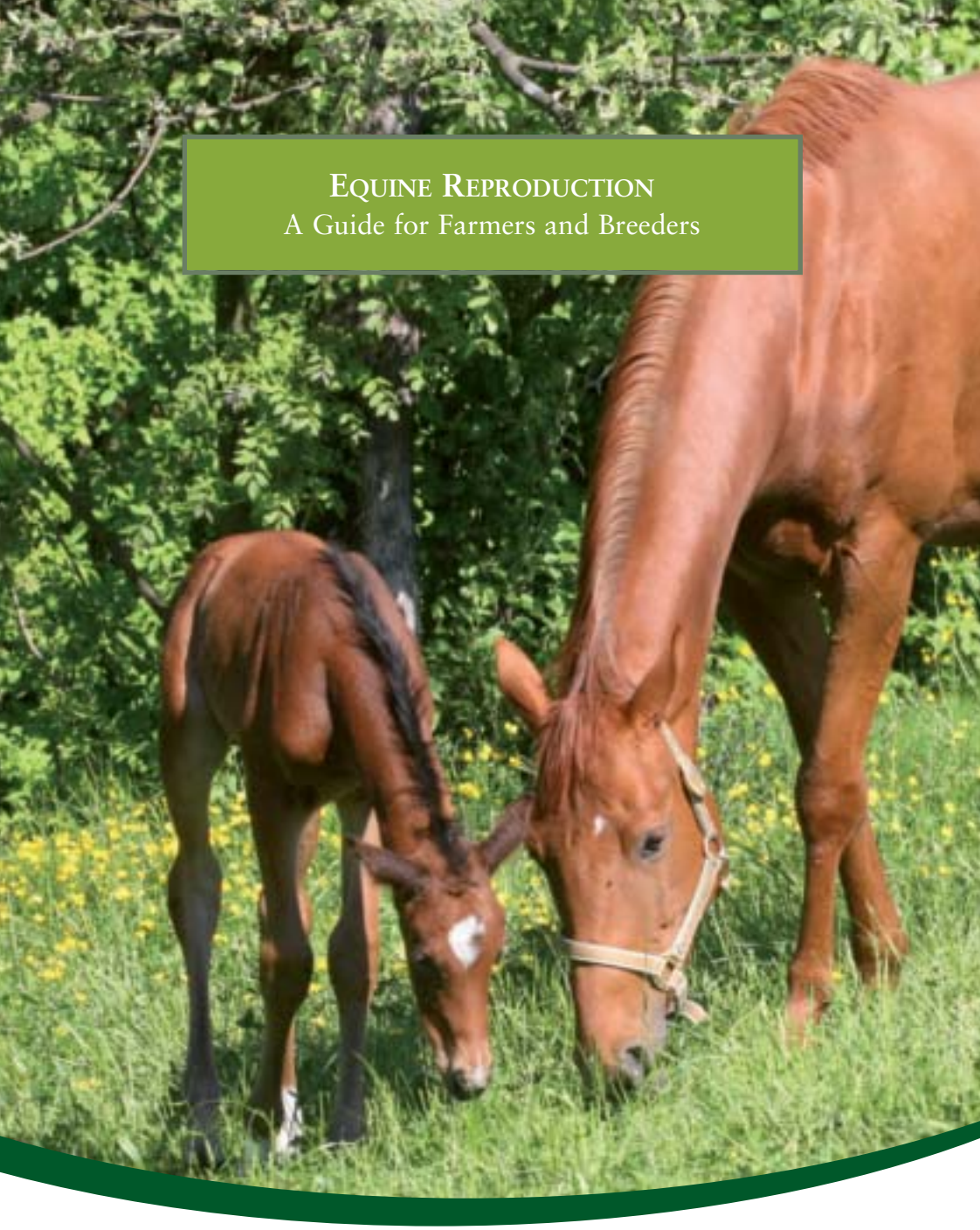

Equine Reproduction

A Guide for Farmers and Breeders

teagasc
Agriculture and Food Development Authority

EQUINE REPRODUCTION
A Guide for Farmers and Breeders

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This brochure is intended as a guideline only and is not a substitute for reproductive consultation with your veterinarian.

Introduction

There's a consistent demand for quality horses.

Breeders of top quality sport horses can look forward to a bright future filled with opportunity. The market shows a proven and consistent demand for quality horses and breeders should streamline their operations to take advantage of this situation. Shrewd choice of breeding stock and better management techniques will improve the quality and consistency of foals, and thus improve profit margins at the same time. This guide outlines the basics of breeding, specifically for small and medium-sized breeding operations. Further and more specific information is available from the Teagasc equine specialists.

1. Bloodstock selection

Decide on your breeding goal.

Breeding goal

Every breeding programme begins with a breeding goal and the first decision to be made is what type of horse you wish to breed.

The national breeding goal for the Irish sport horse is:
'To produce a correct, sound, athletic sport horse with good basic paces, pleasant to ride with a good temperament to be used as a pleasure or performance horse capable of competing in jumping, eventing and dressage at national and international level'.

As a breeder, you must decide where your enterprise fits within this broad definition. Do you want to breed a showjumper or an eventer, a show horse or a dressage animal? Having decided on your breeding goal, the next step is to match mares and stallions that are most likely to help you achieve it.
There is a market for horses destined for international equestrian sport and competition, but also for leisure horses and horses for amateur riders. In both cases the demand is for an athletic, sound and good-looking horse with good movement and temperament.

Selection of breeding stock

Choosing and matching dams and sires is directly related to your breeding goal. If your aim is to produce a quality show horse then selection is based on conformation and movement, together with show success on both the mare and stallion sides. If on the other hand your outlook is to produce a competition horse, then proven performance of the dam and sire along with an assessment of the performance results of other offspring and relatives of both sire and dam are critical. If your objective is to produce a pleasure horse then the characteristics of primary interest are temperament, hardiness and good looks.

Reproductive soundness is important regardless of the type of animal you intend to breed. This is the ability to produce a healthy offspring with minimal financial cost and minimal danger to the mare. Likewise, soundness of wind and limb is important.

Temperament impacts on ease of management, training and riding. The professional rider will cope with temperament 'issues' better than the amateur and leisure rider. However, even in the professional world ease of riding impacts on performance, regardless of ability.

Criteria for selection of a broodmare

The broodmare must be veterinarily sound with good conformation and athletic movement. She must have a good temperament and pedigree, i.e., be well related to other animals that demonstrate the performance attributes you, the breeder, are seeking to reproduce. The mare must demonstrate an ability to perform in the sport you have chosen to breed for. For example, if the goal is to produce international jumpers the mare must demonstrate excellent technique and scope over fences coupled with a good canter. If finance to test the mare in competition is unavailable, have you the skills to assess her yourself or is advice required?

The mare must be fertile, otherwise it is a very costly initiative. It is very important to have a breeding soundness examination conducted by a vet prior to the purchase of a potential broodmare.

Criteria for selection of a stallion

The breeder must get as much information as possible before selecting a stallion. Stallions are selected for temperament, conformation, movement, veterinary soundness,

performance, pedigree and progeny. The stallion must have good fertility to enhance the mare's chances of going in foal. The mare's shortcomings should be balanced with the stallion's strong points.

Pedigree, performance records and genetic indices should be checked. Information on a stallion's breeding value is compiled and presented in different formats so breeders must understand it and use it to maximise their investment.

Horse Sport Ireland (HSI) publishes five categories of stallions: Approved (Apr); Section 1 (S1); Section 2 (S2); Supplementary 1 (U1); and Supplementary 2 (U2). S1 and S2 stallions are in the main studbook with pedigree recorded while U1 and U2 stallions are listed in the supplementary studbook and have only partial pedigree or no pedigree recorded.

Current ISH classification system		
Main section	**Approved stallions**	Passed veterinary examination, conformation, movement and, where appropriate, performance.
	Section 1 stallions (S1)	Passed veterinary examination, but have not passed inspection for approval.
	Section 2 stallions (S2)	Failed veterinary inspection.
Supplementary section	**Supplementary Approved (SA)**	Passed veterinary inspection and stallion and/or progeny competing to a specified level.
	Supplementary 1 (U1)	Partial pedigree and passed veterinary examination.
	Supplementary 2 (U2)	Partial pedigree and failed veterinary inspection.

Recent research by Karen Hennessy, UCD, shows that foals by approved stallions achieve, on average, €400 more at auction than those by other stallions.

Planned traffic light system from January 2010

From January 2010 it is planned to implement a new classification system for Irish sport horse stallions using a 'traffic light system' with three classification categories: Recommended for Breeding; Preliminary Recommendation for Breeding; and, Not Recommended for Breeding.

Recommended for Breeding

Stallion has demonstrated the required standard in ALL elements of the inspection process:

- veterinary examination;
- conformation and movement;
- athleticism and competition performance; and,
- progeny.

Additional merits

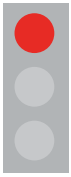
Stallions can be rated 1* to 5* based on their own performance or performance of their progeny.

Preliminary Recommendation for Breeding

Stallion has demonstrated the required standard in:

- veterinary examination;
- initial conformation/movement; and,
- initial athleticism.

However, the stallion must complete either riding and/or competition requirements.



NOT Recommended for Breeding

Stallion did not demonstrate the required standard in one or more of the following:

- veterinary examination;
- conformation and movement;
- athleticism and competition performance; and,
- progeny.

Transfer of stallions from current ISH classification system to new classification system:

Stallions currently in the Approved category will transfer to the Green category. Those currently rated S1 will transfer to the Orange category, while those presently rated S2 will transfer to the Red category.

The animals listed in the Supplementary category, and considered not approved for breeding, will not be published by HSI.

Stallions' standing abroad

Where stallions from abroad are being used, it is essential that the breeder becomes familiar with the approval system in the relevant studbook and researches as much information as possible.

Research as much information as possible.

2. ESTIMATED BREEDING VALUES

EBVs are a good indication for breeding traits.

Estimated breeding values (EBVs) are predictions of the genetic advantage that a stallion or mare will pass on to its offspring for a particular trait. The KWPN in Holland and other European studbooks are using genetic evaluations for stallions very successfully.

HSI has compiled EBVs for jumping, conformation, movement, temperament and athleticism. In simple terms, a stallion like Cruising or Clover Hill is more likely to breed jumpers than other stallions. EBVs estimate how much that improvement can be expected to be in the offspring.

EBVs are expressed as an index with an average value of 100. The higher the EBV figure the better. A horse with an EBV of 140 for jumping will have a better chance of breeding jumpers than one with a value of 120. On the other hand, stallions with values below 100 are unlikely to improve that aspect in their offspring. The more information that is included in the EBV, the more reliable the results will be. The accuracy can range from 0 to 1. EBVs with an accuracy of 0.7 or greater have a good level of reliability.

EBVs are not the absolute answer to breeding, but they are a good indication. As more results are included they will become more reliable.

Research by Karen Hennessy, UCD, shows that 70% of the offspring of stallions with an EBV greater than 120 competing in show jumping competitions will reach the level of 1m 30 or above. This rate falls to only 15% where the EBV is less than 100.
Karen's research also shows that foals by stallions with an EBV for jumping ability above 120 achieve, on average, €1,100 more at auction than foals by stallions with EBVs below 100. Foals out of high EBV mares achieve, on average, €2,200 more than foals out of low EBV mares.

Stallion viewing

Upon completion of a list of suitable stallions, arrange a viewing and, if possible, also a viewing of some of the progeny before deciding on the stallion most suited to your individual mare. Do not make a decision based on marketing material alone. Where stallions' standing abroad are being used, ask for a DVD or CD; this will allow a more accurate evaluation when combined with information on own and progeny performance.

3. Reading a pedigree

A pedigree is a very useful selection tool.

A pedigree shows the horse's ancestry. It is often illustrated in a grid-like format. The horse's sire and dam are the first generation, the grandsire and granddam are the second generation, and so on.

First generation	Second generation	Third generation	Fourth generation
Sire	**Paternal grandsire**	Great grandsire	Great great GS
		Great granddam	Great great GD
	Paternal granddam	Great grandsire	Great great GS
		Great granddam	Great great GD
Dam	**Maternal grandsire**	Great grandsire	Great great GS
		Great granddam	Great great GD
	Maternal granddam	Great grandsire	Great great GS
		Great granddam	Great great GD

A pedigree is a very useful selection tool. Researching a pedigree can tell you a lot. It is like a history book of the horse's genetic past, and the past can be used to help plan the future. The pedigree can help to determine the type of performance the horse is best suited to; how its ancestors have performed; the type of crosses used to produce the horse; and how the next generation might be bred. However, if the horse's performance record, conformation and disposition are not known, the value of the animal's pedigree is limited. The more information that is available about the weaknesses and strengths of the horses in the pedigree then the better job can be done in planning the next generation. This accumulation of information relies on the owner, breeder or buyer talking to people that have been associated with specific bloodlines to learn the weaknesses and strengths of those lines. Pedigree is more than just a family tree, it is a book of information that can be used as a management tool to help improve the next generation of horses.

Percentage of influence of individuals in a pedigree by generation position

1st generation	2nd generation	3rd generation	4th generation	5th generation
50%	25%	12.5%	6.25%	3.125%
6th generation	**7th generation**	**8th generation**	**9th generation**	**10th generation**
1.56%	0.78%	0.39%	0.195%	0.01%

4. REPRODUCTIVE ANATOMY OF THE MARE

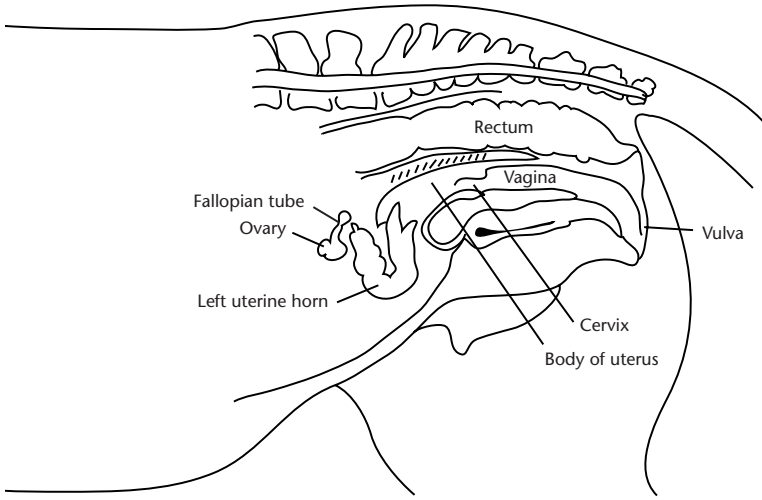


FIGURE 1: The mare's reproductive system.

The mare's breeding organs include two ovaries, fallopian tubes, the uterus (womb), the cervix and the vagina. There is a complicated relationship between the various parts of the reproductive system and the glands that control the release of hormones. The hormones play a crucial role in controlling the mare's reproductive cycle.

The mare's reproductive system has three important seals that help to protect it. These are the vulva, the entrance to the vagina and the cervix (the entrance to the uterus).

A mare with good perineal conformation has a vulva that is upright and vertical with the anus (**Figure 2**). In mares with poor perineal conformation the vulva slopes forward above the floor of the pelvis. In some mares the lips of the vulva do not form a tight seal.

These conformation faults predispose the mare to sucking air and faecal material into her vagina ('windsucking'). Windsucking allows harmful microorganisms to enter the reproductive tract and therefore creates the potential for infection and inflammation to develop.

Figure 2: Example of good perineal conformation.

Poor perineal conformation.
Note the shelf and very relaxed vulval lips.

Caslicks performed on the vulva.

A procedure known as a Caslicks can be performed to help mares with poor perineal conformation. The edges of the vulva lips are cut and then sewn together. The sewn portion of the lips heal together to form a protective barrier that prevents the mare from 'windsucking'. The mare is still able to urinate freely and discharge can still drain through the lips.

The mare may need to have the lips opened and re-stitched to permit breeding. In all cases the stitches must be opened approximately two weeks before foaling (when the mare's udder has bagged up and foaling is close). Consult your vet for advice.

5. THE REPRODUCTIVE CYCLE OF THE MARE

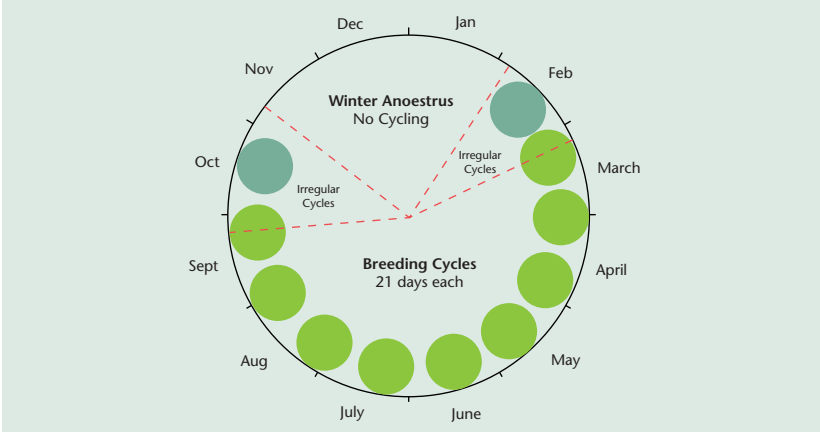


FIGURE 3: Breeding cycle of a mare.

The mare has a reproductive season and a non-reproductive season, both of which are controlled by light. The non-reproductive season, known as anoestrus, occurs in the autumn and winter when there is little natural light. The reproductive season begins in the spring when light levels increase and continues through the summer.

Mares therefore cycle naturally from March/April through to September/October. The peak of the breeding season is in May, June and July.

Two other periods are known as the spring and autumn transitional stages. One occurs just before the mare becomes reproductively active in the spring and the other occurs just before anoestrus in the winter. During these periods mares are generally erratic in their cycles and sexual behaviour. The spring transition period coincides with increased daylight hours, increased grass growth and ambient temperatures. As the season progresses cycles become regular.

Puberty in the filly occurs, on average, at one-and-a-half years of age. Spring-born fillies show heat as yearlings and those born later in the year generally do not cycle until they are two years old.

The mare's breeding cycle is, on average, 21 days, but this can vary greatly between

Knowledge of the reproductive cycle of a mare is critical to successful breeding of competitive sport horses.

individual mares. For a period of around five to seven days within the 21-day cycle the mare is 'in heat', 'in season', 'horsing', 'in oestrus' or 'receptive' to the stallion. The other 14 to 16 days the mare is 'out-of-season', 'in dioestrus' or 'not receptive' to the stallion.

The behaviour of mares in season can include squatting, 'winking' of the vulva, and frequent urination.

Mares also tend to become restless during oestrus. In the absence of stallions a mare might tease to a gelding, or another mare. Maiden mares and mares with foals at foot may fail to show oestrus behaviour.

In early oestrus the mare may only show lukewarm signs of being in season. The intensity of the signs usually increase so that the mare is very receptive within one to three days of her ovulation. The mare can remain receptive to being bred for 24 to 48 hours after ovulation (when the egg is released from its follicle). Most mares are receptive during the 24 hours surrounding ovulation. Changes in intensity can be subtle and it is important to pay attention to behaviour, although it is difficult to determine by behaviour alone when a mare will ovulate. Ovulation can be assumed to have occurred 24 to 48 hours before the mare begins 'teasing off'. Veterinary use of ultrasound scanners makes it possible to monitor follicle growth and predict timing of ovulation.

When the mare is not in season she will usually refuse to stand still, will swish her tail, pin her ears back, and possibly squeal and kick at the stallion. Mares remain unreceptive until their next oestrus period, which is usually 14 to 18 days after an ovulation if she has not conceived.

6. Manipulating the mare's reproductive cycle

Pregnant mares need turnout.

Manipulation of the mare's cycle may be needed for either of two reasons:

1. To produce foals early in the year.
   (Producing sport horse foals early in the year for the purpose of having strong foals to show adds considerably to labour and input costs.)
2. Where the mare has difficulty cycling naturally.

It is possible to manipulate the mare's reproductive cycle in a number of ways:
A: Hormonally. Hormonal manipulation is best undertaken with veterinary advice.
B: Placing a mare under artificial light can trick her system into cycling earlier in the season than under natural conditions. Mares exposed daily to a light period of 16 hours (including natural daylight hours) will experience their first ovulation 60-90 days after the light programme begins. A 100- to 150-watt bulb is usually sufficient.
To have mares cycling and ready to begin breeding between mid-February and the beginning of March, for example, the mare must be placed under the daily extended light period between mid-November and the beginning of December.

C: Increased diet and ambient temperature can also assist in preparing the mare for early breeding especially when combined with increasing exposure to light. Fresh air and freedom help keep horses healthy; however, if the goal is to trick the mare into believing it is spring, then it is more advisable that they are not turned out in very wintry conditions. In these circumstances, alternative forms of exercise, e.g., lunging or the horse walker must be available.

Putting rugs on mares is also a worthwhile consideration, particularly for maiden and barren mares. It is not wise to rug pregnant mares in the event of foaling without supervision, as the foal might get tangled in the rug straps. Rugs will also hinder suckling.

7. Pre-breeding management of mares

Young mare in ideal body condition.

The first step in raising a healthy foal is to have a healthy mare. If the mare is not in good health her reproductive system is unlikely to perform optimally.

Age should also be considered. 2-3% of younger mares are problem breeders, while 20-25% of older mares (13yrs +) are problem breeders. In general, a mare's fertility decreases after she is 12 to 13 years of age.

When considering breeding a young mare it is advisable to choose one that is physically mature enough to handle the demands of pregnancy and lactation without compromising her own or her potential foal's well-being. The young mare must be fed appropriately to meet both her growth and pregnancy needs.

The mare's body condition should be evaluated to ensure that she is neither too thin nor overweight when it is time to breed her. A mare should carry enough flesh to cover her ribs and have a relatively flat topline when viewed from the rear. Excessive fat seen as deposits of fat around the tail-head, a cresty neck and having difficulty feeling the ribs with moderate finger-tip pressure should be avoided if possible.

Before breeding, a mare should be up to date on essential influenza and tetanus vaccinations. The usual timeline for 'flu and tetanus combined injections after the initial injection is:

Second 'flu/tetanus injection	Not less than 21 days and no more than 90 days after the initial injection
Third 'flu/tetanus injection	No less than 150 days and no more than 215 days after the second injection
Booster injections	Minimum of yearly intervals thereafter, but owners should consult rules re performance horse requirements

Mares must be on a regular effective de-worming schedule. Consult the Teagasc Horse Ownership manual for information on worming and parasite control. It is extremely important to read the product instructions with regard to suitability for use in pregnant and lactating mares.

Any dental problems should be corrected and annual floating (*smoothing or contouring the teeth with a file called a 'float'*) completed so that the mare can make the most of her diet and not need stressful dental procedures during late pregnancy.

Routine foot trimming should also be up to date. A mare's feet must be trimmed regularly (every six to eight weeks). Mares with broken or cracked feet, long toes, flat soles and weak heels can become lame and often may be difficult to get in foal. Most mares can be kept without shoes but those with bad feet may require shoes in front. Never put on shoes behind in case she harms her own foal or other mares or foals. Pick out her feet regularly, as this is an opportunity to assess her foot condition and also prevents stone bruises. The mare should be able to support the added weight of pregnancy without undue pain or distress.

Pay attention to the mare's vaccination and deworming schedules, teeth and feet.

Ideally, the decision to breed a performance mare should be made the autumn before the breeding season. This allows an adjustment period for the mare in coping with being teased and managed for breeding. It also allows the time and patience required in handling a maiden mare as she learns to adjust to her new role in life.

8. Gestation period

In general, mares will foal when they are ready.

The average equine pregnancy lasts for 340 days. Pregnancy length can range from 310 to 374 days. Foals born earlier than 300 days are unlikely to survive. Many owners become concerned if a pregnancy exceeds the expected duration. In general, mares will foal when they are ready and this is not necessarily when they are calculated to be 'due'. If worried about the duration or any other aspect of your late-pregnant mare, ask your vet to check all is well with the pregnancy.

The estimated foaling date can be calculated from the following:

Estimated foaling date = the date of the last covering plus one year minus 25 days.

Example: If a mare was covered on 1 May 2009 she is due to foal on 5 April 2010.

9. RECORD KEEPING

Good records can save a lot of time and improve breeding performance. Detailed and accurate health and reproductive records are extremely important when breeding and foaling mares. The details should include the mare's vaccinations, de-worming schedule, hoof and dental maintenance, medications and any health problems.
Specific reproductive records for a given mare should also be maintained season to season in a dedicated diary. Mares tend to repeat breeding and foaling patterns.
The records should include: the year, mare's age, previous relevant reproductive history (for example number of foals, foaling complications, breeding injuries, tendency to pool urine, abortions and their identified cause, previous uterine biopsy scores if undertaken). The mare's status at the beginning of the current season (maiden, open, barren or foaling) should also be recorded.

A **maiden** mare is a non-pregnant mare that has never been bred; an **open** mare is a non-pregnant mare that has previously produced a foal but was not bred during the previous breeding season; a **barren** mare is a non-pregnant mare that was bred during the previous breeding season and is not in foal at the end of the breeding season; a **foaling** mare is a pregnant mare that will foal some time during the upcoming breeding season.

Detailed records of each oestrus cycle are critical for effective management. For example, record the date non-pregnant mares are put under lights and subsequent daily teasing activity. For foaling mares record daily pre-foaling changes in her udder and teat development. Record the date of foaling, difficulty of delivery, and any post-foaling complications, as well as the details of her first post-foaling reproductive examinations. A record should also be kept of the time of foaling, the time the foal stands, the time of first suckling and also the time the afterbirth is passed.
For cycling mares, records of the daily events should include how the mare teased and details of any veterinary examinations. Coding can be used to make records easy to follow and quick to enter.

Example

Follicles	1R = 1cm follicle on right ovary	2L = 2cm follicle on left ovary
Cervix	CX = cervix closed	3C = cervix open 3cm
Mating	SI = served by insemination	SN = served naturally
Scanning	U = scanned in foal	Ux = scanned not in foal
Others	F = foaled	O = ovulated
Others	S = stitched	

For recording teasing behaviour a simple one to five scale can be used as follows:

Scale	Description
1	Resists the teaser, pins ears back, kicks at the teaser
2	Indifferent towards the teaser, tolerates his presence
3	Interested in the teaser as evident by advancing towards him and lifting the tail
4	Stands close to the teaser, sometimes in a squatting position, some urination and winking of the vulva lips
5	Squatting, frequent urination, winking of the vulva, leaning toward the teaser

This is very useful information both for you in the management of your mare and for your vet. See appendix A for examples of keeping a diary record.

10. TEASING

Example of a teasing board hinged to the wall, which can be pulled out for teasing. Teasing should take place across a solid barrier for safety reasons.

Teasing is an important breeding management tool which should not be overlooked unless a farm cannot accommodate the maintenance and handling of a teaser male. A teaser can either be a stallion or a gelding which demonstrates good libido. He must be persistent and stimulatory to a mare. He should sniff, nudge and nip at the mare but never be vicious or savage. He should be easy to handle and obedient so that he will back away from a mare when directed to do so.

It is best if the same person observes the daily teasing of the mare so that subtle changes in her behaviour as she progresses through her cycle are more likely to be noticed. Some mares are obvious in their behaviour. They stand, break down, urinate, and wink their vulva the instant they come into contact with the teaser. These mares literally have to be pulled away when teasing is over. They are also blatantly 'out' when they are in dioestrus. They then immediately pin their ears back, swish their tails, move about at the first nicker of the teaser and begin letting fly with their hind legs.

Some mares are shy and routinely resist a teaser's advances even when they are approaching ovulation. These mares finally break down with a little patience and persistence on the part of handlers and the teaser. The extreme is the mare who strikes out with her front and rear feet, then perhaps stands still for a moment or two (close to ovulation time) while the teaser cautiously sniffs her over.

If possible tease the mare at the same time of day. Give her time to show but do not tease for too long at any one time, five minutes is more than sufficient and most will respond much more quickly.

If a mare is suspected of having silent heats, have her examined by a veterinary surgeon. This is where, by your daily day count after foaling she should be in season and perhaps internally she is doing all the right things, but is showing no external signs.

Start teasing mares on day five or six after foaling. Mares in season should be teased daily through their heats so that the intensity of their signs can be monitored and to double check that the mare teases out as expected. Mares thought to be in dioestrus and/or early pregnancy (less than 40 days) should still be teased at least two to three times a week so that short-cycling (early return to oestrus) and mares which lose their pregnancies and unexpectedly return to oestrus are not missed. Pay careful attention during the 16 to 18 days following ovulation to tease mares daily so as not to miss the beginning of the next oestrus period.

Mares which have been diagnosed as not pregnant, and then fail to come back into season, warrant a second ultrasound examination. It is possible that she is pregnant and the embryo was missed at the first scan because it was a little small for its gestational age or because the mare conceived on a second undetected ovulation a couple of days after the first ovulation. Likewise, it can sometimes be difficult to determine accurately the early pregnancy status of mares who have cysts in the uterus. A pregnancy should grow and a cyst does not, otherwise they appear similar and there can be a difficulty in differentiating between the two in early pregnancy.

Mares which have been given prostaglandin (PG) to bring them back into heat also need close daily teasing so as not to miss the start of the next oestrus period. Late winter anoestrus and spring transitional mares should also be teased twice weekly to get a handle on their progress.

Some mares (maiden mares; performance mares; mares with very young foals) simply do not display signs of behavioural oestrus even though they are cycling normally. In these instances, more intensive observation is required to detect subtle signs such as vulva lengthening, clear and slight mucous vulva discharge, increased restlessness, and vocalisations, all of which might indicate the mare is in oestrus.

11. TIMING OF BREEDING

Breeding on the foal heat (six to ten days post-foaling) should only be considered if the mare has had a normal delivery, passed her placenta (the afterbirth) within four hours of delivery and experienced no other apparent problems.

Maiden and barren mares generally have a lower conception rate at the first heat of the season.

Mares are usually receptive to being bred for five to seven days. They normally ovulate during the last 24 to 48 hours of that heat period but accurately predicting exactly which day a mare will ovulate is impossible with teasing alone.

The traditional natural breeding strategy is to cover a mare every 48 hours during her heat, beginning on the second day of showing oestrus signs. This is continued until she is no longer receptive to the stallion. The average fertile stallion's semen will last for at least 48 hours in the mare. The main disadvantage with this strategy is an increased risk of the mare developing a uterine infection and overuse of a busy stallion. Semen is not sterile, and every natural covering introduces contaminants and bacteria as well as sperm into the uterus.

A healthy, young mare with good perineal conformation can clear contamination within 48 hours. This sort of mare is less likely to become infected as a result of breeding.

The following categories of mares have a much more difficult time clearing contamination:

- older mares which are predisposed to windsucking through poor perineal conformation;
- mares predisposed to pooling of urine in the vagina;
- mares that experience accumulation of uterine fluid; and,
- mares which have a cervix that fails to relax completely during oestrus.

Another strategy is to breed the mare before, and as close to the time of ovulation as possible. This will limit the number of coverings/inseminations necessary, which is important:

- with susceptible mares described above;
- with stallions with large books of mares;
- when the number of artificial insemination breeding doses is limited; and,
- where frozen semen is used.

When the mare is bred 48 hours or less before her ovulation she should only need to be bred once during the cycle.

Optimal timing of covering/insemination	
Natural covering/fresh semen	24-48 hours before ovulation
Chilled semen	12-18 hours before ovulation
Frozen semen	6 hours before to 6 hours after ovulation

In situations where breeding must be based solely on the mare's behaviour, one effective strategy, for some farms with exceptionally good and careful teasing management, is to breed mares on the third day of their behavioural oestrus and once more on the fifth day should they continue to tease strongly.

Experienced vets can accurately predict ovulation time. With the aid of the ultrasound scanner it is possible to be much more accurate in the timing of coverings relative to ovulation.

In general, when a dominant follicle reaches a diameter of 3.5 to 4cm and softens, it is a reasonable guesstimate to say that the mare is within 24 to 48 hours of ovulation. This prediction can be tweaked based on how the follicle looks and feels, how strongly the mare is teasing in, what her uterine and cervical tone feel like, and previous ovulation histories. This is where record keeping is important.

Veterinary intervention prior to breeding would involve:

- speculum examination to assess the cervix;
- swabbing the mare's uterus when she is in season to check if she needs treatment/wash outs prior to covering;
- possible opening of a stitched mare for covering;
- scanning to monitor the development of follicles;
- assessing the mare for presence of uterine fluid, urine pooling, inflamed or irritated cervix and presence of cysts; and,
- possible administration of hormones.

Cost implications

Consider the following when making your decision about the extent of veterinary involvement in your breeding programme:

- increased veterinary input increases costs in the form of professional fees and often materials such as hormones, washes/treatments

but, minimal veterinary input and scanning can bring its own hidden costs:

- covering more often increases the chances of your mare being infected, increasing the possibility of her not conceiving and the subsequent necessity for more intense veterinary treatment, wash outs and injections;
- less veterinary supervision may mean longer stays at stud or indeed missing ovulations, which proves costly through increased transport costs, and increased keep costs; and,
- low veterinary input means that mares with reproductive problems are not identified quickly, thus wasting your investment.
- A.I. necessitates greater veterinary monitoring to ensure there is no wastage of semen,

■ allows transport and boarding costs to be eliminated if keeping the mare at home or indeed reduced if using a local vet clinic or stud farm.

Handling stocks make veterinary examinations safer and easier.

Speculum examination to view the cervix

12. ARTIFICIAL INSEMINATION (A.I.)

The use of artificial insemination (A.I.) has increased during the past couple of seasons. Its advantages are:

- the addition of antibiotics to semen extenders reduces venereal transmission of bacterial diseases, where the stallion serves as a carrier. Treated semen also reduces the risk of infection in susceptible mares
- there is reduced risk of breeding injuries to both the stallion and the mare
- semen collection with an artificial vagina allows evaluation of semen quality and assists in the early detection of infertility problems in the stallion
- reduced need to transport the mare and young foals
- removes the necessity for boarding at stud farms (cost factor and exposure to disease)
- the best stallion for the mare can be used irrespective of location
- can prevent the transmission of infection

A.I. is a highly effective, convenient and safe method of horse breeding.

Dummy used to collect semen from stallions for artificial insemination.

Chilled semen

Semen is collected from the stallion, using a dummy, in an artificial vagina (AV). It is examined under microscrope in the laboratory for quality. Depending on the quality, the semen is extended – diluted – into a number of doses. The extender contains food for the sperm and antibiotics to reduce the risk of disease spread. The extended semen is chilled and packaged ready for transportation to the breeder. Chilled semen gives access to stallions standing abroad, competition stallions and stallions in other parts of the country without the mare having to travel. Chilled semen will remain viable for 48 to 56 hours if stored correctly.

Not all stallions produce semen that will tolerate storage. When processed and handled correctly, chilled semen can achieve pregnancy rates equal to those achieved with natural service.

If using chilled, transported semen it is important to establish good communication between the vet and those selling it. Proper timing of insemination, 12 to18 hours before ovulation is critical, so accurate prediction of ovulation time is important. The time required for transport of semen and the stage of the mare's oestrus cycle must be synchronised. The stallion farm should be notified on the first day of oestrus and again requested to transport at least 24 hours in advance of the insemination time.

Additional costs include the cost of transport arrangements and container, and veterinary certificate.

Frozen semen

Semen may be frozen and stored indefinitely for future use. Frozen semen allows access to stallions standing abroad, competition stallions, ill or injured stallions, overbooked, or even deceased. Frozen semen can be transported to the vet or mare owner in advance, thus cutting out the anxiety and logistical headaches associated with chilled semen breeding. Frozen semen is transported in a nitrogen vapour container. These containers maintain near liquid nitrogen temperatures (around minus 190^{o}C) for days or weeks without the use of liquid nitrogen. Long-term storage is in liquid nitrogen storage tanks.

Semen for export must be collected and frozen at a facility inspected regularly and certified by the authorities (Department of Agriculture, Fisheries and Food in Ireland). The centre must meet the regulations required for processing semen for export (this also applies to chilled semen for export).

Insemination procedure.

Additional costs related to frozen semen include the cost of transport arrangements, nitrogen storage containers, and a veterinary certificate. When using frozen semen it is necessary to scan mares every six hours to ensure optimal timing of insemination.

While no specific standards of frozen semen quality exist in the equine industry, there are some generally accepted guidelines. Most commercially distributed semen contains 600 million to one billion sperm per dose. It is generally accepted that thawed semen should contain >30% progressively motile sperm and >200 million progressively motile sperm per dose. The total sperm per dose varies depending upon the stallion's initial semen quality and the initial test freeze evaluation. The goal is to provide >300 million progressively motile sperm per dose after thawing.

Purchase of semen

Different terms and conditions apply when importing semen either chilled or frozen and it is important to check them out carefully. Some farms only sell semen per insemination dose but do not give a quality guarantee; this is very risky for the mare owner. If your mare does not

conceive you cannot claim any reimbursement of the stud fee or any kind of stud fee credit for the following year.
For chilled semen some farms will credit half of the paid stud fee if a mare does not conceive or re-absorbs. It may be possible to receive a free covering for the following year if the mare does not conceive. Other farms only offer a free-of-charge re-insemination in the following season for mares returning to the same stallion before 1 April, for example. In all cases a veterinary certificate must be presented stating that the mare is not in foal by a predetermined date.
Some farms give absolutely no guarantee for A.I. that takes place off their premises.
It is important that semen is examined on arrival at your farm by your veterinarian to ensure that appropriate quality standards are met.

It is absolutely crucial that you read the small print and are aware of the terms and conditions when purchasing semen.

13. Post-breeding management of the mare

After a mare has been covered or inseminated, daily teasing should continue and scanning performed to confirm she has ovulated and gone out of heat. The vet may recommend administration of the hormone LH (luteinising hormone) to ensure ovulation after covering/insemination. Examination of the mare's reproductive tract by the vet within the first six to twenty four hours after breeding also means any abnormal build up of uterine fluid will be identified quickly and treated. As the embryo does not enter the uterus for five to six days after ovulation there is no risk to the embryo in treating the uterus during this period.

Rapid identification and treatment of mares that do not clear contamination, fluid and inflammation after breeding can help prevent persistent inflammation of the uterus lining (endometritis) and save a pregnancy.

Repeated examination and teasing of the mare after breeding helps to detect double ovulations (which can result in twin pregnancies) when they occur. It is best to follow mares through the first 48 hours after ovulation to ensure that there are no lingering problems.

Mares which fail to conceive after covering are expected to begin teasing back 16 to 18 days after ovulation. Ultrasound scanning for pregnancy should begin by day 15/16 after ovulation. Twin pregnancies identified prior to day 16 after ovulation are easier to manipulate

Mare being scanned.

Ultrasound scan image.

and reduce due to the mobile nature of the embryo in the uterus up to this time. Follow-up pregnancy examinations are recommended between day 28 and day 30 for detection of a heartbeat and to monitor continued normal development of the identified embryo and tone of the uterus.

Mares may be monitored again at 40 days and 60 days and then examined for confirmation of pregnancy at the end of September (particularly if the covering fee is paid under 1 October terms and conditions).

14. Infertility in the mare

Properly managed mares almost always conceive.

The Irish Sport Horse mare herd has a fertility rate of 72%, which can still be improved upon. **With good management and fertile semen, fertilisation rates in young, fertile mares of 90% are achievable.** Properly managed mares almost always conceive. Infertility results in huge economic loss to the breeder.

Causes of infertility

The first area to examine in addressing fertility is the general management of the mare's health. If she is in poor body condition, has any underlying cause of pain, or an infection this may be enough to prevent her going in foal. Nature has inbuilt protection mechanisms.

In some instances mares that are still in spring transition are being asked to breed and old mares past their reproductive prime are being asked the same question.

The mare cannot become pregnant no matter how well she is managed if fertile semen is not available and if it is not deposited in the uterus at the right time. Likewise, during artificial insemination semen can be mishandled at any point in the process or a stallion's semen may not transport or freeze well. Also, a normally fertile stallion may experience a

period of infertility due to an insult to his testicles (heat or injury) or have reduced sperm production due to overuse.

For conception to occur viable sperm must be present at the same time as a viable egg. If a mare is bred too early relative to her ovulation there will not be any viable sperm to fertilise the egg. If the mare is bred too late the egg is no longer viable. Even if fertilisation still occurs, embryos resulting from aged eggs frequently do not survive long.

Early embryonic loss

The death of developing embryos prior to 50 days of gestation is common in all equine pregnancies, and makes a significant contribution to reproductive failure in infertile and aged mares. This normal loss in otherwise healthy mares can be viewed as nature's way of eliminating genetic errors that might have occurred at some point before or at conception.

In subfertile mares, high rates of embryonic loss are caused by both embryo and mare factors. Mare factors are generally considered to be age-related changes or pathologic conditions that lead to poor overall uterus and/or oviduct environments. A poor or even hostile environment is not conducive to normal embryo survival or development.

Poor uterine environment – endometritis

Endometritis is inflammation of the uterus lining. This can interfere with conception as a build up of inflammatory products and pathogens within the uterus is detrimental to normal sperm motility and survival. **Abnormally persistent post-breeding uterine inflammation (unresolved at approximately 48 hours after ovulation) can harm the embryo when it arrives at the uterus five to six days after ovulation.**

Normal healthy mares experience various levels of contamination and inflammation after foaling, but this will not persist. It will have cleared by 36 hours post breeding so there are no adverse effects on fertility. These mares have uterine defense mechanisms that function normally and can prevent access to the uterus or rapidly eliminate irritants such as those associated with the presence of semen in the uterus after breeding.

Susceptible mares have one or multiple breakdowns in their uterine defense mechanisms, allowing easy contamination of the uterus. Once contaminated, they cannot readily clear

inflammatory debris and invading organisms. Contamination that would normally only result in minor inflammation in a healthy mare can result in persistent inflammation in a susceptible mare. These mares easily develop established inflammation and infections within their uterus. Even when treated they can experience recurrent infections with each new covering.

Uterine defense mechanisms include good perineal conformation, competent anatomical barriers (vulva, vagina and cervix), timely uterine clearance, and action of white blood cells. All of these can be negatively affected by ageing, the number of foals produced, injury and poor body condition.

15. Disease prevention

The disease free status in Ireland must be maintained. A couple of years ago there was an outbreak of Equine Infectious Anaemia (E.I.A.) or Swamp Fever in Ireland. Abortions and deaths have also resulted from infections of E.H.V. – Equine Herpes Virus.

These diseases along with Contagious Equine Metritis (C.E.M.) and Equine Viral Arteritis are very serious diseases and could destroy our industry if they became established.

Some diseases are listed as notifiable with the Department of Agriculture, Fisheries and Food. To this end if your mare aborts or you notice anything unusual you should contact your vet immediately.

It is of critical importance to help maintain a disease free status in Ireland. It should be established prior to breeding that the mare is free from infection.

Breeding-related diseases	
C.E.M.	Contagious Equine Metritis
E.V.A.	Equine Viral Arteritis
E.H.V.	Equine Herpes Virus
E.I.A.	Equine Infectious Anaemia

Taking a uterine swab.

Taking a clitoral swab.

The most important means of preventing disease is establishing freedom from infection before starting breeding activities; checking horses remain free from infection during breeding activities, and exercising strict hygiene measures during breeding activities.

Swabs may be taken from the genitalia of the mare for culturing in a laboratory to test for the presence of infective organisms. A clitoral swab can be taken at any point during the reproductive cycle and for pregnant mares may be taken before or after foaling. A swab is taken from the lining of the uterus through an open cervix when the mare is in season. No horse should be used for breeding activities until or unless all swab results are available and negative.

In the case of EVA and EIA blood samples can be taken for laboratory testing.

Vaccination is available for stallions and teasers against EVA and for mares against EHV. Vaccination of all breeding stock, under veterinary direction, raises the level of protection and is believed to help in preventing abortion storms in the case of EHV. However, vaccination will not necessarily provide total protection.

It should also be noted that EVA survives in chilled and frozen semen and is not affected by the antibiotics added.

Management of breeding stock

Breeding stock should therefore be managed in ways that will minimise the risk of spread of infection between horses:

- pregnant mares should be kept separate from all other stock;
- where possible mares should foal at home and go to the stallion with a healthy foal at foot;
- if foaling at home is not possible, pregnant mares should go to the stallion or boarding stud 28 days before foaling is due. Mares should be isolated in groups with other healthy mares at a similar stage of pregnancy; the groups should be as small as possible;
- mares from sales yards or overseas are a particular risk and should be grouped away from pregnant mares;
- isolated groups and individuals should be separated as far as possible from weaned foals, yearlings, horses out of training and competition horses. Fillies out of training/competition yards are a particular risk to pregnant mares;
- mares in late pregnancy should not travel with other stock, particularly mares which have aborted recently;

Mares from sales yards are a particular risk and should be isolated from pregnant mares.

- any foster mare introduced to the premises should be isolated, particularly from pregnant mares, until it has been proved that her own foal's death was not caused by EHV; and,
- disinfection of housing, equipment, and transport vehicles on a regular basis with appropriate disinfectants such as Equisept, Virkon and others is necessary.

16. Breeder skill requirements

The management skills a breeder needs depend on the age at which he/she intends to sell the offspring.

If selling as foals (weanlings) the breeder must:

- be able to assess the mare;
- have the knowledge to use all available resource materials to evaluate pedigree and performance information of breeding stock;
- have the ability to choose a complementary stallion for the mare;
- have appropriate land and facilities;
- ensure a high level of health and welfare with a good understanding of the requirements for nutrition, foot care, vaccination and parasite control;
- maintain excellent pasture management procedures;
- handle foals in a calm and confident manner when leading, grooming, and loading for transport. This will result in a confident and obedient weanling on the day of sale; and,
- have the ability to assess the true value of a foal or seek unbiased professional advice.

If selling as a three-year-old the breeder must:

- have all of the above;
- have the skill to manage young horses from weanling stage to three years;
- have extra facilities to allow controlled schooling on the lunge rein and over small fences;
- have the ability to assess the movement and jumping ability and to assign a true value;
- take on the risks associated with the vetting for sale that are not necessary when selling foals; and,
- have the skills to produce a three-year-old for sale or be willing to have the horse produced professionally if it is of value to do so.

17. Average cost of producing a foal to weanling

Veterinary costs vary significantly.

Asking how much it costs to breed and produce a foal is a bit like asking how long is a piece of string as there are so many variables.

Many people are breeding horses with the uncalculated assumption that they might make a profit for the time and money invested. But how many are actually working out how much money is being spent and what the margins are?

The costs on page 47 are calculated on the basis of getting an average mare in foal and include all the usual husbandry practices for both mare and foal. Stud fees can range from as low as €200 to €4,500 and more. Costs only assume minimal veterinary treatments and this is an area where costs can dramatically alter. None of the figures on page 47 take into account sales entry fees, commission, depreciation of the broodmare, wages paid to the breeder or any outside professional help. These can add significantly to the final tally of how much it costs to breed a mare every year.

Mare	
Stud Fee	€850** hugely variable
Keep at Stud	€150 (three weeks) (maybe absent for AI)
Farrier	€160 (five trims; two pairs front shoes)
Dentist	€40 (annual)
Dosing	€100 (six doses)
Meal	€85 (pre and post foaling)
Hay	€150 (50 bales)
Bedding	€36 (30 bales of straw)
Veterinary	€200 (routine scanning and vaccinations) *** this can be much more
Grazing	€35 (fertiliser, fencing repair)
Transport	€50 (to stud/vet) *** variable
Miscellaneous	€80
Total	**€1,936**

Foal	
Farrier	€45 (three trims)
Dosing	€15
Meal	€20 (to weaning)
Hay	€12 (four bales)
Bedding	€12
Veterinary	€150 (vaccinations, marking/microchip)
Grazing	€15
Registration	€50
Miscellaneous	€60
Total	**€379**

To track production costs, the Teagasc Excel-based 'Equine Cost Control Planner' is an excellent tool and is available free of charge to Teagasc clients. It is a user friendly programme and records all expenditure, both incoming and outgoing. This is essential in the analysis of the financial situation of the breeding enterprise ensuring sound financial and breeding decisions are made in the future.

Ask for your copy of the Teagasc Equine Cost Control Planner.

APPENDIX A: BROODMARE RECORD CHART

Broodmare Record Chart

Year 20 _____

Name _____ IHR Number _____

Year of Birth _____ Sire _____ Dam _____

Dam Sire _____ Breeder _____

Foal Record

Date of Birth _____ Sex _____ Sire _____ IHR Number _____

Time of Foaling _____ Time First Stood _____

Time First Suck _____ Time Afterbirth Passed After Foaling _____

Other Remarks _____

Breeding Record

Status: _____

Last Service Date (last year): _____ Due Date (this year): _____

Last Service Date (this year): _____ Due Date (next year): _____

Covering Sire: _____ Method of Service: _____

Example:

Month – April

1	2		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		F						T-		T+		T+	C		T-														T-	

F = Date foaled; T = Date teased; T- = Not in season; T+ = In season; C = Date covered; U = In foal; Ux = Not in foal

Farrier Record

Date	Action

Veterinary Record

Date	Action

Other Records

Date	Action

APPENDIX B

For further information contact any member of the Teagasc Equine Specialist Advisory Service:

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Acknowledgements

The authors would like to acknowledge the assistance of the following people in proofreading this publication and providing photographs:

Bridget McGing M.V.B. M.R.C.V.S.
Steffania Bucca M.V.B. M.R.C.V.S.
Vivienne Duggan M.V.B. M.R.C.V.S.
Tina Roche M.V.B. M.R.C.V.S.
Jacqueline Yeomans M.V.B. M.R.C.V.S.
Lesley Emerson, PR West

Production: Th!nkMedia Ltd

November 2009

Published by:
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