Impact of maize genetics on faecal starch losses and milk production

Topic Sheet

P7034 – the first early flowering Dent hybrid to be fully adapted to the UK growing conditions and meet the M³ advancement criteria.

For years livestock farmers have commented that maize silage feeds better when it has been in the clamp for 3 or more months. This is because flint hybrids have a higher proportion of vitreous starch, densely bound in a protein matrix which makes it less readily available for the first 3 months. Ruminal starch digestion increases over time in fermented storage due to bacterial action solubilizing the zein proteins that surround starch granules.

After 3 months in the silage pit, activity within the clamp breaks down the protein matrix explaining why flint type maize silage feeds better after 3 months.

Dent starch is high in soft, floury endosperm and is more readily broken down in the rumen than the hard, vitreous endosperm of flint starch. This means it is significantly more available in the first 3 months of ensiling. Another benefit of the soft, floury genetics is a significant reduction in feacal starch losses.

4 years of data from 33 trial sites up until 2021, on both favorable and less favorable locations plus 000's of hectares grown commercially, clearly show that in terms of maturity, yield and starch content P7034 is fully adapted to all but the least favourable sites in the UK.

Whole plant forage, less favourable sites, 2018 - 2021

Number of Years Tested	Number of Sites	Fresh Yield (t/ha)	Dry Matter (%)	Hybrid	Yield (Tonnes Dry Matter/Hectare)	Whole Plant Digestibility (%)	Starch Yield Converted to Grain at 15% Moisture (t/ha)	Dry Matter Yield Advantage / Disadvantage vs Control (%)
4	33	40.344	38.8%	P7034	36.5% 3% 100%	71%	8.752	0%
4	33	38.735	38.9%	ambition*	36.4% 3% 96%	72%	8.387	-4%
1	9	34.393	42.5%	calvini kws*	32.6% 3% 93%	70%	7.278	-7%
4	31	36.444	39.9%	glory*	36.0% 3% 93%	71%	7.994	-7%

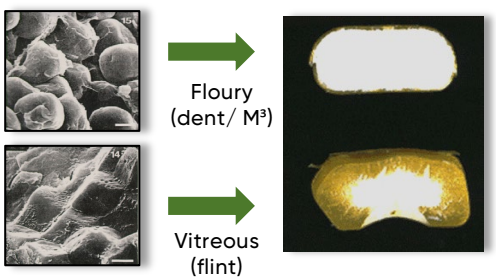
** = competitor hybrid*

PACTs results show that P7034 delivers, on average, well over 80% rumen degradable starch at harvest.

Planning feed out:
As maize silage ages in the clamp, the products of fermentation break down more starch and differences in degradability become less significant. Farmers are therefore recommended to harvest dent hybrids last, so they are the first silage fed out of the clamp to capture their starch degradability advantage.

Kernel basics: floury (dent/M³) vs. vitreous (flint) endosperm

Shown are post-black layer kernels (grain harvesting maturity).



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Less Favourable PACTS® Sites 2018-2021				
Hybrid	Rumen Degradable Starch Analyses			
	Sites Tested	Years Tested	Pioneer Relative Rumen Degradable Starch Content (%)	Pioneer Relative Rumen Degradable Starch Yield; Tonnes Dry Matter / Hectare
P7034	27	4	85.5%	4.890
glory*	27	4	67.6%	3.535
ambition*	30	4	67.6%	3.707
calvini kws*	9	1	65.8%	3.130

** = competitor hybrid*

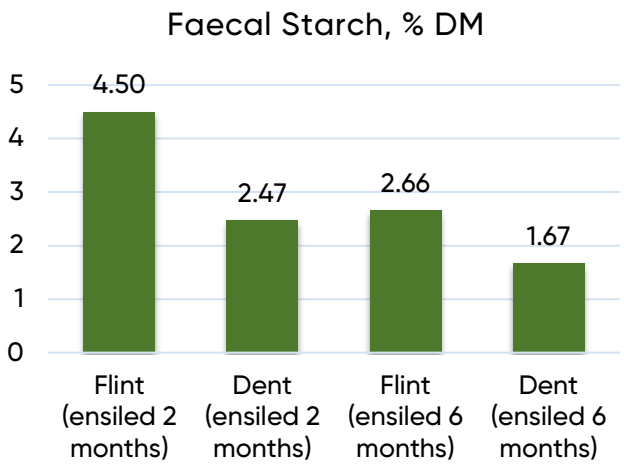
Genetic advantages of M³ starch
When feeding dairy or beef cattle, M³ genetics provide a significant nutritional advantage which is increased starch ruminal degradability.

Dent starch is high in soft-floury endosperm and is more readily broken down in the rumen than the hard, vitreous endosperm of flint starch.

Faecal starch losses
- Starch that is not broken down and digested in the rumen or hindgut will pass through the cow to be excreted in the faeces
- Nutritionally, this is an expensive loss indicating poor utilization, nutrient losses and wasted energy
- Ideally, residual starch in faecal samples should be less than 5%, but ideally less than 3%

Source: Progressive Dairy, 11th Oct 2011-Faecal starch analysis: a closer look (Jon Urness)

Faecal starch content by lactating cows fed flint or dent maize silage stored two or six months prior to feeding (genetic type P<0.01 and storage time P<0.01), as per table below:



Source: 2015 French Dairy Trial, University of Lorraine Laflotte, A, L. Aubry, B. Mahanna and F. Owens. Proceedings 2016 JAM Meeting Abstract 15902, Salt Lake City, July 2016

Faecal starch losses
Studies have shown that in the first 2 months of ensiling, Dent hybrids demonstrate a 2% reduction in faecal starch losses compared to typical Flint hybrids. There is still a 1% difference 6 months after ensiling with the advantage to the dent type genetics.

Source: Dairy Performance, 29th September 2011- Getting the rest of the story on fecal starch

Poor starch digestion can reduce milk production. With each 1% increase in faecal starch, milk yield can be reduced by 0.72 lb/cow (0.35 l /cow).

Source: Dr James D. Ferguson, BA, MS VMD
Prof. Emeritus, University of Pennsylvania
American College of Veterinary Nutritionists

The value of the extra milk and liveweight grain produced from dent hybrids compared with flints. Based on the following information:
- Dent hybrids show 2% reduction in faecal starch loss vs. Flint *(Laflotte, A, L., et al July 2016)*
- Each 1% reduction in faecal starch equates to an extra 0.35 L milk/ day *(Ferguson, J.D. 2003)*
- The 2% reduction in faecal starch with Dent hybrids x 0.35 L / day = + 0.7 L /cow/day
- Typical forage intake is 30 kgs maize silage/cow/day so 33 cows eat 1 T of maize silage/day + 0.7 L / cow / day x 33 cows = + 23 L milk / tonne maize silage
- 48p / L for milk x 23 L of milk / tonne of maize silage = + £11.00 worth of milk / T of Dent silage
- NB The energy required to produce 23l of milk equates to approximately 3.5kg of liveweight gain
- Assuming 15 T of maize / acre the advantage of Dent maize is 15 T x £7.36/ T = + £250 / acre
- After ensiling for 2 months, the benefit of dents over flint is worth £250/ acre
- Six months after ensiling, the benefit is reduced but still worth £125 / acre

Spencer Mogridge - Thornton Farm, Sturminster Newton, Dorset

*" The fat and protein content of the milk went up when we started feeding P7034 - the butterfat up from 4.2 to 4.6% and the protein up 0.2 – 0.3%. That is worth half a pence a litre" ***

* Saving worth £170 / day
** Worth £45 / cow per year (£8,500 for the herd)

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