

Introduction

Repeat breeding syndrome (RBS) is a common reproductive problem in the buffaloes which is characterized by failure to conceive after multiple artificial insemination or mating attempts during the fertile period. It is one of the leading causes of infertility in the buffaloes and presents a significant challenge in the tropical regions where the factors such as heat stress, poor nutrition and diseases play a role in decreasing the reproductive efficiency. The condition results in extended calving intervals leads to financial losses for the dairy and breeding operations. Identifying the underlying causes of RBS and implementing the corrective management strategies help to improve the fertility and overall herd productivity.

Causes

Several factors contribute to the repeat breeding syndrome in the buffaloes and often in combination. These causes are broadly categorized into management-related, nutritional, physiological and disease-related factors.

Management and environmental factors

- Heat stress: In the tropical climates, heat stress is a major contributor to the repeat breeding syndrome. Elevated temperatures and humidity affect the ovarian function, reduce sperm motility and delay ovulation. Heat stress also impairs the estrus detection and reduces the conception rates.
- Poor estrus detection: Inefficient or delayed detection of estrus results in missed breeding opportunities leads to failure in conception. Inadequate estrus observation practices especially during the nocturnal or early-morning estrus periods leads to breeding outside the optimal window.
- Improper artificial insemination time or mating time: Failure to breed the buffalo at

the right time of estrus (mid-estrus period) results in fertilization failure leads to repeat breeding.

Nutritional factors

- Energy and protein deficiency: Poor nutritional management especially low energy or protein intake leads to hormonal imbalances and delayed ovulation. A negative energy balance also leads to poor conception rates.
- Mineral deficiencies: Deficiencies in essential minerals such as calcium, phosphorus and magnesium affects the reproductive function. These deficiencies lead to delayed estrus or poor fertilization.
- Overfeeding or obesity: Overfeeding especially of high-energy concentrates leads to obesity and hormonal imbalances which in turn disrupts the reproductive cycles.

Physiological factors

- Hormonal imbalances: Abnormal levels of reproductive hormones such as progesterone, estrogen and luteinizing hormone (LH) prevent the proper follicular development or luteal function which are the contributing factor for repeat breeding.
- Ovarian cysts: The presence of ovarian cysts (follicular or luteal cysts) disrupt the normal ovarian cyclicity leads to failure to conceive despite the repeated breeding attempts.
- Inadequate uterine environment: Uterine health plays an important role in the successful fertilization and embryo development. Poor uterine health due to infections, retained placenta or uterine scarring impair the embryo implantation leads to repeat breeding.

Infectious diseases

- Endometritis: Chronic uterine infections especially endometritis are common



causes of repeat breeding. Infections disrupt the uterine environment, reduce fertility and delay the conception.

- Brucellosis and Leptospirosis: These infectious diseases induce the infertility, delayed return to estrus or abortions leads to prolonged calving intervals.
- Bacterial or viral infections: Other infections such as those caused by Mycoplasma also affect the reproductive organs and lead to infertility.

Genetic factors

Hereditary issues: Certain buffalo breeds have genetic predispositions to poor reproductive performance. These genetic factors contribute to the repeat breeding syndrome particularly when coupled with environmental stress or poor management.

Incidence

The incidence of repeat breeding syndrome in buffaloes varies significantly between the regions, management systems and individual farms. In tropical regions, the incidence tends to be higher due to the combined effects of heat stress, inadequate nutrition and higher disease burdens. The incidence rate is ranged from 5% to 20% or more depending on the farm managemental practices. In the tropical countries, poor estrus detection, heat stress, inadequate nutrition and prevalent diseases are the key contributing factors. However, with proper management, the incidence of repeat breeding is significantly reduced.

Pathophysiology

Repeat breeding syndrome occurs due to the failure of the buffalo to conceive after multiple breeding attempts, despite the normal estrus behaviour. The underlying pathophysiological mechanisms involve

Hormonal imbalance:

- In buffaloes with RBS, there is insufficient or irregular secretion of key reproductive hormones such as LH, FSH and progesterone. This imbalance interferes with normal follicular development, ovulation and luteal function.
- Anovulation: The failure to ovulate at the right time leads to an extended period of estrus and prevention of conception.

- Persistent follicles or cysts: Follicles that do not ovulate or luteinize properly form the ovarian cysts which in turn disrupts the normal estrous cycle and prevent conception.

Uterine environment

- An unhealthy uterine environment is caused by infections (endometritis) or inflammation prevents the proper embryo development and implantation. This makes fertilization unsuccessful and even if ovulation occurs.

Sperm factors

- Heat stress negatively affects the sperm quality such as motility, morphology and fertilizing ability. This reduces the chances of successful fertilization even if ovulation and mating are occurred at the right time.
- Sperm-host interaction: In some cases, the immune response of the female buffalo to sperm cells reduces the fertilization rates which in turn contribute to the repeat breeding.

Clinical symptoms

Buffaloes with repeat breeding syndrome exhibit the following symptoms

- Normal estrus behaviour: The buffalo shows the signs of estrus (heat) but fails to conceive after multiple artificial insemination or mating attempts during the fertile period.
- Normal cycle length: The buffalo's estrous cycle is normal in terms of length and frequency; however, the fertilization fails each time.
- Failure to conceive: The buffalo does not become pregnant despite the repeated breeding attempts with healthy semen (either natural service or artificial insemination).
- Infertility signs: Prolonged periods without conception and repeated estrus cycles are also observed.

Diagnosis

Clinical history

A thorough review of the buffalo's breeding history is essential. A record of repeated breeding attempts without conception and normal estrus behavior points toward repeat breeding syndrome.

Estrus detection

Monitoring for the proper estrus detection and ensuring the optimal timing for breeding is important to rule out the missed opportunities for conception.

Rectal and ultrasound examination

- Ovarian palpation: Rectal examination helps to identify the ovarian cysts, retained corpus luteum (CL) or other abnormalities that interfere with normal cyclicity and ovulation.
- Ultrasound imaging: Ultrasound helps to identify the cysts, uterine infections or structural abnormalities that in turn affect the fertility.

Hormonal assays

- Progesterone levels: Measurement of progesterone levels during the luteal phase helps to detect the anovulatory cycles or persistent luteal bodies.
- Gonadotropin levels: Blood tests help to measure the LH, FSH and prolactin which in turn helps to identify the hormonal imbalances that affect ovulation.

Uterine health examination:

- Endometrial biopsy: A biopsy helps to check the uterine infections, endometritis or other uterine abnormalities that could impair fertility.
- Culture tests: Culturing the uterine fluids helps to identify the bacterial infections or other pathogens that might be affecting fertility.

Treatment

Treatment of RBS is aimed at correcting the underlying causes. The following approaches are commonly used.

Hormonal therapy

- Prostaglandin F_{2α} (PGF_{2α}): It is used to induce the luteolysis (breakdown of the corpus luteum) in persistent CL or cysts.
- GnRH: Gonadotropin-releasing hormone (GnRH) is administered to stimulate the follicular maturation and ovulation.
- Estrogen or progesterone: Hormonal treatments are used to correct any hormonal imbalances and induce estrus.

Uterine infection treatment:

- Antibiotics and anti-inflammatory drugs: If endometritis or other uterine infections

are diagnosed, appropriate antibiotics and anti-inflammatory drugs are used to clear the infection and restore the uterine health.

- Oxytocin: In cases of retained placenta or uterine inertia, oxytocin is used to help expel the placenta and promote the uterine involution.

Nutritional support

- Balanced Feed: Providing a balanced feed with adequate energy, protein and essential minerals helps to improve the reproductive health and reduces the incidence of repeat breeding due to nutritional deficiencies.
- Mineral supplements: Supplementing with calcium, magnesium and phosphorus help to correct the mineral imbalances.

Sperm quality improvement

- Ensure that the semen used for artificial insemination (AI) is of high quality is important. Improving the semen quality especially during periods of heat stress increase the chances of successful fertilization.

Control and prevention

- Timely breeding and estrus detection: Employ the accurate and efficient estrus detection methods to ensure the timely breeding during the optimal estrus period.
- Nutritional management: Provide a well-balanced feed with sufficient energy, protein and minerals to maintain the reproductive health and optimize the fertility.
- Heat stress management: Minimize the heat stress by providing the proper shade, ventilation and cooling systems for the buffaloes during hot months.
- Regular veterinary check-ups: Routine veterinary care is essential for early detection of reproductive disorders, infections or hormonal imbalances.
- Disease prevention and vaccination: Prevent the diseases such as brucellosis, leptospirosis, and others that contribute to the infertility. Regular vaccinations and health checks should be part of farm management.
- Management of ovarian disorders: Use the appropriate hormonal treatments such as



PGF2 α or GnRH for the managing ovarian cysts or hormonal imbalances.

Conclusion

Repeat breeding syndrome is a multifactorial problem that requires a comprehensive approach to diagnosis and management. Addressing the underlying factors such as nutritional deficiencies, heat stress, infections farming.

and hormonal imbalances improves the fertility and reduces the incidence of repeat breeding in the buffalo herds in tropical regions. Effective control and prevention measures such as proper estrus detection, nutritional management and regular veterinary care are important for the higher reproductive success in the buffalo