



3.3.5 Use of biotechnologies to improve feed quantity and quality: Adaptation to the changing climate from the animal nutrition perspective

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Achieving food security is one of the most important challenges with a view to the future and taking into account the continued increase of the world's population. An additional major challenge for food production is the threatening or already existing impact of climate change. Increased extreme weather events like hurricanes, heavy rainfall, flooding, heat waves and drought are likely to occur in different regions of the world and may affect both the growth conditions of cereal and forage crops and livestock production.

Plants can be regarded as the starting point for the whole human food chain. Therefore, to achieve food security, plant breeding and crop production play an important role. High yields of highly-digestible phytogetic biomass produced with low external inputs of non-renewable resources and low emissions of GHGs during cultivation are required. In addition, the plants should have low concentrations of undesirable substances and high resistance against biotic and abiotic stressors including the ability of adaptation to potential impacts of climate change.

Food of animal origin is characterized by a high bio-availability of most nutrients and is a source of some important trace elements and vitamins. The consumption of meat, fish, milk, eggs and other protein and energy sources may contribute substantially to covering the human requirements for amino acids and energy. A rapid increase in the demand for food of animal origin is expected in the foreseeable future. In this context, it should be noted that the conversion of energy and protein from feed into food of animal origin is relatively low with about 3 percent for the conversion of energy into beef. It may vary, however, up to about 40 percent for the conversion of energy into milk and of protein into chicken meat. As a result, the production of livestock feed must grow disproportionately higher to meet the growing demand.

Increased production of feed with improved quality may only to a small extent be based on the further expansion of agriculturally productive land. The major part of the necessary additional livestock feed should result from an increased productivity per unit of land and reduced post-harvest losses. This approach appears applicable throughout the world and could be of particular relevance for smallholders in developing countries. A steady increase in productivity requires specialized

knowledge and depends on a variety of factors to improve production systems. In this regard, agricultural biotechnologies play an important role.

Agricultural biotechnologies represent a number of technological applications used in food and agriculture. Some of these technologies are used by plant breeders for the genetic improvement of plant varieties. This includes, amongst others, improvement of the nutrient content of edible plant parts, higher nitrogen and water efficiency and better pest resistance. In addition, the adaptation of plants to the expected adverse impacts of climate change represents a particular challenge.

Feeds are usually characterized according to their composition. The most important feed groups are roughages, concentrates and co-products from agriculture, food and the biofuel industry. Feeds from these different groups contain various concentrations of crude nutrients, but also further desired and undesired substances. An additional objective of plant breeding which may be achieved by the use of agricultural biotechnologies is providing feed plants with, for example, lower concentrations of anti-nutritive substances, low concentrations of substances that influence availability of nutrients such as lignin, phytate, enzyme inhibitors and tannins, and plants with a higher concentration of nutritive value-determining components such as amino acids, minerals, vitamins and vitamin precursors.

Feed additives are used to supplement feed with essential or non-essential substances in order to increase the nutrient digestibility of the diets or to cover the demand of the animals. Therefore, the impact of biotechnologies to improve feed quality also includes the use of different feed additives like amino acids, enzymes and silage additives which are partly produced by fermentation technologies based on biotechnological applications.

In conclusion it can be stated that the use of agricultural biotechnologies to improve feed quantity and quality may contribute to solving the important global challenge of food security through the sustainable use of limited natural resources, the avoidance of environmental pollution including the reduction of GHG emission, and the adaption to climate change.