THE REPRODUCTIVE ASPECT OF SHEEP PRODUCTION IN INDONESIA : A RESEARCH PROJECT [1) 2) 3)]

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ABSTRACT

The sheep seems to be a suitable and socio-economically acceptable animal for livestock production in Indonesia due its small and size and certain physiological characteristics of sheep whith may offer advantages for rearing over larger ruminants. The sheep population is however declining up to present. One way for improvement of sheep production has been attempted through crossbeering with imported breeds.

A research project on certain aspects of sheep reproduction is discussed with emphasis on plasma reproduction hormonal levels, and with the ultimate objective to rapidly indrease the presently declining sheep population.

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THE PROBLEM

The sheep is a suitable animal for peasantry livestock production in Indonesia. Because of its small size, little capital is needed for rearing the animal and makes it socio-economically attractive. Rearing sheep functions as a popular way of savings. The animal is an important source of meat for the villages, also a source of manure and in some areas a source of coarse wool for carpet production. The sheep of Indonesia can be classified into three groups: the Priangan, the Fat tailed and the Texel.

The sheep has certain physiological characteristics which may offer advantage over larger ruminants. The local breeds are well adapted to Indonesian conditions, have long extremities assist loss from the body. They are capable to utilize poor quality feed stuffs and are prolificative in reproduction. Nestel (1) reported a decline in sheep population however, which is still the situation at present. May problems of the sheep industry in Indonesia, like poor management, wastage due to parasites, and improper feeding have to be solved.

One center problem is reproduction, since poor reproductive performance is a major determinant of the low productifity in tropical countries. An earlier report indicated that reproduction or conception is as low as 15% in hot climates even with nutrition and parasite investation well under control (2). It is also well established that endocrine compensation may alter the many function of the body, including reproductive ability.

Sheep of temperate regions reach sexual maturity at 16-20 months of age (3). Although there are no availble data on the onset of puberty, one may assume that indigenous sheep reaches sexual maturity at a later age than the average breed under temperate climates. The reproduction of sheep is stroughly influenced by the length of daylight; the seasonal influence of light is greatest in temperate regions, but less avidon in the tropics (4,5). Long daylight would inhibit reproductive activity (6). There is evidence that reproductive periodicity may also be influenced by environmental temperature (7). Indonesia geographically located on the equator has a relatively stable

amount of daylight in addition to a stable temperature throughout the year. Therefore, it is assumed that ewes in this country cycle throughout the year. Preliminary work on parturition dates of the Priangan sheep (8) and field observations of the estrous cycle of sheep (9) supported this notion.

Attempts to increase the sheep population would require improvement of the reproductive performance of these animals. Hormone changes and levels are likely sources of an index of fertility. Recently exotic breeds, namely the Suffolk, was introduced for crossbreeding to improve carcass quality of sheep. The introduction of sheep of heavy body weight in a crossbreeding program aimed at breeding superior carcass may cause difficulties associated with pregnancies and births.

One reliable index, based on plasma progesterone levels, for prediction of litter size and subsequent proper feeding of the dam (10), warrants further investigation. Comparative studies of indigenous with exotic breeds with respect to studies of hormonal interactions, are needed especially when reproductive performances are different under similar and adequate nutritional conditions. Radio - immunoassay and competitive protein binding techniques would have major application in such studies.

PRELIMINARY OBSERVATIONS

Priangan sheep

Ali Rotib (11) presented data on birth characteristics of the Priangan sheep in West Java. A total of 1018 cases of births was recorded of which 24.7% were duplets and 3% triplets. He found that the lamb crop was only 126.3% per year, which indicated a low production of offspring, compared to figures of 150 - 180% reported for some tropical regions (12). Insufficient numbers of rams may impose a

contributing factor to the low reproductivities. The incidence of twinning and lamb crop percentage may be improved through better feeding, and also if mating is manipulated to take place synchronously with heat in the females.

A flock of Priangan sheep is maintained at the University Experimental Station for use in the crossbreeding program with the Suffolk, with some animals kept separated for comparison.

Imported Suffolk rams.

Two Suffolk rams imported from Austalia last year, are utilized for crossbreeding of the Priangan sheep currently. The rams allowed to graze freely during the day, but are kept indoors at night. Additional grass and drinking water are supplied ad libitum. A concentrate mixture at a level of 20% of the dry matter consumption are given the animals. The concentrate is a mixture of rice bran, corn, peanut and coconut-oil residue cakes, bone meal and some minerals, and contains 85% TDN, 12% CP and 87.5% DM.

Mutton type breeds of sheep show seasonal reproductive activity in temperate climates. Even rams show seasonal variation in sexual drive, the lowest being in the summer. Our Suffolk rams, however, demonstrate good sexual performance and seem not to be affected by the hot humid climate. Approximately 3 months after their arrival, 2 samples of semen of each ram were collected with an interval of one week between the collections, for semen quality examination. The result are tabulated below (Table 1).

Table 1. Semen quality of imported Suffolk rams.*

Ram	Volume (ml)	PH	Motility (%)	Concentration (10^9/ml)	Proportion Alive Normal (%)	Proportion Alive Abnormal (%)	Abnormal heads (%)
1	0.9	6.8	75	1.3	81	8	8
2	1.1	6.7	80	1.5	84	7	7

* Unpublished data of the Departement of Pathophysiology of Reproduction, Bogor Agricultural University. (Cited with permission).

The Quality of the semen is considered good in accordance to the Sheep Industrial Development (SID 1970) criteria. A number of Priangan ewes were served by the rams early this year resulting in 100% pregnancies. The F1 Priangan-Suffolk offspring will be used for future hormonal surveys.

The fertility of the rams will be monitored further. The plasma testosterone levels will also be measured for the assessment.

FIELD STUDIES

1. Comparison of the reproductive performance of the Priangan with that of Priangan-Suffolk crosses mantained under similar conditions will be conducted. The study is aimed at measuring plasma levels of LH, FSH, estradiol 17 beta and progesterone during normal estrous cycles of ewes. The observations will be carried out throughout a complete cycle on 8 months old ewes before their first pregnancies. The animals will be allowed to move freely on pasture. A teasing ram will be used to determine the exact time of estrous. Five ml of blood will be collected every day from each ewe by jugular vein puncture. After a rest period of approximately 30 days, a second series of blood samples will be collected throughout another cycle. After completionof all the samplings, the ewes will be

released for breeding.

Blood samples wil. be collected in heparinized tubes and placed on ice. The plasma will be separated by centrifugation within one hour after blood collection and stored frozen at - 20°C in aliquots of 1 ml in capped plastic vials. RIA methods will be employed to assay the hormones in the samples.

2. As perinatal death is highly correlated with birth weight and litter size (10), it seems justified to investigate pregnant Priangan ewes which have been mated by Suffolk rams and compare them to those bred pure. Changes in the peripheral plasma reproductive hormonal levels will be compared between both groups. Emphasis will be given to plasma progesterone levels in the period 85 - 105 days after mating, and these values will be correlated to the number of fatuses for the possible prediction of litter sizes (10).

Some ewes of each group will be used. Frequent samples of blood are taken from each during the course of pregnancy. Sampling will be arranged so that any age in days of pregnancy for each group will be represented by at least one sample. A composite curve of the time-course change in concentration of each hormone under study will be constructed.

LABORATORY EXPERIMENTS

Field studies should be complemented by laboratory investigations on reproductive physiology. Eventhough commercial RIA kits will be used for determinations of levels of the plasma reproductive hormones in the field studies, we should set-up our own radioimmunoassay. Research is necessary to solve the problems connected with this technique. We also intend to study certain aspects of superovulation in ewes following flushing or treatment with

external gonadotrophins. As twin pregnancies bearing du - plets and triplets may be desired from the point of view to rapidly increase the production of lambs, the correct doses of gonadotrophins to induce such superovulations and their subsequent twin pregnancies warrant investiga - tion.

1. Development and validation of RIA methods for measur - ing plasma LH, FSH, estradiol-17beta, progesterone and testosterone.

RIA procedures depend on the production and purifi - cation of radiolabeled antigen, the production of antisera with a high specificity and affinity for the antigen, and a technique suitable for the separation of bound and free antigen (13).

^{3}H and ^{14}C labeled steroids will be obtained from commercial sources.

^{125}I as iodide will be used to label the protein hormones (ovine origin, highly purified). The solutions of the radioactive preparations should have a neutral p^{H}, a high specific activity with good stability and produce unaltered immune reactivity. Sephadex will be used for separation and purification of the tagged antigens.

Estradiol-17beta-hemisuccinate-BSA, progesterone-11-hemisuccinate-BSA, testosterone-3-(o-carboxymethyl)oxime-BSA, ovine LH and ovine FSH, will be utilized for the production of antisera in rabbits. The method of multiple intradermal injection in parallel with a standard schedule using sequential intramuscular injections will be carried out, according to the procedures outlined by lader et al. (14). Primary injections and boosters containing respectively 100_{ug} and 50_{ug} of immunogen in Freund's adjuvant will be asministered to the rabbits. Booster injections will be applied intramuscularly.

The double-antibody technique is the prefered method to separate the bound and free antigen, due to its applicability for partically any RIA.
In addition, the separation is complete with this method and it may be used with large volumes of incubating solutions (13).

2. The induction of superovulation and subsequent twin pregnancies.

Methods of inducing superovulation are based on the assumption that follicle stimulating extracts elicits the development of a large number of follicles, while luteinizing material result in their ovulation (15). The treatment usually consists of daily subcutaneous injections of FSH (PMS) followed by intravenous injections of LH (HCG). Due to the specificity of the breed in responding to genadotrophin, also the nature of the hormonal preparations used and the complicating factor of stage of reproductive cycle of our sheep under Indonesian conditions, the detailed technique of producing superovulation and subsequent twin pregnancies should be established.

In addition to peripheral reproductive hormonal levels, systemic and regional blood flows to the corpus luteum and uterus tissue at various reproductive states will be measured. The hydrogen gas clearance method of Aukland et al. (16) as applied by Partodihardjo (17) for chronic measurements in the rat will be employed for this purpose. The study has the following specific objectives:

a. To evaluate hydrogen gas clearance technique as a method of measuring blood flow in the corpus luteum and uterus of the ewe.

b. To compare corpus luteum blood flow with uterine blood flow and systemic blood flow at various reproductive states especially those related to superovulation and

twin pregnancies following the hormonal treatments.

c. To relate the blood flow data with the fluctuations in reproductive hormonal levels.

In chronic experiments, four sensing electrodes will be implanted in each ewe, one at each ovary, one in the kidney cortex and one in the uteriner horn. Two or 3 hydrogen desaturation curves will be obtained from each electrode at each measuring period. Measurements will be made at frequent intervals throughout the course of gestation. The number of animals to be measured will depend upon the variation encountered.

THE POSSIBILITIES OF APPLICATION

The essential practical problems we wish to solve in this project are, firstly, how to decrease the number of perinatal death of lambs and eliminate the complications associated with multifetal pregnancies in ewes. Secondly, how to enhance the number of lamb production in order to increase the presently declining sheep population.

Information on the normal peripheral hormonal fluctuations in the Priangan and Priangan-Suffolk ewes is of considerable value for the assessment of reproductive activity. The data will provide information as to whether the introduction of the Suffolk in the crossbreeding program of local sheep have advantages with respect to improvement of the reproductive performance. Since the immediate target of improving sheep production in Indonesia is to rapidly increase sheep population, increasing the incidence of multiple births may help to reach this end. In addition, estrous synchronisation and subsequent artificial insemination would be ideal practice to enhance reproduction rates. Multiple births in heavier breeds resulting from crossbreeding of local animals with heavier improved sheep may be a disadvantage unless nutrition and

management is optimal. Therefore, a reliable method for prediction of litter size is essential.

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