Does **Embryo Transfer** Have an Effect?

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The first successful collection and transfer of cattle embryos occurred in 1951. It was not until the early 1970s, however, that nonsurgical procedures for embryo transfer (ET) converted the practice from a clinical technique to an on-farm one. That change and the discovery of methods for freezing and thawing bovine embryos markedly reduced the cost and increased the use of ET in the cattle industry.

The use of ET has been confined mainly to the purebred segment of the beef industry, and the Angus breed leads all others in the number of ET registrations. There has been a fivefold increase in the use of ET among Angus breeders over the past 15 years (see Table 1). However, the percentage of registered cattle derived from ET is still only a small proportion, 7.1%, of the 261,000 Angus cattle registered last year. In that respect, the effect of ET has been minimal.

There is no argument that the changes in ET that have occurred during the past 50 years have increased its use. However, the effect of ET on the purebred industry is debated often. The question most often posed is *does embryo transfer have an effect on genetic improvement?*

Superovulation, collection and transfer of embryos from superior cows should increase the rate of genetic improvement by increasing selection intensity. Likewise, increasing the number of offspring from a cow should provide more progeny information and increase the accuracy of selection.

There are problems with both of these concepts. First, superior cows are much harder to accurately identify than superior bulls. Cows, even cows with ET calves, have fewer progeny than bulls used in artificial insemination (AI) programs. Therefore, breeding values of cows are less accurate and more prone to change.

Table 1: Total registrations and registrations of Angus cattle born by embryo transfer (ET), 1984-1999

Year	Total reg.	ET reg.	% ET
1984	174,539	3,298	1.9
1985	156,150	4,206	2.7
1986	133,475	4,307	3.2
1987	141,239	5,105	3.6
1988	143,520	5,339	3.7
1989	156,697	5,850	3.7
1990	159,036	5,359	3.4
1991	166,769	6,073	3.6
1992	174,414	6,453	3.7
1993	193,401	6,965	3.6
1994	214,261	7,582	3.5
1995	224,710	9,242	4.1
1996	220,586	10,963	5.0
1997	239,476	13,564	5.7
1998	252,969	15,078	6.0
1999	260,907	18,456	7.1

Second, the performance of ET calves is masked by the maternal ability (good or bad) of the recipient female that raises the calf. Hence, performance data on ET calves is not credited to the performance evaluation of the donor cow. Therefore, even though a donor cow has more progeny, that data is not useful in calculating her expected progeny differences (EPDs) until the ET progeny have calves themselves. The bottom line, according to animal geneticists, is that identifying genetically superior cows is, at best, somewhat difficult to accomplish.

Contrary to the academic wisdom of geneticists, most breeders of purebred cattle argue that they *know* the best females in their herd and can choose successfully superior donor candidates. Are they right or wrong?

In theory they are wrong, but in a practical sense, they may be right. Most breeders choose donors based on a variety of qualities (EPDs, performance, pedigree, visual appraisal, marketability, etc.). In most cases, breeders — unlike geneticists — are not solely concerned with the rate of genetic improvement.

In support of the breeders' ability to identify superior donor cows, it should be noted that bulls that are the product of ET have had a significant effect on the purebred industry. Three of the top 10 sires in the Angus breed based on number of registrations in 1999 were ET calves themselves (see Table 2). Because the rate of ET among top-10 bulls (30%) is higher than the rate of ET used in the entire Angus breed (7%), it is obvious that ET has had a significant effect in producing at least some of the most-popular bulls, if not the bulls with the greatest genetic merit.

A survey of the proportion of Angus bulls in AI bull studs that are ET progeny also supports the concept that use of ET on selected donor cows is more likely to produce Angus bulls that are used widely (Table 3). When the birth status of the Angus sires advertised by four major AI studs was investigated, it revealed that 28% of the AI bulls at those studs were products of embryo transfer.

Angus bulls selected by AI companies are still more likely to have been natural calves than ET calves; however, the use of ET is certainly more highly represented among AI sires than among the general population of Angus cattle.

Both the ET representation among the 10 most popular Angus bulls and the proportion of Angus sires chosen by AI studs that are ET progeny point to the fact that breeders may be able to use ET to produce more-desirable bulls. Despite the pitfalls of identifying genetically superior cows, ET appears to work for producing progeny that are viewed as industry leaders by AI studs and purebred Angus breeders. Hence, ET does have an effect on the purebred beef industry.

While ET has affected genetic improvement, it's obvious the use of ET in purebred operations has served two purposes: to improve genetic selection and to multiply the number of cattle in a program, expanding the herd or meeting marketing demands.

Using ET to multiply the herd for expansion or marketing purposes is common. The opportunities for increasing genetic improvement in herds that use ET to multiply progeny numbers depend on the rearing and marketing strategy for the ET calves.

In herds that market all their ET bulls and heifers, the opportunity for improving the nucleus herd is lost. Conversely, if heifers raised in cooperator herds are returned to the nucleus herd to calve, their performance can be evaluated, and the superior females can be incorporated into the nucleus herd. Regardless of whether the purpose is genetic improvement, herd expansion or for marketing purposes, the use of ET is likely to increase.

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Table 2: Angus sires with the most registered progeny in 1999

Angus sire	Type of birth	Progeny registered
N-Bar Emulation EXT	Natural	7,798
TC Stockman 365	Natural	4,543
RR Scotchcap 9440	Natural	3,912
Krugerrand of Donamere 490	Natural	3,524
SAF Fame	Natural	3,112
VDAR Lucy's Boy	ET	2,986
Sitz Traveler 8180	Natural	2,787
Rito 9FB3 of 5H11 Fullback	ET	2,202
RR 9440 Scotchcap 1483	Natural	1,909
Leachman Right Time	ET	1,806

Table 3: Percentage of Angus sires in AI studs born by ET

AI company[a]	No. Angus sires[b]	% sires ET
ABS	69	23%
Alta Genetics	36	19%
Integrated Genetics	43	37%
Select Sires	27	37%

[a]Mention of commercial establishments is not intended to serve as an endorsement, nor is failure to mention a specific company an indication of lack of endorsement.

[b]This is the number of Angus sires presented in this year's semen sales catalogs from each company.