance of maize, root and tubers and grain legumes as the main food crops in Mozambique. It should be noted that the research policy gives higher priority to the main food crops.

Some investment was made in sorghum and millets in 1995 as result of SADC ICRISAT Sorghum and Millets Programme input. However, was a dramatic decline in 2001 after this project has ended

Very little investment has been done in crop improvement of fruits and vegetables, cotton and cashew nuts. This picture will change in near future since the government has started to consider seriously the promotion of research addressing the need of the private sector hence will increasing importance given to the cashew nut, coconut, sugarcane and cotton.

IV.4.6. Question 6

The active development of germplasm and production of lines were, almost, exclusively carried out in maize, roots and tubers, groundnuts and sunflower. The other crop improvement programmes were mainly carrying out evaluation work of both local and exotic germplam for selection of better performing material.

IV.4.7. Question 7

Overall, the crop improvement programmes were mainly carrying out evaluation work of both local and exotic germplam for selection of better performing material except maize, roots and tubers, groundnuts and sunflower where there were active breeding programmes.

No significant investment has been done in plant biotechnology research except tissue culture work done in 1990's at INIA.

IV.4.8. Question 8.

Biotechnology research has never been seriously undertaken at INIA due the lack of functional laboratory facilities and trained personnel. There was a tissue culture laboratory in 1990's at Umbeluzi Research Station (about 30 Km from INIA headquarters). This laboratory was designed for production of diseases-free plant material and micro-propagation. However, this laboratory has faced problems related to

the supply of clean water and fluctuation of electricity supply which limited its regular functioning. Moreover, floods in 1994 caused severe damage to both the laboratory infra-structure and equipment. For this reason, it is still closed up to now.

Provisions have been made to establish a new laboratory at INIA headquarters to be completed by end of the 2003 with the technical assistance of IITA and financial of USAID.

From 2002, the FAEF is involved in plant biotechnology research namely in molecular characterization of local cowpea germplasm.

IV.4.9. Question 9.

The data shown are only for maize and root and tuber crops where there have been very active crop breeding programmes. The figures for groundnuts and sunflower are still being organized.

The other crop improvement programme were mainly carrying out evaluation work of both local and exotic germplam for selection of better performing material.

IV.4.10. Question 10.

The main source of germplasm for food crops (rice, maize, sorghum and millets, groundnuts, roots and tubers and grain legumes) are, in descending order, CGIAR genebanks, evaluating networks as well as local and national genebanks.

For the cash crops (cotton and cashew nuts) the main germplam sources are the private sector and acquisition through bi-lateral agreement. Local and local genebanks play an important role as sources for cashew nuts.

For fruits and vegetables the main source is the private sector and acquisition through bi-lateral agreements. CGIAR genebanks play some role as sources of germplasm for vegetables

Sunflower germplasm is acquired whether through bilateral agreement or public research institution in developed countries.

IV.4.11. Question 11.

Overall, for the majority of food crops (maize, sorghum and millets roots and tubers and grain legumes), high or medium importance was given to biotic and abiotic stress in 1980. In 2001, high importance was given to both biotic and abiotic stress in all these crops.

Favourable conditions were given high importance in both in 1980 and 2001 for the rice crop.

In cotton, high importance was given to favourable conditions and medium importance to biotic stress both in 1980 and 2001.

In fruits and vegetables high importance was given to favourable conditions with medium or medium importance given to biotic stress.

Some food crops included medium and high importance in 2001, due shift in agriculture policy which now equally promotes the private sector.

IV.4.12. Question 12.

Capacity building (training in conventional breeding and biotechnology, infra-development (biotech laboratory), equipment) and the access to germplasm and new biotechnological tools are the main priority areas of investment that can make significant contribution for development of the national crop improvement programmes in Mozambique.

IV.4.13. Question 13.

In 1995, there were more varieties released as this is the year where there was an update of national variety list after some a long period of stagnation. Most of these varieties have been produced in previous years but not registered.

IV.4.14. Question 14.

The most important limiting factors are, in descending order:
Lack of financial resources to carry out field and lab experiments, shortage of staff, updated literature, and lack of expertise in marker assisted breeding and molecular characterisation of germplasm.

V. Conclusions

Only 3 institutions have been actively involved in crop improvement namely, the National Institute of Agriculture Research (a public research institute under the Ministry of Agriculture and Rural Development), the Faculty of Agronomy and Forest Engineering (public higher education institution under the University Eduardo Mondlane) and Mozambique Seeds Company (a private seed production company).

The shortage and quality of the staff have been a major constraint for all crop improvement programmes. This has been exacerbated by continuous change of staff in all programmes

Overall, there was very limited investment in crop improvement. The government budget allocation for crop improvement covered only salaries for national staff and some

running costs (water and electricity bills). The actual cost for running crop improvements came from external sources.

There was more investment in maize, root and tubers and grain legumes all over the period.

Active breeding programmes were exclusively carried out in maize, roots and tubers, groundnuts and sunflower. The other crop improvement programmes were mainly carrying out evaluation work of both local and exotic germplam for selection of better performing material.

No significant investment (infra-structure, equipment, staff and financial resources) has been done in plant biotechnology research except tissue culture work done in 1990's at INIA. FAEF is now involved in molecular characterisation of cowpea germplasm.

The most important limiting factors for plant breeding and biotechnology research include: Low number of qualified staff, lack of financial resources to run field and laboratory experiments and lack of adequate research infra-structures (particularly laboratories) and equipment

VI. Recommendations

1. Plant improvement and biotechnology programmes must be demand driven and they must address the constraints and needs of family farming sector as well as the private sector.

2. Participatory approach in crop improvement and better linkages and coordination with extension services must be strengthened to allow that the products of crop improvement can have significant impact on the farmers.

3. There is a great need to start addressing the needs and constraints of the private sector to be consistent with the current government agriculture policy which also includes the promotion of the emerging private agriculture sector.

4. Although more investment is still need for conventional plant breeding, there is a need to explore some modern biotechnological tools that can enhance the efficiency of conventional breeding particularly, molecular characterisation of germplasm and marker assisted plant breeding.

5. There is a great need for capacity building (training in conventional breeding and biotechnology, infra-development (biotechnology laboratories), equipment) and facilitating the access to germplasm and new biotechnological tools in order to make significant contribution to the development of the national crop improvement programmes in Mozambique.

6. In term of the policy, the development of regulatory framework related to plant breeder's rights and biosafety can create adequate environment for smooth development of plant improvement and biotechnology in the country.

7. Appropriate measures should be taken to recruit, train and retain plant breeders and biotechnologist in the national agriculture research system

8. With regards to collaboration with FAO:

Annex 1: List of people contacted during the survey

INIA

Miloje Denic, PhD, Maize Breeder and former Maize Breeder at SEMOC
Pedro Fato, MSc, Maize breeder
Marcela Libombos, MSc, Grain Legummes breeder
Anabela Zacarias, MSc, Root and Tuber Crops breeder
Alberto Nandja, BSc, Head, Administration and Finance Department

FAEF

Romana Rombe, PhD, Research Director
Carla Honwana, MSc, Plant breeder
Mariano Davólio, Admnitrative officer, CICUCPE
Hermínia Cossa, Technician, Plant Breeding Section
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Maria Estrela Alberto, MSc, Seed Registration and Section (DINA) and former rice breeder at SEMOC
José Carlos, BSc, Agronomist

DINA

Paciência Banze, MSc, Head of Department of Seeds

Annex 2: List of documents consulted during the survey

Capacity building is the priority area that need more assistance especially from the FAO, therefore, any further collaborative programme between the FAO and Mozambique should be concentrated on capacity building including the promotion of training (training courses and post-graduate training), the development of plant breeding and biotechnology research facilities (laboratories), facilitating the access to improved germplasm and new biotechnological tools and the enhancement of information sharing and exchange (re-activation of SADC crop research networks

FAO can have important role in facilitating the process of development of the national regulatory frameworks related to plant breeder's rights and biosafety.