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MANAGING GROWTH FOR DIFFERENT COMMERCIAL END POINTS

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Introduction

A horse's maximal mature body size is genetically predetermined, but growth rate can be influenced by a number of factors including environment, nutrition, and management. Optimal growth rate results in a desirable body size at a specific age with the least amount of developmental problems. Managing growth in horses becomes a balance between producing a desirable individual for a particular purpose without creating skeletal problems that will reduce a horse's subsequent athletic ability (Figure 1). Growing a foal too slowly results in the risk of it being too small at a particular age or never obtaining maximal mature body size. Growing a foal too quickly results in the risk of developmental orthopedic disease (DOD) such as physitis, angular limb deformities, and osteochondritis dissecans (OCD). There is no single growth rate that is desirable for all types of horses. Therefore, horses should be managed differently for varying growth rates.

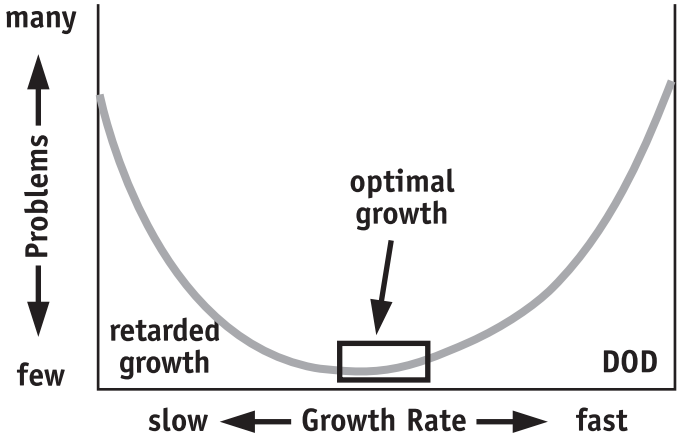

Figure 1. Distribution of growth-related problems during slow and fast growth.

Horses will generally reach physical maturity at around 4-5 years of age. Compared to Thoroughbreds, many breeds such as warmbloods are not expected to compete

until later in life, so there is little incentive for rapid growth. Instead, a slow, steady growth rate that will allow the horse to reach maximal mature body size with the fewest problems is desirable. Thoroughbred racehorses are a different story. They are expected to be competitive athletes at two years of age, reaching 85% of mature body weight and 95% of mature height by 24 months of age.

Table 1. Growth rates of Hanoverian and Thoroughbred foals.

	Hanoverian					*Thoroughbred*				
Age (days)	*Body weight (kg)*	*Body weight (% mature wt[1])*	*Av. daily gain (kg/d)*	*Withers height (cm)*	*Withers height (% mature ht[2])*	*Body weight (kg)*	*Body weight (% mature wt[1])*	*Av. daily gain (kg/d)*	*Withers height (cm)*	*Withers height (% mature ht[2])*
1	60.0	9%	-	104.0	62%	54.5	10%	-	101.9	62%
15	73.0	11%	0.9	107.0	64%	74.9	13%	1.5	106.8	65%
30	87.3	13%	1.0	110.0	66%	94.9	17%	1.3	111.1	67%
46	103.6	16%	1.1	114.0	68%	116.2	20%	1.3	115.7	70%
60	118.7	18%	1.1	116.0	69%	132.7	23%	1.2	118.8	72%
78	136.6	21%	1.1	120.0	72%	151.2	27%	1.2	122.2	74%
90	152.6	23%	1.1	122.0	73%	165.2	29%	1.0	124.6	76%
106	170.8	26%	1.1	125.0	75%	181.1	32%	1.0	127.3	77%
120	186.4	29%	1.1	128.0	77%	193.7	34%	0.9	129.1	78%
135	202.5	31%	1.0	130.0	78%	207.2	36%	0.9	131.1	79%
150	217.7	33%	1.0	132.0	79%	220.3	39%	0.9	132.7	80%
165	231.9	36%	0.9	134.0	80%	233.4	41%	0.9	134.4	81%
180	244.8	38%	0.9	136.0	81%	245.8	43%	0.8	135.7	82%
193	254.9	39%	0.8	137.0	82%	256.5	45%	0.8	136.8	83%
210	266.8	41%	0.7	138.0	83%	269.1	47%	0.7	138.1	84%

[1]Hanoverian - 650 kg (1,430 lb) mature body weight; Thoroughbred - 570 kg (1,254 lb) mature body weight

[2]Hanoverian - 167 cm (16.1 3/4 hands) mature height; Thoroughbred - 165 cm (16.1 hands) mature height

Warmbloods

In practice, warmbloods grow more slowly than Thoroughbreds. Vervuert et al. (2003) measured body weight and withers height in 629 Hanoverian warmblood foals from birth to 7 months of age. Table 1 compares the growth rates of these foals to the growth rates of thousands of Thoroughbred foals from around the world. To evaluate these data it is useful to view them from two perspectives: (1) in absolute terms as kilograms (kg) of body weight or centimeters (cm) of height, and (2) relative to the horse's mature body size. Thoroughbreds typically have mature body weights of around 570 kg and mature heights of around 165 cm

(16.1 hands). Hanoverians tend to be heavier with mature body weights closer to 650 kg and slightly taller with mature heights of 167 cm (16.1 3/4 hands). Although slightly heavier at birth (60 kg vs. 54.5 kg), the Hanoverian foals grew slower than the Thoroughbreds for the first three months of age and were slightly smaller until 5 months of age. By 7 months of age, the Hanoverian and Thoroughbred foals were practically identical in weight and height.

Without great pressure for early rapid growth, the warmblood breeder should utilize feeding programs that are predominantly forage-based with appropriate protein and mineral fortification to promote sound skeletal development. Table 2 illustrates a sound feeding program for warmblood foals.

Table 2. Suggested feeding program for warmblood foals.

Age (months)	*Growth rate (kg/day)*	*Forage intake (kg/day)*	*Oats (kg/day)*	*All-Phase (kg/day)*
6	0.8-0.9	4-6	0-2	1
12	0.4-0.6	4-6	0-2	1
18	0.2-0.4	5-7	0-2	1
24	0.1-0.3	5-7	0-2	1

This program depends on large quantities of forage to supply most of the energy and protein to the foal. The source of forage will vary seasonally depending on pasture availability. The extra protein, vitamins, and minerals needed to support optimal skeletal development are provided by All-Phase, a concentrated supplement pellet from Kentucky Equine Research. Oats can be added as needed to supply extra calories to adjust growth rate to a desirable level. Growth monitoring is essential to assess forage intake and to adjust grain intake to maintain a desirable growth rate.

Thoroughbred Racehorses

Because Thoroughbreds begin their athletic careers at an early age, mature body size is not the most important end point that breeders wish to achieve. In fact, there can be several important developmental milestones that must be reached even before a young Thoroughbred enters its first race. Most Thoroughbreds are sold as either weanlings or yearlings at commercial auctions throughout the year. The size of the foal at auction can greatly impact its selling price, so there is strong incentive to market large weanlings and yearlings. Just as important, however, is the foal's skeletal soundness at the time of the sale. A delicate balancing act exists between accelerated growth and skeletal soundness.

The simplest and safest way to deliver a large, mature yearling to the sale is to produce an early foal. Consignors to early sales certainly appreciate this fact and

yearlings entered in these sales are largely skewed towards early foaling dates (Table 3). At Keeneland's 2002 select yearling sale held July 15-16 in Kentucky, for instance, 48% of the yearlings offered were born in January or February compared to only 26% of all Thoroughbred foals born in North America in 2001. The Northern Hemisphere's official birth date for Thoroughbreds is January 1.

Table 3. Distribution of month of birth in the Thoroughbred population and in early select yearling sales in North America and Australia.

Australia			*North America*		
Birth month	*% of total foal crop (2002)*	*% of Magic Millions sale (2003)*	*Birth month*	*% of total foal crop (2001)*	*% of Keeneland July sale (2002)*
August	15	24	January	8	16
September	30	34	February	18	32
October	34	32	March	27	33
November	18	10	April	29	16
December	2	0	May	16	5

At the 2003 Magic Millions select yearling sale held January 9-12 in Queensland, 58% of the yearlings offered were born in August and September compared to 45% of all Thoroughbred foals born in Australia in 2001. The Southern Hemisphere's official birth date for Thoroughbreds is August 1, not July 1, a date that would mirror the Northern Hemisphere birth date. This explains why a larger number of foals are born early in Australia.

Birth date is much more important for foals that will be marketed in early select sales. Table 4 shows the age of yearlings at sale time in early select sales and in later yearling sales in Kentucky and Australia. In Kentucky, a foal born in May would be of similar age at the September yearling sale to a March foal sold in a July yearling sale. A December foal sold as a yearling at the Australian Easter sale would be of similar age to a September foal sold at the Magic Millions sale in January.

Figure 2 summarizes growth measurements from 400 yearlings raised in central Kentucky. These measurements were taken in June, July, and August of the foal's yearling year. January/February foals would be equivalent to Southern Hemisphere August/September foals; March to October foals, April to November foals; and May to December foals. June, July, and August in the Northern Hemisphere would be equivalent to January, February, and March in the Southern Hemisphere.

About 50% of the foals born in January and February and 33% of the foals born in March were sold at select summer sales. In July, January/February foals

Table 4. Age of yearlings at various yearling sales in Kentucky and Australia.

Australia			*North America*		
Birth date	*Age at Magic Millions sale (Jan 9)*	*Age at Easter yearling sale (Apr 22)*	*Birth date*	*Age at Keeneland July sale (Jul 15)*	*Age at Keeneland Sept sale (Sept 9)*
Aug 15	513 days	616 days	Jan 15	547 days	603 days
Sept 15	482 days	585 days	Feb 15	516 days	572 days
Oct 15	452 days	555 days	Mar 15	488 days	544 days
Nov 15	421 days	524 days	Apr 15	457 days	513 days
Dec 15	391 days	494 days	May 15	427 days	483 days

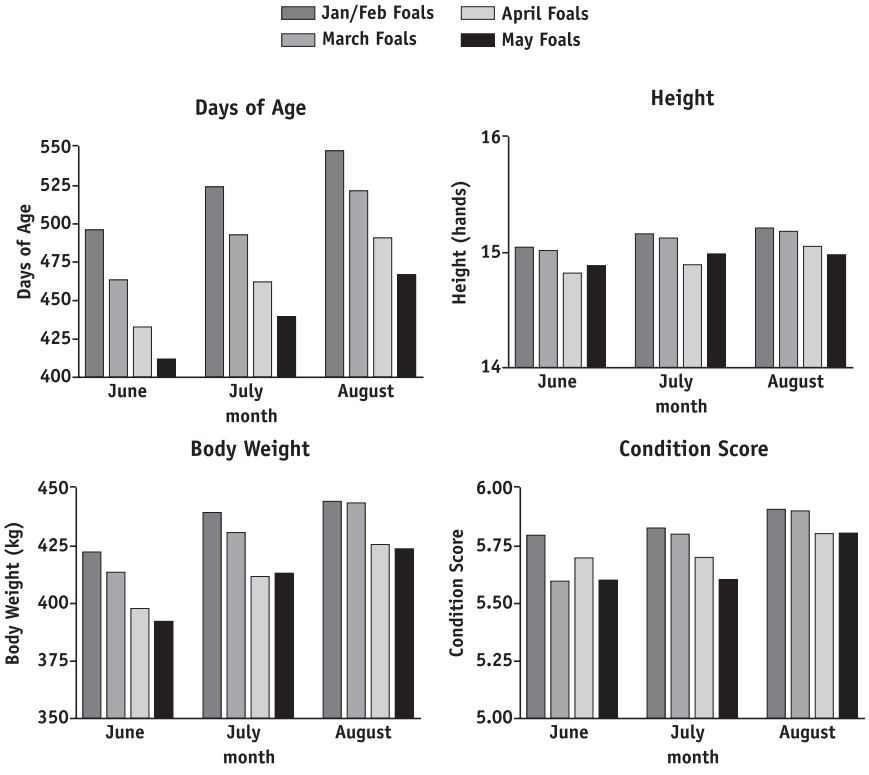

Figure 2. Days of age, height, weight, and condition score of Thoroughbred foals during June, July, and August of their yearling year.

averaged 86 days older than May foals. Withers height averaged around 15 hands in each group and increased only 1-2 cm over the three-month period. There were differences in body weight between groups, but these differences were not as

great as might be expected based purely on age. For example, foals born in March had reached about 72.5% of their mature body weight in June when they averaged 462 days of age. When May foals had reached a similar age in August they averaged about 74% of their mature body weights. Therefore, they had grown at a slightly faster rate than the earlier foals. Still, April and May foals were 27 kg lighter than January/February foals at sale time in July. The April and May foals were 72% of their mature body weight in July, while the January/February foals had achieved 77% of their mature body weight by this time.

Interestingly, condition score measured on a scale from 1-9 was very similar in all groups throughout the three-month period. Condition scores averaged from 5.6-5.8 in all groups in July and reached a maximum of 5.8-5.9 in August. This illustrates that the final 60-90 days of sales prepping is not about getting yearlings fat. Rather, these final days are a time to increase the maturity and athletic appearance of yearlings through a combination of nutrition, exercise, and grooming.

In Thoroughbreds destined for the racetrack, there are three different growth rates that might be appropriate depending on when the foal is born and if or when it is to be sold. A pattern of slow early growth (slow growth in Figure 3 and Table 5) may be most appropriate for foals that will not be offered for sale as weanlings or yearlings. Additionally, foals born early in the year that will be sold in later yearling sales may benefit from this type of growth curve. The advantage to slow early growth is that the skeleton is more susceptible to growth-related problems earlier in life. Delaying more rapid growth until after the foal is more mature (>15 months) will reduce the risk of early developmental problems.

Early foals (January/February in the Northern Hemisphere and August/September in the Southern Hemisphere) can follow the moderate growth pattern shown in Figure 3 and Table 5. This growth curve is also appropriate for later foals that will be marketed at later yearling sales. Such a growth pattern is most commonly followed by Thoroughbred breeders in Kentucky. It produces large yearlings with a limited number of problems. The most aggressive growth program is presented as rapid growth in Figure 3 and Table 5. This growth curve would be most appropriate for late foals that are targeted at early yearling sales. This growth curve is more likely to produce growth skeletal problems but, if properly managed, can result in more mature yearlings earlier in the season. The key to successfully managing this accelerated growth curve is to spread the extra growth over several months rather than trying to add the gain during the traditional prepping period 60-90 days prior to the sale.

Gro-Trac™ and MicroSteed™ are software programs developed by Kentucky Equine Research that allow breeders to accurately track the growth of their foals and develop feeding and management programs that fit the desired rate of growth. Table 6 gives examples of how feeding programs can be tailored to fit a specific growth pattern. Notice that the difference in daily grain intake needed to achieve these different growth rates is only .5 to 1 kg per day. Spread over several months this difference in nutrient intake should result in alterations in growth as depicted

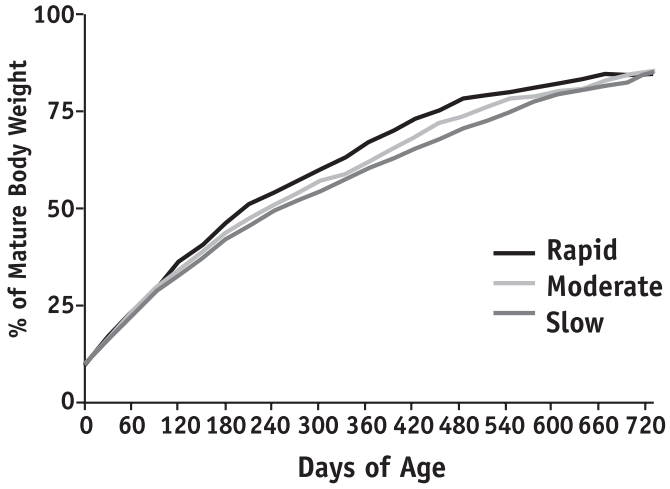

Figure 3. Slow, moderate, and rapid growth rates of Thoroughbred foals.

Table 5. Average daily gains for low, moderate, and rapid growth of Thoroughbred foals.

	Slow growth		*Moderate growth*		*Rapid growth*	
Age (days)	*Body weight (kg)*	*Average daily gain (kg/day)*	*Body weight (kg)*	*Average daily gain (kg/day)*	*Body weight (kg)*	*Average daily gain (kg/day)*
120	190	0.83	194	0.97	203	1.27
181	239	0.80	247	0.87	261	0.95
273	299	0.65	309	0.67	324	0.68
365	344	0.49	352	0.57	380	0.61
455	387	0.48	406	0.50	426	0.51
546	427	0.44	442	0.40	455	0.32
638	461	0.37	467	0.27	472	0.18
730	483	0.24	483	0.17	483	0.12

in Figure 3. Continual growth monitoring is necessary to ensure that the foal has not altered its total nutrient intake by greatly increasing or decreasing forage intake as this will affect growth rate.

In conclusion, the optimal growth rate for an individual foal depends on the foal's intended use and sale date (weanling or yearling). For breeds such as warmbloods that typically do not compete until they have reached their mature size, rapid early growth is not desirable because it may predispose the foal to skeletal problems. For breeds such as Thoroughbreds that will compete as two-year-olds, faster earlier growth is necessary. Foals born later in the year that are

Table 6. Example rations for slow, moderate, and rapid growth.

Age (months)	*Desired growth rate*	*Average daily gain (kg/d)*	*Pasture (kg/day, 100% DM basis)*	*Hay (kg/d, as fed basis)*	*Fortified grain mix (kg/d, as fed basis)*
	Slow	0.80	3.0	1.0	2.5
6	Moderate	0.87	3.0	1.0	3.0
	Fast	0.95	3.0	1.0	3.5
	Slow	0.49	3.0	2.0	3.0
12	Moderate	0.57	3.0	2.0	3.5
	Fast	0.61	3.0	2.0	4.0

pointed at early yearling sales need to follow a more aggressive growth curve than early foals or foals that will be sold in late yearling sales. With this type of accelerated program, it is imperative that growth rate is closely monitored and feed intake adjusted to produce acceptable gains. Growth monitoring combined with regular ration evaluations is the safest and most effective way to produce a sound, athletic individual.

Reference

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