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THE CONTROL OF REPRODUCTION IN THE NURSING COW WITH A PROGESTAGEN SHORT-TERM TREATMENT

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SUMMARY

Post-partum anoestrus is pronounced in the nursing cow of the *Salers* breed. At the time when breeding commences, 60 days after calving, only 20 p. 100 of females have an active corpus luteum. Treatments to be used seek to induce, rather than to block cyclic activity.

Different progestagens and methods of administration have been tested. Subcutaneous implants of SC 21009 (Searle) have proven the most efficient and the most practical.

Three treatment parameters condition this efficiency :

— Duration of treatment : calving rate = 62 p. 100 for a treatment of 7 days, 57.5 p. 100 for 9 days, 45.6 p. 100 for 11 days and 26.0 p. 100 for 13-15 days.

— An injection of oestradiol valerate on the first day of treatment. For a given duration of treatment (13 days) the calving rate is increased from 19.7 p. 100 to 52.8 p. 100.

— The dose of progestagen : 6 mg = 43.4 p. 100, 9 mg = 55.5 p. 100, 12 mg = 60.3 p. 100. An implant containing 6 mg supplemented with an injection of 3 mg at the beginning of treatment gives same results as 9 mg (55.5 p. 100 calving rate).

All these results were obtained after injection of 800 IU PMSG on the last day of treatment.

The most pronounced period of sexual inactivity in cattle occurs after parturition in the cow nursing her calf (OXENREIDER, 1968 ; SHORT *et al.*, 1972). Environmental conditions and herd management alter the duration of this resting phase (WILTBANK *et al.*, 1964 ; BELLOWS *et al.*, 1972 ; TURMAN *et al.*, 1964). For cows of the *Salers* breed in mountainous regions, the long winters, attached stabling and often insufficient hay-based diet produce a lactation anoestrus which is particularly marked. A treatment for the control of reproduction in these nursing cows should thus induce, rather than block, cyclic activity.

During the past 5 years, different progestagens (MAP, DHPA, FGA, Norethandrolone, SC 21009) and different methods of administration (vaginal sponges, intra-

muscular injection, oral administration, subcutaneous implants) have been tested. It has been shown that when the duration of treatment is increased, the degree of synchronization increases and the fertility at the induced oestrus decreases.

With intramuscular injections of norethandrolone, the fertility is 66.6 p. 100 after a treatment of 10 days, and 52.6 p. 100 after a treatment of 18 days. In the latter case, the fertility returns to normal at the second oestrus (CHUPIN *et al.*, 1974 *b*). With FGA given orally, a very good oestrus synchronization is obtained, and calving rates of 45.2 and 52.7 p. 100 after systematic insemination, with treatments of 18 and 10 days respectively (CHUPIN *et al.*, 1974 *a*). But in all these cases, treatments are costly in terms of labour (norethandrolone in daily injections) or product (oral FGA, 30 mg/day).

I. — MATERIAL AND METHODS

A total of 1 425 nursing cows of the *Salers* breed were treated during 4 years of experimentation for the development of treatments based on subcutaneous implants containing SC 21009.

The existence of ovarian activity has been estimated using as criteria, the circulating levels progesterone at the beginning and end of treatment for the control of oestrus. All cows with a level of progesterone greater than 0.5 ng/ml plasma at least once were considered cyclic.

Different doses of progestagen and durations of implant contact were tested.

Doses : 6 mg, 9 mg and 18 mg in implant form and 6 mg in implant form supplemented with an intra-muscular injection of 3 mg of SC 21009.

Durations : Implants were left in place for 7, 9, 11, 13 and 15 days, the day of insertion being day 0.

Treatments of 7, 9 and 11 days, and a part of those lasting 13 days, were completed by an injection of 5 mg of oestradiol valerate in the first day of treatment. On the last day, all cows received 800 IU PMSG.

Different schemes of insemination were tested : insemination with oestrus detection, 3 systematic inseminations at 36, 60 and 84 hours, or 36, 48 and 60 hours after the end of treatment, or 2 systematic AIs 48 and 72 hours alter the end of treatment.

Fertility is always expressed as calving rate, compared with number of cows treated. It is calculated either for inseminations effected at the induced oestrus, or for the inseminations effected at the induced oestrus *plus* those at the eventual returns to oestrus (this corresponds to a calving period of 30 days).

II. — RESULTS

A. — *Cyclicity*

Table 1 shows that depending on the post partum interval, 13-33 p. 100 of cows were cyclic, according to the criterium, progesterone level on the first and last days of treatment.

B. — *Degree of synchronization*

The degree of synchronization varied according to the treatment (68.9-93 p. 100 of cows were in oestrus in the 144 hours following implant removal for treatments with 6 mg SC 21009 for 11 days, or 12 mg for 9 days, respectively). A maximum of females in oestrus is always observed between 36 and 72 hours after implant removal : 58.9-85.9 p. 100 of cows were observed in oestrus during this period (table 2).

TABLE I

Ovarian activity of nursing cows at the beginning of oestrus synchronization treatment

(February-May)

Interval between calving and treatment (days)	40	41-50	51-70	71-90
Number of cows	217	149	200	57
Cycling cows (%)	12.0	21.5	28.0	33.3

Two blood samples at 8 days interval for progesterone assay
> 0,5 ng/ml = +
< 0,5 ng/ml = —

cycling cows = + +
+ —
— +

non cycling cows = — —

TABLE 2

Oestrus synchronization with SC 21009 subcutaneous implants effect of progestagen dose and treatment duration

(maximum percentage of oestrus in a 48 hour period)

Dose (mg)	Duration (days)				Total	
	9 (%)		11 (%)			
6	82.9	(82)	58.9	(90)	70.3	(172)
12	85.9	(57)	82.5	(63)	84.2	(120)
Total	84.2	(139)	68.6	(153)		

( ) Number of cows

C. — *Fertility at the induced oestrus*

The fertility is comparable regardless of the insemination regime, as shown in table 3, for a given type of treatment (12 mg, 9 days). We have grouped the results independantly of the insemination regime. Under these conditions of induction of oestrus and ovulation in nursing cows, three principal parameters associated with the treatment influence the efficiency of SC 21009 implants :

— the length of time the implant remains in place,
— the injection of oestradiol valerate on the day the implant is inserted,
— the dose of progestagen.

TABLE 3

Effect of the scheme for systematic insemination

	No.	No. calving / No. inseminated	No. calving / No. treated
AI at observed oestrus	57	64.7	57.8
3 AI-systematic, 36-60-84 h	53	58.0	58.0
2 AI-systematic, 48-72 h	320	60.3	60.3

1. *Duration of treatment and influence of an injection of œstradiol valerate.*

Increasing the duration of treatment diminishes the fertility at the induced oestrus (table 4) : 56.5 p. 100 of births for treatments of 9 and 11 days, against 28.9 p. 100 for treatments of 13 and 15 days. This comparison is complicated, however, due to the injection of oestradiol valerate at the beginning of the 9 and 11 days treatments, and not for those of 13 and 15 days (WILTBANK and KASSON, 1968 ; CHUPIN *et al.*, 1974 *a*). The importance of this injection is shown by comparing two groups where the duration of treatment was the same (13 days) with and without oestradiol valerate injection on the day of implant insertion (table 5) : birth rates 45.8 p. 100 *vs* 26.9 p. 100 respectively. Thus, part of the effect of the duration of treatment analysed above can be attributed to the action of oestradiol valerate.

TABLE 4

Influence of treatment duration with SC 21009 subcutaneous implants and of oestradiol valerate injection on fertility (calving rate) *at synchronized oestrus* (*Salers* and *Aubrac* breeds)

Treatments	Calving rate
9-11 days with oestradiol valerate	56.5 (161)
13-15 days without oestradiol valerate	28.9 (166)

( ) Number of cows

TABLE 5

Influence of oestradiol valerate on fertility (calving rate) *at synchronized oestrus after removal of SC 21009 implants : treatment duration = 13 days*

(cows and heifers of mixed breeds)
(From CHUPIN *et al.*, 1974 *c*)

Treatment	Percentage of calving at synchronized oestrus
With oestradiol valerate	45.8 (194)
Without oestradiol valerate	26.9 (130)

2. *Dose of progestagen and duration of treatment.*

Factors likely to improve fertility, in particular the dose of progestagen and the duration of treatment (for times less than or equal to 11 days) have been studied more closely (table 6).

TABLE 6

Influence of treatment duration (SC 21009 implants + oestradiol valerate on first day) *and of progestagen dose on fertility* (calving rate) *at induced oestrus*

Implant Dose (mg)	Duration (days) 7	9	11	Total
6	—	45.1 (352)	40.3 (62)	44.4 (414)
6 + 3 mg injected on first day	55.8 (111)	55.1 (147)	—	55.4 (258)
9	—	55.5 (81)	—	55.5 (81)
12	62.0 (108)	60.5 (512)	51.9 (52)	60.1 (672)
Total	58.8 (219)	54.4 (1 092)	45.6 (114)	—

( ) Number of cows.

Fertility increases with the dose (from 6 to 12 mg) and decreases with the duration of treatment (from 7 to 11 days) : the highest calving rate is obtained with 12 mg for 7 days (62 p. 100) and the lowest with 6 mg for 11 days (40.3 p. 100 ($P < 0.01$). An implant containing 9 mg SC 21009, or an implant containing 6 mg supplemented with an injection of 3 mg at the beginning of treatment, gives intermediate results (55.5 p. 100). Whatever the duration, the difference in fertility is significant ($P < 0.01$) between doses of 6 and 12 mg, and ($P < 0.05$) between doses of 6 and 9 mg (sum of

9 mg implant and 6 mg implant + 3 mg injection). Whatever the dose, the difference between treatments of 7 and 11 days approaches significance ($P > 0.05$).

All results presented here were obtained after an injection of PMSG at the end of treatment. The effect of this injection in nursing cows has been shown previously, in particular, its beneficial influence on fertility. After treatment with norethandrolone as intramuscular injections, we obtained a birth rate of 37.5 p. 100 in the group without PMSG, against 53.1 p. 100 in the group injected with PMSG (CHUPIN, unpublished).

D. — *Fertilization at returns to oestrus*

The cumulative percentage of females giving birth over a period of 30 days is relatively low (70 p. 100 approx.) (table 7). As with the fertility at induced oestrus, an effect of the dose of progestagen is seen (6 mg *vs* 12 mg, $P < 0.01$). On the average, only 27 p. 100 of females not fertilized at the induced oestrus become pregnant in the 30 days which follow.

TABLE 7

Calving rate over a 30 day period

Implant Dose (mg)	Duration (days) of treatment		Total
	9	11	
6	63.0 (352)	59.6 (62)	62.5 (414)
9	70.3 (81)	—	70.3 (81)
12	70.8 (371)	76.9 (52)	71.6 (423)
Total	67.4 (804)	67.5 (114)	

( ) Number of cows

III. — DISCUSSION

A. — *Resumption of ovarian activity*

The resumption of ovarian activity after calving is delayed in the nursing cow. The race and the conditions of herd management can influence this lactation anoestrus. In the case of the herds considered in this study, this may be due either to a characteristic of the Salers breed or to an insufficiency regarding alimentation or environment (very gloomy stabling). The importance of these factors has been shown by TURMAN *et al.*, (1964), WILTBANK *et al.*, (1964) OXENREIDER and WAGNER (1971), and BELLOWS *et al.*, (1972). The importance of lighting conditions in stables during the winter period was shown by DEAS (1971) : by maintaining the stables illuminated for 12 hours per day, he reduced the problems relating to fecundity. Thus, when the animals are put

to pasture, this represents a very powerful stimulus. We have observed (PELOT and CHUPIN, unpublished) a difference in the level of cyclic nursing cows of between 21 p. 100 before putting them to pasture, and 81 p. 100 afterwards.

B. — *Effect of the dose of progestagen and the duration of implant contact*

Maximum efficiency of SC 21009 implants was obtained in experiments described here after treatments of short duration, using a high dose of SC 21009. The synchronization of oestrus was at a maximum after a treatment of 12 mg for 9 days. The fertility at the induced oestrus was maximal with a treatment of 12 mg for 7 to 9 days.

The necessity of reducing the duration of treatment with progestagens from 16-18 days to 9-11 days has been shown previously (WILTBANK *et al.*, 1971 ; CHUPIN *et al.*, 1971 ; KNOX *et al.*, 1972 ; CHUPIN *et al.*, 1974 *b*). The results presented here show that this increase in fertility associated with a decrease in the duration of treatment is likewise observed between 11 days and 7 days in the nursing cow.

An increase in the dose of progestagen is associated with an increase in the fertility rate at the induced oestrus, regardless of the duration. The most efficient treatments are those which employ a high dose during a short period. In this way, the risk of « leak » of hypophyseal hormones and a progestative influence which are incompatible with an increase in fertility can be avoided simultaneously. Assays of LH after treatments of 6 or 12 days in the ewe indicate, effectively, a level of this hormone which is reduced after a long treatment (PELLETIER and COGNIE, 1974).

C. — *Fertilization at returns to oestrus*

Taking account of the fertility rate observed at the induced oestrus, one can say that the level of females fertilized during the first returns to oestrus is low (on average 70 p. 100 of fertilization in the 30 days after the end of treatment). We have shown that this can be explained in a large part by the conditions of herd management. It is known that in the nursing cow of the Charolais breed, under correct conditions of alimentation (CHUPIN, unpublished), 80 p. 100 of animals in which oestrus is induced at the end of treatment, come back into oestrus 3 weeks later if they are not pregnant. The Salers cows of the study presented here are less well fed, and it is possible that a certain proportion of them return to an anoestrus condition after the induced oestrus, thus explaining the low percentage of fertilization at the returns to oestrus noted above.

A second explanation migtht be found in the methods of herd management. The long winter period of attached stabling makes it impossible to detect oestrus precisely, and females not fertilized at the induced oestrus, will only be so when put to pasture with a bull. In the *Charolais* breed, it has been shown (table 8) that it is the interval between the end of treatment and access to a bull which determines the level of females fertilized at the returns to oestrus.

An improvement in the conditions of oestrus detection and the method of stabling is unlikely. On the other hand, the early diagnosis of pregnancy by the assay of plasma progesterone 3 weeks after insemination and the possibilities of using prostaglandin analogues have led us to propose regimes of management which allow systematic insemination of non-pregnant cows at a second induced oestrus.

In spite of the difficulties of fertilization at returns to oestrus, one obtains, on average, an advance in the calving date of around one month. After this treatment, we obtain on average 43,4 p. 100 of calvings in January and 27,8 p. 100 in February against 16,2 p. 100 and 35,8 p. 100 for the same months with traditional husbandry (CHUPIN and PELOT, 1974).

TABLE 8

Influence of time between end of treatment and introduction of a bull on overall fertility at the subsequent oestruses in a 30 or 60 day period

(Norethandrolone 10 days. *Charolais* breed)
(From PETIT M., 1972)

Interval end of treatment-introduction of the bull (days)	Number of cows	Percentage of empty cows following AI at the induced oestrus and then fertilized during a period of		Percentage of empty cows at the end of the breeding period
		30 days	60 days	
18	104	42.0	82.0	3.8
25-60	297	22.5	67.5	9.5
No bull	410	22.0	41.0	21.5

IV. — CONCLUSION

With implants of SC 21009 (12 mg for 9 days, with 5 mg oestradiol valerate on the first day, and 800 IU PMSG on the last day) a treatment is available allowing the induction of oestrus, followed by normal fertility rates in cows of the Salers breed during lactation anoestrus (60 p. 100 births after 2 inseminations at the induced oestrus, without prior oestrus detection). The calving rate over a period of 30 days remains low because of management conditions (70 p. 100 on average). This could be improved to 80-85 p. 100 by systematic treatment of animals found to be non-pregnant after the induced oestrus.

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RÉSUMÉ

CONTROLE DE LA REPRODUCTION CHEZ LES VACHES ALLAITANTES GRÂCE A UN TRAITEMENT PROGESTAGÈNE COURT

L'anœstrus post-partum est très marqué chez la vache allaitante de race *Salers*. Au moment de la mise en reproduction, 60 jours après le vêlage, seulement 20 p. 100 des femelles ont un corps jaune actif. Les traitements qui seront utilisés chercheront donc à induire plutôt qu'à bloquer une activité cyclique.

Différents progestagènes et différentes voies d'administration ont été testés. Les implants sous cutanés de SC 21009 (Searle) se sont révélés les plus efficaces et les plus pratiques.

Trois paramètres liés au traitement conditionnent cette efficacité :

— La durée du traitement : le taux de mise bas après l'œstrus est de 62 p. 100 pour un traitement de 7 jours, 57,5 p. 100 pour 9 jours, 45,6 p. 100 pour 11 jours et 26,0 p. 100 pour 13-15 jours.

— L'injection de valérate d'œstradiol le 1er jour du traitement. Pour une même durée de traitements (13 jours) le taux de mises bas augmente de 19,7 à 52,8 p. 100.

— La dose de progestagène : 6 mg = 43,4 p. 100, 9 mg = 55,5 p. 100, 12 mg = 60,3 p. 100. Un implant de 6 mg supplémenté avec une injection de 3 mg donne les mêmes résultats qu'un implant de 9 mg (55,4 p. 100).

Tous ces résultats ont été obtenus en injectant 800 UI de PMSG le dernier jour du traitement.

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