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School of Agriculture and Agricultural Technology, Federal University of Technology, Niger State, Minna, Nigeria

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**PROCEEDINGS**

*of the*

**3rd International Conference**

*of*

**School of Agriculture and Agricultural Technology**

**(SAAT)**

*Held at*

Caverton Hall

Federal University of Technology

Minna

ICAAT 2024

*1st –4th December 2024*

School of Agriculture and Agricultural Technology Federal University of Technology

P. M. B. 65, Minna, Nigeria Email: [icaat2024@gmail.com](mailto:icaat2024@gmail.com)

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Prof. J. H. Tsado

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#### HISTORICAL BACKGROUND OF SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY

The School of Agriculture and Agricultural Technology (SAAT) was established in January 1986 with two Departments (Animal Production and Crop Production) With subsequent development, six more departments (i) Soil Science and Land Management (ii) Water Resources, Aquaculture and Fisheries Technology (iii) Agricultural Economics and Farm Management (iv) Agricultural Extension and Rural Development (v) Food Science and Technology, and (vi) Horticulture were created. The Department of Fisheries Technology started in 1987 as a Unit in the Department of Animal Production which transformed to the Department of Animal Production and Fisheries Technology in 1989 and was split into Department of Animal Production and Department of Fisheries Technology in 1991. The Department was repackaged and renamed Department of Water Resources, Aquaculture and Fisheries Technology in 2006.

A new Unit, Agricultural Economics and Extension Technology was created during the 1997/1998 session under the Department of Crop Production. In 2002, the Unit was separated from the mother Department and upgraded to a full-fledged Department which in turn gave birth to Department of Agricultural Economics and Farm Management and Department of Agricultural Extension and Rural Development in 2017. In 1997, the proposed Department of Food Science and Nutrition took off as a Unit in the Department of Animal Production and became a full-fledged Department of Food Science and Technology in 2013. Similarly, the Horticulture Unit in the Department of Crop Production became a separate Department of Horticulture in 2020. In 2019, the Vice-Chancellor approved an interim Centre for Shea Research and Development. Prof. K.M. Baba was appointed as pioneer Centre Coordinator while a Technical Committee which serves as a Board for the Centre was also constituted, with Prof.

M.A.T. Suleiman as Chairman, to provide policy and strategy direction for the Centre.

The student intake into the school at inception in 1986 was two (one student each for Department of Animal Production and Department of Crop Production), and both graduated in 1989. Since then, the school has witnessed tremendous progress in terms of staff recruitment and development, infrastructural development and student enrolment. In the current 2019/2020 session, academic staff strength is 115 and student population stands at 2,895 for undergraduates and 314 for postgraduate students, totaling 3,209 students.

Dr. Z. Stecki was the first Coordinator for the school (January 1986 to September 1988). Dr.

E.A. Salako took over as School Coordinator from October 1988 to 1990 and served later as Acting Dean. When he became the only Professor in the School, he was made the substantive Dean. After his tenure, the school reverted to the position of Acting Deanship since no Professor was on ground then. The Acting Deans were Dr. J.A. Oladiran (1995-1998) and Dr. S.L. Lamai (1998-2001). By September 2001, with more Professors on ground, the Board of School of Agriculture and Agricultural Technology, in accordance with the University regulations, elected Prof. O.O.A. Fasanya as the Dean of the School for a two-year term. Since then, the Deanship position in the school has been filled by election. Prof. E.A. Salako took over from Prof. O.O. A. Fasanya in 2003 and Prof. S.L. Lamai took over from Prof. E.A. Salako in 2005. In January

2008, following the appointment of Prof. S.L. Lamai as the Dean of Postgraduate School, Prof.

K.M. Baba assumed Deanship of the School. In February 2012, Prof. M.G.M. Kolo succeeded Prof. K.M. Baba who had completed his second two-year term. Professor M.G.M. Kolo was re- elected for another two years from February 2014 but while in his second term, he was appointed Dean of Postgraduate School. In April 2015, Prof. R.J. Kolo was elected as the new Dean of the School and re-elected for second term. Prof. A.J. Odofin assumed the Deanship of the School in



April 2019 and served for only one term of two years. Prof. Job Nmadu took over from Prof. A.J. Odofin as the Dean of School of Agriculture and Agricultural Technology on 9th April, 2021 to April 8th 2023. Prof. Jacob H Tsado is the current Dean of School of Agricultural Technology who assumed duty on 9th April 2023 to date.

Under the leadership of Prof. Faruc Kuta as the Vice Chancellor, the School has witnessed tremendous growth which has resulted in the creation of new departments (Department of Forestry and Wildlife Conservation, and Human Nutrition and Dietetics), also a new programme has been proposed to NUC (Seed Science and Technology) which is awaiting approval.

**PROGRAMME OF EVENTS**

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| **DAY ONE** | **Sunday, 1st December, 2024** |
| 4.00 pm | Arrival of Participants and Settling in |
| **DAY TWO** | **Monday, 2nd December, 2024** |
|  | **Opening Ceremony (Moderator)** |
| 8.00 – 9.40 a.m. | Registration of Participants |
| 9.45 – 10.00 a.m. | Arrival of Dignitaries and Participants |
| 10.00 a.m. | University Anthem  National Anthem |
| 10.10 – 10.15 a.m. | Opening Prayer |
| 10.15 – 10.25 a.m. | Welcome Address by the Vice-Chancellor, Federal University Technology, Minna |
| 10.25 – 10.45 a.m. | Address by the Dean School of Agriculture and Agricultural Technology |
| 10.45 – 11.15 a.m. | **Keynote Address One by:**  Prof. (Mrs.) Mona Zayed  Director of Microbial Inoculants Center, Faculty of Agriculture Ain Shams University, Cairo, Egypt |
| 11.15 – 11.25 a.m. | Goodwill Messages |
| 11.25 – 12.05 a.m. | **Keynote Address Two by:**  Alh. Musa Salihu Bawa Bosso, Niger State Commissioner for Agriculture. Niger State Ministry of Agriculture, Minna |
| 12.05 – 12.35 p.m. | **Keynote Address Three by:**  Dr. Sanusi Muhammad  Director, Department of Artificial Intelligence and Robotics, National Space Research and Development Agency (NASRDA), Abuja, Nigeria |
| 12.35 – 12.45 p.m. | Group Photograph |
| 12.45 – 2.00 p.m. | Lunch Break and Registration |
| 2.00 – 4.30 p.m. | Scientific Session 1 Venue: Rooms 1. 2 & 3 PG Classes, SAAT Phase 2 |
| **DAY THREE** | **Tuesday, 3rd December, 2024** |
| 10.00 – 12 noon | Scientific Session 2 Venue: Rooms 1. 2 & 3 PG Classes, SAAT Phase 2 |
| 12.00 noon | Excursion/ Departure |

**TECHNICAL SESSIONS**



**TABLE OF CONTENTS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Session** | **Subject** | **Venue** | **Chairman** | **Rapporteur** |
| 1 and 2 | Agricultural Economics and Farm Management, Agricultural Extension and Rural Development, Agribusiness | Room 1 PG  Class, SAAT  Phase 2 | Prof. A. A. A.  Coker | Dr. M.  Ibrahim |
| 1 and 2 | Animal Production, Food Science and Technology, Nutrition and Dietetics, and Water Resources, Aquaculture and Fishery  Technology | Room 2 PG  Class, SAAT  Phase 2 | Prof. A. A. Malik | Dr. S. James |
| 1 and 2 | Crop Production, Horticulture, Seed Science and Technology, Soil Science and Land Management, Forestry and Wildlife Technology, and Environmental Management | Room 3 PG  Class, SAAT  Phase 2 | Prof. P. A. Tsado | Dr. (Mrs.) A.  Y. Mamudu |

|  |  |  |
| --- | --- | --- |
| **S/N** | **TITLE/AUTHORS** | **PAGE** |
| 1 | ASSESSMENT OF SMALLHOLDER FARMERS PERCEPTION ON CLIMATE CHANGE AND ADAPTATION STRATEGIES IN AGAIE LOCAL GOVERNMENT AREA, NIGER STATE, NIGERIA  M. Salihu, I. U Gbogan & C. Bature | 18 |
| 2 | RISK SOURCES AND MANAGEMENT STRATEGIES AMONG SOYA BEANS FARMER IN NIGER STATE, NIGERIA  O. F. Suberu,, S**.** Samuel & B. Abdullahi | 27 |
| 3 | DETERMINATION OF RESOURCE USE EFFICIENCY OF VITAMIN A BIOFORTIFIED CASSAVA PRODUCTION IN NIGER STATE  Abdullahi A. Izo, Mohammed A Maikasuwa and Abdulsalam A. Jega | 36 |
| 4 | JOB PREFERENCE AND ENTREPRENEURIAL ORIENTATION AMONG YOUTH UNDERGRADUATE AGRICULTURAL STUDENTS IN NIGER STATE, NIGERIA  S. B. Usman; I. S. Umar & U. H. Muhommad | 47 |
| 5 | FACTORS INFLUENCING THE ADOPTION OF AGRICULTURAL TECHNOLOGIES AMONG FARMERS IN KEBBI STATE, NIGERIA | 55 |

|  |  |  |
| --- | --- | --- |
|  | Alhassan Y. J, Manga T.A, Sanchi I. D, Peni A. A., and Sanda, A. Y |  |
| 6 | FACTORS INFLUENCING ACCESS TO EXTENSION SERVICES AMONG ARTISANAL FISHERS IN YAURI LOCAL GOVERNMENT AREA OF KEBBI STATE, NIGERIA  Manga T. A, Alhassan Y. J, Sanchi I. D, Sabo A. Y and Peni A.A | 63 |
| 7 | WILLINGNESS TO PAY FOR PRIVATE EXTENSION SERVICES BY CROP FARMERS IN DUTSIN-MA, KATSINA STATE, NIGERIA  Ibrahim, U. M., Nazifi, B., Fatima, A. A. and Danmusa, A. H | 74 |
| 8 | SYSTEMATIC REVIEW ON QUALITY ATTRIBUTES AND CONSUMER PREFERENCES FOR PALM OIL IN ANAMBRA AND ONDO STATES, NIGERIA  Nwafor, C. I., Nwafor O. C. and Abdullahi, B. | 82 |
| 9 | FINANCIAL VIABILITY OF OUTGROWER SEED PRODUCTION IN NORTHWEST AND NORTHCENTRAL NIGERIA  C. G. Aguiyi, U.S. Mohammed; C. O. Adebayo; & A. Ogaji | 89 |
| 10 | EFFECTS OF FLOOD ON RICE FARMERS’ FOOD SECURITY IN  AGRICULTURAL ZONE I OF NIGER STATE  Umar., A. Ogaji., A. and Likita, T. | 96 |
| 11 | EFFECTS OF RURAL ACCESS AND MOBILITY PROJECT ON FOOD CROP PRODUCTION AND WELLBEING OF CROP FARMERS IN KADUNA STATE, NIGERIA  Nwafor, O**. C.,** M. Ibrahim**,** I. S. Umar & Tsado, J. H | 104 |
| 12 | ASSESSMENT OF SOCIOECONOMIC CONSTRAINTS OF CLIMATE SMART AGRICULTURAL STRATEGIES AMONGST RICE FARMERS IN NASARAWA STATE  Adamu, D. A., Ogaji, A., Likita, T. & Mohammed U. S. | 111 |
| 13 | ADOPTION OF IMPROVED SESAME PRODUCTION TECHNOLOGIES BY SMALLHOLDER FARMERS IN LAPAI AND AGAIE LOCAL GOVERNMENT AREAS, NIGER STATE, NIGERIA  Y.M. Hassan, M. Ibrahim & R.U. Bako | 118 |
| 14 | ECONOMIC ANALYSIS OF SWEET POTATO (*Ipomoea batatas*) PRODUCTION IN KEFFI LOCAL GOVERNMENT AREA, NASARAWA STATE, NIGERIA | 128 |

|  |  |  |
| --- | --- | --- |
|  | Audu S. I ., Girei, A . A. & Timothy, N. |  |
| 15 | SYSTEMATIC REVIEW ON AWARENESS ABOUT UTILIZATION OF *Moringa Oleifera* SEEDS POWDER AS A NATURAL COAGULANT FOR WATER PURIFICATION AMONG RURAL COMMUNITIES OF NIGER STATE, NIGERIA  Suleiman, H., AJayi, O.J. & Jibrin, S. | 136 |
| 16 | SYSTEMATIC REVIEW OF EFFECTS OF FUEL SUBSIDY REMOVAL ON SOCIAL WELL–BEING OF RURAL FARMING HOUSEHOLDS IN NIGER STATE, NIGERIA  Tsado, E., Muhammed, Y. and A. I. Oseghale | 143 |
| 17 | A REVIEW ON EFFECT OF CLIMATE SMART AGRICULTURAL PRACTICES ON PRODUCTIVITY OF POULTRY FARMERS IN NORTH -CENTRAL NIGERIA  Tuedogheye, J. G**.**; Ndanitsa, M. A; Abdullahi, A.and A. I. Oseghale | 148 |
| 18 | PRODUCTIVITY DIFFERENTIAL AMONG ADOPTERS OF IMPROVED RICE VARIETIES UNDER IFAD-VCDP IN NIGER STATE, NIGERIA  Samuel, S., Baba, K. M. and Ndanitsa, M. A. | 157 |
| 19 | LEVEL OF FARMERS PARTICIPATION IN RURAL ACCESS ROAD AND AGRICULTURAL MARKETING PROJECT IN NIGER STATE, NIGERIA  G. Ibrahim, M. Ibrahim and H. Sallawu | 166 |
| 20 | EFFECT OF CLIMATE CHANGE ON FISH FARMING ACTIVITIES IN NIGER STATE, NIGERIA  Abdulsalam, A., Adzenga, J. I. and U. H. Muhommad | 174 |
| 21 | UTILIZATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) AMONG EXTENSION WORKERS IN NIGER STATE, NIGERIA  D. B. Bako**;** O.J. Ajayi; R. S. & Olaleye | 182 |
| 22 | ADOPTION OF CLIMATE SMART AGRICULTURE AND ITS EFFECT ON INCOME OF SMALLHOLDER FARMERS IN NIGER STATE, NIGERIA  Suleiman, S. D., Ibrahim, M. and Muhammad, U. H. | 190 |
| 23 | EFFECTS OF NATIONAL AGRICULTURAL LAND DEVELOPMENT AUTHORITY (NALDA) PROJECTS ON MAIZE PRODUCTION IN NIGER STATE, NIGERIA | 198 |

|  |  |  |
| --- | --- | --- |
|  | Iliya, B.M., Muhammad, H.U., Muhammed, Y. and Abdullahi, A. |  |
| 24 | EFFECTS OF SHEA BUTTER PROCESSING ON LIVELIHOOD STATUS OF RURAL WOMEN IN NIGER STATE, NIGERIA  Umar, S. S., Mhommad, U. H. & Ibrahim, M. | 207 |
| 25 | ASSESSING THE CONTRIBUTION OF AGRICULTURAL SECTORS TO ECONOMIC GROWTH IN NIGERIA (2014-2023)  Danlami Dauda, Hafsat Muhammad & Timothy Alako | 214 |
| 26 | PROSPECTS FOR INTEGRATION OF OPPORTUNITIES IN CLIMATE CHANGE INTO POLICY AND PRACTICE FOR LIVELIHOODS IN NIGER NORTH SENATORIAL DISTRICT, NIGER STATE, NIGERIA  Adenrele Adeleke, Sawa Bulus Ajiya., Rafiu Olalekan Yusuf, and Sule Muhammad Zubairu | 220 |
| 27 | UTILIZATION OF FARM INPUT AMONG YAM FARMERS IN ZONE B OF NIGER STATE, NIGERIA  Tsado, J. H., Muhammed, Y., Isola, E. O. and Micheal, F. I | 230 |
| 28 | EFFECTS OF FUEL SUBSIDY REMOVAL ON BROILER PRODUCTION IN KARU AND KEFFI LOCAL GOVERNMENT AREAS, NASARAWA STATE, NIGERIA  Adejoh, S. O., Muhammed, Y., Arowolo, K. O. and Odewale, B. E | 240 |
| 29 | DETERMINANTS EFFECTS AND PRODUCTIVITY DIFFERENTIALS AMONG THE ABP CREDIT RICE FARMERS IN EBONYI AND KEBBI STATES, NIGERIA  Salisu, Jibrin, Abubakar, Usman. Kpange, Usman, Ndagi.Sonlawu., Ibrahim, Mohammed Enagi, and Shuaibu, Mohammed. Kabir. | 249 |
| 30 | ADOPTION OF VITAMIN A BIO-FORTIFIED CASSAVA VARIETIES AMONG RURAL FARMERS IN NIGER STATE, NIGERIA  Dan-Azumi, P., Ajayi, O. J., Umar, I. S. and Ibrahim, M | 259 |
| 31 | PERCEIVED EFFECTS OF COVID-19 ON AGRICULTURAL ACTIVITIES OF RURAL HOUSEHOLDS IN NIGER STATE, NIGERIA  Muhammed, Y., Umar, G., Saifulahi, A. H. and Ibrahim, R | 266 |
| 32 | SYSTEMATIC REVIEW ON WOMEN PARTICIPATION IN POST-HARVEST  PROCESSING OF MAIZE USING INDIGENOUS TECHNOLOGIES IN NIGER | 274 |

|  |  |  |
| --- | --- | --- |
|  | STATE, NIGERIA  Mohammed, S., Tsado, J. H and Muhammed, Y. |  |
| 33 | EFFECTS OF POINT OF SALE (POS) SERVICES ON RICE FARMING ACTIVITIES IN RURAL COMMUNITIES OF NIGER STATE, NIGERIA  Shaba, Y. A., I. S. Umar, & Mohammed, H. | 280 |
| 34 | A PRELIMINARY ASSESSMENT OF FISH BIODIVERSITY PATTERNS ACROSS SPATIAL SCALES AT BARO RIVER PORT, NIGER STATE  Ibrahim, A., Yusuf, N. O., Yakubu U. P., Ibrahim, S. U. and Yisa, A. T. | 288 |
| 35 | SOME ASPECTS OF THE BIOLOGY OF SNAKE HEAD FISH (*Parachanna obscura*) GUNTHER 1861 IN CONCRETE TANKS  Okoro, J. O., S. M. Tsadu, S. P. AlatiseA. T YisaS. U Ibrahim and M. J. Abubakar | 293 |
| 36 | EVALUATION OF BODY MASS INDEX AND OXIDATIVE STRESS RESPONSES IN PERIPARTURIENT NIGERIAN SHEEP DURING COLD-DRY SEASON  Hussaini Usman Durkwa, Aliyu Abubakar Yahaya, Lukuman Surukat Yaqub, Buhari Habibu, James Samson Enam, Hiwimem Kutem Elvanus and Muhammaed Umar Kawu | 304 |
| 37 | HARNESSING PHYTOBIOTICS TO COMBAT ANTIMICROBIAL RESISTANCE IN NIGERIAN POULTRY PRODUCTION: A REVIEW  Abolarinwa, E.O., Akande, K.E. & Bala J.D | 311 |
| 38 | INFLUENCE OF DIETARY SUPPLEMENTATION OF ZINC AND SELENIUM NANOPARTICLES ON SENSORY ATTRIBUTE AND SELECTED MEAT QUALITY CHARACTERISTICS OF BROILER CHICKENS  Sa’aci, Z. A. , Ishaku, I2, Alabi, O. J. , Jiya, E.Z. and Ijaiya, A.T | 317 |
| 39 | AMINO ACIDS PROFILE OF *CLARIAS GARIEPINUS* FROM THREE WATER BODIES IN NIGER STATE, NIGERIA  N. O. Yusuf, S. M. Tsadu; A. T. Yisa; S.O.E. Sadiku & A. Ibrahim | 325 |
| 40 | TOXICITY EFFECTS OF CRUDE SEED EXTRACTS OF DESERT DATE  (*Balanite aegyptiaca)* ON CAT FISH (*Clarias gariepinus)* JUVENILES  Mohammed Musa Yahaya; Ojutiku Rasheed Olakunle, Oyero Johnson Olusegun; Audu Bala Sambo; Lamai Solomon Lambuda; Abdullahi Dayyab; Oshinbajo Demola Olusegun; Sulaiman Yusuf & Garba Abdullahi | 331 |
| 41 | EFFECT OF DIETARY INCLUSION LEVELS OF BLOOD MEAL ON | 339 |

|  |  |  |
| --- | --- | --- |
|  | PERFORMANCE OF GROWER PIGS  Ndams, Samuel Shehu., Elaigwu, Sunday and Irokanjo, Tochukwu Japhet |  |
| 42 | NUTRIENT UTILIZATION OF HYBRID AFRICAN CATFISH (*Heteroclarias*) FINGERLINGS FED DIFFERENT INSECTS MEAL  Gana, Aminu Baba; Bake, Gabriel Gana; Sadiku, Suleiman Omeiza Eku; and Orire, Abdullahi Mohammed | 344 |
| 43 | DEFATTED RHINOCEROS BEETLE LARVAE: A POTENTIAL FISHMEAL ALTERNATIVE FOR SUSTAINABLE AQUA-FEEDS  Edah, B. and Owolabi, O.D | 354 |
| 44 | EFFECTS OF DIETARY INCLUSION OF ONION POWDER (*Allium cepa*) ON HAEMATOLOGICAL INDICES OF BROILER CHICKENS  Agwu, Ani Ekwe 2Essien, Kemfon Friday and 3Ekam, Inimfon Simeon | 359 |
| 45 | EXPRESSION OF LIPOPROTEIN LIPASE GENE, MEAT QUALITY AND SENSORY PROFILING OF SOME CHICKEN BREEDS REARED UNDER INTENSIVE MANAGEMENT SYSTEM  H. Garba, S.S.A. Egena, B.O. Out & E.Z. Jiya | 365 |
| 46 | AQUEOUS JAMAICAN YELLOW PEPPER JUICE AND PERFORMANCE CHARACTERISTICS OF THREE STARTER BROILER CHICKENS  Ojimah Christian Oiko+., Otu Bisong Okpata, Abdulkadir Rabiat, Olajide Kehinde Folasade, Uloh Kingsley Chidiebere, Umar Gift Eleojo, Kolawole Ayobami Sofiat, Mohammed Isah, Adegboyega Oluwatobi David, Jibril Hanizat Ozohu, Odegbile Adedoyin Abigail, Abdulkareem Jamiu Olamide and Egena Stephen Sunday Acheneje | 371 |
| 47 | ASSESSMENT OF THE ANTIOXIDANT ACTIVITY OF BLACK PEPPER (*Pipper*  *guineese*)  Olatunji, H. T., Akande, K. E. and Pillah, V. | 376 |
| 48 | EMERGING TECHNOLOGIES IN FISHERIES AND AQUACULTURE: A REVIEW  Hassan Faruk Maradun, Bashir Abdullahi Sani, Umar Faruk, & Haliru Jibrin | 380 |
| 49 | PROXIMATE COMPOSITION AND PHYTOCHEMICAL CONSTITUENTS OF CACTUS PEAR PLANT EXTRACTS USING DIFFERENT SOLVENT  Ojo, Mofoluwaso Olufunmiola, Obi, Fortune Arinze, Femi, Fortune Abidemi. | 386 |

|  |  |  |
| --- | --- | --- |
|  | Maxwell, Yemmy Mitchel Omeiza, Abdulwahab Muhammed1 and Ibrahim, Olaitan Raji |  |
| 50 | AMINO ACID PROFILE AND COLOUR CHARACTERISTICS OF PASTA PRODUCED FROM WHOLE WHEAT AND DEFATTED SESAME SEED COMPOSITE FLOUR  Ojo Mofoluwaso Olufunmilola, Femi Fortune Abidemi, Zubair Bashir Adeiza, Obi Fortune Arinze, Hassan Bijik Elizabeth and Ibrahim Aishat Umhie | 391 |
| 51 | EFFECTS OF FEEDING *Aspergillus niger* FERMENTED SHEA BUTTER CAKE ON GROWTH PERFORMANCE AND APPARENT NUTRIENT DIGESTIBILITY OF WEANER RABBITS  Chakven, J. E., Jiya, E. Z., Malik, A. A., Ojo, M.O., Audu, Y. & Erena, A | 397 |
| 52 | EVALUATION OF PROXIMATE AND ANTI-NUTRITIONAL COMPOSITION OF *MUCUNA PRURIENS* SEED MEAL SUBJECTED TO COMBINED PROCESSING  Kolawole, J. J., Ayanwale, B. A. & Adebayo, R.A. | 404 |
| 53 | PHYTOCHEMICAL EFFECTS OF AQUEOUS EXTRACTS OF “HOSPITAL TOO  FAR” (*Jatropha tanjorensis*) AND BITTER LEAF (*Vernonia amygdalina*) ON BIOCHEMICAL PARAMETERS OF COMPOSITE RABBIT DOES  Ibrahim Abdulsalam Dabban, Alemede Iyabode Comfort, and Kolo Favour Naomi | 409 |
| 54 | REPRODUCTIVE PERFORMANCE OF WEANER RABBITS DOES (*Oryctolagus cunniculus*) FED GARLIC AND GINGER SUPPLEMENTED BASAL DIETS  Abdulsalam, Z. O and Alemede, I. C. | 416 |
| 55 | FREE RADICAL SCAVENGING POTENTIAL OF THE MIXTURE OF  TURMERIC (*Curcuma longa*) AND BLACK PEPPER (*Piper guineense*)  Akande, K.E., Tsado, D.N., Alabi, O.J., Olorunsogo, S.T., Abubakar, Y. and Awobona, E.O. | 421 |
| 56 | EFFECT OF GARLIC (*Allium sativum*) AND GINGER (*Zingiber officinale*) APPARENT NUTRIENT AND CARCASS CHARACTERISTICS IN BRO CHICKENS  Josiah, E.P. and Dikko, A.H | 425 |
| 57 | EVALUATION OF AIR-DRIED LEAF OF AFRICAN ALMOND (*TERMINALIA CATAPPA)* AS A SOURCE OF NATURAL ANTIOXIDANT  Okon, E. E., Akande, K.E., Usman, A., and Kudu, Y.S | 431 |

|  |  |  |
| --- | --- | --- |
| 58 | GROWTH PERFORMANCE OF TILAPIA, HYBRID AND AFRICAN CATFISH IN PONDS UNDER THE CAGES OF PULLETS FED CASSAVA PEEL AND SHEANUT CAKE BASED DIETS  Idris, H., Kudu, Y.S., Abiodun, J.A, Maradun, H.F Girei, I. M and Bello, U.A | 435 |
| 59 | IMPACT OF PROCESSING METHOD ON THE PROXIMATE COMPOSITION AND COST EFFICIENCY RATIO OF MODIFIED BAMBARA NUT BASED READY TO USE THERAPEUTIC FOOD (RUTF)  Ibrahim Baba, Amina., Iorumbur, Lutor Gideon., James, Samaila & Ibrahim, Abdulwalid | 439 |
| 60 | ESSENTIAL AMINO ACID PROFILE OF BAMBARA AND GROUNDNUT BASED READY-TO-USE THERAPEUTIC FOOD (RUTF)  Ibrahim Baba, Amina; Samaila James., Abdulrasheed, Mohammed and Ibrahim Abdulwaliyu | 448 |
| 61 | FAECAL MICROBIAL GROWTH OF WEANER RABBITS (*Oryctolagus cunniculus*) FED GARLIC AND GINGER SUPPLEMENTED BASAL DIETS  Abdulsalam, Z. O and Alemede, I. C. | 455 |
| 62 | SURVEY ON AGROCHEMICAL USAGE PATTERN IN SIX DENSELY POPULATED IRRIGATION VILLAGES AROUND TIGA RESERVOIR, KANO STATE – NIGERIA  Abba Garba Shehu, Tijjani Sabiu Imam, Falmata Ali Mustapha and Musa Ibrahim Gire | 461 |
| 63 | GROWTH PERFORMANCE, FEED EFFICIENCY, AND SURVIVAL OF  AFRICAN BONYTONGUE (*Heterotis niloticus*) FED DIETS WITH VARYING CRUDE PROTEIN LEVELS IN EARTHEN PONDS  Hassan Faruk Maradun, 2Lawali Alkali Argungu, 2Mohammad Yahaya Abubakar,  3Adamu Mani Isa | 472 |
| 64 | COMPARATIVE STUDY OF AMINO ACID PROFILE IN TRADITIONAL SMOKE *CLARIAS GARIEPINUS* FROM WURNO AND TAMBUWAL SOKOTO STATE  Umar Faruk, Sadiku.S.O. E, Ibrahim. S. U and Faruk Hassan Maradun | 478 |
| 65 | PHYTOCHEMICAL PROPERTIES OF MODIFIED BAMBARA-GROUNDNUT BASED PASTE READY-TO-USE THERAPEUTIC FOOD  Ibrahim Baba, Amina., Favour O. Jibrin, Samaila James, Ibrahim Abdulwaliyu | 485 |

|  |  |  |
| --- | --- | --- |
| 66 | EVALUATION OF TAMARIND SEED-BASED DIETS ON PRODUCTION OF  NILE TILAPIA (*Oreochromis niloticus*) FINGERLINGSREARED IN PLASTIC BOWLS  Alatise, S. P., Okoro, J. O., Ibrahim, R and Abubakar, M. J. | 492 |
| 67 | ASSESSMENT OF CONTAGIOUS BOVINE PLEUROPNEUMONIA ANTIBODY TITRES AT THE TEACHING AND RESEARCH FARM FEDERAL UNIVERSITY OF TECHNOLOGY MINNA  Kolawole, J. J. and Usman, A | 500 |
| 68 | NUTRIENT DIGESTIBILITY OF BROILER CHICKENS FED DIET DIFFERENTLY PROCESSED DOUM PALM (*Hyphaene thebaica*) MEAL DIETS  Akaka, A. O., Kudu, Y. S., Ibe, E. A. & Popoola, W. I. | 505 |
| 69 | PREVALENCE OF BLOOD PARASITES AMONG GOAT SOLD AT LIVESTOCK MARKETS IN NIGER STATE  P. S. Kolo, A. O. Maye, J. Y. Adama. K. O. Dauda, S. O. Abel, O. E. Adeniji, | 512 |
| 70 | PREVALENCE OF HARD AND SOFT TICKS AMONG YOUNG AND ADULT CATTLE IN A RESEARCH FARM  Abdulkadir Usman and Dorcas Damilola Alabi | 517 |
| 71 | NUTRITIONAL PROFILE OF COMMONLY CONSUMED INSECTS IN BIDA, NIGERIA  Omachi, B.A. & Abiodun, A.M. | 524 |
| 72 | IMPACT ASSESSMENT OF VALUE ADDITION IN FISH PRODUCTION IN IBEJU-LEKKI LOCAL GOVERNMENT AREA OF LAGOS STATE, NIGERIA  Okelola, O.E, Fakeye, A.O, Obute, C.U, Famogbiele, O.O, Olarewaju, V.O, Ajao,  A.O and Idowu, D.S. | 533 |
| 73 | ASSESSMENT OF FEEDING PRACTICES AND NUTRITIONAL STATUS OF UNDER FIVE CHILDREN IN DOKO, NIGER STATE.  Ejim, Millicent. Nwanneamaka., Omachi, Bosede.Alice., Ahmed-Sani Comfort and Okonkwo,Juliet Chinyere | 539 |
| 74 | GROWTH PERFORMANCE OF RABBITS FED DRY GRADED LEVEL OF BITTER KOLA (*GARCINA KOLA)* AS ADDITIVE  Suleiman, M.D, Kolo, P.S. Otu, B. O. and Akanji, K. O. | 546 |
| 75 | ANALYSIS OF FISH MARKETING IN IKORODU LOCAL GOVERNMENT AREA OF LAGOS STATE, NIGERIA  Okelola, O. E**.**, Korie, B. N., Olarewaju, O. C. U., Ajayi, A. S. and Ajao, A. O. | 552 |

|  |  |  |
| --- | --- | --- |
| 76 | EFFECT OF TWINE SIZES ON CATCH PERFORMANCE OF GILLNETS IN JEBBA LAKE, NIGERIA  Mohammed, Shamsuddeen and Yakubu Umar Paiko | 558 |
| 77 | PHYTOCHEMICAL ANALYSIS AND EFFECT OF ETHANOLIC EXTRACT FROM LEMON PEELS (*Citrus limon*) ON THE SENSORY QUALITY OF  SMOKED *Oreochromis niloticus*  R. Ibrahim, A. A. Orire, S. O. E. Sadiku, M. O. Ojo, S. P. Alatise, A.A. Liman and S.  F. Hamza | 566 |
| 78 | GROWTH PERFORMANCE AND GUT MICROFLORA COUNTS OF ROSS 308 BROILER CHICKENS FED PROBIOTIC BASED DIET AT THE STARTER PHASE  Eniwaiye A. A., Alabi, O.J., Lawal, B.O. and Owolabi, S.J | 574 |
| 79 | ASSESSING THE EFFECTS OF GRADED LEVEL OF GINGER (*ZINGIBER OFFICINALE*) ON THE GROWTH PERFORMANCE OF QUAILS (*Coturnix*  *coturnix japonica*)  Adesina, Oluwatosin Idowu, Tsado Daniel Nma & Ijaiya Abdulmojeed Tunji | 581 |
| 80 | DEVELOPMENT OF A DEEP LEARNING BASED WEED DETECTION SYSTEM FOR MAIZE FARMS  Bala, J. A., Folorunso, T. A., Nuhu, B. K., Abdullahi, I. M., Daniya, E., Adedigba, A. P., Ayuba, S. A., Olaniyi, O. M., and Salaudeen, M. T | 589 |
| 81 | A COMPUTER VISION-BASED ROBOTIC WEED SPRAYER FOR MAIZE FARMLAND PRECISION FARMING  Nuhu, B. K., Folorunso, A, T. Bala, J. A., Abdullahi, I. M., Daniya, E., Adedigba, A. P., Olaniyi, O. M. and Salaudeen, M. T | 599 |
| 82 | RESPONSE OF COMMERCIAL COWPEA VARIETIES TO INOCULATION WITH INDIGENOUS RHIZOBIA ISOLATES  Aliyu Anchau Abdullahi, Jafar Babashi Mustapha and Fatima Jibrin Abubakar | 607 |
| 83 | IMPACT OF SOIL PARENT MATERIALS ON LAND SUITABILITY FOR PRODUCTION OF SELECTED CROPS IN NIGER STATE  Daniel. M, Lawal. B.A, Mohammed. T, Usman. F.A and Ibrahim. P.A. | 616 |
| 84 | MICROALGAE AS SOIL NUTRIENT ENHANCERS: A REVIEW  Azeez Basit Adedoja, Abdulkareem Ambali Saka, Tijani Jimoh Oladejo, Mustapha Sherif Ishola & Sadic Majeed Akanchaliwari | 626 |

|  |  |  |
| --- | --- | --- |
| 85 | PRODUCTION AND ANTIFUNGAL ACTIVITY OF BIOSURFACTANT AGAINST STORED PRODUCT FUNGI  Ogunsola Emmanuel Adeyemi, Udeme J. J. Ijah | 642 |
| 86 | GROWTH AND YIELD PERFORMANCE OF CUCUMBER (*Cucumis sativus* L.) AS INFLUENCED BY NPK 15:15: 15 AND WATERING LEVEL IN IGBOORA, OYO STATE, NIGERIA  Fawole, Tolulope Olaoluwa, Oladapo, Olufemi Stephen, Omilabu, Sylvester Kunle, Oyaniyi, Tolu Onaolapo, Bidmos, Fuad Adetunji, Olla, Noah Olugbemiga | 651 |
| 87 | EFFECT OF POULTRY MANURE SOURCES AND LEVELS ON YIELD OF COWPEA IN MINNA  Saidu, Zaharadeen Bala, Uzoma, Anthony Ozoemenam, Eze, Peter Chukwu, and Abubakar, Hauwa Bosso | 658 |
| 88 | EFFECTS OF BIOFERTILIZER AND PLANT GROWTH ACTIVATOR ON S HEALTH AND AMARANTH PRODUCTIVITY IN ITAKPE, SOUTHERN GUI SAVANNA AGROECOLOGY  Yusuf, Momohjimoh., Yakubu, Nurudeen Okehi., Ateiza Lukman Onoruoiza., Musa, Musa Adamu | 664 |
| 89 | EFFECT OF RHIZOBIUM INOCULATION ON SOIL PHYSICAL AND CHEMICAL PROPERTIES OF ALIERO AND SOKOTO SUDAN SAVANNA ZONE OF NIGRIA  Garba A. I.M Bello.,A. Muhammad, and A. Abdulmalik | 680 |
| 90 | INFLUENCE OF POTASSIUM AND SODIUM CHLORIDES CONCENTRATIONS ON GROWTH AND YIELD OF TOMATO (*Solunum*  *lycopersicum* L.) IN SUDAN SAVANNAH  N. Mukhtar, Y. Unashi, Y. Sani, and M. Bukar | 685 |
| 91 | EFFECT OF DIFFERENT TYPES OF ORGANIC MANURES ON GROWTH AND  YIELD OF CARROT (*Daucus carota* L.)  H.M. Gujbawu, B.H. Kabura, M.S. Na-Allah & A. Muhammad | 692 |
| 92 | EVALUATION OF FALL ARMYWORM (*SPODOPTERA FRUGIPERDA*) INCIDENCE AND MORPHOLOGICAL TRAITS OF MAIZE (*ZEA MAYS* L.) GENOTYPES IN NIGER STATE, NIGERIA  Abubakar, U. F., Gana, A.S. & Oyewale, R.O. | 700 |
| 93 | EFFECTS OF RHIZOBIA INOCULATION ON GROWTH AND YIELD OF | 705 |

|  |  |  |
| --- | --- | --- |
|  | GROUNDNUT (*Arachis hypogaea* L.) VARIETIES IN THE SUDAN SAVANNAH LOCATION OF NIGERIA  Bello I. M., A. Muhammad, A. Abdulmalik and M. S. Na-Allah |  |
| 94 | EFFICACY OF BIODEGRADABLE AROMATIC PLANT EXTRACTS IN MANAGING ROOT-KNOT NEMATODES (*MELOIDOGYNE INCOGNITA*) INFESTATION IN GARDEN EGG (*SOLANUM MELONGENA* LINNAEUS)  Yohanna, J., Bello, L.Y. and Oyewale, R.O. | 711 |
| 95 | EFFECT OF FRUIT COLOUR, PLANT AGE AND WEED CONTROL ON THE  VIABILITY AND VIGOUR OF PEPPER (*Capsicum frutescens.* L) SEEDS  A. A. Moemeke, H. Ibrahim, E. Daniya and B. I. Oluwole | 718 |
| 96 | CHARACTERIZATION OF SHEA BUTTER OBTAINED FROM BIDA REGION, NIGER STATE, NIGERIA  Yunusa Baba Katamba, S. E Adebayo and Z. D. Osunde | 726 |
| 97 | GERMINATION AND SEEDLING GROWTH OF OKRA: A COMPARATIVE STUDY WITH COMPETITIVE WEEDS UNDER SALINITY STRESS  Rohimat Mustapha, Blessing Israel Oluwole1 and Emmanuel Daniya | 732 |
| 98 | TOWARDS THE DEVELOPMENT OF AN INTELLIGENT EVAPORATIVE COOLING SYSTEM FOR POST-HARVEST STORAGE OF SELECTED FRUITS  O. R. Isah, S. E. Adebayo, B. K. Nuhu, B. U. Umar, D. Maliki, I. M. Abdullahi, E. M. Dogo, O. M. Olaniyi & J. Agajo | 739 |
| 99 | EVALUATION OF HERBICIDE MANAGEMENT ON NODULATION OF COWPEA  Ezekiel-Adewoyin, D., E. Olanrewaju, R. Aniyikaiye, F. Tanko & E. Daniya | 748 |
| 100 | THE ROLE OF SPICES IN THE PREVENTION OF MICROBIAL FOOD SPOILAGE: A REVIEW  Akande, J.O. | 756 |
| 101 | EFFECTS OF CRUSHED GROUNDNUT SHELL AND OTHER SOURCES OF  NUTRIENT ON YIELD AND GROWTH OF OKRA (*Abelmoshus esculentus* L.)  Adesina O.A, Olawuyi B. C, & Zubairu Y. | 759 |
| 102 | EVALUATION OF DURUM WHEAT (*Triticum turgidum* L.) PERFORMANCE IN JEGA, SUDAN SAVANNA, OF NIGERIA.  M. Bukar, M. M Akibu, M.S. NaAllah, A. Muhammad, N Muktar and A M. Yusuf | 767 |

|  |  |  |
| --- | --- | --- |
| 103 | ASSESING THE EFFECTS OF DIFFERENT NUTRIENT SOURCES ON THE GROWTH, YIELD AND PHYSIOLOGICAL PROPERTIES OF FLUTED  PUMPKIN (*Telfairia occidentalis* HOOK F.)  Adesina, O. A, Yakubu, S. and Zubairu, Y. | 771 |
| 104 | EFFECT OF POULTRY MANURE RATES ON GROWTH AND YIELDS OF ONION (*Allium cepa L*.) IN SUDAN SAVANNAH OF MAIDUGURI, BORNO STATE NIGERIA  Yusuf. S, A.K. Mohammed & H.M. Gujbawu | 779 |
| 105 | EFFECT OF LAND USE TYPES ON SELECTED SOIL PROPERTIES IN COLLEGE OF AGRICULTURE MOKWA NIGER STATE.  Mohammed., T., Lawal, B. A, Muntaka, H.A., and Daniel, M. | 785 |
| 106 | EFFECTS OF TILLAGE AND NITROGEN FERTILIZATION ON NITROGEN USE EFFICIENCY OF MAIZE IN THE SOUTHERN GUINEA SAVANNA OF NIGERIA  Are, E. C., Adeboye, M.K.A., Odofin, A.J., Eze, P.C., Lawal, B.A and Mohammed, T. | 792 |
| 107 | RESPONSE OF MAIZE (*Zea mays* L.) TO WEED CONTROL TREATMENTS USING NICOSULFURON IN SUDAN SAVANNA AGRO-ECOLOGICAL ZONE OF NIGERIA  U. Ahmad, A. Muhammad, M. S. Na’alla, A.G. Ngaski, and Y.B. Unashi | 800 |
| 108 | MACHINE LEARNING FOR ENHANCED AGRICULTURAL PRODUCTIVITY AND FOOD SECURITY: A REVIEW  Akande, V.O. | 804 |
| 109 | INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT ON SELECTED ENZYME ACTIVITIES IN RELATION TO SELECTED SOIL CHEMICAL PROPERTIES IN RICE FIELD AT BADEGGI NIGER STATE, NIGERIA  Emmanuel, J., Ezekiel-Adewoyin, D.T., Uzoma, A.O. and Osunde, A.O. | 811 |
| 110 | INFLUENCE OF DIFFERENT RATES OF CATTLE DUNG MANURE ON THE GROWTH, YIELD AND YIELD COMPONENTS OF ACHA (*Digitaria iburua*  Kippis Stapf) AT RIYOM, JOS  Dachi, S.N., Muamba, K. E., Alaba I. N., Aminu, A. A., Chakven, J. E., and Amali, P. E | 819 |
| 111 | OCCURRENCE OF MOLDS (FUNGI) IN INDOOR TISSUE CULTURE  LABORATORIES | 826 |

|  |  |  |
| --- | --- | --- |
|  | Ezeofor A. O., Hassan, S. A., Abdul-Hadi, J. S., Iweajunwa, S. O., Onwuzulike, A. N, Odii – Akpa, C V and Salith, H. S. |  |
| 112 | SURVIVAL RATE OF YAM VINE NODAL CUTTINGS AS INFLUENCED BY DIFFERENT SUBSTRATES AND GROWTH HORMONES CONCENTRATION  Ohaegbulem, P.C., Adediran, O.A., & Oyewale, R. O. | 830 |
| 113 | INTELLIGENT RECOGNITION OF MATURED BEAN POD (*VIGNA UNGUICULATA* L*.*): A DEEP LEARNING-BASED APPROACH  Abdullahi, Ibrahim Mohammed, Kparbong, Ponjul Bali, Ibrahim Tauheed Musa, Situ, Ramotalahi Adenike, Olaniyi, Olayemi Mikail, Dauda, Solomon Musa, Balami, Ayuba Audu, Agidi, Gbabo., and Isiaku Aliyu Mohammed | 836 |
| 114 | IMPACT OF SOIL PARENT MATERIALS ON LAND SUITABILITY FOR PRODUCTION OF SELECTED CROPS IN NIGER STATE  Daniel. M, Lawal. B.A, Mohammed. T, Usman. F.A and Ibrahim. P.A. | 848 |
| 115 | VARIATION IN SEED QUALITY OF SESAME (*SESAMUM INDICUM* L.) PRESERVED IN DIFFERENT STORAGE CONTAINERS AND TEMPERATURE REGIME  M.I. Kanko, H. Brahim & O.A. Adediran | 857 |
| 116 | EFFECTS OF HIGH TEMPERATURE AND ELEVATED CO2 CONCENTRATIONS ON GROWTH AND PHYSIOLOGY OF CACAO  (*Theobroma cacao*) SEEDLINGS  Oluwafemi Adewumi Adesina and Andrew Daymond | 864 |
| 117 | EVALUATION OF SOILS AND SOCIO-ECONOMIC CHARACTERISTICS OF RICE FARMERS AROUND RIVER CHANCHAGA FLOODPLAIN IN NIGER STATE, NIGERIA  Ibrahim, A. K Lawal, B. A. Adeboye M.K.A, and Gana, A.S | 873 |
| 118 | INCIDENCE AND SEVERITY OF *TOMATO YELLOW LEAF CURL VIRUS*  DISEASE AND WHITE FLY ABUNDANCE ON TOMATO (*Solanum lycopersicon*  L.) IN SELECTED GROWING AREAS OF KEBBI STATE  J.J. Adigari I. J. Yusuf A., M. S. Na’Allah I.U. Mohammed and A. Muhammad | 882 |
| 119 | RESPONSE OF SWEET POTATO (*Ipomoea batatas* L.) ECOTYPES TO SWEET POTATO LEAF CURL VIRUS (SPLCV) IN ALIERO, KEBBI STATE, NIGERIA  I. J. Yusuf, I.U. Mohammed, A. Musa, A. Muhammad, M.S. Na-Allah, Y.A. Busari  A. Afiu, I. D. Yusif and P. Abraham | 888 |



|  |  |  |
| --- | --- | --- |
| 120 | GROWTH AND YIELD RESPONSE OF COWPEA (*Vigna unguiculata* (L.) Walp) UNDER DIFFERENT WEEDING REGIME AND SPACING  Mamudu, A.Y.; Usman N. & Isah A.S. | 895 |
| 121 | PROPELLER PERFORMANCE AND DOWNWASH CHARACTERISTICS OF AGRICULTURAL DRONES  Adanu E.O, Mat Su, A. S., Ismail S.A., Musa Y, Hammani B, & Audu D**.** | 901 |
| 122 | GROWTH AND AESTHETIC CHARACTERISTIC OF QUEEN OF THE NIGHT  (*Mussaenda philipica*) AND BOUGAINVILLEA *(Bougainvillea spectabolus)* AS INFLUENCED BY DIPPING DURATION IN HORMONE  H. M. Ibrahim, R. O. Oyewale, Y. Zubairu, R. O. Ibrahim, A.A. Bahago, S. G. Saadu and J. C. Nwobu | 910 |
| 123 | RESPONSE OF MAIZE (*Zea mays* L.) TO NICOSULFURON RATES AND WEEDING REGIMES IN SUDAN SAVANNAH OF NIGERIA  O.O. John**,** Na‘Allah, I. J. Yusuf, A. Muhammad, and M.U. Tanimu | 916 |
| 124 | PRODUCTIVITY OF MAIZE *(ZEA MAYS* L.) AS INFLUENCED BY POULTRY DROPPING RATES IN SUDAN SAVANNA AGRO-ECOLOGICAL ZONE OF NIGERIA  M.M. Akibu, A. K Aisha, M.S. Na-Allah and I. J. Yusuf | 925 |
| 125 | EFFECTS OF POULTRY MANURE ON THE NUTRIENT ELEMENT ABSORBTION AND PROXIMATE COMPOSITION OF GARDEN EGGS  (*Solanum melongena* L.)  Waziri, A, Gudugi, I.A.S. and Garba, Y**.** | 932 |

**WELCOME ADDRESS BY THE DEAN, SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY, MINNA**

**ON THE OCCASION OF THE OPENING CEREMONY OF THE**

**3RD INTERNATIONAL CONFERENCE OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY (ICAAT) HELD ON**

**DECEMBER 1ST - 4TH, 2024**

**AT THE CAVERTON LECTURE THEATRE AT 10.00AM PROMPT**

Good morning, distinguished Vice Chancellor, members of the university management team, Deans, Professors, HODs, esteemed keynote and plenary speakers, honoured invited guests, colleagues, scholars, students, and friends.

It is a great privilege and a profound honour to stand before you today as we gather for the opening ceremony of the 3rd International Conference of the School of Agriculture and Agricultural Technology, here at the Federal University of Technology, Minna. I warmly welcome each of you and extend my sincere appreciation for making the time to join us in this significant discourse. Your presence here is a testament to your dedication to the advancement of agricultural research and development for a better and more food-secure world.

The theme for this year’s conference, "Integrated Approaches to Achieving Food Security through Artificial Intelligence and Effective Policy Implementation," underscores the urgency and complexity of our collective mission. As we confront mounting challenges, including food scarcity, climate change, and evolving agricultural demands, we must embrace innovative solutions to ensure the availability, accessibility, and sustainability of food for every member of our global community.

Artificial intelligence has emerged as a transformative tool, offering unprecedented opportunities for precision agriculture, predictive analysis, resource optimization, and data-driven decision- making. However, technological innovation is only one piece of the puzzle. Effective policy implementation—grounded in collaboration, inclusivity, and the practical realities of our farmers and stakeholders—will serve as the necessary enabler for meaningful change. It is this dynamic intersection of innovation and governance that we seek to explore and strengthen over the course of this conference.

I am deeply encouraged by the wealth of knowledge and expertise represented here today. Our esteemed keynote and plenary speakers will provide valuable insights that challenge conventional thinking and illuminate new pathways for progress. The diverse range of research presentations, discussions, and networking opportunities will undoubtedly inspire fresh perspectives and collaborative ventures.

I would like to express my heartfelt thanks to our Vice Chancellor, whose unwavering support and leadership continue to propel the Federal University of Technology, Minna, to the forefront of academic excellence. To the university management, the Niger State Government, our

sponsors, and all those who have contributed to the organization of this conference, your dedication and hard work are the backbone of this success.

As we embark on this important journey together, I encourage every participant to engage openly, exchange ideas, and form connections that extend beyond these sessions. Our shared commitment to food security demands innovation, resilience, and collective action, and I am confident that the deliberations here will leave a lasting impact.

Thank you, and I wish you all a highly successful, enriching, and productive conference.

**Professor Jacob Haruna Tsado,**

**Dean, School of Agriculture and Agricultural Technology December 2, 2024**

#### INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT ON SELECTED ENZYME ACTIVITIES IN RELATION TO SELECTED SOIL CHEMICAL PROPERTIES IN RICE FIELD AT BADEGGI NIGER STATE, NIGERIA

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#### ABSTRACT

Soil enzyme activities provide an easy, relatively rapid and low cost production to monitor soil health. Integrated soil management effect on urease and acid phosphatase activities was determined by collecting ***s***oil samples from four (4) rice farmers field in Badeggi, Niger State. Where***;*** *Control*, Farmers’ practice (NPK); 150 kg ha-1 NPK (15:15:15), OCP special blend; (NPK 15:15:15 fertilizer fortified with Zn and Ca.), 600 kg ha-1, cow dung; (5-ton ha- 1), ½ cow dung + ½ NPK and ½ cow dung + ½ OCP special blend fertilizer were applied accordingly. The experiment was laid out in a Randomized Complete Block Design (RCBD) replicated four times. Data were collected according to standard and subjected to Analysis of Variance using GenStat (11th Edition). Significant means were separated using Least Significant Difference (LSD) (p ≤ 0.05). Results showed that Cow dung application consistently resulted in the highest urease activity throughout the growth stages of rice production, indicating its significant role in promoting ammonium volatilization. This was evident with urease activities of 665 µg NH4+ N g-1 soil h-1, 511 µg NH4+ N g-1 soil h-1 and 427 µg NH4+ N g-1 soil h-1 at planting, flowering and at harvest respectively, surpassing all other treatments. Similarly, cow dung application and its combination with NPK and OCP showed notable effect on acid phosphatase activities all through the different growth stages. There was positive relationship between urease activity and pH while it negatively correlated with the other observed nutrients. Whereas, acid phosphatase activity had positive relationship with pH, Organic carbon, Total nitrogen and Available Phosphorus. The observed significant response variation among treatments at different growth stages of rice, highlights the dynamic nature of soil as it influenced the existing microbes (enzyme activity) in the rhizosphere in response to the various soil management practices adopted by farmers. Hence altering soil health and its productivity. Therefore, the use of OCP special blend for improvement of soil available phosphorus should be encouraged while the sole use of cow dung should be discouraged on rice field.

**Keyword:** Urease, Acid phosphatase, Rice, OCP special blend, NPK, Organic manure

#### INTRODUCTION

In larger parts of Badeggi, rice is being grown under flooded conditions. Rice-rice cropping system is the most dominant cropping system adopted by rice farmers in Zone – A, of Niger State. Submerged soils ecosystems are predominantly anaerobic and are different from upland soils in several physical and biological properties (Adhya and Rao, 2005). The growth rate of world agricultural production and crop yields have slowed, raising fears that the World may not be able to grow enough foods to meet the needs of the present and future population, and generation (Lal, 2015). Declining trend in productivity due to continuous use

of chemical fertilizers alone has been observed in several long term experiments all over Nigeria, which could be attributed to the use of inappropriate agricultural practices and higher dependency on synthetic fertilizers, leading to constant decline in factors of productivity and low yield of crops; hence an adoption of integrated nutrient management (Liu *et al*., 2021).

For soil health/fertility sustainability, integrated soil fertility management (ISFM) is one of the reliable technologies farmers are encouraged to adopt of recent, which implies the combination of different sources of soil amendments in small quantities; to complement the limitations of each component (Ezekiel-Adewoyin *et al*., 2023). Organic manures used in rice cultivation serve as carbon and energy source for proliferation of microorganisms, which may alter the activities of different soil enzymes (Srinivas and Sridhar (2022). Use of chemical fertilizers and organic manures has been found promising in arresting the decline trend in soil-health and productivity through the correction of marginal deficiencies of some macro- nutrients, micro-nutrients, micro-flora and fauna and their beneficial influence on physical and biological properties of soil (Nath *et al*., 2015). Kumar (2018) stated that Integrated Nutrient Management (INM) increased soil urease, phosphatase activities and soil available nutrients. Soil enzymatic activities have been proposed as appropriate indicators because of their intimate relationship to soil biology and rapid response to changes in nutrient management. However, interactions between INM practices, soil chemical properties (nutrient availability, pH), and soil biological properties (microbial communities, enzyme activities) in rice fields are intricate and can vary depending on specific local conditions (Fageria *et al*., 2011; Mandal *et al*., 2019). Urease and phosphatase activity is responsible for N- and P-metabolism in the soil (Nwankwo, 2018). Therefore, the activities of urease and phosphatase play crucial role in N and P cycling, respectively (Garcia-Ruiz *et al*., 2008). Farmers need continuous access to improved rice technologies to boost their rice productivity in Niger State. Enhancing productivity of rice is the major concern to meet the demand for food by the increasing human population. Therefore, addressing the knowledge gap related to INM's influence on soil properties as affected by enzyme activity is vital for sustainable rice production in Baggegi, Niger State, Nigeria.

#### MATERIALS AND METHODS

###### Study Area

***Soil samples were collected from four (4) rice farmers’ field in Badeggi according to the applied treatments.*** Badeggi is situated in the Southern Guinea Savanna ecological zone of Nigeria with: Latitude: 9º 33' 22.68''N, and Longitude: 6º 08' 36.83' E with an elevation of 120 m, above sea level. With a mean annual rainfall of about 1128 mm with mean annual minimum and maximum temperature of 26 ºC and 32 ºC respectively.

##### Experimental Design and Treatments

The trial was established on four (4) farmers’ fields in the study area. The experiment was laid out in a Randomized Complete Block Design (RCBD) with each of the farmers’ field serving as a replicate. The treatments were; Control, Farmers’ practice of 150 kg ha-1 NPK 15:15:15, OCP special blend (NPK 15: 15:15 fertilizer, fortified with Zn and Ca.) 600 kg ha-1 was divided into two equal halves for application at 2 and 4 weeks after transplanting (WATP). Cow dung (5 tons ha-1/ 2 weeks after transplanting (WATP)), ½ Cow dung {2.5 tons ha-1) + ½ Farmers practice (75 kg ha -1 NPK 15:15:15) and ½ Cow dung (2.5 tons ha-1) +

½ OCP special blend fertilizer (300 kg ha-1).

Source of Experimental Materials

Improved seeds of rice (FARO 44) from National Cereals Research Institute (NCRI), farm yard manure (cow dung) from Teaching and Research Farm, Federal University of Technology, Minna and the Nigeria Institute of Soil Science (NISS), Abuja, provided bags of NPK (15:15:15) fertilizer and "Office Cherefien des Phosphates" (OCP) special mix NPK fertilizer (20:10:5+1Zn+2Ca), which is supplemented with calcium and zinc.

##### Soil Sampling and Analysis

Prior to the commencement of the experiment, soil samples from each farmers’ field were randomly collected at a depth of 0 – 15 cm using soil auger. The soil samples were carefully collected at intervals of 5 m, in a plastic bucket, bulked and mixed thoroughly with hand- trowel to form a composite from which sub-sample was collected and labelled according to treatments. Before planting at flowering and after harvest. Chemical and biological analysis was done in Soil Science and Land Management Laboratory, Federal University of Technology, Minna.

pH was determined in 1:2 wt/v mixture of soil and water according to Anderson and Ingram (1993). The organic carbon content was determined using according to Walkley - Black wet oxidation method (Walkley and Black, 1934). Total nitrogen was determined by micro- Kjeldahl digestion method. Available phosphorus was extracted using BrayP-1 method of extraction and determined calorimetrically. Also, laboratory characterization was conducted on the collected cured manure (cow-dung) that was used using the standard methodology. For the release of NH4-N from the hydrolysis of urea as described by Tabatabai and Bremner (1972) and acid phosphatase by Tabatabai method (1994).

##### Statistical Analysis

Data collected was subjected to Analysis of Variance (ANOVA) using GenStat (11TH Edition). Significant differences between treatment means were separated using Least Significant Differences (LSD) at 5 % level of significance. Soil enzyme activities were correlated with the selected soil chemical properties using Pearson correlation.

#### RESULTS

##### Initial soil analysis of the study site

The soil of the study site was slightly acidic in nature with pH 6.1. Total Nitrogen (0.04g kg- 1), Available Phosphorus (5.24 g kg-1) and Organic Carbon (g kg-1) were all low in the soil of the study area according to Chude *et al.* 2011.

##### Effect of integrated nutrient management on urease activity in rice field

The effect of organic and inorganic fertilizer on soil urease activity is presented in Table 1. The treatments significantly affected urease enzyme activity (p ≤ 0.05). Application of cow dung recorded the highest urease activity of 661, 511 and 534 µg NH4+-N g-1 dw soil, before planting, at flowering and at harvest of rice respectively. Followed by ½ cow dung + ½ NPK (392, 371, 321 µg NH4+-N g-1 dw soil) respectively. However, OCP special blend also recorded high activity of 469, 301 and 306 µg NH4+-N g-1 dw soil) respectively, followed by control (294, 175 and 184 µgg-1) respectively, ½ cow dung + OCP special blend (175, 154 and 147 µg NH4+-N g-1 dw soil) respectively, then NPK (77, 112, 77 µg NH4+-N g-1 dw soil) respectively in that arrangement. Urease activity as a result of ½ cow dung + NPK was

significantly higher than that due to the control and application of ½ cow dung + ½ OCP special blend and NPK.

##### Table 1: Effect of Organic and Inorganic Fertilizer on Soil Urease activity (µg NH4+-N g-1 dw soil h-1)

|  |
| --- |
| **Treatments Before planting At flowering At harvest** |
| Control 294d 175d 184d  NPK 77f 112f 77f  OCP 469b 301c 305.7c  Cowdung 665a 511a 534a  ½ Cowdung + ½ NPK 392c 371b 329b  ½ Cowdung + ½ OCP 175e 154e 147e |

Means with same letter in a column are not significantly different at 5 % level of probability.

Effect of integrated nutrient management on acid phosphatase in rice field

Table 2 presents the effect of integrated nutrient management on acid phosphatase in rice field. Control treatment recorded the highest phosphatase activity before planting and at harvest, at flowering 5 tons ha-1 cow dung recorded (2.35 and 22.7 µg p-nitrophenol released g-1 soil h-1) at harvest, while ½ cow dung + ½ OCP special blend had 2.26 µg p-nitrophenol g-

1 soil h-1, NPK had (2.24 µg p-nitrophenol released g-1 soil h-1) before planting and OCP special blend had the lowest activity before planting and at harvest even at flowering it had about the lowest phosphatase activity.

##### Table 2: Effect of Organic and Inorganic Fertilizer on Soil Acid Phosphatase activity (µg p-nitrophenol g-1 soil h-1)

|  |
| --- |
| **Treatments Before planting At flowering At harvest** |
| Control 2.29a 2.30b 2.29a  NPK 2.24c 1.87e 2.12d  OCP 1.93e 2.21d 2.09e  Cowdung 2.22d 2.35a 2.27b  ½ Cowdung + ½ NPK 2.24c 2.27c 2.25c  ½ Cowdung + ½ OCP 2.26b 2.27c 2.25c |

Means with same letter in a column are not significantly different at 5 % level of probability

Relationship between Selected Enzymes’ Activities and Selected Soil Chemical Properties Table 3 presents the results of the correlation analysis, the result obtained depicted positive relationship between urease activities, acid phosphatase and pH (H2O) but urease activity was negatively correlated with Organic carbon (OC), Total nitrogen (TN) and Available phosphorus (AP), and were significantly different (P ≤ 0.05). While there was a positive relationship between acid phosphatase activity with pH, OC, TN, AP and significant at P ≤ 0.05.

**Table 1: Correlation analysis of Enzyme activities with selected soil chemical properties**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Soil | UA | ACP | pH | OC | TN |
| UA ACP | 0.310\* |  |  |  |  |
| pH | 0.261\* | 0.233\* |  |  |  |
| OC | -0.086\* | 0.805 | 0.000 |  |  |
| TN | -0.537\* | 0.290\* | 1.182\* | 0.524 |  |
| AP | -0.574\* | 0.324\* | 0.429 | 0.544 | 0.908 |
| NS: Not significant, \*Significant, @p<0.05, UA: Urease activity, ACP: Acid phosphatase, OC: Organic carbon, AP: Available phosphorus, TN: Total nitrogen. | | | | | |

#### DISCUSSION

##### Initial soil analysis of the study site

Slightly acidic soil nature (pH 6.1) is within the pH limit of 5.8 to 6 recommended for availability of most soil nutrients (Onyekwere *et al*., 2023). The low organic carbon, total N and available P is an indication of high nutrient mining of the soil of the study site due to continuous cultivation of rice year in year out and use of inorganic fertilizer. Therefore, rice Farmers need continuous access to improved rice management technologies to boost rice yield and still sustain soil health: hence the adoption of integrated nutrient management for soil fertility and productivity sustainability cannot be ignored.

##### Elemental composition of the organic fertilizer (cow dung)

The high alkaline pH of the organic fertilizer was due to high presence of exchangeable bases. The high total N (1.75%) and phosphorus (2.15%) content might be attributed to high proportion of nitrogen and phosphorus as plant nutrients in organic manures. This finding agrees with that of (Onyekwere *et al*., 2023) who reported in their studies that organic manures are always richly high in Nitrogen, Phosphorus and Potassium. The C:N and C:P ratio of 14:1 and 11:1 could be as a result of high content of carbon over low N and high content of carbon over P in the feed taken up by the cow. This finding is in accordance with that of (Midya *et al*., 2021) whose studies stated that feed with high proportion of carbon content is required as energy sources for livestock and its by product always high in carbon. This study also conformed with that of (Lal, 2015) who stated that organic matter serves as a nutrient reservoir, holding essential elements like nitrogen (N), phosphorus (P), and potassium (K) as well as trace elements. As organic materials decompose, nutrients are gradually released, ensuring a steady supply to growing plants. This slow-release mechanism helps prevent nutrient leaching and runoff, thereby reducing the risk of environmental pollution.

##### Effect of integrated nutrient management on urease activity in rice field

Urease is an extracellular enzyme involved in the breakdown of soil organic matter into smaller compounds and their measurement has proven to be a powerful tool in evaluating the functionality of soils**.** The importance of urease in N cycle generating accessible N for plant growth is of necessity for quantifying the efficient use of fertilizer applied. Application of cow dung recorded significantly highest urease activity on rice plot, followed by its combination with NPK which was at par with the value recorded on the plot treated with OCP Special Blend. The use of ½ Cow dung + 1/2 OCP and NPK had the lowest urease activity value which was not significantly different from the control.

Soil treatment with cow dung produced the highest urease activity while the treatment with 150 kg ha-1 of NPK produced the lowest activity. This is an indication that cow dung supported the reduction in nitrogen availability due to N loss as a result of NH4+ volatilization in the form of ammonia (NH3). Previous studies have shown that the application of NH4 fertilizer to basic soil converts the NH4 salt to NH3 gas thereby increasing NH4 + volatilization. Applying cow dung with basic pH of 9.40 most likely moved the initial soil pH of 6.1 to an alkaline/basic value thereby converting NH4+ N to NH3. . More so, addition of organic materials brings about proliferation of microorganisms leading to increased enzyme activity (Lloyd and Sheaffe, 1973). The application of NPK (15-15-15) which produced the lowest urease activity invariably produced the highest nitrogen availability or the lowest NH4+ N volatilization. This was probably achieved by lowering the pH of soil and minimizing NH + N volatilization. On the other hand, the addition of OCP special blend to the soil must have altered the initial soil pH of 6.1 to slightly basic value which resulted in urease activity of 306 µg NH4+ N g-1 dw soil that was comparable to urease activity of 329 µg NH4+-N g-1 dw soil due to the application of ½ cow dung + ½ NPK.

4

##### Effect of integrated nutrient management on acid phosphatase activity in rice field

Soil contains acid phosphatase activity in variable amounts depending on microbial count, types of organic materials, other macroscopic living organisms and their activities, the amount of phosphatase released into the soil can then be directly co-related to soil fertility. This study revealed significant differences in the soil phosphatase of the study area with and without the treatments applied. The control plot had the highest value which was however not significantly (P ≤ 0.05) different from the plot treated with cow dung, possibly because phosphorus is unavailable in the form of Aluminum and Iron hydroxy phosphates as a result of the soil reaction (pH (6.1)) and less degradation of the substrate in cow dung at the point in time, thereby increasing the acid phosphatase activity (Wu and Ma 2015). This is similar to the report of Anwesha *et a*l., (2012). Who reported that phosphatase which are present in soil must be heterogeneous because they are generated from various macro and microscopic organisms.

The control plot was higher in acid phosphatase indicating that the inherent available P content of 5.24 mg kg-1 was the lowest compared to all other treatments. Studies have shown that high phosphatase activity is an indicator of low phosphorus availability (Onyekwere *et al*., 2023). An inclusion of cow dung lowered phosphatase activity compared to the control as a result of the solubilization or mineralization of soil organic and inorganic P, which could make phosphorus more available compared to the control. The C:P ratio of cow dung (11:1) explains partly why phosphorus was solubilized or mineralized (Onyekwere *et al*., 2023).

##### Correlation of selected soil enzyme activity with selected chemical properties

Correlation of Urease activity with selected chemical properties in a negative manner signifies an inverse relationship. This means that as urease activity increases, the concentration of the chemical elements decreases. The result demonstrated that urease activity correlated negatively with total nitrogen implying that increase urease activity resulted in decrease in total Nitrogen content of soil due to Ammonium salt volatilization. These agree with the finding of Uzoma *et al.,* (2018) who reported a negative correlation between urease activity and total nitrogen. Similarly, a negative correlation was also observed between acid phosphatase and available phosphorus implying that as phosphatase activity

increases, available phosphorus decreases. Since rice grows in the interactive ecosystem involving soil – microorganism – rice and atmosphere, rice development consequentially affected soil microorganisms and soil enzymatic activities. Among the various enzymes, phosphatase speeds up soil organic phosphorus decomposition and improves soil phosphorous concentration, which is an important index to assess soil phosphorus bio – availability. Phosphatases are capable of catalyzing hydrolysis of esters and hydrides of phosphoric acid. In soil ecosystem, these enzymes are believed to play critical roles in ‘P’ cycle as evidence shows that they are correlated to ‘P’ stress and plant growth. Apart from being good indicators of soil fertility, phosphatase enzymes play key role in the soil system. Acid phosphatase provides a potential index of mineralization of soil organic P.

The results emphasize the importance of integrating organic amendments like cow dung alongside balanced inorganic fertilizers (NPK and OCP) to optimize soil health and enhance enzymatic activities crucial for nutrient availability. Understanding these interactions provides valuable insights for sustainable agricultural practices aimed at improving soil fertility, crop productivity, and environmental stewardship. The use of OCP special blend for improvement of soil available phosphorus should be encouraged while discouraging the use of cow dung only. Likewise, NPK or the combination of ½ cow dung + ½ OCP special blend should be used to reduce NH4+ N loss.

#### REFERENCES

Adhya T K & Rao V R (2005). Microbiology and microbial processes in rice soils. In: Sharma S D, Nayak, B.C. (Eds.), Rice in Indian Perspective. Today and Tomorrow Printers and Publishers, New Delhi, Pages 719–746

Chude, O. S. O. Olayiwola, A. O. Osho, & Daudu, C. K. 2011. Fertilizer use and management, practices th for crops in Nigeria, 4 Edition produced by Federal Fertilizer Department, Federal Ministry of Agriculture and Rural Development, Abuja, December, 2011.

Srinivas D.and T. V. Sridha (2022). Urease Activity and Grain Yield of Rice as Influenced by the Long-term Effect of Application of Organic Manure and Inorganic Fertilizers under Flooded Conditions The Andhra Agric. J 69 (2): 199-203, 2022.

Ezekiel-Adewoyin, D.T. M. Tella, F. Tanko, A.O. Uzoma, R. Ederigbe & P.A. Tsado (2024). Effect of Agricultural Lime, Organic and Inorganic Fertilizer On Arbuscular Mycorrhizal Fungi Population and Diversity In Maize Rhizosphere Soil In Niger State. Journal of Agriculture and Agricultural Technology, Volume 13(1): 57-71.

Fageria, N. K., Baligar, V. C. & Li, Y. C. (2011). The role of nutrient-efficient plants in improving crop yields in the twenty-first century. *Journal of Plant Nutrition*, 34(7), 995-1027.

Garcia-Ruiz, R., Ochoa, V., Hinojosa, M.B., Carreria, J.A. (2008). Suitability of enzyme activities for the monitoring of soil quality improvement in organic agricultural systems. Soil Biol. Biochem. 40, 2137-2145.

International Soil Reference and Information Center/Food and Agriculture Organization (ISRIC/FAO 2015). FAO.ORG

Kumar, U. (2018). Continuous application of inorganic and organic fertilizers over 47 years in paddy soil alters the bacterial community structure and its influence on rice production. *Agricultural Ecosystem Environment*. (2018)

Lal, R. (2015). Restoring soil quality to mitigate soil degradation. Sustainability, 7(5), 5875- 5895.

Liu, W., Zhang, L., Li, Z., & Hu, B. (2021). Reducing nitrogen losses and greenhouse gas emissions with precision agriculture for sustainable intensification of agriculture. *Science of the Total Environment*, 769, 144-492.

Mandal, A., Patra, A. K., Singh, D., Swarup, A., & Masto, R. E. (2019). Effect of long-term application of manure and fertilizer on biological and biochemical activities in soil during crop development stages. Geoderma, 337, 503-512.

Midya, A., Saren, B. K., Dey, J. K., Maitra, S., Praharaj, S., Gaikwad, D. J., & Hossain, A. (2021). Crop establishment methods and integrated nutrient management improve: Part ii. nutrient uptake and use efficiency and soil health in rice (Oryza sativa L.) field in the lower indo-gangetic plain, India. *Agronomy*, *11*(9), 1894.



Nath, D. J., Gogoi, D., Buragohain, S., Gayan, A., Devi, Y. B., & Bhattacharyya, B. (2015). Effect of integrated nutrient management on soil enzymes, microbial biomass carbon and soil chemical properties after eight years of rice (Oryza sativa) cultivation in an Aeric Endoaquept. *Journal of the Indian Society of Soil Science*, 63(4), 406-413.

Nwankwo, V. C. (2018). Performance of upland rice using organic and inorganic fertilizer on an ultisol in Owerri, South East Nigeria.

Oduro, A.O. Olawuyi, T. & Olatoye, O. (2024). Effects of Utilization of improved rice production Technologies on Productivity among Smallholder Farmers in Niger State. Badeggi Journal of Agricultural Research and Environment, 6(6), 59-68. <http://doi/10.35849/BJARE202402/180/006>.

Onyekwere, I. N., Chukwuemeka, O. S., Nnabue, I., Asemtoa, D. O., & Alex-Okorafor, C. (2023). Productivity of cassava and upland rice intercropping system in soils derived from shale parent material in South East Nigeria. Centennial, 698.

Bhavani, S. K Chandra Shaker, G Jayasree and B Padmaja (2017). Effects of long term application of inorganic and organic fertilizers on soil biological properties of rice Journal of Pharmacognosy and Phytochemistry 2017; 6(5): 1107-1110.

Tabatabai, M. A. and Bremner, J. M. (1972). Assessment of urease activity in soils. Soil Biology and Biochemistry 4: 479-487.

Tabatabai M. A. (1994). Soil enzymes in : Weaver R. W., Angle, J. S., Bottomley. P.S. (eds). Methods of soil analysis, part 2. Microbiological and biochemical properties. SSSA Book Series No 5. Soil Sci. Soc. Am. Madison, Wis., pp. 775-833.

Trasar-Cepeda C, Leiros MC, Seoane S, Gil-Sotres F. (2008). Hydrolytic enzyme activities in agricultural and forest soils. Some implications for their use as indicators of soil quality. Soil Biology and Biochemistry. 2008; 40: 2146-2155.

Uzoma, A. O. (2019). Urease Enzyme Activity in Surface Soils under Various Land use Types in Minna, Southern Guinea Savanna. Agricultural Extension Journal 2019; 3(2):78-84. AEXTJ/Apr-Jun-2019/Vol 3/Issue 2.

Walkley, A. and Black, I. A., (1934). An examination of Degtgareff method for determining soil organic matter and a proposed modification of the chronic acid extraction method, Soil Science, (37): 29 –32.