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A Cattleman's View of Different Methods for Utilizing Heterosis

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Introduction

Crossbreeding advantages and disadvantages and crossbreeding systems are not new subjects in the United States beef industry. Crossbreeding has been in practice throughout my lifetime. It would be very difficult to locate a straight bred commercial cow herd in the midwest. Nevertheless, there are still misinterpretations and mistakes being made with crossbreeding methods.

It would be sage to say that a vast majority of producers made their first cross to gain breed complementarity. Straight bred cow herds were bred to a bull of a different breed, usually new breed, to gain the inherent trait advantage of that breed. This was also done to start an "up grading" program of that breed. This is not necessarily a mistake. However, full credit for advantages of the resulting F1 over straight breds, was normally given to the sire breed. Little credit, if any, was given to heterosis or the dam breed. This leads us to the common statement about several breeds introduced into the United States during the last quarter century. "The one half bloods are preferred but the three quarter bloods and higher are not as desirable." This could be true because of breed characteristics, too much of a good thing such as too big, or too lean, or because heterosis was decreasing as we moved toward purebred status, lower reproduction, less calf survival.

The two advantages of crossbreeding are heterosis and breed complementarity. If either is taken to extreme or ignored completely then mistakes can result. For example, we as breeders have been guilty of breeding cattle by pieces. With the use of crossbreeding and the ever increasing choice of breeds this possible mistake can be accomplished to greater extremes. A typical scenario would be the historical development of Cowboy Tom's Herd. Tom's extension agent told him years ago that his weaning weights were too low and his herd was in need of more milk. Cowboy Tom used a dairy breed to add milk. Tom then realized at the county fair that his calves were too small, so Tom added a large continental breed. A year later Tom's vet recommended a small breed for calving ease, and the sale barn owners suggested a heavy muscle breed for carcass merit, and the packer-buyer, later on, recommended yet another breed for marbling. As you can guess by now, Tom's herd today represents a typical industry problem of extreme variation. There is too much range in: carcass weight, fat cover, marbling, cow size, birth weights, fleshing ability, and on and on. This mongrelization is not the fault of crossbreeding even though it has often been blamed. It is the fault of single trait selection without a long term, sound, breeding program. Cattle should not be bred by impulse, by extremes, or in pieces, but as complete, optimal wholes, one generation after another. Cattle should be bred making moderate directional changes based on management ease and net profit

without giving up the whole.

On the other side of the coin, heterosis has been viewed as the magic cure. Crossbreds have been viewed as superior in everything from reproduction efficiency to consumer eating preference and that maximum heterosis should also be retained at any cost. This has led to some costly breeding management decisions, inefficient facility and pasture usage and the high probability that the breeder has become more lackadaisical with intrabreed genetic selections. Breeding cattle is like loading a computer, "garbage in, garbage out". A herd of straight breds was also maintained, with no heterosis advantage, so that maximum heterosis could be maintained in the main herd through the straight bred replacements. It was almost a subconscious belief that if maximum heterosis is not retained then no heterosis is second choice. For some reason a high percent of heterosis retention was not good. That, I feel, was a mistake and was the underlying problem with replacement females. How can F1 females be generated within the herd, or should they be purchased? My thought is simple, use F2 or F3 females or Fn and forget the straight herd producing F1's and don't worry if your herd is not retaining 100% heterosis. Regain instead a high percent heterosis and shift your goals to management ease and net profit. Research shows that weight marketed per cow exposed to breeding can be increased 15.5% in a continuous two breed crossbreeding systems (eight generations) and 20% in a three breed continuous program. It has to again be management of the whole.

One of the biggest mistakes I see in the use of crossbreeding is the use of terminal sires for rotational replacements. Operations will use a two or three breed rotation using maternal sires, check out the champion steer at the county fair, and next year a large terminal sire is in the pasture. The mistake has not yet been made. The mistake is made when the resulting replacement heifers are selected. This is still a common practice. It appears the herds that are large enough and manageable enough can very efficiently use a rotational - terminal - sire system. It is suggested to breed the young half of the cow herd to maternal bulls in rotation keeping size moderate and maintenance cost low, and breeding the oldest half of the cow herd to terminal sires and slaughter all progeny. Key points: 1) Select rotational sires for moderate size, or lose terminal advantage of a moderate cow (low maintenance) and big calf (production). 2) Select rotational sires for fitness traits or longevity. The longer cows stay in the herd, fewer replacements need to be generated, the more cows can be bred terminal, the more money the ranch makes. 3) Select terminal sires for growth and carcass traits while keeping calving ease suitable for mature cows.

There are some legitimate problems with rotational crossbreeding: 1) The composition of the breeds used is always changing. The last breed used accounts for 50% of each progeny, the next to last breed used 25% and so on. This in turn can cause variation or force the breeder to use very compatible breeds, thus giving up complementarity. 2) It is hard to adapt rotational crossbreeding systems in herds that require fewer than three to four bulls. In turn, about 55% of the cows in the United States are in herds of 100 head or smaller which involves 93% of the properties that run cows. 3) There are limitations to the use of rotational crossbreeding in large operations, 500 plus cows, using intense grazing practices or running cows in large multi sire groups unable to be sorted by breed cross. These limitations are even more rigid when these examples are self contained and producing their own replacements.

Research has shown that the use of composite populations can solve the management problems associated with rotational crossbreeding in small herds or large herds on an intense grazing system. After the introduction of composite bulls in a commercial operation it can be managed the same as a straight bred herd. However, a high degree of heterosis will be retained for longer than the normal life of the herd. For example, relative to an F1, which has 100% heterosis, a three breed composite will retain a minimum 65% heterosis, and a eight breed composite will maintain a minimum of 87% retained heterosis. This retention of heterosis plus the use of breed complementarity, which is limited in a rotational crossbreeding system, make the composite program look effective, usable, and simple. The commercial producer has the job of finding a germ plasm source or bull supplier, only once, so the words dependable, predictable, and comfortable can be used to describe the composite system when it's in operation. The commercial man when using a composite crossbreeding program can in summary: 1) Retain high levels of heterosis. 2) Simplify his management on a small or large scale. 3) Take advantage of breed differences. 4) Produce a uniform product generation after generation.

This summary has very clearly led Radakovich Cattle Company (RCC), to the formation of a composite breed. In the early 1980's, RCC felt that agriculture and specifically the cow-calf sector had entered an era of low inputs. RCC wanted to develop a composite for it's commercial clients that would keep production constant and lower inputs, particularly labor and replacement costs. RCC's goal was to produce a red, polled, moderate growth, maternal - rotational composite that would reduce costs and keep production constant. In 1985 RCC had a herd of registered polled and horned Hereford cattle. These cattle all carried at least 50% C.S.U. breeding through the old inbred Prospector line. The Prospector line had survived the severe inbreeding bottleneck and were noted for fitness, growth, and maternal characteristics. With the use of semen, RCC bred these females to polled, proven Barzona bulls. The Barzona breed was the key to achieving RCC's goal. The breed brought into the composite moderate production, with inherent disease and parasite resistance, fertility, and longevity. The F1 cross performed as expected. In 1989, the F1's were A.I.'d to older high accuracy Red Angus bulls. It was felt the Red Angus breed would keep production constant and add testicle size, muscle, and salability for the midwest market. And that has been successful. Today, RCC has a population of F1 females (1/2 Barzona - 1//2 Hereford) Barzona Hybrids, a population of F2 females (1/2 Red Angus - 1/4 Barzona - 1/4 Hereford) Barzona Reds. In 1992, RCC will cross their F1 and F2 populations and vice versa their F2 and F1 populations producing a (3/8 Barzona - 3/8 Hereford - 1/4 Red Angus) RCC Red. Future matings will be decided by need. RCC's philosophy is - if it isn't broke don't fix it. At the present time the need for change cannot be seen which is difficult for an animal breeder to accept, but that being the case, RCC will move generations very slow, thus keeping inbreeding low. If at some point change is needed, the composite is open ended and can be added to any time. More than likely an addition will be of another composite.

In conclusion, crossbreeding systems have been used extensively in the United States and for many reasons. The two advantages of crossbreeding are heterosis and breed complementarity. The use of composites takes advantage of both heterosis and breed complementarity while keeping the system as manageable as a straight bred herd. The last 50 years of composite usage and success in the swine industry should point out the potential composite populations have in the beef industry. RCC is committed to composites role in their

seedstock operation and confident of the increasing utilization of composites in the commercial beef cattle industry in the world.