Breech Strike Genetics

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EDITORIAL

The Breeding for Breech Strike Resistance Project had its first ewe mating in 2006 and is now in its eighth year. This has been the most comprehensive investigation into the underlying causes of breech strike on unmulesed Merino sheep since the 1920s when Seddon showed how important wrinkles are in increasing the susceptibility of sheep to breech strike. AWI has approved further funding to investigate "odours" for another three years (July 2012 to June 2015).

Since the introduction of surgical mulesing in the late thirties the research focussed on mulesing, and from the early fifties on the use of preventative jetting chemicals to control flystrike. The high initial success rate of chemicals created a strong feeling that mulesing along with chemicals, will be the permanent solution to the breech strike problem. However, in the sixties and seventies it became clear that chemicals won't solve the problem as the blowfly developed resistance to the available chemicals and concerns regarding residues increased. A number of insecticides with different active ingredients have been developed but blowflies have eventually developed some level of resistance and it is increasingly becoming difficult to get new chemicals registered with the APVMA. With the endeavour to phase out mulesing, all this confirms that breeding is an important long term permanent solution to breech strike.

This project so far has clearly identified the key underlying causes of breech strike in winter and summer rainfall environments. The results demonstrated that flocks in Mediterranean regions with lower levels of dags, less urine stain, less wrinkles and lower breech cover will be less prone to be struck by flies. These factors can be managed through strategic crutching and to some extent by improved worm control. However, these husbandry techniques are labour intensive and can be costly and alternative strategies are needed to develop low input, easy care production systems with the extra bonus of clean and green.

The main findings from this genetics experiment to date is that large differences exist between sire progeny groups and that some sires' progeny are naturally very resistant to breech strike. Although wrinkle is an important indicator trait of breech strike (especially in low dag country, the results from Mount Barker, WA has expelled the general myth that breeding plain-bodied sheep will solve all breech strike problems. We have found that some plain-bodied sheep can be more susceptible to breech strike than "normal" Merinos. Dags and urine stain are more important than wrinkles or breech cover in making animals susceptible to breech strike in southern Mediterranean environments, but wrinkles increases the susceptibility of animals with high dags and urine stain. Urine Stain has been added to the newly released AWI and MLA Visual Scores Guide. (see AWI Website)

Another important finding is that it appears that odour from sheep plays an important role in attracting or repelling blowflies. Our work with sniffer dogs trained by Hanrob Dog Academy in Sydney, has clearly shown that dogs can differentiate very successfully between wool from resistant and susceptible lines (from sheep that have not been struck for at least 18 months). AWI is currently funding an in-depth investigation into the chemical compounds that cause the differences in odour with the University of Western Australia. Animals from the breech strike flock at Mt Barker in Western Australia are being used in this study, but this work will later also include animals from the breech strike flock at Chiswick in Armidale, NSW. The odour project is only in its initial stage but encouraging results have been found which support the outcomes found with the sniffer dogs and the likely potential for a commercial outcome for woolgrowers.

This newsletter provides more information on progress during the last 6 months, and we hope that the results will encourage you to adopt the breeding technologies that have flowed from this experiment. This will certainly contribute in you breeding more robust, easy care and profitable Merinos. Ram breeders are making considerable gains (in the context that 10 years is a short time in breeding terms), See article below.

ODOUR RESEARCH - SNIFFER DOGS

Our results to date show that dags, urine stain, wrinkles and breech cover all play a part in making sheep more susceptible to breech strike, but these traits do not explain all the differences between sheep with breech strike. Some low dag, low wrinkle, low cover sheep still get struck with the absence of any chemical prevention. This prompted us to embark on early scoping studies to see whether odour may play a part in attracting blowflies to sheep.

AWI contracted Hanrob Dog Academy in Sydney, who are the official trainers of sniffer dogs at Australian airports, to investigate this issue. The CEO of Hanrob Dog Academy, Andrew Biggs and his Chief trainer, Wayne Grewar, visited Mt Barker research station in Western Australia to assess themselves of the sheep and the environment in which the dogs have to work. A protocol was developed where we sent crutched wool samples of resistant and susceptible sheep that had not been struck in the previous 18 months to Hanrob Dog Academy. They used these samples to train three dogs (originally 20 dogs were selected from a pound in Sydney that were quickly reduced to 3) to determine whether the dogs would be able to differentiate between wool from unstruck sheep from the resistant and susceptible lines. After about a year of training two of the dogs were 100% accurate in differentiating between wool from resistant and susceptible lines. The third dog was taken out of the study because he was not making satisfactory progress.

However, we were not sure whether the dogs were able to differentiate between resistant and susceptible sheep based on differences in wool odour that are related to breech strike, or to differences in odour due to other factors unrelated to the risk of breech strike. To reduce some of the variables, crutched wool samples from the resistant and susceptible sheep from the AWI breech strike flock in Armidale, NSW, were also assessed. This flock lies in a summer rainfall region, has a completely different genetic base, and although genetic links exist between the Mt Barker and Armidale flocks, the resistant and susceptible sheep that were identified were completely unrelated to the Mt Barker sheep that were used for training the dogs.

Hanrob Dog Academy Chief Dog Trainer, Wayne Grewar training one of the dogs used in the odour study.

The dogs were tested on five different occasions with the wool samples from the Armidale flock that the dogs have never been exposed to during their training programme. Both dogs were 82% accurate in identifying wool from resistant sheep and 92% accurate to ignore wool from susceptible sheep in the final test. This was an encouraging result and indicates that wool from sheep that are more resistant to breech strike, seems to smell different to wool from susceptible sheep. Joe Steer, a Ph.D student at the University of Western Australia, is currently working on an AWI funded project with the Forensic Department of the University of Western Australia, to identify these unique odour components in the skin of the sheep in the 2 lines.

Restructuring of the Mt Barker Breech Strike flock

AWI recently approved the funding of the breech strike project for another three years. This phase will focus on finding additional novel indicator traits for breech strike of which odour is the first trait to be investigated. The success of the next phase requires a well characterised flock of genetically resistant and susceptible sheep. A resistant and a susceptible group of animals were selected from the original flock based on their actual level of resistance to breech strike. All potential indicator traits for breech strike were ignored during the selection process as this could bias the final outcome.

After identifying the most resistant animals, the least productive animals were culled using the 7% Dual Purpose index. Control animals were then matched to the resistant group to ensure no differences in production, only in breech strike susceptibility. This was important as selecting the best performing animals in the control group on production would bias the final result, as this could create the impression that resistant animals are less productive than susceptible animals. Table 1 shows the average breeding values (ASBV) for the resistant and control group of mature ewes mated in 2013. Significant differences are found between the lines for breech strike and for some production traits however they are actually relatively small, except for breech strike with a difference of 0.44. Any production trait difference is not due to selecting for breech strike resistance but due to the selection process (balancing productivity traits between the lines) when setting up these lines several years ago.

TRAIT	Resistant	Susceptible (Control)	Level of significance
Number of ewes	274	263	
Breech strike resistance RBV (Birth to hogget age)	-0.29	0.15	**
Breech wrinkle	-0.09	-0.07	ns
Breech cover	-0.10	-0.04	*
Dags	-0.13	-0.04	**
Weaning weight (WWT)	2.43	2.10	*
Hogget weight (HWT)	5.33	4.81	*
Hogget Fat depth (HFAT)	0.49	0.37	*
Hogget Eye muscle depth (HEMD)	0.98	0.88	ns
Fibre diameter (HFD)	-0.42	-0.23	**
Hogget Clean fleece weight (HCFW)	3.28	3.63	ns
Hogget Coefficient of variation of fibre diameter (HFDCV)	-0.81	-0.91	ns
Hogget Staple strength (HSS)	4.18	4.63	*
Weaning Worm egg count (WFEC)	-26.3	-20.4	*
Hogget Worm egg count (HFEC)	-33.8	-22.6	**
Number of lambs weaned (NLW)	0.001	0.003	ns
7% Dual Purpose index	133.6	133.1	

Level of significance. * = 5%; ** = 1%; ns = non significant.

Table 1. Average ASBV of breech strike and for the production traits of ewes in the resistant (BSR R) and control (BSR C) lines. The 2012 drop Merino Stud Breed Average for 7% Dual Purpose Index is 134

Figure 1. Average research breeding values (RBV) of breech strike and the actual mean incidence of breech strike for hogget ewes and rams of the resistant and control lines

Figure 1 shows the average Research Breeding Value (RBV) of breech strike of the 2011 born ram and ewe hoggets of the two lines that were crutched prior to the fly season, and the actual incidence of breech strike observed in these different groups. The difference in the RBV of breech strike between the resistant and control line was about 0.40 which is very similar to that between the mature ewes of the resistant and control lines mated in 2013 (Table 1). This relates to an actual difference between the two lines of 8% in hogget ewes (22% versus 14%) and 2% in hogget rams (4% versus 2%) where the overall incidence of breech strike of the flock was only 10%. Both these values indicate that the resistant line is on average 30% - 40% more resistant than the control line which agree with the difference in RBV of 0.40 that indicates the susceptible line has a higher likelihood to be struck.

This demonstrates the uniqueness of this flock and it is the best resource available to identify other indicator traits that will explain more of the variation in breech strike between susceptible and resistant animals.

Distribution of flies across a farm

For a project such as this, it is important to understand the type of fly challenge the animals received at different times of the year but also across the research station. The appearance of flies in Western Australia has a strong seasonal pattern. Flies generally appear anytime from mid-September and the peak fly season is from October to December. The flies stay around until end of May during which time a few random strikes can occur, depending on the weather conditions.

We also find large variation in the distribution of flies across the research station where this research is being carried out. The following picture shows the average number of flies caught at the Mt Barker Research station over a three year period. The flies were caught with Lucy flytraps strategically placed across the research station. Fly traps were opened for 24 hours once a week during the year and the number of flies in each trap counted.

The average number of flies caught per trap varied from 1.8 to 13.6 flies from the top left corner to the bottom right hand corner of the farm. The number of flies caught depends on the trap site, presence of sheep, preceding fly population and weather. A nearly four-fold difference was found between paddocks divided by a tree line. When sheep are present in the paddock then the number of flies caught was doubled that when no sheep were in the paddock. More flies were also caught near trees (6.3), than in open areas (5.7) and less flies were caught near water (3.7). This information gives us a much better understanding of the fly challenges sheep faced in different paddocks across the farm. These patterns have been confirmed with a second set of traps (now running for 12 months) on a block approximately 7 km south of the above block.

Relationship between Poll strike and Breech strike

All types of strikes are regularly recorded in this breech strike flock. Rams were scored for horns at hogget age where 1 = poll, 2 = poll with signs of horn knobs, 3 = scurs, 4 = small horn and 5 = horn). During this time the average breech and poll strike in rams was 17.1% and 14.3%, respectively. This shows that unmulesed rams get struck nearly as often on the head as in the breech in a management system where the rams did not receive any preventative treatment against poll or breech strike.

Figure 2 shows the average incidence of poll and breech strike for different horn types. As expected polled rams are struck significantly less than rams with scurs or horned rams, but no significant relationship was found between horn type and breech strike. The incidence of sweaty polls is very low in this flock but some rams have a significant skin fold on the head which appears to make them more susceptible. These results confirm the obvious that different factors are responsible for poll and breech strike in Merino rams. In breech strike dags is a key factor, while horns is a key factor in poll strike.

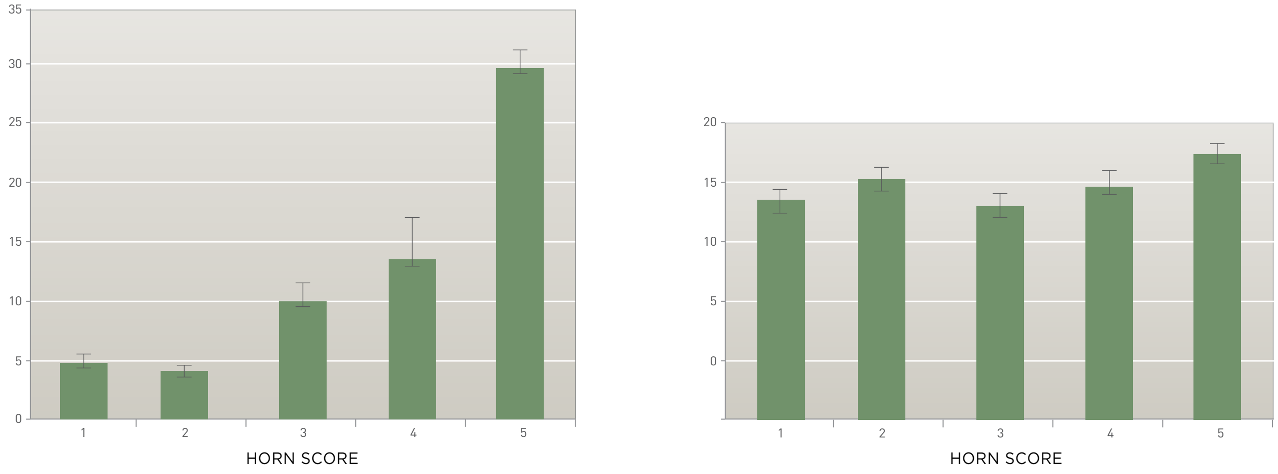

Figure 2. Incidence of poll strike in animals with different horn scores.

Figure 3 shows the relationship between horns and production as indicated by the 7% Dual Purpose plus index published by Sheep Genetics in the 2010 and 2011 born rams. This dataset consisted of 448 hogget rams. No significant differences were found between horn type, thus in this flock poll rams are similar to horn rams as far as production is concerned.

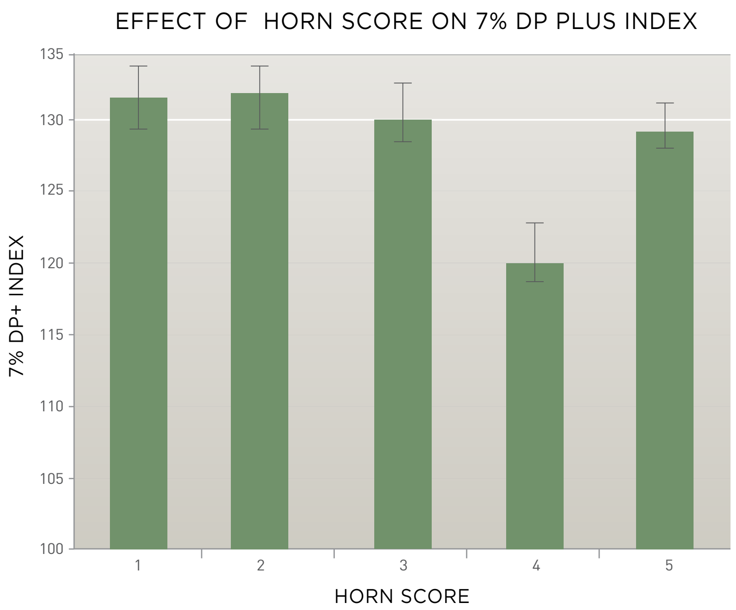

Figure 3. Effect of horn score on production as measured by the MERINOSELECT 7% Dual Purpose Plus index.

Availability of low wrinkle, low dag and low breech cover Industry Sires

Australian Sheep Breeding Values for Wrinkle, Dag and Cover have been available from MERINOSELECT for only the last 3 to 4 years. Increasingly animals are being bred for low wrinkle, dag, stain and cover and also achieving higher levels of productivity, fleece weight, fibre quality and fertility.

Table 2, 3 and 4 list sires according to a range of criteria; on progeny number, breech wrinkle, breech cover, dag, micron, curvature and index. Most of the 29 Industry sires listed have been used across numerous sites, 8 sires have been used in the Sheep CRC Information Nucleus and 6 sires at Sire Evaluation Sites. A number of these sires have 1,500 progeny recorded in the MERINOSELECT data base.

As the average of the top ten sires show across tables 2, 3 and 4, it is more difficult to breed lower micron sheep that are low in wrinkle, dag and cover and will take considerably longer to reach a state where they can reach “non mules” status without the high use of preventative fly control chemical. While it is highly variable between regions Breech Wrinkle of under -0.5 and Breech Cover under -0.3 is a subjective target for “non-mules” status. In some low dag country, a Wrinkle ASBV’s of -0.3 may be sufficient, in other areas -0.7 may be required due to the interaction that better country has on the actual phenotype. In high dag country, mulesing and or breeding for low dags are often insufficient as standalone measures and preventative chemicals are required to control breech strike adequately during the 2 to 3 month high risk period.

Sire A is; -0.5 for breech wrinkle and -1.5 for breech wool cover and in the top 1 % of the merino breed for both of these traits. At the same time his breeding values are top 1% for yearling growth, positive for fat and muscle, top 1% for yearling fleece weight, top 5% for adult fleece weight, top 5% for adult staple strength, top 25% for worm egg count and breed average for fertility.

Sire AC has been bred in the resistant line at the Armidale site of the Breeding for Breech Strike Resistance project. He is top 20% for wrinkle, top 10% for breech cover and top 5% for dag, while also positive for fat and muscle, top 30% for staple strength and, for such a low fibre diameter sire, his fleece weight is fairly good and fertility high.

While it is a daunting task to get wrinkle, dag and cover low enough and achieve high levels of productivity, progress is occurring through keen Industry interest and increasing use of sires with these attributes.

Abbreviations in tables 2, 3 and 4:

WWT; Weaning Weight (%)	YWT: Yearling Weight (%)	AWI: Adult Weight (%)	YFAT: Yearling Fat (mm)
YMD: Yearling Eye Muscle Depth (mm)	YGFW: Yearling Greasy Fleece Weight (%)	AFW: Adult Greasy Fleece Weight (%)	YFD: Yearling Fibre Diameter (μm)
AFD: Adult Fibre Diameter (μm)	YCUR: Yearling Curvature (o /mm)	YSL: Yearling Staple Length (mm)	ASS: Adult Staple Strength (N/Ktex)
YWEC: Yearling Worm Egg Count (%)	NLW: Number of Lambs Weaned (%)	EBWR: Early Breech Wrinkle (score)	EBCOV: Early Breech Cover (score)
LDAG: Late Dag (score)	DP+: Dual Purpose Plus	MP+: Merino Production Plus	FP+: Fibre Production Plus

Table 2. Top 10 Sires, more than 100 progeny, ASBVs Yearling Fibre Diameter stronger than -1, Wrinkle less than -0.2, Dag less than -0.2, Breech Cover less than -0.2 listed in decreasing Dual Purpose Plus index order.

Sire	WWT	YWT	AWT	YFAT	YEMD	YGFW	AGFW	YFD	AFD	YCUR	YSL	ASS	YWEC	NLW	EBWR	EBCOV	LDAG	DP+	Index % ile
A	6.3	13.9	11.0	0.7	2.1	29.8	16.8	-0.1	-0.7	-4.5	14.4	5.9	-27	2%	-0.5	-1.5	-0.3	201	Top 1%
B	5.4	12.3	10.1	-0.2	0.8	21.5	12.8	-1.0	-1.3	0.5	9.5	-0.7	96	3%	-0.4	-0.3	-0.2	179	Top 1%
C	1.8	5.0	5.5	0.0	0.4	8.3	10.3	-0.7	-0.7	-10.8	6.7	1.5	-26	9%	-0.4	-0.4	-0.3	174	Top 1%
D	4.0	8.2	3.6	0.9	1.0	18.4	7.1	-0.6	-1.1	-4.9	15.1	2.5	59	6%	-0.8	-0.4	-0.4	171	Top 5%
E	3.7	9.7	9.3	1.9	3.2	8.7	-5.9	0.4	0.5	-11.5	23.2	-0.1	-20	14%	-1.4	-1.2	-0.2	169	Top 5%
F	2.5	4.8	1.3	1.5	2.9	20.7	7.7	-0.6	-0.7	-7.1	23.1	-5.0	21	9%	-1.0	-0.5	-0.2	166	Top 5%
G	4.8	9.8	9.7	0.4	-0.3	14.0	5.7	-0.9	-1.2	-6.0	6.8	1.6	20	2%	-0.2	-1.1	-0.3	163	Top 5%
H	2.0	7.5	8.6	1.0	1.1	3.7	3.8	0.0	0.3	-4.9	7.4	0.7	6	5%	-0.4	-0.5	-0.5	156	Top 10%
I	5.7	9.1	10.8	0.9	2.1	4.8	-2.4	0.3	0.7	-9.7	14.0	1.1	6	9%	-1.0	-0.9	-0.2	156	Top 10%
J	3.2	6.8	6.5	0.0	1.1	9.2	6.8	-0.6	-0.5	-12.9	13.1	3.0	-34	0%	-0.4	-0.3	-0.3	153	Top 10%
Ave	**3.9**	**8.7**	**7.6**	**0.7**	**1.4**	**13.9**	**6.3**	**-0.4**	**-0.5**	**-7.2**	**13.3**	**1.1**	**10**	**6%**	**-0.7**	**-0.7**	**-0.3**	**169**	

Table 3. Top 10 Sire, more than 100 progeny, ASBVs Yearling Fibre Diameter between -1 and -2, Wrinkle less than -0.1, Dag less than -0.1, Breech Cover less than -0.1 listed in decreasing Merino Production Plus Index order.

Sire	WWT	YWT	AWT	YFAT	YEMD	YGFW	AGFW	YFD	AFD	YCUR	YSL	ASS	YWEC	NLW	EBWR	EBCOV	LDAG	DP+	Index % ile
K	3.5	11.1	8.1	0.5	1.4	22.5	8.0	-1.4	-1.9	-7.1	12.8	-2.1	-77	17%	-0.1	-0.2	-0.1	201	Top 1%
L	2.1	4.8	0.9	-0.2	0.7	25.9	11.4	-1.6	-1.9	-3.1	16.9	2.9	15	-3%	-0.4	-0.2	-0.1	172	Top 1%
M	3.2	7.7	6.1	-0.2	0.3	25.3	16.4	-1.7	-1.9	-5.5	7.8	-2.0	60	0%	-0.2	-0.1	-0.1	172	Top 1%
N	2.6	6.9	5.8	-0.1	-0.1	16.4	7.8	-1.3	-1.6	-7.0	16.1	2.3	-42	0%	-0.3	-0.4	-0.2	170	Top 5%
O	3.6	6.9	6.3	-0.1	-0.5	8.1	3.6	-1.7	-1.9	-10.3	15.9	1.6	-60	2%	-0.9	-0.5	-0.4	166	Top 5%
P	3.6	7.7	3.8	1.4	3.3	11.7	-1.8	-1.2	-1.5	1.0	0.6	0.0	-74	9%	-0.1	-0.3	-0.2	165	Top 5%
Q	1.4	2.9	1.2	0.3	-0.2	15.1	5.7	-1.2	-1.6	-1.7	3.9	3.0	-62	8%	-0.2	-0.3	-0.6	163	Top 5%
R	5.1	8.7	8.2	0.0	0.7	16.3	8.6	-1.3	-1.9	-6.0	9.4	1.9	17	-1%	-0.1	-0.3	-0.1	162	Top 5%
S	1.9	5.2	3.5	1.2	2.8	7.7	0.6	-1.0	-1.6	0.3	6.0	0.4	-55	13%	-0.2	-0.8	-0.2	160	Top 10%
T	1.5	7.0	6.8	1.0	1.8	-5.2	-5.2	-1.6	-2.0	-2.3	3.6	0.4	-64	6%	-0.6	-0.6	-0.2	158	Top 10%
Ave	**2.9**	**6.9**	**5.1**	**0.4**	**1.0**	**14.4**	**5.5**	**-1.4**	**-1.8**	**-4.2**	**9.3**	**0.8**	**-34**	**5%**	**-0.3**	**-0.4**	**-0.2**	**169**	

Table 2. Top 10 Sires, more than 100 progeny, ASBVs Yearling Fibre Diameter stronger than -1, Wrinkle less than -0.2, Dag less than -0.2, Breech Cover less than -0.2 listed in decreasing Dual Purpose Plus index order.

Sire	WWT	YWT	AWT	YFAT	YEMD	YGFW	AGFW	YFD	AFD	YCUR	YSL	ASS	YWEC	NLW	EBWR	EBCOV	LDAG	DP+	Index % ile
U	-1.1	-5.2	-5.0	0.3	-0.3	-16.3	-9.9	-2.4	-3.4	7.1	-4.1	0.6	-14	18%	-0.2	-0.1	-0.1	153	Top 1%
V	-2.7	-5.0	-6.0	0.6	1.0	-18.0	-12.0	-3.0	-3.0	7.2	-3.0	3.2	-34	0%	0.0	-0.1	0	150	Top 1%
W	3.7	11.0	13.1	-0.1	-0.4	-7.2	-14.5	-2.9	-3.8	6.1	3.6	-2.7	-16	6%	-0.4	-0.2	-0.4	146	Top 5%
X	1.0	0.3	-1.7	-1.3	-1.8	-1.2	-12.5	-3.8	-4.8	17.4	-4.7	-2.4	90	-1%	-0.2	0	-0.1	146	Top 5%
Y	-0.1	0.2	-2.0	0.4	0.1	-8.4	-16.0	-3.3	-4.4	14.9	-4.9	-2.6	-43	0%	0.0	0	0	145	Top 5%
Z	1.0	1.7	1.9	-0.4	-1.2	-3.9	-7.8	-2.6	-2.9	6.9	-2.9	-1.0	-49	4%	-0.2	-0.3	-0.1	145	Top 5%
AA	1.6	2.6	2.1	0.3	0.4	-6.4	-10.1	-2.5	-2.7	11.8	-1.8	4.1	-19	-2%	-0.1	0	0	144	Top 5%
AB	0.4	4.7	2.5	-0.3	0.7	-10.6	-16.8	-3.2	-3.5	11.5	0.2	-0.4	-12	4%	-0.1	-0.1	-0.1	142	Top 10%
AC	1.3	4.6	4.3	0.3	1.1	-16.3	-13.7	-2.6	-3.0	6.4	-4.3	1.8	7	6%	-0.3	-0.3	-0.3	141	Top 10%
AD	2.4	4.7	4.3	-0.6	0.1	-13.0	-11.7	-2.3	-2.9	17.6	-11.0	2.5	6	-3%	0.0	0	0	140	Top 10%
Ave	**0.8**	**2.0**	**1.4**	**-0.1**	**0.0**	**-10.1**	**-12.5**	**-2.9**	**-3.4**	**10.7**	**-3.3**	**0.3**	**-8**	**3%**	**-0.2**	**-0.1**	**-0.1**	**145**	

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