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## NOTAT

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# **Comparison of Lean-Meater and Duo-Scan:Go Plus for backfat measurements**

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## Main conclusion

Both the Lean-Meater and the Duo-Scan:Go Plus are recommended for measurement of backfat thickness on sows. Analyses revealed a trend towards a smaller deviation between repeated measurements and a marginally lower backfat thickness in measurements made with the Duo-Scan:Go Plus compared to the Lean-Meater. The Duo-Scan:Go Plus is slightly more efficient for quick measurement of backfat thickness in loose housed sows than the Lean-Meater and it can also be used for gestation scanning in the same workflow.

## Abstract

Two devices for backfat depth measurement, the Lean-Meater and the Duo-Scan:Go Plus, were compared to determine accuracy in measurements and variations in repeatability and the standard deviation of repeated measurements on the same sow made with the same device.

All measurements were made by the same technician over a period of four consecutive weeks. The study comprised 200 sows and backfat was measured twice with each device on each sow at transfer to the farrowing facility. Backfat thickness was measured at P2 and the two devices were used alternately, ie. the same device was never used twice in a row.

Except for measurements made on first parity sows (P = 0.65), results revealed that backfat measurements made with the Duo-Scan:Go Plus were averagely 0.42-0.60 mm lower than those made with the Lean-Meater. These differences were significant for second and third parity sows (P < 0.001) and for sows older than third parity (P = 0.002). Analyses found a statistical trend (P = 0.0712) toward an approx. 27% lower deviation between two sets of measurements made with the Duo-Scan:Go Plus compared with the Lean-Meater. In conclusion, as the differences were rather small, this indicated that both devices were suitable for backfat measurement on Danish pig farms. The Duo-Scan:Go Plus offers backfat measurement and gestation scanning in the same workflow.

## Background

SEGES Innovation trials with gestating and lactating sows often include measurement of backfat thickness to be able to determine changes in body condition over time. It is therefore essential that these measurements are reliable as they are used for the ongoing assessment of optimum body condition of sows at farrowing and service [1].

Over the years, SEGES Innovation has used several different devices to measure backfat thickness, for instance the Sonograder II and the Lean-Meater, both produced by Renco Corporation, USA, and the Anyscan from Hatting [2-8]. In 2013, Sørensen and Vinther [9] compared three devices and used the Krautkramer as control, which was and still is used for measuring backfat thickness on breeding stock in the DanBred system and was therefore assumed to be the most accurate device for this. Results showed that the Sonograder II, the Anyscan and the Lean-Meater measured backfat to be 1.00, 1.23 and 2.14 mm thicker, respectively, than the Krautkramer. Results also revealed differences between the three devices as the Lean-Meater found a significantly thicker level of backfat [9], but also came out with the smallest variation between measurements and thereby the best repeatability. Today, the Lean-Meater is the predominant device used on Danish pig farms. It is easy to use: three lights on the display indicate the number of layers (1-3) detected and the result is shown in mm. However, it can be tricky to obtain a stable measurement of all three layers of backfat and thereby obtain correct reading of backfat thickness. The Duo-Scan:Go Plus is a newer, more advanced device and it offers backfat measurement and gestation scanning in the same workflow. It is connected to a smartphone or a tablet that functions as a display and it is easy to verify that all layers are identified. Backfat thickness is subsequently determined and displayed with one decimal. Accurate measurement of backfat is crucial in trials, and SEGES Innovation decided to investigate alternative devices for use in future trials. This would also help pig producers choose the most accurate device as the feed curves for gestating sows are based on backfat thickness of the individual sow.

The aim of this study was to determine if the Lean-Meater and the Duo-Scan:Go Plus generated identical results in terms of backfat thickness and to determine if repeatability differed between the two devices.

## Materials and methods

The study was performed on one farm and measurements were made by the same technician. Sows were measured in the farrowing unit and were crated during the session where each sow was measured four times. The trial was designed to comprise 200 sows, which was required to ensure that a 25% difference in standard deviation could be detected with a power of minimum 80%.

#### Description of the two devices

The two devices are illustrated in Figure 1A and 2A, and examples of output are shown in Figures 1B and 2B.



**Figure 1A.** The Lean-Meater from Renco Corporation. The display shows backfat thickness in mm and three lights indicate if the output includes 1, 2 or 3 layers of backfat. Picture used with permission from MS Schippers Danmark.



**Figure 2A.** The Duo-Scan:Go Plus from IMV Technologies. The scanning result is transmitted to a smartphone or a tablet connected to the scanner via WiFi. The graphic scanning image shows the layers and the beginning of the loin muscle. Picture used with permission from Kvægdyrlægerne Kronborg.



**Figure 1B.** Backfat thickness measured at P2 with the Lean-Meater from Renco Corporation. Photographer: David Rosted.



**Figure 2B.** Screen during measurement of P2 backfat thickness with the Duo-Scan:Go Plus from IMV Technologies. The green line (—) indicates the end of the inner layer and beginning of the loin muscle. The purple line (—) indicates the depth of the muscle. Backfat thickness is written in green, 14.0 mm, and muscle depth in purple 45.0 mm. Picture used with permission from Kvægdyrlægerne Kronborg.

#### Measuring backfat thickness

Backfat was measured by the same technician on all sows at transfer to the farrowing unit over a period of four consecutive weeks. Measurements were made at P2, which is over the last rib, 7 cm from the dorsal midline. All four measurements on a sow were made on the same day and prior to this, P2 was

identified by the technician to ensure that all measurements were made at the same position. Each set of measurement comprised six sows and was divided into round 1 and round 2: in round 1, backfat was measured twice on each sow, once with each device, and in round 2 this was repeated starting with the first sow from round 1. To ensure that the result was not affected by the order the two devices were used in, the order alternated every time a new sow was measured (see design in Table 1). Cold-pressed rapeseed oil was applied to ensure optimum contact between skin and device. Most sows, all parity 1-8, were measured only on one of the four days (Table 2).

 Table 1. Outline of measurement of backfat using the Lean-Meater and the Duo-Scan:Go Plus. The order alternated

 each time a new sow was measured.

Round	Ŷ	1	2			
	1 <sup>st</sup> measurement	2 <sup>nd</sup> measurement	3 <sup>rd</sup> measurement	4 <sup>th</sup> measurement		
Sows with uneven number <sup>1</sup>	Lean-Meater	Duo-Scan:Go Plus	Lean-Meater	Duo-Scan:Go Plus		
Sows with even number <sup>2</sup>	Duo-Scan:Go Plus	Lean-Meater	Duo-Scan:Go Plus	Lean-Meater		

<sup>1</sup> Of the six sows per round, this included the first, third and fifth sow.

<sup>2</sup> Of the six sows per round, this included the second, fourth and sixth sow.

Table 2.	Number	of sows	included	according	to parity.
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	Parity								Total
	1	2	3	4	5	6	7	8	
Sows	54	25	41	47	21	8	3	1	200

#### Statistical analyses

All analyses were made in SAS, version 9.4, and individual sows were considered as the experimental unit. Scanning results were subjected to analysis in a generalized linear model with device (Lean-Meater or Duo-Scan:Go Plus) and parity (1, 2, 3, 4 or 5) as systematic effects and sow as random effect. Correspondingly, the difference between measurements made with the same device was subjected to analysis in a generalized linear model where device (Lean-Meater or Duo-Scan:Go Plus) and parity (1, 2-3 or  $\geq$ 4) were included as systematic effects and sow as random effect. Results are presented as adjusted mean values (LSMEANS). Results are considered significantly different if P < 0.05, and a P value between 0.05 and 0.10 is considered a statistical tendency.

## Results and discussion

#### Statistical comparison of the Lean-Meater and the Duo-Scan:Go Plus

Overall, the Duo-Scan:Go Plus measured a lower backfat thickness in sows older than first parity compared with the Lean-Meater (Table 3). Measurements made on first parity sows did not differ between the two devices (P = 0.65). The fact that the Duo-Scan:Go Plus found 0.42-0.60 mm less backfat than the Lean-Meater is hardly of any significance under practical conditions. It may be argued that use of the Duo-Scan:Go Plus provides an additional safety margin to prevent sows from becoming too skinny compared with measurements using the Lean-Meater.

The accuracy of the two devices was established by comparing measurements made with the same device on each sow. Analyses showed a trend (P = 0.0712) toward a lower standard deviation (0.96 mm) on measurements made with the Duo-Scan:Go Plus compared with the Lean-Meater (1.29 mm). As a result, variation at repeated measurements was approx. 27% lower with the Duo-Scan:Go Plus. This is partly explained by the fact that the output of the Duo-Scan:Go Plus includes one decimal and the Lean-Meater none. This will in technical terms contribute to a lower standard deviation.

Parity	Lean-Meater	Duo-Scan:Go Plus	P value
1	14.68ª	14.60ª	0.65
2-3	12.78 <sup>b</sup>	12.18 <sup>b</sup>	<0.001
≥ 4	13.80 <sup>ab</sup>	13.38°	0.002

 Table 3. Average backfat thickness according to parity. Adjusted mean values (LSMEANS) based on backfat measurement on 200 sows.

a,b,c Different superscripts within a row indicate significant difference.

Contrary to the previous comparison of three devices [9], this study did not include a control device, and the result is therefore a direct comparison of two devices without any possibility of comparing the output with the 'true' backfat thickness measured with, for instance, the Krautkramer. The 2013 study [9] found that the Lean-Meater measured significantly more backfat than the Krautkramer (+2.14 mm), and assuming this to be the case still, the measurements made with the Duo-Scan:Go Plus will be closer to the true backfat thickness. However, presuming that results using Krautkramer represent the golden standard it remains most likely that the Duo-Scan:Go Plus will still measure a greater backfat thickness.

#### Descriptive results for the Lean-Meater vs the Duo-Scan:Go Plus

Tables 4 and 5 illustrate the descriptive differences and distributions of measurements made with the Lean-Meater and the Duo-Scan:Go Plus. It was not the intention to have a balance in the number of sows/parity because this would not affect the outcome as the aim was to determine deviations between sets of measurements and between devices. However, it is worth noting that the dispersion between the measurements was largely independent of the device used, whereas the numerical difference between sets of measurements made on the same sow was consistently lower when the Duo-Scan:Go Plus was used, which is consistent with the statistical analyses.

Day		Lean-M	eater		Duo-Scan:Go Plus			
	Backfat,	Dispersi	Numeric	Dispersi	Backfat	Dispersi	Numeric	Dispersi
	mm	on	al diff.	on	mm	on	al diff.	on
		between	between	between		between	between	between
		SOWS,	measure	measure		sows,	measure	measure
		mm	ments,	ments,		mm	ments,	ments,
			mm	mm			mm	mm
1	14.44	3.50	0.61	0.80	14.12	3.78	0.56	0.85
2	13.22	3.06	0.80	1.04	12.61	3.32	0.43	0.39
3	13.88	3.63	0.79	0.94	13.49	3.78	0.60	0.63
4	13.17	3.34	0.95	1.21	12.91	3.47	0.66	1.02

**Table 4.** Average backfat and deviation between repeated measurements made on different days. All values are unadjusted mean values + dispersion based on backfat measurement on 200 sows.

Overall, second and third parity sows had a numerically lower backfat thickness (Table 5) which indicates that these sows were in poor body condition, and results show that only the raw averages of the first parity sows met the recommendation that sows have 14-17 mm backfat at farrowing [1]. This did not affect the comparison of the two devices but does emphasize the importance of backfat measurement as a tool to ensure that sows are in the desired body condition in their cycle and reach the optimum backfat thickness at farrowing.

**Table 5.** Average backfat and deviation between repeated measurements on sows (parity 1-8). All values are unadjusted mean values + dispersion based on backfat measurement on 200 sows.

Parity	Lean-Meater				Duo-Scan:Go Plus			
	Backfat,	Dispersi	Numeric	Dispersi	Backfat,	Dispersi	Numeric	Dispersi
	mm	on	al diff.	on	mm	on	al diff.	on
		between	between	between		between	between	between
		SOWS,	measure	measure		SOWS,	measure	measure
		mm	ments,	ments,		mm	ments,	ments,
			mm	mm			mm	mm
1	14.68	3.37	0.91	0.90	14.60	3.40	0.84	0.85
2-3	12.70	3.03	0.80	1.29	12.10	3.27	0.46	0.87
≥4	13.80	3.55	0.70	0.82	13.39	3.73	0.48	0.58

#### Practical use of the backfat devices

The technician was highly skilled in measuring backfat thickness with the Lean-Meater, and Table 6 below presents the pros and cons of both devices as experienced by the technician.

**Table 6.** Pros and cons and practical remarks of measuring backfat with the Lean-Meater and the Duo-Scan:Go

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## Conclusion

Measurements made on 200 sows at P2 twice with Lean-Meater and Duo-Scan:Go Plus, respectively, showed that, with the exception of first parity sows, the Duo-Scan:Go Plus measured averagely 0.42-0.60 mm less backfat than the Lean-Meater. Furthermore, analyses revealed a trend toward a 27% lower standard deviation between the two sets of measurements when the Duo-Scan:Go Plus was compared with the Lean-Meater, ie. a higher repeatability was achieved with the Duo-Scan:Go Plus. These differences were rather small, and therefore both devices are considered suitable for backfat measurement on Danish pig farms. However, experience showed that the Duo-Scan:Go Plus was more suitable for rapid backfat measurements for loose housed sows than the Lean-Meater. The Duo-Scan:Go Plus furthermore offers backfat measurement and gestation scanning in the same workflow.

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#### Partcipants

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