Preliminary Results on Artificial Insemination of Cattle in Suriname. Case Study : Commewijne District

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Summary

In 1990 and with the help of the European Development Fund, a new and completely equipped AI-station was set up in an attempt to improve the genetic basis of the dairy herd in Suriname. Countering the dramatic decrease in local milkproduction being the main consideration. The author reviews the technical results of three years of AI in the eastern district of Commewijne. The AI-service which was directed from the capital in 1992 and 1993, was decentralised towards the regional veterinary service early 1994. The effects of this decentralisation are also discussed.

Technical results realised during the first three years of AI in the Commewijne district are in general disappointing. Only a small number of dairy farmers makes use of AI, while conception rates are low. The results clearly indicate that heat detection is a major problem, leading to long calving intervals. The kind (breed) of semen used does not influence conception rates. On the other hand, the technical skills of the inseminators involved do influence conception rates. So does the ethnic origin of the farmers involved, although this parameter is closely linked to the scale of the farms and the management level.

At first sight, it would seem that decentralisation had a positive effect on technical results. Due to an increase in the number of inseminations performed, the number of AI-calves born increased substantially. Technical results however were inferior to those prior to decentralisation.

Samenvatting

In een poging de neerwaartse tendens in de lokale melkproduktie in Suriname tot staan te brengen, werd in 1990 een projekt opgezet, gericht op de heractivering van de kunstmatige inseminatie van melkvee. Met de hulp van het Europese Ontwikkelings Fonds werd er een nieuw en volledig uitgerust KI-station opgezet. De auteur bespreekt de technische resultaten van de eerste drie jaren kunstmatige inseminatie in het oostelijke district Commewijne. De dienstverlening die in 1992 en 1993 vanuit de hoofdstad plaats vond, werd begin 1994 gedecentraliseerd naar de regionale veterinaire dienst toe. De effekten van deze decentralisatie worden eveneens geanalyseerd.

De technische resultaten die in de eerste drie jaren in dit district behaald werden, zijn over het algemeen teleurstellend. Slechts een klein deel van de (melk)-veehouders neemt deel aan het programma terwijl de bevruchtingsresultaten onbevredigend zijn. Uit de analyse van de gegevens blijkt dat het herkennen van de tochtigheid een groot probleem vormt, hetgeen op zijn beurt aanleiding geeft tot lange tussenkalftijden. Het type (ras) diepvriessperma heeft geen invloed op de bevruchtingsresultaten, de technische prestaties van de inseminatoren echter wel. Hetzelfde geldt voor de bevolkingsgroep op wiens bedrijven geïnsemineerd wordt, met dien verstande dat deze parameter nauw samenhangt met de grootte van de bedrijven en het management niveau.

De effekten van de decentralisatie leken eerst positief. Het aantal KI-kalveren nam beduidend toe. Dit was echter vooral een gevolg van een groter aantal inseminaties, de technische resultaten gingen er op achteruit.

Introduction

For most of the fifties and part of the sixties Suriname managed to be selfproviding in dairy products. The flourishing dairy sector was supported by a governmental artificial insemination service (established in 1952) which had quite some success and dispersion. A peak in the number of inseminations was reached in 1965 with nearly 6000 inseminations per year. In subsequent years this number had dropped drastically and there appears to be a relation to milk supply, rather than to the number of cows. Reasons why milksupply decreased were the expansion of the urban area, the stagnation of the milkprice paid by the sole authorised milkprocessing plant, Melk Centrale Paramaribo (established in 1962) and labour shortage (1). The severe economic crisis which struck Suriname in the eighties led to the virtual destruction of the dairy sector in this country. By 1992, when inflation rose to over 300% per annum milksupply to the milkplant had reached its lowest level since it was established. The development of the dairy sector is now one of the key targets within government policy, especially in the view of import substitution of milkpowder, for which foreign currency is no longer available.

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In 1990 a new artificial insemination service was set up at the abattoir site in the capital Paramaribo. Project n° 5100.35.59.011 (Verbetering van de K.I. in Suriname) was funded by the European Development Fund and included funds for a modern building, liquid nitrogen production apparatus, several small four wheel drives, the necessary equipment for inseminations and tagging of cows and calves and of course imported semen (Holstein and Australian Milking Zebu). The new AI-service has been working as a government service for some 5 years. The aim is to privatise the whole system within the next years.

Although the AI service has had all the necessary equipment needed, insemination of cattle presumably never rose to a relevant qualitative and quantitative level, the ongoing deterioration of the dairy sector being one of the main limitations. Furthermore, while severe inflation increased the cost of living, inseminators kept their same government salary, which led quite some inseminators to leave the service, whereas the remaining inseminators got demotivated. There were no financial incentives as to the quality of their work, neither to the quantity of their work, e.g. weekend allowances were (and still are) virtually symbolic.

This is probably why the service has been limiting itself to the insemination of cattle and never really performed pregnancy-checks and calf-registration measures. Therefore, and because of the lack of computerised dataprocessing, data on the quantity and quality of AI in Suriname were not available until this year (1995).

In 1991, the more remote districts of Commewijne (east of Paramaribo) and Saramacca (west of Paramaribo) were added to the area covered by the inseminators of the AI service in Paramaribo. As from the start inseminations in the Commewijne district were scarce and results (presumably) poor; this was due to the fact that inseminators needed to cross the Suriname, river by ferry, which often is a hazardous undertaking (strikes, technical failures, etc ...). This meant that inseminators often arrived too late for an insemination to be successfull.

Since December 6th, 1993 this service to the Commewijne district has been decentralised, which means that the service is now part of the regional veterinary service, which performs inseminations with its own personnel and makes use of equipment, transportation and semen from the Paramaribo AI-service. Since their is no need to cross the Suriname river every day, one would expect better technical results, due to the fact that one can be at the farmers site more quickly and that inseminations can be performed during weekends, which was not the case in the previous system.

The technical results of inseminations in this district for the period 1992 - 1994 (before and after decentralisation) are presented and discussed hereunder.

Material and methods

The data used in this report were collected from the data-sheets, used by the subsequent inseminators. These consist of individual cow-records (given to the farmer), farm-records (several cows per farm) and insemination records (per inseminator). Overall data available are:

- farm-owner (and ethnic group),
- farm-address,
- farm-registration number,
- name of the cow and cow-eartag number,
- date, invoice-number and semen-choice of first, second, third and/or fourth insemination,
- name of the inseminator and insemination fee.

Unreliable and/or incomplete data were pregnancy-checks, previous calving date, following calving date, calf-eartag number, sex of the calf, fertility-related problems and treatments.

Based on the reliable and complete data available, a computer-program was developed using a database-program called FileMakerPro™, running on an Apple™ Macintosh™-processor. Additional inputs required were:

- results of pregnancy-checks and
- previous calving dates(s).

These additional data were collected through farmvisits. Having these data available, the computer-program calculated a number of additional data for each record (cow):

- expected calving date,
- intervals between inseminations

Based on these data, farm-visits and calf-registration were organised, whereby

- conception (birth/no birth),
- date of birth,
- sex and
- eartag-number

of calves were entered into the database, which enabled the program to calculate

- pregnancy length and
- calving interval.

Once these data were available, the program calculated a range of technical parameters for either a given area, a given ethnic group, a given period of time, a specific farmer, a specific inseminator, a specific choice of semen or any other choice. These parameters were :

- number of AI-farms
- number of AI-cows
- overall number of inseminations
- number of AI-calves born
- number of heifer-calves born
- number of bull-calves born
- average interval between two inseminations
- average number of inseminations per conception
- total number of conceptions following first insemination
- total number of first inseminations
- average calving interval
- average pregnancy-length
- choice of semen

Additional calculations led to the following important parameters:

- average conception rate following first insemination and
- overall average conception rate.

As mentioned above, all these parameters are available for a given period of time, a given bull, a given inseminator or whatever other possibility chosen. The 60- or 90-day non return percentage was not calculated since this parameter is probably of very little value under the Surinamese circumstances in which a lot of farmers switch towards natural service or sell their cows for beef in the occurrence of non-conception following a first insemination.

The conception rates following first insemination in relation to different periods of time (before and after decentralisation), the different technicians involved, the choice of semen and the ethnic origin of the farmers involved, are being compared statistically using a student t-test.

Results

The results presented hereunder cover the period January 1992 - January 1995. However, we make a clear distinction between the periods preceding and following decentralisation on December 6th, 1993, since this will show to have had an important impact on several technical results. This date marked not only the decentralisation of the service towards the district, but also the enrolment of two new inseminators, which is an important variable in all AI-calculations.

Between January 1st, 1992 and December 31st, 1994, 354 inseminations were performed on 277 cows on 171 different AI-farms in the Commewijne district.

On 103 occasions, Holstein semen was the semen of choice (39,7%), 156 inseminations were performed using Australian Milking Zebu-semen (60,3%). The average interval between two inseminations added up to 112 days instead of the usual 21 days. The average pregnancy length was 279 days. The calculated average calving interval was 567 days or 1,5 years, whereas 385 days is considered acceptable under tropical conditions. Table I presents these results for the subsequent years.

Table I. Overview of insemination data from January 1 st, 1992 until December 31 st, 1994.

Year	1992	1993	1994
Number of AI-farms	54	23	94
Number of AI-cows inseminated	76	40	161
Total number of AI performed	99	46	209
Average interval between two inseminations (days)	154 d	90 d	87 d
Choice of Holstein-semen	38	19	46
Choice of AMZ-semen	38	20	98

In 1992, 1993 and most of 1994, the cost of an insemination remained at the same level (Sfl.10,-). The number of inseminations increased considerably after decentralisation in 1994. It was only after the price of inseminations was adapted to Sfl. 750,- on November 1st, 1994, that the demand for inseminations diminished.

The monthly number of first, second, third and fourth inseminations for these three years are presented in figure 1.

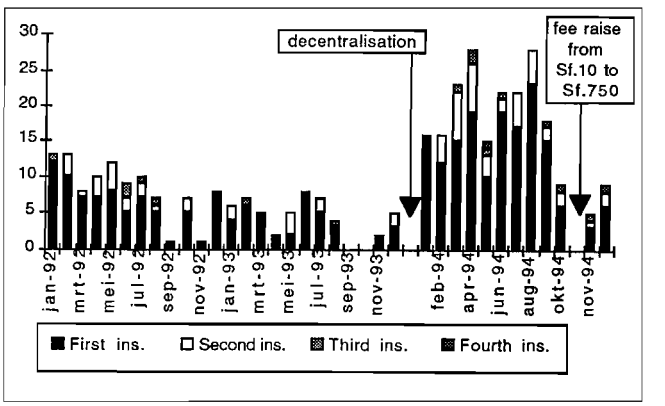

Figure 1. Monthly insemination-data from January 1st, 1992 until December 31st, 1994

In order to compare the results in three consecutive years without the interference of price changes and/or seasonal influences, we compared the technical results in the first five months of 1992, 1993 and 1994. The cost of an insemination remained the same during these three periods.

The technical results of first inseminations performed in the period January 1st until May 31st, 1992, 1993 and 1994 respectively are being presented in table II.

Table II. Overview of technical results for the period January 1st until May 31st, 1992, 1993 and 1994. (normal [no] values between brackets)

Year (January 1st - May 31st)	1992	1993	1994
Total number of files	44	20	72
Total number of files completed	41	20	66
Number of AI-farms	30	9	37
Number of AI-cows inseminated	41	20	66
Total number of AI performed	57	23	96
Average interval between two inseminations, [no = 21 days]	158 d	84 d	98 d
Total number of calves born	18	13	33
Total number of heifer calves born	7	7	20
Total number of bull calves born	11	6	13
Number of inseminations. per conception (overall)	3,16	1,76	2,91
Number of inseminations per conception (pregnant cows only) [no = 1, 5]	1,66	1,26	1,77
Average overall conception rate	44%	65%	50%
Total number of first inseminations	41	20	66
Total number of conceptions following first insemination	14	11	20
Average conception rate following first insemination	34%	55%	30%

Choice of Holstein-semen at first insem.	23	11	14
Average conception rate following first insemination using Holstein	22%	64%	35%
Choice of AMZ-semen at first insem.	18	9	52
Average conception rate following first insemination using AMZ	50%	44%	28%
Total number of first inseminations performed by inseminator X	41	20	0
Average conception rate following first insemination by inseminator X	34%	55%	
Total number of first inseminations performed by inseminator Y	0	0	49
Average conception rate following first insemination by inseminator Y			37%
Total number of first inseminations performed by inseminator Z	0	0	17
Average conception rate following first insemination by inseminator Z			12%
Average pregnancy length [no = 280 days]	277 d	278 d	281 d
Average calving interval [no = 385 day]	480 d	437 d	745 d

The overall technical results for first inseminations performed in the period January, 1st, 1992 until May 31st, 1994 were as follows. 177 cows were inseminated on 233 different occasions and on 109 different farms. The average insemination-interval between two inseminations was 124 days. In 68 (first) inseminations, Holstein was the semen of choice (38,4%), whereas in 108 cases, Australian Milking Zebu was chosen (61,6%). Out of these 177 cows, 90 calves were born, of which 42 heifers (46%) and 48 bulls (54%). The average conception rate following first insemination was 38,41%, while the average overall conception rate was 50,84%. Thus, only one out of two cows eventually got pregnant. The average pregnancy length was 278 days, the calving interval amounted to 590 days.

In an attempt to identify the group of farmers who would be most in need of extension and possibly training concerning heat detection and other AI-parameters, we processed the 1994-results, based on ethnic origin, the three majority populations being (in random order) : creole (african), hindustani (indian subcontinent), and javanese (indonesian archipel). The results are presented in table III.

Table III. Technical results for the period January 1st until May 3lst, 1994 in relation to the ethnic origin of the farmers involved

January 1st - May 31st, 1994	Creole farmers	Hindustani farmers	Javanese farmers
Total number of first inseminations.	11	40	13
Total number of conceptions following first insemination	6	13	1
Average conception rate following first insemination	55%	32%	8%

From the parameters presented in the previous paragraphs only two parameters are of major interest to the farmer and the government (who is heavily supporting this AI-program) : what is the effect of decentralisation on (a) calf-output and (b) on the cost per AI-calf born?

The output of AI-calves increased significantly after decentralisation of the AI-service, though more through a higher number of inseminations than through better technical performance. Indeed, the number of inseminations during the first five months of 1994 more than tripled in comparison to the same period in the previous year. On the other hand conception rates decreased from 55% in 1993 to merely 30% in 1994. These results are visualised in figure 2 by adding the number of first inseminations (n) to the value referring to the conception rate following first insemination (%).

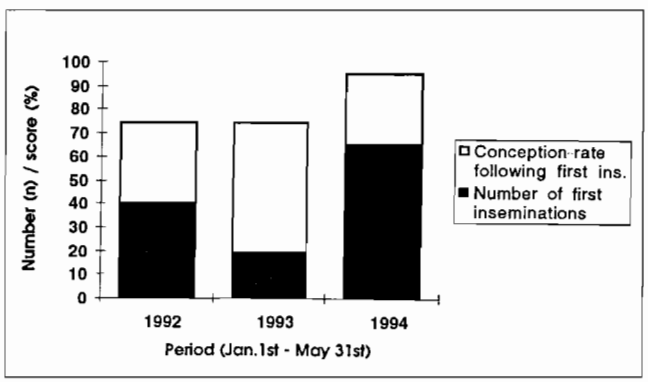

Figure 2. Calf output as a result of the number of inseminations (n) and the conception rate (%) before and after decentralisation

The cost of an AI-calf is closely related to the number of inseminations per conception per cow. While the number of inseminations for the cows that eventually got pregnant remained more or less acceptable before and after decentralisation (1,26 in 1993 and 1,77 in 1994), the overall number of inseminations for all the cows that had been inseminated, increased significantly in 1994 (2,91 in comparison to 1,76 in 1993). Roughly estimating the actual cost of one insemination at approximately US$ 10, this would mean an extra cost of US$ 11,5 per AI-cow calving in comparison to the previous year. It needs to be pointed out however that the overall number of inseminations per cow was even higher in 1992 (3,16 inseminations/ cow).

Discussion

The results presented hereabove are based on relatively small numbers of data and are therefore not always of statistical value. Suriname is a very sparsely populated country (estimated 400,000 inhabitants), with a very small portion of the country being used for habitation and agricultural production (the coast line and parts of the savanna); the remaining part consists of dense tropical rainforest (the Amazon forest). The national herd represents an estimated 93,180 number of cattle (1) (1991 census). The Commewijne district is a rural coastal district, neighboring the capital Paramaribo. The district has an estimated population of 24,000 and an estimated cattle herd of 10,521 (1993 census) (2). Most of the cattle may be considered beef cattle, the greater part being raised on a few semi-extensive enterprises. Estimations of the dairy

herd are not available. Specialised dairy enterprises are almost non existing, dual purpose being the rule. As in most other parts of the country and for the time being, dairy production remains a sector of minor economic importance, which is why A.I. has never become quite as important as policy-makers might have hoped.

Overall technical results

Although several authors (5, 6) consider conception rates at first insemination of 60% or higher to be achievable under tropical rearing conditions, practice reveals far less elevated conception rates. Thatcher and Collier (7) reported on conception rates at first insemination of 47% in heifers and merely 32% in lactating cows on a commercial dairy herd in (tropical) Florida (U.S.A.). The conception rates following first insemination that were revealed through this study are in accordance with those data and may be considered acceptable given the circumstances. Overall conception rates on the other hand, are very disappointing since in average only one out of two cows eventually gets pregnant. Cows that do get pregnant need no more than 1,58 inseminations in average, which is normal. The overall number of inseminations per conceived cow on the other hand is high: 2,59 in average.

What could cause these poor results ?

Based on the average interval between two consecutive inseminations (112 days) and the average calving interval (567 days), it is obvious that heat detection is a major problem. This is due to a relatively low level of education (and experience) of farmers with regard to artificial insemination. Uncontrolled natural service used to be the general practice, very few farmers understand the phenomenon of oestrus and ovulation, even fewer recognize the symptoms and behavioral changes of the animal in heat. Furthermore, it needs to be said that the genetic basis of the dairy cows makes heat detection even more hazardous. A large number of dairy cows are descendents of temperate climate-breeds, such as Holstein or Holstein Friesian or (Dutch) Friesian. The larger the influence of these breeds, the more oestrus and fertility are suppressed by temperatures exceeding 24° C (4, 7), which is usually the case in Suriname, maximum temperatures (under shade) varying from 28°C to 43°C throughout most of the year (3). Cows are kept on pasture during the day-hours and are housed at night. An even larger portion of the cows has a firm genetic *Bos indicus* (Zebu)-influence, caracterised by seasonal ovulation, a-typical oestrus behavior, short or even suppressed oestrus activity, nocturnal oestrus activity and early ovulation. The only breed for which heat detection would not seem to cause any problem is the indigenous Criollo. Pure-bred Criollo-cows unfortunately produce very little milk.

A large portion of the inseminated cows never gets pregnant. Some of them eventually conceive through natural service, an even larger part however suffers from infertility, nutritional deficiencies and heat-suppressed oestrus probably being the major causes.

As far as our records are concerned, the type of semen used is not a factor affecting technical results ($p > 0, 10$). Conception rates differ, but in no particular way. In 1992, conception rates using AMZ were superior to those using Holstein, while in 1993 and 1994 we found the opposite to be true.

Factors undoubtedly affecting technical results are the experience and technical skills of the inseminators involved. The technical results of the (first) inseminator (X) improved (though not significantly) during his second year of practice (1993). Overall technical results of the two new inseminators (Y and Z) in 1994 were inferior to those of inseminator X in 1993. Data show that inseminator Y has obtained better results (conception rate at first insemination : 37%) than inseminator Z (conception rate at first insemination : 12%), although the difference is not significant ($0,05 < p < 0,10$). Training, the (lack of) experience and the number of inseminations performed by inseminators are in our belief, important factors to keep in mind when trying to improve technical results in artificial insemination. On the other hand, financial bonuses paid to inseminations for cows conceiving in response to AI, have (in other countries) also proven to be an effective mean of improving technical results (5).

The segment of farmers who would appear to be most in need of information regarding heat detection and record keeping, appear to be the Javanese. The technical results obtained on Javanese owned farms were significantly ($p < 0,05$) inferior to those obtained on Creole-owned farms and nearly significantly inferior ($0,05 < p < 0,10$) to those obtained on Hindustani-owned farms. Indeed, field experience confirms that these Javanese owned farms are usually the smaller ones, typically characterised _by lack of land, lack of technical skills and often lack of motivation, leading to overall poor production results in terms of milkproduction and calf mortality especially. Since husbandry is in most cases a second occupation, next to a government or private employment, there is often no will to improve results or to enlarge the scale of the operation. As expected, there is no significant difference between technical results obtained on Creole-owned farms and on Hindustani-owned farms.

Finally, an aspect which has not been investigated, is calf mortality in AI-calves, which we suspect to be much higher than average. Improving the number of inseminations and technical results with regard to conception rates, is of little value if calf rearing management measures are not improved in the same way.

Effects of decentralisation

Decentralisation of the AI-service towards the regional veterinary service has proven to be an improvement in terms calf output. Thanks to a definite increase in the number of farms switching towards AI in stead of natural service and an increase in the number of cows being presented to the AI-service, the number of calves born as a result of the inseminations performed during the first five months of 1994, increased with 250%. Unfortunately, these figures might have been even more positive if the conception rate following first

insemination could have been maintained at the level of the previous year and the previous inseminator (55%); in stead it dropped significantly ($p < 0,05$) to merely 30% in 1994. This increased the AI-related cost of an AI-calf with approximately 40%. The decrease in conception rates is probably at least partially related to the relative lack of practical experience of the new inseminators. While inseminator Y scored an average conception rate of 37%, inseminator Z scored even less, merely 12%. Efforts to improve the quality of the inseminations performed by both inseminators, but especially inseminator Z, could improve overall calf output in the near future. The average conception rate scored by inseminator X during his first months of work (1992) was quite (though not significantly) inferior (34%) to his results during the second year (55%), which might indicate that experience improves technical results.

The technical results presented hereabove might very well be different from results in other parts of the country. Area's such as Rijsdijk and Reeberg might show better technical results, due to the presence of larger and more specialised dairy enterprises. Unfortunately insemination and calf-registration data are not available for these areas. So far, the Commewijne district is the only district for which these data are available.

Recently, an attempt has been made to adjust the computer-program used in Commewijne in order to fit the demands of the main A.I. service in Paramaribo. The insemination data for the urban area and the surrounding districts are currently being entered into this program. However, unless calf-registration is undertaken on a structural basis, technical results won't be available for the years to come.

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ADDENDUM

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