Animal Husbandry

Research, Education and Development

P. N. Bhat
M. P. Yadav

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Prof. (Dr.) M.P. Yadav, Ex-Director and Vice Chancellor, Indian Veterinary Research Institute, Izatnagar; Ex-Vice Chancellor, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP), India, is an eminent microbiologist having major research contributions in animal health by development of indigenous vaccines against equine influenza A Equi-2 (H3N8), infectious laryngotracheitis (ILT) and colisepticaemia of poultry, and goat pox; isolation and characterization of animal and poultry viruses, namely equine influenza virus, equine infectious anemia virus, equine herpes virus-1 (EHV-1), EHV-3, EHV-4, equine rotavirus, avian adenovirus, buffalo pox virus; followed by development of sensitive and cost effective diagnostic tests/kits; epidemiology of Q Fever, brucellosis, rabies, bovine herpes virus-1, and disease management.

Prof. Yadav worked as Professor & Head Division of Virology at IVRI, Mukteswar, Director of National Research Centre on Equines, Hisar. He is a Fellow of the National Academy of Agricultural Sciences (NAAS) New Delhi and National Academy of Veterinary Sciences, India. Prof. Yadav has guided the destiny of several professional bodies as President, Indian Virological Society (1996-2003); President, Indian Association of Veterinary Microbiologists & Specialists in Infectious Diseases (1999 to date); President, Indian Agricultural University Association (2006-07); President National Academy of Veterinary Sciences (2011-13), Secretary, National Academy of Agricultural Sciences (2014-16) and Patron, Society of Plant Research (2008 to date).

Prof. Yadav is recipient of numerous national/international awards. To mention a few-OIE, International Meritorius Award 2000; World Intellectual Property Organization (WIPO), Geneva Award 2005; ICAR Special Award 1998; Distinguished Veterinarian Award 2002, Dr. P. Richard Masillamony Oration Award 2003; M.S. Swaminathan Agricultural Scientist Award 2009; Dr. P. G. Pandey Oration Award 2010 (IAVMI); Dr. A. Lingard Memorial Award, 2012 by Indian Academy of Environmental Sciences; Dr. M.R. Dhanda Memorial Oration Award, 2012 (IAPH); Excellence in Virology Award - 2013 of Indian Virology Society (IVS) and Prof. K. S. Bhargaba Oration Award- 2016 (IVS).

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PREFACE

India became independent on August 15, 1947 and new Government started. The contribution of agriculture sector to the total GDP in 1950–51 was 50.5%, of which the share of animal husbandry was 15.5%. During 1980 to 2012–13, the contribution of livestock to agriculture and allied sectors rose from 18.6% to approximately 26% at current prices in contrast to a reduction of crops agricultural output from 41% to approximately 15%. During 2014–15, the value of output from livestock sector as per the estimates of the Central Statistics Office (CSO) at current prices was about INR 7,33,054 crores which is approximately 28.7% of the value of output from agricultural and allied sector.

If we look at overall world meat production, it is predicted to stagnate at about 321 million tonnes in 2016. Poultry is forecasted to register some growth, followed by bovine and ovine meat, while pig meat output could decline. However, global meat trade is expected to recover, growing by 2.8 percent to 30.6 million tonnes. International dairy product prices remained depressed during the first five calendar months of 2016, due to subdued import demand and plentiful export availability. Milk production continues to increase steadily in many countries, although lower prices are expected to dampen growth in world output in 2016 (FAO- Food Outlook, June 2016).

In India meat production from all sources was 7.0 MT in 2015-16 with an average annual growth rate of 7.51% during the last five years (2011-12 to 2015-16). Buffalo meat has grown at approximately 8% annually. Cattle, buffalo, sheep, goat, pigs and poultry contributed 5.0%, 23%, 7%, 13%, 6% and 46.0%, respectively, to total meat production during 2015-16. The poultry population in India is 729.21 million (2012) which is approximately 3% of the world's population; with the growth in annual egg production being 5.6% between the years 2011-12 and 2015-16, and that of chicken meat approximately 3% of the world's production. The contribution of bullock power for agriculture operations was 71.6% in 1961 when the foundation of the green revolution was laid, though over years it was reduced to about 23% (in 1991) due to farm mechanisation. It has remained at approximately 23% until the 19th Livestock Census 2012.

Presently, the contribution of animal draft power to total motive power in agriculture is about 5.8%.

As per 19th Livestock census (2012), India had 109 million buffaloes, which is more than half (57.3%) of the world's buffalo population. Buffaloes constituted 21.23% of the total livestock population. Buffalo is the 'dairy animal of 21st century' in India. With 57 million adult females, population of breedable buffaloes is one-third. Presently, they contribute about 51% of the total milk produced in the country. The buffalo population has increased approximately 151% between 1951 and 2012 (43.4 million in 1951 to 109 million in 2012). As per the 19th Livestock census (2012), the Indian buffalo population consist of 17.05% pure-bred, 39.58% graded and 43.37% non-descript animals. The river buffalo constitute around 65% of the total world buffalo population and accounts for 92% of the total milk produced. India alone contributes 42% of total milk produced by buffaloes. The largest concentration of swamp buffaloes, found in rice growing countries of Asia, will remain about 5%. The distribution of the buffalo is conspicuous by its being confined principally to the areas where animal husbandry is poorly developed and badly organized. By and large, buffaloes are owned only in small numbers generally by resources-poor farmers. In fairness to buffalo stock owners in these regions, it may be stated that they maintain buffaloes not from ignorance of the potentialities of other large ruminants but because they find that in prevailing agricultural situation no other domestic animal will thrive like the buffalo and at the same time be so useful and economical.

Water buffaloes have been responsible for more than 10% of world milk production for several years, but the potential of these animals has seldom been appreciated or recognized. One of the main reasons for this is that those who have a stake in buffalo rearing are generally poor and underprivileged, and not able to project the impact this animal has on their livelihood and well-being. The water buffalo is an important beast of burden in Asian farming. It is widely used to plough, level land, plant crops, puddle rice fields, cultivate field crops, pump water; haul carts, sleds and shallow draft boats. It is also used to carry people, thrash grain, press sugarcane, haul logs and more. Buffaloes have an advantage over other draught animals in wet or muddy areas, with their large hooves. Their legs can withstand wet conditions better than cattle, although they are not as fast as cattle, horses or mules. Buffaloes have been used as draught animals for centuries. This has led to exceptional muscular development; some animals can weigh more than 1000 kg. Though buffalo is a major source of meat, they have not been used solely for meat production until recently. Most buffalo meat is derived from old animals so not surprisingly the meat is considered to be of poor quality. However, this is not true of meat from younger animals. Buffalo meat from animals properly reared and fed, is tender and palatable. Buffaloes are lean

animals. In general, a buffalo carcass has a higher proportion of muscle and a lower ratio of bone and fat than a cattle carcass. Buffaloes are managed under very different conditions over the world. These depend both on the geographic situations and for what purpose the buffaloes are used; any system from multipurpose animals kept in backyards to high yielding milk animals in advanced farms may exist. Over time buffalo rearing has shifted from the backyard to commercial farms and large business enterprises. The immense popularity of buffalo milk and meat products has ensured that buffalo production follow the path of the dairy cattle industry. However, for this species to perform optimally under the pressure of intensive production system, the breeds have to be improved, with clear focus on the desired output. This has not yet happened. Buffalo, although potentially excellent for both milk and meat production still languishes in obscure conditions of poor nutrition and breeding. Management can bring about notable improvements in the productive and reproductive performance of buffalo.

The achievement in agriculture sector are attributed in large part to technology led improvement in productivity and investments in the agriculture R&D with allied sectors. This has been divided into three phases. At the time of independence (1947) the population grew 3.6 times from 361.1 million in 1951 to 1302 million in 2016, while food grain production grew from 51 million tonnes (mt) in 1951 to 273 mt in 2016. India's horticultural production has increased from 25 mt to over 287 mt in the same time, and milk production to 155.5 mt. This has been possible to achieve self-reliance in food security but hunger among the population remains still a cause of worry. While India is still to achieve MDG goal of reducing hunger, the 2016 Global Hunger Index (GHI) report indicate that globally, about 795 million people are chronically undernourished and India has 40% of all such children.

Last century agriculture has shown three distinct phases of growth (i) till 60's it was more dictated where farmer was dictated by food needs of the family and a little for special social requirement, as he did not spend much on produce of such as natural resources or technology, (ii) the second phase was driven by technological production, input driven agriculture, which give high production in food grain crops like rice and wheat under better resources areas and was called Green Revolution, (iii) in third phase emphasis was given to diversification of crop with inclusion of all necessary inputs. This phase was the phase which ensured rural employment, brought in the concept of holistic agriculture and lead to basic agriculture research. In addition, focus on 510 million livestock and 8000 km of coastline will demand agricultural production to lead towards rural agriculture of the country more. India is projected to be the most populous country in the world with about 1.5 billion people by 2030 and

80% of growth will depend on the food production which will be produced, based on research, education, production and human resources.

We started from 1950 and by 2020 we will be holistic and integrated agriculture reckoner. We are now becoming one of the leader in skilled instruction to be no. 1 in education and research and by twenties, our agriculture will be known by broadway, and we are going in the middle of this decade to participate to develop the skill of entrepreneurship and will be more on the path of agriculture and rest of the fast moving India will have good educators of 21st century in the world by 2030. Let God help us.

Prof (Dr) P.N. Bhat
Prof. M.P. Yadav

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ABBREVIATIONS

ADG	Average daily growth
AEZ	Agro-eco-zones
AFS	Australian Friesian Sahiwal
AGID	Agar gel immune diffusion
AHS	African horse sickness
AI	Artificial Insemination
AICRP	All India Coordinated Research Project
AMZ	Australian Milking Zebu
APAU	Andhra Pradesh Agricultural University
APEDA	Agricultural & Processed Food Products Export Development Authority
API	Ayurvedic Pharmacopoeia of India
ARS	Agricultural Research Services
ASMM	Area-specific mineral mixture
ATIC	Agriculture Technology Information Centre
BAH&FS	Basic Animal Husbandry & Fisheries Statistics
BAU	Birsa Agricultural University
BC	Before Christ
BO	Butter Oil
BP	Biological Products
BPD	Business Planning & Development
BQ	Black quarter
BSI	Botanical Survey of India
BUN	Blood urea nitrogen
BVC	Birsa Veterinary College
BVD	Bovine Viral Diarrhoea
BZ	Benzimidazole
CAE	Caprine Arthritis Encephalitis
CAFT	Centre for Advance Faculty Training
CAL	Carcinoscorpius amoebocyte lysate
CARI	Central Avian Research Institute
CB	Cross-bred
CBPP	Contagious bovine pleuro pneumonia
CC	Combination with chloride
CCBF	Central Cattle Breeding Farm
CCPP	Contagious caprine pleuro-pneumonia
CCS	Copper chaperone for superoxide dismutase
CDRI	Central Drug Research Institute
CDV	Canine distemper virus
CE	Capillary electrophoresis
CELO	Chick embryo lethal orphan (virus)
CFB	Complete Feed Blocks
CFTRI	Central Food Technological Research Institute

CIDR	Controlled intra-vaginal drug releasing device
CIE	Counter immuno-electrophoresis
CIRB	Central Institute for Research on Buffaloes
CIRC	Central Institute for Research on Cattle
CIRG	Central Institute for Research on Goat
CLFMA	Compound Livestock Feed Manufacturers Association
CLRI	Central Leather Research Institute
CMVL	Central Military Veterinary Laboratory
Co	Cobalt
CO_2	Carbon dioxide
CP	Control Programme
CPBP	Central Poultry Breeding Programme
CRD	Chronic Respiratory Disease
CSF	Classical Swine Fever
CSO	Central Statistics Office
CSWRI	Central Sheep and Wool Research Institute
Cu	Copper
DAD&F	Department of Animal Husbandry, Dairying and Fisheries
DAH	Department of Animal Husbandry
DARE	Department of Agricultural Research and Education
DCFB	Densified complete feed block
DCS	Dairy cooperative societies
DFRL	Defence Food Research Laboratory
DG	Distillers grains
DIVA	Differentiating infected from vaccinated animals
DNA	Deoxyribonucleic acid
DTMR	Densified total mixed ration
EC	Emulsifying capacity
ECE	Equine coital exanthema
ECP	Estradiol cypionate
EEC	European Economic Community
EHV	Equine herpesvirus
EI	Equine influenza
EIA	Enzyme immunoassay / Equine infectious anaemia
ELISA	Enzyme-linked immunosorbent assay
EMA	European Medicines Agency
ERV	Equine rotavirus
ETT	Embryo transfer technology / Embryo transfer techniques
EU	European Union
EVA	Equine viral arteritis
FAD	Food and Drug Administration
FAO	Food and Agriculture Organization
FAT	Fluorescence antibody technique
FCR	Feed conversion ratio
Fe	Iron
FEC	Faecal egg count
FFS	Food-feed system
FMD	Foot and mouth disease
FROGIN	Forecasting for Rajasthan on ovine gastro intestinal nematodiasis
FSH	Follicle-stimulating hormone
GA	Angora (rabbit) crosses of German
GC	Gas chromatography
GC/MS	Gas chromatography–mass spectrometry

GDP	Gross Domestic Product
GFY	Greasy fleece yield
GHG	Greenhouse gas
GI	Gastrointestinal
GLF	Government Livestock Farm
GMM	Garole × Malpura ×Malpura
GMMP	Garole × Malpura × Malpura × Patanwadi
GMOs	Genetically modified organisms
GMP	Good manufacturing practice
GNP	Gross National Product
GOI	Government of India
GP	Grandparent
GSPA-PHI	Global strategy and plan of action on public health, innovation and intellectual property
H F	Holstein Friesian
HAU	Haryana Agricultural University
HI	Haemagglutination inhibition (assay)
HPL	High Production Livestock
HPLC	High performance liquid chromatography
HPTLC	High-performance thin-layer chromatography
HS	Haemorrhagic septicaemia
HSADL	High Security Animal Disease Laboratory
IARI	Indian Agricultural Research Institute
IB	Infectious bronchitis
IBL	Imperial Baeteriological Laboratory
IBR	Infectious Bovine Rhinotracheitis
ICAR	Indian Council of Agricultural Research
ICDP	Integrated Cattle Development Project
ICDP	Intensive Cattle Development Project
ICMR	Indian Council of Medical Research
ICPC	Indian Cattle Plague Commission
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IDA	Indian Dairy Association
IHA	Indirect haemagglutination
ILRI	International Livestock Research Institute
Imp.	Improved
INR	Indian Rupee
IPDP	Intensive Poultry Development Project
IPT	Immuno peroxidase technique
IR	Infrared
ISGP	Indo-Swiss goat development and fodder production project
IVF	In vitro fertilization
IVM	In vitro maturation
IVRI	Indian Veterinary Research Institute
JH	Jamaica Hope
kg	Kilogram
KLDB	Kerala Livestock Development Board
KMF	Karnataka Milk Federation
KV	Key Village
KVS	Key Village Scheme
LAB	Lactic acid bacteria
LAMP	Loop-mediated isothermal amplification
LCMS	Liquid Chromatography Mass Spectrometry
L-DOPA	L-3,4-dihydroxyphenyl-alanine

LDPE	Low-density polyethylene
LLPD	Lakh litres per day
LPD	Litres per day
LPT	Livestock Products Technology
MAB	Monoclonal antibodies
MAS	Marker Assisted Selection
MFAL	Marginal Farmers and Agricultural Labour Development Agency
MFPI	Ministry of Food Processing Industries
mLF	Mithun Lactoferrin
MMT	Million metric tonnes
Mn	Manganese
MOET	Multi-ovulation embryo transfer technology
MPC	Meat protein concentrate
MS	Mass Spectrometry
MSL	Mean Sea Level
MT	Million tonnes
MV	Measles virus
MVC	Madras Veterinary College
MW	Megawatt
MWMP	Modified Worm Management Programme
NABARD	National Bank for Agriculture and Rural Development
NABCONS	NABARD Consultancy Services Pvt. Ltd
NARI	Nimbkar Agricultural Research Institute
NARS	National Agricultural Research System
NBAGR	National Bureau of Animal Genetic Resources
NCA	National Commission on Agriculture
NDDB	National Dairy Development Board
NDP	National Dairy Plan
NDRI	National Dairy Research Institute
NEH	North Eastern Hills
NER	North Eastern Region
NET	National Eligibility Test
NGO	Non-Government Organizations
NIANP	National Institute of Animal Nutrition and Physiology
NMG	National milk grid
NPSI	Network Project on Sheep Improvement
NRCC	National Research Centre on Camel
NRCE	National Research Centre on Equines
NRCM	National Research Centre on Mithun
NRCP	National Research Centre on Pig
NRCY	National Research Centre on Yak
NSP	Non-structural proteins
OECD	Organisation for Economic Co-operation and Development
OF	Operation Flood
OFP	Operation Flood Programme
ONBS	Open Nucleus Breeding System
OPU	Ovum pick up
PAN	Precision animal nutrition
PAU	Punjab Agricultural University
PCR	Polymerase chain reaction
PDP	Project Directorate on Poultry
PFR	Pineapple fruit residue
PIC	Polymorphic information content
PKC	Palm kernel cake

PPR	Peste-des-petits ruminants
PPRV	Peste-des-petits-ruminants virus
PT	Progeny tested
R&D	Research & Development
RAPD	Random Amplified Polymorphic DNA
RCA	Royal Commission on Agriculture
RFI	Residual feed intake
RFLP	Restriction fragment length polymorphism
RP	Rinderpest
Rs	Red Sindhi
RST	Random Sample Test
RV	Rinderpest virus
SAU	State Agricultural University
SFDA	Small Farmers Development Agency
Sh	Sahiwal
SMP	Skim milk powder
SNF	Solids-not-fat
SPF	Specific Pathogen Free
STPP	Sodium tripolyphosphate
SVU	State Veterinary University
TB	Tuberculosis
TCM	Technical Co-operation Mission
TCRP	Tissue-culture rinderpest vaccine
TEM	Transmission Electron Microscope
Thp	Tharparkar
TLC	Thin layer chromatography
TLR	Toll-like Receptor
TMR	Total Mixed Ration
TNAU	Tamil Nadu Agricultural University
TST	Targeted selective treatment
U.P.	Uttar Pradesh
UGC	University Grants Commission
UHT	Ultra-heat treatment
UK	United Kingdom
UMMB	Urea-molasses-mineral block
UNDP	United Nations Development Programme
USA	United States of America
USAID	United States Agency for International Development
USD	US Dollar
USSR	Union of Soviet Socialist Republics
UV	Ultraviolet
VN	Virus neutralisation
VTCC	Veterinary Type Culture Collection
WFP	World Food Programme
WHA	World Health Assembly
WHC	Water holding capacity
WHO	World Health Organization
WRL	World Reference Lab
Zn	Zinc
ZTM	Zonal Technology Management
ZTMC	Zonal Technology Management Centre

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