

Hormoners produktionsfremmende effekter i kvæg - betydning globalt og i Norden



Bull calves on pasture

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HISTORICAL UPDATE ON HORMONE USE

(1940'es) 1950:-

- Use of sex steroids in beef cattle introduced in USA

Before 1988:

- Sex steroids allowed for growing cattle in Europe - Used in UK, Ireland, France...

1988:

- EU bans the use of sex steroids and stops import of beef from countries which use sex steroids

1985 - 1996 (or longer):

- Illegal use of sex steroids and beta-agonists (i.e., clenbuterol), cortisone (i.e., dexamethasone), and various 'cocktails' of above
- Hormone scandals (veterinarians killed, drug mafia, cases of food poisoning....)

1995:

- EU scientific committee concludes: 'no firm evidence that the use of hormones in meat poses any risk to human health'.
- EU decides to continue the ban (2010: the ban is still in place).

ENDOCRINE MANIPULATION OF MUSCLE GROWTH AND MILK YIELD IN CATTLE

1. Sex steroids (**kønshormoner**)
2. Growth hormone – Somatotropin (**væksthormon**)
3. Beta-adrenergic agonists (**β-agonister**)
4. Other types of manipulation (**andre hormoner**)

SEX STEROIDS TREATMENT (AND IMMUNIZATION*)

- Used for feed-lot steers and heifers (and cull cows)
- 1-3 treatments (50-90 days between/before slaughter)
- Hormone implant (silicon tube)
- Insert at ear base
- 100-300 mg testosterone / 50-100 mg estrogens/
progesterone
- Cost per implant: \$ 2-3 and return to farmer: \$20 per
steer

- (* Includes immunization against GnRH and LH (immunocastration) in bulls
to reduce aggressive behaviour)



An organic Danish steer
Do we use hormone implants?
NO, but we have removed
a lot of sex hormones
AND thus growth capacity



SEX-HORMONE TREATMENT OF FEED LOT BEEF STEERS FOR 115 DAYS PRIOR TO SLAUGHTER AT A SIMILAR AGE

JOHNSON ET AL. 1996. J ANIM SCI 75: 363-371

	Control	Implanted steers*
Feed intake, kg/d	9.9	10.6
Av. Daily Gain, kg/day	1.55	1.87
Feed conversion ratio, kg/kg	6.5	5.7
Live weight at slaughter, kg	575	614
Dressing %	62	61
L muscle area, cm ²	85	91
Fat thickness, mm	8	9
Protein in primerib, %	14.6	14.9
Fat in primerib, %	34	33

*Trenbolone acetate (TBA) + Estradiol (E)



EARLY WEANING (BULL CALVES VS IMPLANTED STEERS) (ANG X SIM) FED A HIGH GRAIN DIET

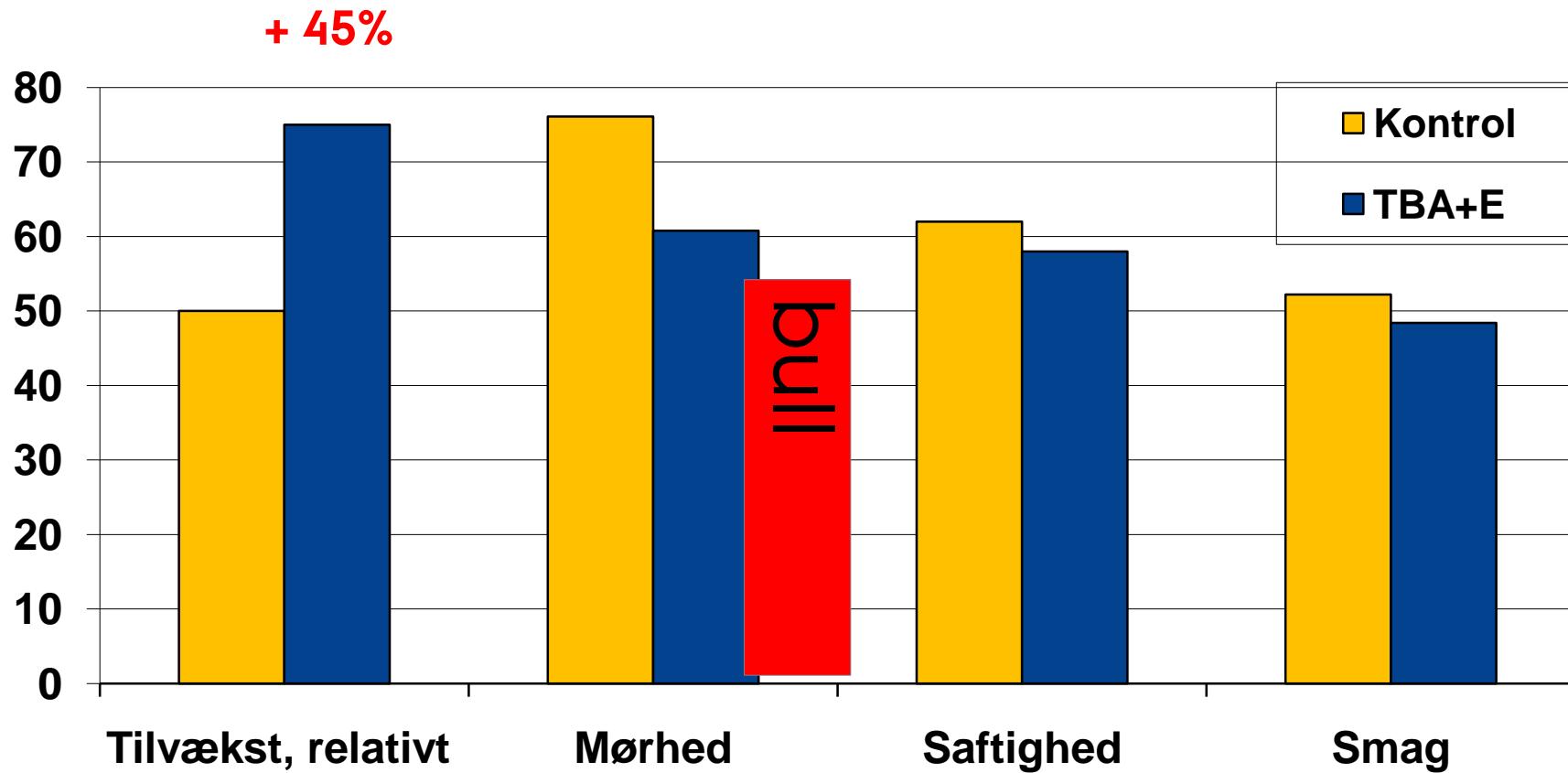
SCHOONMAKER ET AL. 2002 J ANIM SCI 80:900-910

	Bull calves	Implanted steers*
Weaning, d	119	116
ADG, d 115-200	1.75	1.60
ADG, d 201-277	1.46	1.62
ADG, d 277-slaughter	1.41	1.46
IGF-I, ng/mL	120-200	170-280
Days in feedlot	249	231
LW (d 277), kg	432	424
Carcass wt, kg	263	254
L muscle area, cm ²	71	70

*Estradiol (E)+Progesteron at d 130, E+Trenbolone (TBA) at d 200 and 277



SEX HORMONE-TREATMENT OF STEERS: DAILY GAIN AND EATING QUALITY OF LOIN MUSCLE (OUALI ET AL., 1988)



EFFECTS OF GROWTH HORMONE

(BOVINE GROWTH HORMONE = bGH
= BOVINE SOMATOTROPIN = bST)

- **Injection under the skin (neck, tailhead)**
- **Daily or every two weeks**
- **0.05-0.15 mg / kg animal / day**
- **500 mg /dairy cow / 2 weeks**

*rbST = recombinant (i.e., produced in bST-transgenic microorganisms) as compared to earlier used pituitary-extracted sources of growth hormone

Effekt af svinets væksthormon (rpGH = pST) i amerikanske svin



Photo from T.D. Etherton et al.

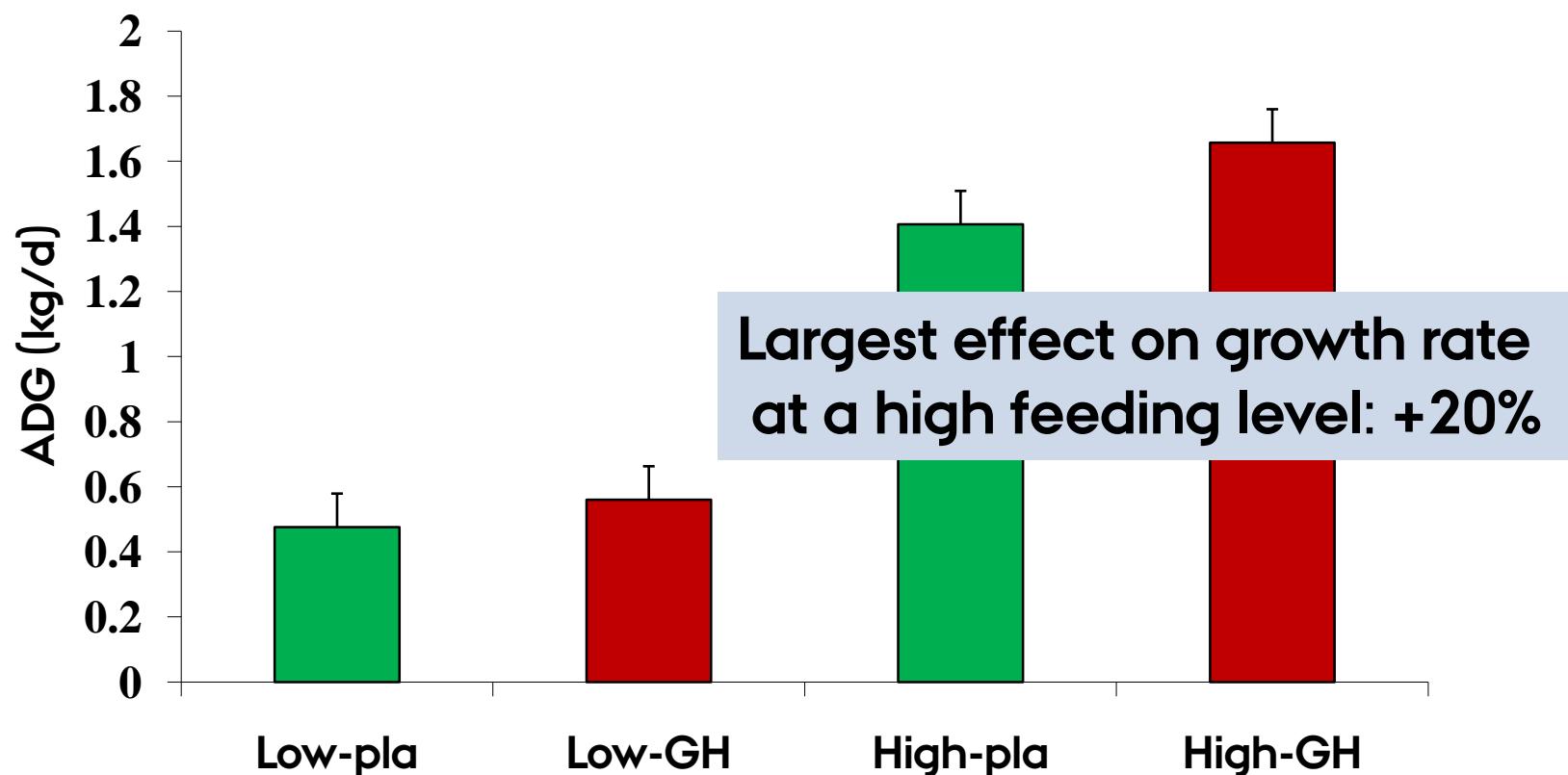
What happens to me if they give me growth hormone (bST)?



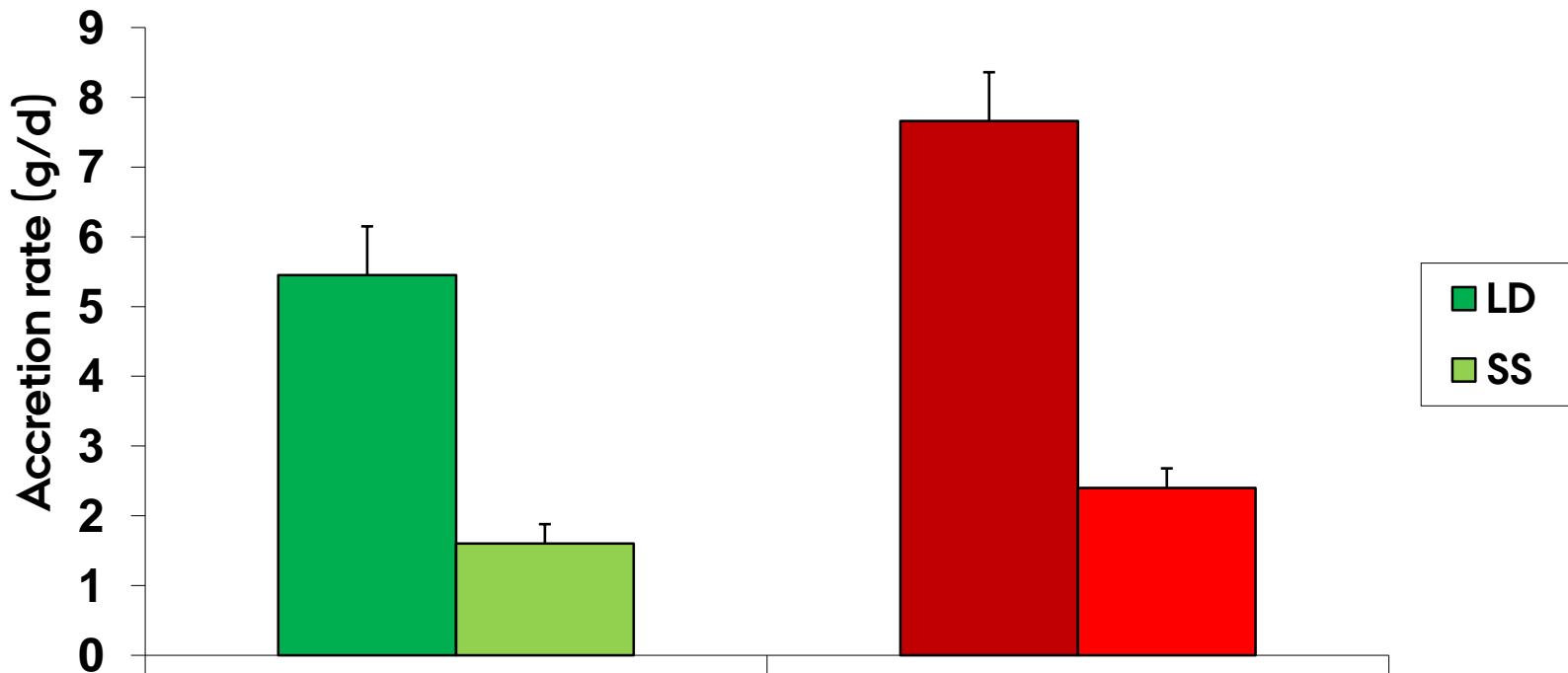


AVERAGE DAILY GAIN OF PREPUBERTAL HEIFERS DURING A 5-WEEK bGH-TREATMENT PERIOD ON LOW AND HIGH-FEEDING LEVEL

VESTERGAARD ET AL. 2003



THE EFFECT OF GROWTH HORMONE ON MUSCLE ACCRETION RATE IN LONGISSIMUS (LD) AND SUPRASPINATUS (SS) MUSCLES



bST => larger muscles in young animals !
All types of muscles increased (+smooth muscles)

Behandling af kviekalve med væksthormon før puberteten øger mængden af mælkekirtelvæv og den senere mælkelydelse

(Sejrsen et al., 1986)

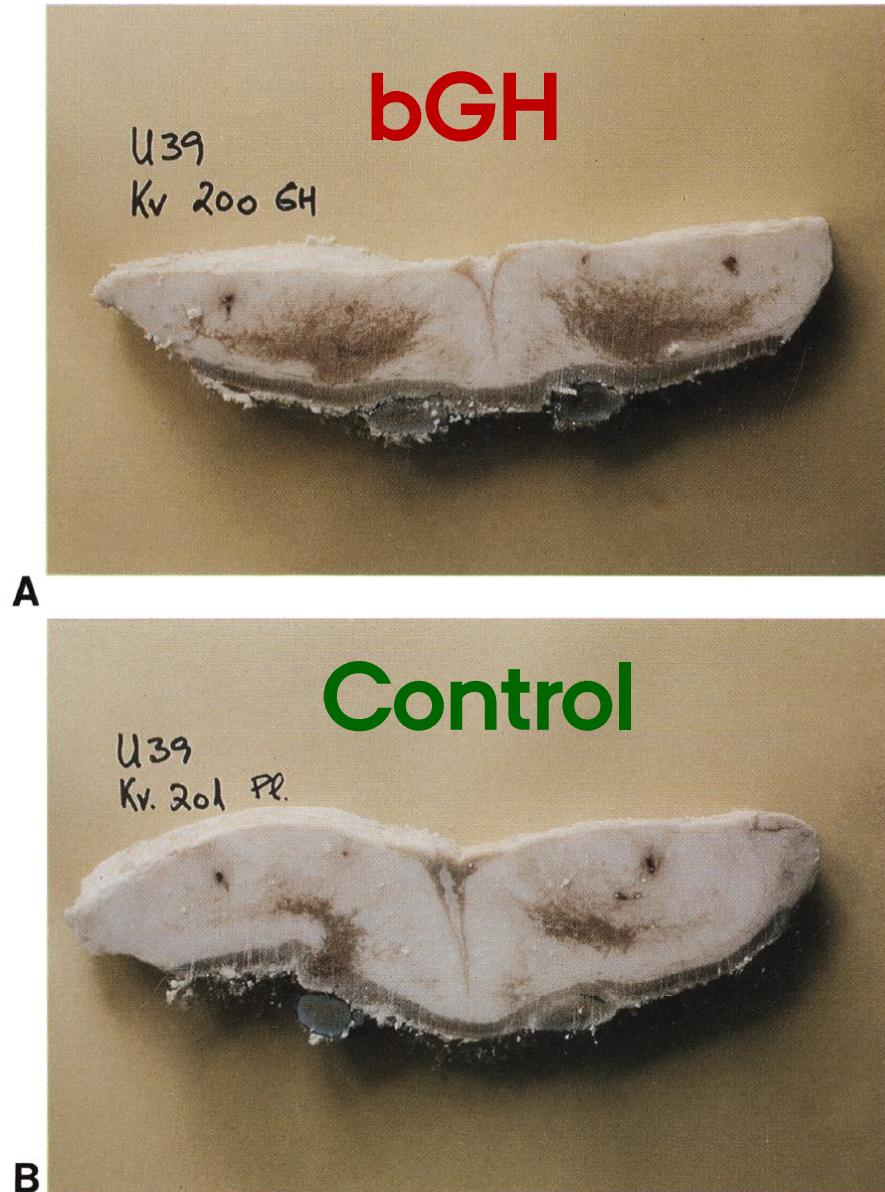


Figure 1. Photographs of a cross-section of the mammary gland from a heifer injected with somatotropin (A) and the corresponding cross-section from her identical twin sister injected with excipient (B).

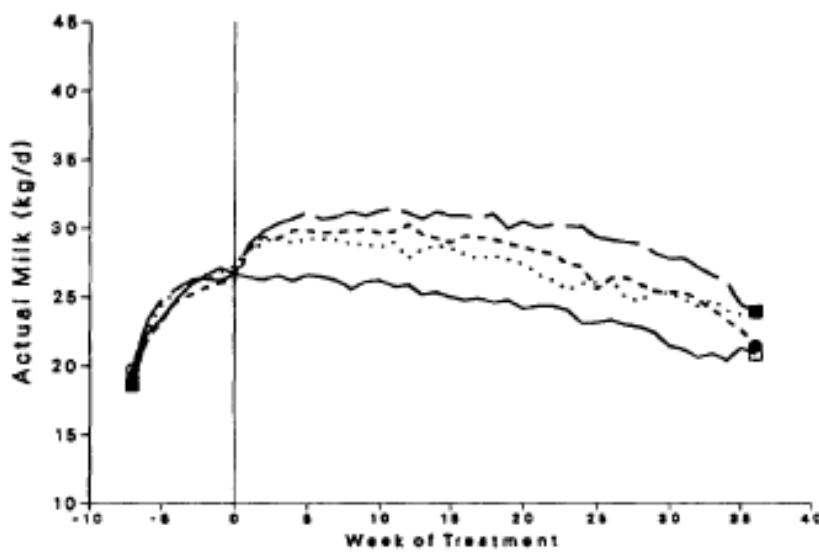
Indflydelse af væksthormon på køers mælkkeydelse (Sejrsen et al. 1993)

	Kontrol	bST	Forskel
Mælk, kg	27,5	36,5	+ 8,7
Fedt %	4,69	4,60	- 0,09
Protein %	3,50	3,35	+ 0,15
EKM, kg	30,3	39,0	+ 8,7
Tørstofoptagelse, kg	20,5	21,9	+ 1,5
Vægtændring, kg	47,6	11,2	- 36,4

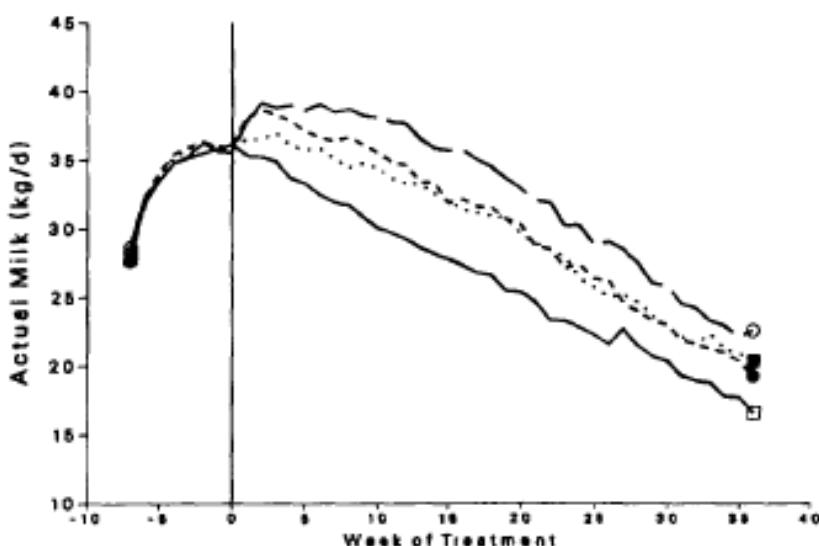
BST IS USED FOR DAIRY COWS IN USA, MEXICO, RUSIA

- It has been approved in the United States since 1993
- EU veterinary committee did not see a problem for animals or humans if bST is used correct (1996)
- EU, Japan, Australia and Canada have all outlawed the use of bST in animal production due to the possible animal and human health concerns.
- EU might also have political reasons ?

Primiparous Cows



Multiparous Cows



Evaluation of Sometribove in a Prolonged-Release System in Lactating Dairy Cows—Production Responses

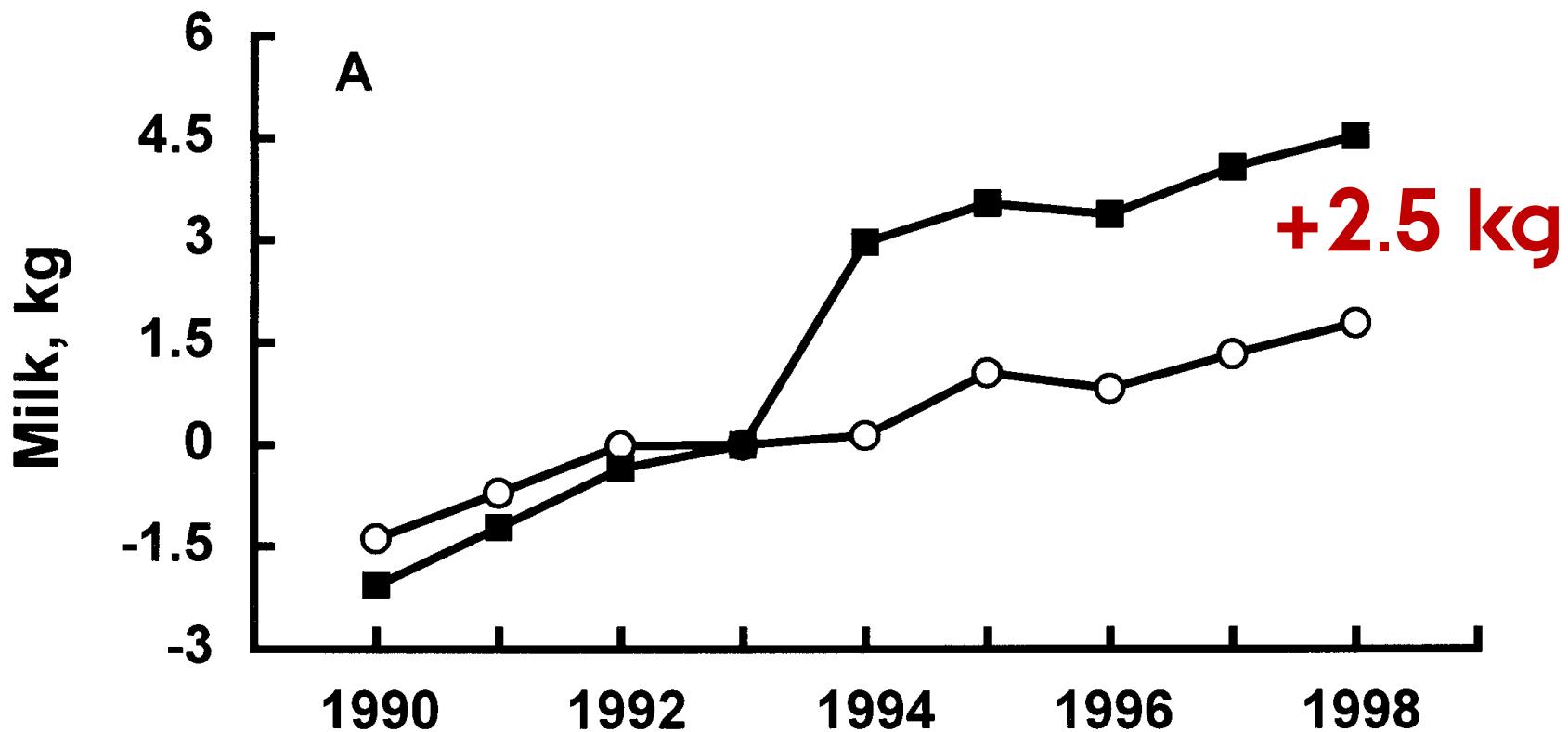
G. F. HARTNELL, S. E. FRANSON, D. E. BAUMAN,¹ H. H. HEAD,² J. T. HUBER,³
R. C. LAMB,⁴ K. S. MADSEN, W. J. COLE, and R. L. HINTZ
Monsanto Company
Animal Sciences Division
St. Louis, MO 63198

Effekt af 14-dages bST præparat (0, 250, 500 og 750 mg) på mælkeydelsen hos 1. kalvskører og ældre køer.

NB: mælkens sammensætning ændres over de 14 dage

Ændring i mælkeydelsen i amerikanske besætninger før og efter bST behandling

(Bauman et al. 1999)



BETA-ADRENERGIC AGONISTS ('ANGEL DUST')

- Salbutamol, Terbutaline, Clenbuterol, Cimaterol, L-644,969 etc. (**NOT ALLOWED**)
- Ractopamine = PayLean® and OPTAFLEXX®
- Zilpaterol = Zilmax® and ZilpaMex®
- Allowed in USA, Mexico, Australia...

- **In the feed, e.g., 2 x daily**
- **5-30 mg / kg feed / day**
- **Fed for 21-49 days before slaughter**
- **0-3 days withdrawal before slaughter**



CIMATEROL (BETA-2 ADRENERGIC AGONIST) FED AT 0.06 MG/KG LW FOR 90 DAYS TO GROWING BULLS (VESTERGAARD ET AL. 1994)

LW at start:	Bull calves (160 kg)	Young bulls (300 kg)	
ADG, g/d	1369	1506	1363
Feed intake, SFU	4.5	4.6	6.8
Carcass gain, g/d	687	888	750
EUROP conformation	3.8	8.0	5.3
<i>M. Longiss.</i> area, cm ²	39	54	66
Organ fat, kg	2.8	1.8	6.2
Shear force, kg	5.8	17.7	6.1
			21.4

EFFECT OF CIMATEROL ON CARCASS CONFORMATION IN HF YOUNG BULLS

Enæggede tvillinger



KØD OG FEDT I HØJREB OG VÆGT AF FILET FRA TYREKALVE OG UNGTYRE TILDELT BETA-AGONISTEN CIMATEROL

(WESTERGAARD ET AL. 1994)

Kategori af dyr	Tyrekalve		Ungtyre	
	Kontrol	Cimaterol	Kontrol	Cimaterol
Levende vægt, kg	286	297	503	531
Kød i højreb, %	69.5	75.1	66.3	73.3
Fedt i højreb, %	7.5	5.8	12.8	8.9
Filét, kg	3.21	4.08	6.93	8.30

β-agonister giver mere slagtekrop og mindre fedt
Kun skeletmuskler (kød) øges og mest på ryg og lår

ZILPATEROL TREATMENT OF STEERS: EFFECTS ON GROWTH PERFORMANCE

VASCONCELOS ET AL. 2008 JAS

8.3 MG/KG FEED FOR 40 DAYS + 3 DAYS WITHDRAWAL

	CONTROL	ZILPATEROL	Effect
Weight at start, kg	539	539	
Weight at end. kg	596	604	+8 kg
ADG, kg/d	1.33	1.52	+14%
Feed intake, kg/d	8.9	8.5	
Carcass weight, kg	384	402	+18 kg
Dressing %	64.4	66.6	
Lmuscle area, cm ²	90	100	+10%

Negativ effekt af zilpaterol på fedtmarmorering



Control



Carcass
9
Steak
01

Zilpaterol



Carcass
85
Steak
01

CONCLUSIONS AND PERSPECTIVES

Kønshormoner og beta-agonister:

- Store positive effekter på produktion og slagtekvalitet
 - Negative effekter på kødets mørhed
- Foreløbig importforbud fra lande med hormon-anvendelse
 - Vil Brasilien, Argentina mfl. fristes ? Hvad med WTO ?

Væksthormon:

- bST=> mere mælk, uændret holdbarhed, evt. lidt øget mastitis
 - pST godkendelse evt. i Australien

Norden er en del af verden:

- Kontrolsystem af illegal anvendelse nødvendig
 - Fintfølende analysemetoder findes, antal stikprøver ?
- Vi bruger også hormoner (også skjult anvendelse), antibiotika og andre 'hjælpemidller': Hvad er værst ?
- Skal Norden være 'fri for hjælpemidller' ?



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