Use of Biotechnology in Milk Production in Egypt

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Biotechnology applications in livestock production cover a wide range and vary in their nature and objectives. Biotechnology in its broad terms refers to the technology used to control or manipulate certain biological function(s) of animal as a whole or in part, applied either in vivo or in vitro. Recombinant bovine somatotropin (BST) is one of the modern technologies used to improve milk production. Bovine somatotropin, or BST, which is produced by the recombinant DNA biotechnology, has been recognized for its ability to increase milk production from dairy cows in many countries over the last decade. There is no question that BST use increase milk yield and production response, and the results obtained are varied widely.
In Egypt, some large dairy farms have used BST to increase milk yield as well as to increase their income. It is argued that large commercial dairy operations can begin using new technologies such as BST more easily, rapidly, and efficiently than smaller ones.
This brief paper addresses some of the issues that surround BST use in Egyptian dairy farms after its commercial availability. Specifically, the focus of our inquiry is on, has this technology been profitable and productive at the farm level? Is the BST an economically feasible technology?

Keywords: recombinant bovine somatotropin, adoption, profitability, economic feasibility, Egypt

Bovine somatotropin is a naturally occurring (protein) hormone produced in cattle and all species of animals, by the pituitary gland. This hormone is important for growth, development, and other body functions of animals (Butler, 1999). In the 1930's, it was discovered that injecting extracted BST into lactating cows could increase milk production. In the late of 1970's, Bauman, successfully transferred the gene responsible for BST production to a bacterium. The resulting product was called recombinant bovine somatotropin, BST. Simple multiplication of the bacterium meant that BST could easily be produced in commercial quantities at reasonable cost Though BST is a peptide hormone and not a (much-maligned) steroid hormone (Butler, 1999). The basic findings of BST were as follows:

- Using recombinant bovine somatotropin, could cause a 10-20% increase in milk yield and accordingly increases milk efficiency. It also decreases the feed costs per unit of milk produced by reducing the needed maintenance feed (Butler, 1999).
- Using recombinant bovine somatotropin, seems to be safe for both human milk consumption and cows because of its nature as a protein

It took until November of 1993 to gain Food and Drug Administration (FDA) approval, and it was not released commercially until February of 1994.

Use of BST in Developing Countries:

The first trial with BST in the tropics was carried out by Ludri and his colleagues in 1989 in India with milking Buffalo. In Africa, Phipps et al (1997) suggested that BST increased total milk production in Zimbabwe (Fig.1). Further trails have been carried in Gambia (Fig. 2) and Kenya (Fig. 3)[3].

Use of BST in Egypt:

In Egypt, BST was approved in 1996 and was used commercially in two large private dairy farms at the end of the same year. Starting from the year of 1997, the number of dairy farms that adopted BST technology has linearly increased being nine dairy farms and accordingly the number of cows injected with BST which also increased to be 2000 lactating cows by the year 1998.

Thereafter, the treated cows with BST, in Egypt, has dramatically decreased reaching to the lowest number being 500 cows (Fig.4). Seven farms were stopped to use BST which may be due to the following reasons

- 57% of the dairy farms claims from its negative effect on reproduction, including increase of the days open, increase number of services per conception and lowering the conception rate.
- 29% suggested that there is no significant economical return with using BST as a result of low production response to the BST and low milk price.
- 14% observed that using BST did not increase milk production compared with the untreated cows.

Figure 4: Number of BST treated cows from 1996 to 2000 in Egypt

Nowadays, the controversy surrounding the use of BST in Egypt that has existed since 1996, health of animals treated with BST. Therefore, the researchers in Egypt, conducted the first trail about the using of BST in commercial herds under the Egyptian condition and its effects an milk yield, reproduction and animal health (El-Ghandour, 2000).

The main results of this study could be summarized as follows:

The overall average percentage increase in milk yield that resulted from BST treatment found in this study is in line with the average increase of 10-20 % reported in many trials such as the study conducted in Egypt by El-Harairy (2000) on Holstein cows. The magnitude of increase in milk yield in this study was, however, significantly larger in early treated (starting on day 65 postpartum) than in later treated cows (starting on day 105 postpartum). Such difference would be mainly a function of the length of time during which cows were subjected to treatment.

The finding that multiparous cows had significantly higher response to BST (percentage increase in milk yield) than primiparous cows is of great interest. Part of this difference may be related to the relatively limited udder capacity for milk synthesis in primiparous than multiparous cows. Primiparous cows also have less available nutrients for increased milk synthesis, with a significant part of the available nutrients being directed to continue growth, as compared to the situation in the more mature multiparous cows. This finding is of practical importance, as it may be recommended, accordingly, to limit the use of BST to multiparous cows in order to achieve higher economic efficiency of the treatment.

[3] The figures and tables are only available in the print copy (Beihefte zu Der Tropenlandwirt Nr. 71)

One of the most interesting results in the study conducted by El-Ghandour (2000) is the discrepancy in the response to BST treatment due to the level of milk yield, with the high yielders showing higher response to treatment, being almost three times higher than the response obtained in low producers (22 v. 6%). Such finding which, to our knowledge, has not been reported elsewhere, has serious practical impact, with the recommendation to limit the use of BST to high and medium-producing animals only, to achieve highest economic efficiency of the treatment. This was illustrated clearly in the economic analysis conducted (Table 1), where the treatment of low producing cows did not seem to be profitable, since the small increase in milk yield obtained did not cover the cost of treatment itself. This finding also raises an important question, whether BST treatment would be biologically and economically effective in other circumstances with low producing cattle genotypes of buffaloes? Such a question deserves an answer through future detailed studies an our local cattle breed and buffaloes.

Another interesting result that emerged from this study is the significantly higher response to BST in open cows than in those that conceived during the first eight months of lactation. This is likely to be due to the effect of gestation and the diversion of part of the available nutrients to meet the demands of the conceptus. This, however, opens the debate on “to what extent we can extend the calving interval to achieve maximum profitability in high yielding dairy cows". This question is of practical importance for commercial dairy herds. It's answer can only be achieved through future studies that should also take into account the changes in total production of a cow over its herd life time, both from milk and calves born, the possible implications of long lactation periods on cows body condition score (BCS) and health, and in turn its productivity in subsequent lactations (Aboul-Ela et al., 2000).

Unfortunately, the effect of BST on cows reproductive performance could not be studied thoroughly, mainly due to the rather poor reproductive management system applied in the herd, as indicated from the performance of all groups including the control, where about half of the cows did not get in calf for over eight months (El-Ghandour, 2000).

The lack of monensin (RM) effect on milk yield is consistent with the results of other investigations, as discussed by Aboul-Ela et al.,(2000). This, however, should be taken care of in future studies to elucidate the mechanism through which RM treatment could alleviate the negative effect of BST treatment on BCS.

Profitability of using BST in Egypt:

There is no doubt that the major contributing factor for profitability with BST is the magnitude of response which is directly related to management, including cow health, feed quality and intake, water intake, cows comfort. Therefore, providing a high quality of management can optimize the profitability of BST. The other contributing factors to BST profitability are milk price, feed price, BST price, and labor costs. Since milk price is the most changeable factor, the profitability of BST was calculated as a function of milk price (ranging from 0.55 to 1.25 LE/kg) and the magnitude of response to BST. This index (Table 1) is suggested as a guide for profitability of BST under these conditions (El-Ghandour, 2000). Furthermore, milk price up to LE 0.65/kg makes it not profitable under similar conditions of response, feed, and labor costs. In addition, using BST was more profitable in high and medium producers compared with in low producers, which was not profitable.

As shown in Table 1, return on investment and, of course, profitability of BST is increased with increasing in milk price and the magnitude of lactation response to BST

treatment. Under the conditions of the study by El-Ghandour (2000), one may recommend the use of BST as a treatment to increase milk production in multiparous and in both high and medium producers cows, and to exclude primiparous and low producing cows from the treatment, in order to achieve maximum profitability. However, it should be stressed that an economic analysis should be made for each given condition, taken into account various aspects of the production process, particularly the level of milk production, the magnitude of milk yield response to treatment, and the milk price along with the cost of treatment.

Table 1: Profitability of using BST as a function of milk response and price (El-Ghandour, 2000)*

Conclusion

On the light of the results under Egyptian conditions, there are beneficial effects of using BST in improving milk production, however, these depend to large extant on the management system applied in the farms including nutrition, reproduction, and body condition score. Additionally, large commercial dairy operations can using modern technologies (BST) more easily, efficiently, and economically than smaller ones.

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