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Message from Director General



Director General

We are pleased to share with you the 2018 research activity report of the National Agricultural Research Institute (NARI). This report highlights the research activities conducted in 2018, the technologies identified and the farming communities reached to test the identified technologies.

NARI as a research institute maintains strong linkages with International and National Research Institutes of excellence to source highly promising technologies which can help our farmers to significantly increase their production and productivity. The technologies introduced into the country are tested on-station and on-farm to ensure our farmers are able to acquire positive economic returns from the use of such technologies before any recommendation is made for their mass dissemination across the country.

NARI is putting a lot of emphasis on research activities that are environmentally friendly. It is encouraging to note that the NARI's Pest Management Directorate is providing much needed technical service in terms of insect identification and diagnostic services. The NARI is very much aware of the negative effects chemicals have on our environment. For this reason, efforts are made to promote the use of botanicals, natural enemy biodiversity, resistance varieties and cultural control measures which are environmentally friendly and help to improve the quality of farmers' produce for local consumption and export.

The Horticulture Unit under the Crop Research directorate has sourced and provided much needed clean planting materials of biofortified (cuttings) crops to Development Agencies such as United Purpose and Farming communities.

Climate change is high on the political agenda of the country. NARI has paid considerable attention to climate change and the negative effects it has on the agricultural sector. In an effort to combat climate change, we are bringing trees to crop land through our Agro-forestry and cropping systems research directorate. We have introduced multi-purpose tree species such as Leuceana, Alcacina Albeda, Alcecina Ciamia, Gliricidia sepium in our farming communities and we are using soil conservation techniques to restore the fertility of our poor soils.

These achievements were possible through good funding support from partners such as the Food and Agriculture Organization of the United Nations, European Union, CORAF and ASTI. We managed our finances with high prudence despite suffering a D 9,230,000 million (77%) shortfall in the government's development budget allocation during the year.

On behalf of the Board, we would like to thank the Office of Deputy Director General, Director of Research, Senior Management and staff for their commitment and contributions which is foundation for the institution's growing accomplishments.

DIRECTORATE OF FINANCE

Financial status and management

The subvention and development funding continue to be the main source of financing for the institute. The allocation of fund from the Government Development Fund was D2.7 Million compared to a budget of 12 Million Dalasis. The Government subvention fund and other operational cost was 25 Million compared to a budget request of 21 million which shows improvement in resources allocation due to the new transport allowance rate paid to Civil Servants. With the current budget allocation NARI was able to sustain the institution's personnel and recurrent cost and also conduct research based on the work plan and budget from the Development allocations.

The institute was able to come up with prudent resources mobilization measures to complement some of the on-going research funding gaps through Research Grants in line with the National Development Plan. The institution's payroll liability on staff social security, still remain a challenge but NARI Management was able to enter into a payment plan to ease the settlement of our current liability with SSHFC on a monthly basis and this has facilitated the payment of staff pension as and when Staff retired.

Staffing

The staff of the National Agricultural Research Institute is categorized into scientists, administrators and accountants. In 2018, 4 staff of the Institute were pursuing PhD training overseas and were expected back in 2019 to strengthen the research manpower. In the same period significant numbers of staff were on BSc and Diploma programs at the University of The Gambia and The Gambia College respectively and expected to complete their studies in 2019 and beyond.

Despite the notable gains in staff strength, the ratio of PhD and MSc qualified researchers to those with BSc calls for further consolidation. In addition, aging of well qualified and experienced researchers many of whom have retired is still a major concern for the Institute.

PEST MANAGEMENT DIRECTORATE

Tested natural substances as alternatives to synthetic pesticides acceptable in agriculture for control of major fruit fly (*Diptera: tephritidae*) species in The Gambia

INTRODUCTION

Fruit tree production is a major agricultural activity in The Gambia. Different varieties of fruit are produced for export. Investment into fruit tree production is a lucrative business in the country. Fruit tree production, especially mango, is threatened by insect pest and diseases. Mango fruit flies (*Diptera: Tephritidae*) are one of the most economically important groups of insects affecting mango production in The Gambia. Most farmers in the country use synthetic chemical pesticides to control fruit flies which make their produce unstable for export. To address this problem, NARI introduced alternative methods such as the use of botanicals, natural enemy biodiversity, resistance varieties and cultural control measures which are environmentally friendly and helps to improve the quality of farmers' produce for export.

Research activities conducted in the 2018-19 mango seasons

1. Evaluation of the efficacy of botanicals such as Hyptis, Eucalyptus, and Neem in the control of mango fruit flies in Berengding, Njogone, Mbulum, and Kinteh kunda in North Bank Region.



Preparation of Botanicals



Trap on Neem treatment



Fruit fly species identification

Overall Objective :

- To protect mangoes from serious damage by fruit flies, reduce use of chemical pesticides and enhance mango production for export

Main research findings

All the botanical extracts tested have significantly reduced the infestation of mango fruit flies in all the communities used for the trial. However,



Hyptis Suaveolens ("Susula Nyamo")

The laboratory test conducted showed that mango fruit fly *Bactrocela dorsalis* was the most dominant fruit fly specie on mangoes in all the study areas.

Hyptis was found to be the most effective botanical control against mango fruit fly.



Bactrocela Dorsalis

Recommendations

It is recommended that *hyptis* be promoted for large scale production and adoption for fruit fly management through extension.

The application of *hyptis* could be integrated with cultural practices such as sanitation and burying of fallen fruits to achieve effective control of mango fruit flies.

Evaluation of the effectiveness of Ocimum Canum in the attraction of mango fruit flies

INTRODUCTION

Ocimum Canum is a fruit fly attractant plant which is used for detecting and mass trapping of fruit fly species of economic importance. It is used as alternative to synthetic pesticides in the control of mango fruit flies. Mass trapping of fruit flies using pheromone traps can be an expensive control method which could increase production cost. Substituting expensive trapping methods (such as annihilation) by a readily available and inexpensive method such as use of plants or plant parts can reduce cost and increase income particularly for low income mango growers in The Gambia. However, the dispersion behavior and host sequence of the fruit flies that can be attracted by plant or plant parts needs to be assessed. For this reason, NARI conducted an evaluation in 2018 to determine the suitability of *Ocimum Canum* in attracting fruit flies.

Objective :

- To determine the effectiveness of *Ocimum Canum* in attracting fruit flies

Communities selected for the evaluation trial

Evaluation of the effectiveness of *Ocimum canum* in the attraction of Mango Fruit Flies was conducted in Jambanjelly, Basori, Tumanitenda and Souma kunda. These communities are all located in West Coast Region.



Ocimum Canum

Main research findings

Both the flowers and leaves of *Ocimum Canum* were found to attract a large number of mango fruit flies. The plant significantly attracted and reduced infestation of fruit flies on mangoes.



Fruit flies on Ocimum Canum

Bactrocera dorsalis was the most dominant mango fruit fly species attracted by *Ocimum Canum*

Recommendations

It is recommended that mango producers should plant *Ocimum Canum* along the perimeters of their Orchards to divert fruit flies from attacking the mango trees. The leaves and flowers of *Ocimum Canum* can be put in bottle traps for the effective control of mango fruit flies.

AGRICULTURAL PRODUCE FOOD CHEMISTRY AND AFLATOXIN PRODUCE QUALITY DIRECTORATE

Aflatoxin and other chemical analysis in products/ produce for clientele

Introduction

Aflatoxins are a major developmental challenge in Africa, adversely affecting household food and nutrition security, trade and income, and public health. Aflatoxins are poisonous chemicals naturally produced by fungi that contaminate many staple crops widely grown across Africa. Contamination of food crops by this deadly toxin begins from the field and is primarily aggravated by adverse climatic conditions and inadequate agricultural practices, and continues during postharvest with improper storage and handling.

Objectives

- Determine aflatoxin levels in products/ produce for clientele destined for export and national use
- Conduct other chemical analysis for clientele for products/ produce destined for export



Analysis of Aflatoxin

Samples were received from:

- NFSPMC (ex-GGC)
- Reliance oil mill
- Food Safety and Quality Assurance (FSQA)
- Lucky lee enterprise
- Naso enterprise
- Agric produce services
- Naffie Company
- Sanitalia Company

Main research findings

- Out of the 81 groundnut samples received from NFSPMC, 25 have high aflatoxin

level which is above the acceptable range for European Union countries (4pph) but 20 of the affected samples were within acceptable range for export to the United states (10 pph)

- All the groundnut samples received from Naffie company, Reliance oil mill and FSQA for aflatoxin analysis were within acceptable range for export to European Union and United States
- Nine groundnut samples were received from NFSPMC and analyzed for Free Fatty Acid and oil content. The results obtained were all within acceptable range for export to EU and USA.
- Three groundnut samples received from a Master's Degree student for his thesis for oil content analysis also showed high oil content within international thresholds.
- One rice sample received from Food safety and Quality Authority analyzed for aflatoxin and moisture content show low moisture level and aflatoxin content within international threshold (<7%) and (<4ppb, EU and 10ppb, USA), respectively

Analysis of pro-vitamin A content in Orange Flesh Sweet Potato

Introduction

A provitamin is a substance that may be converted within the body to a vitamin. "Provitamin A" is a name for β -carotene, which has only about 1/6 the biological activity of retinol (vitamin A); the body uses an enzyme to convert β -carotene to retinol. In other contexts, both β -carotene and retinol are simply considered to be different forms of vitamin A. Vitamin A helps form and maintain healthy teeth, skeletal and soft tissue, mucus membranes, and skin. It is also known as retinol because it produces the pigments in the retina of the eye. Vitamin A promotes good eyesight, especially in low light. It also has a role in healthy pregnancy and breastfeeding. To ensure the 8 Orange Flesh Sweet Potatoes (CRI-Boyhe, Bourgaud, Kandee, Tiebelle, Sumaia, Caromex, CRI-Apomuden and TB 144) being tested by NARI are bio-fortified with provitan A, the Aflatoxin and food chemistry Directorate was tasked to conduct an analysis of pro-vitamin A.

Objective

- To determine the level of pro-vitamin A content in OFSP varieties being tested by NARI under the FAO bio-fortified project activities



Analysis of pro-vitamin A

Main research findings

- Kandeh shows highest pro-vitamin A content among the eight varieties
- TB144 shows the lowest pro-vitamin A
- All varieties are within acceptable range (0.15-25.0 mg/L) and therefore recommended for further multiplication within the vulnerable communities identified by the project

CROP RESEARCH DIRECTORATE



Varietal Purification and Maintenance

Introduction

The varietal purity of seeds that are multiplied into foundation, registered, and certified seeds largely depend on the quality of nucleus/breeder's seeds. It is therefore, of utmost importance that the nucleus/breeder's seed is produced in such a manner that satisfactory genetic purity, identity and other good qualities of seed are maintained. For this reason, crop research directorate was engaged in nucleus/breeder seed production for varietal purification and seed maintenance.



Rice nurseries at SAPU swamps

Objectives

1. To maintain the genetic and phenotypic purity of the released and promising rice varieties
2. To increase the seeds of high yielding varieties in the germplasm
3. To provide pure and true to type varieties to the farming communities

4. To establish linkages with international research institutions in the sub region and beyond for the introduction of germplasm and technology

Planting materials Used

Upland NERICAs, ARICAs and SAHEL series rice varieties



Seed maintenance plot in Sapu

- NARI headquarters to maintain their purity
- Varietal purification and seed maintenance will enable NARI to provide seed of promising and high yielding rice varieties to National Seed Secretariat (NSS), Department of Agriculture (DoA), Nongovernmental Organizations (NGOs) and farmers whenever the need arises.

- Nucleus/breeder's seeds were produced from 16 NERICA, 15 ARICA and 16 SAHEL rice varieties
- 50 grams of pure seeds were taken from each variety and stored in refrigerators at

VARIETAL EVALUATION (RICE, GROUNDNUT, COWPEA, MAIZE, PEARL MILLET, SORGHUM, HUNGRY RICE, SWEET POTATO AND CASSAVA)

Introduction

Continuous cultivation coupled with the use of low yielding local crop varieties have significantly affected crop production and productivity in The Gambia. The soils in most part of the country are depleted of nutrients and can hardly support meaningful crop production. Due to lack of improved crop varieties, for most of the crops cultivated in the country, our farmers rely on low yielding crop varieties most of which are highly susceptible to pest and diseases. To address this problem, NARI collaborated with International Institute of Tropical Agriculture (IITA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Africa Rice Center (AfricaRice) and Institut Senegalais de Recherches Agricoles (ISRA) to introduce improved varieties of rice, groundnut, cowpea, maize, pearl millet, sorghum, hungry rice, sweet potato and cassava that are high yielding and tolerant to pest and diseases. The varieties obtained were tested on-station and on-farm to determine their adaptability to local conditions, resistance to pest and diseases and compare their yield against the best performing local varieties.

objectives

1. To test the varieties for their yield performance, stability and resistance to pest and diseases
2. To determine the adaptability of the improved varieties to local conditions
3. To offer the farmers a chance of selecting the best varieties that suits their needs

Highlights of main research findings

RICE

IRRIGATED LOWLAND MULTI-ENVIRONMENT TRIAL (MET)

- Thirty-two lowland irrigated rice varieties which were sourced from AfricaRice were tested at the lowland rice fields at Sapu
- During a Participatory Varietal Selection, 4 best varieties (ARS 161-3-6-3-B, ARS 169-1-1-B, ARS-755-3-B-3 B and ARS 169-2-B-2-B) were selected based on their tillering capacity, maturity and yield



Irrigated rice trial plot in SAPU

- Each of the irrigated improved varieties selected recorded at least 4t/ha
- Participatory advanced trial will be conducted on the selected varieties to determine their yield stability

MULTI-ENVIRONMENT TRIAL (MET) FOR SALINITY

- Forty-one salt tolerant rice varieties were sourced from AfricaRice to be tested for high yield and adaptability
- All the varieties were tested in Kaiaf, Lower River Region
- Four best salt tolerant varieties (ARS755-B-B-4-B, ARS-NMK-218-F6-PYT-2015DS, ARS134-B-1-B and ARS755-3-

3-1-B) were select for participatory advanced trial to determine their yield stability before they can be released to the farming communities



Seed increase of salt tolerant rice varieties

GROUNDNUT

- Sixty-three improved groundnut varieties were sourced from ICRISAT in Mali which were screened for high yield and adoptability
- Fifteen varieties were selected from the on-stations research trials, each of which recorded a yield of more than 2.5 t/ha on average



Improved groundnut varieties

- The yield of the selected varieties were significantly higher than the widely cultivated groundnut variety (Philippine

Pink) in the country which recorded a yield of 1 t/ha on average

- The selected varieties were further screened and the best 3 (ICGV 97188, ICGV 00005 and ICGV 08056) varieties each of which recorded more than 3t/ha were selected for release to the groundnut farming communities of the country

Cowpea

- Seven improved varieties (Melakh, Yasin, Sam, Kelle, Thieye, Leona, and Lizard) of cowpea were obtained from ISRA which were screened on-station to assess their yield potential and adaptability against the local variety (Mougne)
- All the new varieties performed better than the local variety in-terms of earliness and yield
- Five most promising varieties (Kelle, Melakh, Thieye, Sam and Lizard) which recorded average yields of 1.5, 1.4, 1.4 and 1.39 ton/ha respectively were selected for release to the farming communities



Improved cowpea varietal trial at Site III

- The yield of the selected varieties were higher than local check (Mougne) which recorded a mean grain yield of 1.02 ton/ha
- All the 5 varieties selected (Kelle, Melakh, Thieye, Sam and Lizard) are fortified with beta-carotene

Maize

- Nine improved maize varieties (2011 TZE-Y DT STR, TZEE-W POP HDT C2 STR C5, TZE-Y POP DT C3 STR C5, TZEE-W POP STR C5 (Extra early), 2014 TZE-Y DT STR, 2004 TZE-Y POP DT STR C4, TZE-Y POP DT C4 STR C5, 2013 DTE STR-Y SYN, 2010 TZE-W DT STR) were sourced from IITA for screening on station at Site III, Yundum, to test their yield potential and suitability to our local conditions
- Three most promising varieties (TZE-Y POP DT C4 STR C5, 2004 TZE-Y POP DT STR C4 and TZEE-W POP HDT C2 STR C5) which recorded average yield of 2.04 t/ha, 1.96 t/ha and 1.84 t/ha respectively were selected for further research through multi-locational trials in the different agro-ecological zones of the country
- All the selected varieties yielded significantly higher than the local check (JEKA) which recorded average yield of 1.54 t/ha

Sorghum

- Four improved sorghum varieties (Nguinthe, Nganda, Darou, Faourou) were acquired from ISRA for screening on station at Site III, Yundum, to test their yield potential and adaptability
- Three of the varieties (Darou, Nguinthe and Faourou) which recorded 1.55 ton/ha, 1.5 t/ha and 1.44 t/ha respectively were selected for further research through multi-locational trials in the different agro-ecological zones of the country
- All the selected varieties yielded higher than the local check (Mobal) which recorded average yield of 0.98 t/ha

Bio-fortified Pearl Millet

- Six bio-fortified pearl millet varieties (ICMV 221-Wbr, ICMV-IS 89305, PPB SERKIN HAOUSSA, ICRI-Tabi, GB 8735, CHAKTI) were sourced from ICRISAT for further screening on station at Kerewan Field, Sapu, to test their yield potential
- Three most promising varieties (Chakti, ICRI-Tabi, GB 8735) which recorded an average yield of 1.29, 1.2, and 1.15 t/ha respectively were selected for multi-locational trial to ascertain their yield stability
- The yield of the selected varieties were significantly higher than the local check (Souma 3) which recorded an average yield of 1.06 t/ha
- All the selected varieties are bio-fortified with iron and zinc

Hungry rice

- Five improved Hungry rice (*Findi*) varieties (Peazo, Wodheho, Rane, Konso, Naithia) sourced from Guinea Conakry were screened on station at Site III, Yundum, with 4 local varieties (Momo, Momo Sartou, Ex-Kanilai and Findi Baa) to determine their yield potential
- All the five improved varieties from Guinea Conakry recorded higher grain yield than the local varieties
- The 3 most promising improved varieties (Rane, Peazo and Konso) recorded an average yield of 1.26 t/ha, 1.24 t/ha and 1.21 t/ha respectively which were significantly higher than the average yield obtained from the most promising local variety (Momo) which recorded 1.06 t/ha

- Multi-locational trial will be conducted on the varieties selected to ascertain their yield stability



Improved hungry rice (*Digiteria exilis*) trial plot at Site III Yundum

Orange Fleshed Sweet Potato

- Five varieties of orange flesh sweet potatoes (Boyhe, Bearegaard, Kandee, Tiebelle, and Sumaia) were sourced from ISRA to be screened for high yield and resistance to pest and diseases



Orange Flesh Sweet Potatoes

- Kandee obtained highest root number per plot but Boyhe recorded highest root yield
- Sumaia had shown some resistant/tolerant to pest (weevils) and it can stay in the soil longer than the other varieties
- For better growth, good yield and high beta-carotene level Boyhe, kandee

and sumaia were selected for release to the farming communities

Cassava

- Six improved cassava varieties (IBA 070578, TME 149, IBA 090590, 419E, Tokumbo and 98/0505) were obtained from IITA to be screened for yield stability and resistance to pest and diseases
- All the improved varieties yielded on average higher than 30 t/ha as compared to a yield of 22 t/ha obtained from the local check
- The best improved variety (IBA 070578) on average produced 56 t/ha
- All the improved varieties tested have been selected for release to the farming communities



IBA 070578 improved cassava variety

Evaluation of the effect of Organic and Inorganic Fertilizers on the Growth and Yield of Onion

Introduction

Onion (*Alliums cepa* L.) is an important vegetable crop cultivated mainly in West Coast and North Bank Region. It is also known as bulb onions which are widely cultivated and used all over the country as food. It can be served as cooked vegetable or part of a prepared savory dish, but can also be eaten raw. The major problem facing the production of onion crop is poor soil condition of most farmland, which is caused by continuous cultivation of farm land without a fallow period. To address this problem, the horticulture unit of NARI tested the efficacy of some organic and inorganic fertilizers on growth and yield of onion.

Objectives

1. To determine the effect of organic and inorganic fertilizers on the growth and yield of onion
2. To identify the most effective fertilizers for the production of onion

Highlights of the main research findings

- Five different types of fertilizers (Agripower, Panamin, Megagreen, NPK 15:15:15, NPK 15:15:15+4MgO and Poultry Manure) were tested on a 5m² onion bed using the recommended application rate for each fertilizer
- The highest yield was obtained from the application of poultry manure which recorded average yield of 11.5 t/ha. This was followed by NPK 15:15:15+4MgO which recorded 7.4 t/ha. The least was obtained from Panamin which produced 1.8 t/ha



Fertilizer trial on onion

- Poultry manure also recorded the highest bulb diameter (6.3 cm) which was followed by NPK 15:15:15+4MgO (5.5 cm) and the least was observed from Panamin (3.6 cm)



Onions produced from different fertilizers

- It is recommended that farmers producing onion should use poultry manure which can be applied at a rate of 1kg per meter square

On-farm trials of improved cassava and sweet potato varieties in selected communities

Distribution of Orange Flesh Sweet Potato cuttings

| REGION | DISTRICT | COMMUNITIES REACHED | NUMBER OF CUTTINGS |
|----------------------------|--|---|--------------------|
| West Coast Region | Kombo South, Kombo Central, Kombo East Foni Brefet, Foni Bondali, Foni Bintang | Gunjur, Sanyang, Marakisa Kabelkel, Pirang Bullock, Berefet, Jagil, Somita, Ndemban Jola, Ndemban Tenda, Kassenge, Kangjibat, Kanwally, Bondali Tenda, Bondali Jola, Kayabor, Deenya, Kartakorr, Buniadu Sibanor | 11,140 |
| North Bank Region | Lower Nuimi, Upper Nuimi, Jokadou, Lower Badibou, Upper Badibou, Sabach Sanjal | Berending, Chamen Baidam, Kerr Alagie Malick, Toro Alasan, Njoufen, Fass Njaga Choi, Kerr Sanyang, Fass Saho, Passy Chally, Kerr Alagie Yero, Mbanta, Ndungu Charren, Tambana, Samba Njabeh, Kerr Biran Kani, Bali Mandinka, Kerr Sait Cham, Kerr Demba Holle, Ndungu Kebbeh, Kekuta kunda, Chamunding, Kerr Chikam, Noo-Kunda, Chamen, Yallal Tankonjalla, Kunjo | 8,642 |
| Lower River Region | Kiang West, Kiang Central, Kiang East Jarra West, Jarra Central, Jarra East | Manduar, Misera, Jolie, Keneba, Karantaba, Tankular, Borong, Taborankoto, Nema, Numo Kunda, Kiang Madina, Bamako, Mandaur Kanni Kunda, Pakalinding, Jenoi, Jarra Soma Jarra Madina, Jappineh, Buiba, Badumeh Kuta, Barrow Kunda, Pakaliba | 9,500 |
| Central River Region South | Niamina West, Lower Fulladu, Upper Fulladu, Janjanbureh | Brikamading, Nanaba, Dasilameh, Sukuru, Morea Kunda, Saruja, Kumbaney, Galleh Manda, Mabaly Kuta, Janjanbureh, Dobong Kunda, Kerewan Dumbokono, Manneh Kunda, Njoben | 9,973 |
| Central River Region North | Upper Saloum, Lower Saloum, Niani | Njau, Jahaur, Koffa, Nyanyen, Toubakuta, Batti Yongo, Sareh Maila, Gui Jahanka, Ballanghar, Janneh Kunda, Genjie wollof, Kaur Burang kunda, Chamen, Labbe malick mbaye, Fass, Njoban Fula, Mbayen, Kerr Sait, Torben, Jakaba | 13,191 |
| Upper River Region | Wuli West, Wuli East, Tumanna, Kantora, Jimara and Sandu | Kuwonkuba, Mbaye Kunda, Dasilami Takutala, Kukulay, Chemoi, Sare Demba Dado, Tambasansan, Damphia Kunda, Jabajeng, Tiabatou, Sere Wulom, Jendeh, Sandu Dasilimi, Fantubu | 10,576 |
| Total | | | 60,022 |

On-farm trials of cassava varieties

| REGION | District | COMMUNITIES | NUMBER OF cuttings |
|-----------------------------------|-----------------|------------------------|---------------------------|
| North Bank Region | Upper Nuimi | Jufureh | 559 |
| | Jokadou | Kerr Salleh | 576 |
| | Lower Badibou | Kinteh Kunda Janneh Ya | 294 |
| | Central Badibou | Mandori | 396 |
| | Sabach Sanjal | Kunjo | 205 |
| Central River Region North | Lower Saloum | Ngengi Wollof | 200 |
| | Niani | Wassu | 190 |
| | Sami | Lamin Koto | 250 |
| Upper River Region | Wuli West | Kerewan Nyakoi, | 220 |
| | Sandu | Kuwonkuba | 220 |

CROPPING SYSTEM AND AGRO-FORESTRY RESEARCH DIRECTORATE

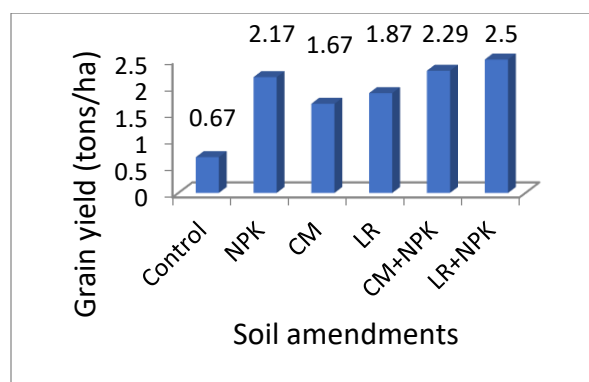
Integrated Effect of Organic and Inorganic Nitrogen Sources on Soil Fertility and Crop Yields in Different Agro-Ecological Zones of The Gambia

The study was carried out to determine the efficiency of different soil amendments using mainly locally available organic materials on soil fertility replenishment and maize yields.

The objectives of the experiment were:

1. To determine the effect of the different amendments on soil fertility status
2. To evaluate the impact of the amendments on the growth and yield of the test crop

Five soil amendments i.e. 1. NPK, 2. Cattle manure, 3. Leucaena Residue, 4. Cattle manure + NPK, 5. Leucaena Residue + NPK and a control (zero application) were examined. The test crop was Swan2 maize variety.



tons/ha with inorganic NPK 15:15:15 at half recommended rate produced higher gains in terms of soil fertility improvement and crop yields.

It can be concluded, therefore, that whereas all soil amendments used in this study promoted crop growth parameters over the zero application, combination of NPK with organics at half rates enhanced grain yield more.

Effect of soil amendments

The results obtained indicates that combine application of Leucaena leucocephala residue at 1

Effects of NPK Rates on Growth and Yield of Maize in Two Different Locations of The Gambia

Maize generally has high demand for nutrients in order to attain higher grain yields. Nitrogen, phosphorus and potassium are the nutrients it requires in greater quantities for efficient growth. Most Gambian soils are both N and P deficient; while N is the most limiting nutrient for cereal crops such as maize, P deficiency also reduces the efficiency of N use by the crop.

To obtain good maize yields under the prevailing soil conditions, applications of these nutrients in optimal quantities is required. Maize varieties, however, are known to differ in their nutrient uptake and use in different locations due to differences in climatic and soil conditions. This study was, therefore, set up to assess the growth and yield responses of four different maize varieties to different fertilizer application rates in different

locations so that the result will guide in carrying out location specific variety recommendations to enhance maize yields in the country.

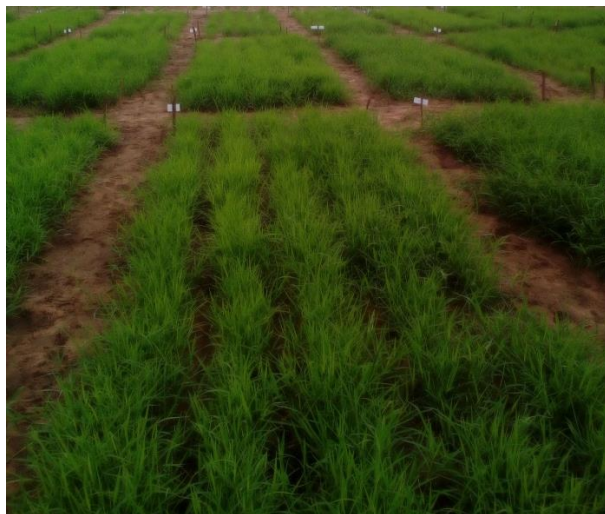
Results from the study confirms that the current recommended rate of 200kg/ha NPK and 200 kg/ha Urea as top dress is good enough for maximum performance. The study also showed that the Swan2 maize variety is the best performing variety and it was, therefore, recommended for cultivation by maize farmers.

Growth and Yield Response of Findi (*Digitaria Exilis*) To Different Fertilizer Rates in Different parts of The Country

The experiment was designed to gather key information on the fertilizer input requirements of *Findi* by studying the appropriate rates to apply, time of application, and also assess the adaptability and productivity of the different *Findi* varieties that are at the possession of research in the different parts of the country.

The objectives of the study were:

1. To assess the effect of different fertilization rates on the growth and grain yield of the *Findi* varieties
2. To evaluate the performance of *Findi* in the different parts of the country



The key findings of the study were that all *Findi* varieties tested responded positively to fertilizer application. However, results indicate that *Findi* under Gambian conditions should be able to yield to potential with application of 100 kg/ha fertilizer which should comprise half NPK applied as basal and half Urea top dressed at late vegetative stage.

Findi variety evaluation trial at Sapu field

Bio-Fortified Maize Variety Screening, Adaptation and Seed Increase

Bio-fortified maize variety (PVA SYN-13) that is Vitamin A enriched was introduced by NARI into the country from IITA in Nigeria. In the 2018 wet season, the variety was screened on-station for adaptability and seed increased. It was found to be highly adaptable to our soil and environmental conditions. From that activity, 2 tons of pure seeds of the variety were produced.

The reason for introducing this variety is because most of the existing maize varieties in the country are lacking in essential vitamins needed by the human body, especially vulnerable groups such as women and children. The existing maize varieties have on average 2 µg/g pro-vitamin A carotenoids, whereas this new variety has 9.4 µg/g. It therefore, has 4 to 5 times more Vitamin A than the existing ones.



Bio-fortified maize produced from a farmer's field in Tabanding, CRR south

The seeds produced during the 2018 cropping season were used in the on-farm activity of 2019 which involved 33 individuals and 7 community farms (Nuimi lamin, Conteh Kunda Niggi, Jumangsarr, Tabanding, Njoben, Mamud Fana and Katamina) growing the variety. More than 18 tons of grain plus seed was obtained from that activity. Farmers attest that the variety is very attractive because of its bright orange grain color, ability to withstand dry spells and good taste in comparison to other varieties they have. The variety was submitted by NARI to the variety release committee, and after careful examination of the evaluation procedures undertaken, it was accepted for release into the national variety catalogue.

AGRICULTURE AND RURAL ECONOMICS DIRECTORATE



Focus group discussion with farmers

FARMER PERCEPTION STUDY ON CLIMATE SMART TECHNOLOGIES TO ADDRESS CLIMATE RELATED PROBLEMS IN NORTHERN GAMBIA

Introduction

Climate-smart agriculture (CSA) is a method used to sustainably increase agricultural productivity, enhance resilience (adaptation), reduce/remove greenhouse gases (mitigation) where possible, and enhance achievement of national food security and development goals. The NARI as the main agricultural research organization of the country is tasked with the responsibility of generating technologies that can withstand the adverse effects of climate change. To facilitate easy adoption of the proposed technologies, farmers perception was assessed on soil fertility restoration techniques through sound Agro-forestry system to improve upland crop productivity, use of early maturing varieties of legumes and cereals including roots and tubers.

Objectives

The overall objective of the study was to assess the perception of the farmers, in Northern Gambia, on the usage of climate smart technologies to address climate related problems affecting the target communities.

Main research findings

- There is a general consensus among all farmers in the targeted communities that climate change is real and that it has adverse effect on their crops and livestock.
- The effect of climate is manifested through introduction of exotic pests and diseases, erratic rainfall pattern, drought, soil degradation, floods, and salt intrusion.

- Efforts to address these problems are mainly geared towards afforestation and the use of early maturing crop varieties.
- No concrete solutions have been found to address the problem of pest and diseases, soil degradation, floods and salt intrusion.

NARI's Intervention to address the problem

Introduction of multi-purpose agro-forestry tree species such as Leuceana, Alcacia Albeda, Alcecia Ciamia, Gliricidia sepium in 5 communities in North Bank Region, 3 communities in Central River Region North and 2 Communities in Upper River Region North. These tree species are used for wind breaking, live fencing and soil fertility restoration.

Monitoring of NARI activities implemented in 2018

Introduction

To ensure all research activities identified by NARI during the year 2018 were implemented according plan and to help improve performance and facilitate the achievement of desired results, the monitoring and evaluation unit of NARI was assigned with the responsibility to monitor the progress of all the research activities implemented by NARI during the year 2018. The purpose of the monitoring was to identify key constraints hindering performance and inform NARI management and others research programs about options to put in place the address the challenges.

Objective

The overall objective of the study was to monitor the progress of all the activities implemented by NARI in 2018. Specifically, the study aims:

1. To monitor the management of the crops at field level
2. To identify key constraints hindering the implementation of the activities
3. To inform NARI management about key options that need to be put in place to address the constraints identified

Main findings

The ten communities targeted for the implementation of on-farm trials in 2018 have been reached.



Ngengi Wolof



Kuwonkuba

The on-farm trials in most of the target communities have been carried out according to

the recommendations set by research which resulted in very good outcomes in most of the communities.



Mandori



Kerewan Nyakoi

However, due to improper agronomic practices a few (Jufureh, Kerr Selleh and Kinteh Kunda) of the communities had problems that affected crop performance.

Recommendations

The following measures were recommended from the monitoring visits:

- Contact farmers should be identified in each target community who should be given responsibility of managing the on-farm trials
- The contact farmers managing the crops should be motivated
- Materials should be provided to protect the crops from animals or all on-farm trials should be conducted in protected places like fenced community gardens
- Contact farmers should be trained on good agronomic practices
- Extension workers should be identified and given responsibility to closely supervise the on-farm trials within each target community

YOUTH ENTREPRENEURSHIP AND JOB CREATION IN AGRICULTURE

The National Agricultural Research Institute (NARI) in partnership with the International Trade Centre (ITC), through its Youth Empowerment Project (YEP) in The Gambia has trained 42 Gambian youths in Plant propagation techniques, Livestock production, Backyard fish pond construction and management and Certified seed production.

The aim of the training was to enhance the capacity, knowledge and skills of Gambian youths in different areas of agriculture to enable them to be self-reliant and become future entrepreneurs. The trainings were run from January to May 2018. The trainees aged between 18 and 35 were selected from across all regions of the country and comprise 17 females and 25 males.

TRAINING IN PLANT PROPAGATION TECHNIQUES

Ten trainees were trained in plant propagation techniques comprising 3 females and 7 males. The training focused mainly on fruit tree propagation, nursery preparation and seedling handling techniques.



Seed bed preparation

Practical demonstrations were delivered on different types of fruit tree propagation techniques such as grafting and budding, compost making, seed sourcing, nursery design and construction.



Compost making

Practical sessions on polybag making through which several thousand polybags were made by trainees for training purposes.



Sizing of polybags

Trainees were taken through practical sessions to demonstrate the grafting process. They carried out harvesting of scions from the desired mother trees and removed leaves



Trainees collecting scions

TRAINING IN BROILER, LAYER AND SMALL RUMINANT PRODUCTION

Ten trainees were trained in broiler, layer and small ruminant production comprising 7 females and 3 males. The training was aimed to equip the youths with skills in poultry and small ruminant production to become self-employed agribusiness entrepreneurs and contribute in the productive sector of the country.

Layer and broiler production training covers the process of incubation; brooding; housing; feeds and feeding; management of broilers and layers; diseases of poultry and control; biosecurity; record keeping; marketing; catching, dressing and packaging of broilers.



Layers in the poultry house

The trainees were also taken through feed formulation for poultry with locally available materials (Maize, Coos bran, Fish meal,

Groundnut cake, Oyster shells, Salt and Moringa leaves).



Feed preparation using local feed resources

The training on small ruminant production centered on selection of fattening stock; management of the stock; housing types and its importance; feed and feeding; diseases of small ruminants; record keeping; vaccination and medication and marketing.



Sheep fattening

Training in backyard fish pond construction and management

Ten trainees were recruited to be trained in backyard fish pond construction and management comprising 3 female and 7 male.



Weighing of Tilapia fingerlings

The training was conducted to improve youth knowledge and skills in backyard fishpond construction, pond management, fish feed formulations and feeding procedures.



Fingerling of stocking

Both theoretical and practical training modules were delivered on fish feed formulations and basic principles of feeding; liming and fertilization, routine pond management and water quality requirements.



Fingerlings harvesting

Training in certified seed production

The training in certified seed production was carried out by NARI in collaboration with the National Seed Secretariat (NSS).



Germination test using Petridis

Twelve (12) trainees were recruited under this component and comprised 4 females and 8 males.



Practical on germination count

The training was hosted in the Sapu research station in the Central River Region (CRR) of the country.



Wet bed nursery

The main target crop was rice and CRR happens to be the rice hub of the country.



Training of youths on puddling

The training was aimed to increase the number of certify seed producers in the country to ensure the availability of quality seed throughout the country.



Fertilizer application

The training focused mainly on seeds selection, viability tests, nursery preparations, seeds and fertilizer rates calculations, field management, harvesting and processing techniques.



Harvesting of rice

Summary of the status of research activities implemented in 2018

| Directorate | Activity | Status | | Remarks |
|---|--|-----------|---------------|--|
| | | Completed | Not completed | |
| Agricultural Produce Food Chemistry and Aflatoxin Produce Quality Directorate | Aflatoxin and other chemical analysis in products/ produce for clientele | | X | This is a routine activity that will continue in 2019 |
| | Analysis of pro-vitamin A content in Orange Flesh Sweet Potato | X | | This activity was completed in 2018 |
| Directorate of crop research | Varietal Purification and Maintenance | | X | This is a routine activity that will continue in 2019 |
| | Evaluation of 32 irrigated and 41 salt tolerant improved rice varieties | | X | Participatory Advance Trials (PAT) will be conducted in 2019 to further evaluate the varieties |
| | Evaluation of 63 improved groundnut varieties | X | | This activity is completed and best performing varieties identified for dissemination to the farming communities |
| | Evaluation of 7 improved cowpea varieties | X | | This activity is completed and best performing varieties identified for dissemination to the farming communities |
| | Evaluation of 9 improved maize varieties | | X | Multi-locational trials will be conducted in 2019 to further evaluate the varieties |
| | Evaluation of 4 improved sorghum varieties | | X | Multi-locational trials will be conducted in 2019 to further evaluate the varieties |
| | Evaluation of 6 bio-fortified pearl millet | | X | Multi-locational trials will be conducted in 2019 to further evaluate the varieties |
| | Evaluation of 5 improved hungry rice varieties | | X | Multi-locational trials will be conducted in 2019 to further evaluate the varieties |
| | Evaluation of 5 Orange Flesh Sweet Potatoes | X | | This activity is completed and best performing varieties identified for dissemination to the farming communities |
| | Evaluation of 6 improved cassava varieties | X | | This activity is completed and best performing varieties identified for dissemination to the farming communities |
| | Evaluation of the effect of Organic and Inorganic Fertilizers on the Growth and Yield of Onion | X | | This activity is completed and most effective fertilizer identified for use by farmers |
| | On-farm testing of improved cassava and sweet potato varieties in selected communities | | X | This activity will continue in 2019 to reach more farming communities |

| | | | | |
|--|--|---|---|--|
| Cropping System and Agro-forestry Research Directorate | Integrated Effect of Organic and Inorganic Nitrogen Sources on Soil Fertility and Crop Yields in Different Agro-Ecological Zones of The Gambia | X | | This activity is completed and the most effective fertilizer combination recommended to farmers |
| | Effects of NPK Rates on Growth and Yield of Maize in Two Different Locations of The Gambia | X | | This activity is completed and the most effective fertilizer rate recommended to farmers |
| | Growth and Yield Response of Findi (<i>Digitaria Exilis</i>) To Different Fertilizer Rates in Different parts of The Country | X | | This activity is completed and the most effective fertilizer rate recommended to farmers |
| | Bio-Fortified Maize Variety Screening, Adaptation and Seed Increase | | X | On-farm trials to be conducted in 2019 cropping season in 7 community farms |
| Pest Management Directorate | Tested natural substances as alternatives to synthetic pesticides acceptable in agriculture for control of major fruit fly (<i>Diptera: tephritidae</i>) species in The Gambia | X | | This activity is completed and most effective botanical pesticide identified for use by farmers |
| | Evaluation of the effectiveness of Ocimum Canum in the attraction of mango fruit flies | X | | This activity is completed and Ocimum Canum has been recommended to farmers for the control of mango fruit flies |
| Agriculture and Rural Economics Directorate | Farmer perception study on climate smart technologies to address climate related problems in Northern Gambia | X | | Climate change related problems affecting farmers identified and recommendations made for NARI's intervention |
| | Monitoring of NARI activities implemented in 2018 | | X | This is a routine activity that will continue in 2019 |

List of donors and partners in 2018

NARI sincerely thanks all the donors and partners who have contributed to its success

- The Government of The Gambia
- Food and Agriculture Organization of the United Nations (FAO)
- European Union
- United purpose
- Agricultural Science and Technology Indicators
- West and Central Africa for Agricultural Research and Development (CORAF)
- Africa Rice Center (AfricaRice)
- Institut Senegalais de Recherches Agricoles (ISRA)
- International Institute of Tropical Agriculture (IITA)
- International Crop Research Institute for the Semi-Arid Tropics (ICRISAT)
- Department of Agriculture (DoA)
- National Seed Secretariat (NSS)

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