Impact of automated boar collection

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In today's swine industry, AI production facilities must reduce production costs and improve efficiency to remain competitive. Maximising labour and collection efficiency can reduce overall production costs and enhance profitability.

In the late 1990s as it became increasingly important to maximise collection efficiency and reduce costs, Genes Diffusion developed the Collectis automated boar collection system for the company's production facilities worldwide.

The Collectis system is designed to allow a single technician to 'manage' multiple collection pens simultaneously while greatly reducing the number of boars a technician must collect manually.

Design characteristics

The Collectis system utilises a design that regulates air pressure and vacuum (very similar to those found in a dairy milking parlour) to control the volume and pressure of air supplied to an artificial vagina (AV), which holds the boar's penis during collection.

In preparation for collection, a nitrile sleeve is inserted into the AV, which keeps the boar from coming in direct contact with the AV during collection.

The nitrile sleeve maintains hygiene and keeps the collection from becoming contaminated. Once prepared, the AV is then connected to the technician's control handle. This is a portable nylon handle that allows the technician to control the functions of the AV while connecting the boar to the system.

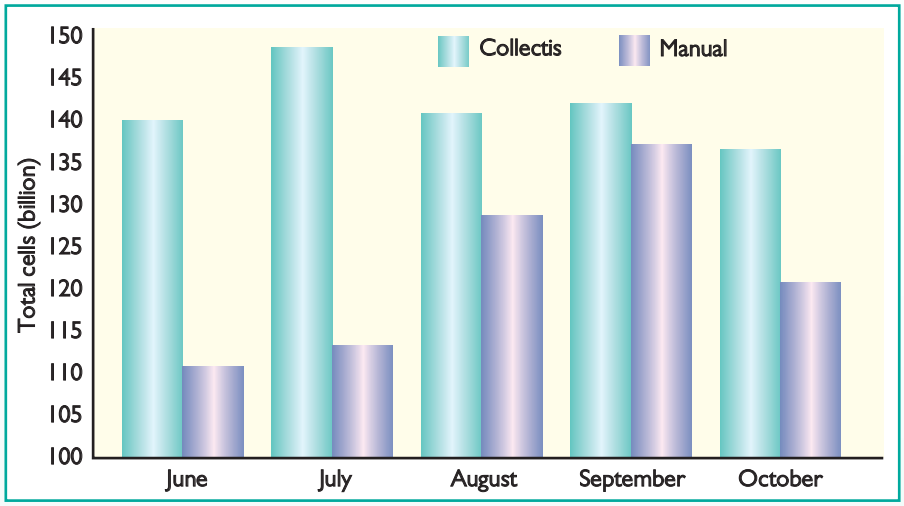

Fig. 1. Comparison of total cells (billion) per ejaculate by each collection method in Trial 1.

The preparation steps prior to collecting a boar using the Collectis system are the same as when collecting manually. These steps include trimming of excess sheath hair, evacuation of preputial fluid and urine from the sheath pouch and cleaning and drying of the immediate area surrounding the sheath.

After the boar mounts and begins to thrust, the technician (using a clean, gloved hand) will then grasp the penis at the tip and, applying firm pressure, pull forward gently to fully extend the penis out of the sheath.

Once extended, the technician then inspects the penis shaft for damage or bleeding and wipes the shaft clean with a paper towel. When the shaft has been inspected and cleaned, the boar is ready for attachment to the Collectis system.

To connect a boar to the system the technician positions the tip of the penis at the opening of the AV. Once in position, the technician inserts the penis into the AV and activates the air pressure to close the AV, gripping the penis.

Once the boar is connected into the AV, a clean filter and collection bag assembly is attached to the bottom of the AV completing a clean environment for collection of the ejaculate.

Table 1. Summary of production data for ejaculates collected using the Collectis system in Trial 1.

2006	Ejaculates collected	Avg. ejaculate volume (ml)	Avg. ejaculate concentration (billion/ml)	Avg. total cells per ejaculate (billion)
June	209	283.49	0.49426	140.12
July	228	292.12	0.50811	148.43
August	220	289.05	0.49400	142.79
September	157	284.37	0.50045	142.31
October	184	276.03	0.49712	137.22
Summary	998	285.45	0.49887	142.40

Production data

Production trials have been conducted in multiple commercial boar studs in the United States.

In these trials, Gene Diffusion's Collectis system was compared with manual collection for production efficiency and labour savings. The following summarises completed trial data.

Trial 1

In the following production trial, a commercial mid-west boar stud installed the Collec-

Continued on page 9

Continued from page 7
tis system to evaluate the production efficiency of the system in a side by side comparison with manual collection over an extended period of time.

The Collectis system was installed in two collection pens, while the two remaining collection pens were used for manual collection. Boars were collected by both manual collection and using the Collectis system to ensure an even representation for each collection method.

Ejaculates collected were processed using the same protocol in the boar studs on-site laboratory and evaluated for volume (ml), ejaculate concentration (billion/ml), and total cells per ejaculate (billion).

The following summarises the production data for ejaculates collected using the Collectis system (Table 1) and for those ejaculates collected using the manual collection method (Table 2).

Also, a comparison of the average total cells per ejaculate collected using each method can be found in Fig. 1.

The volume for Collectis ejaculates averaged 285.45ml while those ejaculates collected manually averaged 225.35ml. The result was a difference of 60.1ml or 21.05%.

The concentration for Collectis ejaculates averaged 0.49887 billion/ml while those ejaculates collected manually averaged 0.54807 billion/ml. The result is a difference of 0.04920 billion/ml or 8.97%.

When both the ejaculate volume and concentration were combined to determine the total sperm cells (billion) per ejaculate (average volume x average concentration) the ejaculates collected using the Collectis system averaged 142.40 billion cells per ejaculate, while the ejaculates collected using the manual collection method averaged 123.51 billion, a difference of 18.89 billion cells or 13.27%.

Trial 2

In this trial, a commercial boar stud already using the Collectis system evaluated production and labour efficiencies compared with manual collection over a 90 day period.

Ejaculates were collected and processed using the boar studs on-site laboratory and evaluated for volume (ml), ejaculate concentration (billion/ml), and total cells per ejaculate (billion). To measure labour efficiency, the length of time a technician had to spend with each boar during collection was also recorded.

The production data summarises the ejaculates collected using the Collectis system (Table 3) and for those ejaculates collected using the manual collection method (Table 4). A comparison of the average total cells per ejaculate collected using each method can be found in Fig. 2.

For the second trial, the average volume for Collectis ejaculates averaged 276.01ml, while those ejaculates collected manually averaged 219.83ml. The result was a difference of 56.18ml or 20.35%.

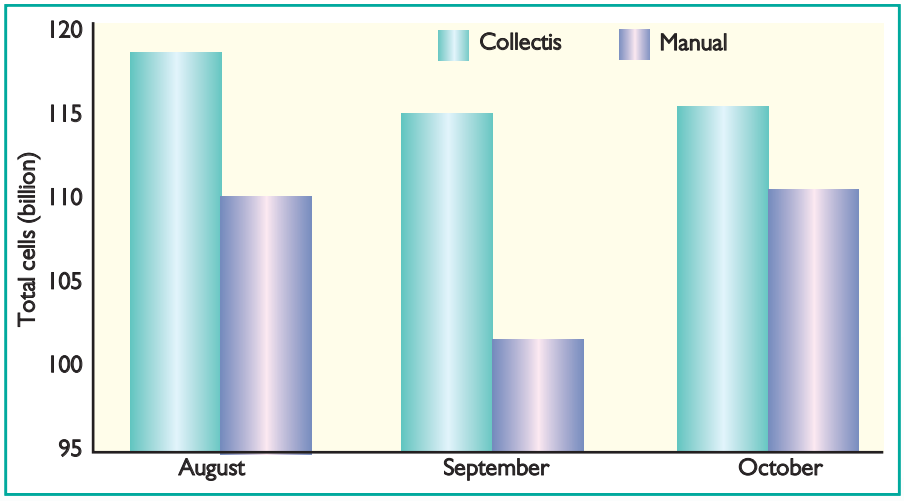

Fig. 2. Comparison of total cells per ejaculate by collection method in Trial 2.

The concentration for Collectis ejaculates averaged 0.42194 billion/ml while those ejaculates collected manually averaged 0.49100 billion/ml. The result is a difference of 0.06906 billion/ml or 14.06%.

Overall, when both the ejaculate volume and concentration were combined to determine the total sperm cells per ejaculate (average volume x average concentration) the ejaculates collected using Collectis averaged 116.46 billion cells per ejaculate, while the manually collected ejaculates averaged 107.94 billion cells, a difference of 8.52 billion cells or 7.31%.

Trial 2 – labour and time

During the second trial, the length of time a technician had to spend with each boar to complete the collection was recorded.

For boars collected using the Collectis system, this included the length of time needed to prepare the boar for collection, connect the boar to the AV, retrieve the collection once the boar was finished and prepare the ejaculate for transport to the laboratory.

For boars collected manually, this included the time needed to prepare the boar, collect the boar, and prepare the ejaculate for transport to the laboratory.

The data summarises, by collection method, the average length of time a technician was required to spend with each boar during a collection (Table 5 and Fig. 3) as well as the average number of ejaculates collected per technician per hour for each collection method (Table 6 and Fig. 4).

The length of time a technician was required to spend with each boar when using the Collectis system averaged 3.57 minutes, while boars collected manually

Continued on page 11

Table 2. Summary of production data for ejaculates collected using manual collection in Trial 1.

2006	Ejaculates collected	Avg. ejaculate volume (ml)	Avg. ejaculate concentration (billion/ml)	Avg. total cells per ejaculate (billion)
June	107	214.50	0.52028	111.60
July	107	210.36	0.53972	113.53
August	124	224.98	0.57145	128.57
September	158	242.49	0.56671	137.42
October	220	225.82	0.53909	121.74
Summary	716	225.35	0.54807	123.51

Table 3. Summary of production data for ejaculates collected using the Collectis system in Trial 2.

2006	Ejaculates collected	Avg. ejaculate volume (ml)	Avg. ejaculate concentration (billion/ml)	Avg. total cells per ejaculate (billion)
August	1856	274.34	0.42863	117.59
September	757	271.60	0.42344	115.00
October	889	281.37	0.41423	116.55
Summary	2,502	276.01	0.42194	116.46

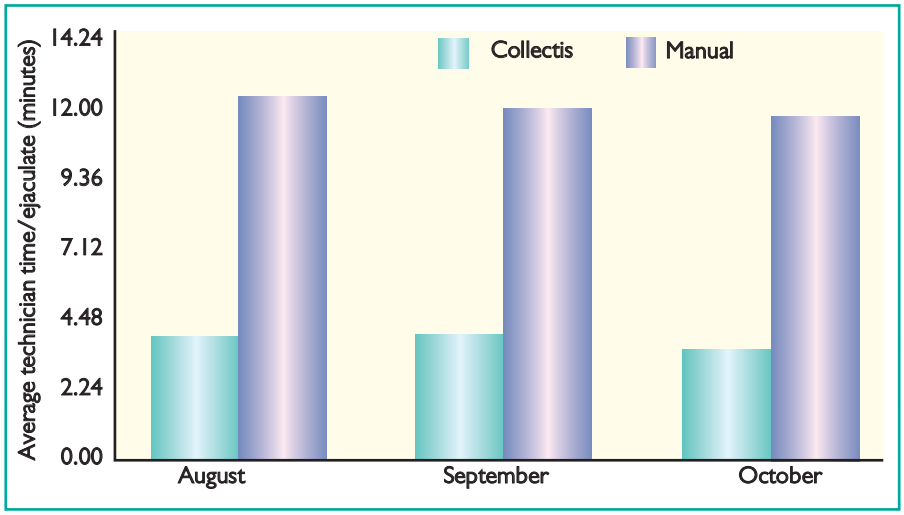

Fig. 3. Summary of labour required per ejaculate for each collection method evaluated in Trial 2.

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required the technician's individual attention for an average of 12.10 minutes. The difference was 8.13 minutes or 67.52% and can be seen in Fig. 3.

The number of ejaculates collected per technician per hour when using the Collectis system averaged 10.12 ejaculates/hour, while the number of ejaculates collected per technician per hour manually averaged of 4.93 ejaculates/hour.

The difference was 5.19 ejaculates/hour or 51.28% and is summarised in Fig. 4.

2006	Ejaculates collected	Avg. ejaculate volume (ml)	Avg. ejaculate concentration (billion/ml)	Avg. total cells per ejaculate (billion)
August	1155	199.65	0.55245	110.29
September	267	222.34	0.46169	102.65
October	228	230.63	0.48355	111.52
Summary	650	219.83	0.49100	107.94

Table 4. Summary of production data for ejaculates collected using the manual system in Trial 2.

Summary

The trial data shows that the Collectis automated boar collection system, when compared to a conventional manual collection method, causes no detrimental effects on semen production per ejaculate collected (total cells per ejaculate).

The data suggests that using the Collectis system resulted in an improvement in the average total number of cells collected per ejaculate when compared with manual collection by 8.52 billion cells or 7.31%.

The improvement in cells per ejaculate is due in part to a higher average ejaculate volume when using the Collectis system of 56.18ml or 20.35% compared with the manual collection method.

Also, the higher average ejaculate volumes observed when using the Collectis system, the average ejaculate concentration (billions per ml) for Collectis ejaculates was slightly lower than ejaculates collected using the manual method by 0.06906 billion per ml or 14.2%.

Overall, when both the ejaculate volume and concentration were combined to determine the total cells per ejaculate (average volume x average concentration) the ejaculates collected using the Collectis system showed a slight advantage in total cells per ejaculate.

In addition, the data shows the Collectis system to have a positive impact on time savings.

When evaluating the average length of time a technician was required to spend with each boar, the Collectis system had a significant labour saving of 8.13 minutes/boar or 67.52% compared with the manual collection method.

Average technician time (minutes) per ejaculate collected		
2006	Collectis	Manual
August	4.01	12.47
September	3.54	12.03
October	3.56	11.46
Overall	3.57	12.10

Table 5. Summary of labour required per ejaculate for each collection method evaluated during Trial 2.

The savings in labour required per boar collected allowed technicians to collect a higher number of boars/hour/technician (10.12 boars/hour) than if they had collected boars using the manual collection method (4.93 boars/hour) resulting in a difference of 5.19 more boars/hour or 51.28%.

Other advantages of the Collectis system include:

- By using the enclosed collection cone and bag assembly, the risk of bacterial contamination is greatly reduced
- The overall hygiene of the ejaculate collected is improved. ■

v	Average ejaculates collected per technician per hour	
2006	Collectis	Manual
August	9.97	4.69
September	10.24	4.98
October	10.17	5.10
Summary	10.12	4.93

Table 6. Summary of the average number of ejaculates collected per technician per hour for each collection method in Trial 2.

Fig. 4. Summary of the average number of ejaculates collected per technician per hour for each collection method in Trial 2.