Extra dairy production – but at what cost?

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In recent years, the dairy sector has been trying to increase production – why and under what conditions?

There is a global shortage of milk, quota systems are broken and the best alternative for most herds is to produce more all around the year.

The immediate available ways to produce more are:

- To increase the number of cows (when the size of the herd is not limited by 'methane regulations') through reducing selection, lowering the marginal economy corrected milk (ECM) threshold for culling, and keeping all the heifers.
- Production 'tricks' – increasing the number of daily milkings, delaying drying off, and increasing hours of light.

This temporary situation prevents investments in new housing and as feed costs are rapidly increasing, the income from milk is lagging behind.

The use of BST is also prohibited in the EU and some other countries.

The dilemma for the farmer is whether all the ways for extra production really are profitable. This article examines the various options available to farmers to increase production and maximise profit.

Identification of factors which adversely affect production and correcting them will enhance production through improvement of the lactation curves.

Table 1 is an example for a potential annual 'return' of 81,556 litres of milk to Herd 1 by reducing loss of production associated with postparturient uterine diseases.

By such causal analyses it is possible to 'return' to Herd 1, by correcting all the mistakes evaluated, a total (maximum) of 414,286 litres per year, which equals 7.4% of its annual quota.

Lactation	First		Second		≥Third		Expected return of milk litres/year/herd
Extended 305 days milk	10,180		12,656		13,209		
Total	No. with PPUD	129	No. with PPUD	135	No. with PPUD	193	
PPUD	63	-235	55	-	108	-639	81,556

Table 1. Expected annual return of milk (litres/herd) by reducing the adverse effects of postparturient uterine diseases (PPUD) on milk yield.

Stocking density

Stocking density, mean days in milk (DIM and somatic cell counts (SCC), which are linked, should be addressed simultaneously.

While the measures of the last two are objective, it is very difficult to estimate the stocking density.

The recommended indexes (22m^2/cow in loose stalls, and 100% cubicles in free stalls) do not necessarily represent the actual stocking density.

When we verified that the housing capacity or quality and management of the herd were stable throughout the period analysed, we then calculated the monthly stocking density (density) as percentages relative to the month with the lowest number of cows in milk in the period analysed.

We estimated the independent effects of the density, DIM and SCC on yield (kg) from monthly data of actual marketing in a random sample of 19 herds (382 herd months all together) applying a linear regression model, where we allowed for the effects of the various herds, months, and % of first lactation cows.

Milk yield comparisons

Fig. 1 compares the predicted milk yields derived from the model to the actual ones.

Except from those herd months circled in red the fit was good and allowed us to apply the model to individual herds.

We estimated that losses of daily production of 0.54kg and 0.52kg per lactating cow were associated with increases of 10% in density and 10 days in mean DIM respectively in our sample.

In view of previous studies that described valid statistical associations between SCC and density, it was essential to establish whether the adverse effect of density on yield in our sample was due to an increase in SCC.

When we added the mean monthly SCC to our model, the losses associated with 10% stocking density reduced from 0.54 to 0.40kg/cow/day but were still statistically significant.

We could conclude that in our

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Fig. 1. The effects of DIM, SCC and herd density on daily yield (kg/milking cow) in 382 herd months in 19 herds 2006/07.

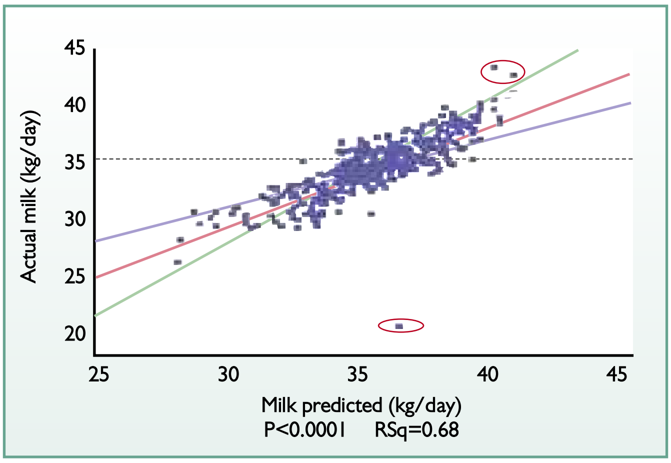
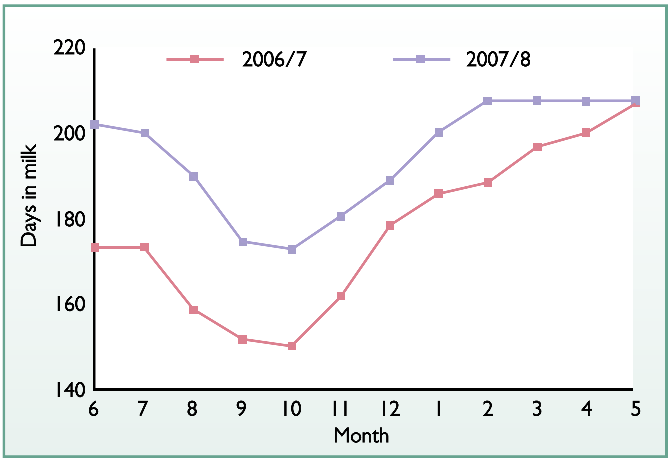


Fig. 2. Mean days in milk (DIM) for lactating cows in Herd 2. An increasing tendency in two consecutive years.



Sample herd	Third or more lactation cows					
	Total		Pregnant to first AI (%)		Open days	
	186		33.9		112	
Lost ≥0.5 u BSC in the dry period	Yes	No	Yes	No	Yes	No
	21	161	19.0*	36.6	134**	109

*p<0.05; **p<0.01

Table 2. The adverse effects of a loss of ≥0.5 units of BCS over the dry period on some fertility indices in Herd 3.

01/11/06-31/10/07	Herd 4	Herd 5
Aborted	59	47
Abortions per 10,000 days pregnancy	4.9	6.6
Aborted (%)	6.3	8.6
Aborted twice	4	3
Abortion profile (trimester of pregnancy)	First	Third
Additional open days for cows that became pregnant again	2079	693
Cows culled without re-breeding	34	36

Table 3. Contribution of abortions to mean DIM in two herds with different abortion profiles.

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sample the adverse effects of stocking density, days in milk, and the somatic cell counts on production were independent of each other.

Reducing mean DIM

Fig. 2 describes the mean DIM of milking cows through two consecutive years in Herd 2.

Similar increase in DIM is presently common to many herds. The two ways to reduce DIM are to improve fertility and to keep the number of abortions down.

Improving fertility

A routine herd health analysis identifies factors which adversely affect fertility (see International Dairy Topics – Vol. 6 No. 4) and contributed to the increased DIM.

Table 2 describes the additional open days associated with a loss of ≥0.5 units of BCS over the dry period in a group of 186 ≥3rd lactations cows.

Reducing abortions

The contribution of abortions to the DIM varies and reflects the stage of abortion in which the abortion took place and the herdsman's policy of culling. Table 3 compares data from two herds with different abortion profiles.

In contrast to Herd 4 the majority of the abortions in Herd 5 were in the first trimester of pregnancy; some of the aborting cows were rebred and conceived in the same lactation.

While the economical damage associated with culling and replacement will be higher in Herd 4, the contribution of the abortions to the mean DIM will be greater in Herd 5.

Herd structure

With the present breaking of the quota system, the relative number of first lactation cows in the herd is increasing; most herds are raising all of the heifers. The traditional ratio of first to ≥second lactations cows of 1:2 is rapidly changing. A narrower ratio is expected to increase the genetic value of the herd, but reduces the monthly cash flow.

Fig. 3 describes milk yields (1000kg) and income (€1000) in changing ratios of first to ≥second lactations cows relative to that of 1:2 in a hypothetical herd of 300 cows.

Difference in annual milk production is between first and older cows = 2000kg; Dry matter intake of first is 90% of that of ≥second lactation cows.

Selection policy and culling

While rates of non-inseminated Israeli multiparous cows were stable in the years 2004-2006 (12.8%) it decreased in 2007 to 9.8%.

On top of slowing down the genetic improvement in the national herd, reduced selection affects the 305 extended milk yields as shown in Herd 6.

Rates of non-inseminated cows were 18.8 and 8.5% in the years 2006 and 2007 respectively, while the mean milk yield of first, second, and third or more lactations dropped between the two years 301, 567, and 794kg respectively.

Culling the marginal cow

We defined a 'marginal cow' as a healthy cow, waiting to be culled and kept as long as profitable.

Profitability of 'marginal cows' should be evaluated continuously using in or extra quota prices.

Table 4 describes such evaluation of the three lowest 'marginal cows' in Herd 2.

Increasing density

When housing conditions, nutrition and management were stable in the previous 24 months we apply the model described in Fig. 1 to individual herds in order to evaluate the independent effects of density, DIM, and the SCC on the mean monthly yield.

We established that in Herd 2, that a daily loss of 0.1 litres/milking cow (p<0.0001) was associated with an increase of 1% stocking density (2.2 cows).

Fig. 4 describes the increasing densities in Herd 2 over the period 06/06-05/08. The herd is housed in freestalls, and the lowest number of milking cows was in July 2006 (222 cows in milk). The increase in den-
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Table 4. 'Marginal cows' in Herd 2 – the three lowest profitable cows in the last monthly milk test.

Cow	milk (kg/day)	ECM (kg/day)	Income from milk (€/day)	DMI (kg/day)	Feeding costs (€/day)	Income over feeding costs (€/day)	Capital and insurance (€/day)	Income over costs (€/day)
5393	11.2	11.8	4.25	16.70	4.93	-0.68	0.50	-1.17
5478	13.0	13.5	4.85	17.30	5.10	-0.25	0.49	-0.74
5557	16.1	16.7	6.00	18.60	5.47	0.52	0.50	0.02

Fig. 3. Milk (in 1000kg) and income (in €1000) in a hypothetical herd of 300 cows related to changing ratios of first to ≥second lactations cows to that of 1:2.

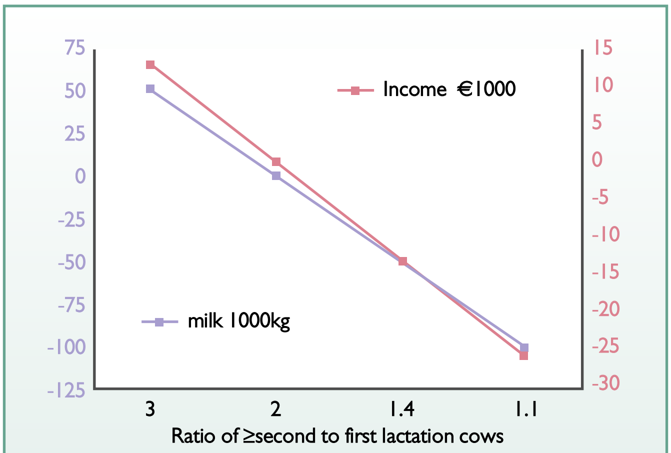
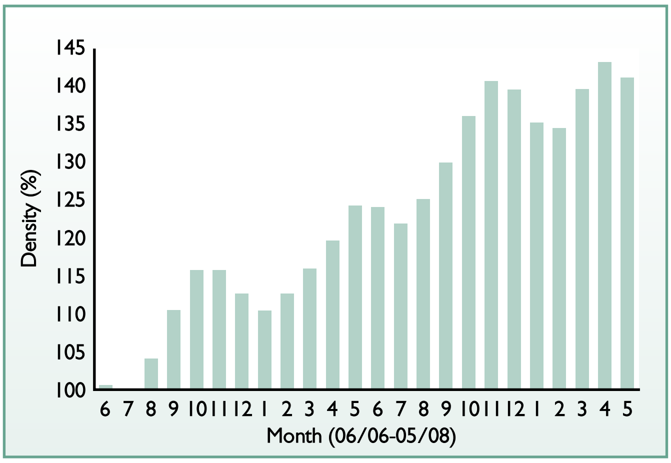


Fig. 4. Monthly stocking densities (%) in two consecutive years in a freestall Herd 2. 07/06 is the month with the lowest number of milking cows (222).



Extra marginal cows to cull	5	10	15	20	25	30	35	40
Extra daily ECM production (l)	-1184.8	-975.8	-754	-523.4	-287.3	-33.6	229.7	498.3
Extra daily income (€)	-186.5	-165	-138.9	-111	-81.6	-47.1	-10.3	27.6

Table 5. Additional daily ECM production and income in keeping the extra 'marginal cows' in Herd 2 (milk test of 05/08, 315 milking cows).

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sity over the last two years is common to other herds.

Table 5 describes the effects of the increasing stocking density (315 milking cows in the milk test of 05/08) on the daily milk production and income of Herd 2.

The balance in milk production and income will only be reached after culling of the extra 30 and 35 cows respectively.

Reducing whole milk use

Under the present prices, farmers use milk substitutes for young calves instead of whole milk, discarded milk (antibiotic or with high SCC) excluded. This amount should be reduced, and the breach of the biological security should not be underestimated, especially in herds that adopted any disease eradication programs.

Production 'tricks'

Various field observations suggest that extra milking of fresh cows (six times daily for 21 (28) days) will add an extra 300 to 800kg per lactation, mainly in first lactation cows; energy balance however should be routinely evaluated.

An example of a herd with adverse effects of negative energy balance (NEB) at the onset of lactation on fertility is in Table 6.

		No. cows		Open >150 DIM (%)	
		198		36.1	
Factor	Rate/value	with	without	with	without
Unobserved heat	-	106	92	51.0**	18.9
High FCM yield[a] (kg)	55.1	62	117	43.5**	29.9
High fat/protein in first test[a]	1.369	44	132	50.0*	29.5

FCM = fat corrected milk; [a]Highest quarter; $*p<0.05$ $**p<0.01$

Table 6. Rates of cows open >150 DIM days in milk and NEB after calving in 198 ≥third lactations cows in Herd 1.

The severe adverse effects of unobserved heat effects on fertility suggest that the cows suffer from inactive ovaries. Both inactive ovaries, high fat corrected milk yield (FCM) and high fat to protein ratio in the first monthly milk test suggest that the cows are in a continuous state of NEB.

In order to prevent a 'negative selection' where high yielding cows are culled because of infertility or 'metabolic calvings' it is not advisable for herds with evidence of NEB to increase the number of daily milkings. Delaying drying off has gained popularity in recent years though the effects of late drying off are equivocal and, to an extent, depend on the cow BCS at drying off.

Table 7 compares future yields and overall income of cows with BCS ≤3.25 units at drying off according to days in pregnancy when dried off.

Conclusion

In conclusion:
- Extra milk is not necessarily extra income.
- Correction of management mistakes and controlling diseases are still the most efficient ways to increase production.
- Reduction of abortions and improving fertility will reduce the mean days in milk and so will increase production of the herd.
- Crowding cows in given housing facilities might lead to loss of income.
- Profitability of the marginal cow should be regularly evaluated.
- The 'prize' associated with 'production tricks' is often known, but not the penalty.
- There is no 'universal truth'. Each herd has its own truth that should be looked for.
- Extra production – yes! But not under all circumstances. ■

Table 7. Losses of yield and income associated with late drying off of cows with BCS of ≤3.25 at drying off.

Milk yield of 'thin' second lactation cows (BCS of ≤3.25 at drying off)		
Days pregnant at drying off	>217 days, 74 cows	≤217 days, 122 cows
305 day milk (kg)	11,561	12,469
Difference (kg)	-908**	
Penalty (€)[a]	17,867	
Milk yield of 'thin' >2nd lactation cows (BCS of ≤3.25 at drying off)		
Days pregnant at drying off	>217 days, 112 cows	≤217 days, 126 cows
305 day milk (kg)	12,513	12,970
Difference (kg)	-456*	
Penalty (€)[a]	11,183	

[a]Extra milk in the present lactation compared to dry periods of 60 days – loss of milk in the next lactation + differences in prices of dry and lactating cows respectively