THE USE OF AN ULTRASONIC DEVICE FOR DETECTION OF PREGNANCY IN THE EWE

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SUMMARY

The efficiency of an ultrasonic device in detecting pregnancy (single or multiple) was examined in three flocks of ewes tested at intervals of a fortnight. Diagnosis of pregnancy with ewes restrained in a cradle gave more accurate results than those obtained following examination of ewes in a sitting position. Diagnostic accuracy was related to the stage of gestation, very low when ewes were less than 60 days' pregnant but very high after 100 days of gestation in ewes examined in a cradle. There was no relationship between diagnoses made at any stage of gestation and the number of lambs born per ewe.

ACCURATE DETECTION of pregnancy in the ewe, and also determination of the number of foetuses carried by the ewe, would be useful aids to farm management. Thus non-pregnant ewes could be separated from the flock and disposed of or kept at reduced levels of feeding. This is particularly pertinent if out-of-season breeding is practised, as non-pregnant ewes may be mated again early in the next breeding season. Differentiation between single- and twin-bearing ewes would facilitate the increased feeding of twin-bearing animals at the expense of those non-pregnant or bearing singles.

There are several reports of the use of ultrasonic techniques for the detection of pregnancy in the ewe (Lindahl, 1966, 1969; Fraser and Robertson, 1968; Hulet, 1969; Wilson and Newton, 1969). However, none of these studies has been successful in the prediction of multiple births, and changes in the efficiency of the technique at different stages of gestation have not been documented adequately. The object of this investigation was to record the efficiency of an ultrasonic pregnancy detector to detect pregnancy (single or multiple) at different stages of gestation.

MATERIALS AND METHODS

Ewes in three flocks were mated with colour harnessed rams and observations of oestrus were made daily over three cycles (51 days). All ewes were examined for preg-

nancy at intervals of approximately 14 days using an Allard V 601 pregnancy detector*. The instrument consists of an amplifier and a transducer. Ultrasound from the transducer in contact with the skin is transmitted into the abdomen and part of this sound is transmitted back from internal structures. Sound reflected from motionless structures is not heard but sound received from moving organs or blood is slightly shifted in frequency and is converted into audible sound.

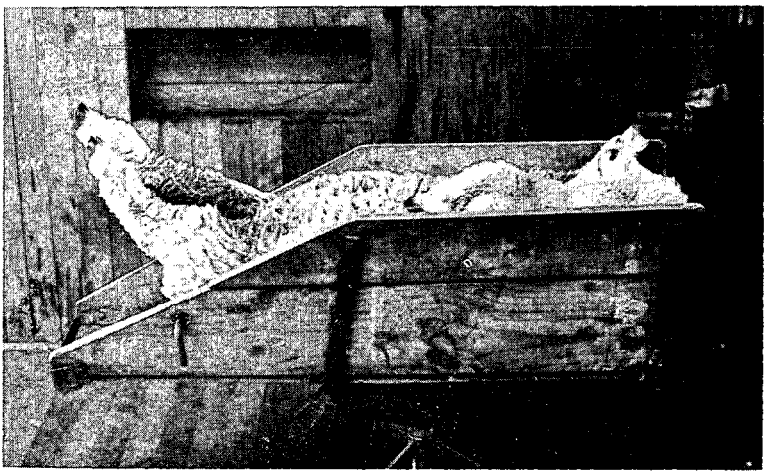

Fig. 1

Ewes were tested either in a sitting position or restrained horizontally in a cradle (Fig. 1) and in one test (Test 1, Flock 3) both methods were compared. Principal features of the study are given in Table 1. Before each test all ewes were fasted overnight. At the first examination, the wool-free area of the lower abdomen was thoroughly cleansed. This was not done at subsequent examinations.

A water-soluble jelly was used to obtain coupling between the transducer and the skin of the ewe. Both sides of the lower abdomen were systematically searched until a foetal heart had been detected on each side or until a time of 2 minutes had elapsed. Detected sounds were classified as follows: no distinctive sounds, foetal movement, uterine blood flow (maternal pulse rate — marked-

*Allard International Pty. Ltd., England.

TABLE 1: PRINCIPAL FEATURES OF THE EXPERIMENT

Flock No.	*No. of Ewes*	*Date Mating Commenced*	*No. and Position of Tests*	*Days from Fertile Mating to First Test**
1	114	1/4/70	3, sitting	102-119
2	122	5/5/70	3, sitting 2, cradle	70-87
3	138	11/6/70	1, sitting and cradle 4, cradle	63-80

*Animals conceiving to first service. Ewes returning to service were at an earlier stage of gestation than indicated by the above ranges.

ly slower than the foetal pulse), foetal arterial or umbilical circulation, or foetal heart beat. These sounds are listed in order of dominance. Of the sounds detected, only the dominant one was recorded. Detection of either the foetal heart or foetal circulation was taken as a positive indication of pregnancy. A foetal heart detected on each side of the abdomen was considered as a possible indication of multiple pregnancy.

Daily records of lambing were kept for all ewes.

RESULTS

Table 2 presents results of the comparison between the two positions of testing. Clearly, diagnosis of pregnancy in

TABLE 2: THE NUMBER OF PREGNANT EWES DIAGNOSED PREGNANT OR NON-PREGNANT IN TWO TESTING POSITIONS (Ewes were tested in both positions on the same day)

Position of Testing and Diagnosis	*Stage of Gestation (Days from Fertile Mating to Diagnosis)*			
	< 61	*61-70*	*71-80*	*Total*
Sitting:				
Non-pregnant	7	31	31	69
Pregnant	1	21	27	49
Cradle:				
Non-pregnant	6	7	4	17
Pregnant	2	45	54	101
Total:				
Non-pregnant	13	38	35	86
Pregnant	3	66	81	150

Significance of differences in distribution:
Stage of gestation, $P < 0.001$
Position of testing, $P < 0.001$

TABLE 3: DIAGNOSIS OF PREGNANCY IN PREGNANT EWES RELATIVE TO STAGE OF GESTATION

(All data pooled within positions of testing)

Position of Testing and Diagnosis	*Stage of Gestation (days)*								
	< 61	*61-70*	*71-80*	*81-90*	*91-100*	*101-110*	*111-120*	*> 120*	*Total*
Sitting:									
Non-pregnant	6	30	35	6	12	8	4	7	108
Foetal movement or uterine circulation	2	6	22	15	16	7	8	7	83
Foetal heart or foetal circulation	1	27	62	75	80	104	78	65	492
No. of observations	9	63	119	96	108	119	90	79	683
% diagnosed pregnant	11	43	52	78	74	87	87	82	72
Cradle:									
Non-pregnant	7	9	4	1	2	1			24
Foetal movement or uterine circulation	2	1	4	6					13
Foetal heart or foetal circulation	4	55	85	82	75	80	79	103	563
No. of observations	13	65	93	89	77	81	79	103	600
% diagnosed pregnant	31	85	91	92	97	99	100	100	94

Significance of differences in distribution:
Stage of gestation, $P < 0.001$
Position of testing, $P < 0.001$
Interaction, Not significant.

ewes restrained in a cradle has given more accurate results. Diagnostic accuracy (the percentage of pregnant ewes in which the foetal heart or arterial pulse was detected) was very low in animals tested within 60 days of fertile mating. However, accuracies of 87 and 93%, respectively, were achieved in ewes examined 61 to 70 and 71 to 80 days after mating. Corresponding figures for ewes tested in the sitting position were only 40 and 47%.

The greater accuracy achieved when ewes were restrained in a cradle is further illustrated in Table 3 which is compiled from all data. The data were classified according to the time from fertile mating to examination and have been pooled (within positions of testing) to simplify presentation. A diagnostic accuracy of 85% or more was reached when sheep were examined in the cradle at and subsequent to 61 to 70 days' gestation. This level of accuracy was not reached for sheep tested in the siting position only between 101 and 120 days after mating. Pregnancy examination of sheep was faster with the aid of the cradle. The numbers of animals examined per hour were approximately 35 (cradle) and 25 (sheep seated).

In multiparous ewes, diagnostic accuracy was approximately 15% greater than in ewes bearing single lambs, prior to 100 days of gestation. This difference was not evident later in gestation.

Thirty-nine ewes failed to lamb. Foetal movement was incorrectly recorded in 9 of 152 observations on these animals. This result may indicate that foetal movement sounds should not be regarded as an irrefutable indication of pregnancy. This also applies to diagnosis of uterine circulation (maternal rate) which was recorded 6 times in non-pregnant ewes examined in a cradle.

Thirty-five ewes lambed twins but attempts to predict multiple pregnancies were unsuccessful. There was no relationship between diagnoses made at any stage of gestation and the number of lambs born. The heart of one foetus was often easily detected from each side of the abdomen, particularly in ewes examined in a cradle. However, in multiparous ewes, the proportion of animals in which a foetal heart was detected on each side was not significantly greater than comparable data recorded in ewes which lambed singles.

DISCUSSION

Lindahl (1969) and Hulet (1969) recorded a high degree of accuracy in detecting pregnant and non-pregnant ewes using ultrasonic techniques. Both authors included foetal

movement as a positive indication of pregnancy and have used 5 minutes as the maximum time for diagnosis. (Hulet (1969) has also examined sheep for 2 minutes.) The use of a longer period of observation and the use of foetal movement as a positive indication of pregnancy would have given a greater diagnostic accuracy in this study but some animals diagnosed pregnant would not have lambed. This has also been noted by Hulet (1969) and Lindahl (1969). With the present study, at any one test in each flock only one such error would have occurred except in the first observation in flock 1 (4 diagnoses of foetal movement in non-pregnant ewes).

Wilson and Newton (1969) reported some success in the diagnosis of multiple births but their data are derived from only 16 ewes and the number of these bearing twins was not stated. In agreement with Lindahl (1969), no success was achieved here, in the prediction of multiple births. Consequently, the successful use of the "Doppler" technique for differentiation between single- and twin-bearing ewes would seem impractical under field conditions. Diagnosis of pregnancy in the field would be much faster than the hourly rates recorded here as further searching for diagnostic criteria is unnecessary following the first detection of either the foetal heart or foetal circulation. The time taken to detect a foetal heart or foetal circulation would be considerably shorter than the time taken to search each side of the abdomen as outlined earlier. The difference in diagnostic accuracy between the methods of testing was important. Examination of ewes in a cradle was faster, more accurate, and animal restraint was also far superior in comparison with pregnancy diagnosis with ewes in the sitting position.

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