

Sexual behaviour and fertility in Icelandhorse herds

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Summary

During recent years horsebreeders in Iceland observed decreasing fertility of their mares. In order to gain knowledge about factors influencing fertility of Icelandhorses on pasture several aspects were monitored.

In the years 1996–1998 close to 100 breeding herds comprising over 2000 mares (from 9 to 39 per herd) with one stallion per herd (age from 2 to 26 years) were monitored repeatedly for 8–9 weeks, starting at least 50 days after the stallion joined the mares. Monitoring comprised weekly serum sampling and determination of pregnancy by means of measuring equine chorionadotropin (eCG) levels by enzyme linked immunosorbent assay (ELISA). An overall pregnancy rate of 76% was found provided the stallion was allowed to serve the mares for at least 10 weeks.

Two other herds were monitored more closely by observing them for one and two heat periods continuously for 24h per day (made possible by sufficiently lucid Icelandic summer nights) by placing a camper in the middle of the pasture and by unequivocal marking of each horse. Some of the mares received clinical, gynaecological, and ultrasonic investigation in order to determine precisely the beginning of their heat and their date of ovulation. Herd A comprised 23 fertile mares plus an 9 years old stallion. Herd B was made up of 10 fertile cycling mares plus 3 years old stallion. These herds received continuous observation for 42 and 28 days, respectively. The stallions served each mare of their herd with 6.0 and 5.7 mounting per heat which lasted in average 4.4 and 4.7 days, respectively. The result of their matings were determined by the subsequent foaling rates of 87% and 90% respectively.

These foaling rates were clearly above the average pregnancy rate determined in the overall eCG-study. Of major influence on the remarkably different mating success (between 36% and 96%) among the herds studied was the mare to stallion ratio per heat period. The age of the stallion and a composition of the mares in the herds is of great importance too. In order to obtain optimal foaling rates with Icelandhorses on pasture these results suggest herds of not more than 15 fertile cycling mares per stallion for one heat cycle of preferably, a maximum of 20 fertile cycling mares per stallion staying in the herd for 6 weeks (two heat cycles) at least.

Keywords: sexual-behaviour, fertility, Icelandhorses, heat-cycles, ovulation

Sexualverhalten und Fruchtbarkeit in Islandpferd-Herden

Während der letzten Jahre wurde von den Pferdezüchtern Islands eine sinkende Fruchtbarkeit in ihren Pferdeherden bemerkt. Um einflussnehmende Faktoren auf die Fruchtbarkeitslage herauszufinden, wurden verschiedene Aspekte in den einzelnen Stuten/Hengstherden untersucht.

Von 1996–1998 wurden nahezu 100 Herden mit mehr als 2000 Stuten (9–39 je Herde) mit je 1 Hengst (Alter 2–26 Jahre) pro Gruppe beobachtet und überwacht. Die Untersuchungen wurden wiederholt über 8–9 Wochen durchgeführt, beginnend spätestens mit dem 50. Tag nach Zuführung des Hengstes zur Herde. Die Untersuchungen umfassten wöchentliche Blutserumentnahmen zur Messung des equinen Chorionadotropin (eCG) mit einem Enzyme linked Immunoabsorbent Assay (ELISA). Die Gesamtträchtigkeitsrate der Herden betrug 76% wenn der jeweilige Hengst für wenigstens 10 Wochen bei der Herde war und die Stuten belegen konnte.

Zwei weitere Herden wurden intensiver untersucht durch tägliche 24stündige Beobachtung über einen Zeitraum von einem und zwei Zyklusperioden, was durch die geographisch bedingten sommerlichen Lichtverhältnisse in Island möglich wurde. Die Beobachtung selbst wurde von einem im Zentrum der Weide platzierten Campingbus aus durchgeführt. Die Stuten waren auf weite Sicht hin markiert. Einige der Stuten wurden klinisch-gynäkologisch einschliesslich ultrasonographisch untersucht, um den Zeitpunkt des Beginns der Rosse und den Tag der Ovulation zu präzisieren. Herde A bestand aus 23 fertilen Stuten und einem 9 Jahre alten Hengst. Herde B wurde aus 10 fertilen Stuten und einem 3jährigen Hengst zusammengestellt. Die Herden wurden 42 Tage bzw. 28 Tage lang kontinuierlich beobachtet. Die Hengste deckten die Stuten ihrer Herden im Mittel 6,0 bzw. 5,7 mal je Rosse die 4,4 bzw. 4,7 Tage dauerte. Das Befruchtungsergebnis, bewertet nach der Abfohlrate, betrug 87% bzw. 90% Abfohlungen, ein Ergebnis, das damit eindeutig über dem Mittelwert (76%) der Trächtigkeitsrate in der anderen großen, eCG-untersuchten Gruppe lag.

Einer der größeren Einflussfaktoren auf den unterschiedlichen Befruchtungserfolg in den einzelnen untersuchten Herden (36%–96%) war das Verhältnis Stutenzahl je Hengst bezogen auf je eine Rosse. Auch das Alter der Hengste und die Zusammensetzung der Stutenherde ist von Bedeutung. Um ein optimales Abfohlergebnis in Islandpferdherden in Weidehaltung zu erzielen, sollte aufgrund der vorliegenden Ergebnisse je Rosse die Anzahl der Stuten pro Hengst nicht größer als 15 betragen oder – vorzugsweise – aus höchstens 20 gesunder und gut rossender Stuten bestehen, die dem Hengst für wenigstens 6 Wochen (= 2 Zyklen) zugeteilt werden.

Schlüsselwörter Sexualverhalten, Fruchtbarkeit, Islandpferde, Rosse, Ovulation

Introduction

The Icelandhorse is the only breed of horses in Iceland. Presently the total population is approximately 80.000. The breed has evolved from the horses that the Vikings brought to Iceland in the years 874–940 AC. Since that time a ban on

horse import has been in effect in Iceland, to prevent the transmission of diseases from abroad and to protect the sturdy breed that had survived the harsh weather the first few decades in their new home, from breeding with weaker kin.

The breeding of horses has become of increasing importance for farmers in the last few decades and naturally so has the demand for satisfactory fertility in the stock. During 1985–1995 owners of mares have increasingly stated their concern over slack performance of stallions and mares. We decided to study the breeding process of Icelandhorses in herds to locate the aspects of the process that affected fertility. The following items were investigated:

- The duration of the heat cycle
- The number of mountings during a heat cycle
- Is the mounting close to ovulation, i.e. does the stallion identify the ovulation
- The time needed for the stallion to ensure satisfactory fertility in the herd
- The optimum number of mares in each herd

Materials and methods

Study 1

During 1996–1997 two herds with stallions were investigated. Herd A comprised an 9 year old stallion and 23 mares age 4–20. The animals were wild and grazing all year around. Herd B comprised a 3 year old stallion with no former experience and 10 tame mares age 3–17 (see table 1). Herd A was observed continuously 24 hours a day for 42 days and herd B for 28 days.

The herds were fenced off for easy observation. A camper was located in the middle of the field and the mares watched continuously from the camper in three shifts. Mares were labelled with large numbers located on both sides of the animal and could be easily identified from a

Tab. 1: Members of the herds

Zusammensetzung der Herden

Herd A Mares /	Age	Number	Foals	Pregnant	Empty
Group 1/	0–8	15*	8	4	2
Group 2/	9–16	7	4	2	1
Group 3/	17–24	1	1	None	None
Stallion	9	1			
Total		24	13	6	3

*One mare had a miscarriage just prior to starting the observation

Herd B Mares /	Age	Number	Foals	Pregnant	Empty
Group 1/	0–8	4	None	None	4
Group 2/	9–16	5	1	None	4
Group 3/	17–24	1	None	None	1
Stallion	3	1			
Total		11	1	None	9

considerable distance through binoculars. All sexual behaviour was observed. A part of the group underwent ultrasonography per rectum (ALOKA, 5 MHz) to determine the exact time of ovulation. A portable PC (Psion-Workabout) with Observer 2.0 was used for data. At intervals data was downloaded to a larger computer. To prevent the loss of data, the sexual behaviour was also written on ready made data-forms. All events were logged in real time, and the position of the group was logged every hour.

Study 2

In the years 1996–1998 close to 100 breeding herds comprising over 2000 mares (from 9 to 39 per herd) with one stallion per herd (age from 2 to 26 years) were monitored repeatedly for 8–9 weeks, starting at least 50 days after the stallion joined the mares. Monitoring comprised weekly serum sampling and determination of pregnancy by means of measuring equine choriogonadotropin (eCG) levels by enzyme linked immunosorbent assay (ELISA). Each stallion was introduced to a herd of mares in the beginning of June and did not leave until in the beginning of September. The fertility hormone, eCG, starts to appear in the bloodstream 37–41 day after conception (Hoppen, 1994). First samples for eCG assays were taken in late July, when the stallion had been with the mares for 55 days (± 3.5). Positive results at that time indicated the number of pregnancies obtained during the first two weeks of the study.

Results

Study 1

The 3 year old stallion started out by collecting the mares once it was released into the herd. The older stallion had

Tab. 2: Pregnancies (% of total) during a 9 week period with stallions of different ages in the years 1996 and 1997

Trächtigkeitsraten (% von gesamt) während eines 9-wöchigen Zeitraums mit Hengsten unterschiedlichen Alters

Stallions		Pregnant	Number of mares	Mares/ Stallion
2 years	n=3	74%	n=34	11
3 years	n=7	80%	n=138	20
4 years	n=4	76%	n=82	21
5 years	n=5	78%	n=122	24
6 years	n=6	73%	n=155	26
7–13 years	n=20	76%	n=520	26
14–25 years	n=8	69%	n=163	20
Total	53		1214	23
Average		75%		

been grazing with the mares all year around. A characteristic behaviour for both stallions was that they collected the mares and kept them in a tight group during the mating season. This behaviour is well known amongst other breeds and has been described by *Antonius (1937)*, *Ebhardt (1957)*, *McDonnell (1986)*. The stallions were constantly moving around the herd while it was grazing and behind the herd while it was moving. When mares attempted to leave the group the stallion stopped them with force and collected them back into the group. When it was herding the mares it lowered the head close to the ground and laid the ears backwards as if it was threatening the mares. The mares were scared by this behaviour and the stallion only needed to show it for the mares to behave. The younger stallion was not as good as the older stallion in herding the mares. Both stallions kept mostly behind the mares while they were moving and grazing. They inspected the area where the mares had been and searched for new dung spots or places where the mares had urinated. They sniffed the

excrement very carefully, made a flehmen response although not always, and either urinated or defecated on top of the newly deposited dung or urine. It looked like they were driving the herd on in order for them to investigate the area where the mares had been. A stallion can have a relationship with a mare and her excrement for days on while the mare is in heat. *Sveinsson (1997)* has observed a correlation between herding and the above described behaviour in 4 additional Icelandic horse herds with stallions which he studied in 1995 and 1996.

Both stallion and mares were active during the mating period. A few days prior to copulation the mares (one or more in heat) started to follow the stallion and to present themselves by lifting the tail, winking, and backing towards the nose of the stallion, repeating the behaviour many times during an hour. The mare allowed the stallion to mount and copulate without protest if she was in heat. A mare in heat often stayed close by the stallion and often they were grazing side by side. The stallion then sometimes

Tab. 3: Results of eCG assays for herds with 9–15 mares

Ergebnisse der Messung des equinen Choriongonadotropins für Herden mit 9-15 Stuten

Stallion	Age	Pregnant	Mares/group	Pregnant,%	We.1*	We.2	We.3	We.4	We.5	We.6	We.7	We.8	We.9
V 37	2	6	9	67	4	1	1						
N 37	5	9	10	90	5	2	1			1			
A 26	4	10	11	91	4		3		1			2	
N 56	4	9	11	82				5		4			
F 26	2	7	12	58	3	1	2	1					
V 16	18	11	12	92	7		2	2					
B 26	3	11	13	85	2		1	2	1	3		1	1
A 17	2	12	13	92	4		5	1		1	1		
A 27	3	10	13	77	4		4			1	1		
M 26	9	11	14	79	6	1	3	1					
G 27	6	14	15	93	8		2	4					
Total		110	133	906	47	5	24	16	2	10	2	3	1
Average	5.3	10	12	82%									
Cumulative pregnancies, mares					47	52	76	92	94	104	106	109	110
Cumulative pregnancies (%) of total pregnant mares					43%	47%	69%	84%	85%	95%	96%	99%	100%
Cumulative pregnancies (%) of total mares					35%	39%	57%	69%	71%	78%	80%	82%	83%
Average pregnancies in first 3 weeks/stallion: (52/11) = 5													
Average pregnancies in first 6 weeks/stallion: (94/11) = 9													
Average pregnancies in 9 weeks/stallion: (110/11) = 10													
Average number of mares/stallion: (133/11) = 12													
Empty mares/stallion: (133-110)/11 = 2													
Age range of stallions: 2–18 years													
Average age of stallions: 5,3 years													
* Number of mares pregnant/week													

We = Week

mounted her without all foreplay and copulated. It could take less than one minute for some cases. Often the stallion rests for a few seconds on the mare after ejaculation. Then they resumed grazing side by side or went each their separate ways. On the other hand, if the mare is not in heat or just about to enter the heat period, she fights back by kicking with the hindlegs towards the stallion. Several times the stallions attempted to mount mares not in heat. They fought back vigorously, the stallion herded them back and forth for up to 20 minutes to wear them out. If they succumbed the stallion mounted them and entered, but if they were stronger he gave up. The stallion kept itself on the perimeter of the herd most of the time. Sometimes he stopped grazing very suddenly, neighed loudly, ran into the group mares and mounted a certain mare. Most often it was a mare in heat and depending on if she was in full heat or not, he mounted and entered quickly and surely. The stallion only showed interest to those mares that were in full heat when many mares were in heat. Of those, the mares that were most active in presenting themselves were the ones that he mounted and entered most often.

Tab. 4: Results of eCG assays for herds with 16–20 mares

Ergebnisse der Messung des equinen Choriongonadotropins für Herden mit 16–20 Stuten

Stallion	Age	Pregnant	Mares/group	Pregnant,%	We.1*	We.2	We.3	We.4	We.5	We.6	We.7	We.8	We.9
V 27	25	12	16	75	4	3	3		1		1		
N 27	10	13	17	76	8	1	1	1	1		1		
T 17	18	7	17	41	2	1	2		1	1			
A 16	5	16	18	89	4		1	6	3			2	
L 16	11	15	18	83	9	3		2		1			
N 36	6	10	19	53	5		3	1	1				
K 17	12	17	19	89	9	3		2	2	1			
L 37	3	17	19	89	11	6							
X 17	3	19	20	95	7	7	3	1	1				
V 26	24	13	20	65	11		1	1					
Total		139	183	755	70	24	14	14	10	3	2	2	
Average	12	14	18	76%									
Cumulative pregnancies, mares					70	94	108	122	132	135	137	139	
Cumulative pregnancies (%) of total pregnant mares					50%	68%	78%	88%	95%	97%	99%	100%	
Cumulative pregnancies (%) of total mares					38%	51%	59%	67%	72%	73%	75%	76%	
Average pregnancies in first 3 weeks/stallion: (94/10) = 9													
Average pregnancies in first 6 weeks/stallion: (132/10) = 13													
Average pregnancies in 9 weeks/stallion: (139/10) = 14													
Average number of mares/stallion: (183/10) = 18													
Empty mares/stallion: (183–139)/10 = 4													
Age range of stallions: 3–25 years													
Average age of stallions: 12 years													
* Number of mares pregnant/week													

We = Week

The mares in herd A were 4.4 days in heat on the average and the mares in herd B were 4.7 days. Individual mares were in heat from 2 to 8 days. A mare was considered starting in heat if she presented herself to the stallion or agreed to copulation. The mare stopped being in heat when the stallion did not want her anymore or if she fought him off. Sometimes the stallion tried to mount mares that were not in heat or just starting in heat, when no mares in heat were available. Also, mares presented themselves to the stallion up to two days after ovulation, but the stallion was usually not interested. The number of days that passed from the time the stallion started to show interest and until the mare was ready was on the average 1.3 days. The mares continued presenting themselves following ovulation on the average for 1.6 days. When these numbers are taken into account the heat cycle was 7.3 days for mares in herd A and 7.6 days for herd B which is similar to what other authors have reported for other breeds (*Asa et al., 1979; Day, 1940; McKenzie and Andrews, 1937; Ginther, 1979*). On the basis of the findings the heat cycle can be divided into three events: pre-heat; full-heat and post-heat cycle. Since the

transition from one event to the next was often difficult to pinpoint the heat cycle used in this study was from the time that both parties showed interest and until one party lost interest. The stallions copulated with mares at all times during day or night. A successful copulation was noted when the stallion mounted, entered the mare, flagged his tail and jumped off with a limp penis. The stallion in herd A had 6 copulations with each mare on the average or from 1–11 with individual mares. Unsuccessful attempts were 4 on the average and between 2–9 for each mare. The stallion in herd B had 5.7 copulations and 2.4 unsuccessful attempts. Stallion A was more attentive to the mares than stallion B because he had only one mare to attend at any one time, whereas for stallion B up to 7 mares could be in heat at one

time. This can also be shown from the length of time the stallions showed mares in heat interest. For stallion A the average time was 55 hours with a range from 3682 hours and for stallion B the average time was 58 hours with a range from 12152 hours. Although the average time was similar between the horses, the range was larger for B. When many mares were in heat at the same time the stallion had less time for each of them and some of them got left out for a while (explaining the upper limit). The stallions used only 2.2–2.4 days on the average to copulate with the mares, even though the mares were in heat for 4.4–4.7 days, which indicated that the stallions maybe identified their time of ovulation. Another indication of the stallions sense of timing was that they lost interest in the mare very shortly following ovulation.

Tab. 5: Results of eCG assays for herds with 21–25 mares

Ergebnisse der Messung des equinen Choriongonadotropins für Herden mit 21–25 Stuten

Stallion	Age	Pregnant	Mares/group	Pregnant,%	We.1*	We.2	We.3	We.4	We.5	We.6	We.7	We.8	We.9
L 36	9	20	21	95	12	2	5					1	
N 26	9	16	21	76	8	3	3			2			
V 36	3	18	22	82	11	1	2	1	1	1		1	
L 16	14	8	22	36	2	1	1		1	2	1		
T 26	16	18	22	82	8	4	4	2					
B 27	6	16	23	70	5		1		4	5		1	
T 16	8	13	23	57	9	1	2	1					
N 16	9	19	23	83	12	1	3		2				1
X 16	11	17	23	74	8	1		4	4				
G 17	4	16	24	67	12				1		2	1	
K 26	5	19	24	79	5	5	5	1	2	1			
B 16	6	21	24	88	1		2	3		11	2	2	
B 17	7	23	24	96	15	1	3	2	2				
N 17	10	19	24	79	13	1	3			1		1	
K 27	3	17	25	68	9	3	2	2	1				
Total		260	345	1132	130	24	36	16	18	23	5	7	1
Average	8	17	23	75%									
Cumulative pregnancies, mares					130	154	190	206	224	247	252	259	260
Cumulative pregnancies (%) of total pregnant mares					50%	59%	70%	79%	86%	95%	97%	99%	100%
Cumulative pregnancies (%) of total mares					38%	45%	55%	60%	65%	72%	73%	75%	75%
Average pregnancies in first 3 weeks/stallion: (154/15) = 10													
Average pregnancies in first 6 weeks/stallion: (224/15) = 15													
Average pregnancies in 9 weeks/stallion: (260/15) = 17													
Average number of mares/stallion: (345/15) = 23													
Empty mares/stallion: (345-260)/15 = 6													
Age range of stallions: 3-16 years													
Average age of stallions: 8 years													
* Number of mares pregnant/week													

We = Week

Study 2

In 1996 and 1997 the pregnancy hormone eCG was assayed in mares from 53 herds with one stallion in each herd. The total number of mares was 1214. Blood samples from each mare were taken once every week for 8–9 weeks onwards starting 55 days (\pm 3.5 days) after each stallion was first introduced to his herd. The first week of sampling was termed week 1. The number of positive results for the eCG hormone in week 1 indicated the number of mares that became pregnant in the first two weeks with the stallion.

The results from week 2 indicated successful pregnancies in the third week with the stallion and so on. The results for the 9 week period are shown in table 2.

Pregnant mares were 75% of total mares during the years 1996 and 1997 (table 2) and in the following year (1998/ data not shown) the percentage of pregnant mares was 76% from a large sample of wild herds ($>$ 1000 mares). As can be seen from the table, the fertility of the stallions was not significantly dependent on age until in the age group 14–25 years where a decrease from the average was seen (69% vs 75%).

Tab. 6: Results of eCG assays for herds with 26–39 mares

Ergebnisse der Messung des equinen Choriongonadotropins für Herden mit 26–39 Stuten

Stallion	Age	Pregnant	Mares/group	Pregnant,%	We.1*	We.2	We.3	We.4	We.5	We.6	We.7	We.8	We.9
V 17	3	19	26	73	5	3	4	1		2	4		
N 47	7	15	27	56	10		1		3			1	
F 16	16	22	27	81	8	3	5	1	2	3			
R 17	18	21	27	78	9		1	5	1	4		1	
F 47	8	18	29	62	7	3		5	1	2			
R 27	13	24	29	83	13	2	5	1	1		1	1	
G 16	5	26	32	81	14	1	2	4		3	2		
L 17	10	27	32	84	8	8	3	3	2	1		2	
L 27	11	24	32	75	9	6	3	1	3	1			1
K 37	8	26	33	79	9	4	2	4	4	3			
E 17	6	28	35	80	15	5	5		2	1			
K 36	4	27	36	75	14	3	3	3	4				
P 16	8	20	37	54	12	3	1	2	2				
M 16	11	22	37	59	11	1	1	6		1		2	
P 17	9	28	37	76	15	1	4	1	2		4	1	
F 16	5	25	38	66	14		6	2		1	1	1	
N 46	6	24	39	62	7	4	2	2	1	2	3		3
Total		396	553	1224	180	47	48	41	28	24	15	9	4
Average	9	23	33	72%									
Cumulative pregnancies, mares					180	227	275	316	344	368	383	392	396
Cumulative pregnancies (%) of total pregnant mares					45%	57%	69%	80%	87%	93%	97%	99%	100%
Cumulative pregnancies (%) of total mares					33%	41%	50%	57%	62%	67%	69%	71%	72%
Average pregnancies in first 3 weeks/stallion: (227/17) = 13													
Average pregnancies in first 6 weeks/stallion: (344/17) = 20													
Average pregnancies in 9 weeks/stallion: (396/17) = 23													
Average number of mares/stallion: (553/17) = 33													
Empty mares/stallion: (553–396)/17 = 9													
Age range of stallions: 3–18 years													
Average age of stallions: 9 years													
* Number of mares pregnant/week													

We = Week

The average age of stallions in table 3 was the lowest (5.3) of all sets studied, they however had the highest ratio of pregnant mares (82%). The reason was most likely that they had relatively few mares per herd, or 12 on the average. The gestation was late, most likely, due to inexperience of the young stallions.

In the set of mares described in table 4, the percentage of pregnant mares was satisfactory (76%) in week 5 (after 6 weeks with the stallion). The average age of stallions was 12 years and average number of mares with the stallion was 18. The average number of mares with the stallion was 23 in the set described in table 5. The satisfactory percentage of pregnant mares (75%) was attained in week 6 one week later than for the set in table 4 where the average number of mares with stallion was 18. The pregnancy rate between the two sets was similar but the stallions appeared to need slightly more time to serve the mares. When the number of mares exceeded 26 per stallion the fertility decreased. As the number of mares per stallion increased the total number of pregnancies during the 10 weeks with stallion increased but so did also the number of empty mares. The average pregnancies/stallion was 23 when the total number of mares was 33 (table 6). In week 5 the percentage of pregnant mares was 62% and 67% in week 6. The high number of mares thus placed a limit on the rate of making mares pregnant as well as the overall success of the stallion (71%).

Discussion

The sexual behaviour of the Icelandic horse was not different from what authors have described for other breeds (Asa *et al.* 1979; Asa, 1986; Bristol, 1982; McDonnell, 1992; Tyler, 1972). Both the stallion and the mare took an active part in the sexual activity. It appeared that the stallion herded the mares in a tight group, maybe in order to be able to determine more easily which mares were in heat and when they were getting close to ovulation. By inspecting their excrement they were able to obtain the information possibly through pheromones. The fact that they spent only 2.2–2.4 days on the average for copulations even though the mares were in heat for 4.4–4.7 days, substantiated this idea. Asa (1986) claims that when the mare is winking it may be informing the stallion of her situation through pheromones. Other authors have explained this differently (Feist and McCullough, 1976; Klingel, 1972; Pellegrini, 1971; Schloeth, 1958). The stallions copulated with mares at any time day or night and more often with the ones that were active in presenting themselves. Some mares were left out and had fewer servings if many mares were in heat at the same time, increasing the possibility of non pregnancy for those mares. The results for the large sample of wild herds indicated that the age of stallions was not a significant issue in fertility management as it did not affect their fertility from 3

to 14 years of age and only slightly thereafter. Even a very old stallion (25 years) had 75% pregnant mares from a herd of 16 mares and the 2 year olds were reasonably successful (74%) with small herds. The size of the herd was a larger issue. Stallions with an excess of mares made 13 mares pregnant on the average during the first 3 weeks and 20 during the first 6 weeks of contact. The highest overall pregnancies (82%) were obtained for stallions that had the fewest number of mares (12) in the herd. Satisfactory results (76%) were also obtained with herds of 16–20 mares. When the stallion had an excess of mares, the rate at which he made the mares pregnant decreased when compared to the average of all herds. This observation was in accordance with the results from the behaviour study, where it was observed that the stallion had less time for each mare and left some of them out for a while, if many mares were in heat at the same time.

From the study we can conclude that the optimum number of mares with a stallion for 3–4 weeks is not more than 13–15 if a high rate of pregnancy is to be obtained. For even better results the mares should stay with the stallion for two heat periods (6 weeks) but not exceeding 20 mares/herd.

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