Survey of tetraploid and diploid perennial pastures in the Waikato for number of spores produced by the fungus *Pithomyces chartarum*

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Introduction Facial eczema (FE) is a disease of livestock, caused by a toxin released into the bloodstream after digestion of spores of *Pithomyces chartarum,* a fungus residing in necrotic plant material in the base of pastures (di Menna & Bailey, 1973). Spore numbers tend to be highest in warm, humid conditions, where high post grazing residuals have lead to a build up of necrotic plant material. Tetraploid perennial ryegrass pastures tend to be more palatable, and with lower post gazing residuals, than equivalent diploid pastures; thus we hypothesised that spore numbers would be lower in tetraploid pastures. A survey of tetraploid and diploid pastures was carried out to investigate the relationship between FE spore numbers, and perennial ryegrass ploidy levels.

Material and methods Fifty pairs of diploid and tetraploid perennial ryegrass based pastures from 37 farms in the greater Waikato area were sampled for FE spores during March, April and May 2004. Eight cultivars were represented in the diploid pastures, while cv. Quartet (4 weeks later flowering than most of the diploid pastures) was the sole ryegrass in 84% of the tetraploid pastures, with 16% based on cv. Banquet. Both paddock and farm information was collected for sowing date, sown cultivars, soil type (silt/ash, sandy loam, clay, peat), soil fertility status (Olsen-P either <20 or $\geq$ 20) and stocking rate. Before each assessment, pasture cover (measured using a capacitance probe) and days since last grazing were recorded, and a grass sample was collected. FE spore numbers were assessed in a sub-sample (20-25 g) while a second (100 g) sub-sample was oven dried for 24 hours at 80°C to determine dry matter (DM) percentage. Data analyses used the Generalised Linear Mixed Model procedure of Genstat 7. Back transformed means are presented in this paper.

Results Average spore numbers in 2004 were below the long-term average, but higher spore counts were observed each month in diploid perennial ryegrass pastures relative to tetraploid pastures (Table 1). The largest difference was in April (P<0.05). Similarly pastures sown on clay soils contained consistently more FE spores than pastures on the other three soil types, the difference being significant compared to the other three soil types in March, but only compared to ash/silt soil in April (P<0.05). In April, pastures on peat soils contained more (P<0.05) spores than those on ash/silt soil. Spore counts were higher when Olsen-P levels were lower (<20) than with higher levels (>20), the difference was significant in March (P<0.05). No other factor had a significant effect on spore counts at any time. Farms and paddocks had some (NS) effect on FE spore counts that may have been due to varying weather conditions, and/or differences in farm management strategies.

Table 1 *Pithomyces chartarum* spore numbers over three consecutive months on pastures with different ploidy levels, soil types and soil fertility status (spores/g DM pasture)

Ploidy	March	April	May	Total
Diploid[1]	127,000	105,000	64,000	339,000
Tetraploid[1]	99,000	66,000	38,000	240,000
LSR (5%)[2]	1.62	1.6	1.9	1.5
Soil type				
Ash/Silt	78,000	44,000	45,000	189,000
(Sandy) Loam	107,000	75,000	40,000	272,000
Clay	326,000	121,000	66,000	511,000
Peat	59,000	119,000	51,000	250,000
LSR (5%)	2.6	2.2	3.9	2.1
OlsenP status				
Olsen-P <20	245,000	127,000	101,000	508,000
Olsen-P $\geq$20	51,000	54,000	24,000	160,000
LSR (5%)	3.5	2.8	5.2	2.4

[1] Diploid, 8 cv's; Tetraploids Quartet (84%), Banquet (16%)
[2] LSR (5%) stands for least significant ratio

Conclusions Pastures that mostly consisted of the late flowering cv. Quartet showed lower spore numbers relative to diploid pastures. Further work is required to confirm whether this is a ploidy effect and not flowering date or some other cultivar factor. The survey also indicates that spore numbers are likely to be higher when Olsen-P levels are low (<20) and on clay soils. Higher spore numbers on clay soils could be a consequence of high moisture retention capacity, or differences in pasture growth rate and grazing pressure.

References

Di Menna, M.E. & J. R. Bailey (1973). *Pithomyces chartarum* spore counts in pasture. *New Zealand Journal of Agricultural Research,* 16, 343-351.

What research is required for economically and environmentally sustainable farming?

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This Congress is being held on an island that is a Nitrate Vulnerable Zone.No other land area in the western world has achieved such a status!

With this designation come completely new parameters for agriculture in general and grassland production in particular. Alongside this change in emphasis for the grass based industry is the implementation of the Common Agricultural Policy reform. For farming within the European Union it is not completely about maximising production, about "growing two blades of grass where one grew before". It's also about creating a diverse landscape, about less pollution about greater recreational opportunities, about sustainability about protection of flora and fauna. For the first time in our history, we as grassland farmers and livestock producers will be paid for our multifunctionality in 2005.

That change in emphasis brings immense challenges for me as an "intensive" dairy farmer. How can I react to a 170 kgs/ hectare N limit on my enterprises? How do I manage a system that produces vast quantities of waste? How do I reduce phosphorous inputs within my farming system? How do I maintain a competitive farm business within an increasingly global marketplace that is sustainable economically and environmentally? Can I adapt my grass-based farming systems to be both nutrients efficient, input efficient and profitable? Can I cope with the legislation coming down the "track" on air emissions in a business where ammonia and methane are produced in large quantities?

A survey of research projects at a number of centres throughout the British Isles would suggest to me that much of the previous and current research is serving yesterday's industry and there are few answers to my list of concerns about how I shape my business to meet current legislation or future legislation on water and air quality. Much of the current research has three main strands:

- The first seeks to maintain or increase production whilst constraining or reducing costs.
- The second seeks to develop land management approaches to reduce the impact of farming on the landscape.
- The third seeks to create added value away from the farm gate, using farm outputs as global commodities.

These strands are far from integrated, certainly do not enhance sustainability, and in most cases do no more than quantify the problems rather than identify the solutions.

The areas of food chain connections that maximise the human health attributes of grass-based livestock products, the role of technology transfer and the public perception of science are the challenges ahead.