

Summary of diagnosis and surveillance activities

Purpose	2019	2020	2021
For Routine diagnosis			
Received or collected	3014	8502	2866
Tested	3014	8502	2866
For Epidemiological surveillance or disease monitoring			
Received or collected	25728	48060	16009
Tested	25728	48060	16009

INFECTIOUS DISEASE	No. of suspected cases received / No. confirmed		
	2019	2020	2021
Highly Pathogenic Avian Influenza	858 (11)	721(2)	794(185)
Newcastle disease virus	858 (16)	721(20)	794(48)
Rabies	207(137)	177 (109)	125 (81)
Foot and Mouth Disease	116 (21)	1239 (885)	667 (8)
African Swine Fever	1762/213	369/114	67/7
Pest des petit ruminants	267/90	148/39	951/350
Contagious Bovine Pleuro-Pneumonia (CBPP)	325 (47)	551 (258)	325 (95)
Brucellosis	650 (46)	1142 (0)	161 (3)
COVID-19	-	40323	12045
Rabbit Hemorrhagic Disease	-	3951 (5)	(5) 2

RESEARCH HIGHLIGHTS

Naphthylisoquinoline alkaloids derived from Nigerian *Ancistrocladus uncinatus* as potential therapeutic against African Swine Fever virus.

The African swine fever virus (ASFv) is the cause of one of the most devastating haemorrhagic disease of domestic pigs and poses a significant threat to pork production globally. There is currently no known effective vaccine or therapeutic agents for the control ASF. Ongoing search for effective anti-ASF viral drugs has been limited mainly to *in vitro* experimental studies using known antibiotics and plant metabolites. Previously, the inhibitory effects of crude extracts of *Ancistrocladus uncinatus* on ASFv *in vitro* has been demonstrated by a research group in the Institute. This plant contains naphthylisoquinoline alkaloids (NIQs), a class of structurally and biosynthetically unique polyketide-derived natural products.

Therefore, a project was designed to prepare pure NIQ compounds and assess the anti-ASFv activities *in vitro* using cellular and molecular end-points.

So far, plant materials were obtained from Abang region of Cross-River state, identified and voucher specimen deposited. Furthermore, extraction of active ingredients and the subsequent isolation and structural elucidation of purified alkaloids was performed using high performance liquid chromatography, mass spectrometry and nuclear magnetic resonance analyses according to standard procedures. From the materials subjected to the analyses, 16 pure NIQs compounds were identified. Serial dilutions of 7 NIQs were prepared and the determination of the *in vitro* activity of the compounds on ASFv is currently ongoing in partnership with the Biotechnology Division, NVRI.

Some of the processes were conducted in the facilities of the Institute of Organic Chemistry, University of Würzburg, Germany in partnership with Prof Gerhard Bringmann.

It is anticipated that the outcome of this project will pave way for the isolation and development of products with high therapeutic effect against ASFv for the control of ASF in Nigeria.

Development of an herbal based topical agent for the control of Dermatophilosis

Dermatophilosis (locally called kirchi) is a skin disease of livestock caused by a bacterium called *Dermatophilus congolensis*. It affects many species of domestic animals such as cattle, sheep, goats, horses, and less frequently, dogs, pigs and cats, resulting to financial and economic loss to the farmer. Zoonotic potentials of the diseases have been documented. Treatment is usually by the administration of systemic antibiotic in combination with topical medications, but results are not usually satisfactory. Lamstreptocide a formulation of the Institute using natural products has been a major topical preparation used in the treatment of this disease with good results. However, the raw materials for its production has become scarce and expensive. This necessitated the search for alternative effective substitutes. To this end, a project was designed to assess the efficacy and suitability of dried leaf powder of *Vernonia amygdalina* (bitter leaf) as chief ingredient for the formulation of a topical medication against dermatophilosis and other skin diseases of animals and man.

Leaves of *Vernonia amygdalina* were collected and air-dried, pounded and sieved into fine powder. The powder was used in the production of medications for topical application for the control of dermatophilosis.

The current product is prescribed to be applied on affected part of the body twice per week. Results obtained from field trails on animals naturally infected with dermatophilosis is promising with most cases resolving within eight weeks after the initiation application of the newly formulated product.

BACTERIAL RESEARCH DIVISION

Function and Mandate

1. Conduct research on bacterial diseases of economic and public health importance which include but not limited to:
 - a. *Mycoplasma* infection
 - b. *Pasteurella* infection
 - c. *Brucella* infection
 - d. *Campylobacter* infection
 - e. *Salmonella* infections
 - f. *Escherichia coli* infection
 - g. Other bacterial infections as the need arise.
2. Determination of drug efficacy on bacterial isolates of economic and public health importance.
3. Development of biologicals and sera (antigens and antisera) for the diagnosis, treatment and control of economically important bacterial diseases of livestock.
4. Type culture collection and storage of bacterial agents of livestock diseases.
5. Routine diagnosis of referral samples (serology, culture and molecular analysis) for the identification of bacterial agents.
6. Conduct surveillance for emerging and re-emerging bacterial diseases

Specific notable activities

***Brucella* research laboratory**

1. A survey of camel brucellosis was carried out in Kano and Jigawa states where 473 samples were collected from abattoirs and camel markets. Four samples (0.8%) were positive for *Brucella* by the by Rose Bengal Precipitation Test (RBPT).
2. Routine serological diagnosis of *Brucella* was carried out on 1117 serum samples consisting of 447 from cattle, 268 from dogs, 112 from goats, 349 from sheep and 1 from a pig. Positive samples were recorded in 11, 4, and 2 samples from cattle, sheep and goats, respectively.
3. Routine culture for the isolation of *Brucella* was conducted on 22 vaginal swabs and one each of lungs, liver, and abomasum content of cattle. No *Brucella* isolate was obtained from all the samples.
4. Student project supervision-The Laboratory provided bench space and assisted eight students to conduct their postgraduate (PhD-1 and MSc-1) and Higher National Diploma (HND-6) research projects.

***Mycoplasma* research laboratory**

The *Mycoplasma* laboratory received 551 samples (sera, lung tissue and nasal swab) from cattle and 16 (oropharyngeal swab) from poultry for the routine diagnosis of *Mycoplasma*

spp. infection. Out of the samples screened 258 (46.8%) from cattle were positive. None of the samples from poultry was positive.

Additionally, 760 samples from cattle, 108 from poultry and one each from sheep and goat were collected for analysis. The results are being awaited.

Three (3) PhD students from ABU Zaria and one (1) from Usman Danfodio University Sokoto are conducting their research projects in the Mycoplasma Research laboratory.

Achievements

1. Proposal for the “**Development of a Novel Vaccine against CBPP**” was submitted and awaiting funding.
2. The micro plate reader (Multiskan®) is presently repaired and effectively in use.
3. Reagents for media preparation were procured. (Mycoplasma agar and broth bases)
4. Continuous surveillance for CBPP outbreaks is on-going
5. PCR analysis of isolated Mmm colonies and sequence analysis for identification of circulating strain(s) of Mmm and detection of vaccine candidate gene(s) has been conducted.

Salmonella research laboratory

The laboratory provided bench space and assisted five students to conduct their postgraduate (PhD-1 and MSc-1), Higher National Diploma (HND-2) and National Diploma (ND-1) research projects. A total of 826 samples were analyzed. Ninety-one of these samples were positive for Salmonellae and ten were positive for *Escherichia coli*.

Furthermore, 426 samples were received from two organizations; Olein hatchery Kaduna and Nigeria Agricultural Quarantine Services for analysis and detection of *Salmonella* and *E. coli* infections. The samples were processed using the Pre-enrichment, enrichment and isolation of *Salmonella/ E. coli* method. Salmonellae suspect were detected in nine samples while *E. coli* was detected in 15 samples.

Routine laboratory diagnosis. Nine samples from NVRI poultry and CDL were processed for identification of Salmonellae. Three (3) *Salmonella* spp. suspects were isolated.

Antimicrobial Susceptible Testing (AST): AST was conducted on 30 *Salmonella* isolates.

Challenges

- Inadequate equipment like autoclave, functional deep-freezer.
- Insufficient working space which results in unnecessary contamination.
- Inadequate media and reagent which slows the work or leads to incomplete work
- Lack of antibiotics disc for antimicrobial susceptibility testing.
- Inadequate staff especially junior staff.

- Inadequate office accommodation
- Lack of funds for research projects

Training

The Division hosted fellowship trainees from the College of Veterinary Surgeons as well as students from various tertiary Institutions across Nigeria from practical attachments.

Future plans

1. Production of *Brucella* antigens for research and diagnosis
2. Molecular diagnosis of *Brucella* species
3. Serology (ELISA, Complement fixation test and Florescence polarization assay).
4. Isolation and identification of *Salmonella* and *E. coli* from poultry
5. Surveillance for antimicrobial resistance and susceptibility testing

BACTERIAL VACCINES PRODUCTION DIVISION

The Bacterial Vaccine Production Division (BVPD) produces quality bacterial animal vaccines to meet national and regional demands. Despite the hiccup experienced due to COVID-19 pandemic such as, movement restrictions and the END SARS protest, a fairly smooth production of bacterial vaccines was achieved in 2020. Some other factors also militated against the full production of specific vaccines during the period under review. Production activities were suspended towards the end of the year due to the renovation work in the building complex housing the Division to avoid contamination of products during production process.

All the eight but one bacterial vaccine (*Brucella* vaccine) were produced in 2020. The total combined production figure for all the bacterial vaccines was **12, 607, 340.00** doses. This is slightly lower than the production **16, 310, 720** doses recorded for 2019. Production was at the peak during the first and second quarters of the year with the freeze-dried vaccines (CBPPV and FTV) recording the highest in demand and production as well as Hemorrhagic Septicaemia Vaccine (HSV). Production was highest for CBPPV vaccine (**5, 141, 600** doses) see Tables 1.

Overall Bacterial Vaccine Production in 2020

Anthrax Spore Vaccine: A total of **1, 527, 080** doses were produced; which is slightly lower than the 2, 042,800 doses produced in 2019. This was due to suspension of production in the last quarter as a result of the ongoing renovation of Bacterial Research Division building.

Black Quarter Vaccine (BQV): A total of **2, 959, 560** doses were produced. This figure was lower than that of 2019 (3, 484, 000 doses) due to non-availability of 100ml amber bottles.

Brucella (S19) Vaccine: There was no production of Brucella vaccine in 2020. There was no demand and the awareness about the availability and use of the vaccine was low among the end-users.

Contagious Bovine Pleuropneumonia Vaccine: A total of **5, 912, 400** doses were produced this is slightly lower than 5, 917,400 doses of 2019. This was partly due to insufficient supply of heat inactivated horse serum which is critical for the production of this vaccine.

FOWL CHOLERA VACCINE: A total of **68, 600** doses were produced, which is much lower than the 383,400 doses produced in 2019.

FOWL TYPHOID VACCINE: A total of **2, 534, 500** doses were produced compared to the **3, 946,400** doses produced in 2019.

HAEMORRAGIC SEPTICAEMIA VACCINE: **263,120** doses of HSV were produced. This figure is lower than **341, 120** doses produced in 2019.

HANTAVAC: A total of **112,880** doses of HANTAVAC were produced lower than the **195,600** doses produced in 2019.

Research Studies

1. Development of *Brucella* antigen for diagnosis of Brucellosis disease (***On-going***).

Notable activities

Provision of working materials/consumables

The under-listed items/reagents were procured/repared or donated during the period under review.

- Procurement and installation of one hot air oven and one refrigerator in media section
- Repair and installation of expeller fan in media and air conditioners in the Anthrax Spore Vaccine unit.
- Repair of Divisional central incubator and one Amsteel autoclaves was successfully completed.
- Donation of Hemorrhagic Septicaemia Type B Vaccine Master Seed.
- Media, reagents, chemicals and other consumables were procured through the 2020 DUE Process procurement.

Challenges

- Inadequate number of staff and production facility for each vaccine type is one of the challenges being experienced by the Division. In order to conform to international best practice, an individual should not be involved in the production of more than one vaccine type neither should a production laboratory be used for the production of more than one vaccine types as is currently being practiced in this Division. Such practice is prone to cross-contamination of vaccines thereby compromising vaccine quality and standard.
- Frequent breakdown of walk-in incubator, autoclaves and sometimes lack of production reagents and consumables
- Irregular water supply to the Division
- Lack of biosafety cabinets in the laboratories in the Division

Future Plans

- Explore the possibilities of using a mild adjuvant such as sodium alginate to overcome the challenges associated with adjuvanting both HSV and FC vaccines.
- To conduct experimental studies to determine the shelf life of the NVRI Fowl cholera vaccine (FCV).
- Consolidate on the promising preliminary results on the production of freeze-dried anthrax spore vaccine ASV and intensify the research effort in this line, in order to possibly replace the bulk liquid ASV currently being used.
- Continuous training of staff of the Division on the relevant techniques to improve on vaccine quality.

TABLE 1**JANUARY - DECEMBER 2020 VACCINE PRODUCTION FIGURES IN DOSES**

Month	ASV	BV	BQV	CBPPV	FCV	FTV	HSV	Hantavac	TOTAL
January	-	-	-	770800,00	-	-	25 640,00	-	25 640,00
February	-	-	-	776 600,00	-	782 100,00	28 160,00	-	1 586 860,00
March	407 600,00	-	761 000,00	813 800,00	-	-	-	-	1 982 400,00
April	-	-	-	-	-	-	-	-	-
May	694 800,00	-	-	585 200,00	-	839 000,00	63 800,00	49 560,00	2 232 360,00
June	-	-	-	1 048 700,00	-	-	67 040,00	-	1 115 740,00
July	-	-	737 000,00	-	68 600,00	-	33 720,00	33 680,00	873 000,00
August	-	-	736 060,00	-	-	-	-	-	736 060,00
September	37 480,00	-	725 500,00	318 200,00	-	458 300,00	44 760,00	29 640,00	1 613 880,00
October	387 200,00	-	-	800 000,00	-	455 100,00	-	-	1 642 300,00
November	-	-	-	799 100,00	-	-	-	-	799 100,00
December	-	-	-	-	-	-	-	-	-
	1 527 080,00	-	2 959 560,00	5 141 600,00	68 600,00	2 534 500,00	263 120,00	112 880,00	12 607 340,00

BIOCHEMISTRY DIVISION

The mandate of the Division is *“To conduct research into all aspects of Animal Nutrition, Veterinary Toxicology, Chemical Pathology and Water Quality for the prevention, treatment and control of Animal diseases”*. The Division is subdivided into four sections namely: Nutrition, Toxicology, Clinical Biochemistry and Water Quality.

The Biochemistry Division engages in research activities covering the various aspects of biochemistry and its application in the control, prevention and treatment of animal diseases. The Division also perform quality checks to ensure standard of chemicals and biologicals. To ensure staff are abreast with current trends in biochemistry research the Division organized internal activities that motivate research conduct and promote productivity. Divisional and research staff meetings and seminars are held monthly for continuous administrative briefings and review of on-going and new research projects. Collaborations with other researchers involved in similar activities are continuously encouraged, with guest researchers visiting the Division regularly.

Specific (Notable) Activities

- Routine sample analysis for research and diagnosis. Water samples from NVRI water reservoir were routinely assessed for safety. Similar services were provided to industries such as; NASCO Foods Ltd, Jos and the University of Jos. Several requests for range of services from some organizations in Nigeria including but not limited to the Nigerian Agricultural Quarantine Services, Abuja, Nigerian Export Promotion Council, Abuja, Federal Department of Livestock and Pest Control Services, Abuja were also received and processed.
- Research activities and diagnostic support for the control of animal diseases.
- Training of students on SIWES.
- Production and supply of distilled water to various Divisions in the Institute.

Achievements

A. Training

- Successfully trained and mentored students on IT from various tertiary institutions across the nation.
- Organized a hands-on training workshop on chromatographic separation of phytochemicals.

B. Internally generated revenue

- The sum of six hundred and four thousand naira (N604, 000.00) was generated in revenue. This was accrued from the analyses of 273 samples for various parameters.

Challenges

1. The new Gas Chromatograph-Mass Spectrometer (procured by V&PCS, FMARD, Abuja in 2019) and the Amino acid auto-analyser (procured in 2009) are still awaiting installation and training despite several applications and follow-up.
2. The High performance liquid chromatography (HPLC) procured in 2009 has been installed and training took place. However, chemicals and reagents needed for the commencement of HPLC analysis are yet to be procured. Despite the non-use, leakages were noticed some of the tubes attached to the machine. This need to be fixed before putting the machine to use.
3. The Atomic Absorption Spectrophotometer (AAS) was installed and fully functioning in May 2014 but it was reported to be leaking in August of the same year. The equipment is still not functioning despite a visit and repairs by the Service Engineer. This is hindering micro and macro mineral elements analysis.
4. The chemistry auto-analyzer (ACCENT 300) that was installed with training provided to some staff has not been functioning since it was last repaired and serviced in September 2015 by the Service Engineer and reagent kits procured.
5. Fluctuations in power supply is a recurrent problem causing frequent damage to electric cables and thus affecting sample digestion in the fume cupboard.
6. Lack of constant water supply to the labs is a serious drawback to our activities.

7. Inadequate and irregular supply of reagents.
8. Inadequate office furniture for staff and students on training.

FUTURE PLANS

1. To procure a new spectrophotometer and chemistry analyzer
2. Intensify efforts to repair/fix or replace the 4 major non-functioning and others faulty equipment in the Division.
3. To introduce new analysis parameters when the faulty equipment list above have been repaired and are fully functional for enhanced research and revenue generation.
4. To include 2 parameters (acid and neutral detergent fibre tests) for analysis in Nutrition lab as well as 5 parameters (GSH, MDA, SOD, DPPH & catalase tests) for Clinical Chemistry lab.
5. Improving the turnaround time for the diagnoses of poisonings and food contaminants in the Toxicology laboratory.
6. To vigorously pursue some uncompleted research projects to logical conclusion.
7. Timely preparations for hosting new set of NEF Interns.
8. Plan to develop an *in vitro* cell and tissue culture toxicity laboratory to reduce the frequent need for and use of laboratory animals.
9. To embark on research entitled "Assessing the level of adherence to standards on poultry feed formulation - A 10-year retrospective study" by Nutrition Section.
9. To provided support services to the Bee and Honey Programme in the National Residue Monitoring Programme of the Federal Government for the EU Third Country listing, a market access requirement for the export of honey to the EU market.

BIOTECHNOLOGY DIVISION

In line with the mandate of the Institute, the Division carried out the following routine diagnostic and research activities.

- Development of biological (recombinant vaccines, proteins, antigens) for the control of animal diseases.
- Serves as a centre for biotechnology collaborative research with national and international research institutions and universities.
- Development and validation of biotechnology techniques for national use in diagnosis & research.
- Detection & characterization of animal disease pathogens using biotechnology techniques.
- Investigation of emerging & re-emerging infectious diseases and other zoonotic agents using biotechnology techniques.
- Conducting national and international trainings on biotechnology methodologies for diagnosis & research.
- Serves as a centre for DNA Barcoding of animals, disease vector insects, invasive pests and insects.
- Serves as one of the centres of research for the National Animal Genetic Resource.

Specific Activities

During the period under review, the under-listed research and diagnostic activities were conducted.

1. Identification of ectoparasites (mites), protozoans (Trypanosomes, *Eimeria* spp., *Cryptosporidium* spp. and *Plasmodium falciparum*) by PCR analysis
2. Determination of antimalarial drug resistance gene by PCR analysis
3. Purification and sporulation/culturing of *Eimeria* and *Cryptosporidium* species oocysts.
4. Molecular docking analysis of some phytochemicals on two SARS-CoV-2 targets
5. Comparison of colorimetric loop-mediated isothermal amplification kit and reverse transcription-PCR in the diagnosis of peste des petits ruminants in sheep and goats in Southeast Nigeria.
6. Laboratory diagnosis of a new outbreak of acute African swine fever in smallholder pig farms in Jos, Nigeria.
7. Genetic analysis and emergence of Canine Parvovirus type 2c in South Eastern Nigeria
8. Surveillance to determine the country-wide status of African swine fever in Nigeria.

A total of nine hundred and fourteen samples (914) were analyzed from the Molecular Virology Unit during the report period. Eight hundred and eighty (880) samples were for ASF, twenty-four (24) for Dengue fever, and ten (10) for rabies.

ON-GOING PROJECTS

1. TETFUND Special Grant for COVID-19 Research Projects: Award of Research Grant: **Evaluation of the Inhibitory activities of Silymarin against SARS-CoV-2**

2. **West African Center for Emerging Infectious Disease (WAC-EID)**. Subgrant under NIAID grant award No. JIT:1U01AI 151801-01
3. African Union (AU) Grant No. AURG II-1-196-2016. Titled “**Developing innovative and sustainable approaches to prevent the spread of African swine fever in Africa (ASF-RESIST)**”
4. IAEA Technical Cooperation Project (TCP): **Controlling parasitic and transboundary animal diseases to improve animal productivity in smallholder farms using nuclear and molecular techniques**”, NIR5040 (NIR2014002)
5. IAEA Research Contract No:18347/R0. R1. R2. R3. Titled “**Molecular epidemiology of African swine fever in Nigeria**” under IAEA coordinated Research Project “D32031”
6. NCRC funding: **Validation and implementation of multiple point-of-care COVID-19 diagnostic tests with RT-PCR in North Central and North Eastern Nigeria**
7. Collection of serum samples and nasal swabs from 250 camels and 250 donkeys in northern Nigeria to screen for emerging viral pathogens.
8. Collection of serum, cloacal and nasal swabs from ducks, turkeys and geese to screen for emerging viral pathogens in domestic bird types.
9. Collection of ticks from ruminants to screen for arboviruses.
10. Collection of specimens from wild indigenous and migratory birds to screen for transboundary pathogens.

Other Achievements

Networking with International and Reference Laboratories on special pathogens.

Molecular detection and characterization of various disease pathogens of livestock both for research and diagnosis; identification of novel strains of some disease pathogens (eg *Campylobacter*).

Assisting research students as well as staff members conduct analyses using molecular techniques to identify disease pathogens, gene fragments of biological interest, as well as analyses of sequence data.

Provided technical support for other trainings in collaboration with other Divisions within the Institute

Currently participating in a 3-year research project on African swine fever (ASF), a collaborative research in partnership with Makerere University, Uganda, funded by the African Union research grant scheme. Project is to terminate in 2021.

Establishment of working protocols for various parasites analysed by the unit.

Some members of staff were trained on micropipette calibration and maintenance.

Sporulation of *Eimeria* and *Cryptosporidium* species oocyst

Identification of *Eimeria* and *Cryptosporidium* oocyst (under the microscope).

Challenges

Broken down camera for the BioRad Gel documentation system needs to be fixed.

An autoclave is urgently needed for sterilization of prepared reagents and consumables as well as decontamination of samples before disposal.

General maintenance of biosafety cabinets and calibration of pipettes are urgently needed.

PCR reagents and consumables for routine diagnosis and training are required for optimal diagnostic work.

Health challenge posed by prolonged use of ethidium bromide for electrophoresis (irritation reported by some members of staff). The institute should consider a less toxic gel staining dye.

Power fluctuation and lack of stabilizers leading to breakdown of equipment such as freezers

Limited cold storage facilities for samples and reagents.

Lack of adequate water supply to the laboratories to enable proper cleaning/sanitation and other emergencies

Non-functional air-conditioners to provide conducive environment for the longevity and smooth operation of laboratory equipment.

Future Plans

- To procure Nanopore MinION for sequencing of viral genomes
- Organize training on real-time PCR (RT-PCR), protein analysis, bioinformatics and Grant writing
- Pursue research collaboration with some laboratories, universities and agencies within and outside Nigeria
- Development of research projects focusing on antimicrobial resistance in *Salmonella* and *E. coli* from poultry.
- Conduct ecological studies to determine the reservoirs for viruses of the family Arenaviridae (Lassa virus, Lymphatic choriomeningitis virus, Mopeia virus, Luna virus, Gairo virus etc.) and genetic diversity of Lassa viruses.
- Determination of a candidate Lassa fever vaccine strains specific to Nigeria from field isolates. This study is being planned in collaboration with researchers from a specialized P4 laboratory in Canada.
- The use of molecular techniques in the evaluation of genetic insertions into the genome of Fowl Pox vaccines in N.V.R.I Vom.

DAGWOM FARM

Dagwom farm is a Division under the Livestock Investigation Department (LID) of the Institute. It comprises of the Feed Mill, Rabittry, Store and Fabrication sections. These sections are committed to excellent service delivery for enhanced productivity and research in the relevant Divisions for the achievement of the overall mandate of the Institute.

Specifically, the Division has the following mandate: -

- a. Research and production of standard quality livestock feeds to support vaccine production and research.
- b. Production of rabbits for replacement and extension to interested organisations, institutions and individuals.
- c. Investigation of common diseases of rabbits to improve performance.
- d. Fabrication and production of high efficiency kerosene incubators to meet the demands of small scale farmers and other interested persons.

Specific Activities

Some of the activities of the Division are presented in the tables 1-4

Table 1. Rabbit production for research, replacement and sales

S/N	Categories of rabbits	Opening stock	Closing Stock	Production
1	Does	26	15	
2	Bucks	11	13	
3	Growers	1	36	
4	Weaners	-	14	
5	Litters	7	3	114
6	TOTAL	45	81	114

Table 2. Feed production and distribution

FEED TYPE	Divisions/Institutions										TOTAL (tons)
	POULT	D/FARM	DIAG	FCMLT	BIO CHEM	RLAI&TAD	RL	QCD	VR	D/F TRIAL	
QLM	18.250										18.2500
LM	9.500										9.5000
GP		0.6825	4.39		1.305	0.170	0.270	1.115			7.9325
GM		0.1050				0.405	0.025	3.130			3.6650
CM	16.250										16.2500
TOTAL (TONS)	44.000	0.7875	4.39		1.305	0.575	0.575	4.245			55.5975

Table 3. Soya beans processed in the year

PERIOD	QTY OF SOYA BEANS RECEIVED (KG)	QTY OF SBC PROD (KG)	QTY OF FF PROD (KG)	QTY OF SBC USED (KG)	QTY OF FF USED (KG)	QTY OF OIL PROD (LITRES)	QTY OF OIL SOLD/SLUDGE/USED (LITRES)	AMOUNT (N)
JAN-DEC	13,450	9,754.25	2,655.5	10,426.0	2,809.5	981	578	144,500.00

Table 4. Activities/ sales of kerosene

	B/ F	no. constructed	no. under construction	no. sold	target	cost per unit	total
1 ST Quarter		3	3	2	33	105,000	210,000.00
2 nd Quarter		0	1	1	33	105,000	105,000.00
3 rd Quarter		1	2	1	33	105,000	105,000.00
4 th Quarter		2		2	33	105,000	210,000.00
TOTAL		6		6	132		630,000.00

Challenges

- Intermittent breakdown of some oilseed processing unit machines (Extruder, Expeller and Auger) due to ageing.
- Lack of good storage facilities of feed materials/ ingredients.
- Lack of a weigh bridge to determine actual quantity of raw materials (feedstuffs) received from suppliers.
- Lack of a stationed vehicle for feed mill operations.
- Lack of water supply to the feed mill for extruding and pelleting of feed (bore hole)
- Lack of protective clothing like lab coats, overalls, safety boots, head gears, nose masks, rain coats and rain boots for staff and visitors in the feed mill in line with bio-safety requirements.
- In-sufficient tools and machines leads to poor result of set target, some of these machines includes guillotine machines, folding machine, rolling machine and wood work multi-purpose machine (3d machine).
- Most of our machines are obsolete
- Delay in release of funds lead to the set back of our set target.
- Requirements for drugs, disinfectant and consumables.
- Lack of internet services in farm, this encourages staff movement.
- Constitution of feed stuff procurement committee to set standard for all incoming grains and premixes
- Feed stuff was supplied in used sacks making storage condition impossible.
- Renovation of the store houses/old grain silo.

FUTURE PLANS

Rabbitry – To produce 475 rabbits of different breeds

Feed Mill – Production of 101,345kg of feeds. Production of soya bean cake 18,935kg and 4,695kg of full fats soya, and oil 16451 Litres.

Fabrication – Production of 30 sets of incubators.

Research – Hybridization of kerosene powered incubator.

	<p>mean that given all the necessary reagents, we can carry out SDS-PAGE successfully and regularly.</p> <p>Ethno-Veterinary Products Section</p> <p>The following products were produced.</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>Dermatocide 3M Soap</td> <td>7,692 tablets</td> </tr> <tr> <td>Big Ointment (120g)</td> <td>415 bottles</td> </tr> <tr> <td>Small Ointment (40g)</td> <td>285 bottles</td> </tr> <tr> <td>Lotion (120ml)</td> <td>60 tubes</td> </tr> <tr> <td>Dermasol ointment</td> <td>1,160 bottles</td> </tr> <tr> <td>Lamstreptocide A& B (1L)</td> <td>354 Litres</td> </tr> </tbody> </table>	Product	Quantity	Dermatocide 3M Soap	7,692 tablets	Big Ointment (120g)	415 bottles	Small Ointment (40g)	285 bottles	Lotion (120ml)	60 tubes	Dermasol ointment	1,160 bottles	Lamstreptocide A& B (1L)	354 Litres
Product	Quantity														
Dermatocide 3M Soap	7,692 tablets														
Big Ointment (120g)	415 bottles														
Small Ointment (40g)	285 bottles														
Lotion (120ml)	60 tubes														
Dermasol ointment	1,160 bottles														
Lamstreptocide A& B (1L)	354 Litres														
<p>Achievements</p>	<ol style="list-style-type: none"> i. A new ethno veterinary product against dermatophilosis was developed. ii. The ethno-veterinary product formulated from <i>Vernonia amygdalina</i> (bitter leave) was very effective against Dermatophilosis. Complete recovery of naturally infected animals with <i>D. congolensis</i> was achieved in 8 weeks of application. iii. Renovation and repainting of the entire Dermatophilosis Complex was carried out thereby giving it a new outlook. 														
<p>Challenges</p>	<ul style="list-style-type: none"> • The only biosafety cabinet level II in the Division has broken down. We now manage with an old wooden inoculation hood for all isolation works. • Inadequate/lack of some vital reagents such as SDA, Lactophenol etc delays the conduct of research work in the Division • Constant breakdown of the available microscope in the Division. • Lack of appropriate facility for a long time storage of <i>D.</i> 														

	<i>congolensis</i> and fungal isolates.
Future Plans	<ul style="list-style-type: none"> i. To undertake surveillance of <i>D. congolensis</i> in cattle in Plateau State. ii. To continue with the clinical trial of the newly formulated product against Dermatophilosis and other skin infections of cattle. iii. To fully equip the immunology laboratory to make it fully functional for immunological work.

DRUG DEVELOPMENT DIVISION

The Division is saddled with the responsibility of conducting research for the identification of substances or active ingredients and the subsequent development into products for the prevention, diagnosis, treatment and mitigation of diseases. The research activities conducted in the Division include projects initiated by the staff of the division or those conceived by individuals outside the institute but require the services and expertise of personnel from the Division. The mandate of the division is outlined as follows:

- Research and development of substances from natural and/or synthetic sources for the prevention, treatment and control of diseases
- Research into the safety of substances from natural or synthetic sources used in the prevention, treatment and control of diseases
- Provide services to researchers/scientists from other establishments/institutions working in the area of drug development and related research
- Establish and maintain a herbarium for archiving medicinal plants
- Provide training on various aspects of drug development to students, interns and researchers

NOTABLE ACTIVITIES

In contribution to the global effort to curb the menace of COVID-19, the Division deployed its expertise to respond to the urgent need for the provision of accessible and effective veridical agents in form of sanitizers. The outcome being;

1. Formulation and production of hand sanitizer spray and gel: Upon the outbreak of COVID-19, the Division formulated two types of hand sanitizers (spray and gel) for use in the institute and sale to clients outside the Institute.
2. Collaboration with Plateau state COVID-19 research group to conducted safety evaluation of an anti COVID-19 preparation produced by the COVID-19 research team that was constituted by the Plateau state government.

3. Initiated an antimicrobial research project: The Division designed a project aimed at developing or isolating antimicrobial compounds from locally available plants that are used to treat “antimicrobial resistant” infections.

ACHIVEMENTS

As a result of the activities carried out, the achievements recorded were:

1. Organized regular divisional and technical meeting where each functional unit briefed other members about activities of their units.
2. Produced over 1000 litres of hand sanitizers for use within the Institute and for sale to the general public.
3. Continued research project entitled “Isolation of antimicrobial compounds from *Euphorbia hirta*.”
4. Sub-acute toxicity evaluation of 3 herbal formulations prepared by the Plateau state COVID-19 Research Team using experimental rats.
5. Evaluated the effect of *Khaya senegalensis* seed extract on blood glucose concentration of alloxan induced hyperglycemic rats for a client on commercial basis.
6. Seminar presentation titled “Strategic Planning for Productive Research was presented in the Division”.

CHALLENGES

1. Lack of basic equipment such as:
 - Sensitive weighing balance: This slows down work and makes it more cumbersome because we have to go to another laboratory every time.
 - Large soxhlet extraction apparatus: There is usually need to extract large quantities of materials which requires large extraction set up.
 - Rotary evaporator: After extraction, there is need to evaporate solvent and dry extract as soon as possible. This will be enhanced when a rotary evaporator is available.
 - Broken down water distiller and freeze dryer.
2. Lack of laboratory space: The Division has one laboratory only, thus every activity is carried out within the same laboratory including animal experiments, chromatography, production of hand sanitizer, and drying of plants and extracts.

3. In adequate office accommodation and furniture: There is no office for the Head of Division and some staff thus making the administrative aspect of the work to suffer.
4. Inadequate staff: There is only one technician in the Division and no Divisional secretary.

FUTURE PLANS

The Division plans the following for 2021 and beyond:

1. Establish a journal club for the Division to discuss publications and make presentations in order to improve the writing and communication skills of staff members.
2. Intensify the research on isolation of antimicrobials from plants in order to tackle the scourge of antimicrobial resistance.
3. Formulate products using the antimicrobial plants as active ingredients.
4. Pursue wider collaboration with other researchers within and outside the Institute in order to increase productivity.
5. Seek and apply for grants as external source of funding in order to improve on the activity and productivity of the division.

FOOT-AND-MOUTH DISEASE (FMD) LABORATORY DIVISION

The mandate of the Division includes; to conduct research, undertake surveillance and diagnosis of FMD and related economically important livestock diseases in Nigeria. To develop vaccine and biological (antiserum) with reference to African swine fever, Foot and Mouth disease, bovine viral diarrhoea, middle east respiratory syndrome (MERscov), rift valley fever and African Horse Sickness.

Diagnostic and Research Activities

During the period under review laboratory capacity for FMDV antibody detection, antigen detection, virus isolation and reverse transcriptase polymerase chain reaction platform were established. Currently, a total of 6,502 sera and 344 epithelial tissue specimens were received from field as laboratory submissions for analysis. Of the total sera received 48.5% (95%CI: 47.3-49.7) were from cattle, 11.7% (95%CI: 11.0-12.5) from sheep and goats, 33.8% (95%CI: 32.7-35) from pigs, 5.5 % (95%CI: 4.90-6.11) from camels and 0.43% (95%CI: 0.29-0.61) from various wildlife species.

In the area of human capacity development, four staff members completed their PhD program. Other laboratory trainings were also organized during the period under review. The laboratory also participated in several FMD Proficiency tests within this period and has published and presented research outputs at several scientific conferences and workshop. The laboratory has good working relationship with the WRLFMD, the Pirbright Institute, UK, and completed an OIE Laboratory Twinning Programme with Sciensano, Belgium. Currently, the laboratory is collaborating with the Canadian National Center for Foreign Animal Disease (NCFAD) on capacity building for National and Regional Foot-and-Mouth-Disease Control Strategy (2019 - 2022). NVRI, VOM have also signed a material transfer and contract manufacturing agreement amongst EXCEL-VET CONSULTANTS and MIDDLE EAST FOR VACCINES (MEVAC) EGYPT for the production of FMD bulk antigen using the master seed virus of NVRI VOM, to produce FMD Vaccine in Nigeria.

On-Going Projects

- Currently, the laboratory is collaborating with the Canadian National Center for Foreign Animal Disease (NCFAD) on capacity building for the development of a

diagnostic kit (In-house ELISA) as part of a National and Regional Foot-and-Mouth Disease Control Strategy (2019 –2022).

- Supporting Evidence-based Interventions to Achieve Agricultural Development Goals Programme (**SEBI**). Under this project an agreement has been reached among **EXCELVET-CONSULTANTS, NATIONAL VETERINARY RESEARCH INSTITUTE, VOM** and the **MIDDLE EAST FOR VACCINE, Egypt (MEVAC)** for the production and distribution of FMD vaccines in Nigeria. It is expected that EXCELVET will fund the project, **MEVAC** will produce the bulk antigen and **NVRI** will formulate the vaccine, packaged and sale the vaccine.

New project

- Study on the evaluation of the role of small ruminants in the spread and endemicity of Foot-and-Mouth Disease in Northern Nigeria. **EU-FMD funded project: New project**
- Evaluation of antigenic and genomic methods to assess foot and mouth disease virus vaccine. **IVVN funded project in collaboration with The Pirbright Institute, UK**

Achievements of the Division

- The laboratory has developed an inactivated Foot and Mouth Disease Vaccine which is currently undergoing field trials.

Challenges

Some of the immediate challenges confronting the Division include;

1. Irregular water supply to the laboratories
2. Lack of Fetal calf serum
3. Lack of wash-up facilities.
4. Shortfall in number of requisite technical staff (technicians and Vet. Research officers).
5. Inadequate number of biosafety cabinets.
6. Lack of functional molecular biology unit equipped with basic equipment such as; Thermocycler Refrigerated centrifuge, gel electrophoresis apparatus + accessories, UV lamp, vortex)
7. Lack of a Co₂ incubator

INTERNAL AUDIT

The Internal Audit provides a comprehensive and continues audit of the accounts and records of the Institute, as well as conduct management audit. This is achieved through performing the following routine functions;

- i. Regular checking of relevant documents to ensure compliance with laws, instructions and directives of the government
- ii. Promoting economic efficiency and effective use of resources
- iii. Checking the adequacy and accuracy of financial and accounting records and systems
- iv. Ensuring economic sanity by detecting and preventing errors/frauds as early as possible
- v. Ensuring that proper internal control, checks and balances are put in place and operational so as to ensure that activities and resources are channeled towards achieving the overall goals of the Institute.

Notable Activities

- i. Conducted 100% prepayment audit.
- ii. Conducted regular post-payment audit including payrolls under the IPPIS.

Achievements

- a. Ensured that proper books of accounts were maintained and regularly up-dated.
- b. Evaluated the efficiency of operations and make recommendations to the Chief Executive on ways to improve efficiency and boost revenue generation.
- c. Achieve more than 90% prepayment Audit checks on payment vouchers and emphasized on the practice of complete documentation of records before signing.
- d. Ensured that all goods and grains brought into the main store and poultry/Dagwom Farm were properly inspected and verified.

Challenges

- (i) Lack of strict compliance with Auditors recommendations for remedial actions to correct lapses/deficiencies.
- (ii) Inability to visit and perform routine audit of the Outstation Laboratories due to paucity of funds.
- (iii) Inadequate number of personnel.
- (iv) Lack of training in the area of modern Auditing and ICT for the past two years.

Future Plan

The Department plans to enlarge her scope of operation to cover risk management Audit in consonance with modern Audit practice. Also, determine to achieve faster and better results within the confines of the resources available.

LIBRARY AND ICT DIVISION

Libraries are necessary components of any research or academic institution. In most societies is a widely accepted and flexible agency for the delivery of information from a variety of sources, in different formats to the users at various levels of needs.

In the case of N.V.R.I, the library collection concentrates on materials of educational value in the fields of veterinary, medical laboratory and allied sciences to support research and development in animal diseases treatment and control.

In order to carry out these functions the library is divided into 4 sections: - Circulation and Reference, Serial, Technical and the e-library.

Overall, the Division performs the following:

1. Provide research staff access to the right information, in the right form at the right time.
2. Establish a computerized information system for easy access to current information on animal health and production from all over the world.
3. Create and manage local databases on the country's animal health and production research activities.
4. Make information on the country's animal health and production activities available to stakeholders from all states of the federation
5. Provide extension workers nation-wide access to expert advice on wide range of problems, to enable them transfer this knowledge to end-users.
6. Avail researchers and academicians from universities, polytechnics and other institutions of higher learning as well as businessmen and policy makers with relevant scientific information.

Activities were generally low during the reporting period due to the movement restrictions/lockdown/sit at home order imposed by the government as a control measure against the COVID-19 pandemic. However, 67 queries were received from students on referrals for their project work. Furthermore, 7 publications were received as gift from ACIAR, 6 CBN publications and 18 staff theses and projects.

Challenges

1. Lack of internet connectivity in the e-library to support the research work in the Institute.
2. The library software meant for the retrospective conversion is not functioning.
3. The computers in the e- library are not functional.
4. None subscription of journal titles held in reference.
5. Lack of scanner to help in preparing documents for full automation of library resources especially staff publications that are brittle for preservation.

Future plan

1. Reassessing the free subscription status of online databases e.g AGORA, HINARI etc.
2. Subscription to new online databases.
3. Staff training in ICT especially on database management creation.

CYBER CAFÉ UNIT

This unit is responsible for the maintenance of internet services and interconnectivity of Divisions in the Institute. The Unit is saddled with the responsibility of resolving internet downtimes, software's upgrades, installations, troubleshooting hardware and IT equipment maintenance within the institute and managing the institute website.

During the year under review, the basic activities the team carried out include;

1. Managed the created official email with (NVRI) domain addresses for staff
2. Managed the NVRI website www.nvri.gov.ng
3. Development of software's application for the institute
4. Computer maintenance and repairs
5. Installed and upgraded software on personal computers
6. Attended ICT meetings/presentations and deliberated on IT related issues as a team
7. Training of IT students
8. Scan and printed documents

Challenges

Some of the constraints of the unit includes;

- i. Lack of general internet service for the Institute
- ii. Personnel with very little or no knowledge on use of computer and internet
- iii. Lack of relevant software for installation, upgrade and maintenance
- iv. Lack of hardware replacement component systems available for users

LIVESTOCK INVESTIGATION DIVISION

The Livestock Investigation Division (LID) is an animal rearing facility of the Institute charged with the responsibility of raising, adaptation of exotic animals and upgrading local stocks for vaccine production and research. The Division is also involved in the production of livestock forage and feed formulation. To achieve these targets, the Division is divided into several sections namely: Health, Dairy, Piggery, Beef, Equine, Goat and Sheep production. Others are; cultivation and pasture development, Feed-mill, Laboratory cattle and replacement, Farm Machinery and Agronomy, and Liquid Nitrogen.

Specific Activities

- Semen collection, evaluation, processing and preservation.
- Improving indigenous breeds of cattle through artificial insemination using NVRI, Vom processed semen of Friesian bulls.
- Herd health and fertility check and selection of animals for planned breeding programmes.
- Manpower development in artificial insemination through capacity building.
- Management of exotic and cross bred bulls.
- Maintenance and management of weaned calves to heifers and yearling bulls or bull calves.
- Herd health inspection and routine parasite control programs.
- Annual vaccination of all the herds on the farm against common bacterial and viral diseases.
- Cultivation and management of pasture for the production of silage and hay.
- Maintenance, repairs and servicing of farm tractors, implements and machineries.
- Formulating and production of feeds for various classes of animals on the farm.

Achievements

- Maintenance and periodic assessment of preserved bovine semen
- Reduced mortality of livestock on the farm.
- Repair of MF 465 tractor that was broken down for several years
- Production of 470 metric tons of silage from the cultivated 14.8 hectares of land.
- More than 3,818 bales of hay have been harvested and stored for use during the dry season.
- Yearlings were properly managed to adults and eventually distributed to dairy and beef section according to the scale of preference.

- Practical demonstration of various farm operations and procedures to undergraduate and/ postgraduate students on excursions, SIWES students and other visitors.

Challenges

Irregular to non-existent electricity supply on the farm

Lack of pure breed Friesian bulls on the farm.

Delay in the supply of drugs and feed supplements.

Lack of standard laboratory setting, equipment and offices for Artificial Insemination (AI) operation.

Dilapidated bull pens.

Inadequate office furniture.

Lack of protective wears for the workers.

Inadequate/obsolete machinery and working equipment e.g. wheelbarrow, shovels, garden forks, milking machine etc.

Delay or late supply of farm input and agro-chemicals (fertilizer, herbicide, seeds, and seed-dress).

Security challenges on the farm.

Lack of conveniences (toilet facilities) on the farm.

FUTURE PLANS

The Division plans to consolidate and improve on its previous achievements. This will be made possible if the following issues are addressed.

- Procure an electro ejaculator (Electrojac 6) for the continuous production of chilled and frozen semen. This will enable the Division to embark on oestrus synchronization and insemination of all the heifers on the farm.
- Increase the production capacity of the dairy cattle through On-farm and On-station insemination as well as extending the services to interested farmers.
- Accord prompt attention to the veterinary health care of animals for appropriate actions.
- Timely provision of appropriate feed supplements (concentrates, salt) to animals for improved health and productivity.
- Application/memo for the request of purchase of new farm machineries/implements to the NVRI management in order to revamp the farm was made.

- Plead with NVRI management to rehabilitate the roads leading to and within the Farm to ease farm operations.
- Liaise with NVRI management to provide adequate security and lightening on the farm.

Furthermore, the Division intends to conduct the following research projects to assess the outcome of our activities:

- Pregnancy rate (PR) of indigenous cattle following artificial insemination using Vom Cryopreserved semen and imported Cryopreserved semen.
- Fertility and hatchability trials of poultry eggs following artificial insemination.
- Fertility and seminal characteristics of Friesian bulls raised on the Jos Plateau.

PARASITOLOGY DIVISION

In line with the Mandate of the Institute, the Division is charged with the responsibility of conducting research and diagnosis of economically important parasitic diseases of poultry and livestock in Nigeria, and to formulate appropriate control measures. In order to effectively achieve this mandate, the Division is structured into sections namely; protozoology, helminthology, entomology, immunodiagnostic, molecular biology and ethno-veterinary research laboratories. During the year under review, the Division performed the following research and diagnostic activities outlined in this report.

Notable achievements

Reactivation of the Molecular Biology Unit

Some basic items necessary for molecular biology work were purchased and added to the Molecular Biology Unit courtesy of Small Grant fund obtained by a staff of the Division. Now the unit is functional and capable of conducting DNA extraction, Polymerase Chain Reaction (PCR) and gel documentation subject to availability of primers and some basic laboratory consumables. A project entitled “Molecular epidemiology of pathogenic leptospire in bats (Chiroptera) in Nigeria, West Africa” sponsored by the Royal Society of Tropical Medicine and Hygiene (RSTMH) was successfully completed in the Unit with support from the Biotechnology Division of the Institute.

Routine research and diagnostic activities

During the review period, samples for research and diagnosis were received from the Central Diagnostic Laboratory or directly from clients and processed accordingly and results dispatched promptly. The number of samples and the results from each unit are present below.

Protozoology Laboratory Unit

In the protozoology laboratory, a total of 257 blood and brain samples of animals were received from clients and were processed and examined for the identification of various blood parasites according to standard procedures. From the number submitted, 30 were positive for various blood parasites as presented on (Table 1).

Table 1: Number of samples and hemoparasite type detected in blood/ brain samples from various animal species

S/N	Animal species	No positive/ No of sample (%)	Parasite type identified
1	Cattle	25/194 (12.9)	<i>Babesia bigemina</i> , <i>B. bovis</i> , <i>Trypanasoma spp</i>
2	Dog	9/21 (42.9)	<i>Babesia canis</i>
3	Goat	3/11 (27.3)	<i>Babesia ovis</i>
4	Sheep	2/29 (6.9)	<i>B. motasi</i> , <i>B. ovis</i>
5	Pig	0/2 (0)	Nil
Total		30/257 (11.7)	

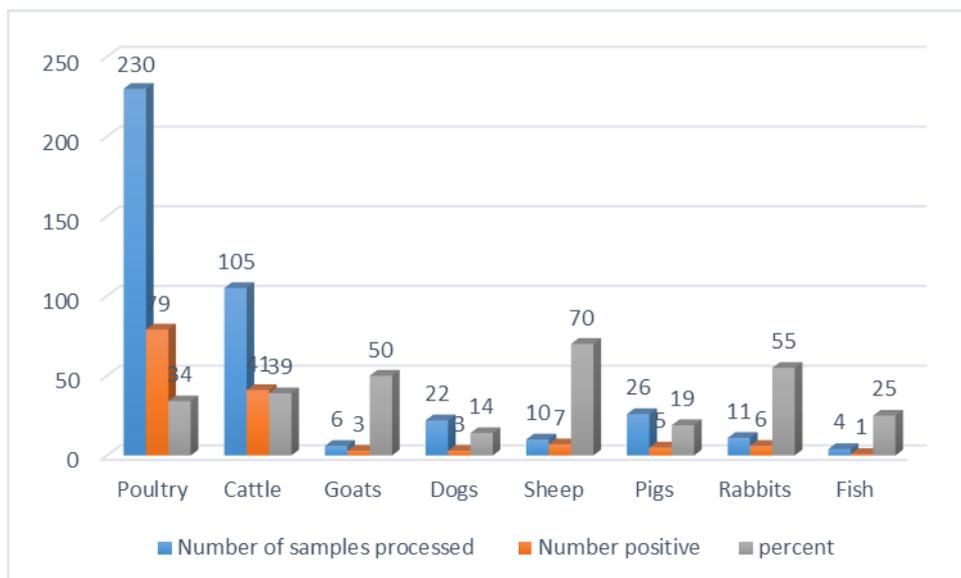
Helminthology Unit

Four hundred and fourteen fecal and intestinal samples were received for the diagnosis of gastro-intestinal parasites during the period under review compared to 493 in the preceding year. Samples were processed using the simple floatation and sedimentation techniques for the identification of various helminth eggs and protozoan Oocysts. Overall, 145 of the samples were positive for various intestinal helminths and protozoans (Fig 1). The common parasites detected in the samples from the various animal species are presented on Table 2

Table 2: Gastrointestinal parasites detected in samples submitted in 2019

S/N	Animal species	Parasite type detected
1	Poultry	<i>Ascaridia galli</i> , <i>Eimeria spp.</i> , <i>Heterakis spp.</i> , <i>Capillaria spp.</i> ,
2	Cattle	<i>Strongyle</i> eggs, <i>Eimeria spp.</i> , <i>Monezia, spp.</i> <i>Haemonchus spp.</i> , <i>Oesophagostomum radiatum</i> , <i>Fasciola</i> eggs, <i>Cooperia, spp.</i> ,
3	Dog	<i>Toxocara spp.</i> , <i>Ancylostomma spp.</i> , <i>Cystoisospora spp.</i> ,
4	Goat	<i>Eimeria spp.</i> , <i>Haemonchus spp.</i> ,
5	Rabbit	<i>Eimeria spp.</i> , <i>Strongyloides spp.</i> ,
6	Sheep	<i>Strongyle</i> eggs, <i>Oesophagostomum spp.</i> , <i>Haemonchus spp.</i>
7	Pig	<i>Ascaris suum</i> , <i>Eimeria spp.</i> , <i>Strongyle</i> eggs
8	Fish	<i>Diphyllobothrium latum</i>

Figure 1. Distribution of samples tested and number (%) positive according to animal species.



Entomology Unit

Ectoparasites and skin infections remain a huge problem in livestock and pets in Nigeria. In an effort to curb the effects of these parasites, farmers submitted 211 samples which included ticks (208) and three skin scrapings to the Entomology Unit. The samples were processed according to standard procedures for the identification of the ectoparasites. The findings are presented on Table 3.

Table 3: Samples and ectoparasite type identified from animals

S/N	Animal species	Type of Sample	Number of samples	Ectoparasite type identified
1	Cattle	Ticks	51	<i>Amblyomma variegatum</i> , <i>Hyalomma spp.</i> <i>Boophilus spp</i>
2	Dog	Ticks/ Skin Scrapings	132	<i>Rh. sanguineus</i> , <i>Haemaphysalis spp.</i> <i>Sarcoptes spp</i>
3	Sheep	Ticks	28	<i>Rhipicephalus (Boophilus) spp</i> , <i>Rh. sanguineous</i> , <i>Hyalomma truncatum</i>
Total			211	

Ethnoveterinary Research and Production Unit

The Unit remains committed to the search for remedies to animal and human skin infections through alternative medicine approach. However, due to the challenges of

COVID-19 pandemic, research on the identification and addition of herbs to the formulations for the production of herbal based scabicur[®] was suspended. During the period under review, the Unit produced and supplied a total of 2,137 range of Scabicur[®] products to the Consultancy Unit of the Institute for sale to the public. The products produced and supplied included, 1529 soap, 387 ointments and 221 lotions.

Supervision of Students Projects

The Division provided bench space and supervised research projects for 15 graduate, undergraduate and diploma students (ND-5, HND-2, BSc-3., MSc-3. PhD-1) from different Universities, Polytechnics, Mono-technics in Nigeria. The staff of the Division provided the needed expertise and guidance to the students on sample analysis, interpretation of results and report writing.

Challenges

Under listed are some of the problems that mitigate against the optimal performance of research, diagnostic and production activities in the Division

1. Inadequate and irregular water supply to the laboratories
2. Lack of funds for research
3. Inability to install some new equipment/faulty and malfunction of new equipment (water distiller, ELISA reader etc)
4. Lack of a fully functional PCR machine, and gel documentation system in the Molecular Biology Unit
5. Inadequate light microscopes, dissecting microscopes
6. Lack of a photomicroscope deter our efforts to document/photograph rare and important parasites for teaching and publication purposes

FUTURE PLANS

The Division hopes to explore several avenues to improve on her performances in the future. These includes but not limited to:

- a) Seek for external grants to bolster research activities in the Division

- b) Establish collaborations with Universities and Research Institutes for research on areas of mutual interest
- c) Obtain NAFDAC registration for Scabicur® products
- d) Train and retraining of staff on grantsmanship and other relevant areas of Research and Development (R&D).

PLANNING DIVISION

The Planning Division is responsible for the collection, collation and analyzing of all data generated in the Institute. Information generated from the data is used as a guide for the formulation of policies and the co-ordination of activities in the Institute. This is to ensure the smooth running of the Institute projects and programmes for the achievement of the Institute's mandate. It also serves as the DATA BANK of the Institute.

The Division processed several data related to research, vaccine production, socio-economic activities, Institute's landed properties and Human Resource Planning in the year under review.

The data collected this year were used for:

- The compilation of the Ministerial Baselines, Targets and performance from 2018 – 2023 and submitted to Federal Ministry of Agriculture & Rural Development.
- The compilation of the ARCN high level M&E Template and submitted to ARCN.

The Division also carried out the following activities:

- Inspected the Institute's landed properties in Vom and its environs. The documentation of these properties is on-going with the Plateau State Government.
- Updated the 2020 Institute Nominal Roll for the purpose of statistical analysis.
- Distributed the Institute's publications to dignitaries that visited the Institute.
- Processed and produced three hundred (300) PVC Staff Identification Cards.
- Compiled and analyzed the vaccine production data and also the vaccine demand & supply data.

The following figures show bacterial and viral Vaccine production as well as vaccine demand, supply & excess demand charts.

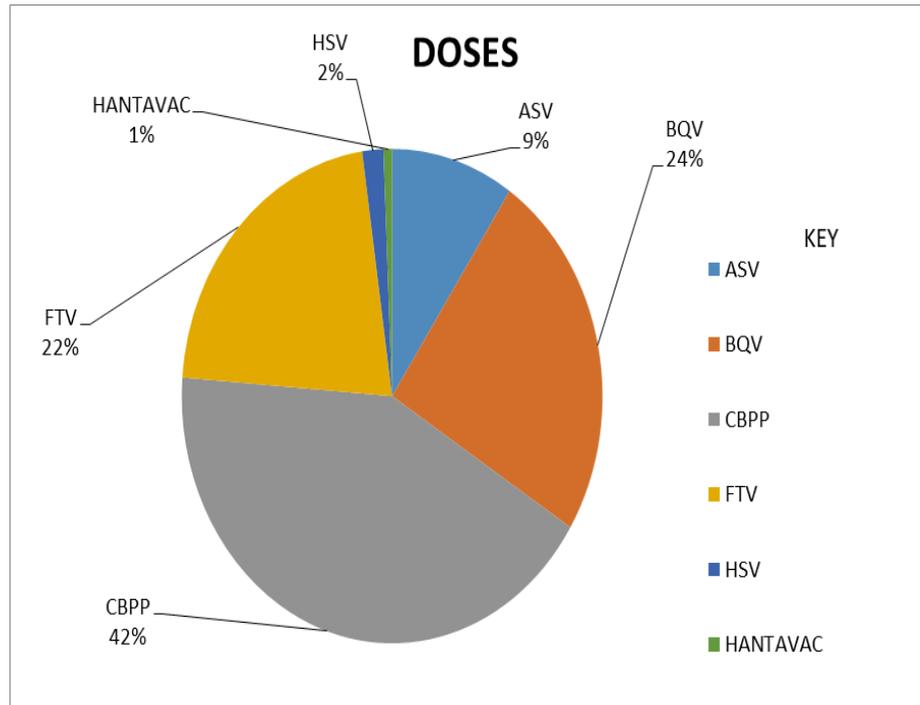


Fig. 1: Bacterial Vaccine Production

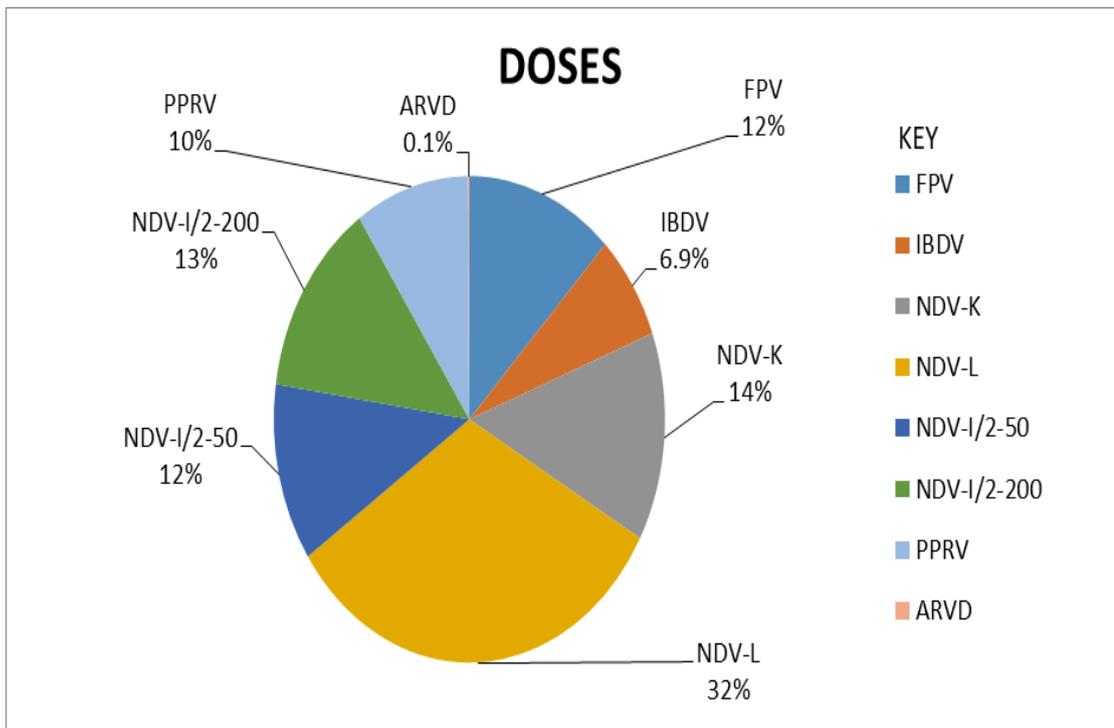


Fig.2: Viral Vaccine production

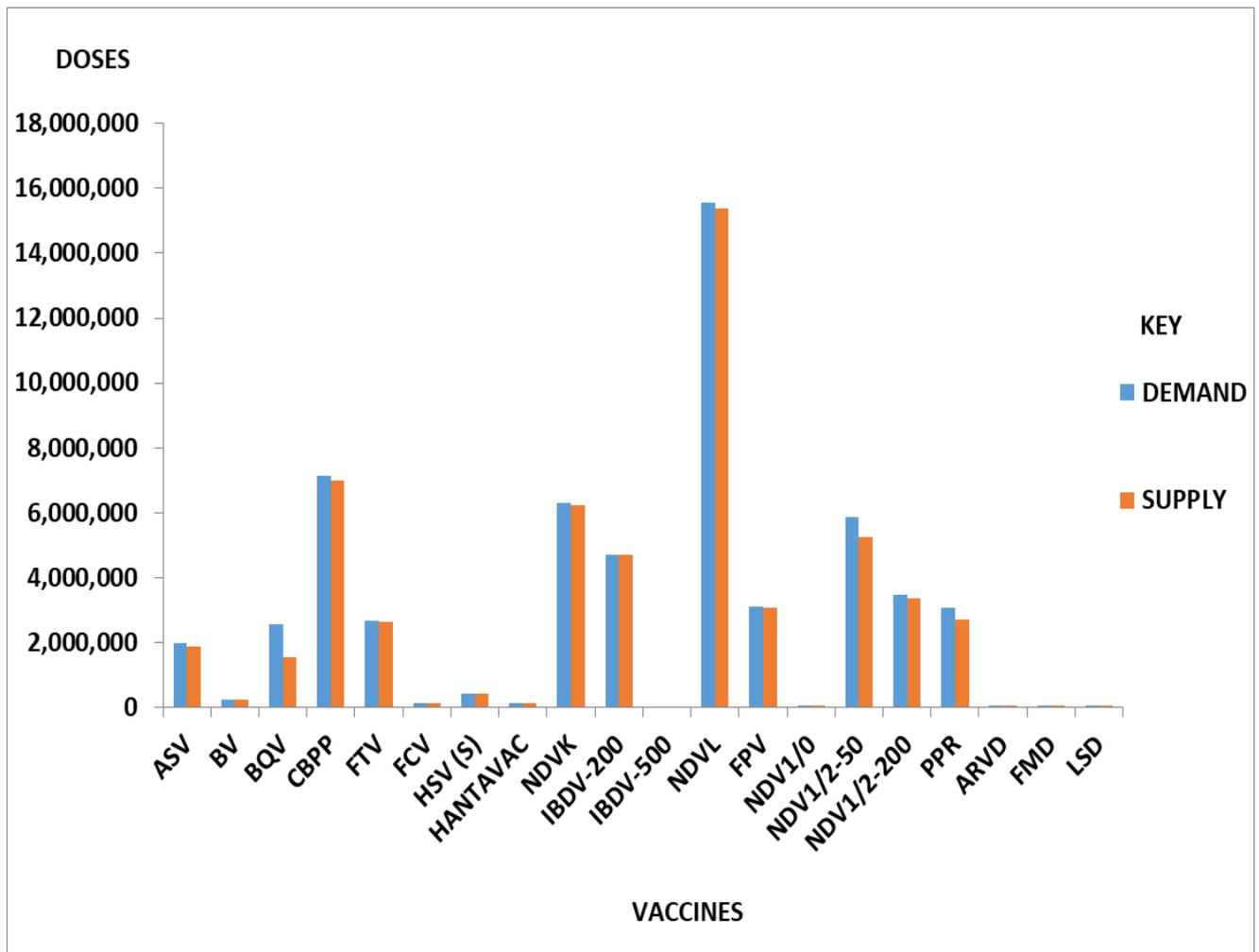


Fig. 3: Vaccine demand and supply

In the year under review, some members of the staff of the Division participated in workshops and trainings as follows:

- Two Planning Officers were nominated for the Procurement Planning training workshop in Zaria.
- One Planning Officer was also nominated for the Tenders & Contracts Management training workshop in Zaria.
- Four Staff from the Division participated in SPSS and ADAPTI training workshop held at the Institute.

- The Ag. Director, HOD and one Planning Officer attended the Strategic Planning Retreat held for Directors, Heads of Divisions and Change Agents at Novel Suits, Jos.
- Two Planning Officers were nominated for the Ministerial online zoom M&E training.

Challenge

- Inadequate office space for staff and for keeping sensitive documents.

FUTURE PLANS

- To establish effective and efficient information systems to manage the Institute's database.
- Good planning and organisational skills with a strong focus on attention to details, quality and high performance.

POULTRY DIVISION

The Division engages in poultry research and production activities geared towards the achievement of the mandate of the Institute. In addition, some products and services of the Division aimed at increasing protein supply to the populace are extended to staff of the Institute and the general public. Major activities of the Division include;

1. The production of fertile eggs and chicks for research, vaccine production and testing
2. Investigate diseases of poultry that may hamper productivity
3. Investigate nutritional and management aspects of all classes of poultry and their effects on disease management
4. Introduction, adaptation, and disease management of exotic breeds of poultry.
5. Research and teaching on production and health of poultry generally.

Specific Activities and achievements

- Production of fertile eggs /birds for vaccine production and research (Tables 1-3).
- NVRI/GCL collaborative research projects on production parameters.
- Production of birds for research (ducks, guinea fowls, quails, black bantam, geese etc.)
- Practical training on Artificial Insemination in chickens and turkeys

Health Section

During the period under review, biosecurity optimization formed the fulcrum of our efforts towards the prevention, mitigation, and control of diseases on the farm. Frequent training of all cadre of staff on biosecurity and the strict enforcement as it relates to management practices and productivity resulted in the significant reduction in the number of disease incidents during the year under review.

Furthermore, disease mitigation strategies like instituting early prophylaxis based on accurate prediction of disease signs and trends assisted in reducing mortality and morbidity.

Other activities of the Division are presented in the table 1-4

Table 1: Vaccine birds egg production and disposal

Month	Total production	broken	hatching	virology Setting	B/factory	DEA	Sales
Jan	43,324	1,706	-	11,018	26,340	570	5,306
Feb	26,624	2,155	-	14,239	7,140	390	2,700
March	49,664	3,300	-	16,900	24,930	2,655	1,879
April	90,470	5,785	5,000	21,815	32,640	6,030	19,200
May	91,211	4,805	-	21,600	50,160	2,070	12,576
June	90,048	7,728	2,120	20,380	46,110	1,710	12,000
July	88,805	5,775	2,200	23,380	44,610	840	12,000
August	87,952	6,040	2,200	27,792	37,050	2,760	13,400
Sept	84,303	7,729	-	27,940	37,650	3,509	7,202
Oct	83,790	5,989	3,000	19,576	39,390	2,041	13,794
Nov	71,156	5,286	-	13,520	43,020	1,515	7,815
Dec	66,703	3,278	-	6,410	47,880	3,265	5,870
Total	874,050	59,576	14,520	224,570	436,920	27,355	113,742

Table 2: Vaccine eggs supplied to Production and Research laboratories

MONTH	NDV	IBDV	AI	Q/C	FPV	RES	ARV	Infertile	Dead embryo
Jan	3,500	1,160	1,500	210	3,008	90	2,500	644	158
Feb	4,830	600	1,500	420	3,606	70	2,953	1,689	747
March	8,700	-	900	210	3,990	-	2,800	2,021	820
April	15,000	-	-	-	6,000	15	2,000	2,768	1,501
May	16,000	-	-	-	4,600	-	1,000	2,641	1,611
June	12,000	-	-	420	3,600	450	2,000	2,919	1,012
July	13,000	-	420	210	3,600	240	3,500	1,873	846
August	15,500	-	1,082	210	4,800	-	4,000	2,341	904
Sept	20,000	-	630	-	4,800	510	2,000	2,062	754
Oct	12,000	-	210	210	4,800	795	-	1,843	649
Nov	8,000	-	420	210	2,400	430	2,000	1,684	521
Dec	4,000	-	-	210	1,200	30	1,000	642	210
Total	132,530	1,760	6,662	2,310	46,404	2,630	25,753	23,127	9,733

Table 3: Egg production from other species of birds

Month	Quail A	Quail B	Black Bantam	Naked Neck	Duck	Geese	Fulani	Tiv	FUNAAB Alpha	Frizzle Feather	Turkey	Guinea fowl
Jan	4,934	18,466	192	10	325	22	250	173	13	17	-	-
Feb	8,295	18,876	220	12	342	11	237	181	22	17	-	-
March	5,559	14,059	275	6	348	4	302	247	72	19	-	235
April	14,882	21,978	303	13	558	-	360	227	49	28	-	549
May	17,360	16,621	310	8	514	-	279	180	75	35	-	588
June	12,929	15,790	367	20	551	-	332	182	120	29	8	772
July	2,481	21,089	278	34	497	-	178	152	106	37	-	800
August	6,563	20,792	49	10	60	-	33	36	48	8	3	-
Sept	9,352	10,330	125	10	72	-	19	43	34	12	40	-
Oct	11,488	8,776	174	21	214	18	107	48	44	31	59	-
Nov	967	1,516	201	31	756	30	197	117	39	34	-	-
Dec	-	-	128	19	720	35	108	77	36	28	-	-
Total	94,810	168,293	2,622	194	4,957	120	2,042	1,663	658	295	110	2,944

Challenges

- Inadequate junior staff to handle the operations on the farm.
- Lack of offices and convenience for junior staff
- Dilapidated hatchery due to damage by rainstorm.
- Old and obsolete incubators that need urgent replacement.
- Lack of mini-Poultry processing plant.
- Dilapidated administrative block/staff offices with insufficient tables and chairs.

FUTURE PLANS

- Increase egg production capacity for vaccine production.

PRESS AND PROTOCOL UNIT

The Press and Protocol Unit of the Institute is saddled with the responsibility of giving a positive outlook and projecting the good image of the Institute to the general public. It coordinates the activities geared towards projecting the image of the Institute through liaising with media organizations within and outside the state. The unit also arranges for periodic interviews and interactions between the Director/Chief Executive and media organizations. It also oversees the day to day running of the establishment, caters for the general wellbeing of Institute's visitors/guests by providing accurate information, hospitality and welfare.

Specific and routine functions include:

- To uphold the positive image of the Institute through liaising with the media, both print and electronic within and outside the state.
- Arrange for periodic interviews and interaction between the Director/Chief Executive and media organizations.
- Assist in coordinating conferences, seminars and other official programmes in the Institute.
- Coordinating the D/CEs office activities including meetings and conferences.
- Receive and cater for the general welfare of the Institute's Governing Board members.
- Arrange for tour of the Institute's facilities during courtesy visits by important personalities to the Institute.
- Receiving and accommodating visitors to the Institute as the situation warrants.
- Arrange for the transportation of guest(s) and other important personalities from international and reputable organizations.
- Coordinating meetings between management and staff of the Institute.

Specific Activities

A total of about seven notable individuals and groups were personally received by the Director/Chief Executive. Compared to preceding years the low visit to the Institute in 2020 is not unconnected with the COVID-19 movement restriction measures.

The year 2020 also turned out to be unique as the Institute witnessed two handing over ceremonies from a retiring D/CE to an Acting D/CE and the Acting D/CE to a substantive D/CE.

The notable activities include;

- Visit by the Senior Executive Course SEC No. 42/2020 of NIPSS Kuru on 12th February, 2020 led by the DG Prof. Habu Galadima.
- Handing over ceremony from former D/CE Dr. David Shamaki who retired from service to Dr. Reuben Ocholi who assumed office in acting capacity on 20th March, 2020.
- Visit by the Executive Governor of Plateau State Rt. Hon. Dr. Simon Bako Lalong on 15th April, 2020 to inspect the Biosafety level three (BSL- 3) laboratory for possible use as a COVID-19 testing Centre.
- Visit by the Governing Board Chairman of the Agricultural Research Council of Nigeria, Barr. Adetunji Ajagbe on 16th July, 2020.
- Visit by the Sector Commander FRSC Plateau State Command on 25th August, 2020.
- Handing over ceremony from former Ag. D/CE Dr. Reuben Ocholi to substantive D/CE Dr. Maryam Muhammad on 27th August, 2020.
- Visit by the Commissioner of Police Plateau State Command CP. Edward Chuka Egbuka on 2nd September, 2020.
- 3-day Strategic Planning Retreat for Directors, Assistant Directors, Heads of Divisions and Change agents organized by NVRI Management with the support of Propcom Mai – Karfi and UK Aid held at Novel Suites and Resorts Ltd Rayfield from Thursday 5th to Saturday 7th November, 2020.
- Handing over of laboratories for the Fleming Fund Country Grant Renovation Project on 12th November, 2020.
- Visit of Tetfund Research and Development Standing Committee (One Health Thematic Group) led by Prof. Hadiza Galadanci on 24th November, 2020.
- 5 Day In-house workshop on Basic Metrology and Calibration in Testing Laboratories from 30th November to 4th December, 2020.

Achievements

- The good image of the Institute was portrayed and maintained through adequate use of selected media organizations.
- Visitors were properly accommodated and treated as arranged.
- Items needed for official duties were made available and used accordingly (A new digital camera and other accessories were approved for purchase for the audio visual section).

Challenges

- There is need for more staff to man the protocol unit.
- Inadequate use of the media to further portray the activities and potentials of NVRI, Vom to the generality of Nigerians.
- Inadequate information and sometimes short notice to the unit about upcoming events which often lead to haphazard preparations.
- There is the need for training and retraining of Press and Protocol Officers to meet up with the current trends for improved job performance.

FUTURE PLANS

- To organize short courses and trainings for Press and Protocol Officers from the Institute in conjunction with relevant organizations (NIPR, Jos Business School, ASCON Badagry).
- To engage in activities that will assist in improving on the good image of the Institute.
- To arrange for periodic interactive sessions with the Institute community at large to assess common challenges and chart a course for image laundering of the Institute.

PRINTING AND PUBLICATION DIVISION

The Printing and Publication Division is a Service Department of the Institute charged with the responsibility of meeting the numerous printing requirements of NVRI and other interested organizations and individuals. Specifically, the Division is saddled with the responsibility of formulating new concept, design, code and printing of all the Institute vaccines labels. In addition, the Division perform the following printing task;

- Scientific and Technical Reports/ Journals.
- Vaccine Labels
- Official Sales Invoices
- Officials Receipts
- Official headed papers, envelops and File Jackets
- Examination answers booklets for the colleges etc.
- Annual Report
- Other printing and publications as may be instructed by the NVRI management

Official jobs handled in 2020

The following official jobs were executed during the year under review.

NDV (Komorov)	-	19020 pieces
IBDV	-	29,680 pieces
NDV-I2	-	94,518 pieces
NDV (lasota)	-	55,476 pieces
Fwol typhiod	-	17,450 pieces
CBPP	-	73,551 pieces
Newcastle disease IOS	-	4,130 pieces
PPR	-	68,390pieces
ASV	-	4,745pieces
FPV	-	20,670 pieces
FCV	-	620 pieces
HSV	-	9,168 pieces
Hantavac	-	3,102 pieces
ARV	-	38,660 pieces

Brucella	-	5,009 pieces
BQV	-	6,165 pieces
Lumpy skin disease (LSD)	-	1,148 pieces
2015 Annual Report	-	300 Books
2016 Annual Report	-	300 Books
2017 Annual Report	-	300 Books
2018 Annual Report	-	300 Books
ED/CEO headed paper	-	5,000 pieces
ED/CEO Visitors Slip	-	1,000 pieces
NVRI Gate Pass Tally	-	300 pieces

Constraints

- Shortage of technical staff- the Division need five additional technical staff
- Lack of modern printing equipment
- Inadequate office accommodation
- Lack of toilet convenience in the Division

Future Plans

At the moment, there are several printing technologies evolving with benefits and value. The Division desires to adopt and commence the use of such modern printing technology. The versatility of the modern printing technology will facilitate the production of quality products with security features, ultimately protecting the Institute's brands. Other benefits of having such facilities in the Institute include;

- i. Increased revenue generation
- ii. Promote speed and cost effective production.
- iii. Deliver goods of the right quality and quantity at the right time, and at the right price.
- iv. It motivates and boost the morale of staff

The Division looks forward to the Procurement and installation of modern printing equipment to enable us commence the printing of synthetic vaccine labels compare to other non-tire able water proof labels.

Additionally, staff of the Division should be trained and granted the opportunity to attend conferences, Book Fairs and International Printing Exhibitions. These are avenues for staff to acquaint themselves with various printing technologies from different companies from all over the world.

QUALITY CONTROL DIVISION

The Quality Control Division has the responsibility of standardization of services and products of the National Veterinary Research Institute. This is achieved through implementation of quality management system in the production of veterinary vaccines, biological and diagnostic services. The Division routinely conduct quality control tests on various vaccines produced by the Institute to ascertain fitness for use in the field and issue certificate accordingly for each batch of vaccine tested. These tests routinely conducted include, sterility, potency, purity, viability, safety, and absence extraneous agents. The Division also facilitates the external quality assessment of vaccines produced by the Institute by the African Union - Pan African Veterinary Vaccine Centre (AU-PANVAC) in Debre zeit, Ethiopia.

The Division also conduct internal audit of all the testing laboratories in the Institute to ensure Good Laboratory Practice in line with the requirements of the ISO 17025.

Specific activities

The year under review was an unusual one with disruptions caused by the emergence of COVID-19 and the various measures instituted by the government to stem the spread of the disease. Thus, the Division was unable to conduct lab audit as expected, however limited tests were conducted on produced vaccines to ensure minimum requirement for quality. The Division also shipped vaccines to the AU-PANVAC for the purpose of external quality assessment.

Vaccines submitted for internal Quality control

In total, 108 batches of 17 different vaccines were received from the production divisions for both internal and external quality assessment. Forty-two batches of eight bacterial vaccines and 66 batches of nine viral vaccines respectively, were received. Details are presented on Tables 1 and 2, respectively. In addition, the Viral Vaccines Production Division also submitted 1 vial each of **NDVI₂**, **NDVL** and **NDVK** vaccine **seed** for quality assessment.

Table 1: Bacterial vaccines subjected to quality assessment in 2020

Vaccine Type	Dose/vial	Number of Batches
Anthrax Spore Vaccine (ASV)	200	6
Brucella Abortus Vaccine (BAV)	100	1
Black Quarter Vaccine (BQV)	500	5
Contagious Bovine Pleuropneumonia Vaccine (CBPPV)	100	11
Fowl Cholera Vaccine (FCV)	200	2
Fowl Typhoid Vaccine (FTV)	100	4
Hemorrhagic Septicaemia Vaccine (HSV)	40	9
Hanta Vaccine (Hantavac)	40	4
Total		42

The vaccines were assessed for purity, safety, sterility, pH, temperature, vacuum and solubility during reconstitution.

Table 2: Viral vaccines subjected to quality assessment in 2020

Vaccine Type	Dose/vial	Number of Batches
Newcastle Disease Vaccine I ₂ (NDV-I ₂)	50	16
Newcastle Disease Vaccine I ₂ (NDV-I ₂)	200	3
Newcastle Disease Vaccine Lasota (NDVL)	200	12
Newcastle Disease Vaccine Komarov (NDVK)	200	5
Newcastle Disease Vaccine intraocular (i/o)	200	1
Fowl Pox Vaccine (FPV)	200	3
Infectious Bursal Disease Vaccine (IBDV)	200	4
Peste des Petits Ruminant Vaccine (PPRV)	50	15
Anti-Rabies Vaccine (ARV)	1	6
Lumpy Skin Disease Vaccine	50	1
Total		66

Quality parameters including purity, safety, sterility, pH, temperature, vacuum and solubility during reconstitution were assessed. Only sterility test was conducted for ARV, IBDV, and FPV due to unavailability of specific required materials.

Vaccines sent to AU-PANVAC, DebreZeit, Ethiopia for external quality control

In the course of the year under review, the Division shipped 13 representative batches of different vaccines to the AU-PANVAC for external quality control and certification. The details of the vaccines shipped are presented in Table 3.

Table 3: Details of representative batches of different vaccines sent to AU-PANVAC for external quality control

Vaccine Type	Batch No.
Newcastle Disease Vaccine I ₂ Thermostable (NDVI-2) 200 doses	01/2020
Newcastle Disease Vaccine I ₂ Thermostable (NDVI-2) 200 doses	02/2020
Newcastle Disease Vaccine I ₂ Thermostable (NDVI-2) 50 doses	03/2020

Newcastle Disease Vaccine I ₂ Thermostable (NDVI-2) 50 doses	07/2020
Newcastle Disease Vaccine-Lasota (NDVL)	01/2020
Newcastle Disease Vaccine-Lasota (NDVL)	05/2020
Anthrax Spore Vaccine (ASV)	01/2020
Anthrax Spore Vaccine (ASV)	02/2020
Black Quarter Vaccine(BQV)	01/2020
Fowl Typhoid Vaccine (FTV)	02/2020
Haemorrhagic Septicaemia Vaccine (HSV)	01/2020
Haemorrhagic Septicaemia Vaccine (HSV)	02/2020
Hantavac Vaccine (HV)	01/2020

Repairs and maintenance

- i. The Division received a new desktop attached to the inverted microscope used in the titration of cell culture based vaccines.
- ii. Repairs of the Divisional convenience facilities and the wash up section
- iii. Maintenance of two (2) autoclaves was carried out

Challenges

- Shortage or non-availability of laboratory materials such as media, reagents and glass wares
- Lack of Centrifuge for the Cell Culture laboratory.
- Non-functional Molecular Biology Unit necessary for the molecular identification of pathogens
- Inadequate equipment in the animal experimental house to enable effective conduct of potency and safety assay of Institute vaccines.

- Faulty equipment such as Bio safety cabinets with difficulty in accessing technical expertise

FUTURE PLANS

- Activating the Molecular Biology section of the Division.
- Provision of essential equipment, media and reagents required by the Division.
- Comprehensive renovation and equipping the experimental animal house to be cGMP compliant

RABIES RESEARCH AND DIAGNOSTIC LABORATORY

The Rabies Laboratory is charged with the following specific mandates

- i. Conduct research on rabies virus and rabies-related Lyssaviruses that cause neurological disorders that are clinically indistinguishable.
- ii. Confirmatory laboratory diagnosis of animal rabies infections caused by rabies and rabies-related *Lyssaviruses*, using *in vitro* and *in vivo* methods
- iii. Development and production of rabies antigens and antisera for research and diagnosis.
- iv. Assessment antigenicity of rabies vaccine and vaccine viruses by *in vitro* and *in vivo* methods
- v. Clinical trials and field evaluation of NVRI rabies vaccines and sero-monitoring of vaccinated dogs
- vi. Participation in national surveillance of rabies and rabies-related viruses
- vii. Participation in rabies proficiency test administered annually by the Nancy Laboratory alongside other reputable laboratories in the world.
- viii. Training and capacity building.

Notable Activities

i) Laboratory Diagnosis

A total of 176 specimens from seven (7) animal species (dogs, cat, sheep, goat, cattle, pig, and bats) were received and tested for rabies. Of these number, 161 (91.5 %) were from domestic dogs, 4 (2.3%) from cats, 8 (4.5%) from livestock (sheep, goat pig, and cattle) and 3 (1.7%) from bats. A total of 110 (62.5%) of all samples submitted were confirmed positive, while the remaining 66 (37.5%) were negative. 103 (93.6%) of the 110 positive samples were from domestic dogs. Table 1 shows the distribution of samples tested in the period under review.

In addition, a total of 154 research samples were tested for rabies by the direct fluorescent antibody test and 77 samples (diagnosis samples with human exposure which were tested negative by FAT) were inoculated in a total of 593 mice.

Table 1: Distribution of samples submitted for rabies diagnosis

State	Dog		Cat		Cattle		Sheep		Pig		Bat		Goat		Total
	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	
Bauchi	11	4	1	1	-	-	-	1	-	-	-	-	-	-	18
Kano	12	1	-	-	-	-	-	-	-	-	-	-	-	-	13
Ogun	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Kaduna	7	2	-	-	-	-	-	-	-	-	-	-	-	-	9
Gombe	4	2	-	-	-	-	-	-	-	-	-	-	-	-	6
Kebbi	1	-	-	-	2	-	-	-	-	-	-	-	-	-	3
Kwara	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
A/Ibom	2	2	-	-	-	-	-	-	2	-	-	-	-	-	6
Borno	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
FCT	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Katsina	2	-	-	-	-	-	-	-	-	-	-	-	1	-	3
Zamfara	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Bayelsa	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Ebonyi	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Plateau	57	46	-	2	-	1	1	-	-	-	-	3	-	-	110
Total	103	58	1	3	2	1	1	1	2	-	-	3	1	-	176

Key: +ve – Positive

-ve – Negative

ii) Collaboration/Bench Work Activities:

The laboratory hosted a PhD student from the Faculty of Veterinary Medicine, University of Ibadan and four HND students from the College of Animal Health and Production Technology Vom, who carried out their research work on rabies.

Achievements

Human anti-rabies pre- and post-exposure prophylaxis:

The Division facilitated administration of human anti-rabies pre-exposure prophylaxis to 52 staff (who were categorized “high risk group” or exposed to the virus) of the viral vaccine production division of the institute.

Challenges

- A.** Delay in furnishing/equipping the new Rabies Lab due to delay in clearance of imported materials at the Lagos port
- B.** Non-availability of the following equipment:
 - i. Biosafety cabinet class II
 - ii. Ultra-Low freezer (-80°C)
 - iii. Refrigerated centrifuge (+4°C)
- C.** Inadequate number of the following equipment:
 - i. Carbon dioxide (CO₂) Incubator (+37°C)
 - ii. Deep freezers (-20°C)
- D.** Non-availability of panel of monoclonal antibody to Nigerian isolates of rabies virus

FUTURE PLANS

- 1.** To replace the MIT with rabies tissue culture isolation test (RTCIT) using BHK cell line for isolation of rabies and related viruses, in order to conform to international standards.
- 2.** Seek the Institute’s approval for funds to purchase a panel of monoclonal antibody (MAb) to Nigerian isolates of the rabies virus. This is meant for antigenic typing of available rabies and related virus isolates in the archive of laboratory and as services to research community and the teeming clients of the Institute.
- 3.** Submission of proposal to the Institute on a survey of rabies and/or related viruses in bats, rodents and wildlife that are incriminated in the epidemiology of rabies in Nigeria.
- 4.** Submission of concept note to the Institute on assessment of immunogenicity of NVRI Low Egg Passage (LEP) Flurry dog rabies vaccine against circulating strains of rabies virus in domestic dog in Nigeria.

REGIONAL LABORATORY FOR ANIMAL INFLUENZA AND OTHER TRANSBOUNDARY ANIMAL DISEASES (TADs)

Mandate of the Laboratory

The Regional Laboratory is saddled with the following responsibilities: -

1. Diagnosis and research into avian viral diseases such as, Newcastle disease, avian influenza, Infectious bursal disease and Infectious bronchitis.
2. Preparation of viral transport media, antisera and antigens
3. Quality control assessment of avian viral vaccines
4. Field assessment of NVRI avian viral vaccines through seromonitoring of vaccinated flocks
5. Participating in national surveillance of avian influenza.
6. Participating in national and international networks and surveillance for emerging infectious/zoonotic/transboundary diseases
7. Rendering support to other West African Laboratories, as the Regional Reference Laboratory
8. Reference lab for West Africa Health Organization (WAHO)

Laboratory activities

The laboratory was actively involved in the diagnosis of COVID-19. More than 38,000 human samples from five states in northern Nigeria were received and screened for COVID-19 using molecular methods. The results were promptly dispatched through the appropriate channels.

The laboratory also carried out routine diagnosis and passive surveillance on 754 samples for the detection of avian influenza (AI), Newcastle disease (NCD), Infectious bursal disease (IBD) and fowl pox (FP). Overall, 36 samples were positive. Avian influenza virus was detected in 12 out of 309 (3.9%), NDV in 11 out of 311 (3.5%), IBDV in 9 out of 118 (7.6%) and Rabbit hemorrhagic disease virus in 4 out of 14 (28.6%) samples.

The Department conducted field assessment of NDV vaccines through sero-monitoring of vaccinated flocks. A total of 1378 sera samples were screened for sero conversion. The results and recommendations were communicated to the farmers for necessary actions.

Other Notable Activities

1. The Division completed the OIE twinning project on avian influenza with IZSVe, Italy. This was aimed at improving NVRI laboratory capacity for a better control of the Avian Influenza virus at National and Regional levels. During the twinning, five members of staff were trained on biosafety and biosecurity measures for avian influenza. Other topics covered were, classical and molecular techniques applied in the diagnosis of avian influenza, and epidemiology and the use of geographical information systems for the monitoring of animal diseases. Also staff were trained on laboratory quality management system. The final meeting/closing ceremony took place on the 25th November, 2020 virtually through Zoom.
2. The collaboration with CDC Atlanta/ and NCDC, FELTP on ecological surveillance of monkeypox disease in animals is still ongoing.
3. COVID-19 diagnosis and testing of human samples
4. Production of virus transport media (VTM) for COVID-19 sample collection/public health intervention
5. The Division participated in the baseline audit towards accreditation for testing laboratories with support from the West Africa Health Organization (WAHO)
6. Participation in national surveillance for Rabbit Hemorrhagic Disease by REDISSE
7. Participation in LIDISKI project on Newcastle disease virus

Achievements

1. Diagnosis of COVID-19 in Nigeria (over 38,000 human samples were analyzed)
2. The Division detected the **first incursion of a new disease into the country**; the Rabbit hemorrhagic disease virus.
3. Completion of the twinning programme with IZSVe, Italy

Challenges

1. Low performance of the inverter meant for the provision of stable power to the PCR machines.
2. There is need for the calibration of our pipettes by specialized companies as precision and accuracy is being affected

3. Only two of the biosafety cabinets are functioning in the laboratory; hence there is need to service and repair the others

FUTURE PLANS

1. The ecological surveillance of monkeypox disease in animals will continue in 2021
2. Continue with active surveillance for highly pathogenic avian influenza virus in live bird markets continues. This on-going collection, collation and analysis of data from live bird market will help in the prevention of future outbreaks as suspected cases will be properly handled.
3. Analysis of RHDV surveillance samples in 2021
4. Research and development of vaccine for the control of rabbit hemorrhagic disease
5. Strengthening national and international networks and collaborations
6. Expansion of other R & D products and services.

GENERAL SERVICES DIVISION (STORE)

The Stores Division ensures uninterrupted flow of working materials to the production and services departments of the Institute thereby contributing to the attainment of the Institute's objectives. In order to meet and cater for the demands of the specialized Departments of the Institute, the Central Store is organized into the following units; Drugs, Chemicals & Reagents, Glass Wares, Expendable and Non-Expendable and Consumable, Vaccine Despatch, and Receiving Stores Sections. Others are Workshop and Maintenance,

Dagwom Farm, LID, Furniture, Ledger and Scrap Stores Units.

Activities in the Units/Sections are effectively coordinated and discharged by 12 senior and 2 casual staff.

Specific Activities

During the period under review, the following activities were carried out.

- Receive all Institutes' stocks (Supplies from contract and finished goods from productions).
- Issue stocks to user departments and units based on approved needs.
- Documentation of consignment Receipts, Issue and posting.
- Carrying out all inventories of all materials and equipment in the Institute.
- Designate new location for new incoming items/materials.
- Collate requirements for replenishments.
- Monitor stock balance of stores items.
- Carryout stock count and Reconciliation exercise.
- Liaise with all the Divisions and Departments for their requirements/needs.

Achievements

During the year under review, we were able to achieve the following:

- Sort and grouped some items according to their classes.
- Fostered relationship among Divisional staff and with staff of other departments of the Institute.
- Reconciled physical items with the Bin Cards and Ledgers.

- Ensured that weekly, monthly and quarterly records were updated
- Cleanliness of the store houses is maintained.
- Continuous and timely production of vaccines reports.
- Effective documentation of all receipts and Issues
- Encouraged and insist that inventory cards are hung on the walls of all offices and laboratories in the Institute.

Challenges

Despite the installation of a central stock software with a server in the Accounts Division of the Institute, its effective use has not been achieved. Therefore, the attainment of desired results in the Stores have not been realized. This is attributable to;

- a. Staff have not been trained to handle the software
- b. Network failure from the server.
- c. Only two computers are linked to the server.

Other challenges of the Division are:

- Poor ventilation in the Stores house.
- Faulty power house door at workshop
- Lack of space due to stockpile of outdated or obsolete material/ items.
- The Store house is also chocked up with slow moving items and some expired drugs, chemicals and reagents.
- The vaccine cold room is not functioning hence needs total overhaul.
- Lack of protective clothing for all store staff
- Difficulty in proper documentation due to lack of central and coordinated procurement system giving rise to piecemeal individual/departmental purchases.
- Lack of mobility to ease the activity of the staff that is stationed at Dagwom Farm but covers the store operations in Poultry and LID.
- Lack of a cold van to convey vaccines from production Divisions to the designated sites.
- Inadequate numbers of staff to cope with increasing work in the Stores
- Lack of proper fencing of the stock yard for junk/returned materials
- Hazardous condition of the store house be looked at.

FUTURE PLANS

- Organize the training of staff of Stores Division on the use of store software and other FGN ICT compliance activity (GIFMIS)/ as well as procedures for handling of some of the dangerous chemicals.
- Request for the purchase of store handling equipment (Trolley, forklift)
- Diesel surface tank needs to be re-enforced against rainy season.
- A regular maintenance of cold room /diesel dispensing pump.
- To carry out quarterly inventory in the Institute.
- Discourage direct purchase or notify the stores whenever such purchases are made
- Upgrade the Store operations to Computer compliant standard
- Engage a specialist to recommend appropriate strategies for overhauling the Store for enhanced service delivery
- Provision of more furniture for staff

VETERINARY EXTENSION SERVICES DIVISION

The Veterinary Extension Services (VES) Division was created in January 2020. The department is responsible for transfer of technology from research to farmers, to address their livestock and poultry health needs. Technologies generated from the research departments are collated and packaged for dissemination to farmers. Questions from farmers are addressed and disseminated using appropriate medium for others to benefit.

The primary goal of the Division is to reach out to livestock and poultry farmers with veterinary health care extension messages. The department also liaises with the State Agricultural Development Project (ADPs) for effective dissemination of information and receiving feedback from farmers.

Veterinary Extension activities are executed through:

- A. Participation in extension and outreach meetings including:
 - Monthly technology review meetings (MTRM)
 - Zonal Steering committee and Zonal technical committee meetings
 - National Annual Research Review Meetings
 - Research extension farmer input linkage system (REFILS) workshop
- B. Publications (Electronic and Print)
- C. Representing the Institute at Agricultural shows and Trade fairs
- D. Organizing Training workshops, Open days, and seminars
- E. Stakeholder interactions
- F. Outreach activities including Agricultural Research Outreach Centres (AROC)
- G. Surveys (Thematic and General)
- H. OFAR (On-Farm-Adaptive-Research Trials)

Specific activities

- Baseline surveys were conducted in some Propcom selected states in collaboration with Propcom Maikarfi under the 'Digitalization of veterinary extension' grant. This was aimed at establishing livestock/poultry disease bench mark in the study areas.

- A veterinary extension phone application tool was developed in collaboration with Farm innovation Nigeria (FIN), with the sponsorship of the Propcom grant. Field testing of the App was also carried out.
- Open day was held on the 27th February 2020 with about 150 farmers in attendance.
- The Division participated in the zonal steering committee meeting that held at the Nigerian Stored Products Research Institute (NSPRI), Ilorin, Kwara state in March 2020.
- Staff of the Division visited Federal Radio corporations in Kaduna, Ibadan and Enugu to review the current status of the Institute's contract with each radio station. This was to explore the possibilities of resuscitating the airing of the extension radio programmes that had been suspended for some years.
- Staff of the Division participated in the LIDISKI (Livestock Disease Surveillance Knowledge Integration) training. Specifically, staff were involved in advocacy, data collection, extension services, and capacity building for biostatistics, participatory approaches and socio-economics. The Division was also involved in the validation of extension flyers to be used by the project.
- Staff of the Division were involved in the EU-FMD Project, participating in advocacy, sample collection and extension services (particularly amongst pastoralists). The ongoing study is on the role of small ruminants in the endemicity of Foot and mouth disease (FMD) in Nigeria.
- The Division represented the Institute at the 2020 Annual Review meeting held in Zaria
- The Division participated the 2020 REFILS Workshop held in Abuja.

Achievements

- Successful development of the veterinary extension phone application App for community animal health workers especially in areas hard to access.

FUTURE PLANS

- Capacity building through training and retraining of staff in modern extension methods

- Strengthen collaboration with the Cattle breeders association and establish collaborations with different livestock associations including Poultry Farmers Association and Pig Farmers Association. This will foster stakeholder interaction
- Consolidate on the newly created Photo database to be used for extension publications.
- To conduct diagnostic survey to establish livestock and poultry disease bench mark for the six agro-ecological zones
- Production of extension bulletins on: a). the responsible use of antibiotics in food animals by Poultry farmers, b). biosecurity in veterinary practice and c). effects of pesticides and other toxic chemicals on livestock, poultry and human health.
- To commence the airing of the Institute's extension radio programmes.

VETERINARY PATHOLOGY DIVISION

The is one of the four divisions carved out of the former Central Diagnostic Division (CDL) in the year 2020. The Veterinary Pathology Division has the following section: - Reception, Necropsy, Histopathology, Laundry and Incineration.

The Division serves as the major driver in fulfilling the institute's mandate on animal disease diagnosis and as a National and Regional Laboratory for Avian Influenza and other trans-boundary animal diseases for West and Central Africa.

The functions of the Division include:

1. Receive and document all cases / samples coming into the Institute and assign an identification /tracking number to each sample and dispatch same to the appropriate laboratory for analysis.
2. Conduct diagnosis and surveillance of diseases (emerging and re-emerging) within the nation and sub region as the situation may demand.
3. Report all notifiable diseases diagnosed immediately through the approved channel.
4. Constitute a team for field investigation of any animal disease outbreak.
5. The division provide ambulatory services to livestock and poultry farms and wild life parks.
6. Giving advice to livestock and poultry farmers based on cases /complaints received.

Specific Activities

A total of 841 cases were received and documented between 1st January 2020 to November 2020 (Table 1). Necropsy was conducted and appropriate samples were sent to the relevant laboratories for isolation, culture, morphological, biochemical or molecular identifications. The laboratory results were compiled and a final diagnostic reports were issued to the client and other stake holders according to the approved reporting channel.

The major disease conditions diagnosed in poultry were; Coccidiosis, colibacillosis, Salmonellosis, and helminthosis. In cattle the most prevalent conditions were Contagious Bovine Pleuro-pneumonia (CBPP), Colibacillosis and helminthosis. Rabies was the predominant diseases diagnosed in dogs and cats. High incidence of African Swine Fever

(ASF) was reported in pigs while Peste des petit ruminants (PPR) and mastitis were the commonly detected diseases in goats.

Table 1. Number of cases received for diagnosis in 2020

Animal spp	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Total
Poultry	49	53	33	24	21	26	36	21	28	18	29	338
Cattle	11	8	3	2	6	1	8	4	10	10	6	69
Dogs	14	20	17	10	15	13	28	23	15	12	18	185
Goats	0	0	2	1	1	6	5	3	3	0	3	24
Crabs	0	0	0	1	0	0	0	0	0	0	0	1
Horse	0	0	0	0	0	0	0	0	0	0	0	0
Cat	1	0	0	0	0	0	0	1	1	1	1	5
Human	0	0	0	0	0	0	1	0	0	0	1	2
Rabbit	5	3	2	3	4	1	1	3	7	10	8	47
Sheep	1	2	1	0	3	3	7	4	2	3	2	28
Pig	3	1	14	3	1	11	9	18	16	10	9	95
Fish	0	8	0	2	1	0	0	1	0	0	0	12
Plates	1	2	0	0	0	2	0	0	1	1	1	8
Water	0	3	0	1	0	0	0	0	0	0	0	4
Wildlife	0	0	17	0	0	0	0	0	0	0	1	18
Feeds	1	0	2	0	0	0	0	0	1	0	1	5
TOTAL												841

WASTE DISPOSAL

Wastes generated from various Divisions in the Institute and other organizations in Plateau state were received and properly disposed of through incineration in line with international standards. The unit incinerated waste estimated to weight **25,506.2kg (Table 2)**.

Tables 2: INCINERATION WASTE, 2020

Location	Weight of waste disposed
Necropsy	5,244.7
Rabies	956.2
Viral vaccine production	13,253.8
Bacterial Research	639.9
Bacterial Vaccine Production	847.5
Drug development	79.4
Regional Lab.	368.1
Viral Research	157.9
Mycology	127.4
Clinical pathology	45
Covid-19 Testing Centre	1,218.8
Histopathology Lab	138.1
Para CDL	54.6
Quality Control	45.1
Bio-technology	216.7
Unknown	1,582
CDL	405.3
FMD Lab	11.7
Biochemistry Lab	81.2
Dagwom Farm	22.9
Fieldwork	8.9
Vet. Clinic	1
Total	25,506.2

CHALLENGES

1. Lack of staff motivation in view of the nature of the duties performed
2. The Division is under staffed. There is need for additional requisite staff such as 3 veterinary pathologists and 5 Livestock attendants.
3. None availability or late supply of consumables such as samples bottles, universal bottles, hard gloves, nose mask, (protective kits) detergents, absolute alcohol, formalin, zylene, Hematoxylin and Eosin stains etc.
4. Due to the frequent break down of the incinerator, materials awaiting incineration especially vaccine eggs get piled up, constituting health risks to the staff of the Division.
5. We have difficulty getting some laboratory results, especially with the regional and PPR laboratories. We pray the management will help plead with them to help shorten our turnaround time.
6. Non availability of a cold room (+2 - +5°C) as part of the Post-Mortem facility for the preservation of carcasses and tissue samples.
7. Broken down laboratory equipments; microwave

FUTURE PLANS

1. Provision of modern teaching photomicroscopes to aid in histological reading of slides and facilitate teaching.
2. Timely provision of laboratory consumables and laboratory protective wares in good number.
3. Installation of a cold room (+2 - +5°C) as part of the postmortem facility for the preservation of carcasses and tissue samples.
4. The incinerator need to be replaced with a new one as the current one is old (over 40 years) and is gulping so much money for maintenance and an operation.
5. Cooperation of other laboratories to reduce turnaround time.

VETERINARY PUBLIC HEALTH AND PREVENTIVE MEDICINE DIVISION (VPH&PMD)

The VPH&PMD was created to enhance the collation and analyses of research and diagnostic data generated in the Institute. The ultimate aim is to process and present the data in an accessible and legible format to the end-users and policy makers. Basically, the Division discharges her duties through routine activities such as; disease survey, monitoring, surveillance and notification as well as maintaining an active epidemiology data bank and information system.

These activities ultimately lead to active collection, collation, analysis, and processing of animal diseases data. Subsequently, the data generated will be converted to an active epidemiology data bank and information system using requisite professional software. This will be used for the provision of a sustainable and readily accessible information about diseases affecting animals and their economic and public health implications.

The Division also ensures that the information gets to all relevant stakeholders and end users for enhance policy formulation that will promote animal and public health, livestock production and food security/safety.

Functions and mandate of the Division

These include:

- Creation of sustainable animal disease database.
- Collection and collation of all data on animal disease diagnosed in all the laboratories of the Institute.
- Storage and recording of all data collated into a customized database.
- Research and investigations of outbreak of diseases of public health importance.
- Organize surveillance, surveys and monitoring of endemic diseases and/or disease outbreaks, especially emerging and re-emerging zoonoses.
- Disease modelling and forecasting.
- Designing disease control and prevention strategies.
- Providing timely and evidence-based information to policy makers on animal disease control measures to be adopted.

- Providing direction for future studies on animal diseases.

Specific notable activities

- Preparation and dissemination of monthly disease reports to all designated authorities and stakeholders.
- Creation of animal database from 2015-2019.
- Ongoing creation of animal database from 2010-2014.
- Training on participatory epidemiology for the staff of the Division under the LIDISKI project.
- Preliminary training on R programming for the staff of the Division under the LIDISKI project.
- Prompt notification of the designated authorities about incidence and outbreaks of notifiable animal diseases such as increase trend of ASF cases in southern states of the country. Notification of appropriate authorities of the detection of about Rabbit Haemorrhagic disease in Nigeria.

Achievements

Analysis of 2015-2019 available data on the following: top 10 states reporting diseases to NVRI; top 5 most reported and 5 least reported diseases per species; number of OIE notifiable disease occurrence in time and space, and disease occurrence of zoonotic diseases per species in time and space.

Challenges

Presently, the Division has no office accommodation and laboratories. The Division does not have adequate number of requisite staff to handle her activities. The required staffing level for the effective take-off of the Division is as listed:

1. Disease Notification and Reporting Section: 1 PVRO, 1 SVRO, 1 Biostatistician and 1 Bio-data manager.
2. Field work/Outbreak Investigation Section: 1 CVRO, 1 PVRO, 1 SVRO, 1 VRO, 1 Field Epidemiologist (Laboratory Track), 1 Environmental Health Officer and 1 Livestock Officer.

3. Animal Disease Data Collation and Database Maintenance: 1 CVRO, 1 PVRO, 1 SVRO, 1 VRO, 1 Field Epidemiologist (Laboratory Track) and 2 Biostatistician.

Furthermore, the following items/equipment/gadgets such as laptops with capability for complex modelling activities and epidemiological simulations of disease dynamics are required for effective and efficient data management. In addition, licensed Microsoft packages, statistical and epidemiological software packages (Decision tools suit 6.1 Palisade Computation, MATLAB R2016a, Stats graphics) are critical for data management and should be provided. A dedicated vehicle for prompt response to reported outbreaks alongside basic sample collecting materials and personal protection equipment are also needed. Voltage stabilizers for provision of uninterrupted power supply and external storage devices are needed to ensure safety of appliances and a back-up for the Institute's data.

Future plans

The Division intends to develop a robust and real-time database of common diseases of animals in Nigeria.

Establish a link with all the Divisions in the Institute and other relevant national and international bodies for continuous disease surveillance in Nigeria.

To generate epidemiological profile of major livestock and poultry diseases in Nigeria in order to produce disease mappings and models for disease predictions. This will serve as early warning signals needed to develop emergency preparedness plans against economically important or zoonotic disease outbreaks.

VIROLOGY RESEARCH DIVISION

Activities conducted in the various sections of the division within the period under review includes;

Morbillivirus and related viruses Laboratory

1. Surveillance for morbilliviruses (Peste des petits ruminants and canine distemper) and related viruses (Canine Parvovirus) in all states of the federation especially in response to reported outbreaks.
2. Diagnosis of the viruses using serological (competitive ELISA, blocking ELISA), Immuno-capture ELISA and molecular biology (RT-PCR) techniques.
3. Research to identify and characterize the morbilliviruses strains circulating in Nigeria to enrich existing knowledge and epidemiology of the disease in country.
4. Isolation of viruses using appropriate cell lines.
5. Research into more effective vaccine options for PPR control in Nigeria.
6. Training of candidates of the College of Veterinary Surgeons of Nigeria and students on Industrial Work Experience Scheme (SIWES) posting from tertiary institutions across Nigeria.

Viral Skin Diseases laboratory

1. Research on Lumpy skin disease in cattle, sheep and goat pox, contagious ecthyma and bovine papilloma viruses.
2. Routine diagnosis of lumpy skin disease, sheep and goat pox and contagious ecthyma from field samples using ELISA, conventional and real time multiplex PCR.
3. Production of lumpy skin disease vaccine and goat pox vaccine in cell culture.
4. Coordinate the national surveillance on the status of lumpy skin disease, sheep and goat pox and contagious ecthyma in Nigeria.
5. Development of pen side/field technique for the diagnosis of livestock diseases using Loop mediated Isothermal amplification assay.
6. Isolation of lumpy skin disease virus, Pox viruses from different animal species, Orf Virus, Bovine Papilloma Viruses and Pseudolumpy skin disease virus in embryonated eggs and cell lines

Avian Viral Diseases laboratory

1. Research on avian viral diseases especially Newcastle, Infectious bursal disease, Chicken infectious anemia and fowl pox viral diseases in Nigeria.
2. Surveillance and diagnosis of avian viral diseases in Nigeria using Haemagglutination inhibition, agar gel immunodiffusion and polymerase chain reaction (PCR) followed by sequencing.
3. Isolation of NCDV, IBDV, FPV using embryonated chicken eggs and cell lines.
4. Determination of the antiviral activities of some indigenous plant extracts are routinely carried out on some of the isolated avian viral agents.
5. The laboratory also assisted students from higher institutions with their final year projects

VIRAL VACCINES PRODUCTION DIVISION

The Division has a primary responsibility of producing viral vaccines for the prevention of livestock and poultry viral diseases of economic and/or public health importance in Nigeria and other West African countries.

In addition, the Division produces distilled water and cell lines and media for use by other Divisions within the institute. In view of the domiciliation of the Freeze Drying and Labeling Machines within the Division, it also renders services to other Divisions involved in the production of vaccines and other biologics.

During the year under review, the Division produced the following vaccines:

Infectious Bursal Disease Vaccine or IBDV (Gumboro)

Fowl Pox vaccine (FPV)

Newcastle disease vaccine (La Sota)

Newcastle disease vaccine (Hitchner B1-Intra-ocular)

Newcastle disease vaccine (Komarov)

Thermotolerant Newcastle disease vaccine (NDV I-2)

Peste des Petits Ruminants (PPR) vaccine

Rabies vaccine for dogs (ARV)

Lumpy Skin disease (LSD) vaccine

Vaccines production

The Division produced **54,182,928** doses of the various veterinary viral vaccines between January and December, 2020. The details and summary of vaccine production for this period by the Division are presented on Tables 1 and 2.

The Division produced about **5000** litres of distilled and MilliQ water for its use and that of other Divisions in the Institute. Various cell culture media (GMEM, DMEM, EMEM, RPMI, F-12, HBSS) and cell cultures in monolayer and suspension including Vero R133, CEF and BHK-21 were also produced for research as well as quality control of viral vaccines and for use in various divisions of the Institute and the two colleges. A culture bank of these same cells are being maintained in liquid nitrogen in the Division.

The Freeze Drying Section also lyophilized bacterial vaccines produced by the Bacterial Vaccine Production Division (BVPD) which included Contagious Bovine Pleuropneumonia (CBPP) vaccine, Fowl Typhoid Vaccine (FTV), and *Brucella* S vaccines.

Table 1: Viral vaccines production (doses)

Month	ARV	IBDV	FPV	NDV-K	NDV-L	NDV- $\frac{1}{2}$ o	NDV I200	NDV I250	PPRV	Total
January	0	1,082,000	0	1,783,200	2,503,200	0	2,017,600	289,450	0	7,675,450
February	18972	0	0	953,000	3,207,200	0	0	622,450	490,950	5,292,572
March	18906	0	2,204,400	0	0	0	0	0	777,350	3,000,656
TOTAL	37,878	1,082,000	2,204,400	2,736,200	5,710,400	0	2,017,600	911,900	1,268,300	15,968,678
April	0	0	0	0	0	0	0	0	0	0

May	0	2,335,600	0	0	0	0	0	561,450	423,750	3,320,800
June	0	0	1,851,600	0	1,054,800	0	0	1,042,450	0	3,948,850
TOTAL	0	2,335,600	1,851,600	0	1,054,800	0	0	1,603,900	423,750	7,269,650
July	0	0	0	0	1,926,600	0	1,954,200	494,850	280,750	4,656,400
August	0	0	0	0	0	0	0	0	439,950	439,950
September	0	0	0	936,200	2,000,600	0	2,357,000	0	498,400	5,792,200
TOTAL	0	0	0	936,200	3,927,200	0	4,311,200	494,850	1,219,100	10,888,550
October	0	2,401,000	1,413,000	0	4,007,600	2,392,200	0	0	0	10,213,800
November	0	0	0	1,965,800	3,839,200	0		1,093,000	962,200	7,858,200
December	0	0	0	0	2,007,400	0	0	2,199,800	0	4,207,200
TOTAL	0	2,401,000	1,413,000	1,965,800	9,854,200	2,392,200	0	3,292,800	962,200	22,279,200

Table 2: Summary of vaccine production in 2020

S/No	VACCINES	DOSES
1.	ARV	37,878
2.	IBDV	5,818,600
3.	FPV	5,469,000
4.	NDV-K	5,638,200
5.	NDV-L	20,546,600
6.	NDV-I/O	2,392,200
7.	NDV-12 (50 DOSES)	6,303,450
8.	NDV-12 (200 DOSES)	4,103,650
9.	PPRV	3,873,350
TOTAL		54,182,928

Notable Activities

- Repairs of two refrigerated centrifuges
- Activation and utilization of the repaired Newmann Labelling Machine for the labelling of vaccines

Challenges/Constraints

- Poor quality fertile eggs for vaccine production
- Delay in supply of critical reagents for vaccine production
- Frequent breakdown of the Lyovac GT 40 Freeze Dryer and software and computer-related breakdown of the LyoFast 7 Boc Edward Freeze Dryer
- Unavailability of potent master seed for vaccine production to increase vaccine dosages and titres.

FUTURE PLANS

- Increase dose/vial of critical vaccines for cost effectiveness
- Resuscitation of roller machines for the increased production of cell culture-based vaccines
- Development of cell culture based anti-Rabies and Fowl pox vaccine

STAFF PUBLICATIONS

- Forcados GE, Sallau AM, Muhammad A, Ochuko LE, James DB.** (2020). *Vitex doniana* leaves extract ameliorates associated with 7, 12-Dimethyl Benz[a]Anthracene-induced mammary damage in female Wistar rats. *Nutrition and Cancer*, March 28: 1-15. doi: 1.1080/01635581.2020.1743866.
- Akpa AR, Ayo JO, Mika'il HG, Zakari FO.** (2020). Protective effect of fisetin against subchronic chlorpyrifos-induced toxicity on oxidative stress biomarkers and neurobehavioural parameters in adult male albino mice. *Toxicology Research*, doi: 10.1007/s43188-02000049-y.
- Muraina I, Idris I, Otor M, Bata S, Makama S.** (2020). Physiochemical analysis for quality and safety of some selected animal soaps compared to human soap in Plateau state. *IOSR Journal of Applied Chemistry*. 13 (3): Ser. II (March. 2020), 25-28.
- Oladipo OO, Akanbi BO, Ekong PS, Uchendu C, Ajani O.** (2020). Lead toxicoses in free ranged chickens in gold-mining communities, Zamfara, Nigeria. *Journal of Health & Pollution*, 10 (26): 200606, June 2020.
- Laleye, A.T.** and Abolnik, C., 2020. Emergence of highly pathogenic H5N2 and H7N1 influenza A viruses from low pathogenic precursors by serial passage in ovo. *PLoS one*, 15(10), p.e0240290. <https://doi.org/10.1371/journal.pone.0240290>
- Shittu, I., Bianco, A., Gado, D., Mkpuma, N., Sulaiman, L., Laleye, A., Gobbo, F., Bortolami, A., Bonfante, F., Vakuru, C. and Meseko, C.,** 2020. First detection of highly pathogenic H5N6 avian influenza virus on the African continent. *Emerging Microbes & Infections*, pp.1-14.
- A.N. Egbuji, A. A Chukwuedo, L. N. Shedua, J. K. Gyallak, L. N. Swomen, N. C. Obene, U. K. Akachi, H. C. Ngwu, K. O. Idahor, M. Muhammad and L. U. Enurah** (2020). Overdose administration of Thermostable Newcastle Disease Vaccines to Naïve Unvaccinated 6 weeks Old Cockerels at NVRI, Vom Plateau State, Nigeria *Journal of Advances in Microbiology*. 20(2): 29-34, 2020
- A. N. Egbuji, A. A. Chukwuedo, L. N. Shedua, J. K. Gyallak, L. N. Swomen, M. Muhammad, C. I. Nwosuh, L. U. Enurah** (2020). Effect of Extended Transit and Temperature Variations on EID₅₀ Values of Thermostable NDVI-2 Vaccines. *European Journal of Biology and Biotechnology*. Vol 1 Issue 5, September 2020

M. Dauda, **Y. J. Atuman**, G. S. N. Kia, D. O. Omoniwa and **I. S. Tekki** (2020). A Case Study of Rabies in a Two Month Old Bull Calf in Bauchi, Nig. *Asian Journal of Research in Animal and Veterinary Sciences* 6(3): 32-36, 2020; Article no. AJRAVS.61631

Christianah Odita, Ishaya Tekki , Adigun Abass , Israel Barde , Emmanuel Hambolu, Gyang Moses, Joseph Davou , Yakubu Dashe , Chika Nwosuh and Reuben Ocholi (2020). effects of road networks and human population density on the risk of dog bite incidence and rabies in Nigeria. Presented at the Annual (Virtual) Meeting of The American Society of Tropical Medicine and Hygiene. November 15Th - 19Th 2020

Sándor Hornok, Jenő Kontschán, Nóra Takács, Anne-Lise Chaber, Ali Halajian, Getachew Abichu, **Joshua Kamani**, Sándor Szekeres, Olivier Plantard. (2020). Molecular phylogeny of *Amblyomma exornatum* and *Amblyomma transversale*, with reinstatement of the genus *Africaniella* (Acari: Ixodidae) for the latter. *Ticks and Tick-borne Diseases* 11 (2020) 101494

Di Cataldo S., **Kamani J.**, Cevidanes A., **Msheliza EG.**, Milan J (2020). Hemotropic mycoplasmas in bats captured near to human settlements in Nigeria. *Comparative Immunology, Microbiology and Infectious Diseases* 70:101448.

Kamani J., Yidawi JP., **Sada A.**, **Msheliza EG.**, Usman A. Turaki UA (2020). Prevalence and morphotype diversity of *Trichuris* species and other soil-transmitted helminths in captive non-human Primates in northern Nigeria. *Journal of Threatened Taxa* 12(10): 16239–16244.

Kamani J., Msheliza EG., Yidawi JP., Sada A., Turaki A.U., Javier G-M (2020). Prevalence and diversity of endoparasites in wildlife in northern Nigeria. *Nigerian Journal of Parasitology* 41(2):150-157