

ASSOCIATION OF GENE FOR LOW POTASSIUM IN SHEEP WITH WOOL PRODUCTION

Asociación del gene del bajo contenido en potasio
con la producción lanar en ovino

Association du gène pour le bas contenu en potassium
avec la production de laine chez les ovins

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Studies on the polymorphism in potassium concentration of sheep red blood cell have been in progress in this Institute for the last ten years. Both high (*HK*) and low (*LK*) potassium types have been observed in the indigenous breeds although the *HK*'s predominate. The exotic breeds (Soviet Merino, Rambouillet, German Merino, Polwarth, etc.) maintained in India are all *LK*'s. The physiological differences between these types and their genetic basis have been studied in depth and the work done so far has been reviewed recently (TANEJA, 1970, 1973). In particular, the results on the relationship of blood potassium concentration/type with wool quality are of considerable interest. In their extensive review on the subject the Australian scientists have reported the confirmation of these findings (AGAR, *et al.*, 1973). There is a strong genetic correlation between potassium concentration and wool quality and quantity, as the selection practiced for and against various wool traits in Australian Merino also shifted the blood potassium concentration (EVANS, *et al.*, 1973). It is also established that the breeds with lower concentration of potassium in the red blood cell in the *LK* type have finer wools than those with higher concentration (TANEJA *et al.*, 1969; EVANS *et al.*, 1973). An inter-relationship exists between the frequency of gene for low potassium type (K^L) and the quality of wool. The phenotypic correlations between potassium concentration and wool quality and quantity within breed vary considerably. EVANS *et al.* (1973) did not observe any significant correlations between these traits whereas TANEJA (unpublished) recorded complete absence of a correlation in some breeds and significant correlation in others.

Absence of significant phenotypic correlations between potassium concentration and wool quality and quantity has been suggested to be the obstacle in using the genetic correlations between these traits for sheep improvement (EVANS *et al.*,

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1973). Low phenotypic correlations are understandable because the potassium concentration between the mature and immature red cells varies considerably and perhaps for this reason the repeatability of potassium concentration is low. We have observed that all the fine wool bearing Merino strains in India are homozygous LK 's whereas indigenous LK 's are largely heterozygous (TANEJA *et al.*, 1969).

This stimulated our interest in raising homozygous LK sheep in our indigenous flocks with a hope to improve their wool quality. Apparently the selection is to be made for the K^L gene to raise its frequency in the population rather than for potassium concentration which has either weak or low phenotypic correlation with wool characteristics. Accordingly, a breeding programme designed to raise the frequency of K^L gene in the native breeds as organised. In this experiment $LK \times LK$ and $HK \times HK$ matings were set up in two of the coarse wool producing breeds of sheep viz. Marwari and Magra. The progenies produced in these matings were compared with their mid-parents and it was observed that the progenies resulting from $LK \times LK$ matings in Marwari and Magra breeds produced 49 and 19 per cent more wool respectively than their mid-parents. On the other hand, there was no increase in the wool yield in the HK progeny resulting from $HK \times HK$ matings. These data, however, involved fewer animals and naturally the sampling errors could be large. Only 39 daughter-dam pairs spread over two breeds were available for the study. However, when these findings are considered in the light of the results obtained by us recently on the flocks in which the three genotypes viz. homozygous LK ($K^L K^L$) heterozygous LK ($K^L K^H$) and homozygous HK ($K^H K^H$) were segregated by antigen-antibody reaction, we are tempted to conclude that the K^L gene is decidedly associated with wool production. In our experiment, the animals in 4 flocks of different breeds were graded for wool quality by an experienced grader who had no knowledge of the animals belonging to different genotypes. It was observed that all the $K^L K^L$ which were, no doubt, fewer in number in each breed, bore the top grade wool of the breed and all the strong and coarse wool bearing sheep were heterozygous LK 's and HK 's.

The obvious trend in our data are that the homozygous LK within the breed are superior in wool quality and next to them are the heterozygous LK .

Economically, these results have far reaching effects particularly in the underdeveloped and developing countries. The local sheep in these countries are poor yielder and the wool produced by them varies from coarse to medium quality. These sheep are well adapted to local environment, worm infestation, diseases and poor forage and improving of these breeds is more economical than importing foreign breeds and raising of crossbred progeny. Sheep in these countries can be classified into LK and HK and it is recommended that only HK animals should be allowed for slaughter. This will allow gradual building up of LK homozygous strain yielding heavier wools with finer medullated fibres (TANEJA, 1970).

SUMMARY

The native breeds of sheep tend to have high gene frequencies for HK , and naturally if the above scheme of breeding homozygous LK is put into practice, the balanced polymorphism in blood potassium type which, at present exists, would be upset. HK 's have certain advantages over LK 's in this region (TANEJA, 1973) therefore, in order to successfully implement the proposed scheme, the

current primitive husbandry practices shall have to be improved and it is hoped with the improved management and better health conditions, *LK*s would have as good a chance of survival, resistance to drought, etc., as *HK*'s have at present. *LK*'s have successfully inhabited several desert and semi-desert regions in the world and similar areas in the developing countries cannot be an exception to it.

RESUMEN

Las razas ovinas nativas tienden a dar una gran frecuencia génica para *HK*, y, desde luego, si el precedente esquema de cría en homocigosis *LK* se pone en práctica, el polimorfismo equilibrado tipo potasio en sangre que existe en la actualidad sería cambiado. Los *HK* tienen ciertas ventajas sobre los *LK* en esta zona (TANEJA, 1973); por tanto, para llevar a cabo con éxito el esquema propuesto, las primitivas formas de producción han de ser mejoradas, y es de esperar que con mejor administración y mejores condiciones sanitarias, los *LK* tendrán tantas oportunidades de supervivencia, resistencia a la sequía, etc., como tienen actualmente los *HK*. Los *LK* han vivido satisfactoriamente en regiones desérticas y semidesérticas; las zonas semejantes en los países en desarrollo no deberían constituir una excepción.

RESUME

Les races natives de brebis tendent à avoir une haute fréquence de gènes pour *HK*, et naturellement si le précédent projet d'élevage homozygote est mis en pratique, le polymorphisme équilibré du type potassium dans le sang qui existe à présent serait changé. Les *HK* ont de certains avantages sur les *LK* dans cette région (TANEJA, 1973), donc, de façon à outiller avec succès le projet proposé, les pratiques d'élevage primitives et courantes devront être améliorées et on espère qu'avec l'amélioration de la direction et de meilleures conditions de santé, les *LK* auraient autant de chance de survie, résistance à la sécheresse etc. que les *HK* ont actuellement. Les *LK* ont habité avec succès de nombreux déserts et demi-déserts dans le monde et des régions semblables dans les pays en développement ne peuvent pas être une exception.

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