DEVELOPMENT OF BEEF CATTLE PERFORMANCE TESTING IN THE UNITED STATES

El desarrollo de las pruebas de produccion de carne

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INTRODUCTION

Programs for genetic improvement must be based on accurate measures of performance of individual animals. The traits must be measurable and heritable if selection is to be effective. Traits that are measurable early in life and are moderate to high in transmittability are more amenable to rapid progress through selection. Individual merit, based on performance test records, is the most important basis for selection, although information on performance records of ancestors, collateral relatives and the progeny test are valuable aids to individual selection for specific traits.

EARLY RESEARCH ON GROWTH PERFORMANCE

The U.S.D.A., in cooperation with the Montana Agricultural Experiment Station, initiated research in 1928 at Miles City, Montana aimed at developing methods of measuring performance in beef cattle. For the next four years, the American Society of Animal Production held its annual meeting at the Station with the primary objective to study and discuss projects underway and to give consideration and suggestions for improving the long-term program of research there. At their first conference in 1928, 19 state and USDA personnel were represented. Several committees were formed to consider the various phases of range livestock investigations. The results of the discussion by the committee appointed on beef cattle investigations was a recommendation for the establishment of a project to measure and increase the individual performance of beef cattle with the following objectives: 1) to measure the efficiency with which individual cattle produce beef, 2) to discover reliable external manifestations of feeder cattle capacity for efficient weight gains with maximum percentages of high quality beef, and 3) to develop fertile strains of beef cattle with maximum efficiency in production of a high percentage of edible beef.

Early research at the USDA station at Beltsville, MD and the Minnesota station demonstrated clearly that cattle vary in their ability to grow, in feed efficiency and in quality of the final product. On the premise that these observed differences were hereditary, at least in part, preliminary proposals were made for record of performance (ROP) procedures. Black (2) reported the results of a questionnaire sent to 48 state agricultural experiment stations in 1936 seeking information on birth weight, gains, efficiency of feed utilization, etc. Only five stations reported having any definite breeding projects with cattle. State experiment stations doing some research prior to WW II were Arkansas, California, Colorado, Georgia, Minnesota, Montana, New Mexico, Texas and perhaps a few others (13).

In 1946, Congress passed the Research and Marketing Act which provided for cooperative regional projects on agricultural problems. As a result, three regional beef cattle breeding projects were organized and functioning by 1948. Within 10 years, 35 state experiment stations and 6 federal stations had active projects. Each federal

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station operated cooperatively with the state in which located. It was the Fed-State cooperative effort at the Front Royal, VA station that stimulated the development of the first state performance testing program for beef cattle (in VA) in 1954.

LATER RESEARCH ON HERITABILITY, GENETIC AND PHENOTYPIC CORRELATIONS, ETC.

Knapp and Nordskog (7) presented the first estimates of h^2 of quantitative traits in beef cattle, based on data collected at the US Range Livestock Experiment Station at Miles City, MT. Those estimates were positive, ranging from small to moderate for birth and weaning weights to extremely high h^2's for postweaning feedlot gain, feed efficiency and final weight. Estimates for weaning conformation score, slaughter grade, carcass grade and ribeye area were all above 50%. Early studies by Winters and McMahon (15) and Knapp and Baker (5) indicated that rate and efficiency of gain were highly correlated (70 to 80%) in beef cattle. This generalization has since been confirmed by a number of workers (14). Since those original estimates, numerous studies have been conducted to estimate the heritability of the most economically important traits in beef cattle (5, 11, 14). Most research has been directed toward developing objective measures of evaluating beef cattle. The combined knowledge gained from the numerous estimates enabled animal scientists to develop statistical formulae for estimating breeding values of animals with a relatively high degree of accuracy.

With the recognition of the importance of cow productivity as measured by the weight and quality of calves at weaning time, interests in gaining information on preweaning performance also developed. Koger and Knox (8) found that performance of brood cows, as measured by weight and conformation score of their calves, was a repeatable characteristic and that the average performance of a herd could be improved by culling out those cows with poor records on the basis of their first calf. Their findings have also been confirmed in many other studies. It now appears that, under most conditions, repeatability of cow performance is in the neighborhood of .4 to .5 (14). Recognizing that there are many environmental factors that influence the weaning weights of calves, as well as the repeatability of this and other traits, much effort went into research during the 50's and 60's related to such environmental factors as age of dam, sex of calf, season of birth, etc., on performance of calves. It soon became apparent that adjustments were needed if maximum selection accuracy was to be obtained (10).

With the new found knowledge that 1) beef cattle differ in their inherent productivity, 2) that these differences are fairly highly heritable, 3) that rate and efficiency of gain are rather highly correlated, and 4) that brood cow performance is important to the total economy of beef production and that it is a repeatable trait, a great impetus was provided to develop efficient and effective performance testing programs (9, 14). At first, the programs differed considerably in detail, but most of them provided for evaluating weight and conformation of calves at weaning and again as yearlings after a period in a feedlot or on pasture. By the end of the 1950's or early 1960's, some 35 states (all states with a sizable beef cattle population) had established some kind of a statewide performance testing program for the benefit of both purebred and commercial producers.

DEVELOPMENT OF PERFORMANCE TESTING ORGANIZATIONS

The VA Beef Cattle Improvement Association (BCIA) was organized on January 26, 1955 to sponsor the performance testing of beef cattle in VA. The Performance Registry International (PRI) was organized in May of the same year by a small group of cattle breeders in Texas and Oklahoma. These two pioneer organizations encour-

aged and assisted the organization and development of numerous other state and breed association programs. Both organizations held annual meetings, conducted educational and promotional programs, and encouraged broad attendance. At the 2nd Annual Meeting of PRI in Louisville, KY, in 1957, I was asked to present the Virginia system of performance testing. This was one of many such presentations to state and breed organizations during the 1950's and 1960's. The major breakthrough for PRI was at the Fourth Annual Meeting (1959) in Miles City, MT. Attended by 40 cattlemen from Canada and 256 from 29 states and D. C., the membership voted overwhelmingly to employ a full-time executive secretary. The group also approved the acceptance of weight records from state BCIA's. A similar invitation went out to all beef breed associations. PRI headquarters was moved from Canyon, Texas to Denver, Colorado. By 1960 more than 20 state associations had affiliated with PRI (1). Unfortunately, most breed associations "drug their feet" and became affiliated, grudgingly, only after considerable pressure from their more progressive members.

The fifth annual convention of PRI was held in Charlottesville, VA, in June, 1960. It was at that meeting that representatives from the affiliated state BCIA's became the directing board of the international organization. That was a step of great significance in the history of the use of scientific standards for the improvement of beef cattle. Registration was held in the Thomas Jefferson Inn where the first beef cattle improvement association in the U.S. had been organized 5 1/2 years earlier. At that conference Mr. Charles E. Bell, Jr., (1), then Chief of Livestock Extension for USDA, stated that "performance testing is now generally accepted as an essential tool in a sound beef cattle improvement program. Techniques and procedures currently in use have been developed as a result of extensive research studies and experience gained during the past 25 years." State and federal extension workers interpreted the research results in terms of applied practices and served as liaison between the research staff and the people they served, working with cattle producers in developing practical methods for securing and using performance information. Through the cooperation of research and extension personnel in the states, on-the-farm performance testing programs were developed independently in many states. Although the basic procedures were essentially the same, the programs varied considerably with respect to adjustment factors, standards of measurement, and methods of computing and reporting performance data (11).

One of the major efforts of PRI was to recommend uniform procedures in adjusting performance data and reporting for the convenience of cattlemen throughout the nation. Leaders of the beef cattle industry relied heavily on research and extension personnel from land grant college and universities and USDA in the early stages of development. Progress came slow at first because of scepticism and misinterpretation in the minds of many producers. However, by 1960, acceptance of the program was beginning to spread rapidly. A 1959 survey revealed that over 3,000 herds representing approximately 200,000 brood cows were enrolled in state performance testing programs (1). The late Professor John Knox, New Mexico State University, stated in 1960 that "Performance Registry International has done more than any other single agency to bring the advantages of performance testing to the attention of stockmen in a forceful manner. Much has been accomplished along this line, but much is yet to be done."

It was recognized early that if performance testing was to be widespread throughout the industry that the initiative would have to come from the cattlemen themselves because of the limitation on extension resources for servicing the program, that producer organizations would be required to provide services needed for an expanded program so that extension workers would be free to carry on only the educational aspects. In anticipation of this need, Virginia organized the first state beef cattle improvement association in the U.S. in January 1955 (1). The pattern set by

Virginia was soon followed by other states so that by the early 1970's every state with a sizable beef cattle population had a similar program.

BEEF IMPROVEMENT FEDERATION

The Beef Improvement Federation (BIF) was organized in 1968 to extend and further improve the numerous state and breed association programs of performance testing (6). The major difference between BIF and PRI is that the major emphasis by BIF has been on the establishment of uniform procedures for measuring and recording data to permit more widespread use of the results in animal evaluation and selection, whereas PRI was also a data gathering and processing organization. With time, data processing has shifted from PRI and the State BCIA's to the national breed associations.

Two areas of interest have evolved in performance testing from the mid 50's, 1) on-farm or ranch testing and 2) the testing of young bulls at central test stations. In both situations, effective programs require that animals being compared be given equal opportunity to perform under uniform feeding and management conditions. Preweaning and postweaning growth and development are usually handled as two separate phases in line with the general division of the commercial beef enterprise in the U.S.

Preweaning phase. Calves are weighed prior to weaning (160-250 days) and their weights are adjusted for age of dam, sex of calf and to 205-days of age and used to evaluate differences in maternal performance and growth potential. In computing preweaning average daily gains (ADG) birth weight is subtracted from weaning weight and the difference divided by the calf's age in days. The adjusted ADG is multiplied by 205 and added to birth weight to obtain the adjusted 205-day weight.

Postweaning phase. Postweaning performance is measured in terms of ADG from weaning to 12, 15 or 18 months, along with the adjusted weight at each of these periods. Yearling weights are important because of their high genetic association with efficiency of gain and yield of retail cuts. Yearling weights are reported separately for each sex. The most commonly used comparative weights in the U.S. are weaning weights for females and 365-day weights for males.

The Central Test Station concept originated early in the development of performance testing, as a way of comparing performance of cattle originating in different environments. Young bulls, brought in from breeders' herds, are given a short adjustment period prior to starting the official test. They are then fed a uniform ration under uniform management for at least 140 days and their growth performance evaluated. Most central test stations require that herds consigning bulls must have an on-farm or ranch testing program for preweaning performance, with records being processed through a State BCIA or a national breed association. The consigned bulls must have met minimum requirements for entry. Most test stations hold sales (public auction) in which only bulls meeting minimum standards are eligible for sale. In addition to test gains and adjusted yearling weights, some sales require a minimum frame size, degree of muscling, scrotal circumference, conformation score, and soundness evaluations. To aid buyers and breeders in making comparisons, many test stations now express adjusted weaning weights, test gains and adjusted yearling weights as ratios within contemporary groups.

NATIONAL SIRE EVALUATION

A more recent development and a direct outgrowth of 25 years of performance testing is the national sire evaluation programs. The leader of this development in the U.S. beef industry has been the American Simmental Association (ASA), which has

published a national sire summary for most of its ten years of existence. Most other breed associations have followed suit and now publish some kind of an annual sire summary for the benefit of their members. These summaries provide expected breeding values (EBV) for the most important economic traits. Since a major portion of any genetic change comes through the sire, this information becomes very critical in the breeder's selection of herd sires. Dick Tetherow, Chairman of the ASA Performance Committee, states in the preface to the 1982 National Simmental Sire Summary, "Total performance includes many areas of economic importance. We have recorded birth weights, calving ease, weaning weights, yearling weights, daughters calving ease, daughters first calf weaning weights, and various carcass traits. . . We now make reliable predictions for the performance of progeny using the estimated breeding value concept. A breeder can now more easily assess the interaction of different traits in his own herd relative to the national average." The number of performance records analyzed by the ASA has doubled in the last four years, to the present rate of almost a half million.

CONCLUSION

Although slow in developing during the early years of the 50's and 60's, performance and progeny testing of beef breeding stock in the U.S. has moved forward rapidly in recent years and is now having a major impact on the beef industry of my country. More than 50 organizations now provide beef cattle improvement programs. It has been most gratifying, but at times frustrating, to watch this tremendous growth since I developed the first statewide on-farm testing program and helped organize the first State BCIA in the U.S. in 1955. Even with this tremendous thrust forward, we are only reaching a relatively small segment of the total beef cattle industry and I look forward to even greater strides with the resulting improvement in beef production during the remainder of this century.

SUMMARY

Early research at Beltsville, Minnesota, Montana and New Mexico established premises on which performance testing was developed. Marketing and Research Act (1946) provided for regional research. Three regional beef breeding projects were functioning by 1948. Cooperative research at 35 state and 6 federal stations produced the base for sound testing programs. Since 1946, studies of heritability of traits, environmental factors that influence performance, and statistical procedures making comparisons more meaningful have enabled development of viable, efficient programs at state and national levels. Starting with the Virginia program in 1954, there were 35 state programs by the early 1960's. Performance Registry International (1955) and Beef Improvement Federation, since 1968, provided a national forum for bringing about uniformity in state and national procedures. More than 50 organizations now provide improvement programs for the beef cattle industry. Although slow in developing, performance and progeny testing of beef breeding stock have moved forward rapidly in recent years and is now having a major impact on our beef industry. A more recent development is the national beef sire evaluation programs, which provide expected breeding values for most important traits.

RESUMEN

Las Primeras investigaciones en Beltsville, Minnesota, Montana, y New Mexico establecieron las premisas sobre las cuales se desarrolló el uso de pruebas de produccion. Marketing and Research Act (1946) psoporcionó el dinero para los

investigaciones regionales. Tres proyectos regionales de la cria de ganado vacuno de carne ya funcionaban en 1948. Investigaciones cooperativos en 6 estaciones federales y en 35 de los estados produjeron la base para programas solidas de evaluacion. Desde 1946, los estudios de la heredabilidad de caracteristicas, factores ambientales que influyen capacidad, y los procedimientos estadisticos que hacen más significativos las comparaciones han hecho posibles el desarrollo de programas viables y eficientes en niveles federales y de los estados. Virginia tenía el primer programa en 1954 y en la primera parte de la decada de 1960 había 35 estados con programas. Performance Registry International (1955) y Beef Improvement Federation, desde 1968, ofrecieron un faro para realizar uniformidad en los procedimientos federales y de los estados. Más de 50 organizaciones ahora ofrecen programas de mejoramiento para la cría de ganado vacuno de carne. Aunque se desarrolló lentamente, la evaluación de capacidad y progenie de ganado ha avanyado rapidamente en los años recientes y ahora influye mucho nuestra industria de criar ganado vacuno de carne. Un desarrollo más reciente es los programas nacionales de la evaluacion de los toros, los cuales proveen los valores esperados de cría para la mayor porte de las caracteristicas.

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