FINAL REPORT

INTERNATIONAL COLLABORATIVE RESEARCH PROJECT ON

INCIDENCE AND FIELD MANAGEMENT OF INFERTILITY IN CATTLE AND BUFFALOES IN RURAL HARYANA, INDIA

Funded By

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Research and University Relations
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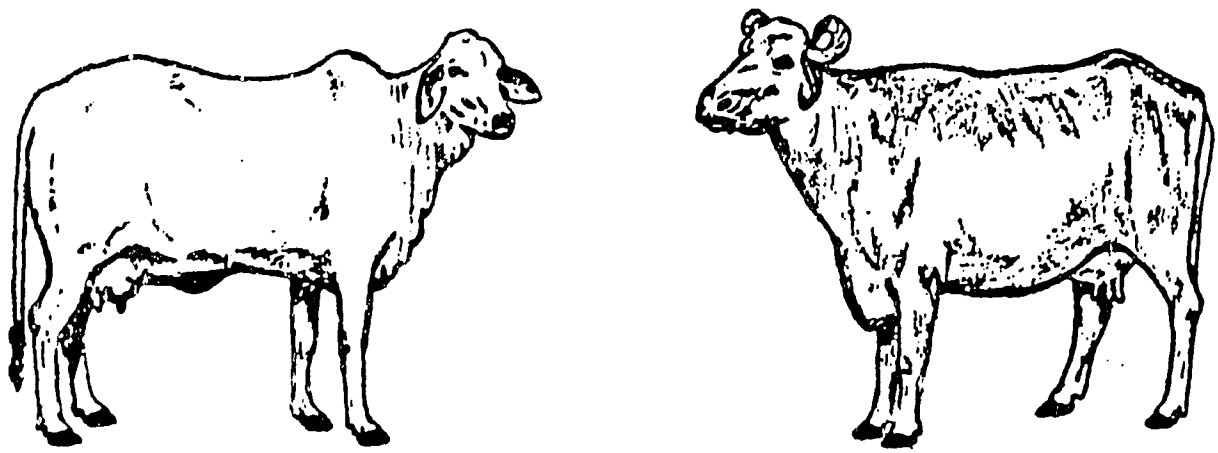

Submitted by K.L. Arora, DVM, Ph. D.
Head, Department of Veterinary Science, Fort Valley State College
Fort Valley, Georgia, U.S.A. 31030-3298

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Fort Valley State College
Department of Veterinary Science
Fort Valley, Georgia, U.S.A.
and
Haryana Agricultural University
Hisar, India

COLLABORATING INSTITUTIONS

I. FORT VALLEY STATE COLLEGE
DEPARTMENT OF VETERINARY SCIENCE
FORT VALLEY, GEORGIA 31030-3298 U.S.A.

Project Leader: Dr. K.L. Arora, DVM. Ph.D.
Professor and Head

II. HARYANA AGRICULTURAL UNIVERSITY
HISAR, HARYANA, INDIA 125004

1. DEPARTMENT OF ANIMAL PRODUCTION PHYSIOLOGY
COLLEGE OF ANIMAL SCIENCE

Project Leader: Dr. S.P. Singal, MVSc, Ph.D.
Professor

2. DEPARTMENT OF VETERINARY GYNECOLOGY AND OBSTETRICS
COLLEGE OF VETERINARY SCIENCE

Project Leader: Dr. S.K. Verma, MVSc, Ph.D.
Professor and Head

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ACKNOWLEDGEMENTS

My sincere thanks to the USAID/ST/RUR for funding this project--The incidence and field management of infertility in cattle and buffaloes in rural Haryana, India. I am also very grateful to Dr. R. M. Acharya, Deputy Director General (Animal Sciences), Indian Council of Agricultural Research (ICAR), Government of India (GOI) for taking a personal interest in approving this project and also for facilitating its quick approval from other GOI agencies. In addition, the help received from the USAID mission in New Delhi (Dr. Ron Pollock and Dr. Surjan Singh) in this connection is highly appreciated.

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encouraged my participation in the international programs, but also developed a suitable survey instrument for collecting information on the role of women in routine livestock rearing practices at the village level. She shared many ideas and provided a lot of help in the preparation of this report. Also, I sincerely appreciate the cooperation and encouragement of my children, Urmil, Vimal, and Suresh, during the course of this project.

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II. INTRODUCTION

Haryana is a small farming state in the Democratic Republic of India. About 80% of its population lives in villages as small farmers who depend upon a small acreage and a few head of cattle for their subsistence. The people of this state are mostly vegetarians; they supplement their diet with milk and milk products which constitute a major source of vitamins, minerals, proteins, and other essential dietary elements. In addition, the sale of fresh milk provides the farmers with some cash income for meeting the day-to-day needs of their families. The raising of dairy cattle (Bos indicus) and buffaloes (Bubalus bubalis) has become a productive endeavor for the farmers as a source of income for their dietary needs as well as for improving their economic well being.

With the adoption of new crop varieties and modern farming techniques, agricultural production has significantly increased in the state; whereas, livestock production continues to lag behind due to infertility and sub-fertility which are very common among dairy cows and buffaloes. A survey conducted by the university scientists (1979-81; see appendix I) revealed frequent reproductive problems in apparently healthy cattle and buffaloes; 78.3% of 847 breedable buffaloes examined in one area were found to have impaired fertility due to ovarian dysfunction and infantile reproductive organs.

Types of reproductive disorders and their underlying causes have not, as yet, been systematically identified, and these aberrations are drastically affecting livestock production in this area. Therefore, it was considered highly desirable to identify these and other associated problems and relate them, if possible, to various nutritional, environmental and livestock husbandry practices customarily being used by the farmers and subsequently devise some corrective measures.

III. STATEMENT OF THE PROBLEM

Haryana state is located in the plains of India at the foothills of the Himalayas in the north, and bordering Delhi and Utter Pradesh on the east, Punjab on the northwest, and the desert of Rajasthan in the southwest. Its economy is mainly agriculture-based, however, industrial development is quite rapid due to its close proximity to the national capital. Haryana has a population of 12.8 million with an area of 44,222 square kilometer (km), and a population density of 290 per sq. km. Although Haryana is a comparatively small state, it is composed of diverse agro-climatic regions, cultures and livestock husbandry practices. Northern Haryana has very fertile land with abundant irrigation facilities like canals, tube wells, and receives ample rainfall, whereas, Southern Haryana bordering Rajasthan has very scanty irrigation resources and, at the same time, the underground water is unfit for irrigation. Therefore, in Southern Haryana, the agricultural success depends mainly on rainfall. Likewise, the socio-economic status, literacy status, and the livestock husbandry practices differ in these two regions; being higher and more advanced in the northern region. Furthermore, the farmers in high rain and irrigated regions in the north are more receptive to the newer farming and animal husbandry technologies while the farmers in the southern regions continue to remain traditional and are reluctant to switch over to newer technologies.

Although agriculture is the major thrust in rural Haryana, the raising of cattle and buffaloes for milk and draft purposes is considered to be a vital enterprise for the farmers. At the same time, livestock production receives inadequate attention, particularly with respect to nutrition, housing and reproductive management. Ultimately, this results in huge unnoticed economic losses in terms of calf crop and lifetime productivity. Although,

the farmers are becoming more conscientious about these problems due to commercialization of dairy farming, the incidence of reproductive disorders continues to remain at an alarming level. Hence, this pilot project was undertaken to investigate reproductive problems affecting cattle production and to develop some suitable strategies to correct them.

IV. MAJOR OBJECTIVES OF THE PROJECT

This project addressed mainly the following two aspects of the reproductive problems in breedable cows and buffaloes:

1. Identification of various types and frequencies of reproductive disorders in two agro-climatic zones of the state.
2. Adoption of appropriate management and therapeutic measures to prevent/correct reproductive disorders.

In addition, this project conducted benchmark surveys on livestock holdings of the farmers, and the involvement of women in day-to-day livestock management practices (Appendices A and B).

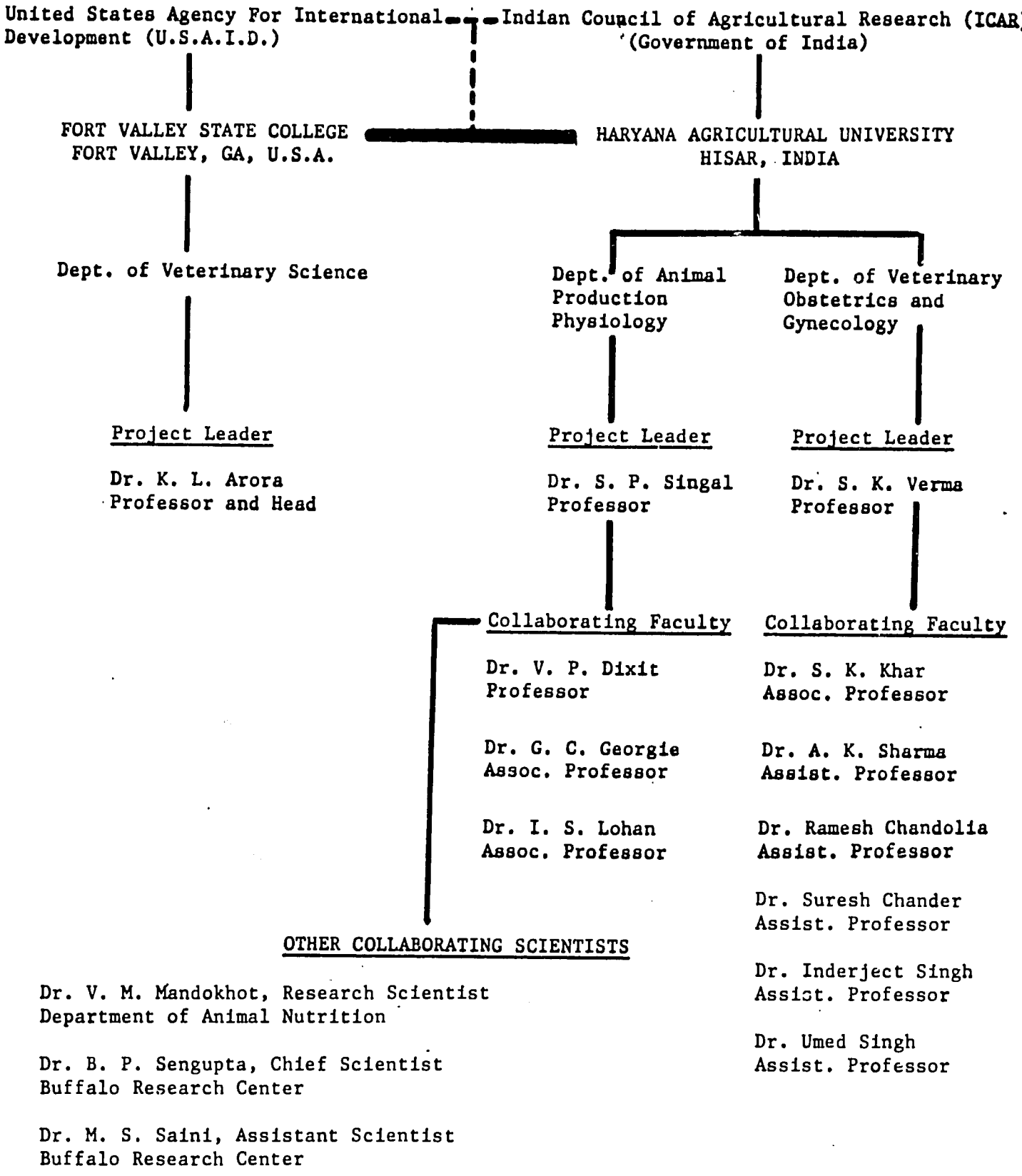
V. PROJECT LOCATIONS/SITES

The project was approved for Fort Valley State College, Fort Valley, GA, with Dr. K. L. Arora as the Principal Investigator, for implementation in the State of Haryana, India, in collaboration with the faculty from the Haryana Agricultural University (HAU), Hisar. At HAU, the implementation of the project was shared by the following two departments:

1. Department of Animal Production Physiology (APP), College of Animal Science--Project Leader: Dr. S. P. Singal.
2. Department of Veterinary Obstetrics and Gynecology (VOG), College of Veterinary Science--Project Leader: Dr. S. K. Verma.

A complete listing of the project leaders and the collaborating faculty is given on page 4.

VI. PROJECT LEADERS AND COLLABORATING FACULTY



OTHER COLLABORATING SCIENTISTS

Dr. V. M. Mandokhot, Research Scientist
Department of Animal Nutrition

Dr. B. P. Sengupta, Chief Scientist
Buffalo Research Center

Dr. M. S. Saini, Assistant Scientist
Buffalo Research Center

VII. TASK ASSIGNMENTS AMONG THE FACULTY

The participating faculty were assigned specific tasks for the execution of the project as follows:

1. DEPARTMENT OF ANIMAL PRODUCTION PHYSIOLOGY (APP)

   -Identification of anestrus and repeat breeding cows and buffaloes in the adopted villages.

   -Determination of various macro-and microminerals in the blood of the affected animals (with the help of the Dept. of Animal Nutrition).

   -Correction of the reproductive disorders of the animals through organized and supervised breeding procedures, changes in the management practices, and the use of various hormones and feed supplements such as vitamins and minerals.

   -Induction of estrous cyclicity in the buffaloes with the use of Synchromate-B.

2. DEPARTMENT OF VETERINARY OBSTETRICS AND GYNECOLOGY (VOG)

   -Determination of the incidence of infertility in cows and buffaloes with particular reference to the infectious diseases and pathological disorders.

   -Treatment of reproductive disorders using antibiotics, hormones, and surgical interventions.

   -Performing microbiological investigations on the affected animals.

   -Analysis of the impact of this project on the livestock husbandry practices and on the overall well-being of the small farmers.

VIII. SELECTION OF VILLAGES AND FIELD OPERATIONS

Four (4) villages located in two contrasting agro-climatic zones in the State of Haryana were selected for this study. Two villages are located in the DRY OR ARID ZONE (Kungar and Jhumpa in Bhiwani District) and two in the WET OR SUB-HUMID ZONE (Panjokhra Saheb and Chormastpur in Ambala District).

In selecting these villages, the following criteria were considered desirable for each village:

1. A minimum of 500 breedable cows and buffaloes in each village.
2. Willingness of the farmers to participate in the project.
3. Accessibility by road.
4. Proximity to a diagnostic laboratory.
5. Availability of facilities for overnight stay for the investigators.
6. Existence of a Veterinary Dispensary or Stockman Center.

The adopted villages in the two zones are delineated on the enclosed map of the State of Haryana on pages 8 and 9.

FIELD OPERATIONS

The following procedures/plans were adopted for the execution of the project at the village/farmers' level:

1. SURVEY WORK:

   Two questionnaires were designed for survey work; one dealt with livestock inventory, health, and treatment, and the other with the involvement of women in day-to-day livestock management (Appendices A and B). Locally available educated youths were employed to conduct these surveys. Various equipment and supplies needed for the implementation of this project were acquired locally (Appendix F). In addition, some hormones, drugs, and supplies were shipped from the USA (Appendix G).

2. REPRODUCTIVE HEALTH CONTROL CAMPS:

   On specified days and times, a team of scientists from both departments (APP and VOG) visited four adopted villages separately or jointly, examined animals with reproductive problems, and provided

suitable corrective measures and/or made recommendations for improving nutritional and management practices to the farmers. Research fellows hired under this project conducted follow-ups visits (Appendix H).

3. COLLECTION OF SAMPLES FROM THE AFFECTED ANIMALS:

Blood samples from the affected animals were transported to the laboratory at HAU in cold thermos bottles for biochemical and hormonal estimations. Similarly, microbial samples (swabs) were cultured for the identification of causal organisms including mycoplasmosis. Some fecal samples were examined for the identification of endoparasites, and for assessing the degree of infestation.

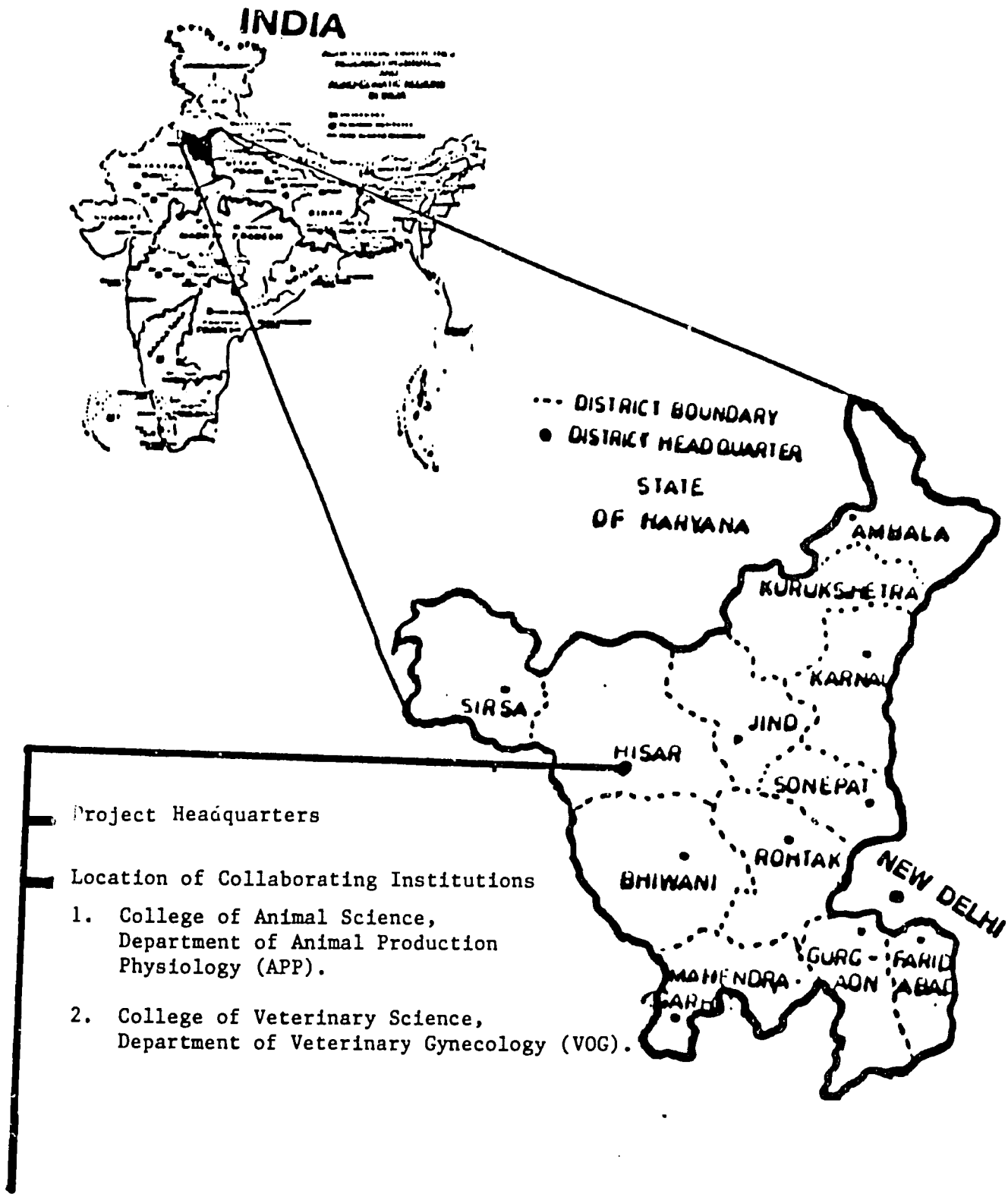
4. ANALYSIS OF DATA:

Various statistics such as mean, standard error, and frequency values were calculated as needed. Analysis of the variance was also conducted to assess statistical significance of results among different groups of animals.

IX. PROFILES OF THE SELECTED VILLAGES

The state of Haryana is composed of variable agro-climatic regions, cultures and livestock husbandry operations. Two diverse regions based on agro-climatic conditions were selected for this study. The WET ZONE in the northern part of the state is characterized by an annual rainfall between 750 and 1000 mm, and assured irrigation facilities from canals and tube wells (pump sets). The soil is of a reddish chestnut type and the mean temperature for eight months of the year exceeds 20°C. For two winter months it is less than 15 °C. The DRY ZONE in the soutwest part of the state has under developed or non-existant irrigation facilities with an average annual rainfall between 300 and 500 mm. The soil is mainly of a Sierozem or desert type (Appendix D).

The risk of crop losses is maximal in this area due to scanty and erratic rainfall and lack of assured irrigation facilities. Droughts are a common occurance in this region. The climate is more or less a desert type and much warmer when compared to the Wet Zone.


INDIA
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DISTRICT HEADQUARTER
STATE
OF HARYANA
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KURUKSHETRA
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NEW DELHI
GURG-
AON
FARID
ABAD
MAHENDRA
GARH
Project Headquarters
Location of Collaborating Institutions
1. College of Animal Science,
Department of Animal Production
Physiology (APP).
2. College of Veterinary Science,
Department of Veterinary Gynecology (VOG).

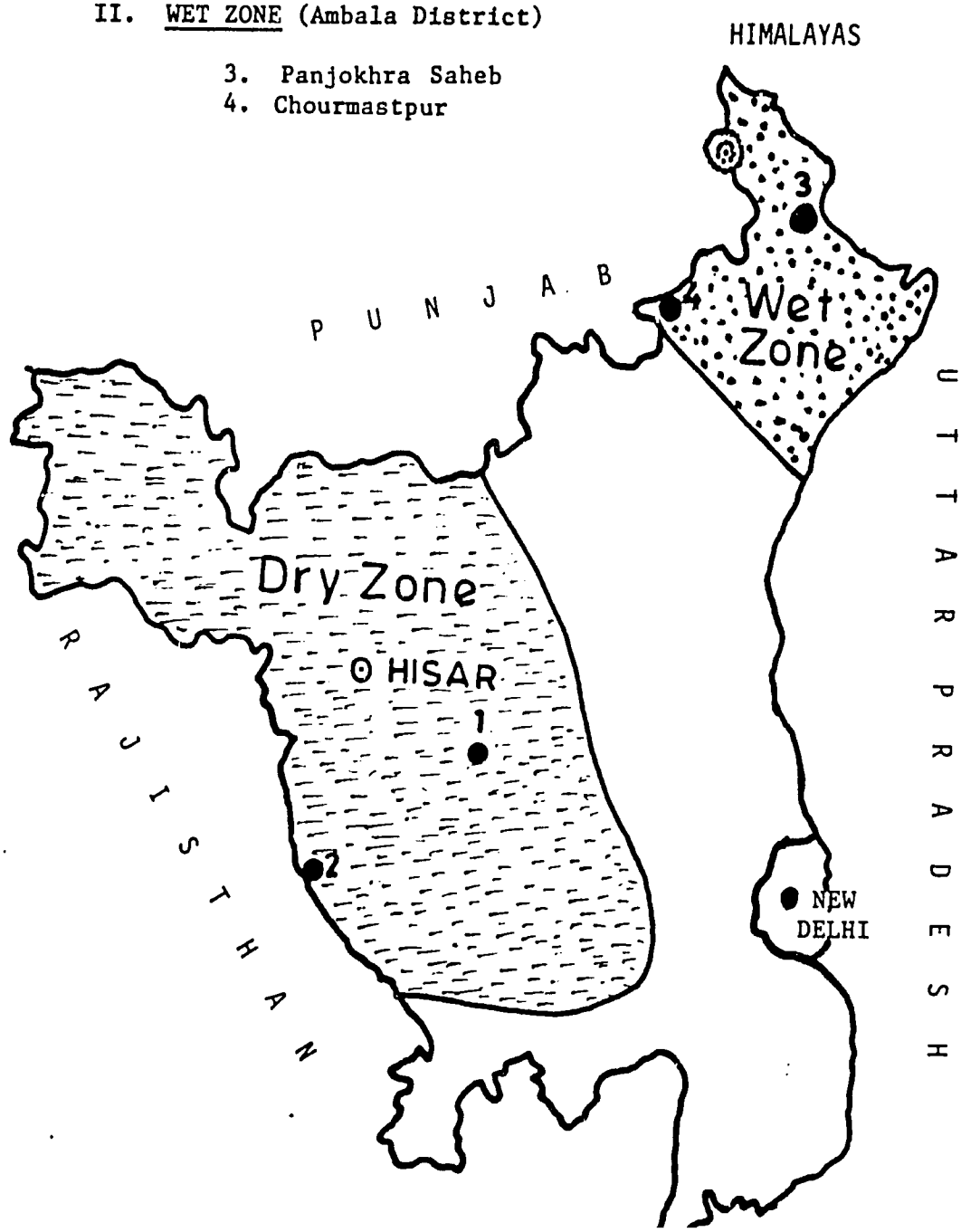
MAP OF HARYANA STATE SHOWING THE LOCATION OF FOUR ADOPTED VILLAGES:

I. DRY ZONE (Bhiwani District)

1. Kungar
2. Jhumpa

II. WET ZONE (Ambala District)

3. Panjokhra Saheb
4. Chourmastpur



VARIOUS VILLAGE PROFILE COMPONENTS EVALUATED

ZONE :

NAME OF VILLAGE

Location

Education

Farm Machinery

Mass Media

Animal Management

Breeding Bulls

Detection of Estrus

Artificial Insemination

Feeding

Veterinary Help

Incidence of Reproductive Problems

Treatment of Infertility

A. DRY ZONE

This region is located in the southwestern part of the state. It has underdeveloped or non-existant irrigation facilities with an average annual rainfall between 300-500 mm. The climate is of a desert type and droughts are common. The risk of crop losses is high in this area due to scanty and erratic rainfall, and lack of assured irrigation facilities. Two of the four selected villages are located in this zone (KUNGAR and JHUMPA). See map on page 9.

1. KUNGAR VILLAGE

Location

This is one of the two villages selected in the DRY ZONE. It is located about 30 km from the district headquarters at Bhiwani, and is well connected by roads. It has a population of about 6,000.

Education

The village has two primary schools, one for boys and the other for girls. Village youths attend colleges in the nearby cities. The education of girls is not a taboo, and some of the village girls are employed as well. In general, the farmers are illiterate. None of the farmers have received any formal training in livestock management. Family size is large and ranges between 5 and 11 members. Although the farmers are aware of the availability of various family planning programs, very few of them have adopted any of these practices. Land holdings are small (average 5-10 acres), and the farmers are receptive to new technologies.

Farm Machinery

Bullocks (oxen) are extensively employed for ploughing, transportation, and routine agricultural operations. Some well-to-do farmers have tractors (about 10 in the whole village) which they purchased mainly through bank loans. For irrigation, the farmers depend upon tube wells (pumpsets) when canal water is not available.

Mass Media

For news, the farmers mainly depend upon radio transmissions. Although there are about 40 television sets in the village, the farmers are not aware of the agricultural programs that are broadcast. Television is mainly used as a source of entertainment. The majority of the farmers are not capable of reading newspapers, and only about 15 copies were being received in the whole village.

Livestock Management

Our survey revealed that the village had more buffaloes than cattle (Table 1). There were also a large number of bullocks (oxen). The cattle were mainly of the indigenous type, and crossbreds were very few. The sale of milk is considered a taboo, and is consumed by the farmers and their children as such, or in the form of yogurt or buttermilk. A large number of animals are sold annually for a profit. High yielding animals are invariably purchased by middlemen for resale in metropolitan cities at higher prices. Therefore, the main source of income for the farm families in this region is from the sale of crops (grains) and animals.

Breeding Bulls:

The village had 10 buffalo-bulls and 6 dairy-bulls. They were community bulls and were being used for breeding purposes by the whole village. Only 4 buffalo-bulls and 5 dairy-bulls were found to be fit for use in breeding. These bulls apparently did not belong to anyone, therefore, no one had taken the responsiblity for their feeding, shelter, and veterinary care. They roamed about freely in the village among the herds.

One serious problem discovered was the overuse of the community bulls. Only 4 buffalo-bulls were being used to service more than 800 buffaloes in the village. Furthermore, there was a tendency among the farmers to get as many mounts as possible from a bull to assure conceptions. The overuse of a limited number of bulls was apparently responsible for a higher incidence of repeat breeding. Another problem was that, these bulls had never been examined for breeeding or the presence of venereal diseases.

Artifical Insemination:

Semen for Artificial Insemination (AI) was being supplied from the Intensive Cattle Development Project (ICDP), Bhiwani, about 30 km from this village. The village dispensary had no facilities for semen evaluation. The refrigeration and sterilization facilities were inadequate. Semen and liquid nitrogen were brought bi-weekly in a vehicle.

Other information collected regarding the AI services:

1. The farmers preferred natural service over AI. They brought their animals for AI only when the community bulls would not mount.

2. Although AI in cows and buffaloes was started in the village about ten years ago, its impact appeared to be negligible.

3. The man responsible for performing AI was not well trained for the job and was available for only 4-6 hours during the day. As a result, the animals which came into estrus in the early morning or late evening had to be serviced by the community bulls, if available, or were not serviced at all.

4. In the opinion of the farmers, the animals were not settling to AI and invariably ended up as repeat breeders.

5. The frozen semen was found to be contaminated with pathogenic organisms such as Staphylococcus, Streptococcus, E. Coli, Gram positive sporulating rods, etc.

Feeding:

It was observed that supplemental green fodder and concentrates were fed only to the lactating animals, whereas, dry animals and heifers were left on grazing alone. When in-house, they were provided only dry fodder in the form of wheat, straw and some green fodder, if available. Rarely was any feed concentrate provided to the animals that yielded little or no milk. The farmers were unaware of silage making techniques. We did not see farmers providing a salt/mineral lick for their animals.

It was noted that general management of animals (including feeding, watering, milking, and estrus detection) rested mainly with the womenfolk and children. Menfolk were rarely involved in these activities.

Detection of Estrus:

Since effective estrus detection is the key to maximizing reproductive efficiency, the estrus detection procedures were evaluated very closely. It was observed that the womenfolk and herdsmen who were mainly responsible for estrus detection, neither adopted any estrus detection devices nor spent sufficient time to closely monitor changes in the animals' behavior. Lack of proper detection of estrus was one of the major managemental neglects.

Veterinary Help:

The village veterinary dispensary had no facilities for providing even minimal preliminary veterinary care. The center was manned by a stockman and a bull attendant. They did not reside in the village and were available for only 4-6 hours during the day time.

Incidence of Reproductive Problems:

Our house-to-house survey revealed that reproductive disorders were the major cause of economic losses. The incidence of various reproductive disorders among buffaloes and cows in this village is listed in Tables 1, 12, and 13.

1. Buffaloes:

   In buffaloes, the two major reproductive problems encountered were: ANESTRUS (in both heifers and post-partum animals) and REPEAT BREEDING. Amazingly, a large number of heifers in the age group of 3-4 years (or more) had not yet expressed the first estrus.

   The incidence of post-partum anestrus was also quite high; several buffaloes which had calved more than a year ago had not exhibited estrus.

   Among the repeat breeders, some buffaloes exhibited abnormal discharges. It was learned that these animals became repeat

breeders following the AI services and subsequently developed metritis. Several other animals became repeat breeders following unproductive matings with overused community buffalo-bulls.

2. Cows:

Anestrus and repeat breeding were also common among cows but the incidence of silent estrus was less frequent as compared to buffaloes. Post-partum anestrus was also a problem; many of these animals had smooth and inactive ovaries and were in poor physical condition due to nutritional deficiencies or disease. All of the repeat breeders appeared quite normal with the exception of 3 animals which had normal discharge due to metritis. Some farmers expressed that poor AI practices were to blame for most of the repeat breeders.

Treatment of Infertility

The anestrus and repeat breeding buffaloes, cows, and heifers were subjected to different treatment regimens and their responses are given in Tables 2, 3, and 11.

TABLE 1: KUNGAR VILLAGE: CATTLE POPULATION AND INCIDENCE OF REPRODUCTIVE DISORDERS IN COWS AND BUFFALOES (APP-VOG)

CATTLE POPULATION (APP)

I. ZEBU

Cows	460
Heifers	196
Bulls	2
TOTAL:	658

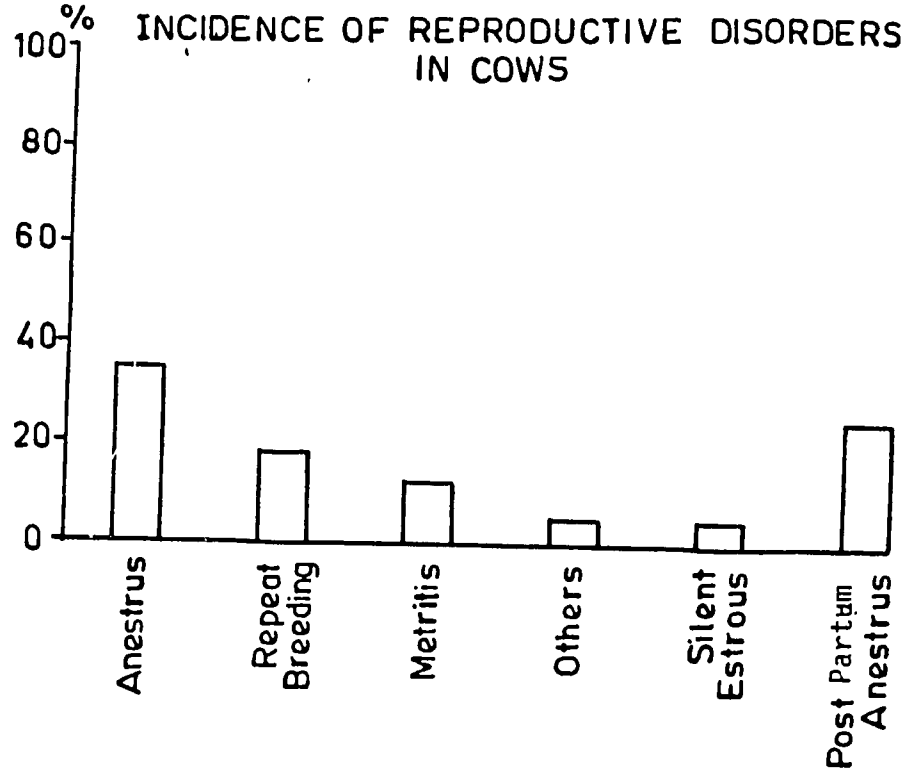
II. CROSSBRED

Cows	85
Heifers	64
Bulls	4
TOTAL:	153

III. BUFFALO

Cows	810
Heifers	410
Bulls	10
TOTAL:	1,230

GRAND TOTAL: 2,041



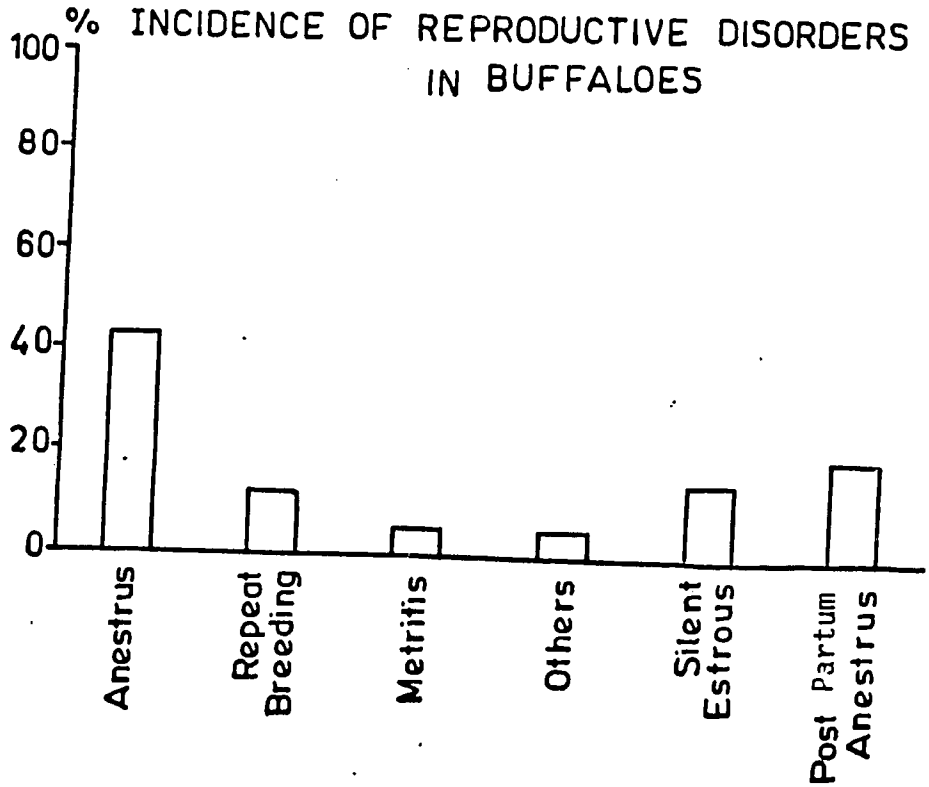


TABLE 2: KUNGAR VILLAGE: RESPONSES TO INFERTILITY TREATMENT IN CATTLE (VOG)

1 Reproductive Disorder	2 Sample Size n	3 Type of Treatment	4 # of Cows Exhibiting Estrus n (%)	5 # of Cows Impregnated** n (%)
1. ANESTRUS				
Group A	10	-Feeding Mineral Mixture AND -Lugal Iodine Painting on the Cervix	4 (40.0)	3 (75.0)
Group B	10	PMSG (rolligon) 1,000-1,500 IU/IM	7 (70.0)	4 (57.1)
Group C	10	Estradial 10 mg/IM	7 (70.0)	1 (14.3)
2. REPEAT BREEDERS				
Group A (with abnormal vaginal discharge)	9	-Antibiotics and Twice Intra-uterine Infusion of Lugol Iodine Solution (1:20), -Sexual Rest	7 (77.8)	5 (71.4)
Group B (with normal vaginal discharge)	15	-No Therapeutic Treatment -Control of Managemental and Human Factors*	- ------	- ------

*These included improper AI techniques; lack of accurate estrus detection; overuse, non-availability and poor libido of the community bulls; untrained inseminators, poor semen quality, and others.

**Percent of Column #4

TABLE 3: KUNGAR VILLAGE: RESPONSES TO INFERTILITY IN BUFFALOES AND HEIFERS (VOG)

1 Reproductive Disorders	2 Features	3 Sample Size n	4 Type of Treatment	5 # of Cows Exhibiting Estrus n %	6 # of Cows Impregnated** n %
1. Silent Estrus	Cyclic Structures Present on the Ovaries	20	PGF2 -alpha (Dinofertin) 25 mg/IM	18 (90.0)	7 (38.9)
2. Anestrus (Heifers)	Absence of Ovarian Cyclicity	20	PMSG (Folligon) 1,500-2,000 IU/IM	13 (65.0)	4 (30.8)
3. Post-Partum Anestrus	Absence of Estrus for 6-12 months Post-Partum	20	-Feeding Mineral Mixture and, -Iodine Painting on the Cervix	11 (55.0)	6 (54.5)
4. Repeat Breeders	a. Unsettled Cows with Abnormal Vaginal Discharge	20	-In-utero Antibiotic Infusions (Sensitivity Tests) -Sexual Rest	14 (70.0)	9 (64.3)
	b. Unsettled Cows with Normal Vaginal Discharge	--	Control of Manage-mental and Human factors (No Therapeutic Treatment)	-- ------	-- ------

*These included improper AI techniques; lack of accurate estrus detection; overuse, non-availability and poor libido of the community bulls; untrained inseminators, poor semen quality, and others.

**Percent of Column #5

2. JHUMPA VILLAGE

Location:

This is the second village in the Dry Zone selected for survey work and infertility investigations. It is located about 40 km from the Haryana Agricultural University in Hisar. The village is easily accessible by roads and railways. Soils are sandy and desert-like. There is no canal irrigation system in the area. The subsoil water is very deep and the use of tube wells (pumpsets) is not successful. The people depend on village wells or piped water supply for their drinking needs. For agriculture, they depend solely on rainfall.

Education:

The village has a population of about 4,000. There is only one primary school for boys and girls. For further education, the children have to go to nearby cities. The unemployment rate as well as the illiteracy rate among the farmers is very high. There are only a few progressive farmers in the village who are in touch with various developments involved pertaining to agriculture. However, their impact on other farmers was negligible.

Family Size and Land Holdings:

Family size is large and ranged between 5-10 members. The older generation is skeptical about the adoption of family planning methods. Land holdings are comparatively large (10-20 acres) but, unfortunately, the yield from the land is erratic and meager due to a complete lack of irrigational facilities. In a year in which rainfall was adequate, the farmers would reap good harvests of cereals like gram, bazra, etc., with a minimal of input costs. However, when the rainfall is untimely and scanty, the farmers have to depend upon their reserve stock. Therefore, the income from agriculture was highly undependable.

Farm Machinery:

Camels are extensively utilized for local transport as well as for routine agricultural operations. There are only five tractors in the whole village which were purchased through bank loans.

Mass Media:

For news and information, the farmers are mainly dependent upon radio broadcasts. Although there are a few television sets (6) in the village; they were rarely in use because of poor reception. The village is almost beyond the transmission range. Newspapers reach the village 10-12 hours late and the subscribers are mostly government officials and well-to-do farmers.

Veterinary Help:

The village has a full-fledged veterinary hospital and AI Center. It is staffed by a veterinary surgeon, stock assistant, compounder, and two laborers. These personnel were available 24 hours a day because they resided

in the village. A refrigerator for storing liquid semen had been provided only recently. No frozen semen facilities were available. The AI work was being conducted with liquid semen supplied from a distance of 80 km (ICDP, Bhiwani) through a courier.

Animal Population:

A general survey revealed that the number of buffaloes in the village was fewer than cows (Table 4). Crossbred cows were very few. The presence of a large number of camels (approx. 500) reflected the dependence of farmers on them for use in draft.

There was no organized sale of milk or milk products in the village. No cooperative dairy organization existed in the village. Sale of milk is considered a taboo, and is mainly consumed by the farmers and their children.

Management of Breeding Bulls:

The village had 4 buffalo-bulls and 4 dairy bulls readily available for breeding purposes. Their physical examination revealed that only 2 buffalo-bulls and 3 dairy bulls were fit for breeding. As in other villages, no one was responsible for their feeding or management. These bulls were being overused for breeding purposes.

Artificial Insemination:

Liquid semen was being supplied from ICDP Bhiwani, which lies about 80 km from the village. The dispensary had no autoclaving facilities. Frozen semen was not available. In general, AI was unpopular in the village. Its impact was negligible, even after ten years of existance.

Feeding:

Since milk is not a source of income for these farmers, they take very little interest in the reproductive efficiency and management of their animals. There were very few community pastures. Green fodder was scarce and, if available, was of poor quality and available only for a few months during the year. Usually the animals depended upon dry fodder (invariably gram bhusa) and concentrates. Concentrate mixture was not provided regularly to the heifers and dry animals. Salt brick or mineral supplements were not provided. Drinking water was not available ad-lib to the animals.

Estrus Detection:

General management, feeding, milking, and heat detection responsibilities rested with the womenfolk. The farmers were not sensitive to the economic importance of estrus detection and were not aware of any estrus detection devices available.

Incidence of Reproductive Problems:

It was observed that reproductive disorders were the major cause of economic losses. Two major types of reproductive disorders observed in cows and buffaloes are given in Tables 4, 12 and 13. These were:

1. **Anestrus:** Anestrus was common in heifers and post-partum animals. Several animals had parturated a year or more ago and were still anestrus. Similarly, the incidence of anestrus in heifers was very high due to their retarded growth and poor health. This study was conducted during the year when there was a severe drought in the area. The anestrus animals possessed smooth and inactive ovaries.

2. **Repeat Breeding:** After anestrus, repeat breeding was the second major reproductive problem.

   The major causes of anestrus were perhaps nutritional deficiencies. The effect of severe drought was widespread. There was an acute shortage of fodder. Obtaining adequate fodder was simply beyond the reach of small and marginal farmers from the expense standpoint. Even the lactating animals were kept on a subsistence ration with no access to green fodder for almost two years. Drinking water was in short supply. The drought had substantially reduced the economic power of the small farmers; and several of them had turned loose animals because they had nothing to feed them. Gynecological examination of these animals revealed smooth ovaries and subnormal size of reproductive organs (infantile).

Treatment of Infertility:

The responses of the cattle and buffaloes to various treatment regimens are given in Tables 5 and 11.

TABLE 4: JHUMPA VILLAGE: CATTLE POPULATION AND INCIDENCE OF REPRODUCTIVE DISORDERS IN BUFFALOES
(VOG-APP)

CATTLE POPULATION (APP)

I. ZEBU

Cows	685
Heifers	210
Bulls	2
	897

II. CROSSBRED

Cows	120
Heifers	46
Bulls	2
	168

III. BUFFALO

Cows	934
Heifers	480
Bulls	4
	1,418

GRAND TOTAL: 2,483

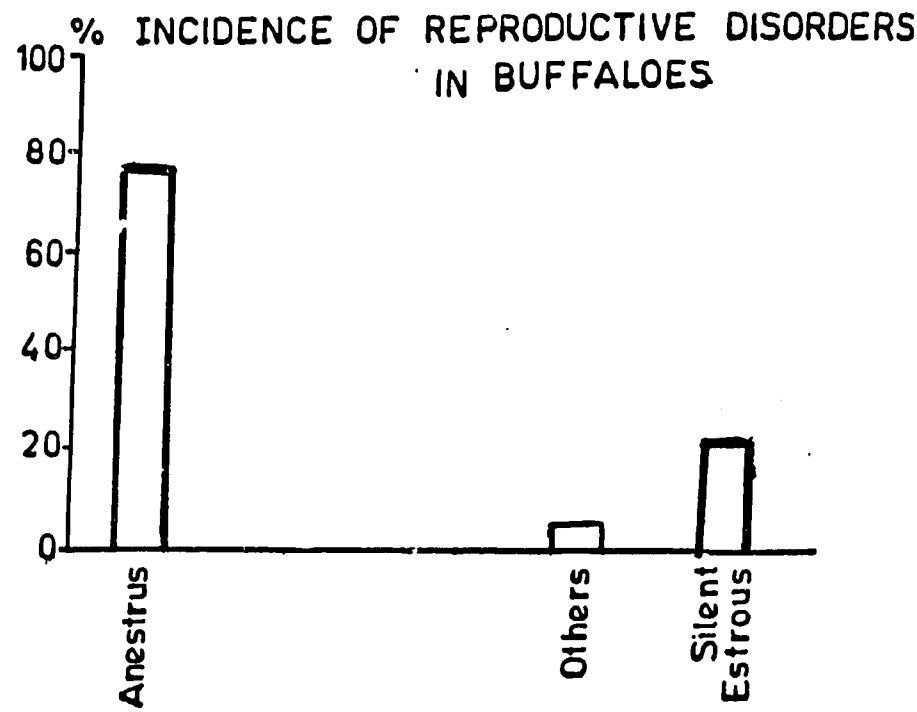


TABLE 5: JHUMPA VILLAGE: RESPONSES TO INFERTILITY TREATMENT IN COWS AND BUFFALOES (VOG)

Reproductive Disorder	Symptoms	Species	No. of Animals	Type of Treatment	Number of Animals Exhibiting Estrus
1. Silent Estrus	Poor Expression of Estrus	Cows	10	PGF 2-alpha 25 mg/IM	8(80%)
		Buffalo	10		2(20%)
2. Anestrus (Heifers and Adults)	No signs of Estrus	Cows	20	-Lugol Iodine painting -FSH 1000-1500 IU/IM	6(30%)
		Buffalo	12		3(25%)
3. Repeat Breeders	Normal Estrus	Cows	10	Recommended good nutrition, A.I. from quality semen or natural mating with a quality bull	
		Buffalo	18		

*These observations were made during the period when a severe drought was prevailing in this area. The farmers had to abandon their animals due to the lack of water, feed, and fodder.

B. WET ZONE

This zone is located in the northern part of the state. It has fertile land, ample annual rainfall (750-1,000 mm), and assured irrigation facilities from canals and tube wells. Two of the four selected villages are located in this zone (Chormastpur and Panjokhra Saheb). See map on page 9.

1. CHORMASTPUR VILLAGE

Location:

This village is located about 10 km from Ambala city and is well connected by roads. It has a population of about 10,000. The land is well irrigated by canals. In addition, some farmers have pump sets for use when there is scarcity of canal water.

Education:

The village has one primary school for children. For higher education, the children go to nearby towns. The majority of the farmers were illiterate (46%) or only educated up to the primary school level. Only a few (16%) had received a high school education. It was reported that only one or two individuals from the whole village had gone on to the college/university level of education. The size of the family was generally large and varied between 5 and 9 members.

Farm Machinery and Land Holdings:

Nearly one-third of the families are landless laborers, another one third had land holdings under 5 acres and the remainder had between 5-25 acres. Most of the farmers (72%) are dependent on bullocks for transportation and routine agricultural operations. Only a few farmers (13%) owned tractors, while many others rented bullocks or tractors when needed.

Mass Media:

Most of the farmers (67%) owned radio sets and many of them owned television sets as well. Surprisingly, the farmers were using them for recreational purposes rather than gathering information on agriculture and livestock production. Very few farmers (12%) had access to daily newspapers and many more (38%) had no access to any of the mass media.

Livestock Management:

The village has quite a large buffalo population (Table 6). Crossbred cows are also quite popular with the farmers who were using frozen semen from exotic bulls. Bullocks (oxen) are extensively used for agricultural operations and transportation. Invariably among all the animals owned by a farmer, there was at least one animal in lactation. Most of the live-

stock management activities such as feeding, milking, cleaning sheds, collection of manure, and detection of estrus, rested with the women-folk. The hard and laborious tasks of chaff-cutting, transport and stocking of large scale feeds and fodder, and agricultural produce were usually handled by the menfolk. Children also play very important role by assisting in the cleaning of sheds, and the watering, and grazing of animals.

In spite of easily available marketing facilities provided by the State of Dairy Cooperative, most of the farmers preferred consuming the milk in their homes. A large number of the low income families, usually from the lower castes, sold their milk to earn some cash income for their day-to-day needs. Quite a few heifers and lactating cows were sold by the farmers for some additional income. High yielding buffaloes are in big demand, and are usually purchased by the middlemen for resale in the metropolitan cities at exorbitant prices.

Veterinary Help:

The village has a Stockman Center and the services of an untrained inseminator. The animals had received vaccinations against Hemorrhagic Septicemia (H.S.), Foot and Mouth Disease (FMD), and Rinderpest. The vaccination for Rinderpest was done sporadically. Only about 20% of the animals had received vaccination against FMD; perhaps this lag was due to the high cost of the vaccine and/or lack of sensitivity among the farmers for the economic losses resulting from diseases.

Breeding of Bulls and Artificial Insemination:

There were 9 buffalo-bulls and 12 dairy-bulls in the village, which were found to be adequate for use in breeding. They were owned collectively by the whole village (panchayat), and roamed freely among the herds. Sexual exhaustion was quite common among these bulls, particularly during the breeding season when a large number of females were presented for service during a short period. This resulted in repeat breeding among both cattle and buffaloes. The bulls were never examined for breeding soundness or screened for venereal diseases.

The AI services were available at the Stockman Center as well as at the Milk Cooperative Center, using fresh or frozen semen respectively. The semen quality was rarely examined prior to the inseminations. Many of the animals in estrus were missed or unnoticed due to human negligence. This, along with poor semen quality and faulty AI techniques, accounted for most of the repeat breeding cases. Heat detection errors were also quite common, especially among buffaloes where silent estrus was a common occurance.

Feeding:

In general, an adequate quantity of green fodder and concentrate mixtures were provided to the lactating animals. The heifers, as well as dry animals, were maintained mostly on dry fodder and grazing. The green fodder was provided to them only when it was available in abundance or could be spared from the lactating animals. The female calves received preferential treatment over the male calves being allowed more suckling time and/or by providing

them additional green fodder and concentrates. The male calves, on the other hand, were used only for milk "let down" and not given sufficient suckling time. This led to high mortality among the male calves due to malnutrition and parasitic infestation.

Incidence of Reproductive Problems:

From the examination of about 150 dairy cows and 300 buffaloe cows during the fertility camps, it was observed that reproductive problems were the major cause of economic losses. This was because of the delayed puberty, prolonged post-partum anestrus (long intercalving interval), repeat breeding and other problems (Tables 6, 8, 12, 13). Anestrus and silent estrus cases were more frequent among the buffaloes than among dairy cows. Some cases of abortion, endometritis, and cervicitis were also observed.

Treatment of Infertility

The responses of the affected animals to various treatment regimens are given in Tables 9 and 10.

TABLE 6: CHORMASTPUR VILLAGE: CATTLE POPULATION AND INCIDENCE OF REPRODUCTIVE DISORDERS IN COWS AND BUFFALOES (APP-VOG)

CATTLE POPULATION (APP)

I. ZEBU

Cows	902
Heifers	311
Bulls	8
TOTAL:	1,221

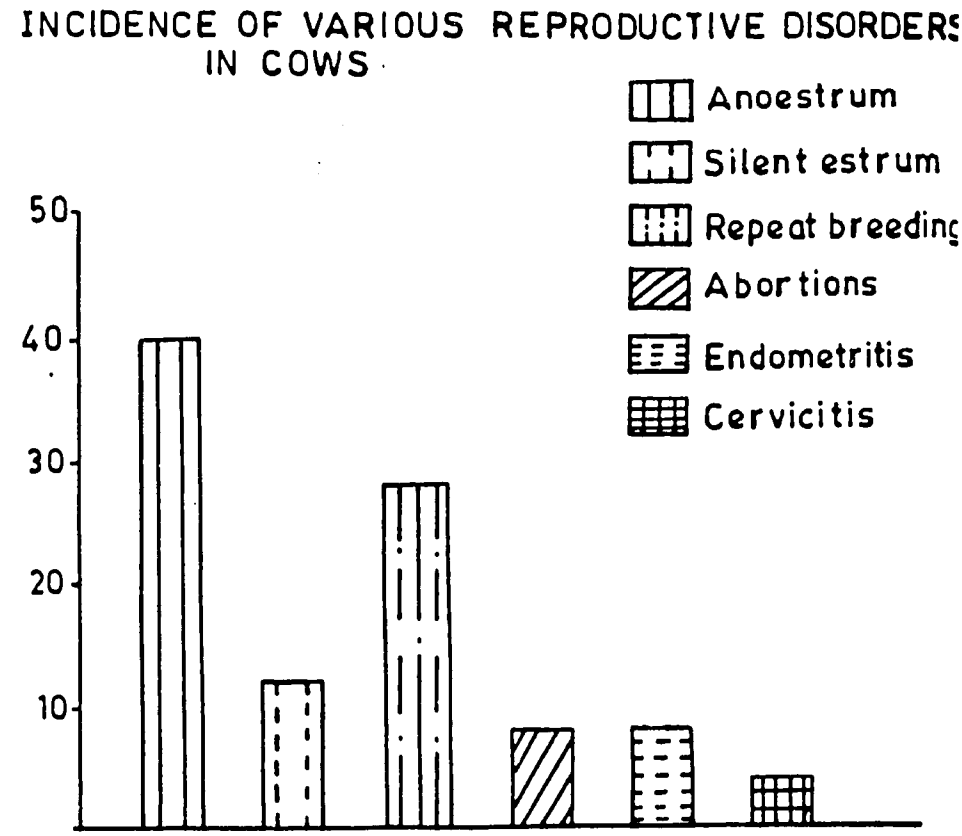
II. CROSSBRED

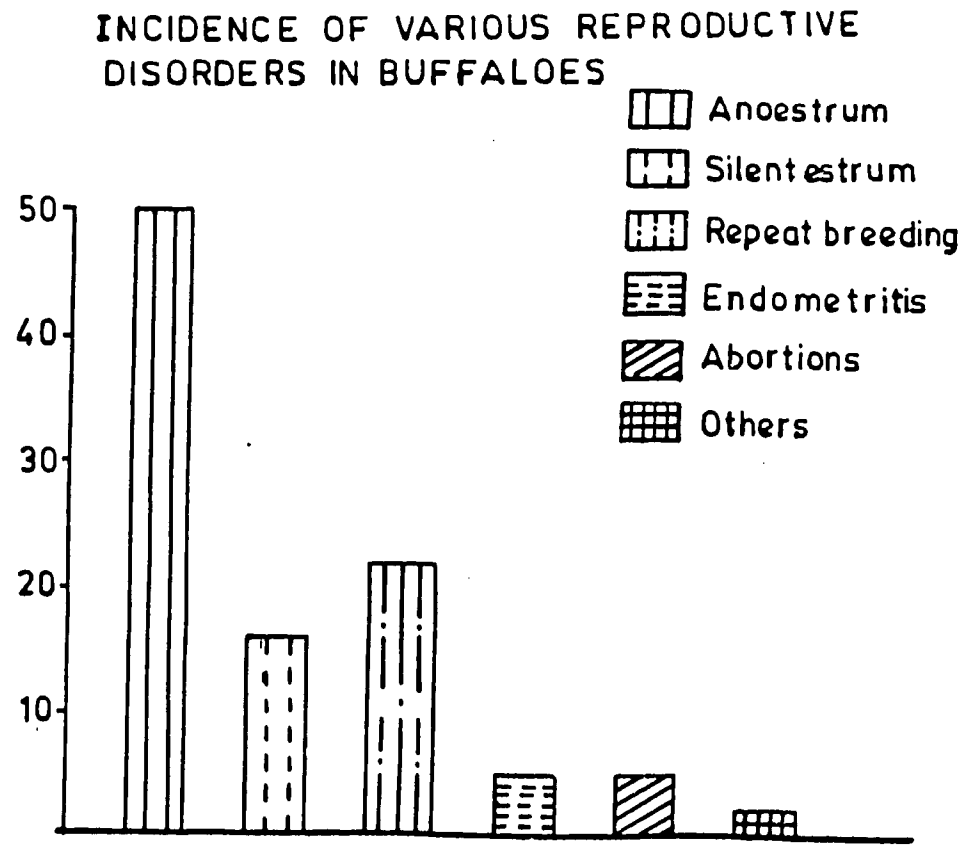
Cows	412
Heifers	180
Bulls	4
TOTAL:	596

III. BUFFALO

Cows	900
Heifers	260
Bulls	9
TOTAL:	1,169

GRAND TOTAL: 2,986





2. PANJOKHRA SAHEB VILLAGE

This is the second selected village in the WET ZONE. It is located about 20 km from the Ambala city. It is well connected by roads. It has a population of about 6,000 and consists of people from different castes and socio-economic background.

Education:

There is one co-educational primary school in the village, whereas the high school is located at a distance of about 10 km. More than 50% of the people are illiterate. Among the educated people, however there were some graduate degree holders.

Family Size and Land Holdings:

Most of the families are extended families varying in size from 5-12 members. There are only a few nuclear families. The number of landless farmers is about 15-20%. Most of the farmers have land holdings of less than 10 acres and very few have 20 or more acres.

Farm Machinery:

About 60% of the small land holders are dependent upon bullocks (oxen) for transportation and various agricultural operations. Only 2% of the farmers own tractors, and the remainder depend upon hired bullocks and/or tractors for their agricultural needs. About 10% of the farmers have pump sets for use during times when canal and rain water is inadequate.

Mass Media:

About 65% of the farmers possessed radios and used them for information and entertainment. About 10% of the people had access to newspapers, and several farmers (about 20%) had no access to any type of mass media. About 16% of the families had television sets and they were mainly being used as a source of entertainment.

Veterinary Help:

This village has a full-fledged Veterinary Hospital, well equipped with facilities for treating routine clinical problems, and also to carry out artificial insemination. In addition, the dairymen at the Milk Cooperative also carry out the AI work.

Animals in this village were being vaccinated regularly against H.S.. However, the vaccination against FMD was limited; only 40% of the cattle, particularly the crossbreds and high milk yielding animals belonging to well-to-do farmers, had received vaccinations. Vaccination against R.P. was done seasonally.

Animal Management:

The survey revealed that buffaloes were predominant with the farmers (Table 7). Most of the cows were nondescript, and only a few crossbreds were noticed. The buffaloes were of Murrah breed. Invariably, every house had at least one buffalo in lactation. Rich farmers also maintained a few bullocks (oxen) for their agricultural operations.

Most of the households produced between 3 and 20 liters of milk each per day. Quite a few of them sold part of the milk to the Milk Cooperative and the remainder was consumed at home. An average of 0.5 liter of milk was available to each and every individual in the family. Every year a large number of heifers and pregnant animals were sold for additional income.

Breeding Bulls:

A total of 13 bulls were available in the village; 5 Murrah buffalo-bulls and 8 dairy-bulls of the indigenous breed. They roamed freely among the village herds and were easily accessible. No one was responsible for their feeding, watering, housing or veterinary care. According to the farmers, their breeding performances were satisfactory. The overuse of these bulls, especially during the breeding season, resulted in a large number of repeat breeders.

Artificial Insemination:

Artificial Insemination services were available at both the Veterinary Hospital and the Cooperative Dairy Center using liquid semen and frozen semen, respectively. The liquid semen was suppplied from the Intensive Cattle Development Project, Jagadhari (about 60 km away) via train. The frozen semen and liquid nitrogen for the Cooperative Dairy AI Center came from the Cooperative Dairy Semen Bank, Rohtak, situated about 120 km from this village.

Feeding:

It was noted that adequate green fodder, dry fodder, and concentrate mixtures were being provided to the lactating animals. The female calves were also being well taken care of, however, the male calves were neglected. The dry animals did not receive enough green fodder and concentrates except during the season when these items were available in abundance. The animals were regularly taken out for grazing and exercise.

Management:

Most of the managemental activities such as feeding, cleaning of animals and sheds, estrus detection, calf raising, milking, etc. were carried out routinely by the womenfolk. The children also helped by taking the animals out for grazing. The menfolk assisted in the harder jobs including stocking the fodder and chaff-cutting. The inability to accurately detect estrus led to repeat breeders, particularly in buffaloes where silent estrus was very common.

Incidence of Reproductive Disorders:

The evaluation of 250 dairy-cows and 600 buffaloes in this village revealed that infertility was the most common cause of economic losses to the farmers. This was mainly due to delayed puberty, an increased inter-calving interval, and a longer dry period. The incidence of various types of infertility problems in cattle and buffaloes in this village is given in Table 7, 8, 12, and 13. It appears that anestrus and silent estrus were more common among buffaloes, whereas, repeat breeding and endometritis were more common among the dairy cows.

Treatment of Infertility:

The responses of the affected animals to various treatment regimens are given in Tables 9 and 10.

TABLE 7: PANJOKHRA SAHEB VILLAGE: CATTLE POPULATION AND INCIDENCE OF REPRODUCTIVE DISORDERS IN COWS AND BUFFALOES
(APP-VOG)

CATTLE POPULATION (APP)

I. ZEBU

Cows	835
Heifers	410
Bulls	3
TOTAL:	1,248

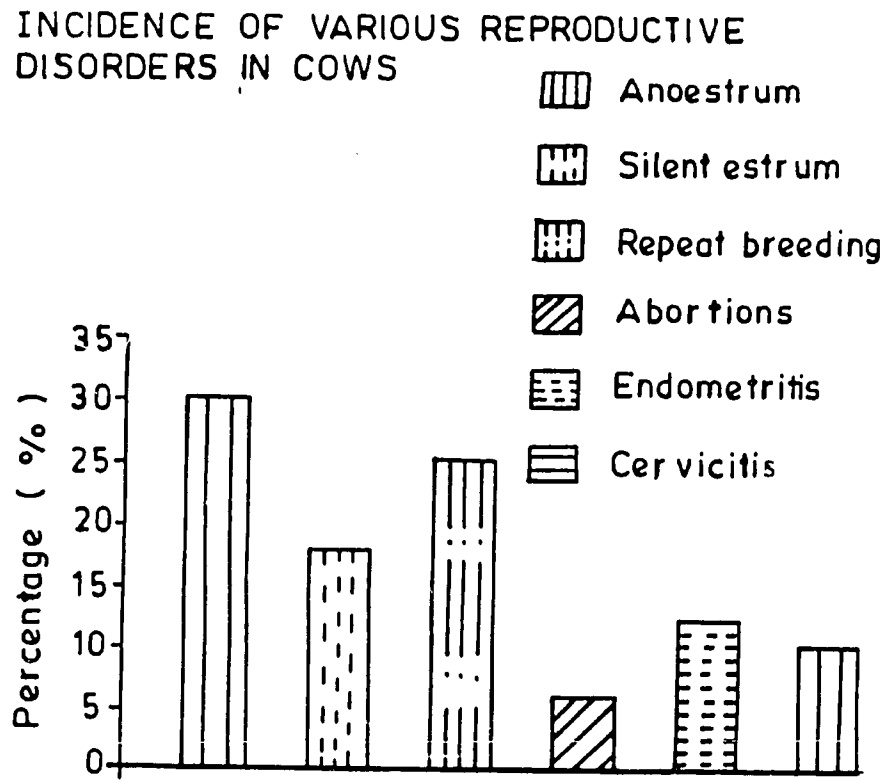
II. CROSS BREDS

Cows	530
Heifers	60
Bulls	2
TOTAL:	592

III. BUFFALO

Cows	1,290
Heifers	520
Bulls	8
TOTAL:	1,818

GRAND TOTAL: 3,658



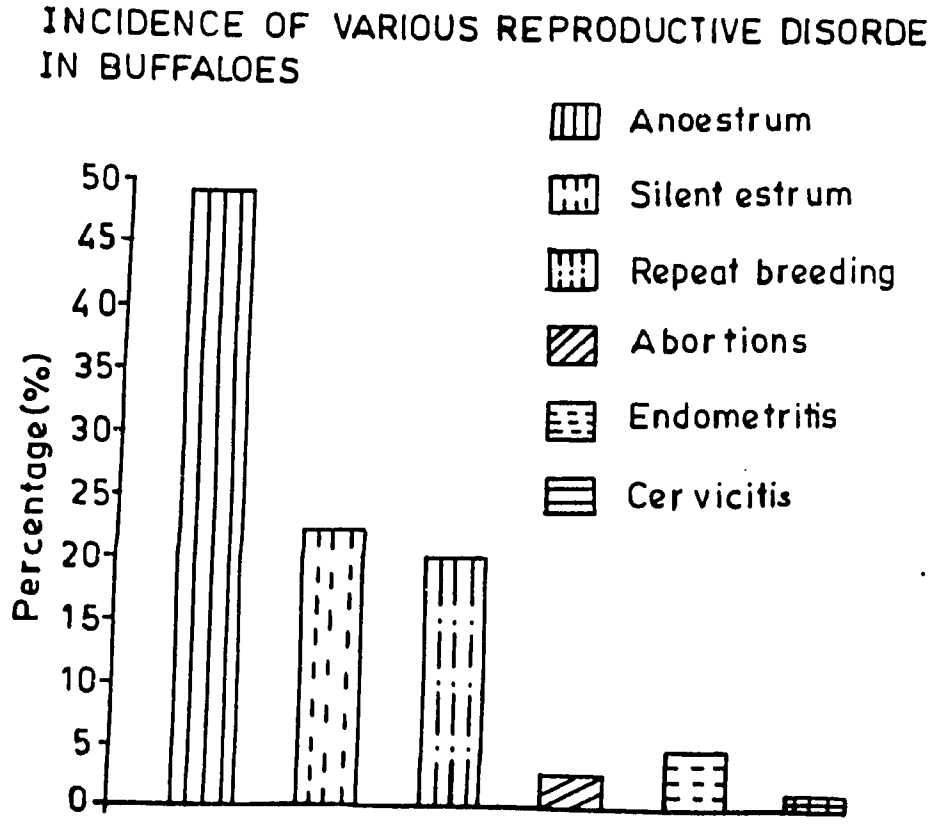


TABLE 8: INCIDENCE (%) OF REPRODUCTIVE DISORDERS IN COWS AND BUFFALOES IN CHORMASTPUR AND PANJOKHRA SAHEB VILLAGES (WET ZONE)
(VOG)

Reproductive Disorders	PANJOKHRA SAHEB		CHORMASTPUR	
	Cows	Buffaloes	Cows	Buffaloes
Anestrus	30	49	40	50
Silent Estrus	18	22	12	16
Repeat Breeders	25	20	28	22
Abortion	6	3	8	5
Endometritis	12	5	8	5
Cervicitis	9	1	4	2

TABLE 9: TREATMENT OF ANESTRUS AND SILENT HEAT CASES IN BUFFALOES AND COWS IN CHORMASTPUR AND PANJOKHRA SAHEB VILLAGES (WET ZONE)
(VOG)

Type of Treatment Given in Anestrus Cases	Species	PANJOKHRA SAHEB			CHORMASTPUR		
		# of Animals Used	In Estrus	Conceptions in Responding Animals	# of Animals	In Estrus	Conceptions in Responding Animals
1-Mineral mixture 50 gm O.D. for 21 days PLUS -Vit. A 6000 IU for 3 alternate days/IM	Buffalo	15	10(77%)	5(50%)	—	———	———
	Cows	—	———	———	—	———	———
2-Lugol Iodine painting on cervix PLUS -Mineral mixture 50 gm O.D. for 21 days	Buffalo	15	12(80%)	6(50%)	10	8(80%)	4(50%)
	Cows	10	7(70%)	4(57%)	—	———	———
3-Estradiol valerate inj. 10 mg/IM	Buffalo	15	15(100%)	3(20%)	10	8(80%)	2(25%)
	Cows	10	8(80%)	2(25%)	10	7(70%)	2(20%)
4-PMSG inj. (Folligon) 1000IU/IM	Buffalo	15	14(93%)	8(57%)	10	6(60%)	4(66%)
	Cows	—	———	———	10	5(50%)	4(80%)
	SILENT HEAT						
PGF.2∝(Lutalyse) 25 mg/IM	Buffalo	15	14(93%)	8(57%)	10	8(80%)	5(62%)
	Cows	10	8(80%)	4(50%)	10	9(90%)	4(45%)

TABLE 10: RESPONSES TO VARIOUS TREATMENT REGIMENS IN COWS AND BUFFALOES IN CHORMASTPUR AND PANJOKHRA SAHEB VILLAGES (WET ZONE)

(VOG)

TYPE OF TREATMENT (in 20-30 ml solution intra-uterine)	SPECIES	PANJOKHRA SAHEB		CHORMASTPUR	
		# of Animals	Conception Rate	# of Animals	Conception Rate
1. Lugol Iodine (1:20)	Buffalo	20	12(60%)	10	6(60%)
	Cows	10	6(60%)	10	5(50%)
2. Gentamycin (1 gm)	Buffalo	20	10(50%)	—	———
	Cows			10	6(60%)
3. Ampicillin (2 gm)	Buffalo	20	11(55%)	—	———
	Cows	—	———	—	———
4. Nitrofurazone (2 gm)	Buffalo	20	12(60%)	—	———
	Cows	10	5(50%)	—	———
5. Streptomycin (2 gm)	Buffalo	—	———	10	5(50%)
	Cows	—	———	10	4(40%)
6. Tetracycline (2 gm)	Buffalo	—	———	10	10(40%)
	Cows	10	4(40%)	—	———

TABLE 11: RESPONSES TO INFERTILITY TREATMENT IN BUFFALOES IN DRY ZONE (APP)
(OCT. 1987-SEPT. 1988)

Type of Treatment	CATAGORY I (53.5%) Smooth and Inactive Ovaries			CATEGORY II (27.3%) Ovaries Bearing Follicles			CATEGORY III (19.2%) Ovaries Bearing Corpus Luteum		
	N	Cows Exhibiting Estrus n (%)	Time Lag (Days)	N	Cows Exhibiting Estrus n (%)	Time Lag (Days)	N	Cows Exhibiting Estrus n (%)	Time Lag (Days)
Utero-Ovarian Message	13	4 (30.8)	28	-	-	-	-	-	-
Painting Cervix with Lugal Iodine	26	11 (42.3)	22	26	15 (57.7)	5	18	6 (33.3)	17
GnRH/IM	13	7 (53.8)	19	-	- -	-	-	- -	-
PGF2 Alpha/IM	-	- -	-	-	- -	-	18	11 (61.1)	4.5
Estradiol/IM	10	5 (50.0)	4	-	- -	-	-	- -	-
PMSG/IM	6	4 (66.7)	5	25	9 (36.0)	19	-	- -	-
Synchromate-B Implant	32	24 (75.0)	1½-4	-	- -	-	-	- -	-

TABLE 12: INCIDENCE OF REPRODUCTIVE PROBLEMS IN ARID AND WET ZONES (APP)

Reproductive Problems	Cattle				Buffaloes				Total
	Heifers		Cows		Heifers		Cows		
	Arid	Wet	Arid	Wet	Arid	Wet	Arid	Wet	
JHUMPA									
Anestrus	12		14		26		56		108
Sub-estrus	-		-		5		10		15
Luteal Cysts	-		-		2		5		7
Repeaters	-		-		-		-		-
TOTAL	12		14		33		71		130
KUNGAR									
Anestrus	11		5		81		35		132
Sub-estrus	-		-		12		22		34
Luteal Cysts	2		4		5		11		22
Repeaters	-		-		-		1		1
TOTAL	13		9		98		69		189
PANJOKHRA									
Anestrus		9		12		23		7	51
Sub-estrus		3		2		7		8	20
Luteal Cysts		-		3		4		10	17
Repeaters		1		4		11		19	35
Endometritis		-		2		3		-	5
TOTAL		13		23		48		44	128
CHORMASTPUR									
Anestrus		5		13		20		64	102
Sub-estrus		-		-		1		4	5
Luteal Cysts		-		-		5		8	13
Repeaters		5		12		16		22	55
Endometritis		-		-		-		1	1
TOTAL		10		25		42		99	176
GRAND TOTAL	25	23	23	48	131	90	140	143	623

TABLE 13: OVERALL INCIDENCE (%) OF DIFFERENT REPRODUCTIVE PROBLEMS IN CATTLE AND BUFFALOES IN BOTH SUB-HUMID AND ARID ZONES (APP)

Reproductive Problem	Arid Zone (DRY)	Sub-humid Zone (WET)	Combined
		A. CATTLE	
Anestrus	87.50	54.93	68.70
Sub-estrus	0.00	7.04	4.20
Luteal Cysts	12.50	4.22	7.56
Repeaters	0.00	32.39	19.33
Endometritis	0.00	2.89	1.68
		B. BUFFALOES	
Anestrus	73.06	48.93	61.90
Sub-estrus	18.08	8.58	14.09
Luteal Cysts	8.49	11.59	9.92
Repeaters	0.37	29.18	13.69
Endometritis	0.00	1.72	0.79

X. VARIOUS THERAPIES USED FOR THE TREATMENT OF REPRODUCTIVE PROBLEMS IN COWS AND BUFFALOES

TABLE 14: VARIOUS THERAPIES USED FOR THE TREATMENT OF REPRODUCTIVE DISORDERS IN COWS AND BUFFALOES. (VOG)

A. NON-CLINICAL CASES

1. UTERO-OVARIAN MASSAGE
   Rectal message of ovaries and uterine horns at 15-day intervals.

2. LUGOL'S IODINE PAINT
   Painted 5% lugol solution on the cervix. The solution included Iodine 5 gms, Pot. Iodide 10 gms, and water to 100 ml.

3. LUGOL'S IODINE SOLUTION
   20-30 ml (1:20 solution) Intra-uterine.

4. GONADOTROPIN RELEASING HORMONE (GnRH)
   2 ml aqueous solution containing 50 mg of gonadorelin diacetate tetrahydrate per ml/IM.

5. ESTRADIOL VALERATE (CYPTOMATE)
   10 mg/IM, Single injection

6. PREGNANT MARE SERUM GONADOTROPIN (PMSG, FOLLIGON)
   1,000 I.U./IM, single injection.

7. SYNCHROMATE-B (Ceva labs, Inc.)
   Ear implants containing 6 mg of norgestomet and each injectable solution of 2.0 ml containing 3 mg norgestomet and 5 mg of estradiol valerate.

8. PROSTAGLANDIN (PGF2 alpha, Lutalyse, Dinoprost Tronethamine, Upjohn Ltd.)
   25 mg/IM

9. MINERAL MIXTURE
   20 to 50 grams/day for 1 month starting the day of first rectal palpation. The composition of mineral mixture is given in Appendix C.

10. FOLLICULAR STIMULATING HORMONE (FSH-P)
    1,000 to 1,500 I.U./IM

B. CLINICAL CASES

1. MINERAL MIXTURE
   50 grams for 21 days

2. VITAMIN A
   6,000 I.U./IM; 3 times on alternate days.

3. GENTAMYCIN
   1 Gram in 20-30 ml solution, Intra-uterine.

4-7. AMPICILLIN OR NITROFURAZONE OR STREPTOMYCIN OR TETRACYCLINE
   2 Grams in 20-30 ml solution, Intra-uterine.

XI. LAB INVESTIGATION OF VARIOUS REPRODUCTIVE DISORDERS AND FOLLOW-UP TREATMENTS

1. Anestrus Cows and Buffaloes: Hematological studies were carried out in 35 anestrus and 10 normal cycling buffaloes. Blood samples were collected from the jugular veins and were subjected to estimation for Packed Cell Volume (PCV), Hemoglobin (Hb), and Differential Leucocytic Counts using standard techniques.

   The PCV and Hb levels averaged about 32% and 9.5 gm% respectively in the anestrus buffaloes as compared to 35% and 11.0 gm% respectively in cycling buffaloes. The trend for the differences was clear but not statistically significant. Also no significant differences in the differential leucocytic counts between the anestrus and cycling groups of buffaloes were detected. However, a slight neutrophilia was noticed in the anestrus animals.

2. Repeat Breeding Cows and Buffaloes: Several microbiological examinations including in-vitro antibiotic sensitivity tests were performed. Animals not conceiving after 3 or more natural matings or AI services were considered as repeat breeders. The vaginal discharge from some of the animals was thick and cloudy in appearance.

   A total of 60 samples of uterine discharge were collected with Nielsen Catheters for bacteriological investigations. These samples were inoculated on Blood Agar and McConkey Agar for primary isolations. The inoculated plates were incubated at 37°C for 24-48 hours and the colonies were observed for growth characteristics. Smears were prepared from each colony for Gram's staining. These tests reflected infections in 55 out of 60 samples, and the following organisms were isolated and identified:

-Streptococcus aureus
-Streptococcus S.P.(H) and S.P.(N.H.)
-Staphalococcus epidermis
-E. Coli
-Enterobacters sp.

Details on these isolates along with antibiotic sensitivity tests are given in Table 15.

TREATMENT

A. BUFFALOES

A variety of therapies were used for treating reproductive disorders (Table 14). A total of 115 anestrus buffaloes (75 in Panjokhra and 40 in Chormastpur) and 110 repeat breeder buffaloes (80 in Panjokhra and 30 in Chormastpur) were treated. The responses/successes to various treatment regimens are presented in Tables 9 and 10.

Anestrus: Comparative effectiveness of various medications are given in Table 9.

1. Estradiol valerate injections were 100% successful in bringing about the estrus signs but the subsequent conception rates were the poorest. These results confirm the fact that the estrus induced by the use of estradiol is not always followed by ovulation.
2. Pregnant Mare Serum (PMSG) was quite effective for treating anestrus cases; the induced estrus were followed by a high conception rate.
3. Supplementation of feed with Vitamin A injection and mineral mixture (Appendix C) or painting of cervix with Lugol's Iodine provided quite effective and less expensive treatment for anestrus.
4. Prostaglandin (PGF 2 alpha) appeared to be a drug of choice for the treatment of silent estrus.

Repeat Breeding: The repeat breeding buffaloes received mostly intra-uterine treatments with Lugol's Iodine, Gentamycin, Ampicillin, and

Nitrofurazone. The responses and effectiveness of these treatments are given in Table 10.

1. Intra-uterine use of Lugol's Iodine was quite effective in repeat breeding (60% conception rate). Expense-wise, it was the cheapest of all the treatments given.
2. Nitrofurazone was equally effective in terms of conception results.
3. Gentamycin and Ampicillin also gave good results while Tetracycline was the least effective.

Various observations made with repeat breeders suggest that even a mild endometritis lowered fertility. Possible sources of infections could be the use of contaminated instruments used for vaginal examination and/or artificial insemination. Infection could also spread from the infected bulls used for natural matings. The village bulls had never been tested for breeding soundness and venereal diseases. Overuse of the bulls for natural matings and the use of poor quality/infected semen for AI were equally to blame for a high incidence of repeat breeding.

B. COWS

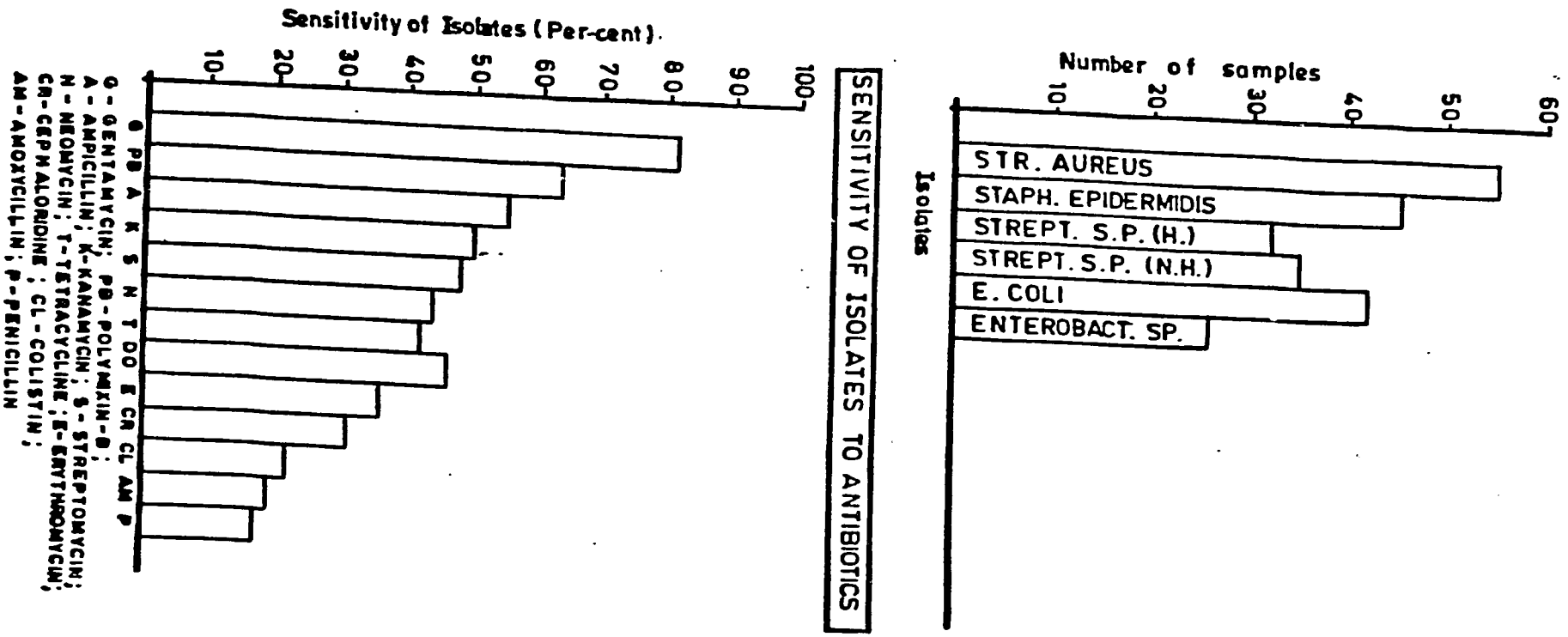
All the affected cows (like the buffaloes) received a variety of therapeutic treatments for the correction of their reproductive problems. The drugs and procedures used in cows were quite similar to that used in buffaloes (Table 14).

A total of 60 anestrous cows (30 cows each from Panjokhra Saheb and Chormastpur) and 60 repeat breeder cows (30 cows from each of the two villages) were included in this study. Comparative effectiveness of the therapies used is given in Table 9.

1. Lugol Iodine painting of the cervix was quite effective for anestrus cows.

2. Prostaglandin (PFG 2 alpha) Treatment: About 80% of the treated animals exhibited estrus following the treatment, and subsequently 50% of them conceived. This was very efffective in animals exhibiting silent heat.
3. The use of PMSG was also helpful in improving conception rates in anestrus cases.
4. Estradiol valerate was not effective for treating fertility problems.
5. For repeat breeders, particularly those with intra-uterine infections, the positive responses in terms of conception rate to the use of Lugol's Iodine solution, Gentamycin, Streptomycin, and Tetracycline varied between 40-60%.

TABLE 15: INCIDENCE OF BACTERIAL ISOLATES IN UTERINE SAMPLES OF REPEAT BREEDING BUFFALOES AND SENSITIVITY OF ISOLATES TO ANTIBIOTICS
(VOG)



XII. PROGESTERONE, PROTEINS, AND MACRO-AND MICROMINERALS IN PLASMA

Plasma samples collected from the animals of three affected/problem categories (Category I: animals with smooth and inactive ovaries; Category II: animals with palpable ovarian follicles; Category III: animals with corpus luteum) were analyzed for progesterone , proteins, and various micro-and macrominerals (Tables 16 and 17). Various macro-and microminerals are essential ingredients for various physiological functions in animals. Their concentration in plant products used for cattle feed are related both to soil concentrations and agronomic areas of production. Cattle and buffaloes consuming feed stuff from deficient areas are likely to be deficient unless additional nutrients are provided by feed supplement or injection. The following conclusions were drawn:

IRON (Fe) : Iron levels were significantly lower in animals from the WET region as compared to the DRY region animals who were found to be within normal range. Iron levels were consistently higher in Category II animals, but the differences were not statiscally significant. Iron content has been reported to be higher in fertile cows as compared to infertile cows, and it is also known to stimulate FSH production.

ZINC (Zn) : Zinc levels were relatively lower in animals from both of the regions. No significant differences were detected among the three problem categories of cows. However, Category II animals had consistently higher levels than the other two categories. Lower zinc values have been reported in anestrus heifers. A zinc plus Vitamin A combination has been reported to improve productivity. Zinc is needed to convert beta-carotene to Vitamin A. Zinc status of Haryana soils is given in Appendix E.

Copper (Cu) : Copper levels were within the normal range in the affected animals from both regions. No significant differences were found between the three categories of problem animals. It has been reported that adults are clinically unaffected unless deficiency is severe and prolonged. Evidence is conflicting as to whether copper deficiency affects fertility, however, young calves are known to exhibit depression in growth rate due to copper deficiency.

MANGANESE (Mn): In all of the samples collected from the dry zone, the manganese levels were below the detectable range of the Atomic

Absorption Spectrophotometer, indicating a manganese deficiency in the Dry Zone animals.

SELENIUM (SE) : No significant differences in selenium levels were observed in any of the problem categories of animals. Overall, values were generally low. The role of selenium in animal reproduction has been well documented. Its deficiency is known to cause retention of placenta, growth depression, anestrus, and silent heat. Some cases of abortions, stillbirths, metritis, cystic ovaries, mastitis, and skeletal myopathies in cows are also known to be associated with selenium deficiency. Selenium along with Vitamin E has been used frequently for reproductive problems in cows. Interestingly, the absorption of dietary selenium is affected by other nutrients including calcium, phosphorus, sulfur, copper, iron, and arsenic.

CALCIUM (Ca) : Category I animals (with smooth and inactive ovaries; anestrus) had significantly higher circulating calcium levels as compared to animals from the other two categories of animals. These findings are in line with the reports that a higher calcium level in blood causes/induces anestrus conditions in cows.

PHOSPHORUS (P): Phosphorus content was significantly lower than normal in all three categories of the affected animals, particularly in animals belonging to Category I (with smooth and inactive ovaries; anestrus). The soil in the Wet Zone is already well known to be phosphorus deficient and most of the feed and forages are low in phosphorus. Evidently, a low phosphorus level in these animals is keeping the ovaries in the state of anestrus. Its deficiency is known to cause decrease in growth rate and milk production; delay in sexual maturity in heifers, and delay in the occurance of post-partum estrus.

There is a delicate balance between the calcium and phosphorus levels. Any significant deviation in the ratio is likely to induce reproductive problems, and this phenomenon is well established in cattle and buffaloes. In Category I animals, the Ca:P ratio was higher (4:1) than would be normally expected (2:1).

TOTAL PLASMA PROTEINS:

The Category I (anestrus) animals had comparatively lower concentrations of circulatory proteins as compared to animals from the other two categories. This indicated that low protein concentration in plasma may have led to anestrus conditions in cows and buffaloes. This blood parameter, in fact, reflects the nutritional status of animals. Its low concentration has been reported to cause low conception rates, delayed estrous cycles, and poor expression of estrus symptoms including silend heat in buffaloes.

PROGESTERONE:

Progesterone level in the blood is an excellent indicator of ovarian cyclicity since it is directly related to the activities of the corpus luteum. A lower concentration of progesterone in Category I animals reflected a completely inactive (acylic) condition of the ovaries. This was confirmation for earlier per-rectal observations. The animals from the Wet Zone, in general, had a low progesterone level. This may be a reflection of phosphorus deficiency (discussed above) commonly associated with animals in this area.

TABLE 16: PROGESTERONE AND VARIOUS MICROMINERALS IN THE PLASMA OF BUFFALOES HAVING DIFFERENT REPRODUCTIVE PROBLEMS FROM THE WET AND DRY ZONES-STUDY I (APP)

BLOOD COMPONENTS	CATEGORY I SMOOTH OVARIES		CATEGORY II OVARIES WITH FOLLICLES		CATEGORY III OVARIES WITH CORPUS LUTEUM	
	Wet (n=18)	Arid (n=32)	Wet (n=14)	Arid (n=12)	Wet (n=11)	Arid (n=12)
Progesterone (ng/dl)	0.11 ± 0.01	0.33 ± 0.04	0.14 ± 0.01	0.32 ± 0.08	0.38 ± 0.01	0.86 ± 0.11
Iron (mg/L)	9.38 ± 1.39	13.75 ± 1.83	10.45 ± 1.31	19.00 ± 2.45	8.00 ± 1.11	13.13 ± 1.28
Zinc mg/L	0.40 ± 0.04	0.36 ± 0.05	0.31 ± 0.04	0.57 ± 0.08	0.31 ± 0.05	0.52 ± 0.07
Copper mg/L	0.85 ± 0.06	0.86 ± 0.01	0.85 ± 0.08	1.80 ± 0.59	0.86 ± 0.10	1.18 ± 0.15
Phosphorus (mg/dl)	13.10 ± 0.52	12.50 ± 0.51	12.80 ± 0.41	12.52 ± 0.78	12.14 ± 0.51	13.30 ± 0.47
Calcium (mg/dl)	3.76 ± 0.75	1.02 ± 0.13	1.95 ± 0.47	3.58 ± 0.55	2.42 ± 0.55	5.25 ± 0.70
Ca:P	3.5	12.2	6.6	3.5	5.3	2.5

TABLE 17: PROGESTERONE AND VARIOUS MIRCOMINERALS IN THE PLASMA OF BUFFALOES HAVING DIFFERENT REPRODUCTIVE PROBLEMS FROM THE DRY ZONE-STUDY II (APP)

BLOOD COMPONENT	CATEGORY I SMOOTH OVARIES (n=52)	CATEGORY II OVARIES WITH FOLLICLES (n=22)	CATEGORY III OVARIES WITH CORPUS LUTEUM (n=36)
Progesterone (ng/dl)	0.29 ± 0.03	0.49 ± 0.06	1.62 ± 0.15
Glucose (mg/dl)	60.50 ± 6.04	72.30 ± 7.28	72.80 ± 6.88
Protein (g/dl)	7.09 ± 0.25	8.05 ± 0.35	7.91 ± 0.24
Copper (mc/dl)	103.40 ± 4.20	108.30 ± 0.20	102.40 ± 5.80
Zinc (ug/dl)	94.50 ± 17.22	102.50 ± 19.17	95.50 ± 17.19
Iron (ug/dl)	621.42 ± 30.34	637.66 ± 40.66	622.93 ± 43.86
Selenium (ug/dl)	29.89 ± 3.28	26.92 ± 2.92	28.37 ± 2.62
Calcium (mg/dl)	13.87 ± 1.77	11.90 ± 1.36	11.86 ± 1.03
Phosphorus (mg/dl)	3.05 ± 0.22	3.89 ± 0.37	3.95 ± 0.39
Ca:P ratio	4.54	3.05	3.01

XIII: USE OF SYNCHROMATE-B FOR THE CORRECTION OF REPRODUCTIVE PROBLEMS IN COWS AND BUFFALOES

The Synchromate-B is known to elicit cyclicity in non-cycling suckled cows and non-cycling pubertal heifers in the USA. It was used in this project to test its potential for correcting anestrus conditions and inducing cyclicity in pubertal heifers in cattle and buffaloes.

The Synchromate-B treatment consists of two parts: a plastic ear implant which contains norgestomet (synthetic progestin); and an injectable solution of norgestomet plus estradiol valerate (synthetic estrogen). In general, this substance inhibits FSH and LH activities, ovulation, and CL development. It could work at any time during the cycle.

A series of trials were conducted and brief results are reported here (Table 18 to 21). Some trials are still continuing at the Buffalo Research Center (BRC), Hisar.

TRIAL I: USE OF SYNCHROMATE-B IN POST-PARTUM ANESTRUS BUFFALO-COWS FROM THE ARID ZONE VILLAGES (APP; October 1989-September 1988).

Thirty-two (32) anestrus buffalo-cows were implanted with Synchromate-B. Twenty-four of them (75%) exhibited moderate to strong estrus symptoms within 36 to 96 hours after the removal of the implants. Subsequently, about 70% of them conceived following AI or natural matings.

TRIAL II: POST-PARTUM ANESTRUS BUFFALO-COWS AND HEIFERS (APP-BRC; April 1987 and Jan.-Feb., 1988).

Eighteen (18) animals (88-212 days post-partum) were implanted with Synchromate-B during the off-breeding season, and five animals (90 days post-partum) during the breeding season. About 39% of the buffalo-cows responded to the treatment with estrus signs, and a subsequent 22% conception rate when treated during the off-season, whereas, all of the animals (100%) responded with estrus signs and more than 75% conceived when the treatment was given during the breeding season (Table 18).

TRIAL III: ANESTRUS BUFFALO HEIFERS (APP-BRC; April 1987)

Twenty-one (21) anestrus heifers (age 2.5-3.0 yrs; mean body of weight 260 kg) were implanted with Synchromate-B during the off-breeding season. None of the animals exhibited estrus signs after the removal of the implants (Table 19).

TRIAL IV: ANESTRUS BUFFALO HEIFERS (APP-BRC; Nov.-Dec. 1987)

Fourteen (14) anestrus heifers (age 2.5-3.0 yrs; mean body weight 296 kg), which had been receiving a supplement of 1.5 kg of concentrate diet and 40 g of mineral mixture every day for about one month prior to the start of the experiment, received Synchromate-B implants during the breeding season. In addition, these animals received 1,000 IU of PMSG (Folligon) at the time of implant removal and 1,500 IU of HCG (Chorulon) at the time of the second insemination 72 hours later.

About 86% of the treated heifers exhibited estrus signs and, subsequently, 57% of them conceived. Only 14% of the anestrus heifers did not respond to the treatment (Table 19).

It was concluded from Trials II, III and IV that:

1. The anestrus buffalo-cows responded to Synchromate-B treatment with moderate success when given during the off-season, whereas, it was even more effective when given during the breeding season.

2. The Synchromate-B treatment given during the off-season was completely ineffective in anestrus animals of age 2.5-3.0 yrs. with mean body weight of 260 kg. This indicates that the ovaries in these animals have not attained the physiological maturation to respond to hormonal induction.

3. The anestrus heifers of the same age group as above (2.5-3.0 yrs.), but with higher body weights (around 300 kg), who had been receiving supplemental ration and a mineral mixture, responded very effectively to the Synchromate-B induction when it was given during the breeding season.

TRIAL V: ANESTRUS HEIFERS (APP-BRC; June-July 1989)

Three (3) groups consisting of 7 anestrus heifers each (age 2.5-3.0 yrs.; mean body weight 306 kg) who had been receiving a higher plan of nutrition for one month prior to the start of treatment were used in this trial. Group B animals received the usual Synchromate-B treatment plus 600 IU of PMSG (Folligon) at the time of implant removal. Group C animals received Synchromate-B treatment alone. Whereas, Group A animals received neither and served as control (Table 20).

It was observed that:

1. None of the animals in Group A (control) exhibited estrus signs. This indicates that attaining a higher body weight alone is not enough to bring about cyclicity in heifers during the off-breeding season.

2. Animals in Group B responded to the treatment much better than animals in Group C indicating that the administration of PMSG as an adjunct to Synchromate-B was more effective in inducing estrus and subsequent conceptions as compared to Synchromate-B alone.

These are very encouraging results as far as treating anestrus heifers during the off-breeding season is concerned. The results were even better than the previous trial conducted with anestrus heifers during the peak breeding season (Trial IV). To test this further, a new batch of 9 anestrus heifers were given a treatment similar to the Group B above during the breeding season in 1989. The pregnancy results were not available at the time of this writing.

TRIAL VI: POST-PARTUM DAIRY COWS-(VOG and Government Livestock Farm Sector, II, Hisar).

Thirty (30) dairy cows having post-partum intervals of 3 to 12 months and having non-cycling smooth ovaries, were treated with Synchromate-B implants in this trial (Table 21). Within 48-72 hours of the removal of implants, 14 animals (48%) exhibited estrus signs and 8 of them subsequently conceived to AI with frozen semen during the first two post-treatment estruses. With the exception of 3 animals, which did not respond to Synchromate-B treatment, the remaining 19 treated animals resumed normal ovarian activities within the succeeding 2-3 estrus cycles and subsequently conceived. It indicates that the Synchromate-B is a very effective tool for inducing ovarian cyclicity and subsequent fertility in anestrus dairy cows.

SUMMARY

Several trials were made (or still in progress) to study the effectiveness of Synchromate-B in eliciting ovarian cycling and correcting reproductive disorders in buffaloes, dairy cows, and puberta, heifers. The following conclusions were drawn:

A. POST-PARTUM COWS AND BUFFALOES:

1. About 40-50% of the anestrus buffalo-cows responded to Synchromate-B treatment during the OFF-BREEDING season with moderate to strong estrus signs, and with subsequent fertility of about 25%. However, the picture was more encouraging when the treatment was given during the breeding season.

2. Synchromate-B treatment was also very effective for inducing ovarian cyclicity and subsequent fertility in anestrus dairy cows.

B. BUFFALO HEIFERS:

1. Pubertal heifers were non-responsive to the Synchromate-B treatment when given at the age of 2.5-3.0 yrs. and a body weight of about 260 kg during the off-breeding season. However, they responded much better when provided with supplemental ration and minerals for about one month (attaining a body weight of around 300 kg) prior to treatment with Synchromate-B. It was further noticed that injecting them with PMSG (approx 600 IU) at the time of implant removal was much more beneficial as reflected by the number of animals exhibiting estrus signs and the subsequent conceptions.

2. As compared to the off-breeding season trials, the treatment of pubertal heifers weighing around 300 kg during the breeding season was very beneficial.

TABLE 18: SYNCHROMATE-B TREATMENT OF POST-PARTUM ANESTRUS BUFFALOES DURING THE BREEDING AND OFF-BREEDING SEASONS (TRIAL II) (APP-BRC)

	Treatment During Off-breeding Season (April 1987)	Treatment During Breeding Season (Jan.-Feb. 1988)
NO. OF ANIMALS	18	5
DAYS OPEN	68 - 212	90
SETTLED TO AI FOLLOWING TREATMENT	1 (5.6%)	3 (60.0%)*
RETURNED TO ESTRUS IN 28 d	6 (33.3%)	2 (40.0%)
RETURNED TO ESTRUS IN 48 d	9 (50.0%)	None
SETTLED DURING POST-TREATMENT ESTRUSES		
1st	3 (16.7%)	@
2nd or Beyond	None	@
TOTAL CONCEIVED	4 (22.2%)	Hopefully more than three (3)
RESPONDERS TO TREATMENT	7 (38.9%)	5 (100.0%)
NON-RESPONDERS TO TREATMENTS	11 (61.1%)	None

* Based on 60 day non-return.

@ Pregnancy results not yet available.

TABLE 19: SYNCHROMATE-B TREATMENT OF ANESTRUS BUFFALO HEIFERS DURING THE BREEDING AND OFF-BREEDING SEASONS (TRIALS III AND IV)
(APP-BRC)

	Treated During Off-Breeding Season (APRIL 1987)	Treated During Breeding Season (Nov.-Dec. 1987)
NO. OF ANIMALS	21	14
AGE AT TREATMENT	2.5 - 3 Yr.	2.5 - 3 Yr.
BODY WT. AT TREATMENT	250 -310 Kg (Mean 260 Kg)	240 - 355 Kg (Mean 296 Kg)
ADDITIONAL TREATMENT	None	Provided 1.5 Kg of concentrates and 40 g mineral mix/day/animal for 1 month before treatment. Folligon (PMSG) 1000 IU/IM at implant removal, and Chorulon (HCG) 1500 IU/IV at 2nd AI.
SETTLED TO AI FOLLOWING TREATMENT	None	3 (21.4%)
RETURNED TO ESTRUS IN 28 d	None	2 (14.3%)
RETURNED TO ESTRUS IN 48 d		7 (58.3%)
SETTLED DURING POST-TREATMENT ESTRUSES		
1st	None	5 (35.7%)
2nd OR Beyond	None	None
TOTAL CONCEIVED	None	8 (57.1%)
RESPONDERS TO TREATMENT	None	12 (86.0%)
NON-RESPONDERS TO TREATMENT	21 (100%)	2 (14.0%)

TABLE 20: SYNCHROMATE-B TREATMENT OF ANESTRUS BUFFALO HEIFERS DURING THE OFF BREEDING-SEASON (JUNE-JULY 1988) (TRIAL V)
(APP-BRC)

	GROUP A (CONTROL)	GROUP B*	GROUP C
NO. OF ANIMALS	7	7	7
AGE AT TREATMENT	2.5 TO 3 Yrs.		
BODY WT. AT TREATMENT	260 TO 405 kG (Mean 306 Kg)		
PRE-TREATMENT MANAGEMENT	Seasonal green fodder and wheat straw ad lib; 1.5 Kg concentrates and 40 g mineral mix per animal for 1 month prior to treatment.		
TREATMENT GIVEN	None	Synchromate B, AI at 48 & 72 hrs post-treatment, Folligon (PMSG) 600 IU/IM at implant removal	Synchromate B, AI at 48 & 72 hrs post-treatment
SETTLED TO AI FOLLOWING TREATMENT	None	3 (42.8%)	None
RETURNED TO ESTRUS IN 28 d	None	2 (28.6%)	None
RETURNED TO ESTRUS IN 48 d	None	None	2 (28.6%)
SETTLED DURING POST-TREATMENT ESTRUSES			
1st	None	1 (14.3%)	2 (28.6%)
2nd OR Beyond	None	1 (14.3%)	None
TOTAL CONCEIVED	None	5 (71.4%)	2 (28.6%)
RESPONDERS TO TREATMENT	None	4 (57.1%)	2 (28.6%)
NON-RESPONSERS TO TREATMENT	7 (100%)	3 (42.9%)	5 (71.4%)

* Another 9 heifers were given a simliar treatment in March 1989 and the pregnancy results are awaited.

TABLE 21: SYNCHROMATE-B TREATMENT OF POST=PARTUM ANESTRUS COWS (TRIAL VI)
(VOG-GLF)

NO. OF ANIMALS USED	30
AGE OF TREATMENT	3-14 years; parity 1-11.
DAYS OPEN	80-360 days
TREATMENT GIVEN	Synchromate-B ear implant as per manufacturers recommendation
NO. OF ANIMAL IN ESTRUS 48-72 HRS. POST-TREATMENT	14 (47%) These animals expressed weak to intense heats and were artifically inseminated with frozen semen.
NO. OF ANIMAL SETTLED DURING THE FIRST POST-TREATMENT ESTRUS AND SUBSEQUENT ESTRUS	9 (64%) Based on 14 animals inseminated
REMAINING ANIMALS WHICH RESUMED CYCLICITY	18 (86% or 21 remaining non-pregnant cows inseminated; Pregnancy results are awaited).
NON-RESPONDERS	3 (10%; Subsequently culled)
TOTAL RESPONDERS TO	27 (90%) Most of these animals eventually became pregnant during a short period following the treatment. Actual figures are awaited.
RECOMMENDATION	SYNCHROMATE IS A VERY EFFECTIVE DRUG FOR INITIATING OVARIAN CYCLICITY IN POST-PARTUM ANESTRUS COWS. IT SHOULD BE RECOMMENDED FOR FIELD APPLICATION FOR SHORTENING INTER-CALVING INTERVAL. Department of Veterinary Gynecology, HAU

XIV. USE OF COMMERCIAL MILK PROGESTERONE TEST KITS FOR EARLY PREGNANCY DIAGNOSIS

Milk progesterone assays can provide information on ovarian activities and make it possible to monitor the reproductive status of the lactating cows. The procedures for performing milk progesterone tests are specific for each test; however, the principles of testing are very similar. Evaluation of the qualitative results is based on either a color or agglutination reaction and comparison to the known standards. Various uses of progesterone testing in a reproductive management program are:

1. assisting in early pregnancy diagnosis,
2. evaluating response to endocrine or other treatment therapy,
3. predicting time of estrus,
4. differentiating types of ovarian cysts, and
5. identifying errors in detection of estrus.

The progesterone test provides quick results and it can be used by the farmers themselves. In general, these kits are designed to determine the relative progesterone concentration (low or high) rather than quantitative.

Early pregnancy diagnosis in buffalo and dairy cows in India can play a vital role in increasing productive and reproductive efficiencies by reducing inter-calving intervals, timely treatment of reproductive disorders, and by reducing errors in the detection of estrus (which are the most common problems in buffalo cows). The following 3 commercially available test kits were utilized in the lactating Murrah buffaloes.

1. Calfcheck (Noctech Ltd., Dublin, Ireland)
2. EstruCHEK (Synbiotics Corp., San Diego, CA, USA)
3. Open Alert (Quidel Inc. LaJolla, CA, USA)

The results obtained from the use of these kits on 69 post-partum buffaloes are given in Table 22. At least six more types of commercial

test kits are available in the market which were not tested. A comparative evaluation of all the commercially available kits on dairy cows in the USA has been reported recently (a,b).

Our results show that all of the three kits are quite effective in early pregnancy diagnosis on days 19 and 23 post-breeding. The results from the Open Alert Kit included two false positives, whereas, the other two kits included some doubtful cases. Overall, the relative efficiency of the three kits was 75-82% for the detection of non-pregnancies and 88-100% for pregnancies. This pilot study indicates that rapid milk progesterone test kits can be used routinely as a diagnostic tool for the early detection of pregnancy, and for early correction of reproductive problems. This will help the farmers and veterinarians enhance the reproductive efficiency of dairy cows and buffaloes.

a
Nebel, R.L., 1988. On-farm Milk Progesterone Tests. J. Dairy Sci. 71:1682-90.

b
Nebel, R.L. et al. 1989. Comparison of Eight Commerical on Farm Milk Progesterone Tests. Theriogenology 31(4):753-764.

TABLE 22: PREGNANCY DIAGNOSIS OF BUFFALOES ON DAY 19 AND DAY 23 POST-AI USING THREE COMMERCIAL ON-FARM MILK PROGESTERONE KITS. (APP)

Trade Name of Test Kits	No. of Animals Tested	Progesterone Test			Rectal Palpation		% Accuracy	
		Non-Pregnant	Pregnant	Doubtful	Non-Pregnant	Pregnant	Non-Pregnant	Pregnant
Calf check	30	18	7	5	22	8	81.7	87.5
Estro-CHEK	27	15	7	5	19	8	79.0	87.5
Open Alert (Bovi-Pro 21)	12	6	6*	-	8	4	75.0	100.00
Overall	69	39	20*	10	49	20	79.6	90.0

*Includes two false positive cases.

XV. ROLE OF WOMEN IN CATTLE PRODUCTION AND HEALTH

Haryana is a farming state. The majority of the population depends on agriculture-based occupations. Among them, the raising of livestock is an important economic activity. Cattle and buffaloes provide milk; income to the households as a result of the sales; and bullocks (oxen) for various agricultural operations such as ploughing, draft, and transportation. Most of the tasks performed on the farms are manual and the use of modern farm machinery is very limited and practically non-accessible to the small and limited-resource farmers. Therefore, for small farmers, the participation of family members in performing various agricultural tasks is essential for their survival. Family size is usually large averaging 7-8 members (extended families). Typically, each farm family unit possesses 6-8 cattle consisting of milch animals, dry animals, heifers, young calves, and at least one pair of oxen.

Milk and milk products constitute the main staple diet of the people in this region; and 90-95% of them are vegetarians. Traditionally, the sale of milk is a taboo, particularly in the dry zone villages discussed in this report. Milk is consumed by the farmers as such, or in the form of yogurt, buttermilk, and butter (or ghee). In a typical farm family unit, the processing of milk and milk products is the responsibility of the womenfolk. As mentioned above, they are also responsible for the care and management of lactating animals which include various chores like milking, feeding, watering, bringing green fodder from the farm, cleaning sheds, preparing cow-dung cakes for use as fuel, grooming, housing, looking after young calves, heat detection, and getting them inseminated. In summary, the womenfolk are fully entrusted with the chores of livestock raising, particularly while they

are in-house. Even the strenous tasks like chaff-cutting are, in most households, handled by womenfolk with little or no assistance from the menfolk. The menfolk are mostly concerned with marketing aspects of the animals and other agricultural produce.

The majority of the womenfolk are illiterate and, as mentioned above, are deeply involved in arranging meals for the family (and other related kitchen work), up-bringing of their children, and caring for livestock, particularly the lactating cows and buffaloes. They appear to be well contented with these traditionally assigned chores in the overall male-dominated society. However, the ladies of the rich farmers perform only the least strenous tasks like milking and supervising the livestock management, which is actually performed by the servants and other hired help. However, the ladies from the lower strata have tougher tasks.

The activities of the womenfolk on a typical day start with the milking of cows around 6-7AM, and then by allowing them out for exercise, grazing, and wallowing under the supervision of herdsmen. After serving breakfast to the family (or occasionally after lunch), they clean sheds, process cow-dung into cakes for fuel, and process milk for preparing yogurt, butter, and buttermilk for the family use. The animals return home about 5PM, and again they busy themselves in feeding milch animals some concentrates and green fodder, and then milking and further processing of the milk. This may also include selling a portion of the milk to the Dairy Cooperative for cash income. Average daily involvement of womenfolk with the animals is about 1.5 hours in the morning and 2 hours in the evening before retiring around 9:00PM. It was estimated that more than 85% of the routine livestock management tasks were being performed by the womenfolk in the villages

surveyed under this project (Appendix J).

The survey reflected that none of the farmers and womenfolk had any training in dairying or any other livestock related enterprises. It was also noticed that the majority of the farmers who owned animals didn't have separate places for keeping animals, and they were being housed on the same premises. In general, both men and womenfolk were not conscious of the economics of reproductive problems. Everything appeared to them as a routine matter and very little attention was given to improving reproductive efficiency of their animals. Overall, the calf rearing practices are sub-standard and are, therefore, partly responsible for their stunted growth and delayed sexual maturity. Just to re-emphasize, the day-to-day caring of the calves is also the responsibility of the womenfolk.

As regards to the breeding of animals, the womenfolk carry the major share of responsiblity. They observe cows for estrus signs and also arrange for natural mating with the community bulls (of whatever genetic merit) or A.I. if facilities for the same are available in the village. On many occasions, estrus goes undetected or is detected too late for the insemination.

Regarding animal health, the early signs of sickness in cows are ignored and, generally, no veterinary assistance is sought unless the animal has reached some advanced stages of disease such as inability to walk, stand up, and ruminate; drop in milk yield; and exhibit clinical disorders. Many times, some local remedies are used for treatment. The womenfolk and children again play a very important role in this matter. Any diseased condition affecting milk production and fertility affects the small farmers and their families dearly. They are generally not aware of animal preventive health care for the animals. They become mindful

of the losses only when the animals stop giving milk, which is an essential component of the routine family diet.

In summary, the womenfolk in the villages play a very important role in day-to-day animal husbandry chores. Unfortunately, most of the animal care chores are traditional in procedure, and no effort is made to improve sanitation, nutrition, and management, including calf rearing practices. Training of womenfolk in livestock management and technology is one of the most pressing needs in the villages.

XVI. RESULTS AND CONCLUSIONS

Agriculture is the main thrust in rural Haryana. Over 85% of the population is vegetarian. Milk and milk products constitute the main staple diet of the people in this region. The raising of livestock, particularly cattle and buffaloes, for draft and milking purposes is a vital enterprise for the small farmers. Though not fully realized, there are huge on-going economic losses to the farmers particularly with respect to calf mortality, poor growth rate, and low lifetime productivity. Overall, very little attention is given to the nutrition, housing, breeding, health, and reproductive management of the animals.

This 2-year study of four selected villages in two different agro-climatic zones included surveys on various demographic aspects of the farmer, cattle and buffalo populations; animal management practices; marketing; breeding and reproductive management of cows and buffaloes; role of womenfolk in day-to-day animal management; farmers' constraints; types and frequencies of reproductive disorders and their management using various preventative and therapeutic measures.

The data on the types and incidence of reproductive disorders in cows and buffaloes in the villages along with the comparative effectiveness of various measures employed for correcting them, are presented in Tables 8 to 15. Microbial isolates from the repeat breeders along with their antibiotic sensitivities are given in Table 15. Estimations on progesterone proteins and various microminerals in the plasma of the affected animals are given in Tables 16 and 17. The effectiveness of Synchromate-B for the correction of post-partum anestrus and for the initiation of ovarian cyclicity in buffalo heifers during the breeding and off-breeding season is outlined in Tables

18 to 21. The usefulness of the Milk Progesterone Test Kits for diagnosing early pregnancy in buffaloes (days 19 and 23) is presented in Table 22. Some studies on the effects of Synchromate-B on blood chemistry and fertility are still continuing and the data were not available at the time of this writing.

The analyses of village profiles revealed that:

1. Among small farmers, cattle and buffalo raising is well integrated in their day-to-day agricultural operations.

2. Most of the farming tasks are manual, and the use of modern farm machinery is limited. Therefore, whole family participation in the agricultural operations is essential.

3. About 85% of the livestock-care chores are performed by the womenfolk. This includes milking, processing of milk, feeding, watering, bringing green fodder from the farm, cleaning sheds, preparing cow-dung cakes for use as fuel, grooming, housing, looking after calves, and detecting heat in cows and arranging follow-up inseminations. In well-to-do families, most of these chores are performed by the hired laborers.

4. Selling of milk is a good source of income in the Wet Zone , whereas, it is a taboo in the Dry Zone, and the milk is consumed by the family as such, or in the form of buttermilk, yogurt, and butter (ghee) or it is used in the preparation of various dishes.

5. Not a single person in all the four villages was found to have received any formal training in livestock management or dairying.

6. Detection of estrus in cows is the responsibility of cow-boys and/or the womenfolk. In herds, the community bulls, which freely roam about, are helpful. Many times, the estrus is missed altogether.

7. There are no organized breeding programs at the village level. The genetic merit of the community bulls is questionable. Only a few bulls are available for natural matings for the total female population in the village. They are overused during the breeding season. No one seems to be responsible for their management or veterinary care. Furthermore, these bulls had never been examined for breeding soundness or venereal diseases.

8. Artificial Insemination (A.I.) facilities are available in all of the four villages. A.I. is quite an acceptable procedure to the farmers in the Wet Zone but not to those in the Dry Zone. The semen available for A.I. was of poor quality. Shipment of semen over long distances (ice cooled) and the lack of storage facilities may account for some of the semen quality problems. In three villages, the inseminators were

not properly qualified or experienced. In two villages, the frozen semen was found to be contaminated with microorganisms. Several farmers in the Dry Zone were of the opinion that poor A.I. practices were to blame for most of the repeat breeding and metritis cases.

9. The majority of the farmers who own animals did not have separate places for housing their animals, and were housing them on the premises where they themselves were living.

10. The lactating animals receive special attention; they are provided with supplemental ration and green fodder. The dry animals and heifers mostly live on grazing and dry fodder. No salt licks/mineral mixtures are provided to the animals.

11. The calf rearing practices are substandard. The calves don't receive enough milk or ration to sustain their growth. This eventually leads to stunted growth, delayed sexual maturity, and low lifetime productivity in females. In many cases, the newly born calves do not get enough colostrum. Calf mortality is considerably high, particularly among male calves who are allowed very little suckling and receive no supplementary ration.

12. The farmers are ignorant/insensitive to the economic losses and implications of infertility problems.

13. In comparison, the wet zone villages are prosperous and more advanced. The level of education, ethnic background, closeness to the cities, road connections, and the degree of government involvement in providing A.I. and veterinary health care facilities are some of the contributing factors. Furthermore, this region has an adequate rainfall and assured canal or tube well irrigation facilities which enable farmers to raise agricultural crops and fodder for their animals with some certainty. The dry zone, on the other hand, falls on the fringes of the great Indian desert. The soil is sandy, rainfall is scanty, no assured irrigation facilities, and droughts are common. Sub-soil water is very deep and brackish and unfit for irrigation. Farming is solely dependent upon rainfall. Even drinking water is scarce. See Appendix D for soil types of Haryana.

14. Typically, each farm family unit (7-8 members; extended family) possesses 6-8 head of cattle consisting of milch animals, dry animals, heifers, young calves, and at least one pair of oxen. Goats and sheep are usually raised by the low caste landless farmers.

15. About 70-75% of the small farmers and their families are illiterate; they cannot read or write. Radio transmissions are the major sources of information and amusement. Quite a few prosperous farmers possessed television sets but they were used mainly for amusement and rarely for agricultural information.

16. The veterinary care facilities are not available in all of the villages. People use several local remedies for treating animals. Veterinary help is not generally sought by the farmers until the animal had reached

some advanced stages of illness. The womenfolk play a very important role in detecting illness in animals and seeking the necessary veterinary help.

17. Reproductive Problems:

DRY ZONE: Anestrus and repeat breeding are the two major reproductive disorders in both cows and buffaloes. Among buffaloes, the problems of delayed puberty, silent estrus and post-partum anestrus are very common. A large number of heifers of breedable age were reported anestrus due to the lack of resumption of ovarian cyclicity even after 3-5 or more years of age. The major contributing factors identified for anestrus were: malnutrition, limited suckling, and poor development of reproductive organs. The major causes of repeat breeding were: poor semen quality, improper heat detection, unskilled inseminators, and overuse of the community bulls for natural matings. The overall incidence of reproductive problems in dry zone villages is given in Tables 12 and 13 and the respones to various treatment regimens are given in Tables 2,3, and 11.

WET ZONE: In buffaloes, the major reproductive problems are: summer infertility, anestrus, silent heat, long intercalving interval, and repeat breeding. Several heifers of the breedable age were reported anestrus. Many of them had not resumed ovarian cyclicity even after 3-5 or more years of age. Their ovaries were smooth and inactive. In silent estrus, the animals had cycling ovaries with poor expression of estrus signs. Post-partum anestrus in lactating animals was quite common. The animals which had calved a year or more ago had not expressed estrus signs and their ovaries were found to be smooth and inactive. The incidence of repeat breeding was higher in cows than in buffaloes. Some of the repeat breeders showed abnormal vaginal discharge due to endometritis and cervicitis.

An overall incidence of reproductive disorders in the Wet Zone villages (Chormastpur and Panjokhra Saheb) is given in Tables 8 and 12, and the responses to various treatment regimens are given in Tables 9 and 10.

18. Various therapeutic agents used for the treatment of reproductive problems in cows and buffaloes are listed in Table 14.

19. Microbial isolations were used for diagnosing cases of endometritis and cervictis, the most common sequelae to the use of infected semen and faulty A.I. practices.

20. Determination of progesterone and various microminerals in the plasma of the affected animals provided very valuable information about the status of their ovaries and other related factors which are known to influence reproductive activity such as Iron, Zinc, Copper, Calcium, and Phosphorus (Tables 16 and 17). Phosphorus deficiency was acute. The nutrient status of Haryana soils is given in Appendix D.

21. Use of Synchromate-B in combination with PMSG (approx. 600 IU) in the prepubertal heifers (body weight around 300 kg) was effective in

eliciting ovarian cyclicity. Furthermore, Synchromate-B treatment gave encouraging results in correcting post-partum anestrus in cows and buffaloes during both breeding and off-breeding seasons (Tables 18-21).

22. The mineral mixture supplement, vitamin A injections, and application of Lugol's iodine to the cervix were the cheapest but still effective treatment therapies for many of the reproductive disorders in cows and buffaloes (Tables 2,3,5,8).

23. Prostaglandins and PMSG were useful hormonal treatments for eliciting ovarian cyclicity in anestrus animals (Table 9).

24. Early diagnosis of pregnancy in cows and buffaloes can play an important role in increasing reproductive efficiency by reducing errors in the detection of estrus, and enabling timely treatment of reproductive disorders (Table 22).

25. Livestock survey of two wet zone villages (Chormastpur and Panjokhra Saheb) revealed 22 cases of abortions in cows and buffaloes (Table 8). The symptoms, as described by the farmers, indicated the existance of some kind of venereal infection.

26. Training of the womenfolk in livestock management and technology is one of the most pressing needs in the villages.

27. PUBLICATIONS:

The data presented in this report will be analyzed further and published. So far, the following have been achieved:

1. Singal, S. P., Lohan, I. S. and Arora, K. L. 1988. Studies on the incidence and reproductive management of infertility in breedable dairy animals in rural Haryana State, India. Proc. XIth Intl. Congress on Anim. Prod. and A.I., Vol. 4: 544-546 (Presentation made at the conference held June 26-30, 1988 in Dublin, Ireland).

2. Yadav, N. K. 1988. A study on the factors causing non-clinical reproductive disorders in breedable buffaloes/heifers and their ameliorative measures in some villages in Dry Zone of Haryana State. M.S. Thesis (Animal Production Physiology) Haryana Agricultural University, Hisar, India.

3. Kaker, M. L., Arora, K. L. et al. Rapid milk progesterone assay kits for early pregnancy diagnosis in Murrah buffaloes. Under preparation.

XVII. IMPACTS OF THIS PROJECT

The implementation of this project at the farmers' level included:

1. SURVEY WORK: This included door-to-door visits to collect information on livestock inventory, infertility problems, feed and fodder types, and other related livestock management practices.

2. REPRODUCTIVE HEALTH CONTROL CAMPS: This included frequent pre-arranged and announced visits to the villages by a team of scientists/specialists for the purpose of examining farmers' animals for reproductive problems. Suitable corrective measures were employed on the spot whenever possible, otherwise, a line of treatment was developed based on the material/data collected (Appendix J).

Various impacts of the above mentioned activities during the two-year period were identified as follows:

1. There was an increased sense of awareness among the farmers (which included womenfolk) with respect to their understanding of the animals' needs for quality feed and fodder, reproductive management, and preventive health care.

2. There was also an increased awareness among the farmers as to to the need to closely monitor their animals for health, disease, and estrus signs, and to acquire timely insemination.

3. The continuous contact and exposure to the visiting scientists resulted in an increase in the number of animals the farmers brought for check-ups and for seeking professional advise.

4. The farmers seemed to accept the need for regular use of mineral mixture in animal feeds, and for seeking prompt veterinary assistance.

5. There was an aroused interest among the farmers (particularly the womenfolk) to undergo formal training in livestock management, particularly dairying.

6. Various therapeutic measures used for treating infertility cases helped increase the animals' productivity and thus lowered economic losses to the farmers.

7. There was an increased awareness among the state officials regarding the need for quality semen (fresh or frozen), storage facilities, trained inseminators, and an organized animal breeding program at the village level.

8. Significantly boosted the research involvements of the collaborating scientists from the Haryana Agricultural University in terms of developing and strengthening their labs and delivery systems (to the farmers) with funds provided under this project.

Hopefully, the momentum generated by this project will continue to increase with more closer involvement of the state animal husbandry department and the university scientists in livestock improvement activities at the farmer's level.

XVIII. SUGGESTIONS FOR FUTURE RESEARCH/EXTENSION PROJECTS

Based upon the experience gained from this project, the following future projects are suggested:

1. Reducing the inter-calving interval in cattle and buffaloes: Investigate the effects of various factors on the ovarian activities such as suckling, temporary or permanent weaning of calves, changes in the managemental practices during the summer months, and the administration of exogenous regulating hormones.

2. Hastening growth rate of heifers: Decreasing the age of puberty and first calving. Determining an optimal body weight for breeding, and devising ways and means to attain it.

3. Development of training programs: Educating rural womenfolk and herdsmen in livestock management technology with emphasis on breeding, health, and nutrition. Developing strong audio-visual programs for extension education of the farmers and their families.

4. Providing quality semen (fresh or frozen) for artificial insemination or an adequate number of quality bulls for natural matings. Provide skilled inseminators.

5. Early diagnosing of reproductive disorders: Providing economical corrective measures. Hormonal therapies should be made available to the farmers.

6. Early diagnosing of pregnancy: Use of commercial progesterone kits. Increasing reproductive efficiency.

7. Enhancing reproductive efficiency of buffaloes during the summer months: Use of exogenous hormones like Synchromate-B, in addition to improving managemental practices.

8. Improving animal genetic resources: Employing well established tools such as progeny testing and propagating superior genotypes through cryopreservation and embryo transfer technology.

9. Conducting comprehensive regional studies on SOIL-PLANT-ANIMAL interrelationships: Devising strategies to meet the nutritional requirements of animals for optimal growth, production, and reproductive performance.

10. Involving the veterinary facilities in the villages for both production and health aspects of livestock management.

XIX. ABSTRACT

A research project---"Incidence and Field Management of Infertility in Cattle and Buffaloes in Rural Haryana, India"---was completed jointly by the Fort Valley State College, Fort Valley, GA, U.S.A., and the Haryana Agricultural University, Hisar, India. The project was funded by the United States Agency for International Development (USAID), Bureau of Science and Technology, Research and University Relations. It was started in March 1987 and completed in September 1989.

The project covered four selected villages; two located in the DRY OR ARID ZONE (Kungar and Jhumpa), and two in the WET OR SUB-HUMID ZONE (Panjokhra Saheb and Chormastpur). These were contrasting agro-climatic zones and provided valuable information on various demographic aspects of the farmers; cattle and buffalo populations; animal management practices; marketing; breeding and reproductive management of cows and buffaloes; role of womenfolk in day-to-day animal management; farmers' constraints; and types and frequencies of reproductive disorders and their management. The data collected on the above mentioned aspects were summarized and are presented here briefly in tabular and/or narrative forms. Some studies are still continuing.

This study revealed that about 80% of the population in this state depends upon an agriculture-based economy and the majority is vegetarian. Milk and milk products are the main ingredients of their day-to-day diets. This is more so in the DRY ZONE where the people are more traditional and are located farther away from the cities and other metropolitan centers. The farmers in the Wet Zone are more receptive to newer technologies and are more prosperous.

Overall, livestock activities are well integrated with routine agricultural operations. Most of the farming tasks are manual and the use of modern farm machinery is limited. Participation of family members, in various agricultural operations, is very essential. Aside from several household responsibilities, the womenfolk perform 85% of the livestock-care chores, particularly among low caste and landless farmers. In well-to-do families, most of these chores are performed by the hired laborers. Not a single person in these villages had received any formal training in dairying or other livestock operations.

There is no organized animal breeding program at the village level. The cows and buffaloes are bred with non-descript bulls which have never been evaluated for their genetic merit, breeding soundness, or the existance of venereal diseases. Local (community) bulls roam about freely amongst the herds. No one seemed to be responsible for their management or veterinary care. There were only a few bulls in each village, and they were overused during the breeding season. This led to their exhaustion and loss of libido and, consequently, poor performance in terms of conception rates, among cows and buffaloes.

Artificial Insemination (AI) facilities existed in all of the four villages. Fresh semen was being brought by the couriers over long distances (in thermos bottles containing ice) which took several hours to reach the AI Centers. There were no adequate refrigeration facilities for storing semen at the AI Centers. At the same time, the inseminators were not properly trained. Conception rates were extremely low due to the poor quality of semen used, inexperienced inseminators, and inseminations at the wrong times. This was more so in the Dry Zone. Several farmers were of the opinion that poor AI services were to blame for most of the repeat breeding cases. Frozen semen had not

reached all of the villages. Veterinary services, though not available in all of the villages, were not sought until an animal had reached some advanced stage of illness.

In the Wet region, the incidence of anestrus was the highest (about 50% in buffaloes and 35% in cows), followed by repeat breeding (about 21% in buffaloes and 27% in cows), silent heat (about 20% in buffaloes and 15% in cows) endometritis and cervicitis (about 14% in cows and 5% in buffaloes), and abortions (about 7% in buffaloes and 4% in cows). Similar problems existed in the Dry Zone, however, the incidence of repeat breeding was comparatively higher and the abortions were not as frequent as in the Wet Zone. Animals in the Dry Zone were relatively "skinny" and malnutritioned. This was probably due to the limited availability of feed and fodder, particularly green fodder and mineral mixtures. In this area, the soil is desert-like with no assured irrigation facilities. Farming is solely dependent upon rain. Droughts are common.

Several types of therapeutic measures were employed for correcting reproductive problems in cows and buffaloes, which included recommendations for a high plane of nutrition and supplementation with Vitamin A and mineral mixtures. The farmers were made aware of the strategies needed to prevent reproductive problems in their animals and to measures needed to increase production. Training of the farmers, particularly the womenfolk, in livestock management technologies was one of the most pressing needs in these villages.

Various critical issues facing livestock developments in this area demand serious attention. These include improving the availability of nutritious feeds and fodder, implementing disease control measures, the organization of

breeding programs, infrastructure, the upgrading of facilities for artificial insemination, expanded extension services, and specialized manpower to implement various developmental projects at the farmers' level.

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XXI. LIST OF APPENDICES

A. Survey Form:-Participation of Women in Routine Livestock Management Practices

B. Survey Form:-HAU-FVSC (USAID) Project on Cattle Infertility

C. Mineral and Vitamin Contents of the Mineral Mixture

D. Soil Types of Haryana

E. Zinc Status of Haryana Soil

F. List of Equipment and Supplies Purchased in India from the Project Funds

G. Hormones and Various Supplies Provided from USA for the Project

H. Research Fellows and Other Personnel Hired in India for the Project

I. Incidence of Reproductive Abnormalities in Village Buffaloes (1979-81 Report from the Haryana Agricultural University)

J. Photographs Reflecting Project Activities and Involvement of the Womenfolk

PARTICIPATION OF WOMEN IN ROUTINE LIVESTOCK MANAGEMENT PRACTICES

Date _____

Name of Respondent _____ Husband's Name _____

Age _____ Village _____ Ward _____

Mailing Address _____

A. SOCIO-ECONOMIC VARIABLES

1. Caste _____ Organization Membership _____
2. Type of house : Hut/Mud house/Brick house/Villa
3. Land holdings : No land/No. of acres _____
4. Family size : Total members and ages _____

   Sex : Males _____ Females _____
5. Type of family : Nuclear/Joint family
6. No. of animals : _____ Lactating animals _____

   Pregnant cows/buffaloes _____

   Bulls _____ Heifers _____

   Calves : Males _____ Females _____

   Total value _____
7. Average monthly income from all sources _____

   From Agriculture _____

   From Animals _____

   Other Sources _____
8. Education level : _____ Illiterate/grade _____

   _____ Read and/or write local language _____

(a) Availability of reading materials and type : _____

_____

(b) How much money can you come up with (Loan, Savings, etc.)

In case of emergency ? _____

7. Was the training beneficial to you ? _____

8. Constraints impeding women participation in training programs :

_____

_____

9. Marketing facilities available : _____

_____

10. Keeping records on animal produce and products :

_____

11. Amount and types of feeds provided to :

_____

(a) Lactating animals _____

(b) Dry animals _____

(c) Newly born calves _____

12. Total milk yield per day from cows _____

13. Current price of milk/liter _____

14. Disposal of milk (amount) :

(a) Selling in market _____

(b) Utilized in home for _____

15. Various milk products prepared at home _____

16. Narrative answers for the following questions :

(a) Livestock activities performed by women (in sequence) after getting up in the morning : _____

_____

(b) Milking practices and frequency of milking : _____

_____

(c) Care of pregnant animals : _____

_____

(d) Care of newly born calves : _____

_____

(e) How would you increase milk production in your cows ?

_____

HAU-FVSC (USAID) Project on Cattle Infertility

GENERAL INFORMATION

Village_____

Farmer No._____

I. BACKGROUND INFORMATION :

Name of Village _____ Owner _____ Address _____ Date _____

Owners Education_____ Family Size_____ (incl. children) Land Holding_____ Farm Machinery_____

Access to T.V. & Radio/Newspaper _____ Veterinary Services Available : Govt. Vety._____ Stock Asstt._____

Any Other_____ Proximity to Vet. Help_____ Proximity to A.I. Centre _____

Routine Vaccination for_____ No. of Animals : Breedable : M_____ F_____ Calves : M_____ F_____

Local Cows/Heifers_____ , C. B. Cows/Heifers _____ , Buffalo Cows/Heifers_____

Ages of Animals_____ Lactating Status_____

Total Daily Milk Yield _____ Quantity Sold/Day_____ (and Rate/Liter) Buyer_____ Milk for Home Use_____ (Liters)

Availability of Milk to the Children and in What Form ?_____

Feeding Practices :

Adult Animals : Lactating_____ Non-Lactating _____

Calves (Age Consideration) _____

Livestock Buying/Selling Practices Including Costs/Earnings During the Past 5 Years _____

_____

II. GENERAL INFORMATION ON MALES :

—No. of Bulls in the Village_____

Cow Bull _____ Breed_____ Buff. Bull_____ Breed _____

—Bull Availability : Usually/Always/Occasional

—Bull Feeding : Panchayat/Individual Farmer (Owner :_____)/Free Roaming Concentrate/Green/Dry/Mineral/Other

—Exercise—Stalled/Roaming

—Mounting Behaviour of the Bull :—Excellent/Good/Does Not Mount. From Where the Bull Was obtained _____

—Has the Bull Ever Been Examined ?_____ When last ? _____

—Opinion of Farmers About the Conception Rate From the Bull _____

III. ARTIFICIAL INSEMINATION :

—Veterinarian/Stock Assistant/Milk Cooperative/Other (_____)

—Use of Liquid/Frozen Semen.

—Source of Semen Supply : ICDP/Other (_____)

—Approx. Distance of Village From the Source of Semen Supply_____

—Whose Responsibility it is to Bring the Semen

—Mode of Semen Transport _____

—Is the Semen Readily Available_____

—Breed of Bulls_____

—Semen Supply : Daily/Bi-weekly/Tri-weekly/Occasionally

—Storage Facilities of Semen in the Village : _____

—Semen Examination Facilities Available (Type_____)

—Examination of Semen Before A.I. : Daily/Occasionally/Never

IV. CALF MORTALITY :

—No. of Calves Died During the Past 5 Years_____

—Cow-Calf_____ Age/Sex_____Sire Breed _____ Wt. at Birth (Size) _____

—Buff-Calf_____ Age/Sex_____ Sire Breed_____ Wt. at Birth (Size) _____

—Cross-Bred _____Age/Sex_____ Sire Breed _____ Wt. at Birth (Size)_____

—Was the Calf Born From : Natural Mating/Liquid Semen A.I./Frozen Semen A.I. —General Health at Birth_____

—Major Symptoms_____

—Probable Causes : No Suckling/Loss Milk Provided/Parasites/Diarrhoea/Blood in Faeces/Other/Unknown

—Did the Dam Given Milk After the Death of the Calf_____

—Opinion of the Farmer About the Calf Mortality_____

—General Health of the Calf at Present_____

—Any Preventive Medications/Procedures Used_____

INDIVIDUAL FEMALE REPRODUCTIVE HEALTH RECORD

1. INFORMATION ON AFFECTED FEMALE :

(a) **General :**

Village_____ Owner_____ Address_____ Date_____ Farmer No. _____ Case No._____

—Breed/Type_____ Tag/Brand No._____ Heifer/Adult_____ Lactating/Non-Lactating _____

--General Health : Amount Lactation No._____

—Body Condition : Very Weak/Weak/Good/Very Good/Fatty

—Exhibiting "heat" : Normal/Silent/Occasional/Anestrus. When "heat" Seen After Last Calving _____

—Any Specific Disease During the Past 2 Years_____ Normal/Abnormal Last Calving _____

—Who Observes Animals for "heat" ? Farmer/Women Folk/_____ Frequency : Daily/Occasional

—Heat Detection by Bull_____

—Pregnancy Status_____

—Vaccination Status_____

—History of Vaginal/Uterine Prolapse : Dystokias/Abortions/Retention of Placenta/Metritis/Pyometra/Monstrosities

(b) **Feeding Practices :**

—Stall Fed/Pasture/Let Loose in Herd/Other (_____)

	Always	Occasional	Year Around	Comments
—Concentrate (Type/Amount)	_____	_____	_____	_____
—Dry (Type/Amount)	_____	_____	_____	_____
—Green (Type/Amount)	_____	_____	_____	_____
—Mineral Supplement	_____	_____	_____	_____

(c) **Gynaecological Examination :**

—Ovaries : —Left : Follicle/Smooth/C.L. (Size : Normal/Pea-like/Thin Streak-like) (Flaccid)
—Right : Follicle/Smooth/C.L. (Size : Normal/Pea-like/Thin Streak-like) (Flaccid)

—Uterine Horns : —Left : Normal Size/Small/Hypoplastic/Toned/Gravid (Stage)/Non-gravid
—Right : Normal Size/Small/Hypoplastic/Toned/Gravid (Stage)/Non-gravid

—Cervix : —Normal Size/Thin/Pencil-like/Enlarged/Patent

—Vagina : —Mucus Membrane : Pale/Hyperemic/Moist/Dry/Lesions (_____)

—Discharge : —Clear Normal/Pus like/Cloudy/Sanguinous

II. **GENERAL TREATMENT RECORD :**

(a) Tentative Diagnosis _____

(b) Specific Laboratory Findings :

1. Blood Chemistry _____
2. Microbiology _____
3. General Blood Profile _____
4. Fecal Examination _____
5. Histo-Pathology _____
6. Hormonal Profile _____

Note :—Details on Laboratory Examinations are Maintained Separately.

(c) Final Diagnosis _____

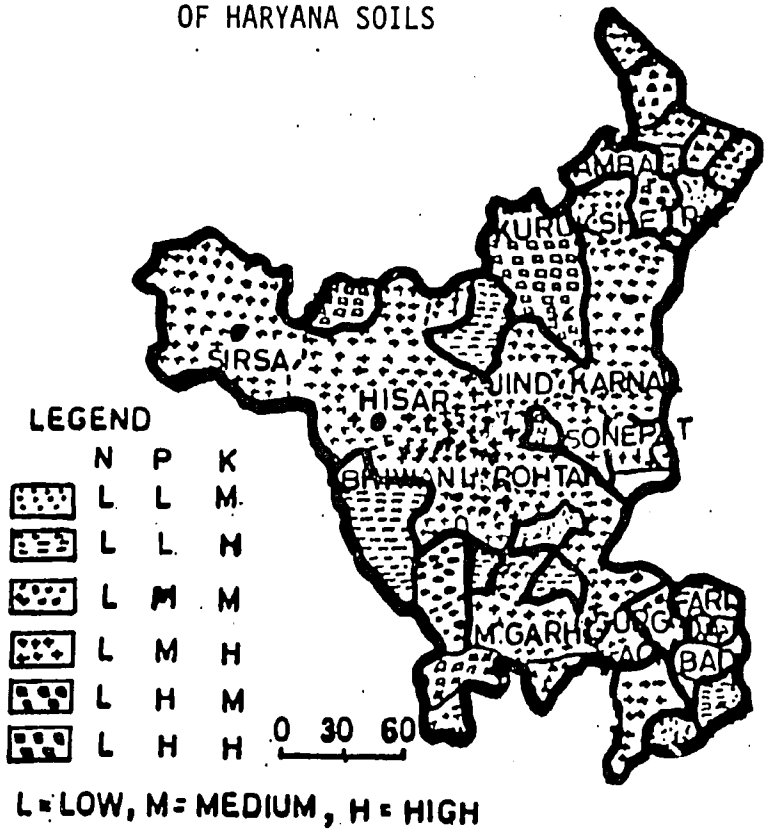
(d) Treatments Given and Advised

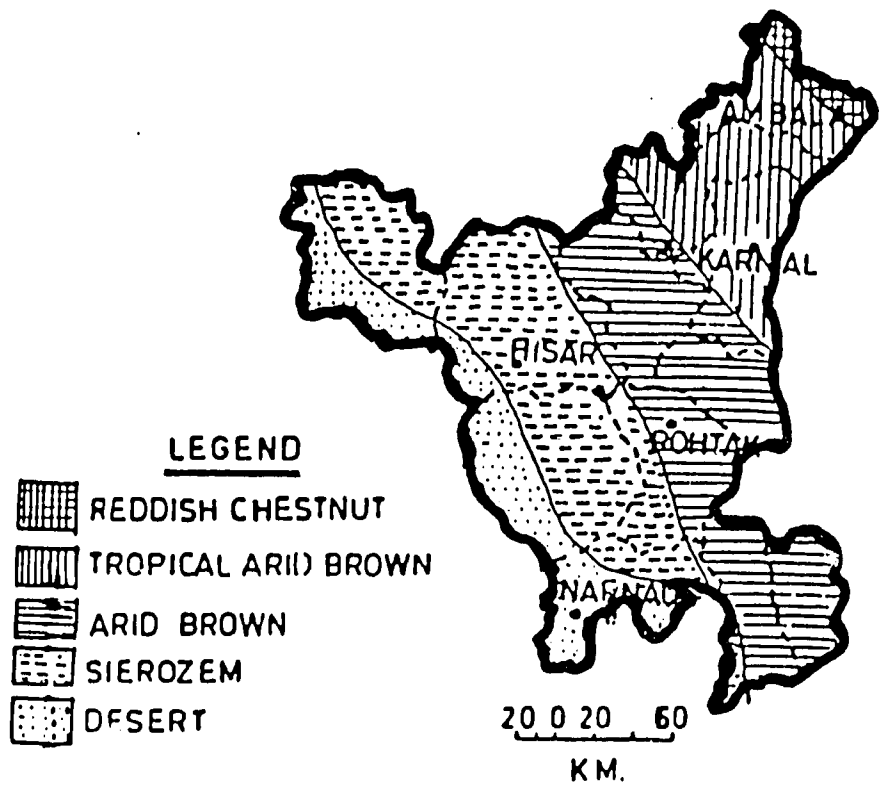
Date	Treatment	Remarks

MINERAL AND VITAMIN CONTENTS OF 100 GRAMS OF MINERAL MIXTURE (LACTVET, ALVED PHARAMA, MADRAS, INDIA).

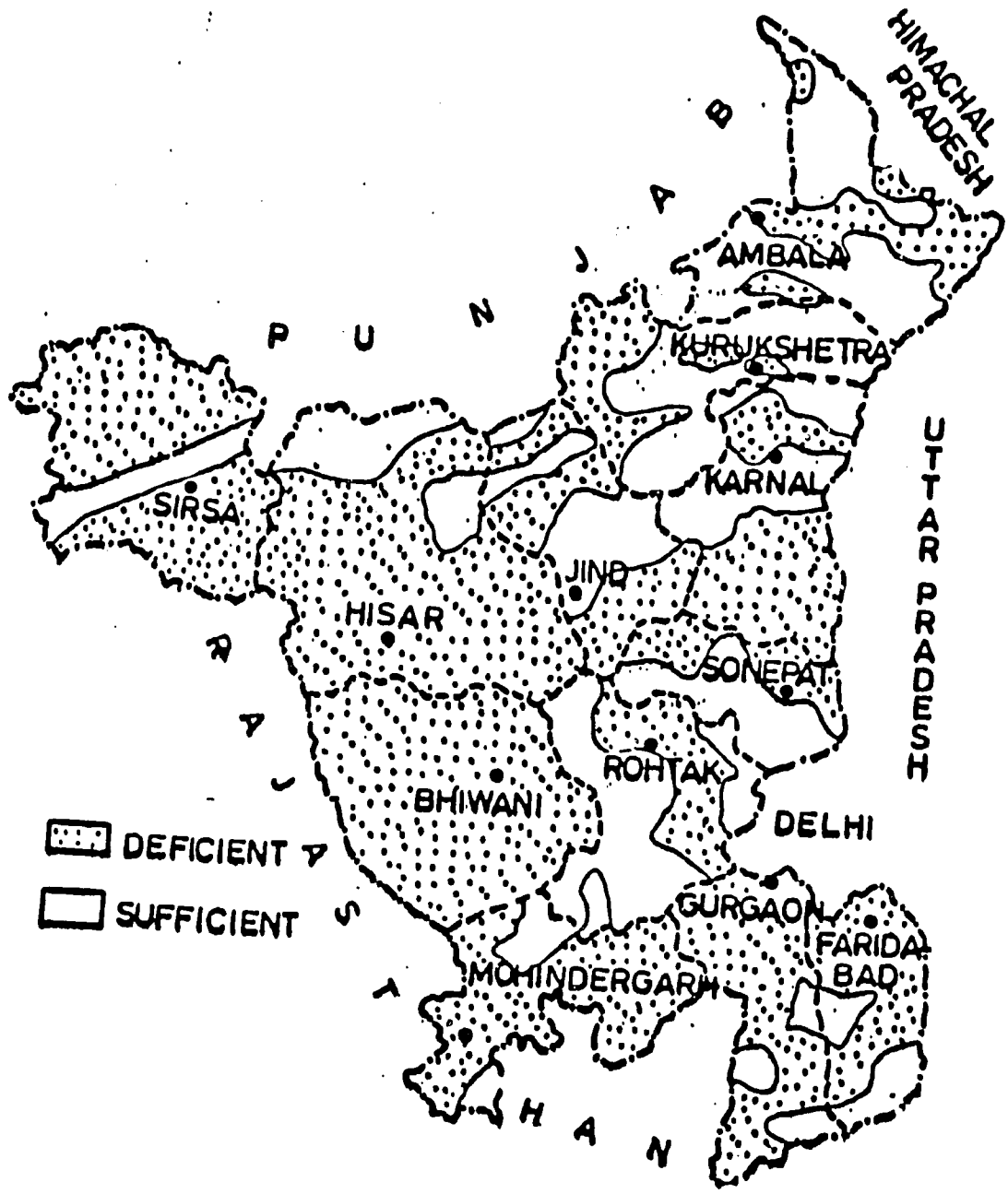
Ingredient	Amount
Vitamin A	125000 I.U.
Vitamin D3	12500 I.U.
Vitamin E	50 I.U.
Calcium	25.20 g
Phosphorus	18.00 g
Manganese	0.20 g
Copper	0.15 g
Zinc	0.10 g
Iodine as iodate	0.05 g
Cobalt	0.02 g
Calcium: Phosphorous ratio	1.4:1

AVAILABLE NUTRIENT STATUS
OF HARYANA SOILS





SOIL TYPES IN HARYANA



Zinc Status of Haryana soils

SOURCE: Gupta, V.K., Karwasra, S.P.S., Raj, H. 1988. ZINC IN AGRICULTURE, Department of Soils, Haryana Agricultural University, Hisar, India. (Monograph).

APPENDIX F

LIST OF EQUIPMENT AND SUPPLIES PURCHASED IN INDIA FROM THE PROJECT FUND

I. DEPARTMENT OF ANIMAL PRODUCTION PHYSIOLOGY (APP)

1. Deep Freezer (2)
2. Oven/Incubator
3. Digital pH Meter
4. Refrigerator
5. Electronic Balance
6. Micropipetter
7. Microelectrodes
8. Gamma Counter Accessories
9. Lab Air-Conditioner
10. Door Locks
11. Office and Lab Fixtures
12. Stereoscopic Microscope
13. Chemicals, Medicines, Hormones, and Glassware
14. Office Supplies

II. DEPARTMENT OF VETERINARY GYNECOLOGY

1. Vehicle (Mohindra & Mohindra Van)
2. Blood Chemistry Analyzer
3. Gamma Counter (I125)
4. Current Stabilizer
5. Room Cooling Fixtures
6. Chemicals, Medicines, Hormones, and Glassware
7. Office Supplies

APPENDIX-G

HORMONES AND OTHER SUPPLIES PROVIDED FROM THE USA FOR THE PROJECT

Antiserum-17B Estradiol

Antiserum-Progesterone

Bacellus subtillis Spore Sus

Calfcheck Progesterone Test

Clinease-EP Progesterone Tes

Cystorelin (GnRH)

Estradiol cypionate

Estrucheck Progesterone Test Kit

FSH

Fetal Bovine Calf Serum-Lypholized

Folly Catheters (2-way, 3-way)

Hot Flash Heat Mount Detectors (with Replacement Triggers)

Human Chorionic Gonadotropin (HCG)

Ivomec

Lutalyse

Synchromate-B (with Implant Gun)

~~FACULTY,~~ RESEARCH FELLOWS AND OTHER PERSONNEL HIRED FOR THE PROJECT

A. DEPARTMENT OF ANIMAL PRODUCTION PHYSIOLOGY (APP)

	NAME	FROM	TO
1.	S. K. Kataria	12-10-87	2-04-87
2.	Prem Singh	12-10-87	2-04-87
3.	N. K. Yadava	8-01-88	9-10-88
4.	Y. P. Sharma	8-01-88	11-11-88
5.	Rajesh Gupta	3-14-88	8-30-89

B. DEPARTMENT OF VETERINARY GYNECOLOGY

1. Research Fellow
2. Research Fellow
3. Driver
4. Daily Paid Laborer

INCIDENCE OF REPRODUCTIVE ABNORMALITIES IN VILLAGE BUFFALOES (1979-81 REPORT OF EARLIER WORK)

# of Villages Surveyed: 32
# of Animals Examined : 847

Reproductive Abnormalities	Buffalo Heifers	Buffalo Cows	Total	Percentage
True Anestrus	181	226	407	48.05
Sub-estrus	71	81	152	17.94
Cystic ovaries	—	4	4	0.47
Persistant CL	8	17	25	2.95
Silent estrus	32	41	73	8.62
Grand Total:	292	369	661	78.03

APPENDIX J

LEGENDS FOR THE PHOTOGRAPHS ATTACHED

1. Registration of infertility cases on the premises of the Veterinary Clinic in Panjokhra Saheb Village.

2. A cross section of buffaloes brought for infertility treatment in Jhumpa village.

3. A veterinarian examining a buffalo for gynecological problems.

4. Gynecological examination of an animal on farmer's premises.

5. Infertility camp organized by the investigators. The van in the photograph was provided from the project funds.

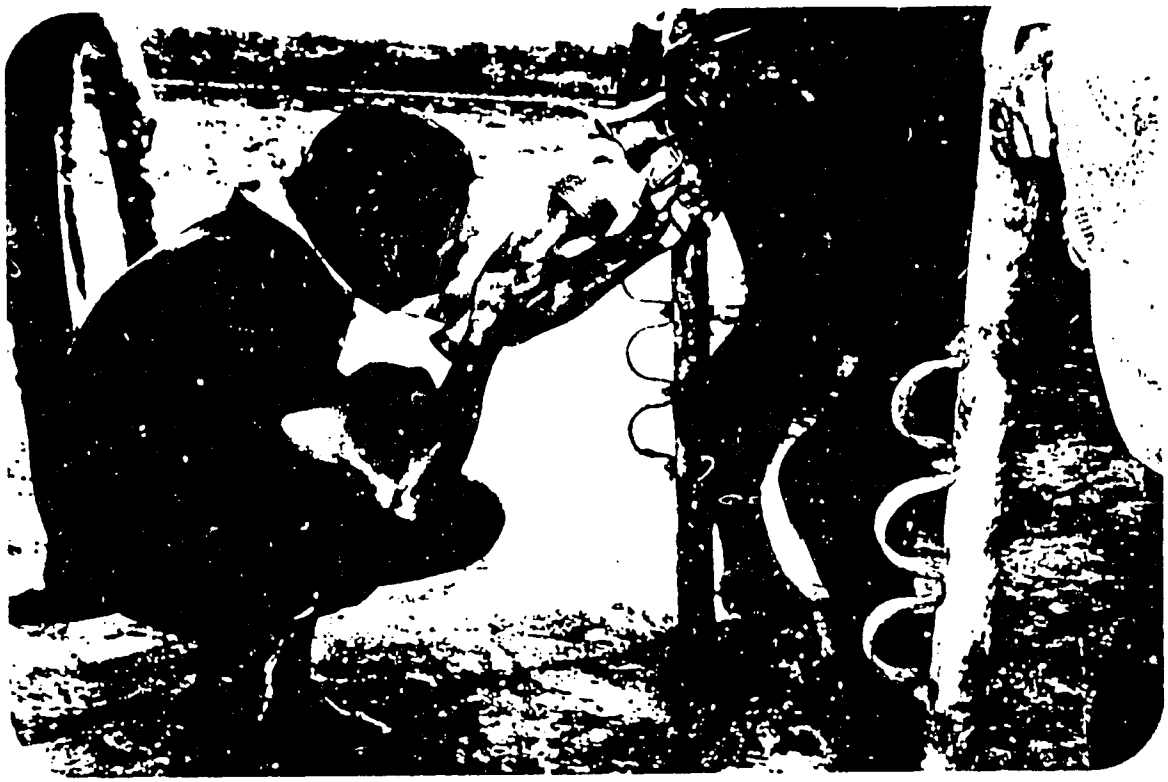
6. Mobile Pharmacy distributing medicine and mineral mixture to the farmers in Chormastpur village.

7. A woman providing green fodder to the lactating animals.

8. A woman preparing to milk her cow. The calves are used to "let-down" milk.

Photograph 1

Photograph 2



Photograph 3

Photograph 4

Photograph 5

Photograph 6

Photograph 7

Photograph 8