

Cost effectiveness of intensive cooling cows in summer in dairy farms located in South China

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Dairy farmers over the world, mostly in hot regions, are familiar with the negative impact of heat stress on their cow's performance, but only few of them have the means to quantify the economical losses caused by hot summer, as well as the potential benefit that can be obtained, when intensively cooling their cows in this season.

In an article published recently, the effect of intensive cooling cows by a combination of wetting and forced ventilation, we developed in Israel and tested under its summer conditions was described. The study compared complete lactations of cows in high yielding, large scale dairy farms, intensively cooling their cows in the summer (6-8 cumulative cooling hours per day), to those who did not cool their cows in summer. According to the results of this study and others, carried out in Israel, we found that intensive cooling dry and lactating cows in summer have the potential to increase cow's annual milk production, under Israeli conditions, by 8% above normal levels reached when cows are not cooled.

The present article calculates, based on Israeli experience, the cost effectiveness of intensive cooling the cows in summer when implemented in a typical large scale dairy farm, located in the South provinces of China, characterized by extremely warm and humid summers, lasting for 150 days per year and having almost similar climatic and productive conditions to those existing in Israel. Average annual milk production in these farms today reaches 6,000 liters per cow. Summer calving cow's lactations are expected to be 1,000 liters/year below those of cows calving in winter (5,500 and 6,500 liters respectively). We assume, based on the experience gained in Israel, that the improvement in milk production due to intensive cooling the cows can range between 5% and 15% annually and in the same time, the improvement in feed efficiency (kg feed required to produce 1 liter of milk), to range also between 5% and 10%. It is important to clarify that our study took in account only the expected increase in milk production and did not take in account other potential economical benefits arising from cooling the cows in summer, such as the expected increase in milk fat and protein content, the reduction in milk Somatic Cell Count (SCC) and the improvement in cow's fertility.

Actual input and output prices in the region were used in order to carry out this study, taking in account the high prices paid for the inputs and the lowest for the extra milk produced in summer.

The following prices were used for the study

- Farm gate price for extra milk produced – 3.8RMB/liter (ranging between 3.8 and 4.6).
- Feed cost – 1.5 RMB/ kg DM milking cows mix (ranging between 1.1 and 1.5).
- Cost of electric power – 0.65 RMB/KW/h.

(As can be seen, In order to be on the “safe side”, we took for our study the low milk price and the high feed price).

Feeding - cows are expected to consume under normal conditions 8 kg DM/day for maintenance and 0.46 kg DM/liter of milk produced.

Cooling – cows cooled by a combination of wetting and forced ventilation for 8 cumulative hours/cow/day, based on the special efficient cooling practices developed recently in Israel. Forced ventilation is provided by fans operating 18 hours per day, 150 days per year. Total cost for cooling cows, including 10 years payback for equipments, as well as operating cost for electricity, water and manpower are evaluated in this study as 500 RMB/cow/year.

In our study we took in account the fact that, because of shortage in fresh milk supply to the local market, farm’s production is unlimited in summer and extra milk produced gets, at least, the normal price. In this case the increase in farm’s annual profit reflects the differential between the increase in farm’s income from extra milk produced (multiplied by the price paid by the processing company for this extra milk) and the extra expenses required for its production (extra expenses for additional feed and for cooling system installation and operation).

Our study was realized for a typical 1000 cows dairy farm located in a warm and humid region of South China. Actually, without using any cooling means in summer, farm’s per cow annual production is expected to be 5,500 liters. We expected that Intensive cooling in summer will increase each cow’s annual production in the range of 5%, 10 % and 15%, (average per cow annual production of 5,800, 6,000 and 6,300 liters, respectively). Independently from the increase in milk production and based on experience gained recently in Israel we consider Intensive cooling the cows in summer also to improve by 5% to 10%, the feed efficiency (feed required for maintenance and milk production), for all the cows in the herd during all summer time. Cost of cooling included the initial cost of equipment, its depreciations and the operational inputs (electric power, water and labor cost) were assumed this cost to be 500 RMB/cow/year.

The increase in per cow annual profit (RMB), due to the increase in income from extra milk produced, after deducing the expenses for extra feeding and the investment required for intensively cooling the cows, is presented in the following table.

Expected increase in annual milk production		5%	10%	15%
Expected Improve in summer Feed efficiency	5%	500	1,400	2,200
	10%	700	1,600	2,400

From the data presented in the table we learn that, under economical and productive conditions, actually existing in South China, the increase in 1000 cows farm annual profit due to intensive cooling the cows in summer can range between 500,000 to 2,400,000 RMB (500 to 2,400 RMB/cow), above actual results. In the “optimistic” case, if extra milk price will be higher than the regular price (4.6 RMB/liter) and feed price will be lower (1.1 RMB/kg DM), then, the increase in cow’s annual production resulted from cooling the cows can even be higher and range between 750 and 3100 RMB/cow/year. “Running” our program with different per cow cooling costs show that the total annual cost of cooling have an negligible influence on the economical results and even if we double it, profit will still remain relatively high.

As mentioned earlier in this article, the present study took in account only the economical benefits, raised from the effect of intensive cooling the cows in summer on herd's total feed expenses and feed efficiency. Other potential economical benefits such as the increase in milk fat and protein content, the reduction in milk SCC and expected improved fertility are not taken in account in the present study and have the potential to further increase the total benefit from intensive cooling the cows in summer.

In conclusion, it seems that the implementation of intensive cooling systems in dairy farms, located in South China, can be one of the most attractive investments to be realized in the farm. For many farms, proper implementation of intensive and efficient cooling method (as it is already done in most of dairy farms in Israel), can be the difference between loosing or gaining money at the end of the year.