International Survey Results Regarding Selection Criteria, Economic and Technology Factors Important to Artificial Insemination Programs

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A survey was designed and administered by ReQuest to determine the position of internationally based artificial insemination (AI) organizations with respect to topics inherently vital to the industry. Countries included: Australia, Canada, France, Italy, Netherlands, New Zealand, United Kingdom and the United States (domestic survey). Some of the topics covered included international competition for Holstein sires, annual number of inquiries for potential bull dams and associated response rate, weightings and parameters (cutoff values) for genetic selection criteria on bull dams, maternal grandams, maternal grandsires, and sires of sons, and the importance of biotechnology to each organization's genetic program.

Survey participants were asked to list the countries in which Holstein sire purchases were made and the countries competing most directly with their organization for Holstein sire purchases. Most organizations indicated that a high percentage of sires are purchased from the United States or Canada. The other countries that round out the top 5 for Holstein sire purchases are the Netherlands, France and Germany. The list changes significantly when reviewing the countries competing for sire purchases. Although the United States is ranked highest for direct competition by many organizations, Japan and England are also cited frequently. New Zealand, Germany, and France round out the top six countries in this category.

The AI organizations were also asked to indicate the number of inquiries made on potential bull dams each year. About 25% of the respondents reported that over 1000 inquiries are made each year. Another 25% reported that between 600 and 800 inquiries are made annually. The remaining 50% reported 600 or fewer inquiries per year. The estimated average response rate to all inquiries is about 98%. Sixty-seven percent of the organizations reported visiting more than 500 dairy operations annually to inspect potential bull dams. The remaining 33% reported visiting fewer than 200 operations annually.

The following section of the survey summary addresses one of three areas:

a. the organizations' **weightings** for genetic selection criteria,
b. the organizations' **parameters** for genetic selection criteria,
c. the organizations' **phenotypic** selection criteria (reported as actual performance or score).

Each organization was requested to indicate their specific selection criteria for bull dams and maternal grandams in reference to the weightings and parameters used and the minimum level of performance required. For sires of sons and maternal grand sires, only weightings and parameters were necessary. Because of the differences from one country to the next in terms of measuring and evaluating potential candidates for addition to an organization's gene pool, no specific numbers are presented for each of the three areas. Indications for the degree or prevalence of specific trait emphasis are made where possible.

Most AI organizations specify weightings on pounds of milk, pounds of protein, pounds of fat, and type. For all of the organizations, pounds of protein is weighted at least as heavily as any other trait with some weightings as high as six times the next emphasized trait. Weightings for pounds of milk range from slightly positive to slightly negative. Unlike United States organizations, over half of the international AI organizations emphasize pounds of fat. The weightings, however, tend to be only slightly positive. No organizations emphasize fat %, and few place any weightings on MFP$ or economic indexes. Both protein% and type were either emphasized heavily or not emphasized at all.

As noted with U.S. AI organizations, the *parameters* established by international AI organizations are less numerous than the *weightings* placed on certain traits. Only two traits appear to be important enough to warrant cutoff values by nearly all AI organizations - protein % and pounds of protein. Cutoff values are occasionally placed on pounds of milk and type as well.

The importance of visually appraised traits to AI organizations is evident when reviewing the list of actual performance minimums for bull dams. Eighty percent of the organizations require a minimum classification score, ranging from 75 to 88; sixty percent also require a minimum udder score. Additional emphasized traits for bull dams are pounds of milk and protein %. For each trait, at least 40% of the AI organizations report a minimum level of performance.

Only 50% of the AI organizations include any criteria for maternal grandams under the genetic weightings, genetic parameters, and actual performance categories. Pounds of fat, pounds of protein, and type are the primary traits receiving weightings. The visually appraised traits are most frequently targeted in the actual performance category. Survey participants reported a minimum classification score for maternal grandams, ranging from 83 to 88, and minimums on udder composition and feet and legs as well.

Similar to the pattern of emphasized traits for maternal grandams, organizations place few specific weightings and parameters on sires of sons. Pounds of milk, pounds of protein, and type are the dominant traits receiving specific weightings. Sixty percent of the AI organizations emphasize pounds of protein at least as much as other traits; some organizations place weights on protein as large as six times those for other traits. Pounds of fat, fat %, and MFP$ generally receive little attention from survey participants.

Unlike the pattern observed with U.S. AI organizations, parameters or cutoffs for genetic selection criteria for sires of sons are extensive and are not limited to a few select traits. Although pounds of milk and pounds of protein are typically targeted by most AI organizations, other traits such as pounds of fat, fat %, type, protein %, and economic indexes also receive attention. Likewise, the traits receiving attention for maternal grandsires include pounds of protein, pounds of milk, protein %, economic indexes, and type with the emphasis placed on pounds of protein and economic indexes by nearly all organizations.

Biotechnological advances have had profound consequences for AI companies and have affected the methods used for selecting future candidates for genetic dissemination. A section of the survey addressed the importance of several technologies and dairy cattle traits to each participant's genetic program. The question of importance for each topic was divided into three subsections: importance of the topic to the organization's **current** genetic program, importance of the topic to the organization's **future** genetic program, and the importance of the topic for **research** with regards to genetic programs in general. A scale of 1 to 5 was used to determine each organization's position with 1 indicating no importance and a 5 indicating extreme importance.

Table I outlines the average response to each topic as well as the standard error of response. A large standard error signifies widely scattered opinions of importance while a smaller standard error is indicative of little reported variation in the level of importance between AI organizations. The topics receiving the highest average scores in terms of importance to **current** genetic programs are protein and linear traits. Though embryo transfer and milk price are ranked highly by U.S. organizations, neither is rated as more than moderately important by international groups. The topics receiving the lowest average scores in this category are cloning and transgenics, similar to what was reported by U.S. organizations. For importance to **future** genetic programs protein, linear traits, and Holstein Association USA TPI/CTPI remain among the highest scoring topics. Again, embryo transfer and milk price are conspicuously missing from the list of important subjects when compared to U.S. organizations.

The two Multiple Ovulation Embryo Transfer (MOET) schemes, adult MOET and juvenile MOET, are ranked lowest in this category by international organizations. When reviewing the **research potential** for each topic, DNA marker assisted selection and dairy manufacturing technology are ranked highly by each participating AI organization. Transgenics, economic indexes and milk pricing also tend to be favored as areas for further research. Classification scores, milk, and adult MOET are generally regarded as areas in which further research is not immediately necessary. For all three subsections (importance to current, future, and research) most topics generally received lower average scores and had larger standard errors when compared to the results of the U.S. AI organization survey.

Table II summarizes current and future use of various technologies by the survey participants. Currently, all AI organizations taking part in the survey use embryo transfer, and another 40% have incorporated DNA marker assisted selection into their genetic programs. However, only 20% of the AI organizations acknowledge the use of cloning in their current operation, and not one reports the use of transgenic biotechnology. Adult MOET is currently used in 60% of the AI organizations, but only 20% report using a juvenile MOET scheme. Insofar as future use of the technologies is concerned, embryo transfer and DNA marker assisted selection show the most promise. The use of at least one Multiple Ovulation Embryo Transfer (MOET) scheme is favored by less than half of the AI organizations. Though cloning was rated as a "maybe" for future use by U.S. organizations, about 60% of the international groups indicate that cloning will definitely be an integral part of their genetic program. Transgenics, a recipient of several high scores in term of research potential, is generally regarded as a "wait-and-see" technology. This is evident by the high percentage of AI organizations rating the technology as a "maybe" for future use.

Conclusions

Theoretical work is important to drive genetic progress. The implementation of research into field situations is the actual driving force of genetic progress. Techniques that are too costly, not able to be logistically implemented or are difficult to obtain public acceptance for have less impact in actual implementation and thus genetic progress. Staff members and dairy producers acceptance of techniques and procedures has a major impact on current genetic progress and will continue in the future.

Funding for this project was provided by the Wisconsin Milk Marketing Board.

International Version

Genetic Selection for Milk Composition Survey - 1993
Conducted by ReQuest for the Wisconsin Milk Marketing Board

The purpose of this confidential survey is to characterize dairy industry genetic programs and opinions relating to the genetic selection for milk composition. Your answers are important to provide direction for genetic selection, milk utilization and research in the dairy industry.

Please:

(1) indicate your answers to the questions by filling in the blank, circling, etc...
(2) add your comments as you wish. These are important to the overall project and will be summarized and remain confidential.
(3) return completed survey by FAX (607.272.4353) to ReQuest before **December 10, 1993.**

Section A 1. List the top five (5) countries for your organization's Holstein (Black & White) sire purchases in the last 18 months.

	Country	Percent of total purchases
1.		
2.		
3.		
4.		
5.		

2. Which five (5) international countries do you compete with most heavily for Holstein sire purchases?

Rank	Country
1.	
2.	
3.	
4.	
5.	

List of countries

Australia	Japan	Other (list)
Canada	Netherlands	
France	New Zealand	
Germany	England	
Italy	USA	

3. Which five (5) international AI or ET organizations do you most heavily compete with for Holstein sire purchases?

	Rank
1.	
2.	
3.	
4.	
5.	

4. Approximately how many potential Holstein bull dams do you make inquiries on each year? i.e. letters, telephone calls, etc... (circle response)

1. Less than 200 inquiries
2. 201 to 400 inquiries
3. 401 to 600 inquiries
4. 601 to 800 inquiries
5. 801 to 1000 inquiries
6. More than 1000 inquires

5. What is the estimated percent of response to these inquiries? _____%

6. Approximately how many dairy operation visits does your organization annually make to inspect potential bull dams?

1. Less than 100 visits
2. 101 to 200 visits
3. 201 to 300 visits
4. 301 to 400 visits
5. 401 to 500 visits
6. More than 500 visits

Section B The following questions regard the genotypic weightings and cutoffs and the phenotypic cutoffs for your organization's genetic programs. The genotypic questions are for bull dams, maternal grandams, sire of sons, and maternal grandsires. The phenotypic questions are for bull dams and maternal grandams only.

If you do not have a weighting, parameter, or cutoff for a trait, please mark it with an X. If your organization uses traits that are not listed please list them with their weighting or cutoff and make any appropriate comments.

7.a. What are your organization's **weightings** for **genetic** (Breeding Values) selection criteria for **bull dams**?
i.e. 1 milk : 2 fat : X fat% : 3 protein : X protein% etc...

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

b. What are your organization's **parameters** for **genetic** (Breeding Values) selection criteria for **bull dams**? (cutoffs)
i.e. >70 units (kg, lbs, etc...) Protein etc...

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

c. What are your organization's **phenotypic** (actual performance or score) selection criteria for **bull dams**? (cutoffs) i.e. >7,000 milk, >400 fat, >325 protein etc... If physical trait terms are not exact, provide closest estimate of the trait or list specific traits.

Milk	Fat	Fat%	Protein	Protein%	Class Score	Frame	Dairy Char.	Body Capacity	Feet & Legs	Udder	Other (list)

Comments:

8.a. What are your organization's **weightings** for **genetic** (BVs) selection criteria for **maternal grandams**?

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

b. What are your organization's **parameters** for **genetic** (BVs) selection criteria for **maternal grandams**?

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

c. What are your organization's **phenotypic** (actual performance or score) selection criteria for **maternal grandams**?

Milk	Fat	Fat%	Protein	Protein%	Class Score	Frame	Dairy Char.	Body Capacity	Feet & Legs	Udder	Other (list)

Comments:

9.a. What are your organization's **weightings** for **genetic** (BVs) selection criteria for **sires of sons**? (weightings)

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

b. What are your organization's **parameters** for **genetic** (BVs) selection criteria for **sires of sons**? (cutoffs)

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

Comments:

10.a. What are your organization's **weightings** for **genetic** (BVs) selection criteria for **maternal grandsires**? (weightings)

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

b. What are your organization's **parameters** for **genetic** (BVs) selection criteria for **maternal grandsires**? (cutoffs)

Milk	Fat	Fat%	Protein	Protein%	Economic Index	Type	Index	Other (list)

Comments:

Section C The following questions deal with the importance of technology and traits in your organization's genetic programs. In considering responses, please consider broad implications combined together. This would include **genetic progress, economics, logistics, and potential benefits to dairy producers** through to **consumers** of dairy products. N/A = Not Applicable

11. Please indicate the importance of the following areas on your organization's **PRESENT** genetic programs.

	Very Important <----------> Not Important					N/A
a) Embryo Transfer	5	4	3	2	1	X
b) Adult MOET	5	4	3	2	1	X
c) Juvenile MOET	5	4	3	2	1	X
d) Cloning	5	4	3	2	1	X
e) DNA Marker Assisted Selection	5	4	3	2	1	X
f) Transgenics	5	4	3	2	1	X
g) Calculated Indexes	5	4	3	2	1	X
h) Linear (Physical) Traits	5	4	3	2	1	X
i) Classification (Phenotypic) Scores	5	4	3	2	1	X
j) Milk	5	4	3	2	1	X
k) Fat	5	4	3	2	1	X
l) Protein	5	4	3	2	1	X
m) Economic Index	5	4	3	2	1	X
n) Milk Pricing	5	4	3	2	1	X
o) Dairy Manufacturing Technology	5	4	3	2	1	X
p) Other _____	5	4	3	2	1	X

Comments:

12. Please indicate the importance of the following areas on your organization's **FUTURE** genetic programs.

	Very Important <----------> Not Important					N/A
a) Embryo Transfer	5	4	3	2	1	X
b) Adult MOET	5	4	3	2	1	X
c) Juvenile MOET	5	4	3	2	1	X
d) Cloning	5	4	3	2	1	X
e) DNA Marker Assisted Selection	5	4	3	2	1	X
f) Transgenics	5	4	3	2	1	X
g) Calculated Indexes	5	4	3	2	1	X
h) Linear (Physical) Traits	5	4	3	2	1	X
i) Classification (Phenotypic) Scores	5	4	3	2	1	X
j) Milk	5	4	3	2	1	X
k) Fat	5	4	3	2	1	X
l) Protein	5	4	3	2	1	X
m) Economic Index	5	4	3	2	1	X
n) Milk Pricing	5	4	3	2	1	X
o) Dairy Manufacturing Technology	5	4	3	2	1	X
p) Other _____	5	4	3	2	1	X

Comments:

13. Please indicate the importance of the following areas for **RESEARCH** with regards to genetic programs.

	Very Important <----------> Not Important					N/A
a) Embryo Transfer	5	4	3	2	1	X
b) Adult MOET	5	4	3	2	1	X
c) Juvenile MOET	5	4	3	2	1	X
d) Cloning	5	4	3	2	1	X
e) DNA Marker Assisted Selection	5	4	3	2	1	X
f) Transgenics	5	4	3	2	1	X
g) Calculated Indexes	5	4	3	2	1	X
h) Linear (Physical) Traits	5	4	3	2	1	X
i) Classification (Phenotypic) Scores	5	4	3	2	1	X
j) Milk	5	4	3	2	1	X
k) Fat	5	4	3	2	1	X
l) Protein	5	4	3	2	1	X
m) Economic Index	5	4	3	2	1	X
n) Milk Pricing	5	4	3	2	1	X
o) Dairy Manufacturing Technology	5	4	3	2	1	X
p) Other _____	5	4	3	2	1	X

Comments:

14. Which technologies are your organization **currently** using and considering using in the **future**?

	Current		Future		
a) DNA Marker Assisted Selection	Yes	No	Yes	No	Maybe
b) Transgenics	Yes	No	Yes	No	Maybe
c) Cloning	Yes	No	Yes	No	Maybe
d) Embryo Transfer	Yes	No	Yes	No	Maybe
e) Adult MOET	Yes	No	Yes	No	Maybe
f) Juvenile MOET	Yes	No	Yes	No	Maybe
g) Other _____	Yes	No	Yes	No	Maybe

Comments:

15. What general comments do you wish to make about genetic selection for milk composition?

Thank you for your cooperation. Your participation is IMPORTANT!

Table I: Mean Values and Standard Errors for Relative Importance of Various Topics to Genetic Programs of International Artificial Insemination Companies[1].

Topic	Importance to Current Program	Importance to Future Program	Importance to Future Research
Embryo Transfer	3.8 ± 1.3	3.6 ± 1.7	3.6 ± 1.7
Adult MOET	3.0 ± 1.4	2.0 ± 1.0	2.0 ± 1.0
Juvenile MOET	2.5 ± 1.7	2.2 ± 1.6	2.6 ± 1.3
Cloning	1.3 ± 0.6	2.5 ± 1.0	3.6 ± 1.3
DNA Marker Assisted Selection	2.0 ± 1.0	3.2 ± 1.1	4.4 ± 0.9
Transgenics	1.0 ± 0.0	2.7 ± 1.5	4.3 ± 1.0
Holstein Assoc TPI/CTPI	4.2 ± 1.3	4.4 ± 1.3	4.0 ± 1.7
Linear Traits	4.4 ± 0.6	4.4 ± 0.6	3.8 ± 1.1
Classification Scores	3.2 ± 1.6	3.2 ± 1.8	2.4 ± 2.0
Milk	2.8 ± 1.8	2.6 ± 1.7	2.4 ± 1.3
Fat	2.8 ± 1.1	2.8 ± 1.1	2.2 ± 1.1
Protein	5.0 ± 0.0	5.0 ± 0.0	3.4 ± 1.5
Economic Index	4.0 ± 1.7	4.0 ± 1.7	4.0 ± 1.7
Milk Pricing	3.8 ± 1.1	3.8 ± 0.8	4.0 ± 1.4
Dairy Manufacturing Technology	2.8 ± 1.1	3.8 ± 0.5	4.8 ± 0.5

[1] Responses were based on a scale of 1 to 5 with 1 being "not important" and 5 being "very important".

Table II: Current and Future Inclusion of Various Technologies by International Artificial Insemination Companies.

	Currently Using Technology?		Considering Future Use of Technology?		
Technology	Yes	No	Yes	No	Maybe
DNA Marker Assisted Selection	40%	60%	75%	0%	25%
Transgenics	0%	100%	20%	0%	80%
Cloning	20%	80%	60%	0%	40%
Embryo Transfer	100%	0%	100%	0%	0%
Adult MOET	60%	40%	40%	40%	20%
Juvenile MOET	20%	80%	20%	40%	40%

Table VI: Current and Future Inclusion of Various Technologies by U.S. Artificial Insemination Companies.

	Currently Using Technology?		Considering Future Use of Technology?		
Technology	Yes	No	Yes	No	Maybe
DNA Marker Assisted Selection	70%	30%	90%	0%	10%
Transgenics	0%	100%	10%	40%	50%
Cloning	0%	100%	0%	10%	90%
Embryo Transfer	100%	0%	100%	0%	0%
Adult MOET	30%	70%	50%	50%	0%
Juvenile MOET	30%	70%	40%	60%	0%

Table V: Mean Values and Standard Errors for Relative Importance of Various Topics to Genetic Programs of U.S. Artificial Insemination Companies[1].

Topic	Importance to Current Program	Importance to Future Program	Importance to Future Research
Embryo Transfer	4.7 ± 0.5	4.8 ± 0.4	2.9 ± 1.5
Adult MOET	3.0 ± 1.1	3.7 ± 0.9	3.4 ± 0.9
Juvenile MOET	3.0 ± 1.2	3.6 ± 1.0	3.6 ± 0.9
Cloning	1.3 ± 0.5	1.8 ± 0.8	3.0 ± 1.4
DNA Marker Assisted Selection	3.6 ± 1.1	4.4 ± 0.8	4.9 ± 0.3
Transgenics	1.7 ± 0.6	2.1 ± 1.0	3.6 ± 1.0
Holstein Assoc TPI/CTPI	2.5 ± 1.3	2.1 ± 1.3	2.1 ± 1.5
Linear Traits	3.9 ± 1.0	4.1 ± 1.0	3.4 ± 1.4
Classification Scores	2.4 ± 1.0	2.4 ± 1.2	1.7 ± 1.0
Milk	4.3 ± 0.7	4.5 ± 0.7	3.7 ± 1.3
Fat	2.5 ± 1.2	2.3 ± 1.6	3.0 ± 1.4
Protein	4.9 ± 0.3	4.8 ± 0.4	3.9 ± 1.3
Economic Index	3.9 ± 1.0	4.3 ± 0.8	4.0 ± 1.3
Milk Pricing	4.6 ± 0.7	4.8 ± 0.4	4.0 ± 1.3
Dairy Manufacturing Technology	2.7 ± 1.5	4.0 ± 0.9	3.9 ± 1.2

[1] Responses were based on a scale of 1 to 5 with 1 being "not important" and 5 being "very important".