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W. Christopher Scruton

Stephen Claas

Layout

David Brown

Logo Design

Ruth Cronje, and Jan Swanson;

based on the original design by Dr. Robert Dunlop

Cover Design

Shawn Welch

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Using AST and RFID to reduce and understand variation in growing pigs

Robert Baarsch, BS; Bob Morrison; and Alejandro Larriestra

Automatic sorting technology or AST can increase average carcass weight per hog sold and improve the final price per pound of the carcass. To understand the value of AST in the finishing barn, one has to understand the markets one sells into. Minimizing sort loss may or may not maximize profit to the producer. Listed below are three abattoir buying matrices (Tables 1–3) in which only one matrix contains the highest margin pig in the zero sort loss range. The oval represents the maximum return per pig. In two out of the three matrices the highest profit pig does not correlate with the lowest sort loss pig.

In the case of the first two packers the “sweet spot” or the pig with the most net margin occurs outside the zero sort loss box. The goal is to sell the carcass with the highest amount of net margin per pig. This is where the marginal cost per additional pound of gain and the marginal revenue for that pound intersect. In our model the pig is the profit center not the sow or the buildings. In this perspective yardage is just another variable cost.

When looking at side by side, results reducing variation increase margin. In Table 4 we provide a summary of our company’s marketings to packer #3.

Figures 1 and 2 provide a comparison of two groups weight distribution at Packer #3, one an AST group and the other a typical hand-sorted group. The difference in the variability is easily seen.

Managing variation

There are two ways to manage variation:

- sort after the fact for the product you desire; or,
- reduce your variation in the manufacturing process and produce a higher percentage of the product in the first place.

AST will reduce variation by more accurate sorting of live hogs prior to slaughter, however AST can also help teach us where and when these sources of variation are occurring in the system. Here (Figure 3) is an example of

Table 1: Packer #1 net margin per hog

Carcass Wt.	Percent Lean								
	0	57+	56-57	55-56	54-55	53-54	52-53	51-52	50-51
147	155	(\$14.97)	(\$14.97)	(\$14.97)	(\$14.97)	(\$15.73)	(\$17.99)	(\$19.50)	(\$21.01)
156	163	\$0.17	\$0.17	\$0.17	(\$1.43)	(\$3.82)	(\$6.21)	(\$7.81)	(\$9.40)
164	171	\$5.74	\$5.74	\$5.74	\$4.90	\$3.23	\$0.71	(\$3.47)	(\$3.47)
172	178	\$9.53	\$9.53	\$9.53	\$8.65	\$6.90	\$4.28	(\$0.10)	(\$0.10)
179	186	\$12.24	\$12.24	\$12.24	\$12.24	\$9.50	\$6.77	\$2.20	\$2.20
187	194	\$19.14	\$19.14	\$19.14	\$15.33	\$12.47	\$9.61	\$4.85	\$4.85
195	202	\$22.30	\$22.30	\$22.30	\$20.31	\$17.33	\$12.37	\$7.41	\$7.41
203	209	\$25.40	\$25.40	\$25.40	\$25.40	\$21.28	\$17.16	\$9.95	\$9.95
210	218	\$27.47	\$27.47	\$27.47	\$27.47	\$23.19	\$18.91	\$11.42	\$11.42
219	225	\$31.61	\$31.61	\$31.61	\$30.50	\$24.95	\$20.51	\$17.18	\$14.96
226	233	\$31.92	\$31.92	\$31.92	\$30.77	\$25.03	\$20.44	\$17.00	\$14.71
234	240	\$30.55	\$30.55	\$30.55	\$29.36	\$23.44	\$18.70	\$15.14	\$12.77
241	248	\$28.99	\$28.99	\$28.99	\$27.77	\$22.88	\$17.99	\$14.32	\$10.65
249	255	\$28.94	\$28.94	\$28.94	\$27.68	\$22.64	\$17.60	\$13.82	\$10.04

Zero Sort Loss in this Box

Table 2: Packer #2 net margin per hog

Carcass Wt		Percent Lean						
		59-57	57-55	55-53	53-51	51-49	49-47	47-45
140	147	(\$14.42)	(\$15.86)	(\$17.29)	(\$18.73)	(\$20.16)	(\$23.46)	(\$24.90)
148	154	(\$9.62)	(\$11.13)	(\$12.64)	(\$14.15)	(\$15.66)	(\$19.13)	(\$20.64)
155	162	(\$1.29)	(\$2.88)	(\$4.46)	(\$6.05)	(\$7.63)	(\$11.28)	(\$12.86)
163	169	\$5.19	\$3.53	\$1.87	\$0.21	(\$1.45)	(\$5.26)	(\$6.92)
170	176	\$10.26	\$8.53	\$6.80	\$5.07	\$3.34	(\$0.64)	(\$2.37)
177	184	\$13.01	\$11.21	\$9.40	\$7.60	\$5.79	\$1.64	(\$0.16)
185	191	\$15.84	\$13.96	\$12.08	\$10.20	\$8.32	\$3.99	\$2.11
192	198	\$18.59	\$16.64	\$14.69	\$12.74	\$10.79	\$6.31	\$4.36
199	206	\$21.56	\$19.51	\$17.51	\$15.49	\$13.46	\$8.81	\$6.78
207	213	\$23.04	\$20.94	\$18.84	\$16.74	\$14.64	\$9.81	\$7.71
214	220	\$23.26	\$21.09	\$18.92	\$16.75	\$14.58	\$9.59	\$7.42
221	228	\$19.60	\$17.36	\$15.11	\$12.87	\$10.62	\$5.46	\$3.22

Table 3: Packer #3 net margin per hog

Carcass Wt	Carc Grade Backfat	1-	1	2	3	4	5	6
		.50/down	.51-.70	.71-.90	.91-1.1	1.11-1.3	1.31-1.5	1.51up
	159/down	(\$38.49)	(\$35.98)	(\$35.98)	(\$38.49)	(\$39.33)	(\$49.36)	(\$60.23)
160	165	(\$19.50)	(\$14.35)	(\$14.35)	(\$19.50)	(\$26.36)	(\$36.66)	(\$47.81)
167	173	(\$13.26)	(\$8.78)	(\$8.78)	(\$13.26)	(\$20.43)	(\$31.19)	(\$42.85)
174	180	(\$1.91)	\$0.89	\$0.89	(\$1.91)	(\$7.52)	(\$18.74)	(\$30.90)
181	187	\$2.28	\$7.14	\$7.14	\$2.28	(\$3.56)	(\$17.19)	(\$29.85)
188	194	\$4.48	\$9.54	\$9.54	\$4.48	(\$1.59)	(\$15.76)	(\$28.91)
195	201	\$6.76	\$12.02	\$12.02	\$6.76	\$0.46	(\$14.25)	(\$27.90)
202	208	\$9.28	\$14.70	\$14.73	\$9.28	\$2.75	(\$12.50)	(\$26.65)
209	215	\$11.87	\$17.51	\$17.51	\$11.87	\$5.11	(\$10.68)	(\$25.34)
216	222	\$13.37	\$16.87	\$16.87	\$12.20	\$7.54	(\$8.79)	(\$23.94)
223	229	\$13.66	\$13.66	\$13.66	\$13.66	\$7.64	(\$9.23)	(\$24.88)
230	236	(\$1.16)	\$2.57	\$2.57	(\$1.16)	(\$8.61)	(\$26.02)	(\$42.18)
237	243	(\$5.15)	(\$1.25)	(\$1.25)	(\$5.15)	(\$12.96)	(\$31.17)	(\$48.08)
	244/up	(\$10.34)	(\$6.31)	(\$6.31)	(\$10.34)	(\$18.39)	(\$37.18)	(\$54.62)

Table 4: Our company's marketings to packer #3

	Hogs Sold Packer #3	Carcass Wt.	Base	Red Box*
Non AST Hogs	6738	199.0	102.2%	82.0%
AST Hogs	2239	206.6	104.3%	92.7%
		-7.6	-2.1%	-10.7%
Dollar Value Difference		\$2.28	\$2.42	\$1.00
				\$5.70

* zero sort loss

Production

Figure 1: R57C a non-AST group distribution (1131 carcasses)

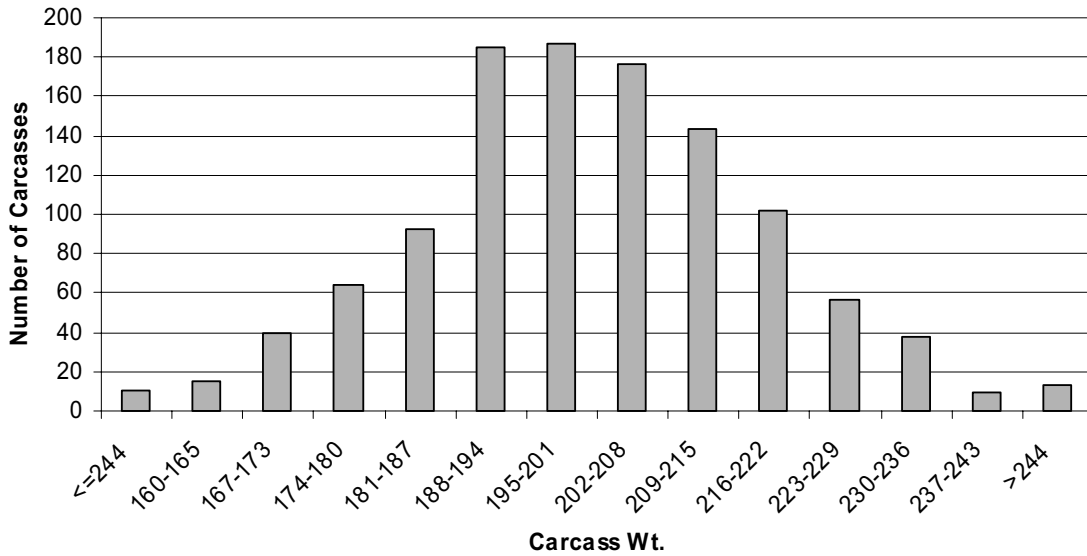


Figure 2: SBM2D 1148 carcasses using AST

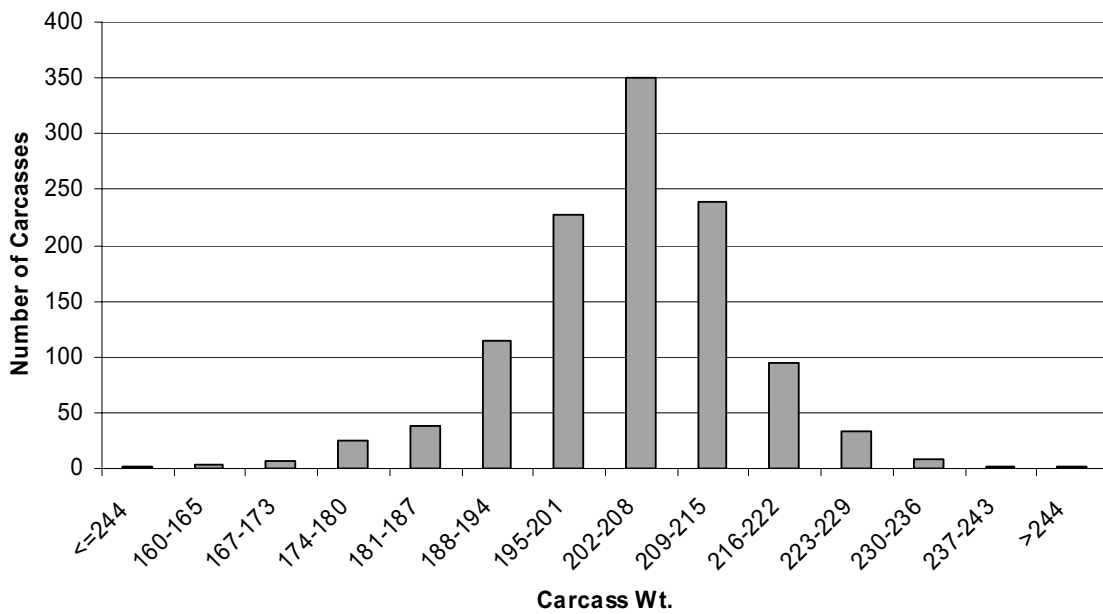
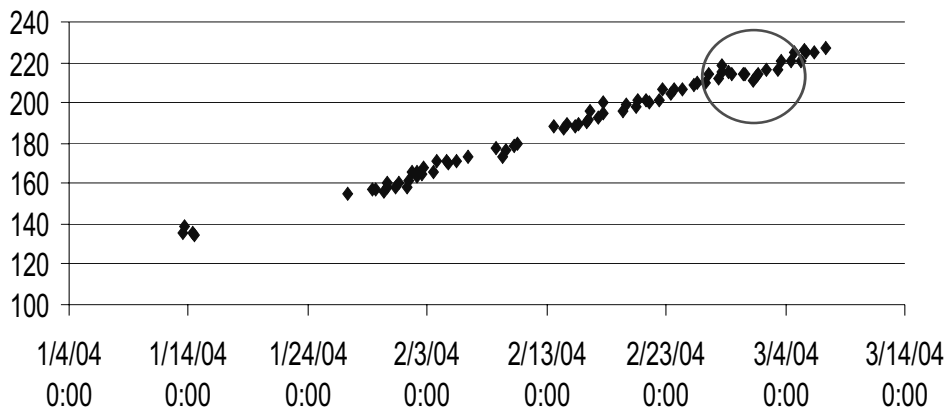


Figure 3: Example of one hog's growth using AST with radio-frequency identification (RFID) reader



Production

one hog's growth using AST with radio frequency identification (RFID) reader.

We collected the first known data set of its kind. Using an AST scale coupled with a compatible antenna and reader a picture emerged of how individual pigs grow in our AST barns. Several observations stood out to us. First off, the entire growth rate in this winter trial (December to April) was very linear. So linear in fact that it was easy to see the 51-hour growth interruption in this particular hog. We saw this same occurrence—at about the same time—several more times among the approximately 40 pigs that were tagged. Although, we can't explain why this occurred, it marks the beginning of a new way to study hog behavior and performance on an individual level. This indicates that, at least for research purposes, we may quickly be able to detect onset of disease in an individual pig relatively, allowing us to search for additional data such as serological information, parity influences, sex, age, birth weight, and genetic differences.

We also observed that once an animal is set on a growth rate it doesn't change much during the finish phase. 80% of the variation in rate of gain can be explained by the pig-to-pig differences versus variability within individual animals. This is certainly only one group and much more work and replication needs to be done in this area.

This trial confirms that pig eating patterns are diurnal and they have preferred times of the day in which they like to eat. We see an increase in visits to the food court in the morning between 8:00 and 9:00 am; the biggest activity spike occurs in the 6:00 pm timeframe.

What else have we learned during this trial?

- Pigs are lighter in the morning and grow through the day;
- The growth rate of the remaining pigs in the barn was unchanged after the first sort for sale; and,
- Lighter pigs at the beginning of the trial had predictably lower growth rates in comparison to the heavier pigs.

Conclusions

AST improves net margin per pig by reducing carcass weight variation at the packer. AST pigs have diurnal eating patterns that are predictable. Growth rates of growing hogs maybe more linear than earlier thought. RFID (radio frequency identification) coupled with AST (automatic sorting technology) increases our understanding of weight and growth variation of growing hogs.

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