Results and discussions

Our results showed that due to their multi-functionality; cattle are the most preferred livestock species (93.8%). Farmers showed slightly more preference to local Zebus (46.7%) compared to Sheko (43.2%) due to the high feed requirements of Sheko cattle, which cannot match with ever increasing feed shortage because of expansion of farm land to feed the rapidly growing population. Moreover, due to the strong physique and aggressive temperament of Sheko cattle, especially older individuals face difficulties in practicing tethered feeding which is now becoming the most common feeding strategy since there is a shortage of herders and shrinkage of grazing land. However, it was reported that Sheko cattle outperform their local Zebu counterparts in their milk yield, draught power, trypanotolerance, longevity and reproductive lifetime, less selective behavior and in adapting to environmental stress (Taye *et al.*, 2009). At the trait level, overall milk production was consistently reported as the most preferred trait, followed by fertility (age at first calving, calving interval and lifetime calf crop) and traction. This order of trait preference perfectly matched with reported ranks for the use of Sheko cattle. However, re-ranking of breed preferences was very common among respondents. However, except for the Shei Bench district for which fertility was the most preferred trait due to remoteness of the district for marketing of milk and milk products, for the other two districts, trait preferences almost showed a similar trend. As a result the breeding stock is largely supplied from the Shei Bench district. Breed preference is not matched with reported trait preferences because for example Sheko excel Zebus in all three most preferred traits. Therefore, the breed management plan for Sheko cattle should target at improving feeds and feeding practices and on selection of less aggressive animals; in line with the improving of the desirable traits of Sheko cattle.

Conclusions

Trait preference of smallholder Sheko cattle owners is multifaceted therefore breeding strategy of Sheko cattle should account for multiple trait preferences using their weighted average rank. Change in the production system has resulted in re-ranking of trait preferences and evolution of the farming system has resulted in the re-ranking of breed preferences.

References

DAGRIS 2007. Kemp S, Mamo Y, Asrat B and Dessie T eds.

Hanotte O, Tawah CL, Bradley DG, Okomo M, Verjee Y, Ochieng J and Rege JEO 2000. Molecular Ecology 9, 387–396.

Taye T, Ayalew W and Hegde BP 2009. Eth. J. Anim. Prod. 9 (1), 1–12.

doi:10.1017/S2040470010000063

A short overview on the main features enabling goats to dwell productively in hot and harsh environments

Nissim Silanikove[†]

ARO, Inst. Anim. Sci., Israël

It is estimated that over 80% of the world's goat population is located in tropical, sub-tropical and arid areas across, Asia, Africa, Central and South America. What makes goats so popular in these areas is their ability to provide high quality food under diverse climatic conditions and resilience to extreme and capricious environments.

Goats employ both panting and sweating to maintain homeothermy, though the level of heterothermy increases under the most severe heat stress conditions. However, in hot-dry environments, the degree of heterothermy employed is determined not by ambient temperatures alone, but also by aridity. When goats have access to sufficient water, they maintain homeothermy rather than implementing heterothermy, even under quite severe heat stress. Indeed, goats increase their water consumption during the summer months. However, when goats, do not have access to sufficient water, they abandon homeothermy and display heterothermy, which would allow them to conserve body water.

Low body mass and low metabolic requirements of goats are important qualities that enable them to minimize their maintenance and water requirements, in areas where water sources are widely distributed and food sources are limited by their quantity and quality. An ability to reduce metabolism allows goats to survive even after prolonged periods of severe limited food availability.

A combination of clever grazing behavior and an efficient digestive system enable goats to attain maximal food intake and efficient food utilization in a given condition. In tropical, sub-tropical and Mediterranean environments goats eat a diet composed of tree-leaves and shrubs (browse), which ensure a trustworthy and stable supply of food all year around, albeit, from a low to medium quality food.

Unlike sheep and cattle which abandon grazing on leafy material during the spring, research in different areas of the world have shown that browse constitutes most of the forages selected by goats all year around. Such a non-opportunistic behavior appears odd at first view,

[†] E-mail: nsilanik@agri.huji.ac.il

particularly if considering that goats are usually characterized as opportunistic with regards to their feeding behavior. Browse is typically rich in tannins and gaining optimal adjustment to tannin-rich diet requires time; thus, skilfully, goats prefer to safeguard their advantage in utilizing food that is available to them at all seasons.

There is a positive interaction between the enhanced recycling rate of urea and a superior digestion of such food in goats adapted to harsh environment. The rumen plays an important role in the developed adaptations by its use as a huge fermentation container and water tank. The water stored in the rumen is utilized during dehydration, and the rumen serves as a container, which accommodates the ingested water upon rehydration. The rumen, the salivary glands and the kidney coordinately take action in the regulation of water intake and water distribution following acute dehydration and rapid rehydration. Some of the physiological features of ruminants defined as intermediate feeders such as a big salivary gland, the large absorptive area of their rumen epithelium, and the capacity to rapidly change the volume of the foregut in response to environmental changes are most likely responsible for the goat's superior digestion.

doi:10.1017/S2040470010000075

Adaptation to tropical climate and research strategies to alleviate heat stress in livestock production

David Renaudeau[1†], Anne Collin[2], S. Yahav[3], V. de Basilio[4], Jean-Luc Gourdine[1] and Robert J. Collier[5]

[1]INRA, UR143Unité de Recherches Zootechniques, F-97170 Petit Bourg, Guadeloupe, France; [2]INRA, UR83 Recherches Avicoles, F-37380 Nouzilly, France; [3]Institute of Animal Science, ARO Volcani Center, Bet Dagan 50250, Israel; [4]Universidad Central De Venezuela Facultad de Agronomia Apdo. 4579, Maracay, Venezuela; [5]University of Arizona, Department of Animal Science, Tucson, Arizona, USA

Over the last decade, livestock production of tropical and subtropical countries has considerably expanded in order to meet a rising population, international meat exchanges and consumer demand. Despite many challenges facing animal producers including environmental problems, diseases, economic pressure, and feed availability, it is still predicted that animal production in developing countries will continue to sustain the future growth of the world's meat production. In these areas, livestock performance is generally lower than those obtained in Western Europe and North America. Although many factors can be involved, climatic factors are the first limiting factors of development of animal production in warm regions. While heat stress can be considered as an occasional problem during summer heat waves occurring in temperate countries, it is a constant challenge in the tropics and subtropics. In addition, global warming will further accentuate heat stress related problems. Livestock animals are homoeothermic and are able to maintain relatively constant body temperature despite widely ranging ambient temperatures by balancing heat production and/or heat loss. Heat production (HP) is the sum of energy for maintenance and metabolic heat associated with the utilization of energy for productive purposes. Consequently, HP is positively related to the production level of an animal. Genetic selection for a rapid growth rate, egg production or high milk production results in animals with high metabolic HP without significant changes in their ability to lose heat. As a result, modern genotypes are more sensitive to heat stress than non-selected or indigenous animals. To sustain the rapid demand for livestock products, high-performance animal stocks are now being imported to developing countries and farmers are advised to use expensive management practices to control ambient temperature in their facilities to maximize performances.

Heat stress is recognized as a critical problem for livestock production. There has been a great deal of research and development into ways of reducing heat stress of livestock animals subjected to short or extended periods of high ambient temperature and humidity. The objective of this paper is to review the effective strategies to alleviate heat stress in the context of tropical livestock production systems. These strategies can be classified in three groups, those increasing feed intake or decreasing metabolic heat production, those enhancing heat loss capacities, and those involving genetic selecting for heat-tolerance. Under heat stress, improved production should be possible through modifications of diet composition that either promotes a higher intake by decreasing diet-induced thermogenesis (low protein or low fiber diets) or compensates the low feed consumption by providing high energy or protein dense diets. Dietary modifications should also include a provision of minerals, vitamins, electrolytes, amino acids, or other additives to cover specific needs of heat-stressed animals. In addition, altering feeding management such as a change in feeding time and/or frequency, are efficient tools to avoid excessive heat load and improve survival rate especially in poultry. Maximizing water intake by providing a sufficient amount of clean and fresh water should also help to maintain feed consumption and facilitate heat loss by increasing water turnover under hot temperature. Methods to enhance heat exchange between the environment and the animal and those changing the environment to prevent or limit heat stress can be used to improve performance under hot climatic conditions. The increase of heat exchange generally involves an increase of heat loss from the body surface by an addition of water to the skin (drip cooling), by enhancing air flow to increase the rate of evaporative or convection heat losses (fan cooling), or by giving access to a cooling zone to improve conductive heat loss (floor cooling). A basic and cost-effective method for protecting animals from heat stress during the day is a simple shade. Supplemental cooling attempts to reduce heat stress by lowering ambient temperature.

† E-mail: david.renaudeau@antilles.inra.fr