DETERMINING THE ACCURACY OF GESTATION FEED DROPS

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Summary

An experiment was conducted to determine the accuracy of three different gestation feed drops. Each drop was tested at three different angles (90, 75, 60°) from the feed line. Feed was collected and weighed at feeder settings of 2, 4, 6, 8, and 10 lb for the Econo-Drop and Accu-Drop feed dispensers. Samples were taken at 2, 4, 6, and 8 lb for the Ultra-Drop feed dispenser due to a smaller storage capacity for feed with this feed drop. There were five replications (five drops of each type) at each feed setting. There was a drop type by angle interaction ($P<0.01$) for the feed dispenser settings versus the actual pounds of feed dropped. At angles of 90 or 60 degrees, the Accu-Drop and the Ultra-Drop feed dispensers more ($P<0.10$) accurately dropped the correct amount of feed at the respective feeder settings. The amount of feed dropped at each dispenser setting was influenced more by angle to the feed line with the Econo-Drop than with the Accu-Drop or Ultra-Drop feed dispensers. This study demonstrated that the Accu-Drop and the Ultra-Drop feed dispensers are more accurate than the Econo-Drop feed dispenser. Therefore, producers should consider the additional feed cost over the lifetime of the feed drops and not rely solely on initial price.

Key Words: Feed Drops, Feed Cost, Slope-intercept.)

Introduction

The use of individual gestation stalls or crates in environmentally controlled barns has generally become the accepted standard method for sow management. Housing sows in stalls allows producers to have direct control over the intake of sows and, ultimately, the overall composition and growth of the animal. Individual feed drops are used to provide a set amount of feed to each individual sow. These feed drops are made by several manufacturers and come in several types, but information on the accuracy of individual feed drops has not been published. As a further complication to the question of accuracy of feed drops, the drops are installed and intended to be used when perpendicular (90° angle) to the feed line. Either during installation or after years of use, many drops are at angles of less than 90° from the feed line, which may influence their accuracy. Testing of different types of feed drops may help producers make equipment decisions for their facilities. Thus, the objective of this experiment was to determine the accuracy of different individual drop feeders when they are fitted at angles of 90, 75, or 60°.

Procedures

This experiment was conducted at the Kansas State University Swine Research and Teaching Center. The experimental diet was a

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corn-soybean meal diet that consisted of 1.15% TID lysine and a ME content of 1,494 kcal/lb (Table 1). All feed dispensers were purchased from Automated Production Systems (AP, Assumption, IL) and were attached to a 2-in diameter feed line. The feed drops used in this experiment were the Ultra-Drop feed dispenser, the Econo-Drop feed dispenser, and the Accu-Drop feed dispenser (Figure 1). The feed dispensers were adjusted to the specific test angles by using a Johnson Magnetic Angle Locator (Johnson Level and Tool, Mequon, WI). Feed was collected and weighed at feeder settings of 2, 4, 6, 8, and 10 lb for the Econo-Drop and Accu-Drop feed dispensers. Samples were taken at 2, 4, 6, and 8 lb for the Ultra-Drop feed dispenser due to a smaller storage capacity for feed with this feed drop. Samples were weighed on an Ohaus Champ II Bench Scale (Ohaus Balance and Scale, Pine Brook, NJ), which allowed for an accurate measurement to one hundredth of a pound.

Table 1. Composition of Diets (As-fed Basis)[a]

Item, %	Diet
Corn	63.14
Soybean meal (46.5%)	33.26
Monocalcium P (21% P, 18% C)	1.40
Limestone	1.25
Salt	0.35
Trace mineral premix	0.20
Vitamin premix	0.15
L-lysine HCl	0.15
L-threonine	0.05
DL-methionine	0.05
Total	100.00

[a]Diet was formulated to contain 1.15% TID lysine and 1,494 kcal/lb.

Data was analyzed as a split-plot design, with the feed dispenser as the whole plot and angle as the subplot. Feed dispensers were randomly blocked based on type, and analysis of variance was performed by using the PROC MIXED procedure of SAS (SAS Inst. Inc., Cary, NC).

Results and Discussion

There was a feed drop type by angle by lb interaction ($P<0.01$; Table 2) for all the selected feeder settings. The Econo-Drop feed dispenser (Figure 2) was affected the most by the treatment angles. At an angle of 90°, the Econo-Drop consistently dropped more feed than the target setting. When set at an angle of 60°, however, the Econo-Drop dropped considerably less than the targeted feed weight. Thus, producers using this drop would have difficulty targeting the correct feeding rate unless all drops in the barn were at the exact same angle to the feed line. On the other hand, the Accu-Drop (Figure 3) and the Ultra Drop feed dispensers (Figure 4) more accurately measured the exact amount of feed. Furthermore, moving the Econo-Drop from a 90 to 60° angle resulted in a larger change in the amount of feed dropped. For example, at the 8-lb setting, moving the dispensers from a 90 to 60° degree angle resulted in an approximately 50% (4.2 lb) change in the amount of feed dropped with the Econo-Drop. The same change in angle for the Accu-Drop and the Ultra-Drop only resulted in an approximately 10% change in the amounts of feed dropped (0.74 and 0.85 lb, respectively).

Pork producers planning to construct new sow barns or replace the feed delivery system in existing facilities should base their purchasing decisions on accuracy of the feed dispensers, not on initial cost. In this study, we determined that the Accu-Drop and the Ultra-Drop are more accurate than the Econo-Drop at a 90-degree angle. Furthermore, as the feed dispenser angle become more skewed on the line, the Accu-Drop and the Ultra-Drop feed dispensers will stay more accurate than the Econo-Drop feed dispensers.

The improvement in accuracy is potentially related to how the individual dispensers are attached to the feed line. As shown in Figure 1, the Accu-Drop and Ultra-Drop feed dispensers are attached to the feed line along the entire top of the drop, whereas the Econo-Drop is only attached in the center. The Econo-Drop and the Ultra-Drop feed dispensers are actually similar in shape and measuring system. Both feed dispensers are "box" shape and measure the amount of fill by use of a "ribbon" measuring system in which the feed enters the dispenser through a chute and fills until the feed level reaches an adjustable "ribbon." But the box, and ultimately the feed delivery chute, are turned 90° for the Ultra-Drop, compared with the Econo-Drop. Because of this, when the drop is rotated away from a perpendicular angle from the feed line, the feed flow is impacted more greatly with the Econo-Drop than with the Ultra-Drop.

For the Accu-Drop dispenser, feed volume is determined by the height setting for the plate within the cylinder. The volume that can enter the cylinder doesn't change greatly as the angle to the feed line changes. One potential concern with this design is that, if the plate doesn't remain on a consistent plane with the feed settings on the cylinder, the drop may become more difficult to set. The volume entering the cylinder wouldn't change if the plate was not flat, but determining the exact setting would be more difficult. A simple and economic solution to this problem would be for the manufacturers to print four equally spaced measuring labels on the sides of the cylinder.

Producers typically may examine the initial cost of equipment when building or retrofitting a gestation facility to make their decision on feed drops. This trial has shown that the accuracy of the drops should also be considered. Consistently over- or under-feeding in gestation has been demonstrated to reduce sow productivity. A small increase in initial investment may greatly reduce feed cost or increase sow productivity over the lifespan of the equipment.

Table 2. Weight Difference of Feed Dropped Versus Actual Feed Dispenser Setting[a]

	Feed Dispenser			
	Econo-Drop	Accu-Drop	Ultra-Drop[a]	SE
2 lb[b]				
90°	0.50^{x}	0.20^{y}	0.30^{y}	0.05
75°	0.12^{x}	0.30^{y}	0.16^{x}	0.05
60°	-0.47^{x}	-0.41^{x}	-0.22^{y}	0.05
Diff 90 to 60° [c]	0.96^{x}	0.61^{xy}	0.52^{y}	0.17
4 lb[b]				
90°	1.00^{x}	0.16^{y}	0.76^{z}	0.10
75°	-0.39^{x}	-0.03^{y}	0.59^{z}	0.10
60°	-1.60^{x}	-0.84^{y}	0.05^{z}	0.10
Diff 90 to 60°[c]	2.61^{x}	1.00^{y}	0.71^{y}	0.17
6 lb[b]				
90°	1.62^{x}	0.24^{y}	0.79^{z}	0.08
75°	-0.18^{x}	-0.03^{x}	0.52^{y}	0.08
60°	-2.30^{x}	-0.62^{y}	-0.08^{z}	0.08
Diff 90 to 60°[c]	3.92^{x}	0.86^{y}	0.87^{y}	0.17
8 lb[b]				
90°	1.34^{x}	0.19^{y}	0.35^{y}	0.11
75°	-0.28^{x}	0.09^{y}	0.22^{y}	0.11
60°	-2.84^{x}	-0.55^{y}	-0.50^{y}	0.11
Diff 90 to 60°[c]	4.19^{x}	0.74^{y}	0.86^{y}	0.17
10 lb[b]				
90°	1.38^{x}	0.28^{y}	---	0.12
75°	0.49^{x}	0.20^{y}	---	0.12
60°	-2.96^{x}	-0.66^{y}	---	0.12
Diff 90 to 60°[c]	4.34^{x}	0.94^{y}	---	0.17

[a]Ultra-Drop Feed Dispenser was not measured at 10 lbs due to limited storage capacity.
[b]Type by angle by lb interaction (P<0.01).
[c]Type by lb interaction (P<0.01).
[x,y,z]Means in the row with different superscripts differ (P<0.10).

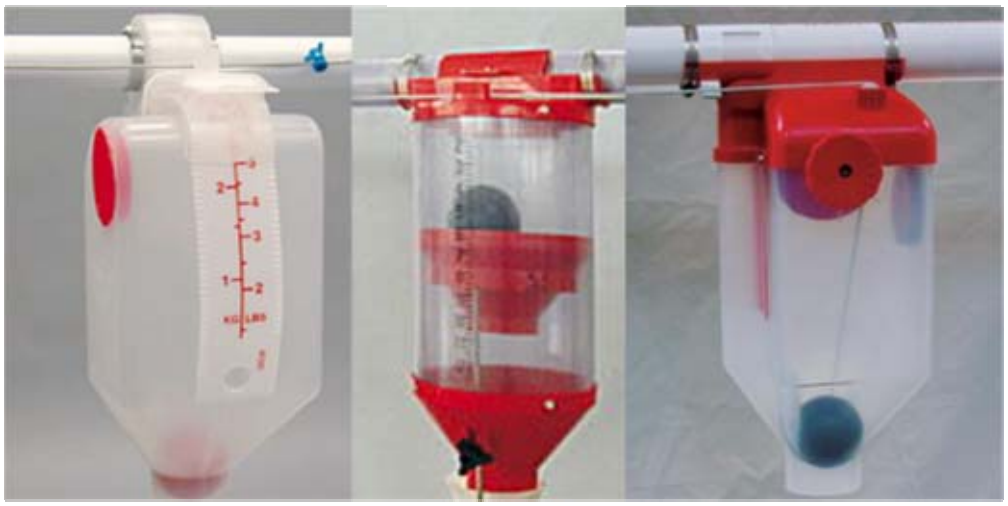

Figure 1. Example of the Types of Feed Dispensers Used in the Present Trial. Left to right: Econo-Drop, Accu-Drop, and the Ultra-Drop feed dispensers. Photos courtesy of Automated Production Systems, Assumption, IL (www.automatedproduction.com).

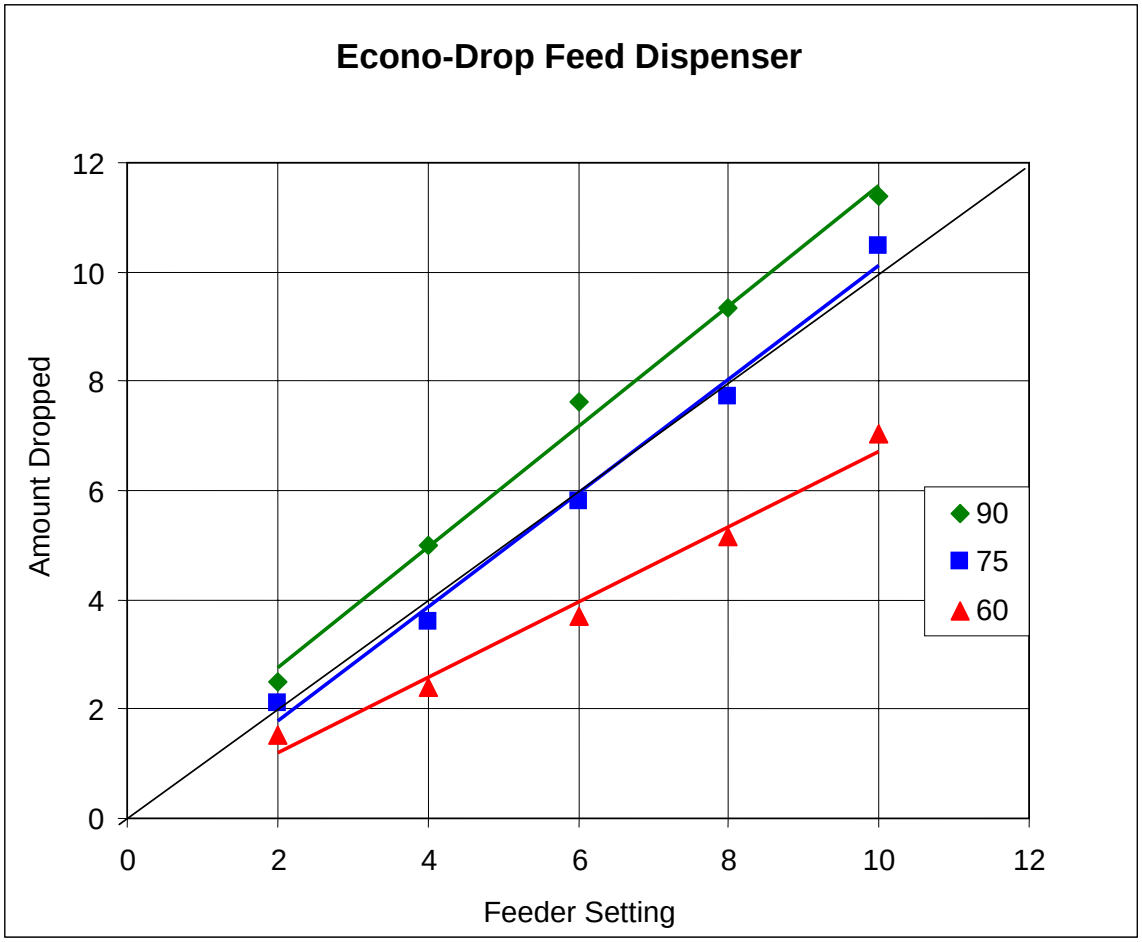

Figure 2. Example of the Actual Amount of Feed Dispensed for Each Feeder Setting Among the Respective Angles Tested for the Econo-Drop Feed Dispenser. Regression equations for the specific angles are listed as: 90°, y = 1.1056(x) + 0.5364; 75°, y = 1.0428(x) – 0.3052; 60°, y = 0.6890(x) – 0.1672. There was a type by angle interaction (P<0.01) for the slope and intercept of the line. The slope was not equal to one for the Econo-Drop feed dispenser at an angle of 90° (P<0.01), 75° (P<0.03), and 60° (P<0.01). The intercept was not equal to zero for the Econo-Drop feed dispenser at an angle of 90° (P<0.01), 75° (P<0.01), and 60° (P<0.07).

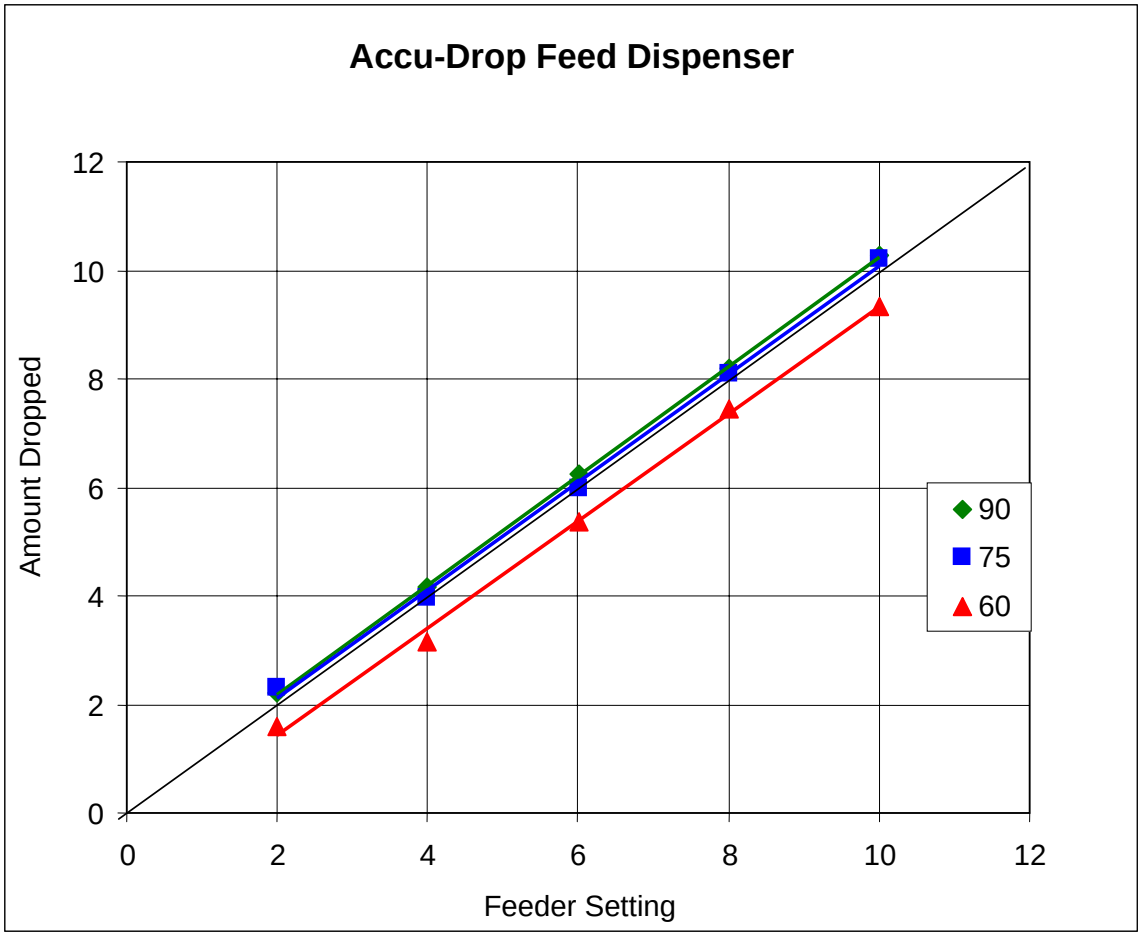

Figure 3. Example of the Actual Amount of Feed Dispensed for Each Feeder Setting Among the Respective Angles Tested for the Accu-Drop Feed Dispenser. Regression equations for the specific angles are listed as: 90°, y = 1.0096(x) + 0.1572; 75°, y = 0.9965(x) + 0.1268; 60°, y = 0.9890(x) – 0.5484. There was a type by angle interaction ($P<0.01$) for the slope and intercept of the line. The slope was equal to one for the Accu-Drop feed dispenser at an angle of 90° ($P>0.54$), 75° ($P>0.84$), and 60° ($P>0.60$). The intercept was not equal to zero for the Accu-Drop feed dispenser at an angle of 75° ($P<0.09$).

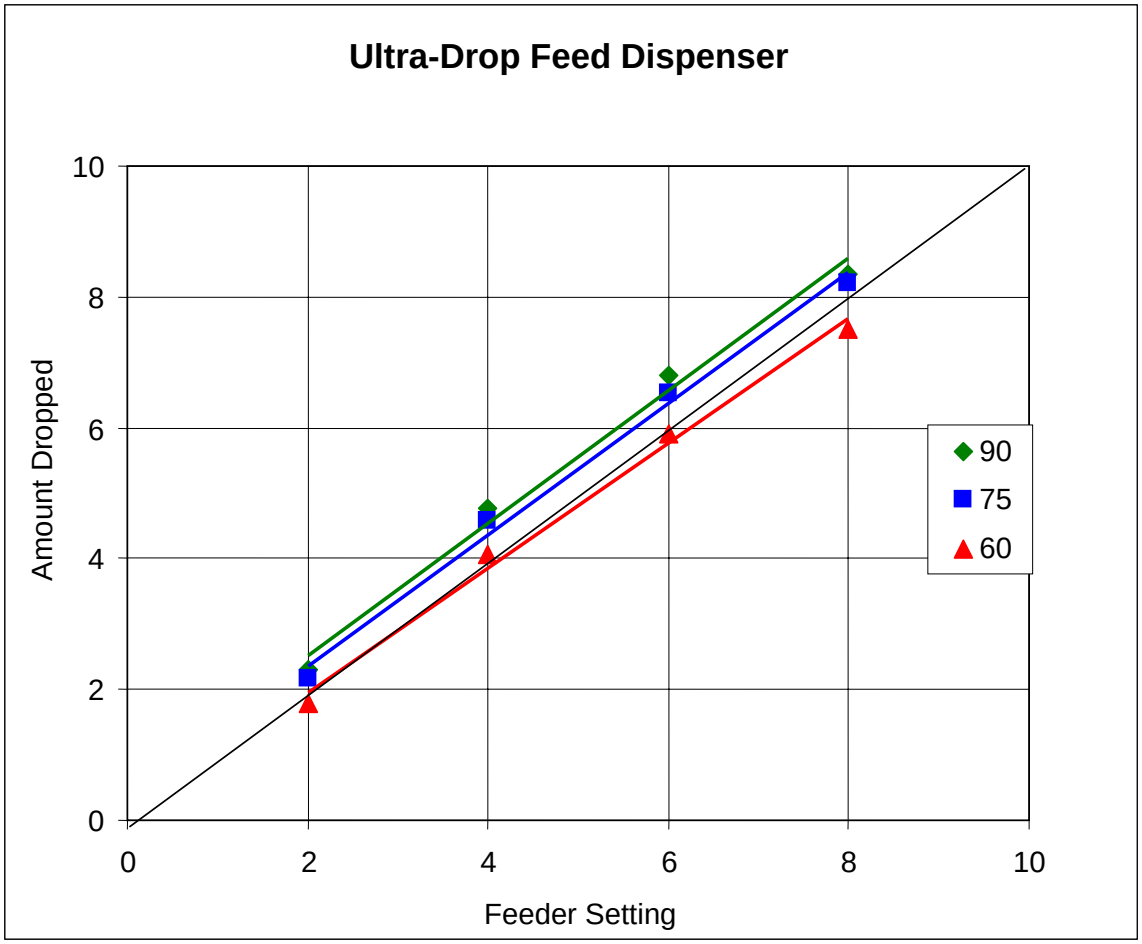

Figure 4. Example of the Actual Amount of Feed Dispensed for Each Feeder Setting Among the Respective Angles Tested for the Ultra-Drop Feed Dispenser. Regression equations for the specific angles are listed as: 90°, y = 1.0088(x) + 0.5080; 75°, y = 1.0054(x) + 0.3430; 60°, y = 0.9509(x) + 0.0560. There was a type by angle interaction ($P<0.01$) for the slope and intercept of the line. The slope was not equal to one for the Ultra-Drop feed dispenser at an angle of 60° ($P<0.02$). The intercept was not equal to zero for the Ultra-Drop feed dispenser at an angle of 90° ($P<0.01$) and 75° ($P<0.01$).