

Purple patch

TEAGASC research has contributed to recommendations on iodine supplementation in the Irish dairy industry.

Grass grown in Ireland is generally deficient in iodine, but excessive supplementation with iodine results in excessive iodine concentrations in milk. A recent industry-wide initiative to reassess the iodine nutrition of lactating dairy cows is having a beneficial effect on milk iodine concentrations.

Iodine

Iodine is an essential trace element for both humans and animals. The only known roles of iodine are related to its incorporation into the thyroid hormones, thyroxine (T4) and triiodothyronine (T3). These hormones control oxidation rate and protein synthesis in all cells, and hence regulate the rate of energy metabolism in the body. Approximately 80-90% of dietary iodine is absorbed, and most of the iodine not taken up by the thyroid gland is ultimately excreted in urine and milk.

Deficiency symptoms

Clinical iodine deficiency results in goitre (enlargement of the thyroid gland), which is easily recognised and is specific for iodine deficiency.

The first indicator of iodine deficiency in a herd is goitre in newborn calves. Iodine deficiency may also result in hairless, weak or dead calves, reduced reproductive performance marked by irregular oestrous cycles, poor conception rates, abortions and retained placenta.

Toxicity symptoms

The upper limit for iodine tolerance in cattle is 50mg/kg DMI. Exposure to excess iodine results in hypothyroidism, because of response inhibition of triiodothyronine synthesis. Nasal discharge, conjunctivitis, coughing, hair loss and dermatitis have been observed following excessive iodine consumption for prolonged periods (years).

Recommendations for iodine intake

International dairy cattle mineral nutrition reference literature indicates that the dietary iodine requirements for lactating dairy cattle are similar in both confinement (USA, UK) and pasture-

based systems (New Zealand; **Table 1**). Rogers and Gately (1998) recommended that dairy cows (dry or lactating) are supplemented with 12-60mg/cow per day, with 12mg meeting the requirements of most animals where supplementation is needed, and that any increase in supplement above 12mg is only required in animals diagnosed with severe deficiency.

Iodine in the diet of Irish dairy cows

Iodine intake in grazed grass and in the total diet was assessed in a Teagasc survey of seasonal variation in mineral nutrition on 44 dairy farms conducted during the 2013 grazing season across the main dairy regions of Ireland (**Figure 1**). On average, a pasture-only diet would have provided 0.25mg iodine per kg DM (range: 0.04-0.98mg).

Based on the National Research Council guideline of 0.5mg/kg DM, a pasture-only diet would have provided 50% (range: 8-190%) of the lactating cow iodine requirements. Of the grass samples analysed, 87% contained less than 0.5mg iodine per kg DM. Hence, supplemental iodine is necessary for the majority of pasture-based cows in Ireland.

While grass was iodine deficient in the 2013 survey, the total diet supply of iodine was generally excessive. When concentrate supplements were fed (especially during March and May), iodine was generally over-supplied in the total diet, with average estimated intakes exceeding 400% of requirements.

Implications of excess iodine on milk iodine concentrations

Iodine toxicity is especially important for newborn infants, who are more sensitive to it because of an immature thyroid gland. Infant milk formula (IMF) is a key market for the growing Irish dairy industry, but milk produced when cows are fed surplus iodine in supplemental concentrate is generally unsuitable for inclusion in IMF.

Iodine concentrations in raw milk (bulk tank) should be maintained between 20 and 150µg/kg. This ensures that cows are maintained in adequate iodine status, and that the milk produced is safe for a diverse product portfolio.

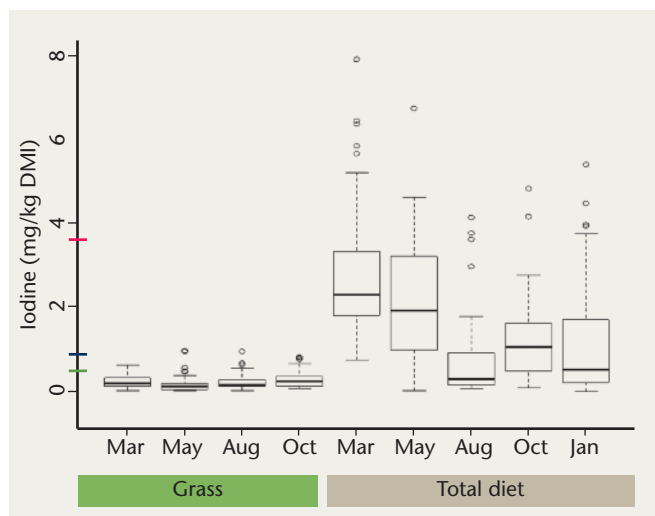


FIGURE 1: Grass iodine content and total iodine intake (mg/kg DM) at five time points in March, May, August and October 2013, and January 2014 (total only). The National Research Council (2001) recommendation is 0.5mg iodine/kg DM for lactating cows (indicated by the green bar on the y-axis). The current Irish recommended lower (12mg/day) and upper (60mg/day) iodine supplementation rates equate to 0.9mg/kg DMI and 3.63mg/kg DMI (blue and red bar on the y-axis, respectively).

Reassessment of Irish recommendations

Until spring 2017, the animal compound feed industry in Ireland had adopted using 60mg iodine per day as the ‘normal’ supplementation rate rather than 12mg iodine per day as originally recommended. In January 2017, all manufacturers of compound feed in Ireland were requested to revert to the recommended rate of 12mg/d. In Moorepark research herds, supplemental iodine intake and milk iodine concentrations measured in September 2017 are illustrated in **Figure 2**. Herd 1 and Herd 2 were receiving close to the target iodine supplementation rate (dashed red line), but Herd 3 was receiving surplus supplemental iodine. Consequently, the bulk tank milk for Herd 1 and Herd 2 was well below the upper limit for milk iodine concentration (dashed blue line), but Herd 3 was exceeding the upper limit. The results clearly indicate that it is feasible to maintain milk iodine concentration at between 20 and 150µg/kg by providing approximately 12mg iodine per day. Initial feedback from processors in 2017 indicates that the iodine specifications for the IMF market have been easier to achieve than in previous years, reflecting the prompt changes to the iodine inclusion rate implemented by the majority of feed manufacturers in line with Teagasc guidelines. Co-operation from dairy farmers, the feed industry, dairy nutritionists and veterinarians is required to continue using the recommended 12mg per day of iodine, facilitating profitable and sustainable growth of the Irish dairy industry.

Acknowledgments

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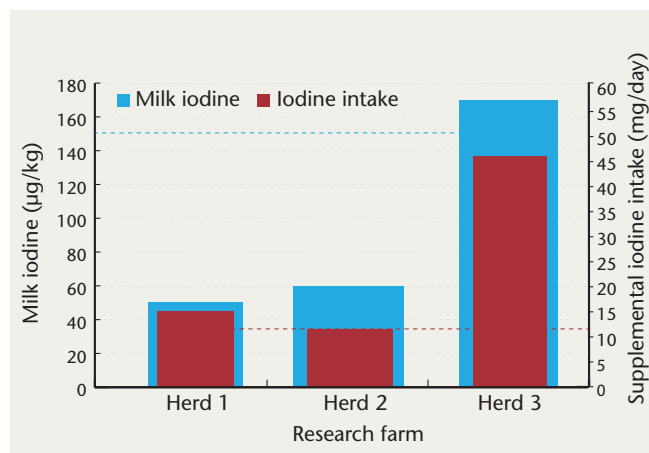


FIGURE 2: Supplemental iodine intake and bulk tank milk iodine concentrations in three research herds during September 2017.

Table 1: Summary of the recommended iodine requirements in lactating cows in different countries.

Country	Iodine requirement (mg/kg DMI)
USA, ¹ UK	0.5
Germany ²	0.5
New Zealand ³	0.5
Ireland ⁴	0.9 to 3.6

References

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