Some Horse Breeding Problems

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Brood mares and foals on pasture at University of Missouri Farm.

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THIS BULLETIN AT A GLANCE

Feeding grain to brood mares and foals.

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Horse breeding is an art practiced for 5000 years. Scientific knowledge of recent times has helped to make the results of breeding practices more certain and predictable. However, problems associated with reproduction still remain to perplex and plague the practical horseman.

These problems are important. Compared to other livestock, horses have a lower reproductive rate and a longer gestation period. A longer time is required to grow a usable or salable animal. With racing and show stock the potential value of the horse is great. Hence, anything that will improve the results usually obtained in horse breeding will help the horseman. The aim of this bulletin is to discuss in popular terms what has been learned by a number of scientific research investigators about some of the problems involved in horse breeding.

THE BREEDING SEASON, ESTRUS, AND THE ESTRUAL CYCLE

Horse breeding has become a seasonal activity in some regions, not essentially because of physiological causes but for economic and geographic reasons. Mares of all types kept under ordinary farm conditions in the United States and on a reasonably high plane of nutrition exhibit reproductive phenomena throughout the year. Foals are born in all months. But most breeders of Thoroughbreds and Standardbreds, as well as those of other light breeds, prefer early spring foals so that the young horses will be well developed when they are put into training for racing, showing, or other uses at 1½ to 2 years of age. Hence, the breeding season for horses in some areas is limited to the late winter and spring months.

Investigations of the problems of estrus, ovulation, and related phenomena in the mare were made by Frederick N. Andrews and Fred F. McKenzie[1] of the University of Missouri at the United States Range Livestock Experiment Station, Miles City, Montana, between April 20 and July 10, 1937 and April 20 and July 15, 1938. Observations were made on 45 draft and 35 light mares most of which were in the herd for each of the two seasons. The mares were kept under range conditions.

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[1]Mo. Ag. Exp. Sta. Res. Bul. 329, "Estrus, Ovulation, and Related Phenomena in the Mare," by Frederick N. Andrews and Fred F. McKenzie.

Regular, systematic teasing of the mares at a teasing pole was practiced through the use of one of six active, vigorous, healthy stallions. The degrees of receptivity and resistance shown by the mares were subject to great individual variation. Most mares became less antagonistic to the stallion 1 to 2 days prior to the onset of heat and were most receptive at the time of and 1 to 2 days preceding ovulation. Ovulation usually occurred 1 to 2 days before the end of the heat period.

Twenty-eight cases of "split" estrus were observed. This phenomenon was characterized by an initial heat period of one or more days, followed by a non-receptive period usually of 1 to 2 days duration, and a subsequent return of heat for one or more days. "Split" estrus appeared among both the draft and also the grade Thoroughbred mares of all age groups.

"Physiological" estrus, or "silent" heat, was manifested by the ovarian, uterine, and vaginal changes characteristic of psychological estrus, but receptivity, or sex-desire, was absent. Eleven cases were observed, all in mares from 2 to 6 years old.

The length of 196 heat periods ranged from 1 to 37 days with a mean of 5.3 days.

The mean length of 90 estrual cycles was 20.7 days with a range of 10 to 37 days.

The length of 106 interestrual periods ranged from 5 to 33 days with a mean of 15.3 days.

The interval from foaling to the first heat period was observed in 33 instances. The average interval was 11.4 days with a range of 2 to 30 days.

TABLE 1* -- DURATION OF ESTRUS IN DRAFT AND LIGHT MARES

Type of Mare	No. of Mares	No. of Periods	Duration of Estrus (Mean days)	Range of Duration of Estrus (days)
Draft	40	127	5.2	1 - 14
Light	35	69	5.5	1 - 37
All	75	196	5.3	1 - 37

*From Table 7, p. 28, Missouri Agr. Exp. Sta. Res. Bul. 329.

TABLE 2* -- LENGTH OF THE ESTRUAL CYCLE IN DRAFT AND LIGHT MARES

Type of Mare	No. of Mares	No. of Cycles	Length of Cycle (mean days)	Range of Cycle Length (days)
Draft	37	63	20.1	10 - 29
Light	18	27	22.0	13 - 37
All	55	90	20.7	10 - 37

*From Table 10, p. 30, Missouri Agr. Exp. Sta. Res. Bul. 329.

TABLE 3* -- LENGTH OF THE INTERESTRUAL PERIOD IN DRAFT AND LIGHT MARES

Type of Mare	No. of Mares	No. of Periods	Length of Period (mean days)	Range of Period (days)
Draft	37	71	14.9	7 - 27
Light	18	35	16.0	5 - 33
All	55	106	15.3	5 - 33

*From Table 13, p. 32, Missouri Agr. Exp. Res. Bul. 329.

To the practical horseman, the variations noted above point up the importance of regular, systematic teasing of all mares during the breeding season if a large percentage of the mares are to be bred at the optimum time for conception to occur.

OVARIAN CHANGES AND OVULATION

Ovulation refers in a broad sense to the development of the egg cell and ovarian follicle and the discharge of the mature egg cell by the rupture of the follicle in the ovary. Follicular growth is accompanied by the secretion of the hormone estrogen which gradually induces heat. For most successful breeding of a species in which the heat period is relatively long, as it is in the mare, a knowledge of the time of ovulation is of major importance. It is highly desirable for the mating to occur near the time of ovulation because neither the egg cell nor the spermatozoa live a long time in the genital tract of the mare. A horseman who has an intimate knowledge of equine anatomy can determine the condition of the ovaries by palpation per rectum.

The ovaries of the mare are kidney- or bean-shaped and vary greatly in size and shape. Age, the stage of the estrual cycle, and pregnancy affect their conformation but they are usally from 4 to 9 cm. in length and 2.5 to 5.0 cm. in thickness. One ovary may be larger than the other. The position of the ovaries is not constant but in most mares they are located in the sub-lumbar region of the abdominal cavity ventral to and 8 to 15 cm. posterior to the kidneys and 5 to 12 cm. from the median plane. During pregnancy the ovaries are drawn downward, and by 10 to 12 weeks are on a level with the pubis. With age and succeeding pregnancies the ovaries tend to move ventrally.

Andrews and McKenzie, working at the United States Range Livestock Experiment Station, Miles City, Montana, observed ovarian changes during two breeding seasons by palpation daily during heat in 45 draft and 32 grade Thoroughbred mares. Examinations were

also made at intervals of 5 to 7 days during the interestrual period and during late and early pregnancy.

Most follicles were taut on the first day of estrus and had an average diameter in draft mares of 3.1 cm. on the left and 2.7 cm. on the right ovaries and in light mares 2.6 cm. and 2.5 cm. on the left and right ovaries respectively. Prior to ovulation 58.4% of the follicles of draft mares were 4 cm. or more in diameter in contrast to 33.3% of a corresponding diameter in light mares.

Ovulation occurred in the left ovary in 60% of the cases in draft mares and in 61.6% of the cases in light mares. No definite pattern for the order of ovulation between the two ovaries was observed. Although more than one follicle was often palpated on one or both ovaries during heat, double ovulation occurred in only 9 instances (3.8% of the cases).

Ovulation was not dependent upon estrus, nor estrus upon ovulation, but in 76.7% of the cases ovulation occurred during the interval from 1 day before to 1 day after the end of heat.

The period between successive ovulations averaged 20.6 days and ranged from 12 to 58 days.

PHYSIOLOGICAL CHANGES IN THE GENITAL TRACT DURING THE ESTRUAL CYCLE AND EARLY AND LATE PREGNANCY

In their research at the United States Range Livestock Experiment Station, Andrews and McKenzie concluded that the color changes of the labia vulvae and vaginal mucosa, although indicative of a trend, were subject to such wide individual variation that they were not a reliable means for the detection of heat in the mare.

The highest vascularity and, hence, the reddest color of the mucosa of the vagina and cervix was observed at the approximate time of ovulation. The least vascularity was noted between the 5th to 10th days of interestrus. As early as the third week of pregnancy, in some cases, the vaginal mucosa had a blanched appearance that was of considerable value in the physical diagnosis of pregnancy.

During the estrual cycle the secretions from the vagina and cervix were most abundant and of the least viscosity during heat. Between the 5th to 10th days of interestrus these secretions were scant and thick. The vaginal and cervical secretions, with few exceptions, were alkaline, and the vagina was usually more alkaline than the cervix. The maximal alkalinity was observed during estrus, the least between the 5th to 10th days of interestrus.

During the period 3 to 7 weeks before foaling the vaginal walls were covered with a thick, mucilaginous substance. This material may

appear by the third week of pregnancy. As early as 15 days after copulation it may be difficult to insert a vaginal speculum. The vulva is usually tight and pale and the vaginal walls are covered with a heavy, viscid mucus. The cervix becomes closed, and a grayish-white, sticky, dry mucus is found at the orifice. During the last three weeks of pregnancy the vaginal walls tended to become separated and the gummy material replaced by a less viscid substance. Between the 1st to 5th day after foaling large amounts of sticky, highly viscous material, sometimes containing blood and other times having a chocolate-colored appearance, were recovered from the vagina. This type of secretion usually disappeared by the first day of foal heat and was replaced by the material characteristic of the estrual cycle.

Cervical tone is a rather reliable indication of estrus. There was a gradual relaxation of the cervix 1 to 2 days before heat, and complete relaxation was usually observed at the time of ovulation. The maximal muscle tone was recorded between the 5th to 10th days of interestrus. By the third week of pregnancy the cervix was usually tortuous and tightly contracted. A gradual relaxation occurred during late pregnancy 1 to 2 weeks before foaling.

Both rectal and vaginal temperatures were slightly higher during heat than interestrus, and those of mares nursing foals were higher than those of dry mares. The range in rectal temperature during estrus was 99.0 to 104.0°F. and 99.0 to 101.9°F. during interestrus. Vaginal temperature during heat ranged from 99.0 to 108.0°F. and during interestrus from 99.0 to 101.8°F.

THE RELATION OF THE PSYCHOLOGICAL AND PHYSIOLOGICAL PHENOMENA OF THE ESTRUAL CYCLE TO BREEDING RESULTS

Breeding operations designed to induce conception in the greatest possible number of cases were carried on by Andrews and McKenzie. To facilitate this end, the mares, with some exceptional cases, were naturally or artificially inseminated at 24-hour intervals, beginning on the second or third day of heat and continuing until after ovulation had occurred. When each mare was considered as a separate individual during both breeding seasons, 110 mares were bred. Of these 76 (69.0%) conceived. When the total services given the 110 mares bred were distributed among the 76 pregnancies which occurred, 7.0 inseminations were required per pregnancy. However, 4.7 of them were artificial and only 2.3 actual ejaculates per conception were made.

There was little difference in the percentage of pregnancies of all lactating and all dry mares — 71.1% and 68.9% respectively. However,

the dry mares required a longer period of time and more services per mare before conception occurred.

Many horse breeders have held the belief that the foal heat is the period of highest fertility in the mare. But the work of numerous investigators, including Andrews and McKenzie, has not borne out this belief. Of 110 mares bred, 76 (69%) became pregnant. Of the draft mares 63.3% conceived, while 76.0% of the grade Thoroughbred mares settled to one or more services.

The results were decidedly inferior during foal heat. Only 44.4% of the draft mares became pregnant when bred at the first heat period after foaling. Only 62.5% of the light mares conceived to service during the foal heat.

Young mares entering the breeding herd for the first time were studied in relationship to the entire group. Such mares are commonly believed to be more difficult to settle than are mares that have already produced foals. Of 19 young mares bred for the first time only 8 (42.1%) became pregnant after an average number of 14.6 services both natural and artificial. Thus it can be seen that more difficulty was experienced with maiden mares than with the entire group in which 69% conceived.

"Split" estrus in itself was not deleterious to fertility, although the cause of such divided heat periods is not fully understood. Ovulation did not occur in the mares exhibiting "split" estrus until after heat had reappeared. Hence, under practical breeding conditions where it is a common practice to cease trying mares after they have apparently gone out of heat, a condition of "split" estrus in a mare might result in a disappointing breeding record.

The incidence of "silent" heat ("physiological" estrus) and of post-estrual ovulation is undoubtedly small in the entire mare population, but these phenomena probably account for some part of the low foaling percentages reported from various parts of the world. Estrus is the only guide to the time of mating under most stud farm conditions. Hence, ovulation in the absence of heat symptoms, or heat with the absence of ovulation, will very likely result in failure to conceive.

The work of Andrews and McKenzie showed that "silent" heat and post-estrual ovulation do not, in themselves, prevent conception providing the development of follicles and the time of ovulation are observed by rectal palpation. Of 8 mares bred while unwilling to accept the stallion even though they were nevertheless in "physiological" heat, 5 (62.5%) conceived.

Ovulation did not occur until after the end of heat in 4 mares that were being bred. Of these, 3 (75.0%) became pregnant.

There is a tendency for breeding irregularities and deficiencies to appear in certain family lines of some breeds of horses. While this problem is of interest to the physiologist and geneticist, it is questionable whether it is advantageous to the horse breeder to propagate lines of stock which exhibit such irregularities.

BREEDING PRACTICES

Mares should be in good flesh but not fat at breeding time. They are usually in the best condition for breeding after they have begun to shed in the spring and they are on good pasture. Mares that have been stabled part of the time will start to shed earlier in the spring than will mares that have run out. Open mares that have been in the fields all winter and that have had good hay at all times and enough oats and corn to maintain thrifty condition will come to the breeding season in excellent condition.

Large breeding farms usually require a health certificate before breeding any outside mare. Therefore, if a mare is booked to a prominent stallion, a veterinarian must examine her.

Regular teasing of the mares to be bred should be started before the breeding season gets under way. Although there is considerable range in estrual cycles, each mare follows a fairly regular pattern, and this should be learned. Ordinarily the heat periods in January and February will be longer and somewhat more irregular than those later in the season. Maiden mares should be carefully initiated to the teasing process so that they will relax and show their true condition in the presence of the stallion.

The teasing may be done over a stall door, at a teasing pole, or a breeding stall. Control and safety of the mare and stallion and safety for the handlers should be considered.

As mentioned in a previous section, a small percentage of mares may fail to show signs of heat. Sometimes these mares will show to be in heat when run with other mares in the field, but not when tried by the stallion. More often they prove to be a special problem to the breeder. They have to be examined by means of a vaginal speculum and by ovarian palpation per rectum to determine when they are in condition to be bred. A systematic plan of examining these speculum mares must be followed.

Some mares with foals will not show heat. A vaginal speculum may have to be used, but some of these mares may react to the stallion if they are teased in a different location or if a twitch is used on them.

In some instances a mare may be neither very receptive nor very antagonistic to the teaser. Examination may reveal her true condition.

If a mare was once thought to be in foal, great care should be used in determining her status before breeding her again. Signs of temper and irritation must be differentiated from heat symptoms because abortion may occur if an already pregnant mare is bred. Mares have been bred and a few weeks later have produced a foal, but there is always danger of abortion under such conditions.

Actual breeding practices vary all the way from pasture breeding to the highly supervised mating on a Kentucky Thoroughbred farm with a veterinarian in attendance. The more valuable the animals involved, the greater the care. When sanitation and safety are considered, some if not all of the following practices will be followed.

After the mare has been teased and found to be in heat her hindquarters are washed and rinsed, and her tail is wrapped with a roller bandage. Sometimes lubricating jelly is put about the vulva, especially with a maiden mare. The mare is stood facing a wall and 2 to 3 feet away from it. She is held by two men, one on each side, and each holding a lead strap. If the stallion is valuable and the mare the least bit unruly, the mare is hobbled. A twitch is applied to the mare, and is held by the man on the near side. A piece of canvas or burlap put over the mare's withers will prevent injury from a possible bite by the stallion. The stud horse is brought up behind the mare and when ready is allowed to mount. During service the mare is steadied by the holders. After the mating is over the mare is led around for a short time to prevent straining.

If a stallion habitually gives a very close cover, it may be advisable to hold a breeding roll or roll of cotton against the mare's buttocks and above the penis of the stallion whenever he is bred to a small mare or to a filly at her first breeding.

Although some stud farms make a practice of impregnating mares following natural service, the value of this practice is debatable. It consists usually of filling a gelatin capsule with semen taken from the stallion when he dismounts, and placing this capsule through the cervix into the uterus with the rubber-gloved hand. Sometimes a glass syringe with tubing attached is used. Extreme sanitation must be observed. Impregnation may have some real advantage if a stallion does not cover closely, or if a small stallion is bred to a large mare.

Experienced horsemen feel that some of the troubles in handling maiden mares at time of service may be eliminated by the following procedure. The mare is teased and handled as if she were actually to be bred except that hobbles are not used. The mare is stood in position facing a wall, twitched, and held by two men. Her left fore leg is strapped up securely with a strap equipped with a buckle that allows

quick release. Then the teasing stallion is allowed to mount but not to breed the mare. The fore leg is released so she can more easily bear the stallion's weight. After one or two such experiences the mare will ordinarily be much more willing to accept the regular breeding stallion.

Another common practice with mares being bred for the first time is to have the veterinarian break the membrane that partially occludes the opening to the vagina. The vaginal speculum or gloved hand is used and there is less hemorrhage and bruising of tissue than if the stallion eliminates the membrane at the first breeding.

The advisability of breeding mares at the foal heat is a question on which horsemen disagree. Some reasons advanced for the practice are that some mares do not come into heat when suckling foals, or at least do not show to the teasing stallion. If the mare has foaled late in the season she may have to be bred at the foal heat or left unbred for the year. And lastly, breeding on the 9th day after foaling is a time honored practice.

Actually, however, research investigators and the records of many Kentucky Thoroughbred nurseries show that only about 50% of the mares bred at the foal heat conceive. If a mare happens to be infected when bred on the 9th day, even though she conceives she is apt to abort as a result of infection. Another reason for questioning the wisdom of breeding during the foal heat is that a week to 10 days is often not enough time for a mare's genital tract to return to normal.

The weather conditions the week after foaling may be the deciding factor. If the mare can be on grass and can exercise she will recover much more rapidly than she will if confined to the stables.

When a mare has suffered a difficult delivery, or has retained the afterbirth, or has produced a dead or diseased foal, she should be examined by a veterinarian. Such a mare should not be bred at the foal heat, but passed over until treated and returned to normal.

Some diseased conditions of the genital tract are plainly shown by abnormal discharges that adhere to the tail and buttocks. If there is any question about breeding health, infections in mares can best be determined by bacterial cultures. Such examinations should be made before the breeding season commences.

Disease organisms most frequently encountered are *Streptococci, Staphylococci, Bacterium coli, Pseudomonas aerugenosa,* and *Aerobacter aerogenes*. These bacteria may be introduced accidentally at the time of breeding, or foaling, or examination.

Some older mares have an altered conformation of the pelvic outlet where the vulva is nearly horizontal instead of vertical. This faulty

conformation coupled with a lack of muscle tone about the vulva draws air and foreign materials into the vagina, thus maintaining an infected condition. Veterinarians can remedy this condition to a large extent by suturing or clamping the upper part of the vulva. This operation will noticeably reduce infertility by preventing further windsucking and introduction of infection. Mares that have been so sutured must often be opened up before breeding and always before foaling. Following service they are re-sutured.

THE FOALING MARE

The length of gestation in the mare varies considerably, but will average 340 days. If a mare carries her foal for almost a year, the foal is usually large and somewhat clumsy and helpless. A foal born 2 or 3 weeks before the due date is premature. If a perfectly normal foal arrives 3 or 4 weeks before he is expected, in all probability the mare conceived to a mating before the last one noted for her. Such a situation can occur, but is not usual. On the average, stallion foals will be carried 1½ to 3 days longer than fillies.

During the 11th month of pregnancy the mare's udder enlarges. Beads of wax may form on the teats a day or two before foaling. The wax may leave and milk run from the udder in some cases before the mare foals. If much of this laxative colostrum milk is lost, the foal must be watched carefully and given an enema. Relaxation of the mare's pelvis, depression of the croup muscles on either side of the tail, slight elevation of the tail, and enlargement and relaxation of the lips of the vulva are other signs of rapidly approaching parturition. Just before foaling the mare may be nervous, paw the bedding, sweat a little, lie down and get up once or twice. The attendant should not disturb the mare, but observe her from a place where he cannot be seen.

The natural place for a mare to foal is on a good, clean pasture. But for valuable breeding stock and for late winter and early spring foals a large foaling stall must be made ready. Every effort should be made to keep this stall clean and disinfected. Near at hand such supplies as soap, buckets, tail bandages, antispetic solution, cotton, navel paint and powder, bulb syringe or enema can and hose, and hot water should be available.

Large stud farms always have a man on duty at night during the foaling season. When this attendant finds that a mare is going to foal he washes the mare's hinquarters and her udder, and wraps her tail. Then he leaves the mare alone unless she later requires help in delivery.

A normal foaling is usually accomplished in a few minutes and when the mare is lying down. A wrong presentation of the foal, however, may be serious, and indicates an immediate need for a veterinarian.

The appearance and rupture of the amnion or outer foetal membrane is a sign of immediate foaling. From 1½ to 3 gallons of straw colored fluid may be present. The attendant can usually soon tell if the foal is in the normal position with the front feet extended, the head extended between the legs, and the foal's back up against the top of the pelvic canal of the mare.

If the foal is large and the delivery slow, the attendant may exert a pull on the foal's legs downward in the direction of the mare's hocks. This assistance should be given only when the mare labors.

Sometimes a foot of the foal may be bent backwards or may extend up instead of out through the vagina if the elbow catches on the brim of the mare's pelvis. An attendant may be able to rectify the position. Extreme cleanliness should be observed. A veterinarian should be called and if possible the mare should be got up and kept walking slowly. This reduces the tendency to labor.

Sometimes the foal may be upside down. In such a case, veterinarians recommend that the mare be made to rise and stand for a few minutes. Often when she lies down again a normal position of the foal has been attained. If not, this procedure should be repeated while waiting for the veterinarian to arrive.

A caudal or backwards presentation may occur in 1 or 2 per cent of the deliveries. A very rapid birth is desired in such circumstances because the navel cord may break and the foal may smother before it is born.

Following delivery the first duty of the attendant is to make sure that the foal can breathe. Any membranes and fluid around the nostrils should be removed at once.

The umbilical cord of a foal is about as long as the foal is tall and may remain intact until the mare gets up and turns toward the foal. Sometimes the cord must be broken by hand. After thoroughly cleansing his hands, the caretaker grasps the cord with both hands and breaks it 2 or 3 inches from the foal's body. The contents of the cord may be gently pressed out. Because the stump of the navel cord offers an avenue of infection, it should be dipped in a glass containing a 10% tincture of iodine solution. Formalin, metaphen, merthiolate, or one of the sulfonamides may also be used for treating the navel. Promptness of treatment is essential. A drying powder should be dusted on the navel several times daily until it has dried and dropped off.

After the mare foals she may be given a drink of tepid water and

a bran mash. The mare's hindquarters should be sponged off and the stall cleaned and rebedded. The after-birth usually is passed within a short time after foaling. If it has not come away after about 4 hours a veterinarian should remove it by hand. A retained placenta will lead to internal infection and foal founder.

The foal should not be hurried in his efforts to rise. A normal, vigorous foal will be up in 10 minutes to an hour after birth. Nor should the caretaker worry unduly about getting the foal to nurse. The nursing instinct is probably the strongest basic impulse with which mammals are born. Occasionally a young mare with her first foal may be a bit nervous and may have to be held when the foal first nurses, but this is not usual.

When the weather permits, the mare and foal may be turned out each day. Judgment must be used. If the mare runs a great deal or if the sun is very hot, the new foal may become exhausted. However, moderate exercise on pasture is a prime factor in restoring normal condition to the mare's reproductive tract. Where the mare and foal can be turned out, the mare will have recovered in 5 or 6 days. On the other hand, if the mare has been confined for the week following foaling, the owner should not consider breeding her during the foal heat because in all likelihood her uterus will not have returned to normal.

DISEASES AND INFECTIONS OF THE NEWBORN FOAL

Many foals seem to have difficulty in passing the meconium or foetal manure. Laying back the ears, switching the tail, raising the hind legs, and straining are common symptoms of constipation. The colostrum has laxative properties, but sometimes, especially when considerable milk has been run from the mare's udder prior to foaling, an enema is needed to start the foal's bowels. One or two quarts of mild soap suds and warm water may be given by means of a bulb syringe with a long nozzle. The enema should be repeated until the normal soft, pasty manure replaces the hard, black pellets of meconium. Some large Kentucky stud farms make a regular routine practice of giving an enema to all newborn foals.

Scours often occur in the young foal when the mare comes into the foal heat about nine days after foaling. When the mare is in heat her temperature rises and her milk may change somewhat. A dose of 2 ounces of castor oil given as a drench will usually stop the scours in the foal. The mare's feed should be reduced and her udder milked out by hand.

Another possible cause of scours in the young foal is eating manure. Stalls and paddocks should be kept as clean as possible.

Most infectious diseases of foals are caused by one of three specific organisms, *Shigella equuili, Streptococci,* and *Bacterium coli.* The presence of these organisms in the foal results in a septicemia or unhealthy condition due to pathogenic bacteria and their associated poisons in the blood. Chills, profuse sweating, irregular intermittent fever, and great prostration may accompany the septicemia. Losses from these infections formerly were difficult or impossible to prevent. However, mortality has been greatly reduced since the development and wider use of antibiotics.

Veterinarians on Kentucky stud farms and at the University of Kentucky have found that about 40% of the diseased foals examined have been infected with *Shigella equuili.* This organism causes the so called sleeper or dummy foals. Such foals are either in a semi-comatose condition or, if able to rise, walk drunkenly. The disease appears early in life and is very rapidly fatal, often within 3 days. Streptomycin has proved effective in some cases, but close observation of the young foal and prompt treatment if trouble arises are necessary.

About one third of the infections of foals are streptococcic. Foals infected with *Streptococci* live two or three weeks, sometimes longer. Fever and tenderness of joints, swelling of joints, diarrhea, and failure of the navel to dry properly may be symptoms of this infection. Here again very close observation of the foal and early treatment with the sulfonamides and penicillin may save the foal.

Bacterium coli infection by itself does not cause a large percentage of deaths among foals, but it may complicate other infections. Loss of equilibrium, inability to rise or to control voluntary movements may be typical of *Bacterium coli* infections. Aureomycin has given good results in some cases where treatment was begun early.

The loss of foals from jaundice is probably more common than many horsemen realize. Sometimes during pregnancy the mare may become sensitized against the red blood cell type of the foal. This incompatibility of blood types results in the production of antibodies in the mare's blood. The antibodies also appear in the colostrum for 12 to 24 hours after foaling. When the foal nurses his dam the antibodies cause the agglutination (or clumping together) of the red blood cells of the foal. A jaundiced condition develops in 12 to 24 hours, or less if the foal nurses strongly. The mucuous membranes become quite pale and yellowish. Death comes in two days or less.

If the red blood cell types of the mare and the stallion to which she is bred are incompatible, then the foal is bound to get jaundice if allowed to nurse. When facilities for blood testing are not available it may be assumed that if a mare's foal from a given mating has de-

veloped jaundice, another foal by the same sire would also be afflicted.

However, when it is known that the blood types are incompatible or when the jaundice is noted early, the foal may be saved by preventing it from nursing. The foal should be muzzled and the mare milked out by hand at frequent intervals for 24 hours. The foal may be fed cow's milk to which has been added one teaspoon of corn syrup per ounce. Of this mixture 4 to 6 ounces should be given every 2 hours.

In cases where the jaundiced condition has started to develop, blood transfusions or, when necessary, blood replacement with blood that has been cross matched and found compatible may save the foal. Close observation of the foal is necessary if early and effective treatment is to be given.

Rheumatic arthritis is a non-infectious, non-contagious, severely crippling disease that may affect the older foal or weanling. This disease affects the muscles, tendons, and joints. There may be swelling of joints and loss of condition. After the acute stage has passed a chronic condition follows in which ringbones, contracted feet, and rough joints are commonly seen. Foals so affected are usually worthless for racing or showing, but may be salvaged for breeding purposes depending on their condition. As is true in human medicine the use of and benefits from ACTH, cortisone, enelone, and such products are still in question.

HANDLING AND MANAGEMENT OF THE STALLION

Some western horse breeders and many pony breeders turn their stallions with a band of mares on pasture. The foal crop percentage under such conditions is usually very high. The horses are living a natural life during the breeding season.

Where breeding stock is kept under more artificial conditions the great importance of exercise and green grass for the stud horse must never be overlooked. The stallion should be on grass at least part of each day if possible. During a heavy breeding season he should be fed like a horse at hard work, that is about 1¼ pounds of grain and 1 pound of hay for every hundred pounds of live weight. Legume or mixed hays are preferable. Vigorous daily exercise under saddle, in harness, or on a longe rein help to maintain hard physical condition and good breeding vigor.

A stallion under good supervision, if mated to mares in good breeding condition, should get 80% of the mares in foal if his fertility is normal.

There are three main causes of low fertility in stallions: (1) poor general health, feeding, and management; (2) masturbation; and (3) heredity.

Ordinarily the more natural conditions can be kept, the better for the stallion. If he gets good grass, an adequate varied ration of grain and hay, daily exercise, and is kept free of parasites, he should be in good health. Supplementing the ration with the Vitamin B-complex may have beneficial systemic effects. Some veterinarians prescribe thyroid therapy for stallions with very low fertility. About 10 to 20 grains per day are given along with high potency B-complex vitamins from natural sources.

Frequency of service is another management problem. The normal stallion is physically capable of many services in a day. However, where the aim of the farm is to get as many mares as possible in foal, the stallion is used only once or twice a day and usually has one free day each week. Young stallions may be bred to 10 to 15 mares during their first breeding season, while mature stallions may cover 40 to 100 or more mares during a long season. If a stallion is of low fertility the number of mares assigned to him should be reduced and each mare should be bred more often during one heat period.

Masturbation usually will not become a problem if the stallion is kept where he can see other horses and if he has plenty of room to exercise. Since this most often is a solitary practice, a stallion may have to be watched very closely to determine if it is the cause of lowered fertility. A stallion ring which fits around the end of the penis may have to be used to prevent masturbation in some cases.

Heredity can also be a cause of low fertility. Certain lines of breeding seem to inherit a tendency to be shy breeders. An example in the Thoroughbred breed is the line from imported St. Germans, himself an uncertain breeder. The Kentucky Derby winners Twenty Grand and Assault were respectively son and grandson of St. Germans, and both were infertile. Other descendants have been of low fertility.

The surest test of a stallion's fertility is the production of a high percentage foal crop. However, a fairly good indication of probable breeding results may be obtained from a laboratory examination of the horse's semen. For this purpose a complete ejaculate should be secured. This may be done either by using a rubber condom or breeding bag on the stallion and permitting him to serve a mare, or by collecting the semen in an artificial vagina when the stallion mounts a mare. Some horses seem to work better with one method, some with the other.

Characteristics of the semen that are specially noted are the volume, the spermatozoon count, the motility of the sperm cells, and their morphology. The color and consistency of the semen and the presence of red blood cells and pus cells are also considered. Stallions of the light breeds normally produce from 40 to 80 cc. of semen per ejaculate. Some may be much higher, as are many draft stallions whose semen

volume may be over 150 cc., or roughly 5 ounces. The sperm count in the normal stallion's ejaculate may range from 135 to 300 million per cc. Normal stallion semen will be high in morphology rating, 90 to 100% of the sperm cells being of normal form. Stained slides are made for morphological study under the microscope. The fertile stallion produces sperm that show vigorous motility that lasts for a considerable time when a drop of the semen is examined microscopically.

Low spermatozoon count, low degree of sperm motility, presence of many abnormally formed sperm cells, and presence of pus cells in the semen may cause either low fertility or virtual infertility in the stallion.

Some stallions retain their breeding vigor for many years, but some show a decreased fertility after 8 or 10 years of stud duty. It is probably good insurance to supplement the stallion's ration with vitamins after he has been in the stud for a number of years.

On big stud farms where racing or show stock is bred the breeding procedure is somewhat as follows. The stallion's genitals are washed and rinsed unless he has already been used that day or the day before. Then the stallion, controlled by bridle and chain, is brought up to about 10 feet to the rear and slightly to the left of the mare and made to stand. The stud man is on the left. When the stallion is fully ready for service he is allowed to mount. Depending on circumstances the stud man may have to help the stallion enter the mare. Following service the stallion is backed away, washed, rinsed, and disinfected, and returned to his stall.

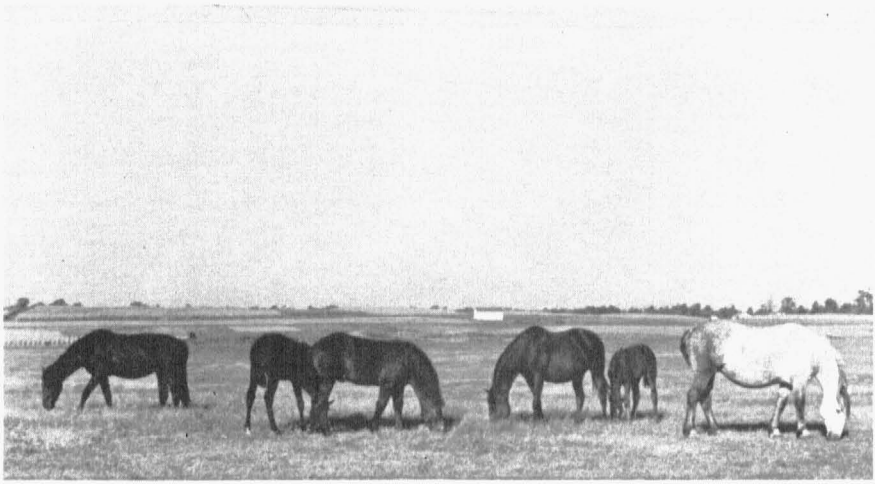
There are two fairly accurate indications of a full, complete service. Following the regular breeding motions and ejaculation a stallion will flag his tail up and down. If this sign is not noted and there is some question about the service, the stallion should be backed off to the rear of the mare. If he gets ready to cover the mare again in a couple of minutes the chances are that he did not ejaculate the first time.

A stallion's first 2 or 3 services and those services immediately following a long period of sexual inactivity may contain an abnormally high percentage of deformed sperm cells. However, if the horse is of normal fertility, his subsequent semen production will be satisfactory.

When the young stallion is first started in breeding service he should be handled by an experienced stud man. The manner of service can be largely influenced by the man on the lead shank, and a stallion's behaviour at breeding time depends a lot on how he was handled as a young horse. A quiet, old, experienced mare should be used for the first service. In many cases the young stallion acts like a veteran the first time. But sometimes colts can be very slow and exasperating to the handler, and may have to be tried for 2 or 3 days before a service

is completed. Hence, the need for a quiet mare and a patient, persistent, experienced stud man. Once a colt has successfully covered a mare, further difficulty is seldom encountered.

One disease that may affect stallions is coital exanthem. Though commonly called pox, it is not the true horse pox. It is a pustular, eruptive dermatitis characterized by small whitish or red gray blisters over the penis. The skin at the affected points sloughs off and leaves a raw surface covered with a yellowish serum that forms a crust. The disease may run its course in 10 to 14 days. Application of silver nitrate followed by a liquid sulfonamide hastens healing.



Pasture is essential for health and reproductive vigor in breeding stock.