DEVELOPMENT OF A DUAL-PURPOSE CATTLE COMPOSITE IN THE TROPICS
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SUMMARY

This paper provides a detailed summary of one effort to develop a new breed of cattle from a composite in eastern Africa. In the late 1950s the Tanzania Ministry of Agriculture, after years of marginal results with straight exotic and indigenous cattle improvement, started a program to develop a dual-purpose zebu-type animal for the peasant cattle owner, from a foundation including the Tanzania Shorthorned Zebu, Boran, Ankole, Red Sindhi, Sahiwal, and mixed European breeding, in varying levels. Historic and contemporary information is presented on breed development strategies; growth, reproduction, lactation, and carcass performance; and breeding stock distribution. Regularly monitored records indicate that in general the Mpwapwa, as the composite was named, increased weight by 25% to 30%, and milk yield by 250% to 350% as compared to indigenous stock under similar management. The paper discusses the more important non-biological factors which influenced genetic progress, field testing, and breed acceptance.

INTRODUCTION AND HISTORY

Numerous efforts have been initiated to develop new breeds or strains of cattle for the tropics, with varying degrees of success (Amble and Jain, 1965; Anon, 1972; Mahadevan, 1966). During the early part of this century, efforts at genetic improvement among cattle in Tanzania was approached largely with the aim of grading up using imported exotic germplasm, usually from the British Isles. In most climatic zones the results were less than acceptable. French (1940) makes reference to a "constitutional failure" syndrome and illustrations show the classic body conformation features of animals under temperature and nutritional stress.

The policy pendulum then swung toward an approach which focused on making genetic improvement through selection within the indigenous small shorthorned zebu population. One large-scale program involved screening a high turn-over population of cattle from about eight defined regional indigenous populations in Tanzania at a commercial ranch (Macfarlane, 1971). Although some baseline information was obtained the program never really got off the ground as a decision was made to convert the ranch to a wholly commercial concern.

Subsequently, efforts were made to utilize two tropically adapted and semi-improved breeds from the Indian subcontinent, the Red Sindhi and the Sahiwal. Importations were made of both breeds and both were used in upgrading programs. After several years of work in East Africa with both breeds, government officials decided to eliminate duplicative efforts; Tanzania would focus on the Red Sindhi and Kenya would utilize and develop the Sahiwal.

Establishment of Foundation Herd

The remnants from breeding work since the early 1930s had resulted in a gene pool of a mixed Indo/African zebu type cattle some of which contained small amounts of European breeding. In 1958 a formal development plan including performance testing, selection, recordkeeping, mating system, and...
progeny testing guidelines was completed and the project initiated. The stated purpose of the project was to develop a dual-purpose zebu type animal for the peasant cattle owners. The two major objectives include:

- To develop a breed of cattle whose cows would regularly yield about 2,270 kg of good quality milk per year in the general environmental conditions of Tanzania, without dependence on large amounts of concentrated foods, and whose steers would yield good quality beef carcasses of about 230 kg dressed carcass weight at less than 4 years of age from unimproved pasture.

- To determine heritabilities (genetic parameters) of characteristics of dual-purpose cattle under Tanzanian conditions.

An analysis of pedigree information indicated that the average genetic composition of the foundation composite was approximately 35% Red Sindhi, 20% Sahiwal, 20% Tanzania Shorthorned Zebu, 10% Boran, 10% European (primarily Ayrshire), and 5% Ankole. The choice foundation breeds was pragmatic, using the available gene pool of about 300 cows. Such choices are not always clear as suggested by Trail (1981). Gregory and Cundiff (1980) show evidence of the advantages in maximizing the number of breeds that contribute to a composite so long as each contributes to the additive genetic composition most appropriate for the feed and climatic environment in which the composite is expected to perform. From the beginning there was no preconceived conformation nor color in mind beyond that which defined itself as a result of selection solely on performance.

Program Eras

During the more than 25 years since the breed development program officially began at least seven research officers have been in charge. From about 1958 to 1965 the program received strong leadership and technical guidance in the progeny testing, recordkeeping, and selection phases. In about 1965 a combination of adverse circumstances brought breed development progress to a halt. Johne's Disease restrictions and eradication procedures, and a senior staff shortage resulted in a return to uncontrolled multiplication as it was prior to 1958. Early in 1971 a small group of the research and administration personnel set the course once again and reaffirmed the need for an improved zebu dual-purpose type animal for the arid, semiarid, and humid areas of Tanzania. A return was made to controlled breeding, within-herd sire selection, and performance testing and progeny testing as advocated in the original protocol. Beginning in 1974, systematic efforts were begun to develop, in addition to the dual-purpose type, two specialized lines for milk and for beef, utilizing the dual-purpose population as a base. The dairy line was established to utilize in a positive way the females resulting from the earlier period when a number of dual-purpose Mpwapwa cows were mated to exotic dairy bulls. The dairy line contains roughly 35% *B. taurus* germplasm and was established by backcrossing F1 cows to the Mpwapwa, followed by inter se matings. The beef line was established by utilizing dual-purpose cows of good disposition that had been culled from the milking herd. Initially cows were mated to beefier dual-purpose bulls and later to Mpwapwa beef bulls derived from within the beef line. During 1977 a headquarters directive axed the beef program. Currently, the breeding program continues to see new challenges in staffing, institutional structure, and opportunities to improve lactational performance, predictability of performance, and field testing.
BREEDING STRATEGIES

Prior to 1958 little selection had been implemented because of the perceived need to multiply foundation material. Once the breeding program commenced the need for multiplication continued to limit selection pressure on the female side but an intensive program of progeny testing and selection among bulls was introduced. During the early stages of breed development it became apparent that the generally disappointing lactation performance of the Red Sindhi-based strains had caused selection to favor the Sahiwal-based strains of which there were fewer.

Recording System

Prior to the beginning of this project, a universal recording system was developed for all government farms, research centers, and multiplication units. This system included monthly returns of births, deaths, and transfers; and pedigree and performance information. The recording system provided a very sound support structure for the breeding program and selection decisions based on contemporary ratings.

Selection Practices

The primary selection criteria focused on milk production and growth. Both individual performance and progeny performance were included and selection was based on contemporary ratings. Over the years the selection program was implemented with varying degrees of competence.

Calves were hand raised through a dairy calf rearing unit and gradually introduced to supplemental feed and paddock grazing. Initial selection decisions were based primarily on 36-week and 72-week weights and dam milk production level. Selection pressure was much greater among the males. Young bulls were selected based upon their weight-for-age and dam milk production record. According to project design, most heifers were to be bred and enter the milking herd to produce lactation records. The lactation records were used to make selection decisions on individual performance and to support decisions on test-bull merit. A minimum of 10 completed first lactation records per sire was considered adequate for first stage decisions. Young bulls, not selected to be tested as herd sires were maintained as bulls and distributed as breeding stock or were castrated and used to provide carcass data. All males contributed progeny growth data up to at least 156 weeks of age. The program design allowed females to miss calving in not more than two consecutive calving seasons. Failure to conceive and calve usually resulted in culling from the program.

Mating Program

Natural mating was used except during the latter 1960s and early 1970s when a significant level of artificial insemination was practiced. During the first 15 years, single sire herds or hand mating was used. More recently, multi-sire herds were used. This was done to decrease the time required to turn generations. Highly selected young sires were used in these random mating herds. The mating herds were composed of cows of a balanced strata of age and lactation status categories. Sire use was designed to tie mating seasons together. During the period of time during which AI was used most
heavily, a significant number of straightbred Mpwapwa cows were mated to European dairy sires. This, coupled by inaccuracies in recording service sire breed, resulted in the loss of about one generation in the progression toward reaching a stabilized and relatively reliable breeding population.

ANIMAL PERFORMANCE RESULTS

This section provides descriptive statistics characterizing the breed for growth and development, reproduction, lactation, and fattening. Results are reported in ranges because of the variable management environments under which the data were collected. The climatic environment at Mpwapwa is tropical semiarid; the area receives between 650 mm and 750 mm during the December to May rains.

Growth and Development

The average birth weight of Mpwapwa calves, based on several thousand observations, was between 21 kg and 23 kg which is lower than that reported for the Boran (Getz, Kifaro, and Msuya, 1975) and Sahiwal (Trail and Gregory, 1981) but slightly higher than birth weights of straightbred Tanzania Short-horned Zebu (Getz, Kifaro, and Msuya, 1975). At about 75 days of age the calves were weaned. The dual-purpose calves averaged from 52 kg to 56 kg at that age which reflects an average daily gain of roughly 0.43 kg during early life.

Weight at 36 weeks of age reflected growth under pasture conditions where there were yearly variations in supplemental feeding practices, dipping schedules, and intensity of care. Average weight at this age ranged from 100 kg to 110 kg; an average daily gain of 0.29 kg per day since weaning at 75 days of age. Dual-purpose Mpwapwa calves under a single-suckling management system ranged from 165 kg to 170 kg at 224 days of age when weaned.

Because of the influence of the wet-dry season complex on vegetative quality, 72-week weights were influenced by season of birth. Calves at this age would have weathered portions of either one or two dry seasons. Weights ranged from 160 kg to 170 kg for a daily gain of 0.24 kg per day since 36 weeks of age. The average daily gain from birth to 72 weeks averaged approximately 0.28 kg per day.

Reproduction

Age at first calving was influenced by the genetic potential for growth and achieving puberty; and by the feeding program. To enter the mating herd, heifers had to have achieved a weight of 220 kg to 225 kg which represented between 55% and 60% of their mature body weight. Evidence presented by Macfarlane and Worrall (1970) indicated this to be close to optimum for B. indicus heifers. Most Mpwapwa heifers were between 27 and 33 months of age at first mating. Age at first calving was between 36 and 42 months of age. A limited number of associated feeding studies indicated that the genetic potential was available to lower this age if energy level during the growing phase were increased. Economic considerations often influenced the feasibility of doing this, however.
Lactation

Milk yield and lactation length among all first lactation heifers averaged between 650 kg and 750 kg which is relatively low and reflects low daily yields and, most importantly, short duration lactations. Milk production was recorded daily. There was a high degree of variability in first lactation yields. Over the course of the program the amount of selection pressure applied varied considerably. At various stages in the program it was not uncommon for 40% to 60% of those culled to have had lactations of less than 84 days, and 20% to 30% with lactations lasting less than 28 days.

Among cows retained in the breeding herd and being representative of the genetic potential of the composite, the average first, second, and third lactation yields averaged from 1,200 kg to 1,530 kg, 1,425 kg to 1,675 kg, and 1,475 kg to 1,800 kg, respectively. Recent studies of the genetic parameters associated with milk production in the Mwapwa herd indicated heritabilities in the moderate range (Kiwuwa and Kyomo, 1971; D. Mpiri, personal communication).

Finishing and Fattening

Implementation of the steer progeny tests was erratic. Some testing was done at Mwapwa, and some done in cooperation with a government ranch in the district. For the most part the finishing and fattening occurred on native and improved perennial pasture alone. Annual rainfall at the ranch was from 400 mm to 600 mm per year. Annual daily weight gain of Mwapwa steers between one and four years of age ranged from 0.26 kg to 0.33 kg. This was equal to or slightly better than contemporary Boran steers. Interestingly during the five prime grazing months, average daily gain was between 0.72 and 0.79 on grass alone. Carcass information was also collected. The following unadjusted mean values from several sample groups serve to characterize the breed in regard to carcass merit: live weight, 450 kg; warm carcass weight, 243 kg; 10th rib fat, .73 cm; 10th rib eye area, 60 cm²; carcass weight per day of age, .167 kg; carcass lean, 67%; carcass fat, 15%; carcass bone, 18%. Procedures for estimating carcass composition were as suggested by Ledger and Hutchinson (1962). The mean weight of carcass exceeded the level (230 kg) stated in the program objectives.

Distribution and Merchandizing

The distribution and merchandizing policy had a major influence on the rate of genetic progress and on the reputation of the breed. At times relatively large numbers of bred heifers were distributed to farmers rather than being used as replacements for the base herd. Assuming the selection program was effective in identifying improved sires and dams, then the young heifers were the best genetic material available. Further, distribution policy did not reflect the fact there existed considerable variation in lactation performance among heifers. This seriously impacted on the reputation of the breed and program effort. Because of early demand distribution of bulls was at times taken too casually which resulted in the dissemination of less than meritorious germplasm.
CONCLUSIONS

The results of this project aimed at developing a dual-purpose zebu type cattle based on a composite foundation have been mixed. A productive breed was developed; yet perhaps not as productive as could have been at this point in time. To a degree the effort, because of its long-term nature, continues to be overtaken by events (A. M. Macha, personal communication).

REFERENCES


