Impact of new on-farm technologies in dairy cattle breeding

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Current trends of the dairy industry are quite similar worldwide. Consolidation is occurring as the number of herds decrease and the herd size increases. A general increase of automation is also observed at the farm level. An increasing number of farmers have invested in computerized electronic milking systems or in automatic milking systems (robots). Both technologies record milk weights for every animal, every day, every milking. Additionally, they can record milk temperature and conductivity. In-line analysis technology may also be available soon at the farm level.

S.A.E. Afikim from Israel has unveiled Afilab™, an on-line real time milk analyzer. It provides fat, protein, lactose contents and also indications of classes of SCC. Additionally, it monitors for blood in the milk. The Israeli company states that a combination of above parameters serves as indicators for nutrition and health management of dairy farm. At the same time, Lattec, a 50:50 partnership of FOSS and DeLaval, has unveiled the Herd Navigator™. The Danish company reports that the on-farm milk analyzer provides information for udder health, nutrition, and reproduction cycle monitoring, through the analysis results from LDH (enzyme for early detection of clinical mastitis), urea and BHB (a ketone body), and progesterone, respectively. Thus, information on fat, protein, SCC, lactose, MUN, progesterone, ketosis and mastitis indicators may be available on a daily basis for each cow in the herd. In 2006, Miglior *et al*. (2006) surveyed ICAR member organizations and they reported that most countries (53%) had less than 10% of electronic milk meter farms. However, three large dairy countries, namely Denmark, Great Britain and The Netherlands were among those with at least 30% of farms with the automated technology. The same survey by Miglior *et al*. (2006) reports that 11% of organizations worldwide have at least 2% of robotic farms over the total number of farms. Among this group, Denmark had the highest percentage (10%) followed by Sweden (4%), The Netherlands (3.5%) and Luxembourg (2%).

Many dairy farms invest in automatic data collection to make appropriate management decisions in real time. Stored data can also be transferred electronically to DHI organizations for further processing in order to provide data back to the farmer or to provide input data for genetic evaluation units. Given the availability

of this technology, it is easier now to access more milk weight data than was available previously with traditional milk recording 8 to 10 times per year. With automatic data collection the producer will improve the management of the farm, via the use of more accurate data, more indicators, and greater quality control. Can automatic data collection help genetic improvement? As stated before some trends are clearly observable:

1. more traits are recorded;
2. increasing number of larger herds;
3. larger investment to improve equipment for electronic recording.

Additionally, there is an increased worldwide competition among AI organizations. There is a strong demand for increased data accuracy and comprehensiveness, especially for traits with low heritability.

The needs of genetic improvement programs include a continued participation of producers, maintained or improved data quality and adaptation to change. The benefits to genetic improvement from automatic data collection are threefold: improved accuracy, reduced cost and a larger number of economically important traits. However, there are some tradeoffs in adding traits to genetic evaluations and to selection objectives. Most of those new traits may have low heritability, and it may be difficult to estimate the relative economic value. Furthermore, when too many traits are included in a selection index there could be the risk of dissipating the selection differential. Additionally, new electronic devices will also include recording errors.

As summarized before, on-farm data should provide added value to genetic evaluations. Thus, producers may be compensated for data in the future. Currently, AI organizations may pay for progeny-test daughters few incentives bundled with DHI or type classification programs. A new system may be managed by AI organizations directly, connecting to on-farm computers. Then, data quality could be monitored by AI organizations, and the farm will be regarded as data vendor. Thus, producers could market own data to AI organizations and be compensated based on quality collection. Then, a cooperation among producers, DHI and AI Organizations is needed in order to establish mechanism for equitable resolution of competing interests.

Measures of data quality are also needed. Milk weights could be compared with data from milk shipped. With the advent of genomics, parentage verification will be more common, and it will help to improve the accuracy of animal identification and parentage. However, new protocols to avoid electronic ID misreads will have to be put in place by the manufacturers. Within-herd heritability could be used to measure data quality in large herds; a low value of within-herd heritability could identify herds that lack data quality. Next year genomic evaluations will be available in some countries. The advent of genomics will bring higher accuracy of animal EBV and new opportunities for farmers. A dairy producer may then use genomics to genotype the new born females and/or heifers for parentage verification and for early animal evaluation, which will help to keep only those animals carrying the right combination of genetic markers.

In conclusion, automatic data collection is growing and if properly monitored will increase data quantity and quality. Automatic data collection will impact genetic programs with the availability of more traits, higher accuracy of inputs for genetic evaluations, and tighter connection to the sources of data.