Evaluation of breeds and crosses of domestic animals

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MANUAL FOR EVALUATION OF BREEDS AND CROSSES OF DOMESTIC ANIMALS

INTRODUCTION

The purpose of this manual is to suggest practical guidelines for evaluating the usefulness of available breeds or strains of livestock species and their crosses under diverse world production-marketing environments. For many years much attention has been focussed on performance comparisons among breeds and their crosses (see indexes of Animal Breeding Abstracts). This emphasis is justified because genetic differences among breeds or strains are large relative to genetic variation within breeds, (e.g., Cundiff et al., 1986). These differences are an important potential source of genetic improvement in the efficiency of human food production from livestock through 1) expansion of superior breeds, 2) gains in performance from complementary breed effects and heterosis in crossbreeding, 3) development of superior new breeds from selected combinations of several breeds, and 4) preservation of potentially useful genetic stocks that are in danger of extinction.

The enormous number and variety of local breeds and strains of each livestock species (Phillips et al., 1945; Cheng, 1984; OAU, 1985; FAO, 1986; Mason, 1988; Maule, 1989; Crawford, 1990) has developed over very long periods of time. This diversity has developed partly from both natural and artificial selection for performance (Mason, 1973) under diverse world production-marketing environments (Phillips, 1961), and partly from cumulative random changes in gene frequency in relatively small local populations (Lush, 1946; Wright, 1948).

Patterns of human and accompanying migrations have limited the sampling of potentially useful breeds available in any given geographical region, (Stonaker, 1961), and still do, in spite of recent improvements in world-wide communication and transportation. Animal health and trade restrictions also continue to be serious constraints on movement of livestock between countries (CAST, 1984). However, improvements in diagnostic tests for safe movement of animals or frozen semen and embryos are gradually easing these limitations (O.I.E. 1985).

The other serious limitation on effective current and future use of world animal genetic resources is the lack of adequate information on relative performance abilities of alternative genetic stocks under the variety of existing and potential major world production-marketing environments (ecosystems). Feasible improvements in poor production environments also need to be evaluated to allow optimum use of genetic potential (Hammond, 1947, 1949; Dickerson, 1970; Donald, 1973). The problem is how to identify those breeds, wherever located, that are best suited to future needs of each region, and to learn how they may be used most efficiently in producing animal products (Lee and Phillips, 1948; Phillips, 1967; Dickerson, 1969, 1973; Duarte, 1989; Smith, 1989).

Most efficient use of world-wide animal genetic resources in any given country or region would seem to require:

1. Careful definition of performance objectives for the species, considering the economic effects of both production costs and market prices expected under likely future production-marketing systems.

2. Identification and adequate sampling of the more promising indigenous and exotic breeds, based upon existing information.
3. Designing and conducting experiments to determine which breeds and methods of using them are likely to permit greatest gain in efficiency under the economically feasible production/marketing environments.
4. Implementing live or cryopreservation of any endangered genetic stocks shown to be of likely future value.