Improved small stock production — collaboration between scientist and producer

D. Wentzel
Agricultural Research Institute of the Karoo Region, Middelburg

Small stock production in South Africa is practised under a variety of conditions, each of which demands specific management inputs, disease control programmes, specific types of animals, and economic considerations. Improved small stock production involves close cooperation between the animal scientist and the producer. Examples of this are discussed with reference to the mohair industry. Problems relating to abortion, losses during cold spells, and poor growth in young animals lead to research which provides practical solutions to these problems.
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Kleinveeproduksie word in Suid-Afrika onder 'n verskeidenheid van toestande bedryf wat elk die volgende vereis: spesifieke bestuursinsette, siektebeheerprogramme, spesifieke soorte diere en ekonomiese oorwegings. Verbeterde kleinveeproduksie bring noue samewerking tussen die veekundige en die produsent mee. Voorbeelde hiervan word met verwysing na die sybokhaarbedryf bespreek. Probleme in verband met aborsie, verliese gedurende koue en swak groei in jong diere lei tot navorsing wat praktiese oplossings vir hierdie probleme bied.
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D. Wentzel
Agricultural Research Institute of the Karoo Region, Middelburg, Cape, 5900 Republic of South Africa

Small stock production in South Africa is practised under a large variety of conditions, ranging from extensive production systems in the arid areas to semi-intensive systems found in the higher production potential areas with a relatively high rainfall. Each set of conditions calls for specific management inputs, disease control programmes, type of small stock best suited to the ecosystem, economic considerations, etc. It is therefore apparent that although some basic guidelines for small stock production apply to all areas, there are many other considerations affecting the efficiency of a production system in a specific area. Generally speaking, producers are well acquainted with the basic principles of small stock production. It is, however, the producer's knowledge and ability to implement special practices, which under his specific set of circumstances will enhance production and/or reduce losses, that determine the difference between an average production system and a superior one. Obviously, improved small stock production therefore involves firstly the selective implementation of available scientific information relevant to the specific environment. Secondly, the identification of specific problems limiting production, followed by research to provide practical solutions, is of utmost importance. Thirdly, it is imperative to evaluate production systems continuously in order to make necessary adjustments, especially with consideration to economic implications. Finally, an efficient professional advisory service to disseminate information is of critical importance.

In view of the foregoing it is clear that the animal scientist plays a vital role in the mechanism aimed at improving small stock production, whether it be as a basic researcher generating new information or as an applied scientist developing or improving production systems and providing professional advice on all facets of such production systems. On the other hand the producer fulfils an equally important function in that his ingenuity, his willingness to adopt improved practices and skills as a manager of the production system, will play a determining role in the eventual outcome (success or failure) of the whole enterprise. Close and continuous collaboration between these parties is obviously essential to achieve improved small stock production.

In the mohair industry several examples exist of success achieved during the past two decades by this interaction between researcher, specialist and producer in improving production. For the purpose of this paper it is appropriate to refer briefly to the major problems experienced, the research done, the formulation of practical solutions and the eventual success achieved by the producer.

Problems

The major problems which hamper progress of the mohair industry are as follows.

Firstly, low reproduction rates resulting from low conception rates, abortions and a relatively high kid mortality rate. Abortion has generally been regarded as the most serious problem as indicated by a restricted survey which revealed alarming losses of up to 80% of the potential kid crop on some farms (van Heerden, 1963). On average kidding rates of less than 60% were generally accepted as normal. Secondly, frequent and severe losses of Angora goats during cold spells, especially among newly shorn animals, present a serious problem to the mohair producer. In the major mohair-producing areas the losses suffered as a result of adverse weather conditions which quite often prevail in this region, could be disastrous. Finally, poor growth and production in young animals run under extensive conditions, increase the mortality rate and contribute to a reduction in the life-time production of reproducing animals especially.

Research and Solutions

Recognition of the seriousness of these problems triggered off research aimed at providing practical solutions and will be discussed in order of priority.

Abortion

Initial investigation of this phenomenon eliminated the possibility of infectious diseases, and mineral and vitamin deficiencies as a cause of premature pregnancy termination (van Heerden, 1963). According to these results the problem was related to a complex endocrine failure and several detailed and comprehensive studies of the endocrinology of pregnancy and abortion in the Angora followed (van Heerden, 1963, 1964; van der Westhuysen & Wentzel, 1971; van Rensburg, 1963, 1964, 1965, 1970; Wentzel, 1973; Wentzel & Botha, 1976; Wentzel, le Roux & Botha, 1976). These studies led to the eventual identification of two distinct types of abortion with completely different endocrine bases (Wentzel, 1973). In addition ample evidence was obtained that nutritional stress, and probably other types of stress as well, is instrumental in inducing the abortion syndrome (Wentzel, 1973; Wentzel, le Roux & Botha, 1976).

On account of these results it was postulated that the endocrine pathway through which abortions induced by nutritional stress are mediated, originates from a drop in maternal blood glucose concentration. This primary trigger effects a similar hypoglycaemic condition in the foetal circulation which activates the foetal hypothalamic-pituitary-adrenal-axis resulting in an elevated output of steroids, presumably oestrogen precursors. The latter results in an excessive placental secretion of oestrogens into the maternal circulation which in turn mediates regression of the corpus luteum through the release of uterine prostaglandins. Finally, the consequent reduction of the progesterone level permits the onset of labour and hence delivery of the foetus (Wentzel, 1973). The aforementioned hypothesis was substantiated by subsequent studies in which an attempt was made to simulate some of these aetiological conditions.

The aetiology of the other type of abortion proved to be completely different.

According to these results it was postulated that a condition of chronic hyperadrenocorticism interferes with the normal regulation of the water and electrolyte balance of the body, causing placental dysfunction and thus the progressive accumulation of excessive intra-uterine fluids. The latter creates an unfavourable foetal environment which results in foetal oedema, a retarded foetal heart rate, and eventually congestive heart failure (Wentzel, 1973). It is therefore evident that the mechanism involved in abortions of this type is primarily responsible for intra-uterine foetal death. Expulsion of the dead conceptus is merely a consequence of the latter event and is probably mediated through uterine prostaglandin release, induced by autolysis of the dead conceptus, which in turn effects luteal regression. Finally, the resultant cessation of the progesterone block on labour, and other factors involved in normal parturition, permits delivery of the foetus.

The finding that stress as exerted by sub-nutrition, especially as far as energy is concerned (van der Westhuysen & Roelofse, 1971; Wentzel, Morgenthal, van Niekerk & Roelofse, 1974), has such a substantial effect on abortion rate was of special practical significance. This provided an explanation for the more severe spates of abortion usually occurring during droughts and following adverse weather conditions. The only practical measure to limit these abortions is by supplementation, especially of energy. Since this had been advocated, significant declines in abortion rate were reported from practice. According to further research and experience in practice it became evident that most of the abortions occurring under free range conditions are of this type, induced by stress. This fact rendered the other type of abortion identified of very little practical significance.

Further observations in practice led to the identification of additional situations and/or conditions increasing the susceptibility of animals to abortion, e.g. during inclement weather conditions; after shearing when the ewe is exposed to cold climatic conditions and the increased demand for energy is not met with; when animals are moved from the veld to pastures and a temporary energy deficiency is induced by the period of ruminal adaptation to the new diet; when animals are sheltered for prolonged periods without the provision of feed; and that young or old and relatively small ewes are more prone to abort as a result of stressful conditions than well-grown adult ewes.

Losses during cold spells

Research on this problem was aimed firstly at elucidating the physiological and endocrinological changes preceding death of the cold-stressed Angora goat. Aspects related to metabolic heat production, e.g. adrenal and thyroid function, blood glucose concentration, heart rate, rectal temperature, etc. were monitored during this period. According to the results, young animals showed less tolerance to cold stress compared to adult animals, indicating some resemblance with the situation found in the abortion syndrome. The most significant feature elicited by this research, however, was an abrupt drop in blood glucose concentration associated with collapse of the cold-stressed animal, suggesting that this condition is the crucial factor leading to the failure of the mechanism responsible for the required rate of metabolic heat production. This was confirmed by the rapid recovery of cold-stressed animals, following intravenous infusion of an isotonic glucose solution (Wentzel, Viljoen & Botha, 1979). The latter, however, does not offer a practical solution to the problem so producers were advised alternatively to administer a saturated glucose solution intraperitoneally. Although this more practical method has met with considerable success during crises in practice it remained merely an emergency treatment and not a solution to the problem. Research on this aspect was therefore continued by way of another approach to the problem, viz. to increase blood glucose concentration through nutrition. Initial results indicated that the increase in circulating glucose is directly related to the amount of starch ingested by the goat (unpublished results, Wentzel, 1980). The application of the latter concept in practice is, however, seriously limited by the risk of acidosis in free-grazing ruminants not adapted to high concentrate diets. Subsequent research was therefore aimed at overcoming the problem of acidosis which has led to the development of alkali-ionophore-treated whole grain (commonly known as chocolate grain — Wentzel, 1982, 1983). This procedure allowed the *ad lib.* intake of treated grain by goats not previously adapted to such diets without any danger of digestive disorders and acidosis. Furthermore animals having free access to this treated grain showed average increases of 50 – 60% in circulating glucose levels within 48 h after offering the grain. Of special significance was the finding that already within 4 h an average rise in blood glucose of 12% occurred. During cold spells the timeous and rapid increase of the energy status of the cold-stressed goat, achieved in this way, could be a crucial factor in preventing serious losses.

Since the introduction of this new development to practice it has proved to be a valuable management tool to revive cold-stressed animals and/or as a preventative measure to increase rapidly the energy status of the goat, thereby increasing its tolerance to cold.

In addition to the primary purpose for which alkali-ionophore-treated grain was developed, several other applications were soon found in practice, especially to reduce abortion by strategic supplementation during the critical periods mentioned earlier, e.g. during droughts and cold spells, when pregnant ewes are sheltered in enclosures, after shearing and when the diet of ewes changes as a result of a change in pasture. In this respect the feeding of treated grain has proved to be highly effective to halt the physio-endocrine mechanism provoking abortion.

Poor growth in young animals

Impaired growth in growing kids has been a serious concern of mohair producers, not only because of the direct loss in mohair production, but especially because of impaired reproduction experienced in such animals once they become adults. Surveys have shown that live bodymass is one of the primary factors affecting reproduction (Shelton, 1961; van der Westhuysen, 1981) especially in the young maiden ewe at first mating, e.g. a kidding rate of 86% was recorded in well-fed young ewes as compared to a kidding rate of only 19% in unsupplemented young ewes on Karoo pasture.

With due consideration of available information and the previously mentioned energy-related problems, research was concentrated on the effects of energy supplementation on growing kids grazing natural Karoo pasture. The results clearly indicated an energy insufficiency in the natural pasture and quite remarkable responses in growth rate were obtained with energy supplementation. In one trial supplemented two-tooth ewes weighed well in excess of 40 kg whereas the minimum mass set for successful reproduction at this age is only 27 kg.

The incidence of coccidiosis among growing kids was also identified as one of the serious limitations of optimal growth. Subsequent research revealed that this condition could be controlled effectively by the inclusion of antibiotic ionophores in the diet of kids.

In this respect alkali-ionophore-treated grain once again found a valuable application, firstly as a supplement during various stages of the growth cycle, especially after weaning, to ensure optimal growth with several beneficial effects on subsequent reproduction, and secondly, the presence of antibiotic ionophores in the treated grain controls coccidiosis effectively. When kids are kept under conditions conducive to coccidiosis such as on pastures and in kraals, the inclusion rate of the ionophore can easily be adjusted to obtain an effective dose level for the specific situation.

Another application of this treated grain has evolved from research on the effect of flushing on reproductive performance of Angora goats (Loubser, 1983). Increases in kidding rate from 17 to 60% following flushing with 400 – 600 g of alkali-ionophore-treated maize were obtained in various trials. This relatively good response to flushing is ascribed to the abrupt and rather dramatic increase in energy intake which can be achieved only by the feeding of treated grain. By combining flushing with mating during the peak of the breeding season, a high occurrence of oestrus synchronization is achieved with several advantages as far as management is concerned. The fact that 75 – 85% of the breeding flock could conceive within the first 2 weeks of the mating period when flushing has been applied successfully, reduces the total flushing period considerably. This has made the practice much more cost-effective and acceptable to producers.

It should be mentioned that the use of treated grains has also found widespread application in other small stock industries and is at present commonly used for fattening of sheep, drought feeding and supplementation purposes, and for prevention of pregnancy enterotoxaemia in sheep.

The most common problem experienced in practice with the feeding of alkali-ionophore-treated grain is the incidence of scouring which in most cases was traced back to either the omission of the ionophore or the use of calcium carbonate instead of calcium hydroxide. However, a problem which came to the fore and which called for further research was the incidence of urinary calculi formation in male animals, especially well-fed rams, resulting from the excessive intake of treated grain and thus an excessive intake of phosphorus. Investigation of this aspect showed that the problem was greatly alleviated by the use of calcium hydroxide instead of sodium hydroxide, thereby correcting the Ca:P imbalance normally found in grain. The inclusion of 0,5 – 1% ammonium chloride in the recipe for preparing this treated grain to acidify the urine has virtually resolved the problem (van der Westhuysen, Wentzel & Grobler, 1985).

It should also be mentioned that a handbook was compiled on Angora goat farming in South Africa (van der Westhuysen, Wentzel & Grobler, 1985) covering all practical aspects and management practices which have evolved from the interaction between science, applied science and practice. This publication has greatly contributed to the dissemination of information, relevant to improved mohair production, among producers. At present it can be accepted that virtually all established mohair producers are cognizant of the pitfalls of Angora goat farming and that the practical measures to overcome these pitfalls are implemented extensively. This is reflected in the improvement of mohair production during the past two decades. Reproductive rate has increased from less than 60% to a rate approximating 80% at present, whereas average mohair production per animal has increased from 3,18 kg in 1960 to more than 4 kg in 1980 (van der Westhuysen, 1982). This represents the highest average mohair production per animal in the world. Furthermore, the alarming abortion rates mentioned earlier are virtually unknown today.

In retrospect, it is apparent that the combined efforts of researchers, applied scientists and producers have significantly improved Angora goat and mohair production. Continued collaboration between these parties is imperative for maintaining a high level of production, especially in view of the significant expansion of the mohair industry and of rapidly changing economic considerations.

The foregoing experiences in the mohair industry clearly illustrate the success which can be achieved when close collaboration and interaction exist between the primary research level, the applied science level and the producer level. Looking critically at the present dispensation serving the small stock industry in South Africa, it is apparent that although relatively strong contingents of primary researchers and extension officers exist, very limited provision is made for capable applied scientists (specialists or experts) to fulfil the critical function of synthesizing practical applications from primary research results. This situation has led to some kind of separation between research and extension and has consequently reduced the confidence of producers in the system serving small stock production.

Relevant to the foregoing is the fact that the capable applied scientist or specialist is normally a well-experienced senior person with credibility. In the present official system the limited number of small stock specialist posts available does not offer a career to potential specialists because no opportunities for promotion exist, thus excluding the possibility of attracting well-experienced senior officers. As a result of this situation the function of the applied scientist or specialist is fulfilled by a very small number of senior researchers. This is normally handled in addition to their primary task of research, the emphasis being on research because the latter serves as an incentive for promotion. Obviously, this situation is to the detriment of both research and advisory services. Eventually the useful specialist lands in an administrative post as a result of promotion and becomes completely isolated from the stock industry.

A reassessment of the present system, followed by the necessary rectifications will not only restore the confidence of producers in the system but will also benefit the purposefulness of primary research and ensure that more of the vast amount of information generated by research, becomes implemented in and meaningful to practice. Alternatively, the double-appointment system, followed in some of the states of the USA where research and specialist functions are combined, should be duly considered to allow close and continuous interaction between research, applied science and practice. The latter approach has the additional advantage of ensuring active involvement of the researcher in practice. This in turn will promote research applicable to practical production systems which will enhance improved stock production.

In conclusion, the concept of improved small stock production involves the continuous generation of new information, the continuous formulation of improved practices and the adoption of such practices by the producer. A system catering for the latter as well as a free-flow of information between the involved parties is a prerequisite to realize the theme of this conference, namely 'The animal scientist serving the producer'.

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