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GRASS SILAGE 2020

EARLY SEASON MINERAL PROFILE

- MACRO-MINERALS SIMILAR OVER PAST 3 YEARS EXCEPT FOR ELECTROLYTES
- ELECTROLYTE ELEMENTS REPORT LOWER POTASSIUM (-5%), BUT HIGHER SODIUM (+11%)
- CATION-ANION BALANCE DECLINES (-11%) TO +376 meq/kg, BUT RISK TO HYPOCALCAEMIA REMAINS HIGH
- TRACE ELEMENTS GENERALLY HIGHER THAN LAST YEAR, REFLECTING LOWER GRASS YIELDS
- SOIL CONTAMINATION SUBSTANTIALLY HIGHER (+38%), DUE TO LESS FAVOURABLE WEATHER AT GRASS HARVESTING
- MOLYBDENUM INCREASES (+10%) FROM LAST YEARS LOWS. AGAIN WEATHER RELATED
- HYPOCALCAEMIA RISK SLIGHTLY LOWER, BUT ANTAGONISTIC CHALLENGE TO COW FERTILITY AND HEALTH INCREASED

Background

What a difference a year makes when it comes to weather! 2019 was an almost perfect year for growing grass with a warm spring supported by above average rainfall. While 2020 continued the trend of above average monthly temperatures between January and June (+1.2° C) compared to the long term average (1981-2000), rainfall patterns oscillated between flooding and drought. February was particularly wet and stormy, recording 237% of average rainfall. Three named storms roared through these islands during the month. Overall, the past winter was the 5th mildest and wettest since the mid-1800s. As a result, grass continued to grow through the winter, but putting spring calving cows out to grass was challenging and in many cases, impossible. After the deluge in February came the inevitable drought through March to May when rainfall was 56% of the long-term average. Grass growth rates collapsed with disruption to rotational grazing and silage covers. Indeed, through April and May, grass daily DM yields only averaged around 40kg/ha compared to the long-term average of 70kg. This had serious consequences for 1st cut silage yields with harvesting taken earlier as stressed grass encouraged heading.

The wet winter also resulted in a depletion of soil nutrients and while slurry and fertiliser applications occurred through a drier March, there was often insufficient rainfall for nutrients to be washed into soil. Grass pattern levels suffered as a result, although reduced growth rates did mitigate this effect. Following the climate challenges earlier in the year, the conditions for grass growth have generally been ideal with slightly warmer temperatures and regular deposits of above average rainfall. Cumulative grass DM yield has recovered well with 2020 on track for being an average year; a situation which seemed unlikely in April and May. The following comments report our initial findings on the mineral composition of 1st cut silage for this season.

• Macro Minerals

Macro-minerals, of which there are 7, (Calcium, Phosphorous, Magnesium, Potassium, Sodium, Chloride and Sulphur) have multiple roles in the cows physiology. For those elements essential for skeletal development and milk production (Calcium, Phosphorous) and energy utilisation (Phosphorous, Magnesium) mean values over the past 3 years have been very consistent. Against a background of fluctuating climate conditions, this pattern suggests the concentration of these minerals is more dependent on soil chemistry then vegetative growth stages, particularly through the peak growing season. Furthermore, they are less prone to leaching by high winter rainfall due to their relatively low solubility. In contrast, electrolyte elements (Potassium, Sodium, Chloride) which control the physiological conditions within which metabolism occurs , are very soluble and are more likely to reflect available soil levels, as influenced by slurry and spring fertiliser applications. In this scenario winter and spring weather patterns would have a significant effect on residual nutrient carryover from the previous year and subsequent spring availability. During the early challenging months of 2020 the combination of high winter rainfall followed by drought would be expected to be disruptive to electrolyte minerals in general and Potassium, in particular, due to its dominant position. However, Potassium is also influenced by its inverse relationship with Sodium, which appears to which is becoming progressively more apparent, as the positive effect on feeding Salt on cow health is being re-discovered. Finally, within the macro-mineral group, Sulphur has reported the same mean value for the third consecutive year. A balance appears to have been achieved between Sulphur fertiliser inputs and losses due to leaching during periods of high winter rainfall and crop removal.

Mean Monthly Deviation from Long Term Average (1981-2010)

		Temperature °C	Rainfall %	Sunshine %	
January 2019	Warm Spring	+2.0	100	94	
February	Warm Spring	+1.4	237	104	Deluge
March	Warm Spring	+0.1	82	134	Deluge
April	Normal Temp	+1.7	40	151	Drought
May	Normal Temp	+1.0	47	143	Drought
June	Normal Temp	+1.0	144	97	Drought
July	Normal Temp	-0.8	122	83	Wet
August	Normal Temp	+1.0	135	88	Wet

Data obtained from Met Office, Climate Summaries

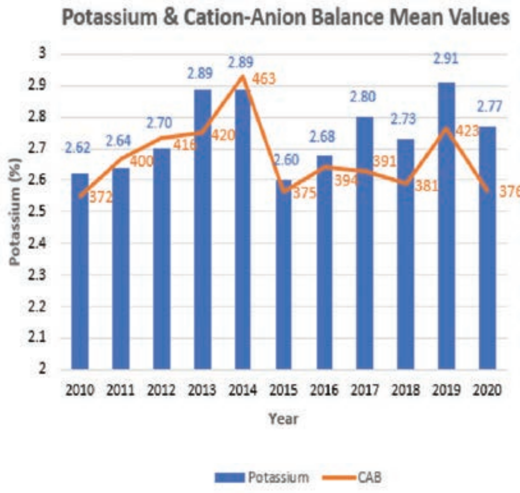
Macro-Minerals Mean Concentration (% DM)

Element	2018	2019	2020	% Difference 2020 v 2019
Calcium	0.61	0.61	0.62	—-
Phosphorus	0.35	0.35	0.34	—-
Magnesium	0.19	0.18	0.19	—-
Potassium	2.73	2.91	2.77	-5
Sodium	0.25	0.28	0.31	+11
Chloride	0.98	1.04	1.12	+8
Sulphur	0.24	0.24	0.24	—-
CAB meq/kg	+381	+423	+376	-11

• Potassium and CAB

Potassium fluctuates widely in grass under the influence of vegetative growth and available soil levels as determined by winter rainfall. This season's mean value of 2.77% is 5% lower than 2019, but very close to the long term average of 2.75%. This is not a surprising result given the weather patterns earlier in the growing season.

Over the last 10 years mean Potassium values have been on a "roller coaster". A progressive increase was evident between 2010-2014, followed by a marked decline, in 2015, which has been reversed in more recent years, albeit in an erratic manner. This pattern is due to 4 key influencing factors;



1. Potash fertiliser "holiday" adopted as a cost cutting exercise. Furthermore, increased soil testing for nutrient management, farm assurance and regulatory purposes has undoubtedly provided more data on which to base the need for chemical fertiliser applications.
2. Increasing volatile winter and spring weather patterns as the decade has progressed, that has had a direct impact on vegetative growth and available soil levels. Clearly, this has been a factor in determining this season's Potassium status.
3. Increased focus on re-seeding pastures with grass and clover mixtures, to reduce the need for chemical Nitrogen, which more recently has extended to multi-species mixtures. Legumes generally contain about 30% more Potassium than PRG. This trend in re-seeding practice is likely to accelerate under the influence of Nitrate Derogation Regulations.
4. The inverse relationship between Potassium and Sodium has already been referred to. Although Potassium is generally x10 higher than Sodium, the increased use of Salt to improve pasture palatability and health, particularly in winter housed cattle has resulted in higher Sodium levels in slurry. The 11% increase in Sodium in this year's data is partly due to a contribution from Salt, but also an opportunity to replace a depressed Potassium content following adverse weather patterns.

• CAB

Cation-Anion Balance (CAB) is highly influenced and dependent on Potassium. As a result, CAB follows the previously described Potassium trends. This season's Potassium value is translated into a corresponding high CAB value of +376 meq/kg, which reverts to the value last reported in 2015. As such it is at the lower end of the range for the past 6 years. However, the risk of hypocalcaemia remains high, although slightly lower than last year. Grass silage CAB values are the single largest contributor to the total dietary Cation-Anion Balance (DCAB).

The majority of TMRS will be calculated within the target range of +200 to +400 meq/DM for milking cows and the value in this season's silage crop will make it difficult to achieve a DCAB of less than +100 meq/kg DM for dry cow diets. For close up or Transition diets for average to high yielding herds the challenge is greater to achieve a DCAB of around zero to –50 for a partial anionic diet and less than –100 meq/kg DM for a full anionic diet. Failure to achieve these DCAB targets will increase the risk of hypocalcaemia which includes:

Nutrient Management Planning based on soil analysis and grass production targets is an essential tool to developing a more balanced and sustainable approach to Potassium supply from slurry and fertiliser. This year the average Potassium supply level of 2.77% is 11% above the 2.50% target for optimal grass vegetative growth. Excess Potassium has the potential to disrupt electrolyte balance, which will adversely impact water balance. In addition, increased pressure on Magnesium, which is essential for cow health occurs. These aspects are exaggerated in the dry cow, where excess Potassium increases metabolic alkalinity and the risk of hypocalcaemia.

The occurrence of Sub-Clinical Hypocalcaemia is widespread and will inevitably depress milk production, fertility and health in the forthcoming lactation. Consequently, it is a key action point to analyse grass silage for minerals from which a Cation-Anion Balance can be calculated. This can then be used in balancing pre-calver diets with the purpose of minimising hypocalcaemia.

- Retained cleansings
- Uterine infections
- Displaced abomasum
- Depressed Dry Matter intake
- Poor milk initiation
- Ketosis
- Milk Fever

• Sulphur

Sulphur is an essential macro-element for grass growth and in combination with Nitrogen is important for protein production. Like Nitrogen, Sulphur is mobile in soils, particularly light soils, and needs to be applied annually. The significant atmospheric deposition of Sulphur from coal the fired industry has long gone, and the reliance of fertiliser inputs including slurry is critical. The fertiliser industry has long campaigned for Sulphur to be included in Nitrogen based fertilisers and this policy appears to be paying off, as since 2010 the mean grass silage Sulphur level has increased from 0.19% to 0.24% (a 26% increase). This rise in forage Sulphur levels is equivalent to a 4% unit increase in grass protein levels, which represents a significant reduction on the requirement for imported protein feeds.

However, caution must be flagged up at over-supplying fertiliser Sulphur, for while the mean value remains constant at 0.24%, the dataset is variable with a significant minority over 0.30% at which point antagonism to Copper and Selenium kicks in, and a few samples in excess of 0.40%, which is considered to be the threshold for Sulphur toxicity. The primary disease of Sulphur toxicity is Polioencephalomalacia (PEM), which is more prevalent in young cattle and sheep and is similar in pathology to CCN (Cerebrocortical necrosis). Grass analysis in late March/ early April, prior to a 2nd rotation, represents the most sensitive indicator of Sulphur status, from which decisions on fertiliser applications can be made.

• Trace Elements

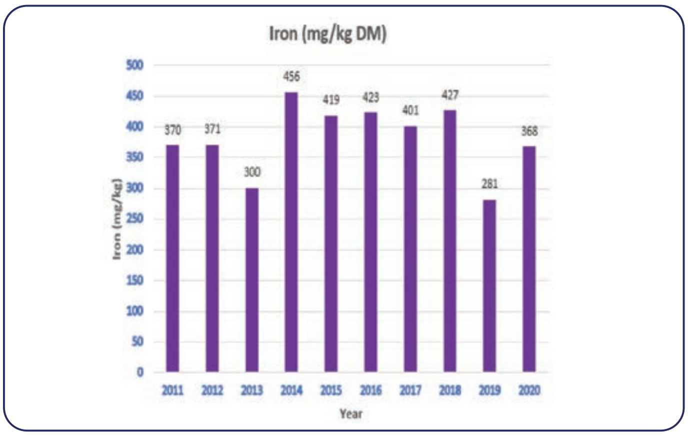
Trace element values have bounced back from the reduced levels reported last year, when higher grass yields diluted element concentrations. The reverse pattern is the case this season where, under the influence of adverse weather conditions, yields are substantially reduced.

	Mean Trace Element Values (mg/kg DM)			% Difference 2020 v 2019
Element	**2018**	**2019**	**2020**	
Manganese	106	94	104	+10
Copper	7.5	7.4	8.1	+9
Zinc	30.1	29.5	31.7	+7
Cobalt	0.25	0.23	0.23	—
Iodine	0.49	0.24	0.30	+25
Selenium	0.09	0.09	0.11	+22
Boron	7.5	6.2	7.3	+18
Iron	427	281	368	+31
Aluminium	156	119	180	+51
Molybdenum	1.91	1.55	1.71	+10
Lead	0.76	0.63	0.52	- 17

This trend is particularly noticeable for Iron (+31%) and Aluminium (+51%) due to higher rates of soil contamination, again weather related. Molybdenum is also higher (+10%) as a result of water logged soils creating the ideal anaerobic soil conditions to encourage Molybdenum uptake. Essential trace elements reported higher mean concentrations ranging from Zinc (+7%) to Iodine (+25%), again influenced by lower DM yields.

• Iron

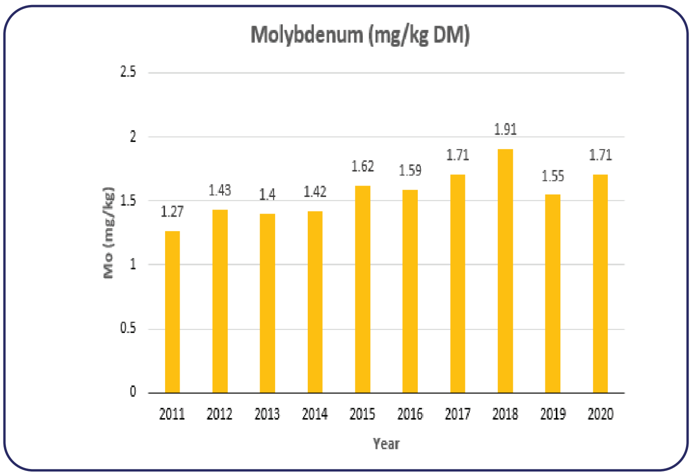
As soil contamination is the main driver for Iron, weather patterns around harvesting exert a major influence on silage levels. Not surprisingly, mean Iron values have fluctuated widely over the past 10 years with mean annual values exceeding 400mg/kg in the period 2014-2018. Last year the reported mean of 281 mg/kg was the lowest for a decade due to the almost perfect harvesting conditions in May and June. This year mean Iron is reported at 368mg/kg, which is close to the 10 year mean of 382mg/kg. While adverse spring weather conditions are the major determinant for soil contamination and associated Iron, it should not be forgotten that a significant proportion of Iron results from root absorption, which is not influenced by soil contamination. Grass is an unusual plant in that it tolerates high Iron concentrations that would kill many broad leafed plants. Hence the use of Ferrous Sulphate on golf courses to control weeds and moss.



A key contributory factor to Iron levels in grass is compaction, which renders soils anaerobic and increases the solubility of Iron, thereby raising root absorption. With livestock dietary Iron requirement reported at between 50-100mg/kg DM, the levels found in grass silage are clearly well in excess of animal needs. A combination of minimising soil contamination at harvest, and reducing soil compaction through the introduction of a soil improvement plan will help to arrest, and hopefully reduce, forage Iron concentration. High Iron intakes are a risk to the absorption of related cations (Manganese, Zinc and Copper) and consequently represents a risk to cow health and fertility. In addition, published research demonstrates that within silage clamps Iron contributed by soil contamination becomes solubilised which makes it more reactive and oxidative. In this highly active form, Iron will readily bind with Copper and Sulphur in the rumen to form insoluble Iron-Copper Sulphides, thereby reducing Copper availability and increasing the dietary requirement. In addition, reactive Iron will increase oxidative stress in cattle to the detriment of health and productivity.
To limit damage, check forage Iron levels and use the data to estimate total dietary levels, which can be used to determine the risk to cow health.

• Molybdenum

As Molybdenum concentrations in grass are very sensitive to soil moisture and oxygen levels, it is inevitable that the mean value has increased this season, back to the 2017 mean (1.71 mg/kg). Over the past 3 years, Molybdenum values have gyrated between a high of 1.91mg/kg in 2018, which was an exceptionally wet season, and a low of 1.55 mg/kg last year when weather conditions were more



favourable.
Of all the elements, Molybdenum is the most sensitive to anaerobic soil conditions. In well-aerated soils, Molybdenum is oxidised which renders it insoluble, thereby making it difficult for plants to absorb through the roots. Once air is excluded from soils by compaction, the chemistry of Molybdenum changes, which makes it more soluble and available for root absorption. In addition, soil pH and Sulphur also play a role in either stimulating or suppressing Molybdenum uptake by grass. Having a knowledge of the mineral composition of both soil and grass is a pre-requisite to developing a soil improvement programme designed to reduce forage Molybdenum levels.

Molybdenum is well recognised as a Copper antagonist which reduces the availability of this essential element through the formation of insoluble compounds. An increased dietary Copper requirement results. The antagonism from Iron and Molybdenum on Copper availability requires additional Copper in a mineral supplement, to overcome the combined suppression of these antagonists. While recognition of the antagonistic challenge to Copper availability in the forthcoming winter season is important, the longer term strategy to reduce both Iron and Molybdenum lies in both soil improvement and practical actions at grass harvesting. Actions based on analytical information are also important to prevent both Copper toxicity and the more prevalent and economically damaging Copper deficiency diseases.

• Forage Mineral Reports

SAMPLE TYPE	Grass Silage	FARMER	Mean of 415 samples
SAMPLE REF	2020	FIELD ID	1st cut 2020
DISTRIBUTOR	Thomson & Joseph Ltd.	POST CODE	
DISTRIBUTOR'S REF		DATE	

Dry Matter 37.8%

MINERAL ELEMENT (DM BASIS)			ASSAY	VERY LOW	LOW	MEAN	HIGH	VERY HIGH
Calcium	Ca	%	0.62	0.3	0.5	0.6	0.7	0.9
Phosphorus	P	%	0.34	0.2	0.3	0.35	0.4	0.55
Magnesium	Mg	%	0.19	0.1	0.15	0.2	0.25	0.4
Potassium	K	%	2.77	0.5	1.5	2	2.5	5
Sodium	Na	%	0.31	0.1	0.2	0.25	0.3	0.4
Chloride	Cl	%	1.12	0.3	0.6	1	1.4	2
Sulphur	S	%	0.24	0.1	0.15	0.2	0.25	0.4
Cation-Anion Balance		meq/kg	376	50	100	200	300	500
Manganese	Mn	mg/kg	104	50	75	100	125	200
Copper	Cu	mg/kg	8.1	5	8	10	12	15
Zinc	Zn	mg/kg	31.7	25	40	60	80	130
Cobalt	Co	mg/kg	0.23	0.1	0.2	0.25	0.3	0.4
Iodine	I	mg/kg	0.30	0.25	0.5	1	1.5	2
Selenium	Se	mg/kg	0.11	0.05	0.1	0.15	0.2	0.25
Boron	B	mg/kg	7.3	1	2	4	6	10
Iron	Fe	mg/kg	368	50	100	150	200	350
Aluminium	Al	mg/kg	180	25	50	100	150	300
Molybdenum	Mo	mg/kg	1.71	0.1	0.35	0.8	1.25	2
Lead	Pb	mg/kg	0.52	1	2	2.5	3	10
Relative Copper Antagonism								
Soil Contamination Index								

	Forage Year	2018	2019	2020	% Difference 2020 v 2019
	No. of Samples	319	384	415	
Dry Matter	%	33.3	33.0	37.8	—
Calcium	%	0.61	0.61	0.62	—
Phosphorus	%	0.35	0.35	0.34	—
Magnesium	%	0.19	0.18	0.19	—
Potassium	%	2.73	2.91	2.77	-5
Sodium	%	0.25	0.28	0.31	+11
Chloride	%	0.98	1.04	1.12	+8
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CAB meq/kg		+381	+423	+376	-11
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Aluminium	mg/kg	156	119	180	+51
Molybdenum	mg/kg	1.91	1.55	1.71	+10
Lead	mg/kg	0.76	0.63	0.52	-17
Relative Copper Antagonism		High	High	High	—
Soil Contamination—Titanium	mg/kg	8.1	6.5	9.0	+38

Data covers the period 1st June to 14th September.
Results are expressed on a Dry Matter basis.

Ask for Headstart Precalver Code 1270

Fe Iron **K** Potassium **Mo** Molybdenum

Potassium and Sodium levels are high this year which can lead to higher incidence of hypocalcaemia. A high Magnesium Precalver, such as Headstart Vet Tech (code 1270) would be important. Iron levels are high so antioxidants such as Vitamins A,D & E are important this year. Molybdenum is also high so a good level of chelated copper is needed. Check your minerals and speak to our nutritionist in your area.

Ask your local Inform Nutrition Ireland Nutritionist for further details

- **Kevin Conroy - Connacht -** 083 159 1892 - kevin@informnutrition.com
- **Liam Lacey - Leinster -** 086 770 2570 - liam@informnutrition.com
- **Howard Pearson - National -** 086 8550759 - howard@informnutrition.com
- **Sam Sweetnam - Munster -** 086 043 7153 - sam@mervuelab.com
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