A refinement in hamster breeding: creating a sustainable colony for vaccine research

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Based on a poster displayed at IAT Congress 22

Abstract

As a commercial breeder, Envigo had a requirement to relocate a hamster breeding colony from the United States of America (USA) to the UK Contract Breeding Services (CBS) Facility. Due to Animals (Scientific Procedures) Act 1986 (ASPA) Code of Practice for the Housing and Care of Animals Bred, Supplied or Used for Scientific Purposes specifications,[1] there was a necessity to amend the established mating regime from trios (2 males, 1 female) to monogamous pairs. On implementing this regime, the number of successful matings was inconsistent and litter sizes were below the expected output. Consequently, the current breeding programme required review. Due to the lack of relevant literature, we had to establish a novel colony plan based on our existing data and expertise as breeders. This poster demonstrates an alternative scheme to produce a sustainable colony with a reduction in numbers of breeding animals used and increased productivity.

Introduction

The Golden Syrian Hamster, *Mesocricetus auratus*, is a desert rodent belonging to the *Cricetidae* family. Due to its unique anatomical and physiological features, it is widely used across a multitude of research areas. The Envigo HsdHan®:AURA colony was first established in 1994 with stock originating from Zentralinstitut fur Versuchstiere in Hannover, Germany. Envigo acquired the line along with the Sprague-Dawley Company in 1973.

In 2016, Envigo was approached by Public Health England (PHE), an executive agency of the Government of the United Kingdom Department of Health and Social Care, to breed and supply cohorts of hamsters for a 4-year experimental programme of work, focussing on the research and development of new treatments for *Clostridium difficile* related illnesses. At this time, the HsdHan®:AURA colony was based in Envigo's North American barrier facility. Due to the duration of this programme of work and the considerable ethical burden associated with transatlantic travel it was deemed more appropriate to have this model readily available in the UK where the experimental work was to be performed.

On relocation of the line from the USA to the UK, due to ASPA Code of Practice specifications, there was a need to revise the established breeding strategy used in the USA of 2 males to 1 female. On review of the literature, of which there was very little relating to hamster breeding, monogamous pairings of hamsters from weaning were deemed the most productive and labour efficient method of breeding. The colony was first housed in isolators before being relocated to Individually Ventilated Cages (IVCs) in November 2019.

Figure 1. Golden Syrian Hamster (*Mesocricetus auratus*).

Method

Continuous mating in isolators

- 15 male and 15 female hamsters were imported from Envigo RMS USA to establish monogamous breeding pairs for continuous mating.
- 15 monogamous pairs were first mated on 18th November 2017 with an expected output of 135 pups born based on the average litter size of 9 pups per female at Envigo's USA barrier.

Results

Continuous mating in isolators

Mating	Actual pups born versus expected pups born	Success %	Average litter size	Pre-wean loss	Age range per cohort of pups born (days)
Weeks 1-5	119/135	88%	9	19%	4 days
Average weeks 1-27	656/1881	35%	6	49%	Highly variable end largely unpredict-able

- Whilst the first mating was 88% successful expected versus actual output, anticipated subsequent matings were sporadic with low productivity and high pre-wean loss.
- Subsequently, it was deemed critical to review the continuous mating scheme.

Method

Peak mating in isolators and IVCs

- All breeding pairs were separated for a period of 10 days.
- Future monogamous pairs (9 males and 9 females) were selected.
- 48 hours prior to mating, nesting material was removed from the female cage and placed into the corresponding male cage.
- Simultaneously, nesting material was removed from the male cage and placed into the corresponding female cage.
- On day 0 the female was transferred into the male cage for mating.
- The female home cage was not cleaned or modified in any way.
- On day 9 the female was removed from the male cage and transferred back to her home cage.

Results

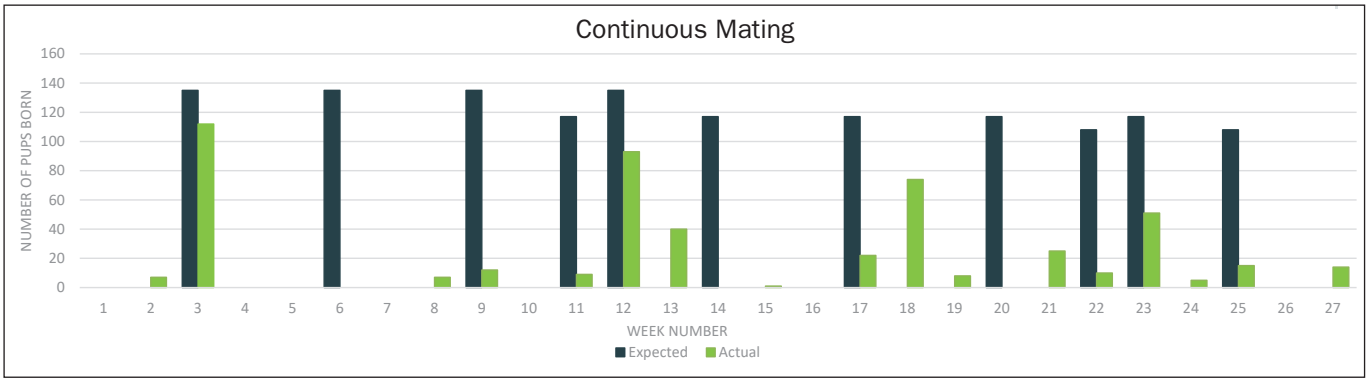
Peak mating in isolators

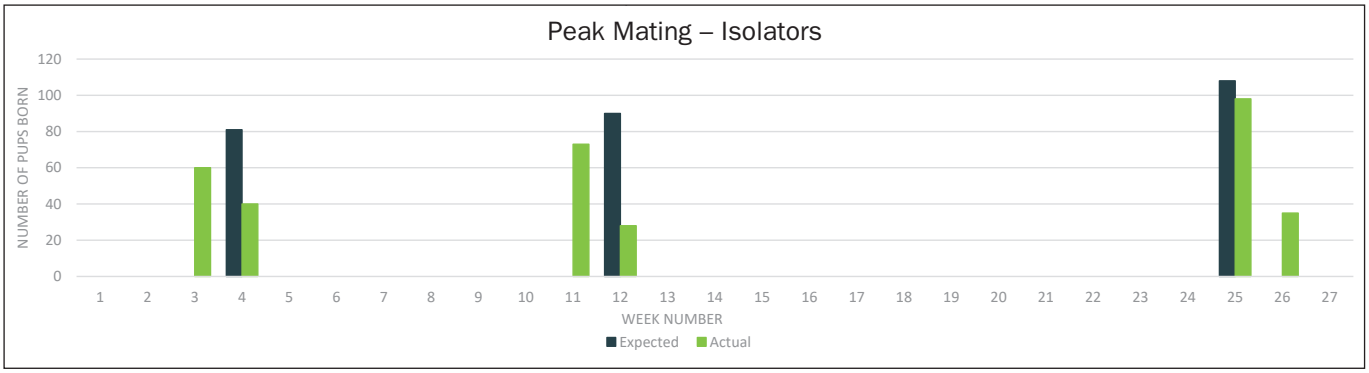
Mating	Actual pups born versus expected pups born	Success %	Average litter size	Pre-wean loss	Age range per cohort of pups born (days)
Weeks 1-5	100/81	123%	11	15%	9
Average weeks 1-27	334/279	120%	11	11%	8

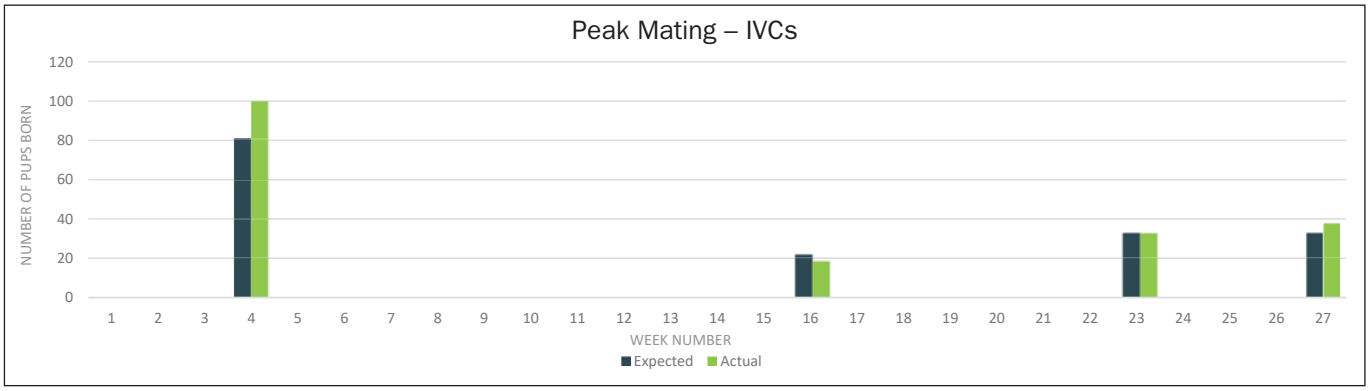
Peak mating in IVCs

Colony was relocated to IVCs in Nov 2019

Mating	Actual pups born versus expected pups born	Success %	Average litter size	Pre-wean loss	Age range per cohort of pups born (days)
Weeks 1-5	26/18	144%	13	0%	1
Average weeks 1-27	116/90	129%	11	11%	1







Conclusions

Following the transfer of a hamster colony from the USA to the UK, we set out to breed cohorts of hamsters for PHE experimental studies. On review of the literature, a monogamous continuous breeding scheme was established. Whilst the output from the first mating was not as successful as the US production colony output, it was in line with expectations. Anticipated subsequent matings were sporadic with low productivity generating cohorts of animals that were unusable for the customer and therefore went to waste. Consequently, it was necessary to review the established breeding scheme. A peak mating scheme was selected. Pre-assigned monogamous pairs were housed separately for a period of 10 days after which the scent of the male hamster was introduced to the female's cage by the transfer of nesting material. Mating was predominantly observed immediately on introduction of the female into the male cage 48 hours after scenting. After 10 days, the female was removed from the male cage and returned to her untouched home cage. On average, the three peak matings performed generated 20% more pups born than anticipated, based on the USA production colony output, with an average litter size of 11. There was a concern that the larger litter sizes would be an increased burden on the female resulting in a higher pre-wean loss. Our data demonstrates that this is not the case. On average pre-wean loss was reduced to 11%. This scheme enabled the production of large cohorts of animals born within on average an 8-day window as per the customer's specifications utilising fewer numbers of breeders to achieve the required output, therefore refining our breeding scheme and eliminating animal wastage.

Since transferring the colony to IVCs, the number of breeders successfully producing a litter has increased from 120% to 129% over a comparative period and the average age range per cohort of pups born has been further refined to 1 day.

Discussion

In addition to the measurable benefits published in this poster on the use of a peak mating scheme versus a continuous mating scheme, it was generally noted that female hamsters showed reduced aggression when being handled. We hypothesise the increased productivity observed in IVCs versus isolators to be due to the females only being able to smell the one male scented to her, rather than many animals, as is the case within an isolator where animals are held in open top cages. In optimising our hamster breeding strategy Envigo has been able to readily support PHE's cohort requirements which has proved critical during the COVID-19 pandemic. The peak mating scheme has also been used with transgenic mouse models and has proved equally successful. As a refinement, we plan to trial a process that reduces the requirement to single housed males for an extended period of time.

Acknowledgements

Envigo would like to say a very special thank you to PHE for their continued support without which this poster would not have been possible.

References

1 **Code of Practice for the Housing and Care of Animals Bred, Supplied or Used for Scientific Purposes.** Print ISBN 9781474112390. Web ISBN 978147411240. https://assets.publishing.service.gov.uk/