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## Summary

This study arose out of an outline proposal, put to members at the 2010 Annual General Meeting, to make changes to the entry requirements for the Society's Grading Register (GR). Following a consultation exercise, it became apparent that members wished for information on past grading-up and its impact on the current Cleveland Bay (CB) population.

The majority of breeders recognise that the CB population is inbred. Inbreeding for the CB breed has been calculated at 22% which is much higher than for other breeds that are considered as being inbred. Inbreeding depression can begin to arise in populations above 20% and can lead to a downward spiral in production and performance with health issues arising. Health statistics do not exist for the breed so it is not possible to determine with any certainty if the Cleveland Bay is beginning to be affected.

However, inbreeding is increasing with each successive generation and builds on what was an already inbred population when the Cleveland Bay Horse Society was founded. Analysis shows many repeats of horses within the same pedigree and Stallion lines can clearly be seen to lead back to three sires, two of which share a common male ancestor.

Introducing new blood has been a part of the Stud Book almost from its foundation but tracing the grading register, since its inception in 1920, shows varying crossing requirements of %CB blood to be achieved prior to acceptance. The only consistent requirements have been the use of Pure bred licensed stallions for all crossing to progress through the GR generations, and male horses with direct non-CB blood have not been accepted on to the register. The grading process was very protracted taking between 20 and 30 years from entry to the GR to gaining full stud book (FSB) entry. Five generation grading to FSB entry at 97.5% appears to have discouraged breeders to consider the grading option.

This study has been based on analyses of registrations in the FSB, GR and Part-bred Register (PB) during the period 1990-2010. A review of the Grading Register shows six mares currently alive but only one has produced registered pure foals.

The majority of the analysis has focused on the 196 registered pure stallions producing foals during 1990-2010. During this period, 1162 pure foals were registered, 65.2% of which were by stallions that had held a Premium at some point.

Analysis of the pedigrees of the stallions revealed that 98.1% of the Premium Stallions had GR blood and 99.2% of the stallions producing pure foals had one or more GR ancestor. In the present pure bred population, five sources of GR blood have been identified and the close relatedness of the current stallions is clearly seen.

The Stallions' pedigrees also revealed how many generations away they are from their nearest GR ancestor. This was termed a 'gradeback' (GB). For the Premium stallions the majority are GB3, for the non-Premium stallions there are concentrations around GB5 and GB7. Reviews of the stallions standing at stud in 2011, show 52% are either GB4 or GB5.

Work on Premium mares show that few have qualified or have been put forward for elevation to Premium status in the last 10 years. Pedigree analysis shows that all of the Premium mares have some GR blood and many from more than one GR ancestral line. An analysis of the Mare Premium scheme, shows the lack of successful breeding and an overall weak breeding statistics.

# **GRADING REGISTER REVIEW – BACKGROUND INFORMATION AND ANALYSIS**

## **1 Introduction**

At the 2010 AGM, the Horse Inspectors proposed changes to the entry requirements and stages of progression for the grading up process within the CBHS stud book to Pure Bred status.

The reasons for the proposed changes were: breeders finding it difficult to source suitable unrelated stallions and pure colts for their pure mares; there had been a drop in both Premium stallion and Premium mare numbers; the current Grading up rules only allowing male progeny of Grade Register mares to be licensed for part breeding (potential valuable genetic loss from the population); an overall reduction in pure breeding leading to further inbreeding, health issues and an overall drop in horse quality; the decline in the number of stallions being awarded QA status.

Following discussion, and a vote, Council was instructed to provide further information on the proposals.

## **2 Purpose**

The purpose of this paper is to provide background history and analysis of the impact of past Grading up to enable members to have an informed debate on proposed changes to the Grading Register (GR) process, at the CBHS AGM on 1 October 2011.

## **3 Background**

Following the 2010 AGM, Council produced draft 'Grading Register Rules and Guidelines' and put these out to members for consultation in late 2010. By February 2011, few early responses had been received to the consultation these being mainly from overseas members.

During February/March 2011, UK members began to discuss the proposals on the CBHS website forum and it became clear that there were many questions being asked and clarity being sought. Council devoted half of its April 2011 meeting to a full and frank discussion of the GR proposals and agreed that members would need detailed Breed analysis, including past grading up records, to help an informed vote on the proposals. Extract of the Council minutes are at *Annex A*.

During summer 2011, Council members have analysed the Full Stud Book (FSB), Grading Register (GR) and Part-bred Register (PB) to assess the impact of past grading up on the pure bred population during 1990-2010. This was considered a suitable period of analysis as it spans the approximate length of the active life of a stallion or breeding mare. It also reflects the state of the current breeding population.

This study has been restricted by a lack of a complete digital stud book with accessible, searchable and manipulative format. Whilst every effort was taken to ensure the accuracy of the following data, the necessary use of paper records may have led to some minor errors.

Any Individually named horses have been included purely for illustrative purposes only.

#### 4 Inbreeding Depression

by Dr Mark Curry Senior Lecturer, Equine Science, Lincoln University,  
CBHS Council Member, August 2011

Inbreeding has played a crucial role in the establishment of almost all of our livestock breeds. Breeding of sometimes very closely related individuals has in the past been used in order to “fix” the desirable characteristics that define different breeds and to try to ensure that animals produce offspring that reliably conform to a breed type or standard.

However, this fixing of desirable traits does come with an inevitable downside which involves a potential increase in two problems. One is the risk that whilst attempting to fix positive characteristics you may simultaneously select for hidden deleterious recessive traits which will then show up more frequently in an inbred population. Secondly and perhaps more importantly the population will show a general reduction in vigour and fertility known as “inbreeding depression”. It has been demonstrated in many livestock species that increases in inbreeding and coefficients of inbreeding in excess of around 20%, are associated with a decrease in a range of production traits e.g. live-weight gain in beef cattle, milk quantity and quality in dairy cattle and wool production, lamb survival and weaned litter weight in sheep. In addition, increased levels of inbreeding at the level of either the dam or the potential offspring are linked with an overall loss in reproductive performance.

The adverse effects of inbreeding have been widely studied in production livestock breeds which are commonly managed with a small number of males used with large female populations but, there has been generally less work done with horses. However, there are a number of studies that show horses are by no means immune from the effects inbreeding depression if inbreeding rates are allowed to get high enough. A few examples include the remaining small captive and feral populations of the original wild horse *Equus przewalski* which are highly inbred and have shown a decrease in birth rate, increases in infertility, abortion and congenital defects, reduced juvenile survival rates and increases in growth abnormalities. A 2004 study identified a link between levels of inbreeding and the incidence of retained placenta in Friesian mares. In 2006 workers at Utrecht University showed that inbreeding had a negative effect on semen quality in young Shetland pony stallions and more recently in 2009 a large Spanish study showed effects of inbreeding depression on body measurements in Andalusian horses.

It is important to note that these are population effects, so high levels of inbreeding will lead for example to lower fertility rates in the population as a whole or to higher rates of congenital malformations being seen within the population; it does not mean that every horse will have poor fertility or will produce offspring with congenital malformations but, the average values across the population will be adversely affected and there will be more instances of poor fertility and of congenital malformations seen.

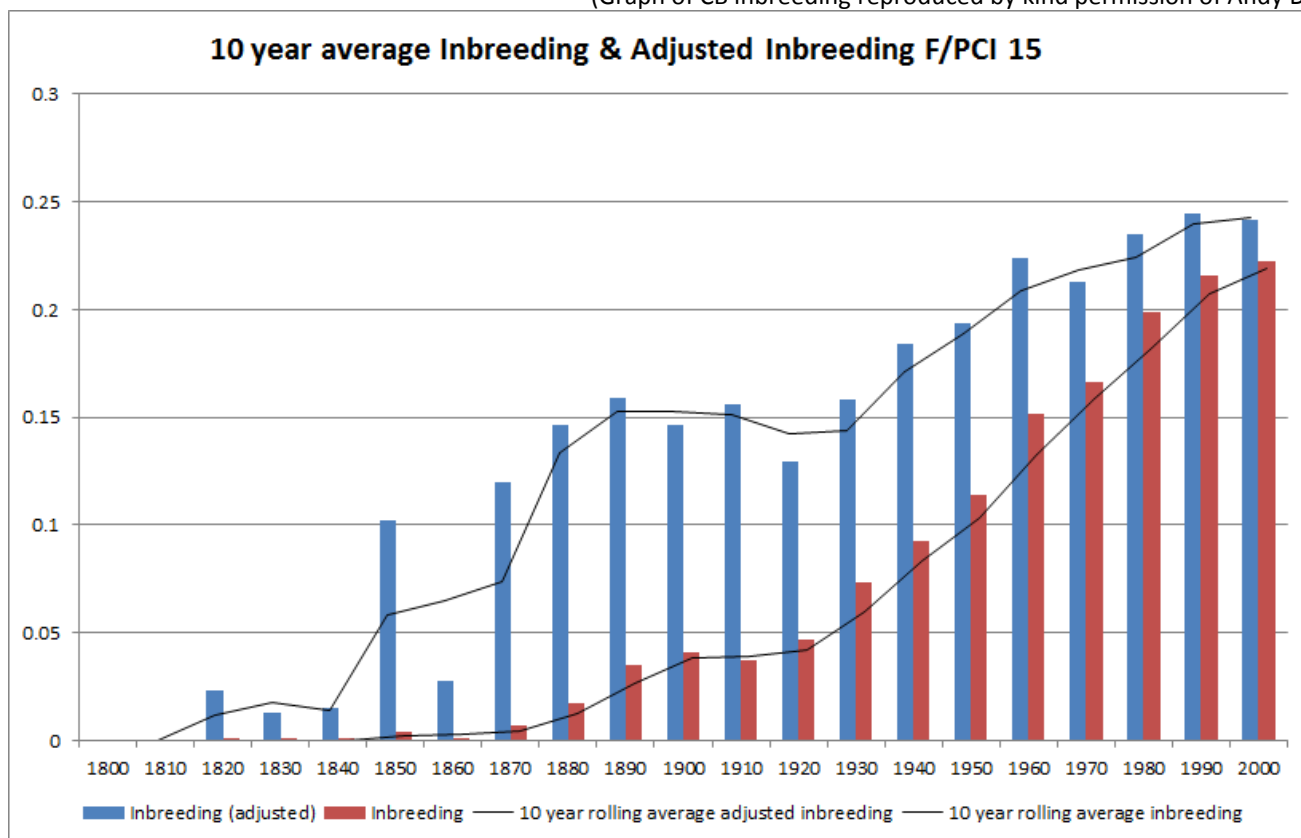
Inbreeding depression can have a negative impact on almost every aspect of reproductive performance affecting fertility, reabsorption and abortion rates, congenital abnormalities, juvenile survival, and abnormal growth effects. **The current level of inbreeding within the Cleveland Bay population, which we estimate at around 22%, puts the breed firmly within a category where we might expect to see some of these problems occurring on the ground.** However, it is not really possible to definitively say that this actually is the case. All of those involved in breeding will have experienced incidences of poor fertility, maybe lost foals or seen examples of low level developmental abnormalities but without proper data it is not possible to say if these incidences are occurring more frequently than in the past or indeed than would be expected in the average breeding population. This sort of data is not always easy to collect as most of us are a bit reluctant to advertise our problems and disappointments but it is a matter of some importance that we should try to address.

Inbreeding can lead to an accelerating downward spiral in production and performance with the danger that if we are not careful the extent of the risk will not be apparent until it is too late to remedy it.

*Table 1 - Population Inbreeding by Breeds (reproduced by kind permission of Andy Dell)*

Breed	Average Inbreeding	Reference
Andalusian horses	8.48%	(Valera et al., 2005)
North American Standardbreds	8.99%	(MacCluer et al., 1983)
Spanish Arab horses	7.0%	(Cervantes et al., 2008)
Thoroughbreds	12.5%	(Mahon and Cunningham, 1982)
Lipizzan horses	10.81%	(Zechner et al., 2002)
Thoroughbred in France	2.40%	(Moureaux et al., 1996)
Arab in France	7.10%	(Moureaux et al., 1996)
Friesian horses	15.7%	(Sevinga et al., 2004)
South German coldblood horses	2.28%	(Aberle et al., 2004)
Black Forest horses	5.21%	(Aberle et al., 2004)

(Graph of CB inbreeding reproduced by kind permission of Andy Dell)



The above graph shows CB inbreeding corrected for pedigree completeness giving a clear indication of how inbred the population was right back at the formation of the society, and that it did not really start at zero in 1884. The chart also shows continually rising inbreeding and that the Breed was already inbred long before the formation of the Society in 1884.

Following is an example of the number of horses typically appearing in the pedigree of a mare (in this case SPARKS Band E MK .2255). The number at the side indicates how many times the horse appears.

The colours indicate some direct relations, eg,

Kingmaker to Aerobatic to Lord Fairfax to Mulgrave,

Lucifer to Cholderton Druid to Cholderton Legend to Chapman,

Lucifer to Brilliant (PB) to Gerrick Fairy Maid to Gerrick Trefoil to Queenbury Snowdrop (GR),

Lucifer to Brilliant (PB) to Gerrick Bubbles to Princess Polly to Princess Emeraldalda to Magnolia.

The full pedigree chart can be seen at Annex B.

Table 2 - 124 horses in a six generation pedigree:

		Cholderton April					
Lord Fairfax	8	Shower	2	Cholderton Enchantress	1	Lady Mulgrave	1
Aerobatic	6	Cholderton Legend	2	Cholderton Grammercy	1	Lord Broughton	1
Morning Star	5	Cholderton Pearl	2	Cholderton Minstrel	1	Magnolia	1
Mulgrave Star	5	Cholderton Queen	2	Coombegrove Aphrodite	1	Marksman	1
Apollo	4	Glenholme	2	Coombegrove Artemis	1	Mercury	1
Eaglescliffe Emperor	4	Hawsker Lassie	2	Coombegrove Astarte	1	Mulgrave Lass	1
Kingmaker	4	Loftus Spirefire	2	Countryman	1	Mulgrave Supreme	1
Lady Fairfax	4	Lucifer	2	Diane of Kent	1	Mulgrave Violet	1
Mulgrave Daisy	4	Mulgrave Contralto	2	Pretty Maid	1	Penrhyn Gladiator	1
Queen May	4	Mulgrave Prince	2	Fryup Queen	1	Phaedria	1
Cholderton Druid	3	Mulgrave Rose	2	Gerrick Bubbles GR64	1	Plush Queen	1
Cholderton Ryecroft	3	Princess Primrose	2	Gerrick Fairy Maid GR65	1	Princess Emeraldalda GR89	1
Mulgrave	3	Viscountess Primrose	2	Gerrick Marquais	1	Princess Polly GR90	1
Airmail	2	Ballybay	1	Gerrick Trefoil GR85	1	Queenbury Snowdrop	1
Chapman	2	Biscay Bay	1	Howe Tallyho	1	GR114	1
Charming Lady	2	Brilliant (PB) by Lucifer	1	Invincible	1	Star of Hope	1
						Toft House Lad	1
						Tregoyd Countrygirl	1

## 5 The Grading Register

### a. Tracing the changes to the grading register through the history of the CBHS

The following are selected extracts from various CBHS Stud Books and include comments on the Breed's evolution and description. **(Notes:)** have been made to identify points of note felt to be relevant to the present proposed changes to the Grading Register.

#### i) Register of inspected mares 1920

By a resolution passed by the Cleveland Bay Horse Society in 1920, a Register was opened to include, after inspection, mares full of Cleveland Bay blood, entirely free from Carting blood, and of the stamp and character of the Cleveland Bay breed. Vol. XV p.7L contains the first animals so registered in this Special Section of the Stud Book, and full requirements for acceptance for entry are to be found at

pages 43-44, Vol. 18; together with a list on page 45 of all animals so registered up to that time. The produce by Cleveland Bay sires of inspected registered mares are eligible to be shown in Cleveland Bay classes, and their female produce **(Note: that is, the second generation of a registered mare = produce of produce)** may, after inspection, be admitted to full entry, **(Note: We think that this is the present Grade A mare = 93.75%)** subject to the unanimous approval of the Editing Committee, with a signed certificate before them showing that the mare is of Cleveland Bay type and is a clean-legged bay with black points. She has no white marks (except for a small star and a few grey-hairs in mane, tail, heel, coronets). She shows no evidence of Carting blood, nor has evidence of such been found. We certify the mare to be suitable for registration.

ii) *Register of inspected stallions and mares: vol 17 1935*

Included in accordance with the following resolution passed by the Cleveland Bay Horse Society, 1920:— There has always been a number of mares of the Cleveland stamp outside the Stud Book, many, full of Cleveland blood and of the stamp we require. There are even some Coaching mares of this type whose pedigrees show them to be full of Cleveland blood, and which are of the sort we want.

We therefore decide that a Selection Committee be appointed with authority to inspect and register bay mares of the old Cleveland type (free from carting blood), and that the produce of such mares by Cleveland stallions be eligible for entry in a special section of the Cleveland Bay Stud Book, after further inspection and approval by the Selection Committee, and that the produce of such registered mares shall, for the purpose of competition and exhibition, be eligible as 'Cleveland Bays' when once they have been accepted for this Section of the Stud Book, and their produce be eligible for full entry in the Stud Book (subject to the rules as to conforming to the breed type). **(Note: Mares were only required to be of 'old Cleveland Bay type'. Entry therefore to the register at ½ (50%) and entry to full stud book could be at 7/8 (87.5%).)**

iii) *Section II. 1938 - Conditions for Admission for full entry and to The Register of Inspected Stallions and Mares.*

**(Note: The inclusion of stallions in the name of the register. Whether any stallions were entered was probably prevented by the outbreak of the 2nd World War when such considerations might have been less of a priority, but the intention appeared to allow this.)**

After the Great War, when a crisis threatened the Cleveland Bay breed, a Register was opened (see P.71 of Vol. XV). In accordance with a resolution passed by the Cleveland Bay Horse Society in 1920, to enable the Society to register in a separate section; mares and stallions of the Cleveland Bay stamp outside the Stud Book. There were mares among these full of Cleveland blood, including bay Yorkshire Coaching Mares, which the Society decided to register after inspection by a Selection Committee, if free from carting blood. At a full meeting of the whole Society held at Whitby, May 28th, 1938, it was decided that as, from July 1st, 1938, the Editing Committee be authorised to accept animals for entry in the Stud Books and in the Registers as follows :—

1. For full entry in the Stud Book, without inspection, the produce by a C.B. stallion of a C.B. mare.
2. For full entry in the Stud Book, subject to, the unanimous recommendation of the Inspection Committee, the female progeny by a C.B. stallion of a registered mare, provided the, sire of such registered mare and the, sire of such registered mare's, dam are both C.B. stallions.

**(Note: The 'registered mare' if being assumed to be ¾ (75%), then mare to be entered as the product of the registered mare would then be 7/8 (87.5%) at least. However, if the registered mare was ½ (50%), which was a requirement of the Special Resolution of 1920, then entry to the Stud Book would be at ¾ (75%).)**

iv) From volume 22 **1966**:

To qualify for the Register a mare must first be approved by the Editing Committee of the Cleveland Bay Horse Society as fulfilling conditions set out at length in Vol. 18 of the Stud Book. To summarise these; they require one parent entered in the Stud Book and the other having a fair proportion (usually taken as 50%) of pure Cleveland blood. 'Mares with three crosses of pure Cleveland blood from a Registered mare (i.e., the great-granddaughter of the mare originally registered, whose sire, grandsires and great-grandsires are all horses entered with a name and number in the Stud Book of the Cleveland Bay Horse Society) can, by a resolution passed at the Annual General Meeting of the Society in October, 1961, be admitted to full entry in the Stud Book'. **(Note: Register horses 'usually taken as 50%' inspected to enter the stud book after three crosses would be entering with 93%.')** As a result of this up grading, mention is made in the Stud Book of one breeder: ..... *But it is gratifying to record that the first mare to gain full admission to the Stud Book under the 1961 resolution was Mr. J. S. Sunley's 'Princess Emerald'; who was bred champion at the Great Yorkshire Show in 1962.* **(Note: An example of Princess Emerald's GR progression can be seen in 'Routes to full stud book' in Section 5c below.)**

v) *Millenium Stud Book vol 35 2000 - The Rules For Entry Onto The Pure Stud Book Grade Registers*

In 1997 a new system of grading was introduced because it was thought that the Breed was losing good mares of pure blood because of miss marking. Into this system was incorporated the old Grading Register for mares whose pedigrees did not carry enough Cleveland crosses for the full Stud Book and a more natural progression towards Stud Book registration was set out.

There are now 3 Grade Registers for females, A, B, and C. Grade D is a male register into which all the male progeny of Grade Register mares are put and also any males rejected, for some reason, from the full Stud Book.

**Grade C** . Only females are eligible. The mare must be accepted by the Breed Committee as having more than 50 % pure Cleveland blood (the usual figure is 75 %); and the animal should normally have been entered in the Society's Part Bred Register.

**Grade B & Grade A** - The female progeny of a Grade C mare by a stallion with a Pure Bred Licence will be automatically eligible without inspection for entry onto the Grade B Register; and female progeny of a Grade B mare by a CB stallion with a Pure Bred Licence will be eligible for entry onto the Grade A Register. The female progeny of Grade A mares by a CB stallion with a Pure Bred Licence will be eligible for inspection and entry to the Full Stud Book subject to the rules.

**Grade D** - The male progeny of a Grade Register mare by a CB stallion with a pure bred licence will be eligible for entry onto the Male Grade Register; Grade D males will, if retained entire, be eligible for a Part Bred Licence only. The male progeny of a Grade register mare or Stud Bok mare by a Grade D stallion will only be eligible for entry onto the Grade D register. The female progeny of any Grade Register mare or Stud Book mare by a Grade D stallion will only be eligible for entry onto the Grade C register subject to the normal inspection rules

**(Note: The 1997 change to the Grading register rules added a further generation to any previous requirements. Grades were introduced and descriptions of the stages of grading by letters with entry level to the GR at Grade C, 'the usual figure of 75%' and progressing through Grade B (87.5%) and then to Grade A (93%). One further crossing was required beyond Grade A to make the Stud Book entry a higher requirement 97.5%.)**

In summary, the %CB blood entry requirements for the Full Stud book since its inception in 1920 are:  
1920 = **93.75%**      1935 = **87.5%**      1938 = **75%**      1966 = **93.75%**      1997 = **97.5%**

vi) *Summary of proposed changes 2011*

*Table 3 - Comparison between the current (1997) grading up system and 2011 proposed changes*

<b>Entry requirement to Grading Up system</b>	<b>Current (1997) Grading up system</b>	<b>Proposed 2011 Grading up system</b>
Horse ownership	Member of CBHS	Member of CBHS, CBHSNA, CBHSA
Age of horse	Minimum 3 years	Minimum 28 months old
Sex of horse	Female only	Male or female
Amount of CB blood	More than 50% (usually 75%)	Minimum 75%
Phenotype	Bay with black points, no white markings allowed other than a small white star. Roaning is not acceptable	Bay with black points, no white markings allowed other than a small white star. Roaning is not acceptable
Height/bone	Minimum 16 hh, 8.5inches bone	Minimum 15.2hh, 8.5inches bone
Registration	Mare has to be on part-bred register Mare's sire must have CBHS pure bred licence	Horse must be on part-bred register
Non CB Horse ancestry	Traceable ancestry (not defined)	TB preferred (no pony/cart/colour/gait) Detailed breeding and performance record 2 generation pedigree Sire/Dam to be all bay (except small white star)
Inspection	Society appointed Vet By CBHS Horse inspector	Pre-approval by supporting information; eg, photos/video. If approved, then following: Inspection by CBHS appointed Horse Inspector 5 stage vetting by Society appointed vet. DNA samples of all horses
Licensed Grading register stallions	Not Allowed	Allowed for Pure bred, Grading Register and part breeding. Placed in appropriate Grade as determined by CB blood.
<b>Entry requirement to Full Stud Book from Grading Register</b>		
Entry	From CBHS GR Grade A	From CBHS GR Grade A
Age of horse	Minimum 3 years	At least 28 months old
Sex of horse	Female only	Male or female
Amount of CB blood	(implied 97.5%)	Minimum 93.75%
Height/bone	Minimum 16 hh, 8.5inches bone	Minimum 15.2hh, 8.5inches bone
Inspection	Yes	Yes, meets minimum inspection score of 100 Must pass 5 stage vetting

b. Grading Register horses

A review of the full female stud book (1884-2010) shows 190 mares with Grading Register (GR) numbers. 20 mares were registered by Yorkshire Coach Horse (YCH) registered Sires, 14 had dams out of YCH registered mares and 16 had both YCH sires and dams. The full list is at *Annex C*. Only 16 GR mares have registered male offspring either in the full stud book or GR Grade D.

Five of the mares went on to have influence on the CB breeding population. These were: the YCH Madam (Y1255, born 1880), Woodlands May (GR21, born 1909), Church House Queenie (GR60, born 1934), and half-sisters Gerrick Bubbles (GR64, born 1948) and Gerrick Fairy Maid (GR65, born 1950) (both out of Brilliant by Lucifer who was sire of the pure stallion Cholderton Druid (see section 7b). For example:

- **Madam** (Y1255) ancestor of: half-sisters April Love(1610) and Spring Fever (1644) (dam of stallion Knaresborough Warlock);
- **Woodlands May** (GR21) ancestor of Cholderton Druid ( grandsire of stallions Mulgrave Supreme and Chapman);
- **Church House Queenie** (GR60) ancestor of half-sisters Manningford Hebe (1708) (dam of stallion Forest Saga) and Borderframe Joyful (1968) (dam of stallion Borderfame Prince Charming);
- **Gerrick Bubbles** (GR64) granddam of Princess Emeralda (1643) (dam of stallion Gerrick Majesty);
- **Gerrick Fairy Maid** (GR65) granddam of Gerrick Tinkerbell (1642) (granddam of stallions Bantry Bere and Penrhyn Aristocrat) and granddam of Queenbury Snowdrop (granddam of stallion Queenbury Hussar).

The five mares listed above are originators or founders of upgrading lines. Their daughters, grand-daughters and great grand-daughters have entered the up grading stages. The majority have dropped out through failing to breed a daughter to a pure bred stallion that would have continued the upgrading.

A further example of their influence can be seen in the Premium Mare Scheme. All of the 51 mares, awarded Premium status, have some link with one or more of these GR mares (analysis of the Premium mares can be found in Section 7c).

Of the 190 GR mares, only 18 were registered between 1991 and 2010; 3 of these are dead, 4 moved into the FSB and 5 are pure bred (by unlicensed stallions). Six mares are currently on the GR but only one (Oaten Whinbush Bay) has produced foals.

*Table 4- Current GR mares*

<b>Mare (studbook No.)</b>	<b>Date of Birth</b>	<b>Sire (studbook No.)</b>	<b>Dam (studbook No.)</b>
Abigail (GRC219)	1994	Storth House Temptation (2054)	Rontree Dinah-mite (1809)
Oaten Whinbush Bay (GRC209)	1993	Heslerton Wayfarer (2066)	Oaten Harriet (PB622)
Harrington Wisdom (GR183)	1993	Heslerton Wayfarer (2066)	Harrington Hope (GR181)
Harrington Token (GR187)	1995	Mr Tobias (2216)	Harrington Hope (GR181)

Mare (studbook No.)	Date of Birth	Sire (studbook No.)	Dam (studbook No.)
Harrington Grenella (GRB203)	1999	Oakenbank Grenadier (2326)	Osberton Rhea (GR168)
Wandale Elsie (GR193)	1996	Wigginton Antonio (2058)	Osberton Odessa (GR186)

c. Grading Register Anomalies

It is clear from the FSB that the rules governing GR have not been consistent throughout its history. Horses have entered the FSB with varying amounts of CB blood and after varying numbers of crosses. A few examples of routes from the GR to FSB are shown below.

Name of mare	Year of birth	Status	% CB blood
Brilliant by Lucifer	1940	GR	50
<b>Gerrick Fairy Maid</b>	1950	GR	<b>75</b>
Gerrick Trefoil	1958	GR	87
Queenbury Snowdrop	1967	GR	93
<b>Magnolia</b>	1971	Full Stud book	<b><u>97</u></b>
	31 years		

Brilliant by Lucifer	1940	GR	50
<b>Gerick Bubbles</b>	1949	GR	<b>75</b>
Princess Polly	1954	GR	87
<b>Princess Emerald</b>	1959	Full Stud book	<b><u>93</u></b>
	19 years	<b>One generation short</b>	

Brilliant by Lucifer	1940	GR	50
<b>Gerrick Fairy Maid</b>	1950	GR	<b>75</b>
Princess Fairfax	1966	GR	87
Amethyst	1982	GR	93
Penrhyn Emerald	1995	GR	97
<b>Penrhyn Helina</b>	2002	Full Stud book	<b><u>98.5</u></b>
42 years but includes additional generation - otherwise 35 years			

Brilliant by Lucifer	1940	GR	50
<b>Gerrick Fairy Maid</b>	1950	GR	<b>75</b>
Fantasy	1956	GR	87
<b>Gerrick Tinkerbelle</b>	1961	Full Stud book	<b><u>93</u></b>
	21years		

Brilliant by Lucifer	1940		50
<b>Gerrick Bloom</b>	1948	GR63	<b>75</b>
Thistle Down	1957	GR86	87

Bernice	1961	GR91	93
Jaqueline Mary	1968	GR110	97
Jubliation	1977	GR131	98.5
<b>Celebration</b>	1981	Full Stud book	<b><u>99.2</u></b>
	41 years	<b>but extra generations</b>	

by Glenholm		GR	50
<b>Church House Queenie</b>	C 48/53	GR	<b>75</b>
Cassandra	1957	GR	87
Coombegrove Harmonia	1964	GR	93
<b>Borderfame Joyful</b>	1982	Full Stud book	<b><u>97</u></b>
	32 years		

Mare by Glenholme (born 1928)			50
<b>Church House Queenie</b>	?C 1948/53	GR	<b>75</b>
Coombegrove Ariadne	1963	GR	87
Osberton Rhea	1982	GR	93
<b>Harrington Medina</b>	1991	Full Stud book	<b><u>97</u></b>
	31 years		

Madam		YCH	% not known
Westerdale Daisy	?	Full St Bk	
Westerdale Madam	1932	Full St Bk	
Westerdale Surprise	1950	Full St Bk	
Spring Fever	1962	Full St Bk	
Knaresborough Welcome	1957	Full St Bk	
	25 years???		

## 6 Breeding Analysis

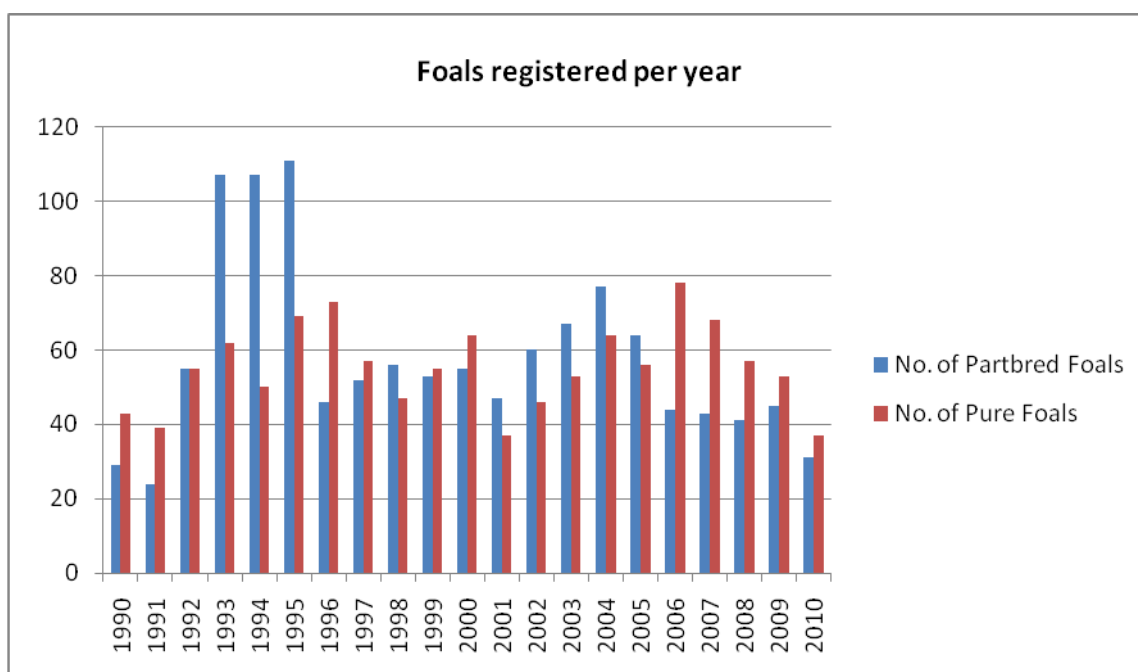
To help understand the impact of past grading up and to assess whether it helped improve quality of the breed the following analysis was undertaken using the FSB and Part bred register for the period 1990-2010:

- Total numbers of foals produced per pure stallion;
- Total foals produced by the Premium stallions;
- Total foals produced by non-Premium stallions;
- Numbers of Pure breeding mares.

The part-bred register was included, primarily as a quality indicator, ie, the ability of pure CB stallions to attract non-CB mares.

### a. Stallion statistics

Annex D shows the results for each stallion breeding during 1990-2010. During this period a total of 196 stallions were used for breeding with 32 being used for pure breeding only and 54 stallions used for part-breeding only. The following graph shows the distribution of foals per year.



The Top40 stallions were ranked. These horses all produced 20 or more foals and only 11 did not hold a Premium, although 8 of the latter were overseas and thus not eligible to apply for a Premium. The Top10 producing stallions are listed below:

Table 5 - Top 10 Pure CB stallions used for pure and part bred breeding 1990-2010

Rank	Top 10 producing Stallions	Pure Foals	Part-bred Foals	Total Foals	Premium/O/seas	Grade Back*	PB/GR Ancestor(s)*
	Listed 'Stallions at Stud 2011'						
1	Storth House Temptation	42	45	87	Y	6	YCH
2	Bantry Bere	36	50	86	Y	3	Brilliant
3	Forest Saga	40	36	76	Y	2	CHQ
4	MrTobias	53	17	70	Y	4	CHQ,YCH
5	Penrhyn Aristocrat	36	23	59	Y	3	Brilliant, YCH
6	Ramblers Renown	11	38	49	O/seas	5	YCH
7	Borderfame Prince Charming	25	22	47	Y	2	CHQ
8	Southbrook Warlord	40	6	46	Y	4	Brilliant
9	Beaujat	4	39	43	O/seas	8	WM
10	Oakenbank Grenadier	21	20	41	Y	3	CHQ, YCH, Brilliant
<b>Total Foals</b>		<b>308</b>	<b>296</b>	<b>604</b>			
<b>As % of all Foals produced 1990-2010</b>		<b>26.5</b>	<b>24.4</b>	<b>25.4</b>			

Note \* - see section 7 below for explanation

Annex D also shows the breeding analysis of the stallions awarded Premium status. This is summarised in the following table which shows that the majority of pure foals (65.2%) during 1990-

2010 were produced by the Premium stallions whilst non-Premium stallions were used more for part breeding.

*Table 6 – Total registered foal production 1990-2010*

	<b>Pure foals</b>	<b>Part-bred foals</b>	<b>Total foals</b>
No. of foals produced 1990-2010	1162	1214	2376
As % of total foals	48.9%	51.1%	
No. of foals by <b>Premium stallions</b>	<b>758</b>	589	1347
As % of foals by Premium stallions	56.3% <b>(65.2% of all pure foals)</b>	43.7% (48.5% of all part foals)	56.7% of total foals
No. of foals by <b>non-Premium stallions</b>	404	625	1029
As % of foals by non-premium stallions	39.3% (34.8% of all pure foals)	60.7% (51.5% of all part foals)	43.3% of total foals

b. Numbers of breeding mares

Total females registered from 1988 who could have bred in the period 1990-2010 (allowing for maturity = 626

Total mares who actually bred a pure foal in the survey period = 414 (ie, 66.24% so approx 2/3 of fillies go on to breed)

Average number of pure foals per mare during 1990-2010 = 2.8

**7 Impact of past Grading up**

a. Stallions

To assess the impact of past grading up, the pedigree for each stallion was checked to ascertain whether it contained any grading-up blood and if so, how many generations back this was introduced (Gradeback (GB)), and whether the GR blood appeared on one side of the pedigree (either sire or dam) or both. The following table shows that 98.1% of the Premium stallions have GR blood and produced 745 pure bred foals (64% of the total pure foal crop).

In total 141 (99.2%) of the stallions producing pure foals over the past two decades have some grading up in their pedigrees. They produced 1149 pure foals (98.9% of the total pure foal crop).

Only one stallion (Midshipman) appears to have no grading up in his pedigree. It would appear that the current CB population has very few, if any, 'genetically pure CB' horses.

Table 7- Grade back found in pure breeding stallions (excludes 54 stallions used for part-breeding only)

	No grade back	Grade back one side	Grade back both sides	Total
No. of <b>Premium stallions</b>	1	11	42	54
% of Premium stallions	1.9%	20.4%	77.7%	
No. of foals produced	13 pure 0 part	99 pure 106 part	646 pure 483 part	758 pure 589 part
No. of <b>Non Premium stallions</b>	0	7	81	88
% of non Premium stallions		8.0%	92.0%	
No. of foals produced		52 pure 43 part	352 pure 403 part	404 pure 446 part
<b>TOTAL No. of Pure Foals by Premium and non-Premium stallions</b>	<b>13</b>	<b>151</b>	<b>998</b>	<b>1162</b>
<b>% of all pure foals</b>	<b>1.1%</b>	<b>13.0%</b>	<b>85.9%</b>	

b. Stallions List 2011

The stallion list for 2011 shows 47 horses licensed for pure breeding in the UK. All stallions go back to Cholderton Druid (32), Aerobatic (12) or Apollo (3). Thirteen of the stallions are 18 years old or older with only 5 having licenced sons as replacements.

The pedigrees of the '2011 stallions' were reviewed and only one (Cholderton Yobi) was found with GR ancestors on only one side of his pedigree. The rest of the stallions have Grading up on both sides, many with multiple GR ancestors showing a concentration beginning to build up as the lack of variability of breeding stock increases.

Overseas there are currently 39 stallions licenced and all appear to have GR ancestors on both sides. *Annex E* has charts showing the inter-relatedness of the current licenced stallions.

As well as checking the presence of GR ancestors in the stallions, the number of generations from the nearest ancestor with GR blood was also noted (represented by a Gradeback (GB) number). This is of interest as it gives an indication of the dilution of the GR blood from its entry into the FSB. All of the stallions producing pure foals during 1990-2010 were examined and the individual results are shown in Annex D. It should be remembered that foals are a further generation away than their sires and that the sires only contribute 50% of the DNA.

The generational shift can be seen when comparing the Premium Stallions with the current licenced stallions. Most Premium Stallions have GB3 and the 2011 stallions have GB4 and GB5. Interestingly, amongst the Premium stallions those in GB4 seem to be the most prolific, averaging 26.3 foals per stallion, and there is a distinct difference between the Premium and non-Premium stallions with regard to productivity. The results are shown in the following tables.

Table 8 – Pure breeding stallions showing number of generations away from the GR ancestor

Gradeback generation (no stallions in GB=1)	No GB	2	3	4	5	6	7	8	9	TOTAL
No. of <b>Premium Stallions</b> breeding during 1990-2010	1	4	<b>14</b>	7	7	7	8	3	3	54
No. of pure foals produced	13	80	186	184	86	103	76	5	25	758
<i>Average foal per stallion</i>	<i>13</i>	<i>20</i>	<i>13.3</i>	<b>26.3</b>	<i>12.3</i>	<i>14.7</i>	<i>9.5</i>	<i>1.6</i>	<i>8.3</i>	<i>14.0</i>
As % foals by premium stallions	1.7	10.6	24.5	24.4	11.3	13.6	10.0	0.6	3.3	100
<b>As % of all pure foals 1990-2010</b>	1.1	6.9	<b>16.0</b>	<b>15.8</b>	7.4	8.9	6.5	0.4	2.1	65.1
No. of <b>non- Premium Stallions</b> breeding during 1990-2010	0	2	10	17	<b>20</b>	12	<b>19</b>	6	2	88
No. of pure foals produced		4	33	81	103	63	103	11	6	404
<i>Average foal per stallion</i>		<i>2</i>	<i>3.3</i>	<i>4.8</i>	<i>5.1</i>	<i>5.2</i>	<b>5.4</b>	<i>1.8</i>	<i>3</i>	<i>4.6</i>
As % foals by non-premium stallions		0.9	8.2	20.1	25.5	15.6	25.5	2.7	1.5	
<b>As % of all pure foals 1990-2010</b>		0.3	2.8	6.9	<b>8.9</b>	5.4	<b>8.9</b>	0.9	0.5	34.6

Table 9 – 2011 listed stallions showing number of generations away from the GR ancestor

Gradeback generation	No GB	1	2	3	4	5	6	7	8	9	TOTAL
No. of UK stallions	0	0	2	7	13	15	4	4	1	1	47
No. of Overseas stallions	0	0	2	4	10	7	7	5	4	0	39
<b>Total No. of stallions</b>			4	11	<b>23</b>	<b>22</b>	11	9	5	1	86
% of current stallions per GB generation			4.6	12.8	<b>26.7</b>	<b>25.6</b>	12.8	10.5	5.8	1.2	100

c. Premium Mares

Ideally, an analysis of the breeding mare population (1990-2010) would have been undertaken to ascertain the level of GR blood. However, given the larger number of mares to review (414), it was felt that the Premium Mares could give a useful representation of the mare population.

The Premium Mare scheme began in 1991. Only pure bred Cleveland Bay mares are eligible which are entered in the Society's Stud Book (including Grade Registers). Mares have to have bred at least one foal prior to approval and be a minimum of 5 years old in the year of foaling to be eligible - ie, 4 years old in the year of service provided she has already had a foal. If approved, mares are put on the Society's Premium Mare Register for life unless a future veterinary examination indicates an hereditary defect. By end 2010, 51 mares had been awarded Premium status.

An analysis of the Premium Mares is at *Annex F*. This shows that only 4 mares are under the age of 10 years old and 20 are over 18 years old. Four mares are known to be dead.

The Premium Mares account for 17 licenced stallions, although 4 have subsequently been gelded.

Two stallions attained Premium status (both are now dead), 3 have QA and 4 are overseas.

13 of the stallions account for 55 pure foals during the period 1990-2010, 3 have yet to produce any foals and one was gelded with no pure offspring.

*Table 10 – Premium Mares showing number of generations away from the GR ancestor*

<b>Gradeback generation</b>	<b>No GB</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>TOTAL</b>
No. of Premium Mares (excl. 2 GR mares)	0	2	1	9	10	8	6	11	1	1	49
No. of pure foals produced		10	4	42	27	34	28	33	2	5	185
<i>Average foals per mare</i>		5	4	4.6	2.7	4.2	4.6	4.1	2	5	3.8
<b>As % of all pure foals 1990-2010</b>		0.9	0.3	<b>3.6</b>	2.3	<b>2.9</b>	2.4	<b>2.8</b>	0.2	0.4	15.9

The distribution of GR generations in the Premium mares could be showing a greater spread of GR ancestors which if, indicative of the whole female breeding population, gives hope that the some variety in bloodlines is still available.

#### 8. Scientific view of grading up

1. Dr Phillip Sponenberg DVM, Ph.D. - The CBHS has been asked not to publish this article in a PDF document. It may be seen on the RBST website via the following link:  
<http://www.rbst.org.uk/files/Graspingthe%20Nettle%20-%20Should%20we%20or%20Shouldn't%20we%20Part%201.pdf>
2. Dr Ian Gill - The CBHS has been asked not to publish this via a PDF document. It may be seen on the RBST website via the following link:  
<http://www.rbst.org.uk/files/Grasping%20the%20Nettle%20-%20Should%20we%20or%20Shouldn't%20we%20Part2.pdf>