Eastern African Agricultural Productivity Project (EAAPP)

Enhancing Adoption of Napier Grass Varieties Tolerant to Stunt Disease for Increased Feed Availability in Smallholder Dairy Systems in East and Central Africa

Achievements (September 2011- February 2013) and Planned activities (2013-2014)

March 2013
The Eastern Africa Agricultural Productivity Project (EAAPP) is a World Bank funded regional project contributing to enhanced agricultural production and productivity in Uganda, Kenya, Tanzania and Ethiopia for the project commodities of Cassava, Dairy, Rice and Wheat. The objectives of EAAPP are to (i) enhance regional specialization in agricultural research; (ii) increase regional collaboration in agricultural training and dissemination and, (iii) facilitate increased sharing of agricultural information, knowledge and technology across national boundaries.

EAAPP – Uganda Project IDA was launched in Uganda in March 2011.

The EAAPP implementing agencies and units in Uganda are: National Agricultural Research Organization (NARO), Uganda under which are the Cassava Regional Center of Excellence (CRCoE) located at the National Crops Resources Research Institute (NaCRRI), Namulonge. Dairy research component (coordinated by the National Livestock Resources Research Institute), Rice, Wheat, Value addition; the Departments of Animal Production and Marketing and Fish Industry under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) for assurance of dairy cattle breeds and quality seeds respectively; National Rural Enterprise 5, National Animal Genetic Resource Centre and Data Base (NAGRC&DB) to support increased access to and use of Artificial Insemination (AI) and high yielding dairy breeding stock. National Agricultural Advisory Services (NAADS) is charged with training and dissemination of technologies and knowledge.

Importance of dairy production in ECA region

Dairy production is of strategic importance in addressing the Millennium Development Goals (MDG). Intensification of dairy sector contributes to sustainable land use in food production. The environmental benefits include enhanced nutrient recycling through crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding and manure utilization in crop residues feeding. Leguminous fodder augment nutrient benefits through biological nitrogen fixation. The increasing demand for dairy products provides a market driven incentive for investment in dairy sector for food and income security. The direct beneficiaries are often women who own the animals and proceeds from sale of their products.

These families derive nutritional benefits from consumption of milk especially in HIV/AIDS affected families. Indirect beneficiaries are poor households who get employment opportunities in the food and dairy processing and marketing sectors of the dairy value chain. Women are developed in Napier grass varieties that are tolerant to Napier stunt disease.

Previous (2007-2010) attempts to mitigate Napier stunt disease in ECA region

The project on “Napier stunt and smut resistance” funded by the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) focused on quantifying the extent of and raising awareness on Napier stunt disease in Kenya, Uganda and Tanzania. The research resulted in identification of potentially stunt tolerant Napier grass varieties and options for management practices that can be used to control and mitigate the disease. Kenya Agricultural Research Institute and more particularly its Regional Dairy Research Centre at Naivasha (RDCoE), developed and disseminated Napier grass varieties that are tolerant to Napier stunt disease.
The project on “Enhancing adoption of Napier grass varieties tolerant to stunt disease for increased feed availability in smallholder systems in East and Central Africa” funded under EAAPP is being implemented in Uganda, Kenya, Tanzania and Ethiopia. The expected project outputs/results are:

1. Enhanced generation of technologies and innovations for managing Napier stunt disease in ECA region.
2. Enhanced adoption of appropriate policies to facilitate transfer of forage genetic materials within the region.
3. Strengthened capacity for stakeholders to utilize technologies for managing stunt disease.
4. Enhanced availability of information on management of Napier stunt disease.

**Results/Activities/Achievements (2011-2013)**

**Activity 1.1: Review literature on Napier stunt disease research in Uganda**

Previous research on Napier stunt disease conducted in Uganda was reviewed and documented. A report “A review of research on Napier stunt disease in Uganda” was produced and shared with collaborators in Kenya, Uganda, Tanzania, Burundi, Rwanda and Ethiopia.

**Activity 1.2: Country inception meeting**

A project inception meeting was held in April 2011 at Mukono Zonal Agricultural Research and Development Centre (MUZARDI) to select study sites and discuss methodologies and share roles. The meeting was attended by 42 (13 women) participants.

**Activity 1.3: Regional consultation meeting for RDCoE, 1st to 3rd December 2013**

The meeting was held in Kenya and attended by 19 research team members from Uganda (4), Kenya (13), Tanzania (1) and Ethiopia (1). The objective of the meeting was to harmonize planned regional activities. During the meeting, direct commissioning of 5 regional projects was recommended:

1. Enhancing adoption of Napier grass varieties tolerant to stunt disease for increased feed availability in smallholder systems in East and Central Africa.
2. Exploiting market opportunities for value added dairy products.
3. Preventing and controlling East Coast fever and zoonotic diseases.
4. Define and harmonize food safety and standards and organize users along value chain.
5. Improving indigenous cattle for dairy production through targeted selection and cross breeding.

**Activity 1.4 Baseline survey**

A baseline survey was conducted in Katakwi, Jinja and Kiruhura districts representing major Agro-ecological Zones (AEZ) of Uganda; the Eastern Semi-Arid Zone (ESAZ), Lake Victoria Basin (LVB) and Western Rangelands (WR), respectively. The objective of the survey was to assess extent of spread and incidence of Napier stunt disease in major agro-ecological zones in Uganda.

**Highlights of survey results**

(a) Majority of the respondents (76%, n=150) in the LVB reported the occurrence of Napier stunt disease on their farms. Thirty two (32%) of the respondents reported the disease in the WR while no respondent reported the occurrence of the disease in the ESAZ.

(b) The high prevalence of the disease in the LVB was attributed to the increased cultivation of improved Napier varieties that are highly susceptible to the disease. The reported absence of the disease in the ESAZ may not necessarily mean that the disease has not affected the region but because farmers devote no efforts on fodder cultivation making it difficult to notice such diseases.

(c) Farmers in the ESAZ mostly depend on local Napier grass varieties in the wilderness which are either tolerant to NSD or farmers have not taken time to diagnose the disease. Also, because only few farmers have taken the initiative to cultivate Napier in ESAZ, the farmers may be ignorant of the occurrence of the disease but yet in the actual sense, they have the disease. This was evidenced during the survey when the farmers mistook the disease for inadequate soil nitrogen implying that many could be ignorant about this disease.

(d) Fifty percent (50%) of the farmers faced with disease ranked it as high (>10 diseased plants in 20 plants) while 35% ranked it as moderate (between 5-10 diseased plants in 20 plants). Only 15% of the affected respondents ranked it as low (<5 diseased plants in 20 plants).

**Activity 1.5: Inventory of feeds and feeding systems technologies for scaling up/out**

An inventory of feeds and feeding systems technologies and innovations for scaling up/out was developed and shared with the collaborators. These included:

(a) Use of trellis for small-scale pasture seed production
(b) Cereal-forage legume intercrop for food and fodder production
(c) Napier grass-forage legume intercrop
(d) Calliandra leaf hay for increased milk yield
(e) Lablab hay as a dry season protein supplement
(f) Nutrient feed blocks.
(g) Homemade concentrates.
(h) Sweet potato vine-based partial milk substitute
(i) *Brachiaria* hybrid cv. Mulato 11 for intensive and semi-intensive dairy production systems

**Activity 1.6: Screen and promote Napier grass varieties tolerant to Napier stunt disease**

Twenty two (22) tolerant Napier grass varieties were obtained from Alupe Research Station in Kenya in September 2011 following phytosanitary procedures. The varietes were screened for disease tolerance, herbage biomass yield and nutritive quality.
Achievements (September 2011- February 2013) and Planned activities (2013-2014)

Mass propagation of Napier grass clones in a screen house at the National Crops Resources Research Institute (NaCRRI)

Napier Stunt Disease screening trial at NaCRRI

Measuring plant height and herbage biomass yield

The varieties were established at the National Crops Resources Research Institute (NaCRRI), Namulonge located in Central Uganda. The plots were first harvested two months after planting to determine the herbage biomass yields, and the subsequent harvestings were done in two month’s interval for seven times.

Highlights of Research results (September 2011 to March 2013)

(a) Disease severity continued to build up in the field with increasing number of harvests and differed significantly between varieties.

(b) Varieties: 103, 117, 79, RBN, 79SN and 117 can be described as susceptible.

(c) Varieties: 105, 112, 16702, 16789, 16805, Kakamega 1, Kakamega 2, Kakamega 3 and 97 had not showed much disease symptoms by the 7th harvest and such can be described as moderately resistant.

(d) Varieties: 104 and 76 had the highest area under Disease Progress Curve (AUDPC) as such are described as highly susceptible to NSD (Figure 1).

Comparison of the disease onset and progress over time between the moderately resistant and susceptible indicated that in the susceptible varieties, the disease onset was as early as 4 months after planting while in moderately resistant, disease onset was after 6 months after planting. Generally the disease progressed faster in the susceptible varieties than in the moderately resistant (Figure 2).
Achievements (September 2011- February 2013) and Planned activities (2013-2014)

Figure 2: Napier stunt disease progress on different Napier varieties over time (1 = no symptoms, 2 = very mild symptoms, 3 = medium mild symptoms, 4 = severe symptoms and 5 = very severe symptoms)

(f) On the contrary, the varieties which had more disease build-up, on average had higher biomass (t/ha) yield (Figure 3).

Figure 3: Average dry matter yield (t/ha) of the different Napier grass varieties

(g) Nutrient composition of different Napier grass varieties varied (Table 1). Variety SN79 which became susceptible to the disease 4 months after planting had higher protein content (9.2%) and lower fibre content (55%) than all other varieties (Table 1).

Table 1: Nutrient content of different Napier grass varieties being evaluated in Uganda

<table>
<thead>
<tr>
<th>Variety</th>
<th>ADF (%)</th>
<th>ASH (%)</th>
<th>CP (%)</th>
<th>DM (%)</th>
<th>NDF (%)</th>
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Activity 1.7: Multiplication of promising tolerant Napier grass varieties

(i) Kakamega 1 and Kakamega 2 were multiplied on 8 household farms in Mafubira sub-county, Junja district.

(ii) Kakamega 1, Kakamega 3 and 16789 will be multiplied in Rwanda and Burundi under a new “Napier stunt disease project” funded by ASARECA and launched in Kigali on 19th February 2013.
Achievements (September 2011- February 2013) and Planned activities (2013-2014)

Introducing 0.5 ha of a mixture of Brachiaria and forage legumes on farms previously dependent on 0.5 ha of a mixture of Napier grass and forage legumes, provided year round feed supply.

The research team formulated a complete feed ration based on maize stover (60%), fodder tree leaf hay (25%) and agro-industrial by-products (bentonite clay, maize bran and cotton seedcake) (15%). The protein content of the ration is 14.7%. The ration can substitute Napier grass fodder by 50%.

Activity 1.9: Impact assessment study

An impact assessment study was conducted in December 2012 in four districts of Uganda; Jinja, Mbarara, Mukono and Wakiso where EAAPP Napier stunt disease project activities had been implemented in the last 12 months. Respondents were assessed on level of farmers' satisfaction with the technology dissemination pathways used.

Highlights of study findings:

(a) Generally, Napier was the most adopted forage species with 75% (n=150) of respondents having adopted it between January to December 2012.

(b) Highest rates of Napier adoption were reported in Wakiso (93.3%), Mukono (76.7%), Jinja (73.3%) and least in Mbarara (56.7%).

(c) In Jinja, Mukono and Wakiso districts, Napier was the most adopted forage with establishments of 0.57, 1.45 and 0.73 acres respectively. Because of the limited land holdings in Jinja, Mukono and Wakiso districts, the predominant dairy farming system practiced is smallholder zero grazing system. As such, the greatest need is availability of high biomass yielding forages that suit the cut and carry system rather than large areas of low yielding pastures. This explains the increased adoption and availability of Napier in most households in Jinja, Mukono and Wakiso compared to Mbarara where extensive dairy production is practiced.

(d) Farmer’s perceptions on gender responsiveness of technologies/innovations disseminated ranged from 9.4% to 39.8%. The highest level of gender responsiveness was reported on technologies on establishment and utilization of improved Napier varieties (39.8%) while the lowest (9.4%) was recorded for technologies concerning silage making.

(e) All technologies and innovations had very low responsiveness to the needs of youths and special groups.

(f) Establishment and utilization of improved Napier varieties (60.8%), establishment and utilization of alternative fodders (36.7%) and hay making (19.2) were highly ranked for gender responsiveness for women, while preparation and use of homemade rations (20.8%), and utilization of crop residues (28.3%) were towards the side of men.

(g) There were only eight dissemination pathways accessed by over 40% of the respondents; farmer to farmer (83.3%), extension officer (81.7%), radio (75%), research officer (60%), exchange visits (53.3%), agricultural shows (52.5%), family and friends (50.9), and print material (46.7).

Activity 1.8: Evaluate and promote alternative forages and feed resources

With additional funding from ASARECA, the project evaluated and promoted Brachiaria hybrid cv. Mulato ii and the use of maize stover as alternative feed resources to Napier grass fodder in Wakiso, Jinja, Kiruhura, Kampala and Masaka districts.

(i) Introducing 0.5 ha of a mixture of Brachiaria and forage legumes on farms previously dependent on 0.5 ha of a mixture of Napier grass and forage legumes, provided year round feed supply.

(ii) The research team formulated a complete feed ration based on maize stover (60%), fodder tree leaf hay (25%) and agro-industrial by-products (bentonite clay, maize bran and cotton seedcake) (15%). The protein content of the ration is 14.7%. The ration can substitute Napier grass fodder by 50%.

Result 2: Strengthened capacity for stakeholders to utilize technologies for managing Napier stunt disease

(a) Three thousand three hundred and thirty nine thousand (3,339) stakeholders (2,049 female) were trained on NSD control/management strategies in Masaka, Mbarara, Kiruhura, Soroti, Kampala, Wakiso, Mukono, Gulu and Jinja districts.

(b) Three (2 female) project staff visited the Regional Dairy Research Centre of Excellence in Kenya.

(c) Eighty nine (55 women) dairy farmers visited study sites at NaCRRI.

(d) World Bank review mission wrap-up meetings in Kenya and Uganda.

(e) The World Bank review mission visited project site at NaCRRI in November 2012.

(f) The research team participated in agricultural shows in Jinja and Soroti districts.
Achievements (September 2011-February 2013) and Planned activities (2013-2014)

Research results were presented during a Napier stunt disease project inception meeting in Kigali, Rwanda, 13th to 16th February 2013.

Agricultural shows and field visits were used to disseminate project activities.

Output 3: Enhanced availability of information on NSD control and management technologies

The research team packaged and disseminated information through:
(a) Baseline survey report (2011)
(b) Impact assessment survey report (December 2012)
(c) Radio and television news
(d) Newspaper articles in The East African and New Vision papers
(e) Project progress reports
(f) Field reports
(g) Publications (Table 1):
(h) Video documentaries

Table 1: Publications

<table>
<thead>
<tr>
<th>Authors</th>
<th>Title of paper</th>
<th>Conference where the paper was presented</th>
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<tbody>
<tr>
<td>Kabirizi, J., Kawube, G., Namazzi, C., Mugerwa, S., and Mukalazi, S.</td>
<td>Enhancing adoption of Napier grass varieties tolerant to stunt disease for increased feed availability in smallholder dairy systems</td>
<td>Submitted to Uganda Journal of Agricultural Sciences</td>
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</table>

3. Farmer leaflets and brochures

Kabirizi, J., Kirunda, H.; Oluka, J. and Mulindwa, H. | The Dairy research component | Brochure |

Kabirizi, J., Kawube, G., Mugerwa, S.; Namazzi, C., | Napier Stunt Disease management strategies for increased feed availability in smallholder farming systems in East and Central Africa |

Kabirizi, J., Kawube, G., Mugerwa, S.; Namazzi, C., | Enhancing adoption of Napier grass varieties tolerant to stunt disease for increased feed availability in smallholder dairy systems in East and Central Africa: Achievements (September 2011-February 2013) and Planned activities (2013-2014) |
Achievements (September 2011 - February 2013) and Planned activities (2013-2014)

Activity 1: Assess the effect of graded levels of cattle manure on the severity and incidence of Napier stunt disease

**Justification**

Information from Masaka district where Napier stunt disease (NSD) was first observed on farmers’ fields in 2001 shows that amendment of Napier fields with cattle dung suppresses the effect of NSD on Napier grass production. Addition of cattle manure improves plant establishment, growth vigor and eventually biomass production from diseased Napier plants. The manure has also been noted to improve the leaf area index leading to high biomass production from diseased Napier grass plants. It seems that manure improves the growth vigor of the grass making it less susceptible to NSD. It is also possible that the manure modifies the micro and macro environments making the survival and proliferation of vectors hard. Despite the observed potential of manure in mitigating NSD on diseased grass plants, limited efforts have been devoted to evaluate the efficacy of the method on controlling NSD. This study will thus assess the effect of graded levels of cattle manure on the severity and incidence of NSD.

**Study sites**

The trials will be established at Kamyenyaniggo District Training and Information Centre in Masaka district, Buginya ZARDI, NaCRRRI, Soroti and Mbarara ZARDI. The multilocation design of this trial will also cater for increased demonstration and popularization of the tolerant varieties and agronomic practices to farmers in all zones.

Activity 2: Multiplication of tolerant Napier grass varieties

Promising varieties will be multiplied in selected sites representing major agro-ecological zones where smallholder dairy production is a major source of income. Promising varieties will be tested and multiplied in Rwanda and Burundi.

Activity 3: Capacity building of stakeholders

Stakeholders will be sensitized on: project activities, Napier stunt disease control strategies and use of alternative forages and feed management technologies and innovations through farmer workshops, scientific conferences, review and planning meetings and media (newspaper articles, radio and television programmes).

Activity 4: Package and disseminate research results

Research results will be published (scientific papers, farmer leaflets, manual and video documentaries).

Acknowledgements

This publication is a product of a project “Enhancing adoption of Napier grass tolerant to stunt disease for increased feed availability in small holder systems in East and Central Africa” of the Dairy research component implemented by the National Livestock Resources Research Institute and funded under EAAPP. We acknowledge financial and technical support from the World Bank; EAAPP and ASARECA.

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