

Modern Breeding Programs for Animals.

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Modern breeding programs for animals have diverged considerably over the last fifty years. An increasing number of large corporate, or land-grant, breeding programs involve a heavily statistical method that selects animals for production by measuring performance. In the private sector this has also become more common, especially in main-stream breeds that are selected for commercial utility. In contrast to these are some programs that are generally in the private sector and involve more the “eye of the breeder” methods. Some of these are based on conformation and eye appeal, others are characterized by an “enlightened detachment” that notices and values disease resistance and environmental adaptation. Yet other programs are targeted to conservation and expansion of rare genetic resources with little current selection for either fancier or production traits. A few programs are targeted at discovering and then characterizing rare, adapted genetic resources.

Why we have various types of breeds is important to consider. Each of these has something different to offer agriculture. The most familiar breeds are the standardized breeds. These include things like Holsteins, Angus, Thoroughbreds, and have been carefully documented and breed as closed populations for years. In addition to these are the industrialized stocks – think chickens and swine – that are incredibly productive in their somewhat narrow production environment. Finally are the landraces, which are more variable than the standardized breeds, and usually exquisitely adapted to their marginal environments. This group is where the greatest challenges of definition and maintenance occur, because they are a product of a specific environment. Their adaptation is essential for future systems.

How to select, manage, use, and conserve these various types of breeds is no easy issue, and to date the public sector has done this more poorly than the private sector. Part of the problem is the definition of balance in an animal. Most statistical methods select for extremes, so that balance is elusive. Once balance is defined, it is possible to select for it.

Selection, by definition, takes a population in a direction. This has consequences for populations, because the goal of the game is change. Change can be good (and often has been) but can also eliminate past variants that might have future applicability. An example is single trait selection, so that carcasses “fits the box” of the modern meat processing industry. Much is left out when all cattle (or sheep) are required to be a narrow range of sizes.

Selection by means of the modern statistically based programs is especially powerful, and in that regard can be especially dangerous. This gets quickly to an “improvement” mentality – improvement means change, and usually this means that outliers in the population are selected for reproduction. Academic breeders and many agriculturalists have a hard time knowing when some animal population is good enough – and when it meets the requirements of the production system adequately to not really need much more change.

An example is a sheep grading example. Sheep are graded at markets to determine relative value. Several years ago I had a group of students that wanted to learn how to do this, so I arranged with the extension personnel to have the students grade some sheep. The extension expert went through, explained it all, and then emphasized that the market wanted 120 pound lambs. This was right before Easter, so I asked how much such lambs were bringing. The answer was \$1 per pound (this example sounds contrived, but is actually true...). \$120 lamb. I then asked what 80 pound lambs were bringing, because I knew that preEaster markets put a premium on lighter lambs. The answer was \$1.50. \$120 lamb. He then went on to further emphasize that we needed all the farmers to raise 120 pound lambs.

As a farmer (part time, for sure) I know it is much, much easier to raise an 80 pound lamb, especially for the same payout at the end. This example shows that the institutional mindset can ignore changing market dynamics – and if this mindset is responsible for breeding goals, then the whole system becomes suspect. The academicians can end up following the lead of the mainstream industry, rather than leading it.

Academic animal breeding also prefers simple answers to complex questions. This is an easy trap into which to fall. Biologic systems are complex, and the interactions of entire genomes with environments is complex indeed.

A few recent examples of simple solutions proposed for complex situations are ongoing programs to breed large, productive hair sheep. The private sector has already come up with the productive and functional Katahdin sheep, so inventing another one may not be all that high a priority.

The dairy cattle industry for years and years emphasized production, and not longevity. This has gotten us to a point that the longevity of the cows is so low that the herd is basically not sustainable from within – in the absence of assisted reproduction technologies such as embryo transfer and the like.

This mindset even affects “newer” targets for agriculture. Many of the reasonably well-informed advocates for grass-fed livestock are pushing a single breed, single shape, and single goal as “the” answer for grass based cattle systems. This glosses over a host of complex environmental interactions, and also relegates very good candidate breeds to continuing rarity (to the point of extinction for some) all because the “experts” have not ferreted out all the potential answers – some of which will certainly work better in certain environments than will some of the others.

The inescapable conclusion is that agricultural systems are complex – and indeed it is desirable for them to be complex) and a single answer is unlikely to fit all situations all that well. The best solutions are going to be tailored so specifically for regions, environments, and production goals that they simply will not be optimal for other situations.

In terms of breed conservation and use, an “investigatory” mindset is rare in North America. The general pattern is to import or otherwise identify a productive genetic resource, and then continue working on that. This is in contrast with the characterization and utilization of genetic resources in Latin America. The breeders and conservers there have a pattern of a local meeting generating a good deal of local excitement and engagement, and then a flurry of activity relating to discovery of genetic resources, then their characterization, and finally their conservation and use in production systems.

Some recent hotspots in the USA include the following issues.

Pineywoods cattle are an adapted local resource that has been in the Gulf Coast region for centuries. These are small, adapted, fertile cattle. The oldest one to calve was 31, which is very, very old for a productive cow! Currently attempts are ongoing to census the population in order to discover what has been lost, as well as what remains. The irony of attitudes among the public sector is highlighted by recent importation of the Colombian Romosinuano breed for detailed research, all the while neglecting to include the local and related Pineywoods and Florida Cracker cattle. This neglect only edges these resources closer to extinction before anyone knows if they have a role to play in rational modern animal production.

Navajo sheep have a long history of service to the Navajo nation under very harsh conditions. The sheep, through public programs, had nearly been eliminated by crossbreeding. The remnant has been saved largely through private or foundation action. This breed has regained importance as a mainstay of regional textile production and cultural identity.

Non industrial turkeys have recently seen an upsurge in numbers (up to a ten fold increase for some varieties in the last five years). This has been due to educational programs as well as to research coordinated by the American Livestock Breeds Conservancy in conjunction with Slow Foods, USA. The key to success was linking a traditional product to a specific market – giving a breed a specific job to do.

Similar efforts are underway with chickens. Chicken egg production is relatively easy as a nonindustrial endeavor. Several productive egg laying breeds still exist, and range-based producers have a variety of

choices. For broiler production this is not the case, although ALBC is coordinating research to try to identify nonindustrial meat birds that might satisfy the market.

One public institution that is providing leadership in breed conservation and documentation is Virginia State University. They have an ongoing project to identify, preserve semen, and document production characters of a variety of goat and hair sheep breeds.