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UNIVERSITET
DCA - NATIONALT CENTER FOR FØDEVARER OG JORDBRUG

Til Fødevarestyrelsen

Vedr. bestillingen: ”Risikovurdering af meldrøjer i korn til foderbrug”

DCA - Nationalt Center for Fødevarer og Jordbrug

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Specialkonsulent

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Fødevarestyrelsen har i en bestilling dateret d. 30. marts 2015 bedt DCA – Nationalt Center for Fødevarer og Jordbrug om at udarbejde et notat indeholdende en vurdering af de dyresundhedsmæssige konsekvenser hvis dyr tildeles foder, der indeholder op til 1500 mg meldrøjer pr kg foder. Notatet, der følger nedenfor, er udarbejdet af lektor Jan Værum Nørgaard, Institut for Husdyrvidenskab, Aarhus Universitet.

Besvarelsen er udarbejdet som led i ”Aftale mellem Aarhus Universitet og Fødevareministeriet om udførelse af forskningsbaseret myndighedsbetjening m.v. ved Aarhus Universitet, DCA – Nationalt Center for Fødevarer og Jordbrug, 2016-2019”.

Venlig hilsen

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Meldrøjer i foder til husdyr

Af Jan Værum Nørgaard, Institut for Husdyrvidenskab

Der er i litteraturen enighed om, at foder med meldrøjer er skadelige for husdyr (Klotz, 2015). Der er kun lavet enkelte dosis-respons studier med fodring af stigende mængder af meldrøjer til husdyr. De toksiske stoffer i meldrøjer er alkaloider, hvoraf ergometrin, ergotamin, ergocornin, ergocryptin og ergocristin samt disses isomerer er de væsentlige. Meldrøjer har et meget varierende indhold af alkaloider, og studier på rug fra forskellige lokaliteter har vist indhold fra 24 til 1569 mg total alkaloid per kg meldrøje tørstof (Mainka et al, 2007). På grund af den store variation af aktivstoffer i meldrøjer har videnskabelige studier ofte fokuseret på niveauet af alkaloider fremfor indholdet af meldrøjer som sådan.

Den centrale problemstilling omkring 50% usikkerhed i analysen for meldrøjer bør ses i relation til meldrøjernes meget varierende indhold af alkaloiderne. Der er i litteraturen en generel opfattelse af, at bestemmelsen af meldrøjer i uformalet korn på vægtbasis er uhensigtsmæssigt, og at alene koncentrationen af alkaloider i færdigfoderet bør tages i betragtning. Analysemetoder til bestemmelse af alkaloid indhold i meldrøjer er angivet af Strickland et al. (2011) og omfatter Elisa og HPLC-MS metoder. Det vil være interessant, at fremadrettede analyser af meldrøjer suppleres med analyser for alkaloider med sigte på hel eller delvist erstatning af den nuværende analysemetode.

MacLachlan et al. (2013) har gennemgået litteraturen for meldrøjer med det formål at anbefale maksimumgrænser for meldrøjer i foder til australsk husdyrproduktion. En af konklusionerne er, at arterne har forskellige tolerance overfor meldrøjer, hvor rækkefølgen for stigende tolerance er kvæg < unge grise < ældre grise < fjerkræ.

Uddrag fra review af MacLachlan et al. (2013) om blandt andet meldrøjer:

‘Ergot alkaloids affect animal production and setting of guidance levels for ergot and ergot alkaloids in stock foods is justified on this basis. Ruminants appear to be more sensitive to the effects of ergot than monogastric animals. The threshold tolerance of cattle and sheep for ergot alkaloids is not clear. In the few Australian cases of livestock poisoning severe hyperthermia was observed in ruminants fed 1–3 mg alkaloids/kg. To avoid severe poisoning it was suggested (Blaney *et al*. 2009) that the total alkaloid content of feed should be restricted to <0.4 mg/kg, which for sclerotia with an alkaloid content of ~0.2% equated to the existing 0.02% limit for ergot sclerotes in stock food in Queensland (Qld 1997).

In a study in Australia, Bourke (2003) produced hyperthermia in cattle fed at the estimated equivalent of 1 mg alkaloids/kg in feed. However, he concluded that stock exposure to sunlight appears to be a critical factor in a particularly lethal form of hyperthermia in cattle and sheep and that toxins other than ergot alkaloids could be involved such as the ergochromes (Franck 1969; Buchta and Cvak 1999). Bourke (2003) suggested that feed likely to contain rye ergot should be avoided for ruminant feed, particularly in feedlot rations. For practical purposes it is preferred to propose a low level rather than a zero tolerance and a level of 0.01% ergot sclerotia in the total diet of cattle, goats and sheep is proposed, with an equivalent alkaloid content limit of 0.2 mg/kg. This limit is lower than that

suggested by Blaney *et al*. (2009), and lower than current state regulations, but given the very low frequency of contamination of bulk grain in Australia, it appears achievable by industry and consistent with the principle of as-low-as-reasonably-achievable.

Pigs and poultry are a better option for use of lightly contaminated grain than ruminants apart from the serious risk of agalactia in sows fed ergot before farrowing, due to the inhibitory effects of ergot alkaloids on release of prolactin (Anderson and Werdin 1977; Kopinski *et al*. 2007). In one Canadian study (Dignean *et al*. 1986) milk production was not affected when sows were fed 0.2% rye ergot (4.5 mg alkaloids/kg of diet) from breeding until weaning, but the authors noted that their results were apparently at variance with other studies showing agalactia produced by lower ergot concentrations. Studies with sorghum ergot fed to sows before farrowing, found adverse effects on milk production at alkaloid concentrations of 1.4–7 mg/kg (Kopinski *et al*. 2007), but higher concentrations were tolerated after lactation had commenced (Kopinski *et al*. 2008*c*). Nevertheless a concentration of 0.02% rye ergot (0.4 mg alkaloids/kg) should provide an adequate safety margin for weaner and breeder pigs. The tolerance of non-lactating pigs is also not clear but a Canadian study (Oresanya *et al*. 2003) suggested maximum tolerances of 0.1% ergot (2 mg alkaloid/kg) and 0.05% based on growth rates and feed intakes respectively for weaner pigs (7–20 kg liveweight). Other studies have shown that grower and finisher pigs are more resistant and 10–15 mg/kg can be tolerated with only minor effects on feed intakes that can be masked with palatable ingredients (Whittemore *et al*. 1977; Mainka *et al*. 2005; Kopinski *et al*. 2008*a*, 2008*b*, 2008*c*). One Australian study (Bakau *et al*. 1988) found reductions in growth rate and feed intake of pigs fed 0.75% ergot (alkaloid content not reported), which were exacerbated by higher temperatures (35°C). On the basis of the above a level of 0.1% rye ergot (2 mg alkaloids/kg) is proposed for grower and finisher pigs.

Various studies have shown that chickens are tolerant of rye ergot at a concentration of 0.5%, but 1–5% progressively affects feed intake, feed conversion and growth rates (Rotter *et al*. 1985*a*, 1985*b*; Bakau and Bryden 1987). A guidance level for poultry of 0.2% rye ergot (4 mg alkaloids/kg) provides an additional safety margin. Guidance levels for rye ergot or total rye ergot alkaloids in the total diet are listed in Table 7 (vist i Tabel 1).

Tabel 1. Uddrag af Tabel 7 fra MacLachlan et al. (2013).

Rye ergots (rye ergot[B] or total rye ergot alkaloids[C] in the total diet)	Cattle, sheep, goats	200 (0.02%) as ergot qw	100 (0.01%) as ergot or 0.2 mg alkaloids/kg DM
	Weaner pigs, breeder pigs	200 (0.02%) as ergot qw	200 (0.02%) as ergot or 0.4 mg alkaloids/kg DM
	Grower pigs, finisher pigs	200 (0.02%) as ergot qw	1000 (0.1%) as ergot or 2 mg alkaloids/kg DM
	Poultry	200 (0.02%) as ergot qw	2000 (0.2%) as ergot or 4 mg alkaloids/kg DM
Ergot other than sorghum ergot	All species	200 (0.02%) as ergot qw	–
Sorghum ergot (sorghum ergot[D] or total sorghum ergot alkaloids[E] in the total diet)	Dairy and breeding cattle, goats, sheep	–	300 (0.03%) as ergot or 0.1 mg alkaloids/kg DM
	Non-breeding cattle, sheep, goats	–	1000 (0.1%) as ergot or 0.3 mg alkaloids/kg DM
	Weaner pigs, breeder pigs	–	1000 (0.1%) as ergot or 0.3 mg alkaloids/kg DM
	Grower pigs, finisher pigs	–	10 000 (1%) as ergot or 3 mg alkaloids/kg DM
	Poultry	–	20 000 (2%) as ergot or 6 mg alkaloids/kg DM
	All species	3000 (0.3%) as ergot qw	–

Som supplement til ovenstående review kan anføres, at smågrise ikke bør fodres med fuldfoder, der indeholder mere end 3,6 mg total meldrøje alkaloider/kg foder (Mainka et al., 2007), og for æglæggende høner er der fundet en tilsvarende koncentration på maksimalt 3,7 mg/kg foder (Dänicke, 2016). Under danske forhold er det fundet at 2.000 ppm meldrøjer tilsat en foderblanding til smågrise gav dårligere produktionsresultater end fodring med hhv. 0, 250, 500 og 1000 ppm meldrøjer (Hansen et al., 1993). Sidstnævnte forsøg illustrer kompleksiteten i grænseværdier for meldrøje, idet grænsen på 1.000 ppm

meldrøje i fx hel rug ikke nødvendigvis kan sidestilles med indholdet i det færdige foder, hvor der sjældent anvendes mere end 40% rug i en blanding, hvorved koncentrationen af meldrøjer fortyndes. I Danmark anbefales ud fra et forsigtighedssyn et maksimumindhold på 500 ppm meldrøjer i foderblandinger til smågrise og slagtesvin (Jørgensen, 2015), hvilket er på niveau med maksimumgrænsen for korn til fødevarer (Tabel 2).

Tabel 2. Maksimalt indhold af meldrøjer i forskellige lande og regioner (Belser-Ehrlich et al., 2013)

Region	Ergot limit in cereal grains (net wt%)	Ergot limit in animal feed (net wt%)	Other details
Australia and New Zealand	0.05	N/A	Triticale: 0%–0.1%
Canada	0–0.05	0.10–0.33	Varies with grade of wheat for each type of grain
European Union	0.05	0.10	–
Switzerland	0.02	N/A	0.05 limit on cereals destined for milling
Japan	0.04	N/A	–
United Kingdom	No tolerance	0.001	–
United States	0.3 (wheat and rye)	0.3 (wheat and rye)	0.1% for barley, oats, and triticale

Konklusion

Som konklusion kan anføres, at usikkerheden i analysen for meldrøjer synes af mindre betydning i forhold til den store variation i koncentrationen af de toksiske alkaloider i meldrøjer, råvarernes varierende iblandingsprocent samt den mangelfulde viden omkring husdyrenes tolerance overfor meldrøje alkaloider.

På baggrund af litteraturgennemgangen kunne det, som allerede nævnt, være interessant, at fremadrettede analyser af meldrøjer suppleres med analyser for alkaloider med sigte på hel eller delvist erstatning af den nuværende analysemetode.

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