REALITIES OF SHEEP ARTIFICIAL INSEMINATION ON FARM LEVEL: FARM AND BREED DIFFERENCES

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Abstract

Since the mid 1970's the artificial centres for sheep were ceased in Hungary the artificial insemination (AI) of ewes has been gradually reduced. In mid sixties more than 63% of the total number of ewes was inseminated (in some part of the country this number was above the 85%) and nowadays it is only 2-3%. In order to examine the present practice and effectiveness of the AI a survey was conducted between 2003 and 2010 covering the dominant part of the sheep farms using these techniques. The inseminated ewes were belonging to various breeds: purebred and crossbred Awassi and British Milksheep, Bábolna Tetra, Charollaise, German Mutton Merino, German Blackhead Mutton Sheep, Ile de France, Hungarian Merino, Lacaune, and Suffolk. The number of ewes, details of the techniques used and the results were evaluated concerning eleven sheep farms inseminating more than ten thousands ewes in the first and about 3 500 heads in the last year. Every detail of the AI techniques from the selection of ewes up to the weaning rate of the lambs born from AI was evaluated. Descriptive statistics and chi-square test of SPSS for Windows-10.0 was applied for processing of data. The main conclusions of the study were as follows: well skilled shepherds could apply the AI with very good results on farm level using dominantly fresh semen collected locally; the conception rate (75-95%) was affected by breed, year, and the farm. The cost of AI varied from € 0.35 to € 8.5 (in oestrus synchronization).

Key words: sheep, breeds, artificial insemination, effectiveness

INTRODUCTION

A contradictory process could be observed in the field of AI in some European countries and in Hungary. While in Hungary the number of artificially inseminated ewes reached 63% of the total sheep flock and some parts of the country exceeded the 85% in the mid 1960's [6] but reduced to 2% by 2010. In some countries (like France, Spain, etc.) the ratio of AI in various breeds could approach the 84% in the case of various breeds [2, 4, 5]. There could be several beliefs and reasons in the background why the AI is not used (lack of knowledge and skilled labour, wrong practice and low effectiveness, level of direct costs, etc.). Apart from these several shepherds were taken part in AI courses in 1999-2000 organised by the part of the authors. In order to get a clean picture on the field of AI in the present Hungary the data of sheep farms using AI were aimed to collect and evaluate.

MATERIAL AND METHODS

In order to study artificial insemination at the farm level, 11 sheep farms (from No. 1 to 11) out of the less than 20 farms in Hungary with available data on AI were selected for this study during the period from 2003 to 2010. The number of ewes bred and the number of inseminated ewes were not the same on the studied farms. Because of the limited length of the paper only the number of ewes in AI was presented here. In general, 90-95% of the ewes kept were involved, but on the farm No 10 only 40% of the ewes were included in AI. Twelve breeds and genotypes of sheep were bred on the studied farms (Table 1). Three breeds were kept on three farms, two breeds were bred on one farm, and only one breed was kept on the other farms.

Two surveys were carried out (2007 and 2011) on the selected farms in order to

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collect the following data: the breeds, the number of ewes kept and inseminated, detecting method of ewes on heat, use of oestrus synchronisation, collecting and handling method and dosage of semen, method of AI, handling of ewes, control of pregnancy, number of lamb born and weaned, and the costs of AI. Pregnancy rate (lambed ewes/inseminated ewes), lambing rate (born lambs/lambed ewes), weaning rate (weaned lamb/born lamb) were calculated. Chi-square test of SPSS 10.0 was applied to compare the breeds and the years by breed. Significant differences between breeds and years were determined at $P \leq 0.05$.

Table 1 Distribution of the number of inseminated ewes by breed and farms

Breed, farm code, year	Hungarian Merino				German Mutton Merino		German Blackhead Mutton Sheep	British Milksheep		British Milksheep Crossbreds
	9	10	3	5	9	4	9	10	11	11
2003	446	-	274	160	438	640	174	-	420	-
2004	458	-	350	200	461	650	159	-	390	-
2005	477	-	385	220	476	690	171	33	350	-
2006	440	-	317	350	462	600	179	41	280	-
2007	522	118	-	165	319	650	147	31	280	70
2008	563	150	-	130	335	670	162	28	240	60
2009	498	150	-	-	288	-	182	41	235	60
2010	475	150*	-	-	310	-	155	70*	240*	65*

Breed, farm code, year	Charollaise	Lacaune			Awassi	Bábolna Tetra	Ile de France	Suffolk
	10	7	8	6	1	2	2	2
2003	-	212	198	-	1960	1717	937	195
2004	-	196	127	-	2120	1379	996	245
2005	-	165	-	-	1760	1222	863	240
2006	-	151	-	-	370	1147	732	224
2007	11	167	-	-	50	1014	866	214
2008	8	127	-	-	-	1043	784	304
2009	16	245	-	297	-	311	310	242
2010	18*	255*	-	369*	-	286	186	107

** lambing after AI made in 2010 started in 2011*

RESULTS

There were several differences found among the farms concerning the details of the utilised AI methods. The use of AI ceased because of several reasons (lack of labour, etc), while on others the AI was introduced.

Preparing ewes and using oestrus synchronisation

From among the several possible methods preparing animals for mating period a kind of "flushing" (improved nutrition) was used on every farm. Ram effect was not really applied; however, on some farms, vasectomised rams were introduced to the flocks two weeks before the start of season. No other method (like lighting program) was applied. Oestrus synchronisation and induction were used on five farms (No. 1, 5, 6, 7 and 10), during the main season and in spring time (No. 1 and 10), or only in spring (No. 5 and 7), or only in winter (No. 6).

Collecting and handling of semen

The semen was collected locally on most of the farms by the shepherds with appropriate skills, except for farm No. 8 where transported semen was used. Artificial insemination was carried out by the shepherds, except for farm No. 1, where it was done by a veterinarian or a technician as service from outside. Visual examination of the semen was performed before use on every farm. It was the only one method used on farm No. 2, 6 and 11. Microscopic and morphological examinations were also carried out on two farms (No. 1 and

7), and microscopic examination was also performed on the other six farms.

Diluting of semen

Several kinds of extenders were available for everyday use, but six (No. 2, 3, 4, 5, 8 and 11) out of the eleven farms did not use any kind of extender to dilute the semen before insemination. The 1:2 and 1:4 diluting ratios were used on the farm No 1 and on farm No. 10, where a 1:3-diluting ratio was used during the last three years. The 1:4 ratios were used on farm No. 9 and 1:8 on farms No. 6 and 7.

Semen dose for insemination

In general, 0.2 ml was the most common dosage of inseminating semen. It was used on seven (No. 1, 2, 3, 4, 5, 7 and 8) out of the 11 farms. Doses of 0.1 and 0.3 ml were used on farms No. 9 and 11, as well as No. 6 and 10, respectively.

Detecting ewes on heat for insemination

The most important factors of successful AI is selecting ewes on heat. Morning and afternoon selections were used on most farms (No. 1, 3, 4, 5 and 8). The selection was only performed in the morning (No. 2, 7 and 9) or in the afternoon (No. 6 and 10). Midday detection was used on farm No. 11 in the first 4 years, and the morning time was applied hereafter. The process made by using entire rams as teaser (No. 3, 4, 6, 9 and 10), or vasectomised (No. 1 and 7) or both kinds of rams (No. 2, 5. 8 and 11).

The time and number of inseminations

Two inseminations were used on most of the farms (No. 1, 2, 3, 4, 5, 6, 7 and 8) about 8 to 10 hours apart (morning-afternoon or afternoon-morning). One insemination made on two farms (in the morning on No. 9 and in the afternoon on No. 11), and three inseminations were (morning – afternoon - morning or afternoon – morning – afternoon) carried out on one farm (No. 10).

Performing insemination

The rear legs of the ewes were lifted up and fixed by one labour on the top of the barrier in almost all of the farms, while on farms No. 6 and 8 ewes were hold by a catcher by hand during the insemination. The operation was carried out by one catcher and one inseminator (who was the owner of the farm), in general (No. 5, 7, 9, 10 and 11), but there were farm differences. On farms No. 1 and 7, technicians conducted the inseminations.

The place of semen deposition

Traditional vaginal insemination was used on farm No. 8 in the first three years of the studied period, and then they changed to cervical deposition. Cervico-uterinal insemination was performed on farms No. 6, 7 and 10 (and sometimes on 11), while cervical insemination (with special catheter developed in Hungary) was used on other farms.

The pregnancy control

The trans-rectal ultrasonography was used on farm No. 1. Ultrasonography was performed within 60 days after AI in every year of farm No. 10, and in the first 4 years (No. 7) or in the first two years (No. 5) of the period. The most common method was the post-mating with entire rams started one cycle after the AI and lasted for two cycles. No post-mating was applied on farm No. 4 and farm No. 7 (in the case of last four years).

The results of artificial insemination

There were significant differences found among the studied farms and among the various breeds kept on various farms and also between the breeds within the farms. The pregnancy rate in general exceeded 80% and results over 90% were not exceptional at all. However, effects of farm, breed and year were observed on the results.

Farms breeding more than one breed

The pregnancy rate on farm No.2 was different among breeds (Table 2) and changed within quite wide range: Bábolna Tetra – 73.1-90.7; Ile de France – 79.6-94.6; and Suffolk – 66.3-85.7%. Apart from this, significant year effects were also observed on the data, as well as the breed-year interactions could also be followed in the results. Breed and year effects were equally found on lambing and weaning data. Lambing rate of Bábolna Tetra breed varied between 1.6 and 2.0, while in Ile de France (1.2 - 1.4); and in Suffolk (1.2-1.7) data were a little bit lower; and significant year effects on the values were observed. The year effect was also significant in the case of weaning rate: Bábolna Tetra – 82.2-97.8; Ile de France – 81.8-91.1; and Suffolk – 68.4-93.2%.

Significant breed and year effects were observed in the pregnancy rate data of the

various breeds kept on the farm No. 9 (Table 2). The values were changed between 89.5 and 97.5% in the case of Hungarian Merino, between 92.2 and 96.3% in German Mutton Merino; as well as between 85.5 and 95.2% in the case of German Blackhead Mutton Sheep. The lambing rate per ewe varied between 1.5 and 1.7 in the case of Hungarian Merino, while it was between 1.6 and 1.8 in German Mutton Merino, and between 1.5-1.8 in the case of German Blackhead Mutton Sheep. These data were 0.2-0.3 higher than the national averages concerning these breeds, as this farm was one of the best sheep farms in the country. The weaning rates changed between 94.9 and 97.4; 95.0 and 96.7; as well as 93.3 and 96.7%, respectively, in the case of Hungarian Merino, German Mutton Merino and German Blackhead Mutton Sheep. Beside the significant breed and year affects some breed: year interactions were also observed on the data.

However, the number of artificially inseminated ewes was much smaller in the case of farm No. 10 than in the previous farms, the significant year and breed effects were also present (Table 2). The values were changed between 87.8 and 100.0 % in the case of British Milksheep breed, and between 72.7 and 100.0 % in Charollaise, as well as between 67.8 and 76.0% in Hungarian Merino. The breed and year had almost equally significant effects on the values. The year had a strong effect on the lambing rate of the British Milksheep (1.9-2.6), the Charollaise (1.4-1.8) and the Hungarian Merino (1.5-1.7) breeds. The breed differences were obvious; however, the data of Merinos were 0.2-0.3 lamb/ewe exceeded the national average. The year effect could also be observed on the weaning rate changed between 65.9 (2006) and 97.0% (2009) in the case of British Milksheep, where this trait gradually and intensively increased by years. A lucky data (100.0%) was observed in 2007 in the case of Charollaise, but the value was above 85.0% in 2009. The weaning rate data were quite steady (90.2-91.8%) in Hungarian Merinos.

Table 2 The pregnancy rate of ewes belonging to different breeds on the farms having more than one breed

Breed /year	Farm No. 2			Farm No. 9		
	BT	ILE	SUF	HMER	GMMER	GBM
2003	82.2^{aA}	81.4^{aA}	76.9^{aA}	89.5^{aA}	92.2^{aA}	87.9^{aA}
2004	86.1^{aB}	83.3^{aA}	73.9^{bAB}	92.4^{aAC}	93.9^{aAB}	85.5^{bA}
2005	87.3^{aBE}	90.4^{bB}	66.3^{cB}	90.4^{aAC}	93.1^{aA}	91.8^{aAC}
2006	79.4^{aC}	92.2^{bB}	77.4^{aA}	97.5^{aB}	96.3^{aB}	89.9^{bAC}
2007	79.7^{aAC}	79.6^{aA}	80.4^{aA}	91.4^{aAC}	92.8^{aA}	95.2^{aBC}
2008	73.1^{aD}	94.6^{bC}	79.6^{cA}	93.1^{aC}	93.7^{aA}	94.4^{aBC}
2009	90.7^{aE}	84.7^{bD}	85.7^{C}	94.6^{aACD}	93.4^{aA}	90.7^{aAC}
2010	86.7^{aABE}	90.3^{aB}	83.2^{aA}	96.4^{aB}	93.5^{aA}	92.9^{aAC}

Breed /year	Farm No. 10			Farm No. 11	
	BMS	CHAR	HMER	BMS	BMS X
2003		-		93.3^{A}	P%
2004				88.5^{B}	-
2005	97.0^{A}	-	-	82.9^{CD}	-
2006	87.8^{A}	-	-	87.5^{BD}	-
2007	100.0^{aAB}	72.7^{acA}	67.8^{bcA}	78.6^{aCD}	78.6^{aA}
2008	89.3^{aA}	100.0^{aA}	76.0^{aA}	83.3^{aBD}	83.3^{aA}
2009	87.8^{aAC}	93.8^{bcA}	70.7^{acA}	83.0^{aBC}	75.0^{aA}
2010	*	*	*	85.7^{BC}	*

BT: Bábolna Tetra; ILE: Ile de France; SUF: Suffolk; HMER: Hungarian Merino; GMMER: German Mutton Merino; GBM: German Blackhead Mutton Sheep; BMS: British Milksheep; CHAR: Charollaise; BMS X: British Milksheep crossbreds.

The different small letters in rows and the different upper case letters in columns mean significant differences (P≤0.05) per trait (pregnancy, weaning) among breeds and years.

**lambing started in 2011*

Practically, no significant differences were found in pregnancy rate between purebred and crossbred British Milksheep on the level of years on farm No. 11 (Table 2). The value of purebred population in 2003 was significantly different from the data of other years. Limited difference was observed in the lambing rate between purebred (2.0-2.4) and crossbred (1.9-2.4) populations on the year level. The highest values were achieved in 2009 (crossbreds) and in 2010 (purebreds) and these data significantly differed from the data of other years. The average weaning rate of the crossbreds (93.9-98.2%) exceeded the data of purebreds (82.4-98.4%; with the intensive increasing trend having significant differences among years).

Farms with only one breed

Apart from the obvious breed differences significant year effect was observed on the pregnancy rate data concerning the farms having ewe's inseminated belonging to only one breed per farm (Table 3.). The Awassi (farm No 1.) and one Lacaune (farm No. 8) population had significantly lower values than the other populations. The case of farm effects could be observed in the case of Hungarian Merinos (farm No. 3 and 5) and within the Lacaune populations (farm No. 6, 7, and 8). No difference was found in lambing rate (1.3) of Awassi sheep on year level. Bigger differences found among Hungarian Merinos (1.2-1.5 and 1.3-1.4) than among the Lacaune (1.4-1.6) populations. The German Mutton Merino (1.4-1.5) had similar results than other Merinos. The year effects could be followed on every population. The year had significant effects on the weaning rate of the studied populations: Awassi – 94.5-95.6%; Hungarian Merino 86.5-96.6% (farm No. 3) and 84.1-97.4% (farm No. 5); German Mutton Merino (88.3-90.9%); Lacaune 95.2 (farm No. 6); 53.0-86.5% (farm No. 7) and 89.8-93.9% (farm No. 8).

The cost of artificial insemination

Rather big differences were observed among the studied farms. In general, the average direct costs of artificial insemination per ewe could reach 0.4 to 0.5 Euros, and in the case of oestrus synchronisation, the total costs could exceed 7 to 8 Euros under present Hungarian circumstances.

Table 3 The pregnancy rate of the ewes belonging to different breeds on farms having only one breed

Farm code	breed/year	2003	2004	2005	2006	2007	2008	2009
1	Awassi + Awassi crossbreds	37.3^{a}	35.0^{a}	45.0^{b}	56.8^{c}	80.0^{d}	-	-
3	Hungarian Merino	83.2^{a}	93.4^{b}	67.0^{c}	83.0^{a}	-	-	-
5	Hungarian Merino	75.0^{a}	67.5^{ac}	78.6^{ab}	62.9^{bc}	66.7^{a}	61.5^{acd}	-
4	German Mutton Merino	84.4^{a}	83.8^{a}	87.0^{ab}	86.7^{a}	84.3^{a}	81.0^{ac}	-
6	Lacaune*	-	-	-	-	-	-	88.2
7	Lacaune*	95.3^{a}	85.2^{b}	81.8^{b}	96.7^{a}	97.6^{a}	82.7^{b}	79.6^{b}
8	Lacaune	58.6^{a}	66.1^{a}	-	-	-	-	-

The different small letters in rows mean significant differences (P≤0.05) among years.

DISCUSSIONS

Similarly to the earlier results (Donovan et al. 2004; and Anel et al. (2005) the breed and the year had significant effect on the results of AI in our study, as well. In general, somewhat higher pregnancy rate was found after AI with fresh semen on the studied farms than published previously [1, 3, 4] mainly because the AI was performed by the owner shepherds of the farms. However, several kinds of extenders could be applied for semen diluting, most of the shepherds used undiluted semen with the 0.1-0.2 ml dosages. The cervical insemination was the dominating techniques; however, the cervico-uterinal system was also used. It seemed that the detecting ewes on heat and performing of AI was quite well organised on the farms. The costs of AI carried out by the owner shepherd had lower costs than those made by companies as services [6].

CONCLUSIONS

The AI used only on limited number of sheep farms; however, the effectiveness of this method was quite reasonable. Apart from the lack of officially-organised education, there were shepherds who could operate the AI with fresh, locally collected, un-diluted semen with good results. Breed, year and the farm had strong effects on the results of AI. The cost of AI depends on the farms, but in general, the direct cost was less than one euro per ewe.

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