BENEFITS OF BIOTECHNOLOGY FOR IMPROVED LIVESTOCK PRODUCTION IN NIGERIA

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ABSTRACT
This review paper discusses the use of biotechnology in livestock production. It takes into consideration the application of biotechnology in solving problems of livestock production, current uses and ethical issues. Application of biotechnology in livestock production include: production of good and high yielding animals, nutrition and feed utilization, reproduction, animal breeding and genetics as well as animal health. Application of biotechnology in animal husbandry has the potential to rapidly increase livestock production, help address some challenges of un-favourable environmental and climatic conditions and food insecurity in Nigeria.

INTRODUCTION
Biotechnology refers to any technique that utilizes living organisms or substances from such organisms to produce or modify a product, to improve animals or to develop micro-organisms for specific purposes (Armstrong and Gilbert, 1991). This sphere of science is becoming a frontier in ensuring a sustainable means of improving livestock production by influencing nutrition, reproduction, breeding and genetics as well as animal health. In recent years, biotechnological achievements have emerged as powerful tools to improve various livestock products including milk and meat products. Other applications of biotechnological tools include: production of high yielding animals, improved animal products, production of hormones, efficient by-product utilization and quality control (Fereja, 2016). Application of biotechnology will lead to a shift in the economic returns from livestock. Livestock production currently accounts for about 6% of the overall gross domestic product and 10% of the agricultural GDP in Nigeria (Rege, 1994). Globally, livestock production is growing faster than any other sector and by 2020 livestock is predicted to become the most important agricultural sector in terms of added value (Fereja, 2016). The demand for livestock products has significantly increased, hence the need to improve livestock and its derivatives through genetic manipulation and related technologies (Onteru *et al.*, 2010). Therefore, the purpose of this paper is to review available biotechnologies which have potential application in livestock production.

Production of good and high yielding animals
Livestock production in Nigeria is expected to grow rapidly with the projected demand for animal products as well as increase in human population (Rege, 1994). This has necessitated that methods of livestock production have to be changed to allow for efficiency and improvement in productivity. Biotechnological research will serve as tools to respond to the pressure of producing feed for animals which in turn will cater for the animal protein requirement of the ever-teeming human population in Nigeria. Transgenic animals such as Cattle, sheep, pigs and rabbits have been developed with the aid of biotechnology (Gupta and Savalia 2012). Transgenesis is a technique that involves the manipulation of genes of one organism and subsequent introduction into the genome of another organism of the same or other species such that the genes are not only expressed but also get transmitted into its progeny (Srinivasa and Goswami 2007). Transgenesis enhances growth rate and improved quality of meat and milk of livestock. For example, transgenic cows were developed to produce milk containing high amount of beta and kappa casein in milk fat and increased level of human lactoferrin (Brophy *et al*., 2003). Similarly, transgenic pigs with IGF 1 had 30 % more loin mass, 10% more carcass lean tissue and 20% less total carcass fat (Pursel *et al*., 1999).

Nutrition and Feed Utilization
The application of Gene-based technologies to improve animal nutrition by modifying feeds to make them more digestible is on the increase (Bedford, 2000). Such applications will go a long way in combating the shortage of feed in most developing countries such as Nigeria as well as reducing the cost of feed ingredients implying reduced production costs. Application of biotechnology in animal nutrition such as the use of enzymes, probiotics, single-cell proteins and prebiotics in feed (Fereja,

2016). In Nigeria some of these technologies are currently being used to improve nutrient availability of feeds and productivity of livestock and poultry.

Reproduction

Artificial insemination (AI) and Embryo Transfer (ET) are popular methods adopted in most developed and developing countries (Cunnigham, E.P. (1990). Artificial insemination is the most widely used biotech in animal reproduction in Nigeria and has resulted in rapid genetic progress that is four times better than natural mating (Van Vleck, 1981). Also, the use of reproductive hormones such as progesterone and pregnant mare's serum gonadotropin (PMSG) treatments as well as immunization against androstenedione have been reported to increase ovulation in both large and small ruminant animals (Kahi and Rewe 2008). However, modern biotechnological techniques which have the potential for increased reproductive efficiency are marred with complexity in process and implementation such as production of transgenic animals and cloning and will probably have low rates of adoption in both large scale and small-scale farms in future. This low adoption rates may be as a result of ethical considerations and not necessarily cost implications (Bonneau and Laarveld 1999).

Animal Breeding and Genetics

Biotech tools have been useful in influencing the rate of genetic gains in different livestock species. Such tools include: marker assisted selection (MAS), Genome mapping through the use of restriction fragment length polymorphism (RFLP) which makes use of amplifiers, short DNA Primers in polymerase chain reaction (PCR) have been essential in developing DNA fingerprinting technique and genetic characterization of a wide range of organisms (Williams *etal.,* 1990, Kahi and Rewe 2008). The application of transgenic techniques in gene manipulation of different livestock is beneficial, such that genes are not only expressed but transmitted to offspring (Gupta and Savalia 2012). These techniques are already in use in Nigeria and have great potential for adoption in livestock breeding schemes.

Animal Health

Biotech in animal health have been developed in a number of areas which includes: disease prevention, diagnosis, treatment and control (Bonneau and Laarveld, 1999). Disease prevention is key to livestock survival as well as production of healthy animals. Vaccine development and vaccination is a biotechnique that is now well rooted in most African countries including Nigeria. Vaccines are widely used either as attenuated or inactivated and have proved very efficient in establishing resistance (Bourne and Bostock,1992). The application of biotech in disease discovery has helped to identify diseases at early stages to facilitate treatment. It has also enabled the application of enzyme-linked immunosorbent assay (ELISA) which now uses recombinant antigens developed via gene cloning and sequencing for detection of antibodies and provide information to antibody recognition sites (Kahi and Rewe 2008).

Biotechnologies and their potential impact on livestock production

Area of Application	Biotechnologies	Scale of Impact	Potential of Adoption	
			Developed Countries	Developing Countries
Animal health	SAD	Large	High	High
	ELISA	Large	High	Moderate
	DNA detection	Large	High	Low
	Vaccination	Large	High	High
	PCR	Large	High	Moderate
Animal nutrition				
	Enzyme degradation of fibrous feeds	Large	High	Low
	Rumen (GIT) manipulation	Large	High	Moderate
Animal reproduction	AI	Large	High	High
	MOET	Large	High	Moderate
	Embryo sexing	Large	High	Low
	Cloning	Large	Low	Low
Animal breeding	Nucleus breeding	Large	High	Moderate
	Developing of composite breeds	Large	High	Moderate
	MAS	Large	Moderate	Low

SAD=specific antibody detection; ELISA=enzyme linked immuno-sorbent assay; DNA=di-neuclic acid; PCR=Polymerase chain reaction; GIT=gastro-intestinal tract; AI = artificial insemination; MOET= multiple ovulation embryo transfer; MAS= marker assisted selection. Modified from Cunnigham (1990) and Doyle and Spradbow (1990)

Constraints in applying Biotechnology

A number of factors act as deterrents against the use of biotechnology for livestock production in developing countries. Developing countries such as Nigeria are plagued withpoor hygiene, poverty, malnutrition and disease incidences. In recent years, the green revolution has brought comparative prosperity to farmers who are land owners, whereas those who keep livestock were neglected. Some of the major constraints in the use of biotechnology are: lack of trained personnel (scientists, technicians and extension agents) to develop and apply the technologies, absence of accurate database on livestock and their herders, high cost of technological inputs (materials, biological and equipment), failure to address issues of biosafety and conduct of risk analysis, as well as the negligible investment in animal biotechnology (Fereja, 2016).

CONCLUSION AND RECOMMENDATION

The application of biotechnology to animal husbandry is of great significance in ensuring increased productivity in the livestock sector of Nigeria. It is therefore necessary to create awareness to encourage its usage amongst livestock producers in Nigeria.

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