
THE PROCEEDINGS OF THE
NEW ZEALAND SOCIETY
OF
ANIMAL PRODUCTION
VOLUME 62 2002

Preference for different pasture grasses by horses in New Zealand

L Randall[a], CW Rogers[a]*, SO Hoskin[a], PC Morel[a] and NM Swainson[b]

[a]*Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Palmerston North, New Zealand.*
[b]*AgResearch Ltd, Palmerston North, New Zealand.*
**Corresponding author. Email: c.w.rogers@massey.ac.nz*

Abstract

In New Zealand, grazed pasture is the primary nutrient source for equines, but little is known about equine grass preferences. A study to identify preferred grass species and/or cultivars (here on referred to as grasses) by horses was conducted in a 0.62 ha paddock containing 22 different test grasses. The grasses tested were planted in 6 x 3 m plots with four replicates of each species/cultivar. Four mature mares 527± 38 kg, mean age 9 ± 3 years, were grazed on the trial plots for a total of five days during May 2007. Grass preference was quantified by; direct DM utilisation (pre- vs post-grazing dry matter cuts), pasture-probe measurement and visual assessment through photographs. Grass preference was similar for each method used to quantify utilisation (r^2=0.73 – 0.76 P<0.0001). The six grasses most preferred by horses were all tetraploid ryegrasses (DM utilisation 74% (inter quartile range 67-81%). Least-preferred grasses were Yorkshire fog and Cocksfoot (DM utilisation down -0.9 to -14%). Hot water soluble carbohydrate and digestible organic matter in the dry matterwere the best predictors of grass preference. There was no significant effect of endophyte status (High, AR1, and Nil) on pasture preference during late autumn.

Keywords: horse; pasture; preference

Introduction

In contrast to many Northern Hemisphere equine production systems, the New Zealand equine industry, and the breeding industry in particular, has a large reliance on pasture as the primary nutrient source (Rogers et al. 2007; Stowers et al. 2009). Despite this reliance on pasture, there is limited literature published on the pasture preference of horses in New Zealand, or internationally (Hunt et al. 1989; Hoskin & Gee 2004). This is somewhat surprising given that pasture preference influences voluntary feed intake and the primary goal of commercial horse breeders is to produce well grown yearlings in an attempt to maximise auction sales price (Waldron et al. 2011).

Pasture provides a cheap and relatively balanced source of nutrition for horses, with reported growth rates comparable to those achieved in the Northern Hemisphere with horses on concentrate diets (Morel et al. 2007; Grace et al. 2003; Brown-Douglas et al. 2005). New Zealand pastures are dominated by grasses (> 90% of the dry matter (DM)), particularly perennial ryegrass. This also appears to be true of commercial equine stud farms, with most farms reporting to have pasture consisting of a perennial ryegrass and clover mix (Rogers et al. 2007). However, the high preference of horses for some grass species and pattern of preferential grazing areas provides significant management issues and can require a high rate of pasture renewal.

In general, it has been suggested that horses prefer young, fast growing herbage (Hunt et al. 1989), and possibly select for a high sugar, rather than low lignin content (Rogalski 1984). Using a photography technique Hunt et al. (1989) investigated differences in the preference for a limited range of grasses and legumes and identified horses had a preference for prairie grass over ryegrasses. Some commercial producers prefer to avoid ryegrass due to the risk of ryegrass staggers, though plant persistence problems often mean limited alternative choices are available.

To begin to evaluate the feeding value of New Zealand grasses for New Zealand horses, information on the preference of different grass species, including modern cultivars, tetraploid versus diploid ryegrasses, and high versus low endophyte status is required. The objectives of this study were to determine the relative preference of different grass species and/or cultivars by horses, and to examine if there was a relationship between pasture preference and chemical composition of the preferred pasture.

Materials and methods

Animals

Four mares (two Thoroughbred and two Standardbred) aged 9 (± 3) years with a mean live weight of 527 (± 38 Kg), were used in the study.

Trial design

Horses were permitted to freely graze a flat 0.62 hectare paddock containing 22 different test grass species and/or cultivars in the vegetative state (Table 1) for five days in May 2007. The test grasses were grown in 6 x 3 m plots, with four replicates per test grass. To avoid latrine behaviour, and pasture avoidance, faecal material was removed daily from the plots.

The test grasses were established swards sown one year prior to the start of the trial and had been lightly rotationally grazed by red deer. One month prior to the start date swards were fertilised with urea (N 46.0) and Cropmaster 15 (N 15.1, P 10.0, K 10.0, S

Table 1 Test grass species and/or cultivars tested for dietary preference by horses.

Cultivar name	**Grass name**	***Latin name***	**Type #**	**Endophyte Status §**
Eastwood	Cocksfoot (Orchardgrass)	*Dactylis glomerata*	N/A	N/A
Tekapo	Cocksfoot (Orchardgrass)	*Dactylis glomerata*	N/A	N/A
Grasslands Maru	Phalaris (Harding grass)	*Phalaris aquatica*	N/A	N/A
Banquet II	Ryegrass	*Lolium multiflorum x L. perenne*	LR T	Endo5
Bronsyn	Ryegrass	*Lolium perenne*	P D	AR1
Delish	Ryegrass	*Lolium multiflorum x L. perenne*	SR T	Nil
Extreme	Ryegrass	*Lolium perenne*	P D	AR6
Feast II	Ryegrass	*Lolium multiflorum*	I T	Nil
Grasslands Impact	Ryegrass	*Lolium perenne*	P D	AR1
Maverick GII	Ryegrass	*Lolium multiflorum x L. perenne*	SR D	Nil
Quartet	Ryegrass	*Lolium perenne*	P T	Nil
Quartet	Ryegrass	*Lolium perenne*	P T	AR1
Quartet	Ryegrass	*Lolium perenne*	P T	SE
Tabu	Ryegrass	*Lolium multiflorum*	I D	Nil
Quantum	Tall fescue	*Festuca arundinacea*	N/A	Nil
Quantum II	Tall fescue	*Festuca arundinacea*	N/A	MaxP
Vulcan	Tall fescue	*Festuca arundinacea*	N/A	Nil
Grasslands Charlton	Timothy	*Phleum pratense*	N/A	N/A
Massey Basyn	Yorkshire fog	*Holcus lanatus*	NA	N/A
Ceres Viking	Timothy	*Phleum pratense*	N/A	N/A
Grasslands Gala	Grazing brome	*Bromus stamineus*	N/A	N/A
Resolute II	Tall fescue	*Festuca arundinacea*	N/A	MaxP

P Perennial; A Annual; I Italian; SR short rotation; LR long rotation; D diploid; T tetraploid; **§** SE standard/wild endophyte; AR 6 lolitrem B is absent (no longer commercially available); AR1 contains only peramine; Max P (AR542) ergovaline is absent; Endo5 lolitrem B is absent, ergovaline reduced.

7.7) (Ravensdown Fertiliser Co-operative Ltd, Ravensbourne, Dunedin) with a total of N 24.44, P 4, K 4, and S 3.08 kg/ha.

Measurements were taken of the DM utilisation of each test grass plot during the trial using pre- and post-grazing herbage yield DM cuts, visual assessment of before and after grazing of individual plots photographs, and before and after grazing estimation of herbage yield using pasture probe measurements.

Forage sampling and measurements

Pre- and post-grazing herbage DM yields were measured using actual DM cuts and a a pasture probe (True-test Ltd, Grassmaster II, Auckand) and a semi-quantitative assessment (Table 2) based on photographs taken daily at the time of pasture sampling. Pasture samples for analysis were obtained daily by removal of a strip of each pasture plot to a height of 6 cm and a 300 g subsample taken (wet weight measured). The subsample was subsequently dried at 80ºC in a convection oven for three days and reweighed to measure pasture DM. A second sub sample (75 g) fresh cut herbage was taken from each plot and frozen (-20ºC) for later chemical composition analysis.

Table 2 Method of scoring pasture utilisation of test grass plots by visual assessment of photographs.

Score	Percentage utilised by animals
1	0-20
2	20-40
3	40-60
4	60-80
5	80-100

Laboratory analysis

Frozen grass samples were freeze-dried and ground to pass a one millimetre diameter sieve. Total N concentration was determined using the Dumas method (AOAC protein 968.06, DM930.15, 925.10) (Leco Corporation, USA 1994) and Organic matter (OM) determined by ashing samples for 16 hours at

Table 3 Preference of grass species by horses in May 2007 based on the proportion of DM utilised (% utilised) ranked from most preferred (top) to least preferred (bottom).

Grass species	Cultivar	Endophyte	% Utilised
Lolium perenne	Quartet#	Nil	81.4 [a]
Lolium perenne	Quartet#	Wild type	81.2 [a]
Lolium perenne	Quartet#	AR1	79.2 [a]
Lolium multiflorum	Feast II#	Nil	69.4 [ab]
Lolium multiflorum x L. perenne	Delish#	Nil	67.3 [ab]
Lolium multiflorum x L. perenne	Banquet II#	Endo5	54.6 [abc]
Festuca arundinacea	Resolute II	MaxP	50.7 [abc]
Lolium multiflorum	Tabu	Nil	49.2 [abc]
Phleum pratense	Ceres Viking	N/A	47.5 [abcd]
Phleum pratense	Grasslands Charlton	N/A	42.3 [bcd]
Festuca arundinacea	Quantum	Nil	40.6 [bcd]
Bromus stamineus	Grasslands Gala	N/A	39.8 [bcd]
Festuca arundinacea	Quantum II	MaxP	38.2 [bcd]
Lolium perenne	Extreme	AR6	37.1
Festuca arundinacea	Vulcan	Nil	36.9 [bcd]
Lolium perenne x L. Multiflorum	Grasslands Impact	AR1	32.2 [cde]
Phalaris aquatic	Grasslands Maru	N/A	30.7 [cde]
Lolium perenne	Bronsyn	AR1	27.9 [cde]
Lolium multiflorum x L. perenne	Maverick GII	Nil	23.8 [cde]
Dactylis glomerata	Tekapo	N/A	13.2 [def]
Holcus lanatus	Massey Basyn	N/A	-0.9 [ef]
Dactylis glomerata	Eastwood	N/A	-14.4 [f]

*superscripts represents differences between grasses in preference (P<0.05),
tetraploid, others diploid.

550°C. Neutral detergent fibre (NDF), acid detergent fibre (ADF) and lignin were determined by the detergent procedures of Van Soest et al. (1991). *In vitro* OM digestibility (OMD) was determined by the enzymatic method of Roughan and Holland (1977). Hot water soluble carbohydrate (HWSC) was determined using Nelson's determination of reducing sugars and pectin was determined using Blumenkrantz method for uronic acid determination (McWilliam et al. 2004).

Statistical analysis

Differences in pasture utilisation between plots were tested using a general linear model. The effect of chemical composition on grass preference, based on direct herbage utilisation was determined by first identifying the best chemical composition predictors of utilisation by Pearson's correlation. The top two best predictors were entered into a linear regression model to determine the equation for best prediction of pasture preference. Significance was declared at $P \leq 0.05$ and a trend reported if $0.05 < P \leq 0.10$, all mean comparisons were by Tukey's least-significant difference. All statistical tests were performed using SAS V9 (SAS 2007).

Results

The mean pre-grazing mass of the plots was 1296±291 kg DM / ha and the mean post grazing mass 773±386 kg DM / ha. There was consistent ranking of pasture species between the DM cuts, pasture probe and semi quantitative techniques ($r^2 = 0.73$-0.76). All three methods had the same top five most preferred and the least preferred grass species.

There was a significant effect of grass type on utilisation ($P < 0.0001$). The top six most preferred grasses were all tetraploid ryegrasses with the Quartet cultivars ranking highest. The cocksfoots (*Dactylis glomerata*, Tekapo and Eastwood) and Yorkshire fog (*Holcus lanatus*, Massey Basyn) were least preferred by horses, with little or negative proportions of DM utilised (pasture growth exceeded intake). Endophyte type did not significantly affect preference. The HWSCcontent and digestible organic matter in the dry matter (DOMD) were the best predictors of preference, explaining 72% of the variation. The prediction equation was: Utilisation = - 346 + 5.27 DOMD (% DM) + 7.64 HWSC (g/100g DM).

Table 4 Chemical composition of grass species and/or cultivars fed to horses adjusted to a dry matter basis. 1. CP: Crude protein, 2. HWSC: Hot water soluble carbohydrate, 3. OM: Organic matter, 4. GE: Gross Energy

	Tabu	Charlton	Quantum II	Vulcan	Quartet HE	Tekapo	Feast II	Mavrick GII	Bronsyn	Massey Basyn	Impact
CP%[1]	24.11	28.05	24.07	24.74	27.17	26.27	31.52	25.41	24.81	26.07	26.44
HWSC[2] g / kg DM(a)	87.38	96.05	84.64	88.81	103.68	78.33	97.64	86.84	85.88	83.03	69.69
Pectin g/kg DM(a)	0.85	0.86	0.67	0.76	0.76	0.67	0.85	0.95	1.05	0.75	0.86
Cellulose% (b)	17.86	19.21	19.12	17.95	16.65	19.30	17.06	19.09	20.04	16.98	17.57
Hemicellulose% (b)	22.51	21.49	22.25	21.82	20.93	21.02	21.52	21.19	20.04	24.63	23.29
Ratio (a:b)	0.22	0.24	0.21	0.23	0.28	0.20	0.26	0.22	0.23	0.20	0.18
Lignin%	1.80	2.09	1.71	1.98	1.62	2.58	1.33	1.72	1.62	1.79	2.39
OM%[3]	84.60	86.90	84.53	84.19	85.61	85.59	85.46	85.11	85.27	84.70	85.41
GE[4] MJ k/g DM	18.62	19.50	18.73	18.52	19.40	19.30	19.34	18.70	18.99	18.87	18.90

	Delish	Quantum	Viking	Gala	Resolute II	Extreme	Quartet AR1	Maru	Eastwood	Quartet Nil	Banquet II
CP %[1]	28.11	23.53	29.18	29.60	25.93	24.86	28.78	27.66	28.58	28.31	26.21
HWSC[2] g / kg DM(a)	93.93	89.08	94.14	87.85	74.92	80.31	93.61	89.65	59.81	125.85	126.16
Pectin g/kg DM (a)	0.85	0.77	0.67	0.76	0.77	0.96	0.96	0.76	0.68	0.76	0.76
Cellulose (b)	16.22	19.35	17.21	17.95	20.75	19.50	16.81	17.74	18.81	15.06	16.70
Hemicellulose (b)	21.92	23.76	24.53	22.63	21.80	21.42	20.06	20.98	22.86	20.69	20.11
Ratio (a:b)	0.25	0.21	0.23	0.22	0.18	0.20	0.26	0.24	0.15	0.35	0.34
Lignin	1.80	2.11	2.19	2.01	1.73	1.82	1.81	1.53	2.41	2.86	2.09
OM%[3]	84.84	85.66	87.18	85.66	86.78	86.00	86.04	84.08	87.03	85.75	85.32
GE[4] MJ k/g DM	19.07	18.49	19.78	19.10	18.73	18.74	19.10	18.69	19.68	19.07	18.69

Discussion

Irrespective of the measurement criteria used in this study the rankings of the preference results were in close agreement. The higher rankings of the ryegrass species were also similar to previous reports of pasture preference using the less robust measures of time spent grazing (Archer 1973; Hunt et al. 1989). Within the ryegrass species, there was a trend for the horses to preferentially select the tetraploid cultivars. These cultivars typically have twice the cell size of diploids and hence are associated with a higher ratio of non-structural to structural carbohydrate. Grasses containing high proportions of non-structural carbohydrates, and low fibre proportions are generally regarded as being highly palatable for ruminants.

Analysis of the chemical composition of the grasses and the relationship of these to utilization supports the hypothesis that grass selection was based on high HWSC and DOMD. Palatability is associated with voluntary feed intake and this in turn directly influences growth and production. Within New Zealand most commercial stud farms have improved pasture predominantly described as a ryegrass-clover mix (Hirst 2011) and regularly resow paddocks with new pasture species (Rogers et al. 2007). The high palatability and preference of horses for these grass cultivars may help explain the comparatble growth rates of Thoroughbred young stock in New Zealand within a pastoral system, compared to young stock within more intensive grain based feeding systems in the Northern Hemisphere (Brown-Douglas et al. 2005; Morel et al. 2007). The ability to grow horses at pasture year round provides a number of developmental advantages for the New Zealand breeder (Rogers et al. 2012) and the opportunity to utilize pasture as the primary source of nutrition may reduce exposure to some risk factors associated with OCD in young stock (Van der Heyden et al. 2013).

The preference for the species with a high ratio of fermentable: structural carbohydrate content (ratio a:b Table 4) while advantageous for horses with a high energy requirement (e.g. growing racehorses), does provide a management issue for owners of ponies or equine more at risk of obesity or laminitis. For these horses the grasses that were least preferred, with a higher fiber content would be more suitable and may provide a pasture based mechanism to manage these at risk equine.

The pasture utilisation results in the current studydid not indicate any differentiation of species or cultivars based on the presence of endophyte which are similar to earlier findings (Hunt 1994). However, these findings do appear counter intuitive given the clinical signs of ryegrass staggers, and our use of older mares. Ryegrass staggers can pose a management issue for some horse owners (Johnstone & Mayhew 2013) and the clinical signs are anecdotally reported to be more severe after repeated exposures The use of older mares in our study should have ensured some previous exposure to endophyte infected ryegrass and previous experience of ryegrass staggers. The lack of differentiation by the horses raises two hypotheses which require further investigation; horses cannot differentiate between endophyte and non-endophyte infected ryegrass, or the clinical signs of ryegrass staggers does not invoke avoidance behaviour in horses.

The preference of the horses in the current study for the improved tetraploid ryegrass species may provide the New Zealand horse breeder with an opportunity to optimise voluntary feed intake and subsequent growth of young stock. The ability to capitalise on a pastoral-based system to grow commercial youngstock provides a number of economic and development advantages.

Acknowledgements

The authors would like to thank Wayne Nichol (PGG Wrightsons) for his assistance with the trial and the New Zealand Equine Research Foundation and PGG Wrightsons for funding the experimental work.

References

Archer M 1973. The species preferences of grazing horses. Grass and Forage Science 28: 123-128.

Brown-Douglas CG, Parkinson TJ, Firth EC, Fennessy PF 2005. Bodyweights and growth rates of spring- and autumn-born thoroughbred horses raised on pasture. New Zealand Veterinary Journal 53: 326-331.

Grace ND, Rogers CW, Firth EC, Faram TL, Shaw HL 2003. Digestible energy intake, dry matter digestibility and effect of increased calcium intake on bone parameters of grazing thoroughbred weanlings in New Zealand. New Zealand Veterinary Journal 51: 165-173.

Hirst RL 2011. Seasonal variation of pasture quality on commerical equine farms in New Zealand. Institute of Veterinary Animal and Biomedical Sciences. New Zealand, Massey University.

Hoskin SO, Gee EK 2004. Feeding value of pastures for horses. New Zealand Veterinary Journal 52: 332-341.

Hunt W 1994. Pasture for horses, Palmerston North, New Zealand, New Zealand Equine Research Foundation.

Hunt W, Hay R, Clark D 1989. Pasture species preference by horses in New Zealand. XVI International Grassland Congress. Nice, France.

Johnstone LK, Mayhew IG 2013. Flow-mediated K+ secretion in horses intoxicated with lolitrem B (perennial ryegrass staggers). New Zealand Veterinary Journal 61: 159-164.

Mcwilliam E, Barry T, Lopez-Villalobos N, Cameron P, Kemp P 2004. The effect of different levels of poplar (Populus) supplementation on the reproductive performance of ewes grazing low quality drought pasture during mating. Animal Feed Science and Technology: 1-8.

Morel PCH, Bokor A, Rogers CW, Firth EC 2007. Growth curves from birth to weaning for Thoroughbred foals raised on pasture. New Zealand Veterinary Journal 55: 319-325.

Rogalski M 1984. Effects of carbohydrates and lignin on preferences for and intakes of pasture plants by mares. Roczniki Akademii Rolniczej w Poznaniu 27: 183-193.

Rogers CW, Bolwell CF, Tanner JC, Van Weeren PR 2012. Early exercise in the horse. Journal of Veterinary Behavior: Clinical Applications and Research 7: 375-379.

Rogers CW, Gee EK, Firth EC 2007. A cross-sectional survey of Thoroughbred stud farm management in the North Island of New Zealand. New Zealand Veterinary Journal 55: 302-307.

Roughan P, Holland R 1977. Predicting in vitro digestibilities of herbages by exhaustive enzymic hydrolysis of cell walls. Journal of Science and Food Agriculture 28: 1057-1064.

Stowers NL, Rogers CW, Hoskin SO 2009. Management of weanlings on commercial Thoroughbred studs farms in the North Island of New Zealand. Proceedings of the New Zealand Society of Animal Production 69: 4-9.

Van Der Heyden L, Lejeune JP, Caudron I, Detilleux J, Sandersen C, Chavatte P, Paris J, Deliege B, Serteyn D 2013. Association of breeding conditions with prevalence of osteochondrosis in foals. Veterinary Record 172: 68-71.

Van Soest PJ, Robertson JB, Lewis BA 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. Journal of Dairy Science 74: 3583-3597.

Waldron K, Rogers CW, Gee EK, Bolwell CF 2011. Production variables influencing the auction sales price of New Zealand Thoroughbred yearlings. Proceedings of the New Zealand Society of Animal Production 71: 92-95.