



CURRENT STATUS OF BIOTECHNOLOGY AND ITS APPLICATIONS: A REVIEW

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Abstract

Biotechnology involves several methods that produce animal proteins and drugs, among other needed substance, for human use. Health issues keep increasing, one of which is the pandemic, cure of which research is looking for. To solve the problem, biotechnology needs to be employed to increase production of animals which could serve as source of materials not only as cure but source of income to enhance economic stability. However, this area of knowledge requires high level of expertise and equipment which are inadequate in the country, coupled-up with epileptic power supply which could serve as hindrance to the success of the operation. Therefore, the country needed more research in biotechnology in order to increase production of meat and drugs for the entire population in the country.

Keywords: Biotechnology; Economic Stability; Drugs; Animals

Introduction

Biotechnology produces genetically modified organisms, with either similar or varying genetic composition. Methods used include; cloning, genetic engineering, embryo transfer, marker-assisted selection, etc. Selective production of farm animals becomes necessary due to varying human needs associated with difference in their geographical areas and physiological status (Smith *et al.*, 2000).

Biotechnology has applications in four major industrial areas, including Health care (medical), Crop production and Agriculture, non-food (industrial) uses of crops and other products (e.g. biodegradable plastics, vegetable oil (biofuels), and environment uses (FDA, 2020). During breeding, several goals are considered to ensure that animals with required qualities are produced. However, not all goals thought of initially have to do with quantity and quality improvement in animals of choice as livestock are used to test for efficacy of drugs among other purposes. Diseases presently experienced among humans and animals are due to various reasons ranging from environmental to genetic mutation which are known to affect organisms negatively by disturbing them from performing their expected functions. In order to cure diseases; genes, organs, milk, drugs, and other products were produced to solve problems facing both humans and animals (Nielsen, 2013).

Cloning

A gene is a segment of DNA containing code for a specific polypeptide. Cloning has been reported to involve duplication of a small portion of the DNA or the entire organism (reproductive cloning). Cloning involves organism from which the required DNA sequence is harvested, the source, in the presence of enzyme, and replicated in the laboratory to produce samples which are used to produce recombinant DNA in the vector.

The recombinant DNA could be inserted into another organism (host) to perform certain function. It could also be inserted into various systems of animals to see individuals that express traits or products of interest. Genes are needed over generations for desirable traits to be shown by livestock possessing them. Ensuring this will preserve the qualitative and quantitative standard, the health and economic aspect of the animals. Out of many animals produced is “Dolly the sheep” which was cloned from an adult cell instead of embryo, making it the first mammal of its kind (Smith *et al.*, 2000). It was cloned to produce milk containing certain protein that is deficient in the humans suffering from hemophilia.

Endangered species could be rescued through cloning by ensuring that the genetic materials obtained, from available species, are worked upon to create individuals that will produce their next generation. Doing this will not only save the animals from extinction, but will also increase products associated with them (Smith *et al.*, 2000).

However, respiratory and circulatory problems have been reported to be prominent in animals produced through cloning. Another setback to this is early/late abortions which could result in high rate of fetal death and compromised immune system. Factors responsible for these disaffections are yet to be understood therefore, little could be achieved in this area of biotechnology (Ibtisham *et al.*, 2017).

Genetic Engineering (GE)

This technique (GE) could be adopted for different reasons, one of which could be creation of vaccines. Farm animals can be a source of vaccine as well as the receiver of vaccine themselves (Pasteur, 1871 and Meeusen *et al.*, 1984). Rabies is a disease known to be zoonotic because it can be transferred from animals to humans. Other animals, apart from dog, can also contact this disease when bitten, scratched and come in contact with the saliva, blood, feces, urine and body fluid of infected animals.

Animals of familiar behaviors and traits were known to exhibit contrast features based on some forms of manipulations carried out in their external and internal environments. Genetically modified organisms are examples of animals on which GE had been experimented for higher economic gains at shortest possible time. Due to artificial selections now practiced by researchers, traits of many animals are now lost only for the display of desired traits which are majorly the result of gene transfer (Phillips, 2008).

Deletions of malfunctioning genes for healthy ones are further becoming popular on daily bases. Exposures of animals to mutagenic substances are known to have changed the functionality of the systems of the body and cause them not to carry out the expected activities. Erwin *et al.* (2015) and Alexander (2003) made it known that animals' traits could be enhanced studying the gene(s) responsible for a trait, remove and replace them with functioning ones.

Transgenic animals are produced by the GE when they are made to carry gene(s) which enable them develop traits, hormones, milk etc that are beneficial to human kind. Mice and other animals like goat, sheep, pig, just to mention a few, had been used and made to carry in their genome foreign genes with therapeutic tendencies for human diseases (Mariana *et al.*, 2013). Transgenic animal is denoted when gene is received from another specie but in a case in which it is done within a species the product is called cisgenic animal.

Embryo Transfer (ET)

During fertilization, there is introduction of sperm cells through male reproductive organ into egg cell(s) of the female reproductive organs. Following from this is implantation at the wall of the uterus. Embryo is formed afterwards, and before implantation this is removed surgically and placed into another female animal of the same species. Farm animals to be subjected to ET need to be hormonally manipulated to ensure readiness to undergo a successful operation which will lead to conception.

Apart from transfer of embryos through surgical operation in the cattle, another method is now used which involves flushing into and out of the super ovulated donor's uterus, a special medium to remove the embryos which are expected to be between 5 and 7 on seventh day after estrus. Having done this, a special type of insemination gun is used to introduce the morula or blastocyst into the uterine horn of the recipient through the rectum-vagina passage. The female animals on which the insemination is carried out are expected to become pregnant at the rate of 60 to 70 percent (Carlos, 2014).

There are several hormones used in ET. Human chorionic gonadotropin is used on cattle to prevent early loss of embryo transferred. Administration of progesterone, according to Taylor (2020), maintains pregnancy and prevents early embryo abortion. Equine chorionic gonadotropin and follicle stimulating hormones help the super ovulated donor cow in the successful release of embryo to be transferred.

This practice (ET) has been reported by Hou (2018) to enable farmers recorded more than the naturally possible numbers of offspring from their proven female animal unlike the artificial insemination which makes it possible for the male animals used in production, to sire more offspring than they can naturally fathered. Through this, number of livestock for meat and milk had greatly increased because the generational interval to make this happen had been decreased, therefore with hormonal induction; it is now possible to collect quality embryos without waiting for it to occur by nature.

Marker Assisted Selection

Traits are responsible for the choice of some animals over the others. Poultry birds are kept for either meat or egg production. In case of broilers; breed, feeding, weight, housing, age etc of birds are of importance and

cannot be overlooked. Selection makes it possible for a breeder to choose individuals which will be the parents of the next generation. It's necessary to be sure of the quality of animals that would give birth to future generation having taken note of results of progenies from comparison, progeny testing and mass selection (Kor and Liesbeth, 2015).

Tools to achieve excellence in reproduction are many while making selection of future parents. Morphologically, animals could be selected when observed to have some traits desired by the breeder. The markers in this category are those that make selection possible through some external features nakedly seen on animals of choice, for example; colour, height, size, shape, sex etc. In case of cytological markers, microscope is used to look out for some features in the cell of animals and the presence or absent of which determines their selection.

Conclusion

The use of biotechnology is not only in Agriculture. It is also useful in the medical, industrial and environmental sectors. The foods produced through it are known to be more in quantity than those produced with the conventional form of agriculture likewise drugs. The methods here stated are already in use but not to the expected level for it to bring about food, animal protein sufficiency in the nation.

Recommendation

The following recommendations were made to further encourage the use of biotechnology in the Agricultural sector:

- i. Constant Electricity has to be ensured to facilitate further researches that will lead to increase in production of food items.
- ii. Learning at the institution needs more funding to enable them acquire necessary equipment and needed livestock.
- iii. Teachers in related areas should be further educated to make them more competent in imparting their students.

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