118,000 million pounds. In 1945, the total production of milk was 119,828 million pounds—almost exactly the same.

In the U.S.A. in 1971, there were 14,976,000 dairy cows and heifers of breeding age. In 1945 there were 31,447,000 dairy cows and heifers of breeding age—more than twice as many.

In the U.S.A. in 1971, the average cow produced 9,609 pounds of milk. In 1945, the average cow produced 4,787 pounds of milk—a little less than half as much per cow.

It is clear that in a little less than three decades the character of the national dairy herd has changed markedly. The same total quantity of milk is now derived from half as many cows because each cow is producing twice as much milk.

In the U.S.A. in 1971, the total population of beef cows, heifers that had calved, the heifers > 500 pounds kept as beef cow replacements was 45,565,000. In the U.S.A. in 1945, the total population of beef cows, heifers two years old and older, and heifers one to two years old (a closely comparable statistic) was 21,525,000—less than half as many.

In a little less than three decades the national beef herd has doubled.

2. **The AI Industry.**—In 1971 the total of dairy cows and heifers of breeding age bred by AI was 7,285,171 or 48.6% of the dairy cattle population. In 1945 the percent of dairy cows and heifers of breeding age bred by AI was 1.1%, in 1950 9.7%, in 1955 20.2%, in 1960 31.8%, in 1965 37.4%, in 1970 46.1%.

Utilization of AI has increased at a remarkably steady rate against a rapidly declining dairy cattle population.

In 1971, in Wisconsin, 1,304,989 or 57.2% of dairy cows and heifers were bred by AI, in New York 697,992 or 57.3%, and in California 675,523 or 69.7%. Of Florida's 164,935 dairy cows and heifers 77.4% were bred by AI.

In 1971 the total of beef cows and replacement heifers bred by AI was 1,357,918—just over 3%. Preceding 1960 the number of beef cows and heifers bred annually by AI was below 100,000. In 1965, the total was 615,147; in 1970 it was 1,258,446.

Utilization of AI in beef cattle has increased at a remarkably rapid rate despite the obviously greater difficulties of implementation in the environment of beef cattle as compared with dairy cattle and despite the overt and covert opposition of the major purebred beef registry associations. Artificial insemination for dairy cattle received the tacit support of the purebred dairy registry associations during developmental phases.

In 1971, in the traditional beef raising states of Texas, Montana, and Kansas, respectively, 77,148, 69,658, and 58,869 beef cows and heifers were bred by AI.

In the U.S.A. in 1971, the combined total of dairy and beef cows and heifers bred by AI was 8,643,089.

From a high in 1953 of 96 AI cooperatives and private AI organizations only 26 remain in 1971. Of these, the five largest produce 82% of the semen. There are 14 organizations producing semen for more than 225,000 cows and heifers per year.

Five AI organizations have their homes in Wisconsin. Approximately 40% of all semen used in AI in the United States is produced in Wisconsin.

Veterinarians and the Present Status of AI

Because there are so few AI organizations remaining in the U.S.A. and only a minority of these employ veterinarians, today there are only about a dozen veterinarians engaged in full-time AI operations or administration.

Nevertheless, there are several hundred veterinary practitioners directly involved in inseminating businesses or otherwise associated with inseminators. Of course, practically all bovine practitioners, except feedlot specialists, are involved professionally with AI in their clients' herds—to one degree or another.

Presently, there are three areas of relationship between the practicing veterinarian and AI worthy of special comment:

1. Veterinary practitioners are sometimes called upon to examine frozen semen suspected of deterioration from mishandling during refrigerated storage or of being inferior in quality when collected and processed. Unwarranted diagnostic conclusions have been the cause of some instances of unfortunate friction and the creation of situations that would challenge most anyone's capability for diplomatic handling.

When examining frozen semen post-thawing using simple optical equipment and without the pre-freezing laboratory data, about the only time a critical evaluation can be made is when all sperm cells are found dead. Such can be the basis for a useful, noncontroversial diagnosis.

A meaningful laboratory work-up for frozen semen requires: (a) excellent optical equipment—preferably dark field or phase; (b) precise temperature control; (c) experience and skill in estimating motility; (d) experience and skill with a

counting chamber; (e) experience and skill in morphological classification of sperm cells; and (f) knowledge as to the extender employed as well as the total number and percent live cells, post-thawing, when the semen was released by the semen processor.

Estimation of percent motility in extended semen is difficult for laboratory workers performing such tasks on a daily, routine basis. For an occasional examiner working with less than ideal equipment and an unfamiliar extender or with an extender with unfavorable optical qualities (i.e., whole milk containing fat globules), the procedure is fraught with probability of error.

Relative to frozen semen one must keep in mind certain facts: (a) If the original motility of sperm cells in freshly collected semen was 70% and the percent survival through freezing was 70%—both *ideal* situations—the percent live cells post-thawing can't be greater than 49% (70% x 70% = 49%). Should the original motility be 50% and the percent survival 50%—not at all an unusual situation—the percent live cells post-thawing can't be greater than 25% (50% x 50% = 25%). With frozen semen, the number of live cells present post-thawing, not the number of dead cells present, is the important consideration. It should be apparent that when an AI organization receives a report from the field to the effect that some semen has been examined locally and pronounced "weak" or "no good" because "half the sperm are dead" that a new, secondary problem has arisen; (b) Deterioration of semen during storage can be recognized only through comparison of laboratory data soon after processing and freezing with the data relative to semen that has been obtained at the place and time of intended use; (c) Fertility of semen in females is not increased through increasing sperm cells "per insemination dose" above an optimal minimum. The economics of AI necessitates the use of fewest possible sperm cells that will achieve maximum fertility when deposited in females in estrus. A diagnosis, based upon examination of a few ampules or straws, to the effect that "the semen was diluted too much," is really quite naive; and (d) Veterinary practitioners might better refer other than perfunctory examination of frozen semen to a willing and well qualified laboratory—of which there are very few—or, better, back to the laboratory of the processor of the semen.

2. There has been a rapid decline in the number of traveling inseminators occupied full-time in multi-herd work. The reasons for this change are both economic and social.

Today, 90% of all beef semen is sold direct and is either owner-used or owner-supervised. Between 30-40% of dairy semen is sold direct and is either owner-used or owner-supervised. In some states almost all semen is sold directly to owners. Direct selling of semen means that semen producing organizations are no longer monitoring and supervising the on-the-farm or on-the-ranch inseminating procedures. This established trend will continue and, probably, accelerate.

In the herds of their clients, practicing veterinarians should assume nothing in respect to AI. They must learn to give consideration to semen source and to quality at the time and place of use and to the proficiency of inseminators. Just as dairy practitioners have accepted they must know how to check out milking machine equipment, they must become cognizant of the on-premises factors that are making or breaking use of AI in their client's herd.

3. The influx into North America of new breeds, largely available only through AI, is having a profound effect and will probably have a lasting effect upon North America's beef cattle industry. Beef cattlemen are increasingly committed to pursuit of the potential 20% advantage from cross breeding with exotics.

The use of AI and of the exotic breeds in beef herds will inevitably present many new problems for the veterinary practitioner.

The capabilities of even the best herd managers will be challenged as the level of feeding and herd management are upgraded to make effective AI possible. Larger calves associated with some of the exotic breeds mean increased incidence of dystocia. The longer gestations associated with some of the exotic breeds require optimal pre-calving nutrition in order to maintain 365-day reproductive cycles.

The implications of need for more involvement by the veterinary practitioner are evident.