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LOW FERTILITY IN DAUGHTERS OF BULLS WITH 1/29 TRANSLOCATION*

By

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REFSDAL, A. O.: *Low fertility in daughters of bulls with 1/29 translocation*. Acta vet. scand. 1976, 17, 190—195. — Non-return rates at different stages after insemination were compared in daughters (n = 21,212) of five translocation heterozygous sires with all cows and heifers (n = 610,714) represented in the Norwegian Red Cattle (NRF) breeding statistics during the period October 1970 to September 1972. The daughters of the carrier bulls showed statistically significant lower non-return rates for 0—30, 30—60, 60—90, 90—120, 120—150, 150—180 and 180—270 days as compared with the control animals. The decline in non-return percentage for the daughters of translocation sires was greater than in the control animals during the period from 0—30 to 60—90 days indicating higher losses of fetuses during the early period after insemination.

Daughter groups of carrier bulls consisting of adult cows only showed higher non-return rates than groups comprising both cows and heifers.

1/29 translocation; bulls; cows; fertility.

In a study of the chromosomes in animals with congenital defects *Amrud & Nes* (1966) detected a characteristic translocation in a sterile heifer of the Norwegian Red Cattle (NRF) breed. Later on *Amrud* (1969) investigated 430 heads of cattle in different herds of NRF-breed and found a reduction of the chromosome number from 60 to 59 in 4.2 % of the animals. The reduction of the chromosome number seemed to be due to centric fusion of two acrocentric autosomes, the biggest and the smallest ones. The investigation suggested that the chromosome aberration had no discernable phenotypic effect in the NRF-breed.

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In Sweden *Gustavsson* (1969) studied the chromosomes of 1173 cattle randomly selected from the Swedish Red and White breed. In this study approx. 14 % of the animals were found to have 59 chromosomes, being heterozygous, and 0.34 % had 58 chromosomes, being homozygous for the translocation. He also found that daughters of translocation sires returned to service more often than daughters of normal sires, and he suggested that this was due to an increased rate of embryonic death.

Later on *Gustavsson* (1971 a) found a relatively high culling rate in daughters of bulls with autosomal translocation of the 1/29 type. In another study of the chromosomes of 263 repeat-breeder heifers *Gustavsson* (1971 b) found 81 (31 %) animals showing the 1/29 type of translocation, confirming that daughters of bulls carrying this translocation have a lowered fertility.

The present investigation was carried out to study the effect of the translocation of the sires on the non-return rates of the daughters at different times after first insemination.

MATERIALS AND METHODS

During the period October 1st, 1970 to September 30th, 1972 non-return rates of daughters of five translocation heterozygote bulls ($n = 21,212$) were obtained from the NRF breeding statistics. These five bulls were Stolpestad 537, his two sons Stig Rognli 837 and Storm Kvakkestad 838 together with Svear 573 and Grad Skjetlein 1296. Bulls nos. 573 and 1296 were not examined cytogenically, but chromosome analyses of their offspring disclosed them to be heterozygous for the translocation. The non-return rates of all the cows and heifers ($n = 610,714$) represented in the statistics during the same period of time were taken for comparison. Thus, these control animals which represented most of the cattle population in Norway during this period consisted of both daughters of bulls and cows with translocation and daughters of normal animals. However, as the control group consists of a great number of animals, the non-return rates in this group were probably not much affected by the results from the daughters of the animals with translocation.

All the animals investigated belonged to the NRF breed. The animals were inseminated with frozen semen from bulls which had been examined cytogenetically and found to have normal chromosomes. The non-return data were obtained 0—30, 30—60,

60—90, 90—120, 120—150, 150—180 and 180—270 days after the first insemination. The recorded data were statistically analysed to study the effect of the translocation of the sires on the non-return data of the daughters. The difference in non-return percentage between daughter groups was tested for significance using Students t-test according to *Steel & Torrie* (1960).

The calculations were done according to the following formula:

$$s = \sqrt{\frac{p_1 \cdot q_1 \cdot (n_1 - 1) + p_2 \cdot q_2 \cdot (n_2 - 1)}{n_1 + n_2 - 2}}$$

$$t = \frac{\bar{d}}{s} \cdot \sqrt{\frac{n_1 \cdot n_2}{n_1 + n_2}}$$

$$s_{\bar{d}} = s \sqrt{\frac{n_1 + n_2}{n_1 \cdot n_2}}$$

s = standard deviation

$s_{\bar{d}}$ = standard error

n = number of animals

p = proportion non-return

$q = 1 - p$

t = Students t .

The five carrier bulls were used in A.I.-breeding in Norway in the period 1954 to 1969. Thus, the daughters tested varied in age between sire groups and within sire groups, as shown in Table 1.

RESULTS

The results are given in Table 1. The daughters of bulls heterozygous for the translocation showed lower non-return rates than the control animals. The difference in non-return percentage was statistically significant for all stages after insemination. Except for the daughters of bull no. 837, single daughter groups revealed significant differences for 60—90, 90—120, 120—150, 150—180, 180—270 days ($P < 0.05$).

DISCUSSION

The differences in non-return percentage between daughters of cytogenetically normal bulls and daughters of translocation heterozygous bulls are probably underestimated in the present

Table 1. Non-return percentage at different stages after the first insemination in daughters of five translocation heterozygous bulls and in a control material consisting of all cows and heifers inseminated during the same period of time (Oct. 1970—Sept. 1972).

Bull no.	Age of daughters	Non-return percentage at different stages after the first insemination							Number
		0—30	30—60	60—90	90—120	120—150	150—180	180—270	
537	> 5 years	89.7	69.0	62.0	60.0	59.4	59.3	59.1	1076
573	> 3 years	91.8	70.2	62.9	61.0	60.4	60.2	60.0	5532
837	> 3 years	92.2	72.9	65.7	63.1	62.4	62.0	61.8	1153
838	1—7 years	90.1	67.7	60.1	57.7	57.0	56.5	56.0	13,170
1296	1—3 years	90.0	65.5	59.8	56.9	56.2	56.2	55.5	281
Mean		90.7	68.7	61.2	59.0	58.3	57.9	57.5	21,212
Mean, control		91.3	71.6	65.7	63.8	63.2	62.9	62.6	610,714
Difference		0.6	2.9	4.5	4.8	4.9	5.0	5.1	
$s_{\bar{a}}$		± 0.2	± 0.3	± 0.3	± 0.3	± 0.3	± 0.3	± 0.3	
P (t-test)		< 0.01	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Daughters divided according to age	adult cows > 3 years	91.6	70.4	63.2	61.2	60.6	60.3	60.1	7761
Difference	cows and heifers	90.1	67.7	60.1	57.7	56.9	56.5	56.0	13,451
$s_{\bar{a}}$		± 0.4	± 0.7	± 0.7	± 0.7	± 0.7	± 0.7	± 0.7	
P (t-test)		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	

study, because of the fact that the control group comprised some daughters of carrier bulls.

The greater decline in non-return percentage in daughters of bulls heterozygous for the 1/29 translocation as compared with the control animals indicates a higher frequency of losses of fetuses in these animals in agreement with the observations of *Gustavsson* (1969). The difference in non-return percentage between the two groups increased rapidly from 0—30 to 60—90 days indicating that most of the losses of fetuses occurred during this period. This is consistent with our own observation that translocation heterozygous heifers may experience abortion from 35 to 60 days after insemination (*Refsdal*, unpublished).

Gustavsson (1971 a) found in the study of the culling rates in daughters of bulls with translocation that in these animals the selection was strongest before the first lactation. He sug-

gested that this was caused by infertility problems in the heifers with translocation. The present investigation supports this conclusion. The differences in non-return percentage between the daughter groups of the translocation heterozygous bulls are probably due to the fact that the age distribution differed between the groups. The non-return percentage in the daughter groups which consisted of both cows and heifers fell to lower levels than in the groups with adult cows only. In the former daughter groups selection against animals with translocation had probably not been as strong as in the latter groups. From this point of view the great decline in non-return percentage for the daughters of translocation heterozygous bulls which has been registered in the present study would have been even greater, if no selection had occurred.

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SAMMENDRAG

Nedsatt fruktbarhet hos døtre etter okser med 1/29 translokasjon.

Ikke-omløpsprosenten på ulike stadier etter inseminasjon ble registrert hos døtre etter fem NRF-okser med translokasjon ($n = 21212$) og hos en kontrollgruppe bestående av alle kuer og kviger representert i NRF's inseminasjonsstatistikk ($n = 610714$). Undersøkelsen omfattet inseminasjoner utført i tidsrommet fra oktober 1970 til september 1972.

Døtre etter okser med translokasjon viste signifikant lavere ikke-omløpsprosent 0—30, 30—60, 60—90, 90—120, 120—150, 150—180 og

180—270 dager etter inseminasjon. Disse dyrene hadde dessuten en sterkere nedgang i ikke-omløpsprosent i perioden fra 0—30 til 60—90 dager etter inseminasjon i forhold til kontrolldyrene. Dette indikerer et større tap av fostere i dette tidsrom etter inseminasjon hos døtre etter okser med translokasjon. Blant disse døtrene viste grupper, som bestod av bare voksne kyr, høyere ikke-omløpstall enn grupper, som inneholdt både voksne kyr og kviger.

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