

# REPRODUCTION



## REPRODUCTION

To profitably manage reproduction of deer herds it is important to understand changes that occur so that management can be adjusted to ensure the best possible reproductive performance of the herd.

Both male and female deer experience an annual cycle of reproductive activity (seasonally poly oestrus) that is principally controlled by day length.

### Male Biology

#### *General*

During early summer (November/December in Southern Australia) male deer are in a state of reproductive inactivity although their velvet antlers are growing rapidly.

During this time testosterone levels are very low and the testicles and accessory sexual organs have significantly regressed in size. Examination of sires pre rut including testicle examination and palpation is recommended. Sires with small or soft testicles should be culled as size is correlated to semen production. Select sires with greatest healthy testicular circumference at the time of antler regrowth removal.

The above characteristics should be considered when devising management strategies for Red deer, with the other principal factor being the requirement to provide nutrition that allows the species to reach its potential as a farm animal.

In February:

- Testosterone levels begin to rise
- Production of sperm begins
- Antlers are calcified
- Neck girth has begun to expand

Testosterone levels reach a maximum in late March and April, although the actual timing may be influenced by various regional factors, and this is the time when male deer are at their full reproductive potential and are ready to breed.

#### *Red Deer, Fallow Deer, Elk/Wapiti*

The beginning of the rutting season for males is clearly obvious as their voice shows characteristic changes. Red deer stags to a deep-throated roar, Wapiti/Elk stags to a bugle sound and Fallow bucks to a groan. Other activities reported by Haigh and Hudson [38] include:

- Antler rubbing/thrashing
- Wallowing (not Fallow Deer)
- Preputial palpitation
- Urine splashing/spraying
- Bugling
- Roaring
- Dominance displays
- Sparring

During the rut season it is important to ensure that subordinate males have adequate space to escape dominant males so they establish their own territory and harem.

Males are extremely aggressive during the rut and must be handled with great care even if the antlers have been removed.

The period of intense rutting activity usually last for four to six weeks although some males continue to be active for long after six weeks.

Males are fertile at around 16 months and can be used successfully as yearlings but rutting behaviour and body changes associated with the rut are not as marked as with older males. Fertility of Red deer and Wapiti/Elk stags peak between 8 and 13 years but above 15, whilst stags continue to produce semen, they show little rutting behaviour.

#### *Rusa Deer*

Most Rusa stags are in velvet antler over summer and so few males are available to mate females during this period. This means spring calving is difficult to achieve. The use of Moluccan (or Javan/Moluccan cross) Rusa stags, with a characteristically more variable velvet antler growth cycle, has aided the ability of Rusa farmers to calve their animals in spring in southern/south-east Queensland.

Javan Rusa stags show most mating activity between July to September, with Javan/Moluccan and Moluccan stags more variable in their mating activity concomitant with timing of hard antler periods. Stag aggressiveness during the rut is usually limited to aggression between hard antler animals and breeding stags establish a hierarchy of dominance.

Unlike some temperate deer species, Rusa stags do not attempt to form hind harems. During the rutting period Rusa stags are also observed to wallow and thrash antlers in long grass. Stags are presumed to be sexually active and fertile in the hard antler stage only.

### Female Biology

Like their male counterparts, the active breeding season for Red deer, Wapiti/Elk and Fallow deer begins in late March or early April in Southern Australia. The most common period for Rusa deer in Northern Australia begins in June.

Female deer cycle regularly, about every 21 days, during the main breeding season and if not pregnant, they cycle irregularly near the end of the breeding season. In Australasia adult hinds rarely cycle before the 15th March.

### ***Red Deer***

As seasonal breeders, Red deer hinds have a number of oestrous cycles (up to eight if not mated) during a breeding season.

The average length of an oestrous cycle is 18.8 days, with oestrus seldom lasting more than 24 hours. Ovulation occurs 24 hours after the first signs of oestrus and fertilisation occurs about 36 hours after mating. Early in the season cycles are often shorter.

Most hinds will conceive on their first oestrous. Matings are equally frequent by day or night, and a stag may mount a hind many times before ejaculation. More than one stag sometimes serves a hind. A hind's position in the social hierarchy does not change at oestrus, but some become much more aggressive towards subordinates and demonstrative towards humans.

The mean duration of gestation is 233 ( $\pm 4.5$ ) days. In Southern States births rarely occur before the first week of November and most calves are born during the first two weeks of December. Although their breeding season rarely begins before mid March in Southern states (in response to decreasing day length) anecdotal evidence suggests that mating and subsequent calving can begin up to three weeks earlier in Southern Queensland.

### ***Fallow Deer***

Fallow deer are seasonal breeders. The duration of the oestrous cycle is 21-26 days and a high proportion of does (about 80%) usually conceive during the first cycle.

The mating season or rut usually begins in mid-April and lasts about two months. In turn gestation length ranges from 225-234 days (average about 230 days) so most fawning occurs in the first two weeks of December, although some fawns can be born in January.

### ***Wapiti/Elk***

Wapiti cows, like most other species of deer, breed seasonally. Their breeding season usually begins in mid March. During their breeding season Wapiti/Elk cows cycle every 21 days. Ovulation occurs 24 hours after the first signs of oestrous and fertilisation occurs about 36 hours after mating. Early in the season cycles are often shorter.

Most cows will conceive on their first oestrous although bulls may mount many times before ejaculation. Some cows become much more aggressive towards subordinates and demonstrative towards humans.

The average gestation length of pure Canadian Wapiti is said to be 255 days while the average for NZ Wapiti is 245 days. Most calves are born during the first two weeks of December but birth can occur from November to January.

### ***Rusa Deer***

Because of their tropical origins, naturally synchronised breeding seasons (affected by photoperiod) are not apparent with Rusa deer. Breeding and calving is possible all year round although a degree of acquired seasonality has occurred within farmed herds in Australia.

### ***Moluccan Rusa***

Moluccan Rusa hinds reproduction cycles and stag antler growth cycles appear to be non seasonal. Calves can be born throughout the year and an average gestation period is about 240 days.

Although unrestricted year round mating is common practice, farmers in areas that experience cooler winter months (particularly June to August) have found a controlled mating program that encourages spring calving (September onwards) beneficial. A three-month mating period from late January is commonly used in commercial enterprises.

Average calving percentage of greater than 90% (number of calves born for number of females mated) is common. Oestrus cycle is 18 to 20 days for both subspecies.

### ***Javan Rusa***

Although Javan Rusa deer are apparently fertile all year round, they are observed, under Queensland farming conditions, to be strongly seasonal in both reproduction and antler cycles. Field observations show that a majority of mature Javan hinds calve between March and May and have gestation periods of about 252 days.

Restricted mating programs (i.e. removal of stags from breeder herd from late October to January to avoid calving in cooler winter months of June to August in southern Queensland areas) are increasingly practised. The predominant calving period for those producing their first calf appears to be between June and October.

Mature Javan Rusa hinds (second calving onwards) have recorded pregnancy rates around 95%, with first calving hinds recording slightly lower pregnancy rates of 85%. Inter-calving intervals have been measured between 271 days (for late calving hinds) to 366 days for those that calve in autumn.

With good management and nutrition, hinds can calve by 19 months of age although most animals first calve at two years of age. Generally no Javan Rusa births are recorded over summer (December to February) periods.

The stress of calving has triggered outbreaks of malignant catarrhal fever in groups of Rusa hinds calving in cold southern winters.

### **Mating Management**

Ideally sires should be removed from the breeding herd after about nine weeks. This allows dominance hierarchies and harems to be formed during the first two weeks and then a period covering two completed oestrus cycles.

This period can be shorter, but not less than six weeks (two complete oestrus cycles) where single sire mating is practiced.

Although common practice is to leave sires with breeding females for longer than six weeks to increase pregnancy rates, it is well accepted that:

- Late calves have a poor rate of survival
- Females that give birth late in the season may not be able to breed early again the next year and this has a compounding effect that means some females will always produce a small offspring late in the season that have a reduced chance of survival

### **Sire Effect**

Although Haigh and Hudson [38] state that it is possible to bring the Wapiti/Elk hinds into oestrus slightly earlier through using the “stag effect”, the effect on other deer species is unsure. The stag effect is initiated by managing a breeding sire within a short distance of the hinds for up to 3 weeks before joining.

The sight, sound and smell of the sire may bring the cows into oestrous by as much as 3 weeks earlier. This practice is commonly used in other extensively managed species and may also be useful in reducing the calving period in other deer species.

### **Joining**

Good records including the date of arrival of the first offspring can assist in determining the optimal time of introducing the sire. If the first calving/fawning date indicates conception corresponds with the date the sire is introduced then this could indicate that all breeding females were cycling when the sire was introduced and an earlier joining may be possible in the following year. Single sire mating is the only successful mating technique if progeny are to be registered or genetic gain using superior sires is sought. Single sire mating also results in less stress on the stag if mating groups can be kept well separated but if mating groups are in close proximity stags may expend considerable time and energy protecting harems from threats that don't exist. To ensure pregnancy, sires should be replaced after three weeks.

If multiple sires are used it is desirable to use a large paddock and introduce them to the breeding females at least two weeks before oestrous activity begins. This will allow dominance hierarchies to be determined, and harems to be formed. It is not rare for a dominant sire to hold the entire hind group for a period of weeks, preventing all other sires from serving females. In this situation it is possible that the sire's fertility will eventually be impaired, and some breeding females will not become pregnant.

To maximise pregnancy rate the dominant sire may be removed after three weeks, allowing the remaining two or three sires to complete the mating of late breeding females. In this way superior sires can be used to effect, with calves identified to sire on the basis of birth dates. However, there may be practical difficulties in this system, not the least of which may be to actually remove the original sire from the paddock. Rutting Red sires are very aggressive and are potentially dangerous - they must be treated with great caution, and handled as little as possible during the breeding season.

Sires need to be checked regularly for injury and ill health. It has been estimated that 10% of sires produce semen of poor quality and are thus of lowered fertility. Sires may also become sexually exhausted before the end of the joining period and in commercial situations replacement with a follow up sire at least 18 days before the end of joining should be considered.

### **Red Deer**

A general recommendation is to introduce sires in late February or early March in anticipation of the first oestrous cycle in mid March. Early introduction of sires can advance oestrous by 6 days and assist in synchronisation of the first oestrous cycles.

To avoid late calves, it is best to remove the sires from the hinds after a defined mating period - by mid-June at the latest. This will ensure that the last calves are born in late January. Remove stags by late April/Mid May to limit calving to the end of December.

A ratio of one sire to 30 hinds is a common ratio used by Red deer farmers although there can be considerable variation around this ration. Well-grown spiker males can be used successfully with a small number of hinds (up to 10) and up to 70 hinds have been successfully mated by one mature sire.

Table 30 is a guide derived from various references and information from specialist Red deer breeders in Australia. However the performance of all stags should be monitored each year on the basis of the number of calves they produce and the spread of calving to help determine the number of hinds they can effectively service.

Hind numbers suggested in table 30 are intended to provide a concentrated calving period of about six weeks. Although some sires may be able to service more hinds in a breeding season, the time required for the sire may be longer than six weeks.

Age (years)	Number of Hinds
Spiker	up to 10
2	25 to 30
3	30 to 50
Proven 4 years and older	40 to 60

*Table 30: Suggested maximum number Red hinds per fertile stag*

There are advantages in mating first calving hinds in separate groups, using an experienced, proven sire. These young females can be given preferential feeding, without bullying from older hinds, and at calving there will be an opportunity to watch this group carefully for problems.

Some breeders warn of 'post mating stress' shown by spiker stags that is associated with their removal from the hinds that they have mated. The stress appears to be directly associated with removing them from the mating paddock and their subsequent isolation from hinds.

Sires removed from mating paddocks should not be returned directly to paddocks with stags that have not been given an opportunity to join with hinds. Those that have been confined to the bachelor herd often attack sire stags returned to a bachelor herd after joining.

A method used to help minimise this stress is to run the spiker stags with weaners after they are removed from the mating paddock.

### ***Fallow Deer***

Most recommendations suggest that bucks should be introduced to does in early April in preparation for the doe's first oestrus cycle. Early introduction of bucks can assist in the synchronisation of oestrus cycles and increase the percentage of does that conceive in the first or second oestrus cycle.

This practice, along with removal of bucks by the end of May can help to minimise the number of late fawning does in the herd.

Male to female ratios of about 1:30 are usually recommended. It should be remembered that bucks can lose up to 30% of their body weight during a 3-4 week period during the rut. As a result, they may require preferential feeding prior to the rut to ensure they have adequate body reserves to sustain them through this period of reduced feed intake.

Females should be exposed to more than one male and the dominant sire is sometimes replaced during the mating season. As bucks are strongly territorial, when more than one buck is used in a joining group, it is important to ensure the area of the joining paddock is large enough to allow bucks to develop non-overlapping territory. If land area is limited bucks can expend too much energy fighting. Younger bucks can also be restricted from mating due to the close proximity of the dominant buck.

Ideally, and especially in large mobs, yearling does should be separated from adult does and mated in yearling groups (young does do not compete well with mature does for the attention of bucks).

Reports suggest that single sire groups can be effective for young bucks (16 months) to prevent the impact of these dominance hierarchies in the population. Asher [98] suggests that single sire mating mobs for Fallow deer sires should not exceed 35 does and that the buck should be promptly removed at the end of the first cycle and replaced. Table 31 shows suggested maximum number Fallow does per fertile buck to ensure a short successful season shown [98].

Age	Number of Does
16 months	10 to 15
27 months	15 to 20
39 months and older	30 to 35

*Table 31: Suggested maximum number Fallow does per fertile buck*

**Wapiti/Elk**

Providing cows are near to their mature weight, bulls can be introduced immediately after weaning and they should cycle by the middle of March and give birth to early calves in mid November. Early introduction of bulls can advance oestrous by 6 days and assist in synchronisation of the first oestrous cycles.

To avoid late calves, it is best to remove the bulls from the cows after a defined mating period, by mid-May at the latest. This will ensure that the last calves are born late in December.

If multiple bulls are used it is desirable to use a large paddock and introduce them to the cows at least two weeks before oestrous activity begins.

A strong management recommendation is to mate first calving cows in separate groups, using an experienced, proven bull. These young females can be given preferential feeding, without bullying from other cows, and at calving there will be an opportunity to watch this group carefully for problems. Recommendations [38] for sire to hind ratio designed to ensure a tight Wapiti/Elk calving season of 6-8 weeks are shown in Table 32.

Age (years)	Number of Hinds
Spiker	5
2	10
3	15
4	20
5	25
6	25-30
7	25
8	25
9	decreasing

Table 32: Suggested maximum number of Wapiti/Elk hinds per fertile sire

**Rusa Deer**

Rusa stags produce sperm at 45 to 50 kg LW and would be able to mate as first hard antler males (spikers) from 12 to 14 months old, however spiker stags would generally be removed from the herd and run in separate 'bachelor' mobs for primarily venison production.

Breeding sires are generally at least 2 years of age. In consideration of non-seasonal breeding, mating management entails a minimum male:female breeding ratio of between 1:30 to 4:100 (ie. approx. 3 to 4%).

Problems with non-restricted mating include the need to muster and yard mixed mobs of hinds in various stages of pregnancy and lactation, young stock and stags in hard antler. As a consequence handling and yarding considerations are more important.

Although mature Rusa stags demonstrate an individual pattern of antler growth and sexual activity, the pattern for individual animals is repeated annually. Like other male deer they can lose up to 15% of pre-rut live weight during the mating season.

While Rusa hinds and stags are still productive at greater than 10 years of age, anecdotal evidence suggests increased production efficiency for culling animals under this age, with a 10 to 15% yearly replacement policy in an established breeder herd.

**Body Weight and Condition Score**

Dams should be in body condition score three (BCS 3) or better at mating whether they are inseminated naturally or artificially and be free of disease and parasites.

General recommendations, mostly from experience with other species suggest that the dams should be on a rising plane of nutrition at the time of insemination.

**Red Deer**

Puberty and conception in hinds is directly related to body weight, with a lower critical body weight at 16 months of 65 kg. This is a minimum weight and not a target, which should be 75 kg at joining [98]. There should be little difficulty in achieving this weight in farm deer, and hinds should then calve each year for 10-12 years at least.

Overseas research has shown that an increase in hind weight of 50% (from 60 to 90 kg) results in a doubling of the number of calves born and surviving and an increase in the weight of the calf drop by 160%. It is essential to feed calves well during their first winter and subsequent summer to ensure that they are able to first conceive at 16 months of age. Feed supplements may be necessary during this period (especially during summer) to ensure adequate growth.

Body condition also has a major influence on conception rates. Hinds in poor or over fat condition will not cycle or may conceive late (maidens that calve late often calve late in subsequent seasons). Hinds should be assessed for condition score prior to the rut (early March) and be provided with supplementary feed if necessary.

The food intake of stags is greatly reduced during the rut, so that dominant animals will lose 15% or more of their body weight, with subdominant stags losing 5-10%. This weight loss cannot be prevented, but it is essential that good feed is available in September, when appetite begins to increase. The winter weight loss will be redeemed by the end of January, with the stags once again going into the rut in the best possible condition.

### ***Fallow Deer***

Mature does should receive adequate nutrition prior to the rut to maximise conception rates. It is generally accepted that a minimum live weight of 36 kg [98] is required in yearling does to attain adequate conception rates. This should be considered a minimum weight, not a target weight. The better grown yearling does are at their first mating, the greater the conception rate and the better the ability of the does to manage their first pregnancy.

Puberty and first conception is directly related to body weight but usually occurs in Fallow does at about 16 months. Fawn birth weight is usually about 10% of adult doe live weight during the rut.

Fallow deer readily adapt to hand feeding and they can be successfully fed a range of supplementary feeds including cereal grains, lupins, silage, good quality hay, and forage crops. Irrigation offers the opportunity to increase the length of the green feed season and can be useful during high feed demand times of late Summer and Autumn.

Poor feeding of pregnant does can reduce fawn birth weights and subsequent survival rates.

### ***Wapiti/Elk***

Puberty and conception in hinds is directly related to body weight. Wapiti mature later than Red deer and maiden cows should be 85% of adult body weight at joining. A guide lower critical body weight at 16 months is 135kg (a minimum weight and not a target) that should increase to 150kg at joining. There should be little difficulty in achieving this weight in farm animals, and cows should then calve each year for 10-12 years at least.

It is essential to feed calves well during their first winter and subsequent summer to ensure that they are able to first conceive at 16 months of age. Feed supplements are recommended during this period (especially during Summer) to ensure adequate growth. Wapiti should have access to good quality roughage (hay) throughout the year.

Body condition also has a major influence on conception rates. Females in poor or over fat condition will not cycle or may conceive late (maidens that calve late often calve late in subsequent seasons). Breeding females should be assessed for condition score prior to the rut (early March) be provided with supplementary feed during the lactation period if necessary.

Bulls lose a considerable percentage of their body weight (up to 30%) during the rut. They should be managed to ensure that prior to the rut they have adequate body condition to maintain them during the rut.

Wapiti bulls mature at an older age than Red deer (4 to 5 years) and continue to grow up to five years of age.

### ***Rusa Deer***

Nutrition management in late pregnancy should avoid hinds being 'over-fat' at calving in order to prevent the incidence of dystocia. Anecdotal evidence of wedge-tailed eagle (*Aquila audax*) attacks on young calves in Queensland has been documented on some properties. While attacks are likely to concentrate on poor/ill-thrift calves, the provision of adequate shelter may minimise losses.

Puberty in Rusa deer is influenced by nutrition. Javan females reach puberty (ability to conceive) at 45 to 50 kg live weight and Moluccan females 35 to 40 kg live weight. Rusa stags generally attain puberty at 30 to 35 kg live weight. These live weights for both sexes should be obtained at around 9 months of age.

Annual growth rates are influenced by seasonal pasture production, with nearly 60% of annual weight gain for mature animals occurring from October to January.

Nutritional strategies on a property must accommodate the feed requirements for maintenance and growth of weaner stock, breeding hinds, breeding stags, cull stags and cull hinds for slaughter. In addition are requirements for pregnancy and lactation, although observations that Rusa hinds appear to carry some fat reserves suggests a capacity to accommodate short periods of nutritional stress.

Seasonal pasture growth patterns in tropical and sub-tropical Queensland shows growth and quality gains during the wet season (approx. October to February/March) with declining growth and quality in the dry season (March/April to September). High nutritional requirements for both stags and hinds do occur during the poorer pasture growth and quality periods (i.e. during autumn (pre-rut and mating, parturition and lactation) and winter. Generally

requirements for post-rut weight gain for stags coincide with wet season induced improvement of pasture growth and quality.

Nutritional deficiencies are met by supplements including grains (legume and cereal), protein meals, molasses, forage crops, good quality hay and silage. Rusa deer can be expected to consume between 2.5 to 3.5 % of their live weight in dry matter daily. Provision of an adequate supply of quality drinking water is essential.

Drought management strategies are important.

### **Artificial Breeding**

Artificial breeding technology including both artificial insemination and embryo transfer is available in the deer industry and is a tried and proven management tool for introducing superior genetic material into a herd at relatively small expense and for increasing the rate of genetic gain in the herd. Results however can be variable and depend largely on the skill of the operator and the management of the deer. Deer farmers contemplating any artificial breeding program should consult with a veterinarian experienced in artificial breeding in deer.

Recent developments with oestrus synchronisation and cervical insemination techniques in Red deer have produced consistently high pregnancy rates making AI much more attractive to commercial deer farmers.

It is essential in any artificial breeding program to eliminate as much stress to the animals as possible. Females in the program should be carefully selected on temperament and only proven breeders used. Facilities should be of a practical design and the animals well educated to using the yards. Offspring should also be weaned from their mothers prior to the commencement of the program.

Advancing the breeding season is also possible through the use of melatonin implants or artificial lighting. These techniques may be useful to better align the time of high feed demand during lactation, with the seasonal pasture production cycle but they both involve a lot of work. Decisions as to whether to use artificial breeding programs must be based on the cost of the program compared to the value of the progeny produced.

### ***Dam Selection***

Criteria for selection of dams for use in breeding programs are similar to criteria used for other species. Generally dams must have produced at least one offspring from natural mating and meet minimum body weight requirements.

Usually animal temperament is an important consideration as the animals must be yarded and handled regularly prior to insemination. Other genetic characteristics required by the herd manager are obviously important.

### ***Oestrus Synchronisation***

Again, similar to most other species, successful insemination of deer included use of drug therapy to synchronise the oestrus cycle of the dams so that they can all be inseminated within a short time frame.

### ***Post AI Management of Dams***

The nutrition and general health of inseminated dams must be carefully monitored to increase likelihood that embryos implant in the uterus and that the foetus survives normal gestation and is born. Entire (backup) males should be run with the dams from about 10 to 14 days post AI to detect and join any females returning to oestrus [65].

### **Pregnancy Diagnosis**

Skilled operators of ultrasound equipment can make a reliable pregnancy diagnosis on Fallow does between 40 to 60 days post insemination [65]. Beatson [10] reports that the optimum method of determining pregnancy in Red deer is with rectal ultrasound scanning undertaken at 28 to 60 days post mating.

Pregnancy testing and culling non-pregnant females removes non-breeders from a herd and selects for fertility. If farmers regard this culling as too severe, detection of non-lactating hinds (wet/drying) prior to joining, then timely pregnancy testing those females post mating and culling those not pregnant will remove those that do not produce an offspring for two successive seasons.

### **Hybridisation**

Hybridisation or cross breeding is a management tool used by animal breeders to improve growth rate and improve reproductive performance of stock.

Advantages of cross breeding include:

- Increased birth weight of off spring
- Earlier marketing of animals for processing
- Heavier carcase for age
- Higher carcase yields
- Increased antler production in males



Disadvantages of crossbreeding may include:

- Longer gestation
- Risks of birth difficulties, particularly with yearling females
- Later sexual maturity
- Require more feed for age
- Larger animals can be more difficult to handle

A major factor that should be considered in the development of any breeding program is that larger animals generally need to eat more food. However pasture may be used more efficiently when hybrid animals graze it because they consume it before it deteriorates (waste less of what is immediately available).

### ***Red Deer***

Whilst hybridisation with Wapiti/Elk genetics can be used to improve animal performance it should not be used as a substitute for optimal nutritional management. The reproductive management of terminal sires as well as the nutritional management of both hinds and offspring need to be optimised in order to obtain maximum benefits from hybridisation.

Caution needs to be exercised when using F1 and F2 Wapiti/Elk hybrids over Red hinds. Hinds must not be allowed to get over fat during pregnancy as over fat animals are predisposed to calving problems.

### ***Fallow Deer***

Hybridisation is possible within the Fallow deer population through the use of the Mesopotamian sub species (*Dama dama mesopotamica*). Various reports show that hybrids have earlier birth dates, high birth weights, and higher growth rates from birth to weaning and during periods of active growth following weaning. This results in higher live weights for the hybrids at 10 months and provides the opportunity for the use of hybrids to decrease the time taken to reach puberty and slaughter weight. Selected strains of Fallow deer (Danish, Hungarian, Yugoslavian, etc) may also offer opportunities to increase growth rates, carcass traits and antler production in offspring.

### ***Wapiti/Elk***

Most hybridisation programs for meat production use purebred females that are mated to a terminal sire (larger animal with select meat traits). Offspring of this type of cross grow quickly and reach processing size more quickly than purebred animals. All hybrid progeny are sold and the pure bred female herd is maintained with a small replacement breeding program or replacements are purchased, and sires are purchased as required.

While a common use of Wapiti/Elk genetics is to improve animal performance it should not be used as a substitute for optimal nutritional management. The reproductive management of terminal sires as well as the nutritional management of both females and offspring need to be optimised to obtain maximum benefits from hybridisation. Caution needs to be exercised when using pure Wapiti/Elk and hybrids over Red hinds. Hinds must not be allowed to get over fat during pregnancy as over fat animals are predisposed to calving problems.

A general recommendation is that sires carrying up to 75% Wapiti (Elk) genes should not be joined to Red deer hinds of less than 105kg live weight. Joining of pure Canadian Wapiti (Elk) bulls with large Red deer hinds should be left to breeding specialists.

### ***Rusa Deer***

Hybridisation with Sambar deer (*Cervus unicolor*) is documented as a fertile cross (Samson deer) but it is currently considered of no commercial farming value in Australia. Natural matings of Rusa stags with Red deer (*Cervus elaphus*) hinds are reported from some Queensland properties with female offspring apparently fertile (males appear to be infertile). However problems in social compatibility of tropical to temperate species breeding cycles has limited crossbreeding with little commercial interest in such hybridisation at this stage.

## **Summary Considerations**

Management considerations to achieve high reproductive performance include:

- Cull females that have been unsuccessful in previous breeding attempts
- Ensure mating paddocks are sited well away from likely disturbance during mating
- Ensure two year old females achieve about 75% of their anticipated mature weight before mating at 15 months of age
  - 75 kgs for Red hinds [9]
  - 36 kgs for Fallow does [98]
  - 150 kgs for Wapiti/Elk hinds in Australia
  - 50 kg for Rusa hinds
- Ensure all females are in body condition score three (BCS 3) before joining, see the chapter on Body Condition Scoring
- Introduce sires at least a month before mating is anticipated
- Use back up sires about one month after mating begins
- Observe stags for signs of injury or lack of libido
- Avoid handling or moving deer during the mating period