Summary

The assumed purpose of breed and crossbreeding evaluation efforts is to allow and encourage optimum use of animal germplasm to improve efficiency of livestock production under the many diverse world production-marketing environments. This requires clear definition of production efficiency and of the effects of alternative genetic changes in performance traits on both output value and input cost under defined production-marketing systems. Prediction of optimum breed use in production systems (ranging from pure breeds to specific or rotation crossbreeding to formation of new composite breeds) requires knowledge of breed differences and crossbreeding heterosis and of any important deviations from expectations for only average and dominant gene effects. This information should include individual, maternal and possible paternal effects on such traits as reproduction, viability, growth, body composition and female production of milk, wool or eggs, and how these are affected by environmental differences. Experimental approaches for obtaining the needed estimates of breed and crossbreeding parameters are described, with examples from the major classes of livestock. In poultry and swine, central tests can be used to characterize available commercial stocks, but designed crossing experiments are needed to fully estimate the parameters required to predict the optimum choices of breeds and system of breeding. In some ruminant species, and especially in dairy cattle, much of the needed information on breed, heterosis and even deviations of interse mated crossbred populations from additive dominance expectations, can be obtained from well planned field records on animals of known pedigree. However, more complete and critical evaluation of exotic breeds and their crosses with indigenous breeds can be accomplished in designed experiments, including the combination of either 1) indigenous breeds, F_1 reciprocal backcrosses, F_2, F_3, and for maternal heterosis, F_1 crosses with a common unrelated breed of sire, or 2) a diallel design, including reciprocal three-breed crosses to measure breed of female performance and maternal heterosis effects, with extension to matings of each set of F_1 and F_2 and two backcross females with a common breed of sire to measure effect of exotic breed fraction, independent of heterosis, and any deviations from additive/dominance expectations. Experiments directly comparing multi-breed composites (F_3 + generations) with constituent breed crosses and parental purebreds provide the most complete evaluation for the role of composites relative to specific or rotation crossbreeding, when the required proportion of industry purebred matings is also considered.