Development and sustainability of Free Walk housing in the Netherlands

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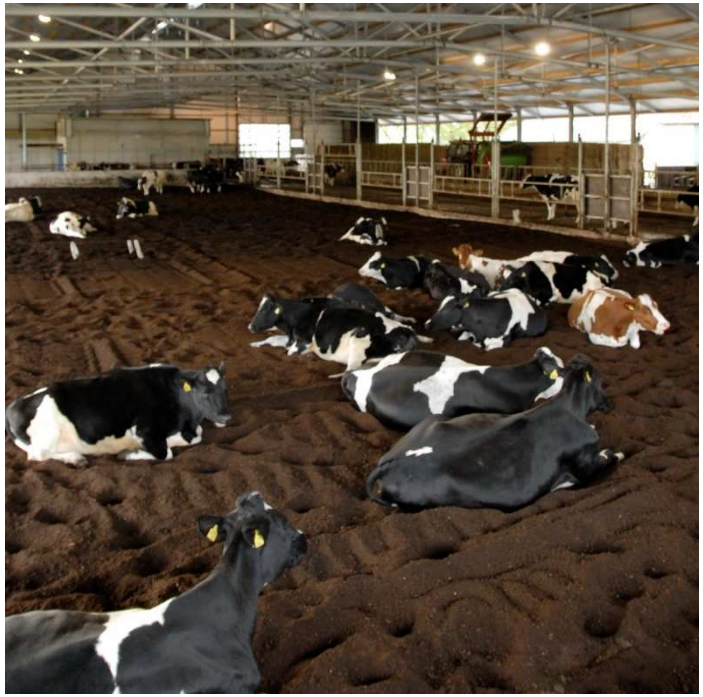
Why Free Walk (Bedded Pack Barns)?

Labour efficiency



Animal welfare and manure quality

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Why Bedded Pack Barns?

Sustainability

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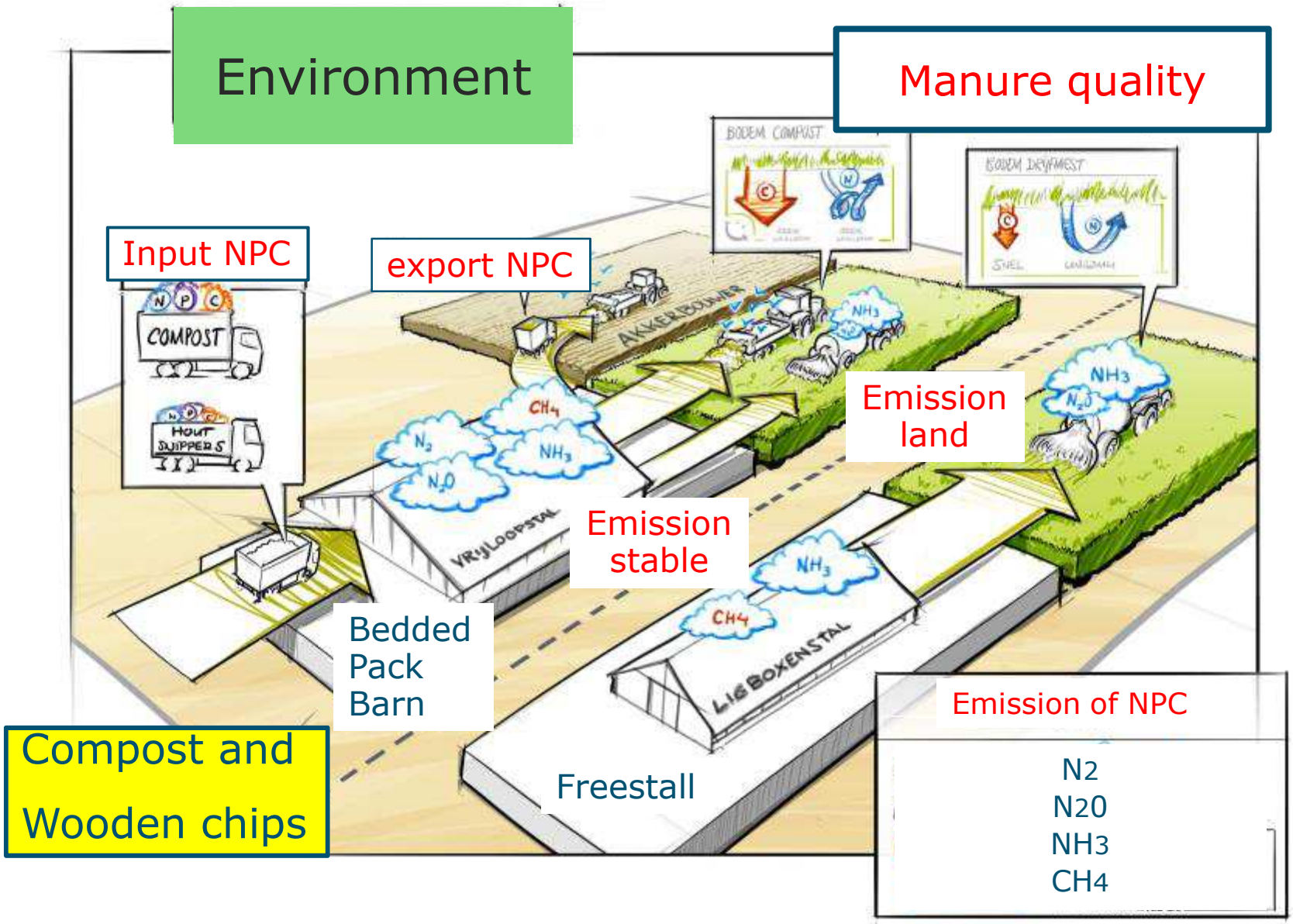
Environment
Manure quality
Input NPC
export NPC
Emission land
Emission stable
Bedded Pack Barn
Freestall
Compost and Wooden chips
Emission of NPC
N2
N20
NH3
CH4
COMPOST
HOUT SNIPPERS
BODEM COMPOST
BODEM DRYFMEST
AKKERBOUWER
VRIJLOOPSTAL
LIGBOXENSTAL
NH3
CH4
N2
N2O

Experiments on 3 regional farms

Composting: wooden chips an sawdust

Drainage with sand

Absorbing with peat ground and reed

Cows in Green house with folie

Monitoring 10 commercial farms; 5 are composting wood chips

1. Blowing air

2. Blowing air

3. Sucking air

4. Sucking air

5. No aerating

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four using green waste compost
one cultivates straw

Farms 6 to 9

use compost

10 Straw

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Composting ...
once a day mill the bedding
12 – 15 m2 per cow

Aerating system,
Blowing air


Aerating system,
Sucking air

Bedding material used on grassland and arable land


Roof from horticulture

Farm characteristics

	1	2	3	4	5	6	7	8	9	10
Number of cows	60	130	50	105	75	55	185	80	15	65
M2 per cow	16	15	13	14	10	22	27	9	20	11
Bedding material	W	W	W	W	W	C	C	C	C	S
Aeration	B	B	S	S	N					
Milking system			AMS	AMS		AMS	AMS	AMS	AMS	
Grazing	No	Yes	Yes	No	No	Yes	No	No	No	Yes

Bedding material

W = wood chips

C = Compost

S = Straw

Aeration system

B = blowing air

S = sucking air

N = no aeration

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Animal welfare & health

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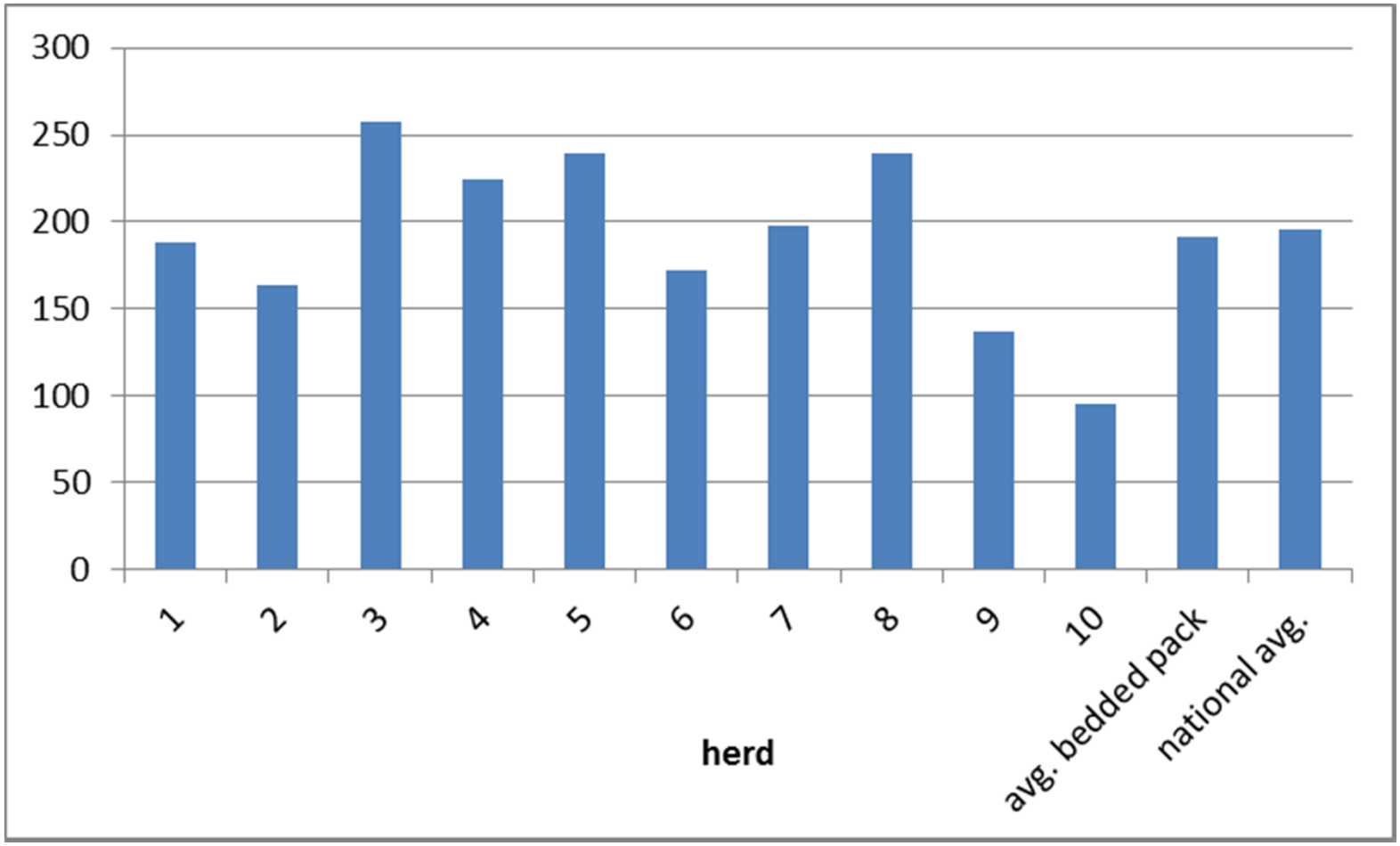
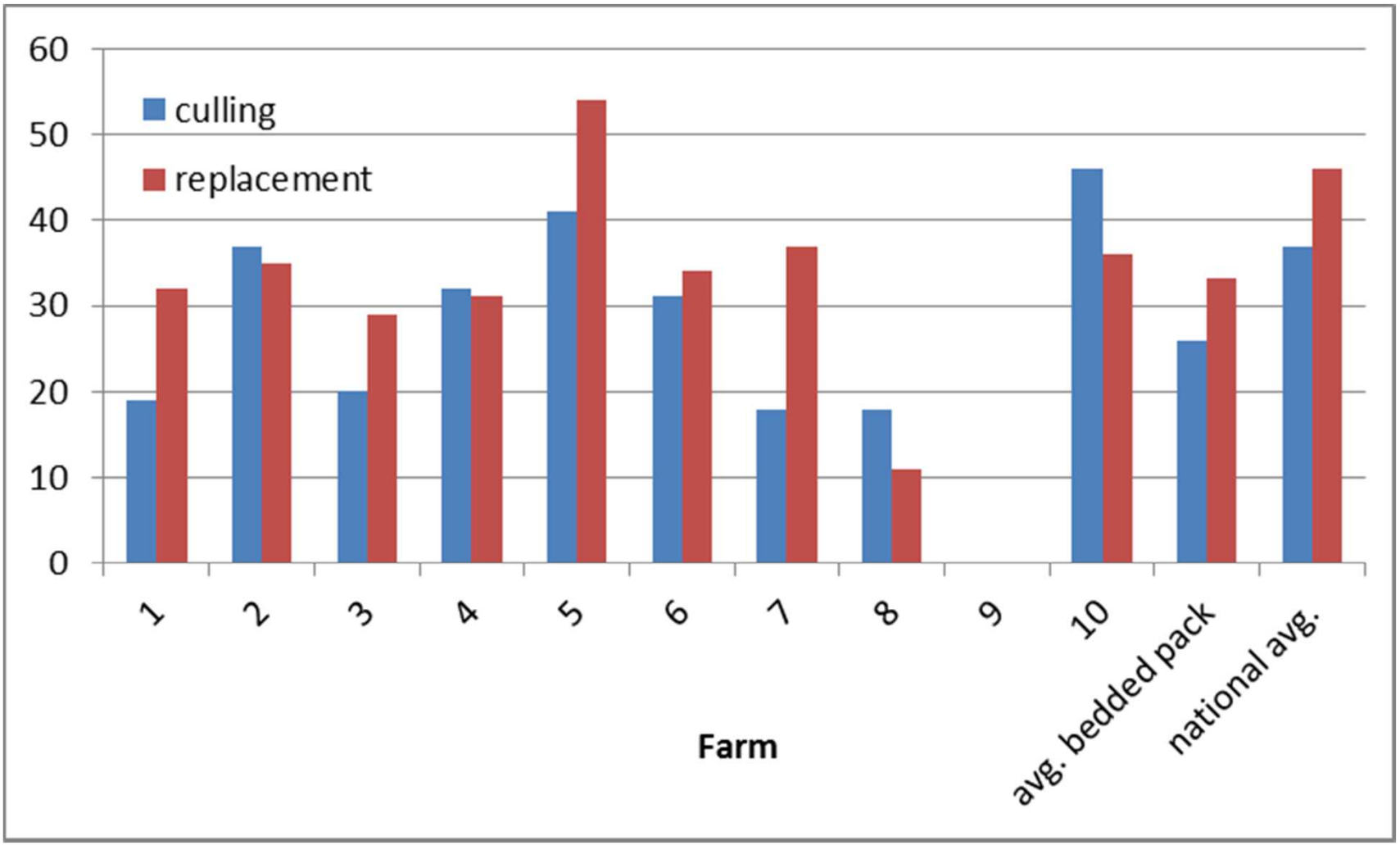
Animal health (Mastitis), SCC (*1000 cells/ml)



Longevity

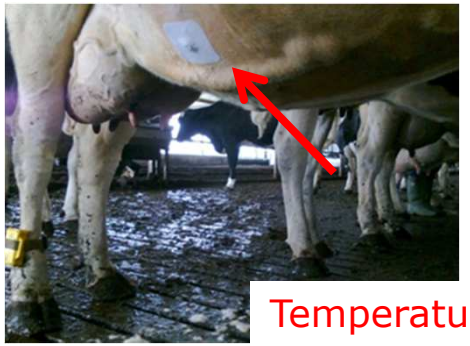

60
50
40
30
20
10
0
culling
replacement
1
2
3
4
5
6
7
8
9
10
avg. bedded pack
national avg.
Farm

Animal welfare and health

Welfare	Bedded pack vs freestall
Time required to lie	+
Hygiene	0/+
Skin injuries	++
Legs and claws	+
Natural behaviour	+
Health	
Udder health	0
Antibiotics usage	0
Longevity	+?

No heat stress from

heat production bedding



Temperature sensor

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Economics

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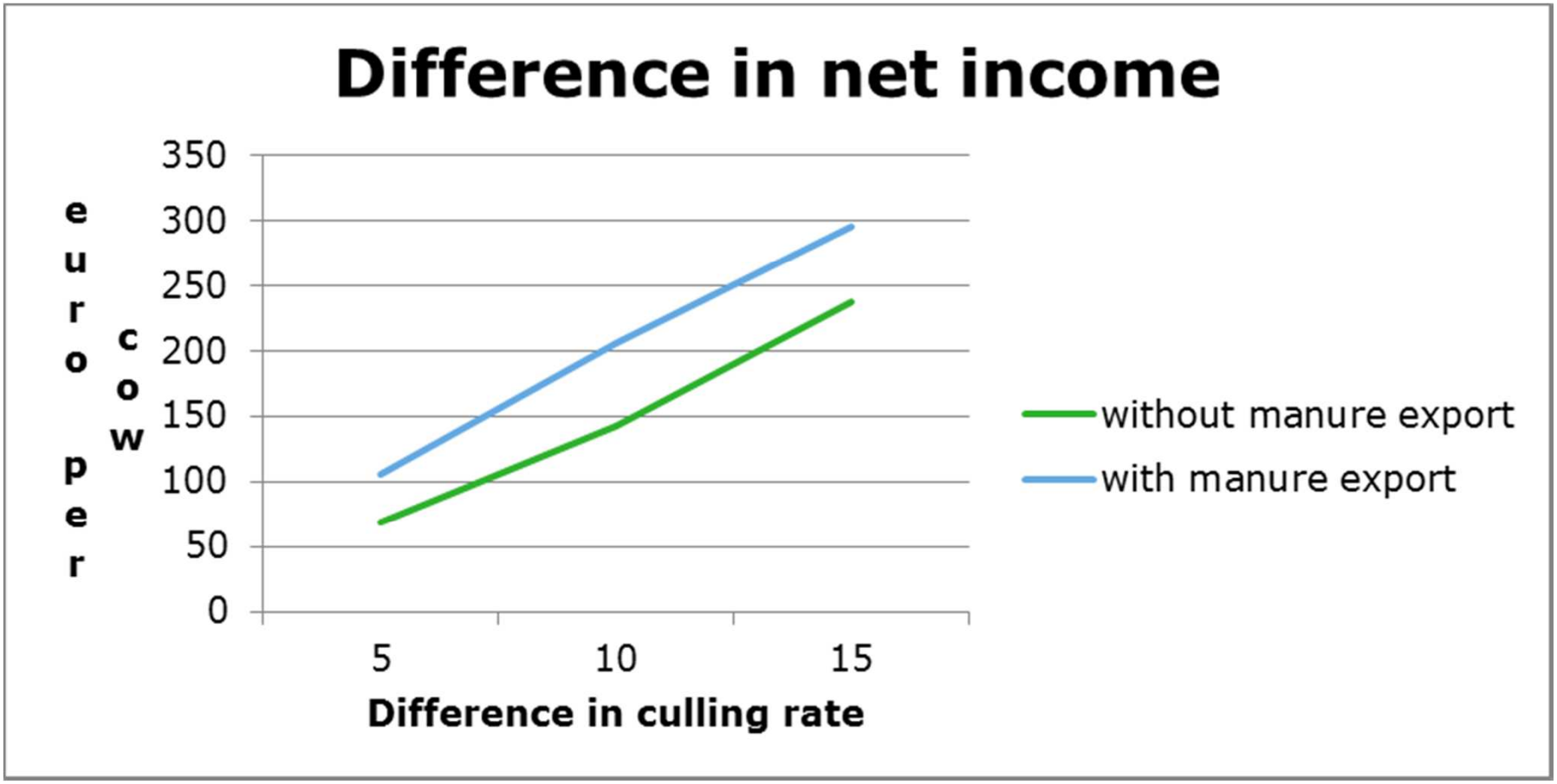
Economic effect of lower culling rate



Economics bedded pack barns

	Bedded pack barn vs freestall
Investment manure storage	-
Investment roof	++
Total investment	+
Yearly costs stable and bedding	+
higher production per cow	+
lower replacement	--
Total yearly cost	-

Sustainability

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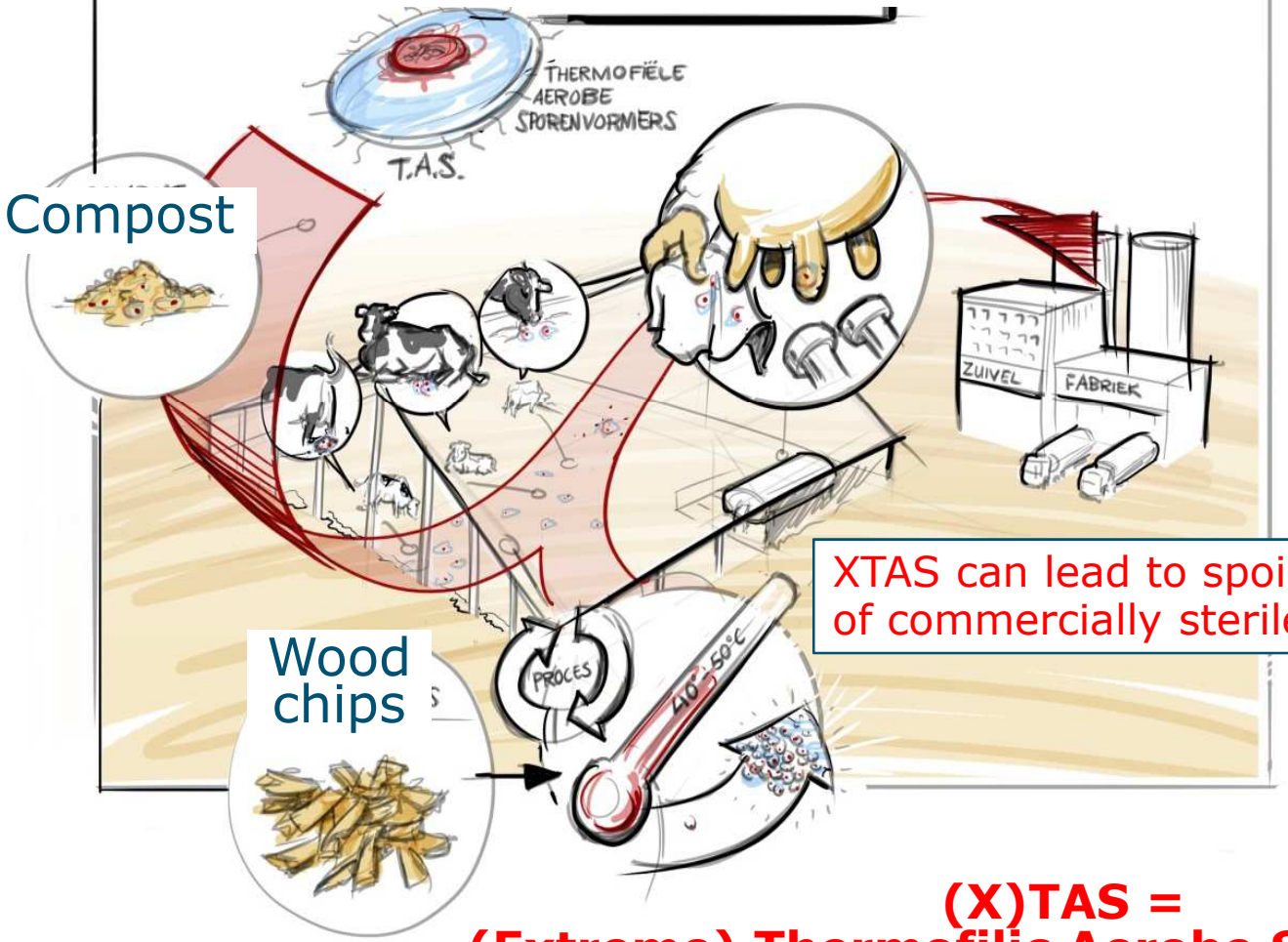
Risk of sporeforming bacteria for milk quality

Route of (X)TAS



XTAS can lead to spoilage problems of commercially sterile dairy products

(X)TAS =
(Extreme) Thermofilic Aerobe Sporenformers

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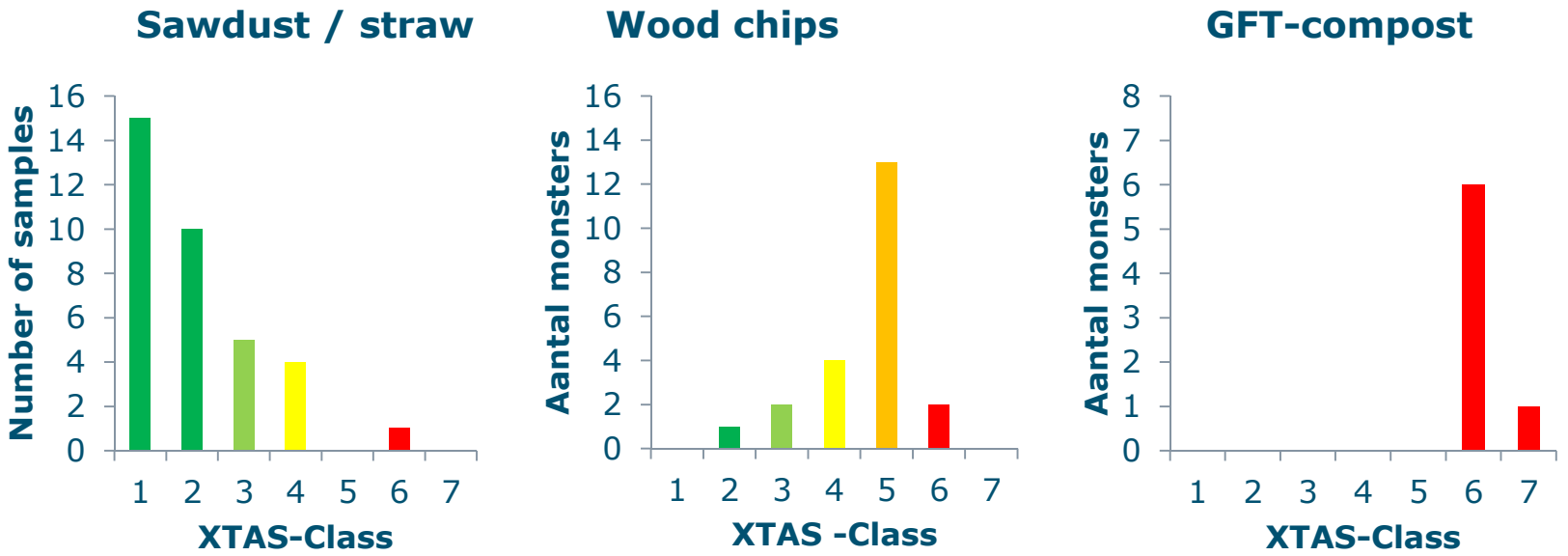
XTAS in bedding materials (cfu / gram on log scale)

variation between samples

Source: NIZO



Directive Dairy Industry: log 5

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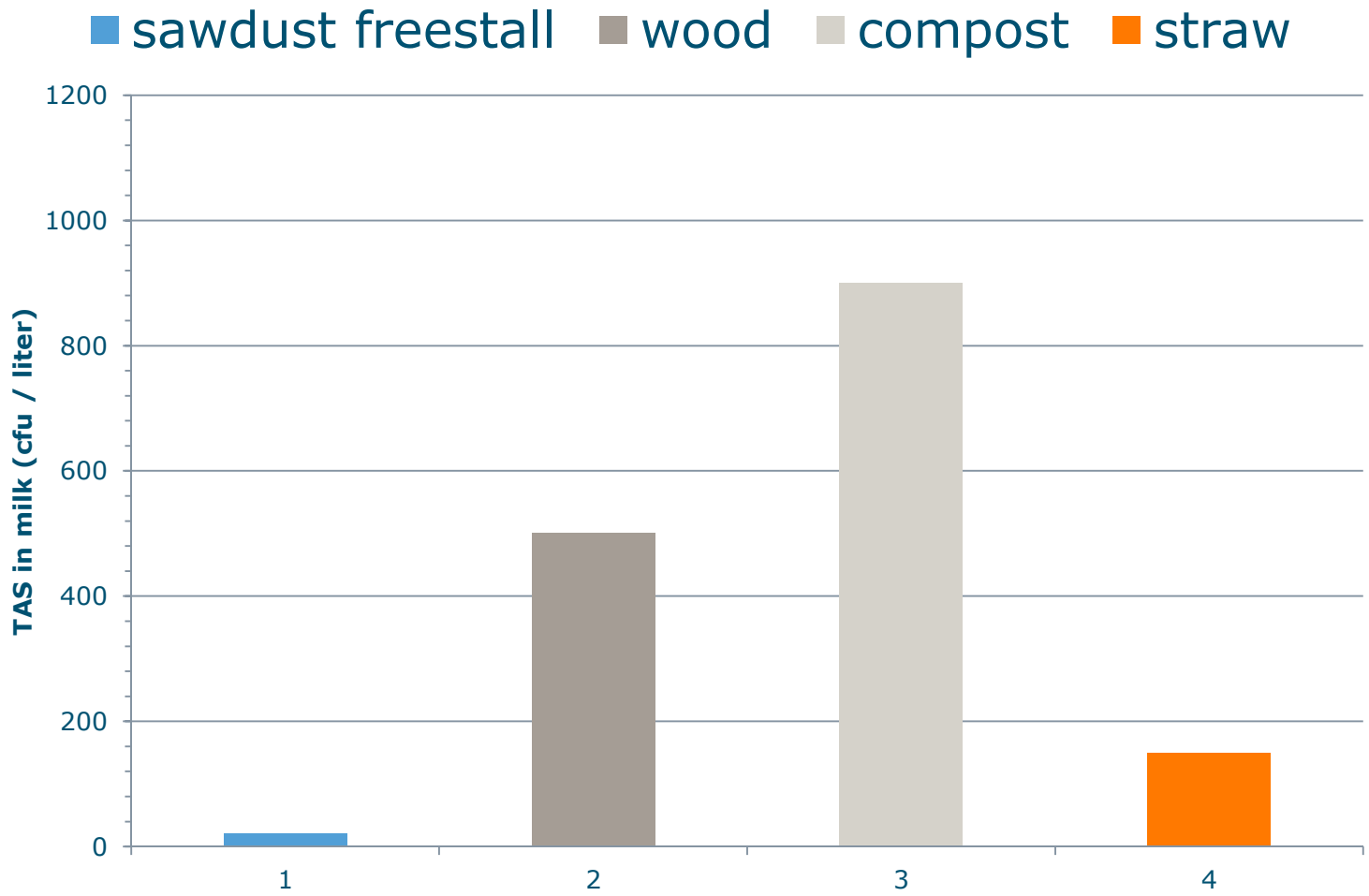
TAS in milk (Source NIZO)



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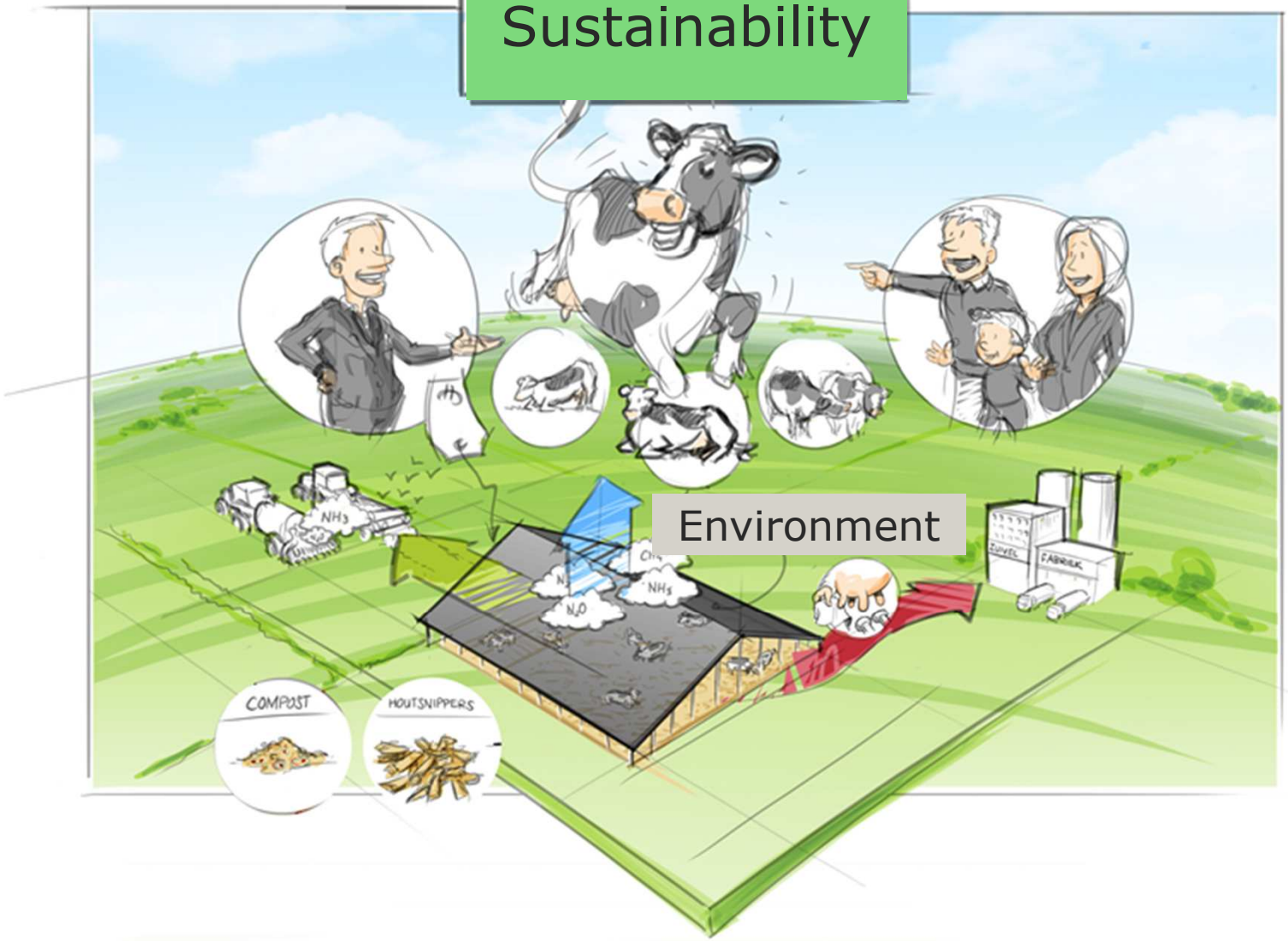

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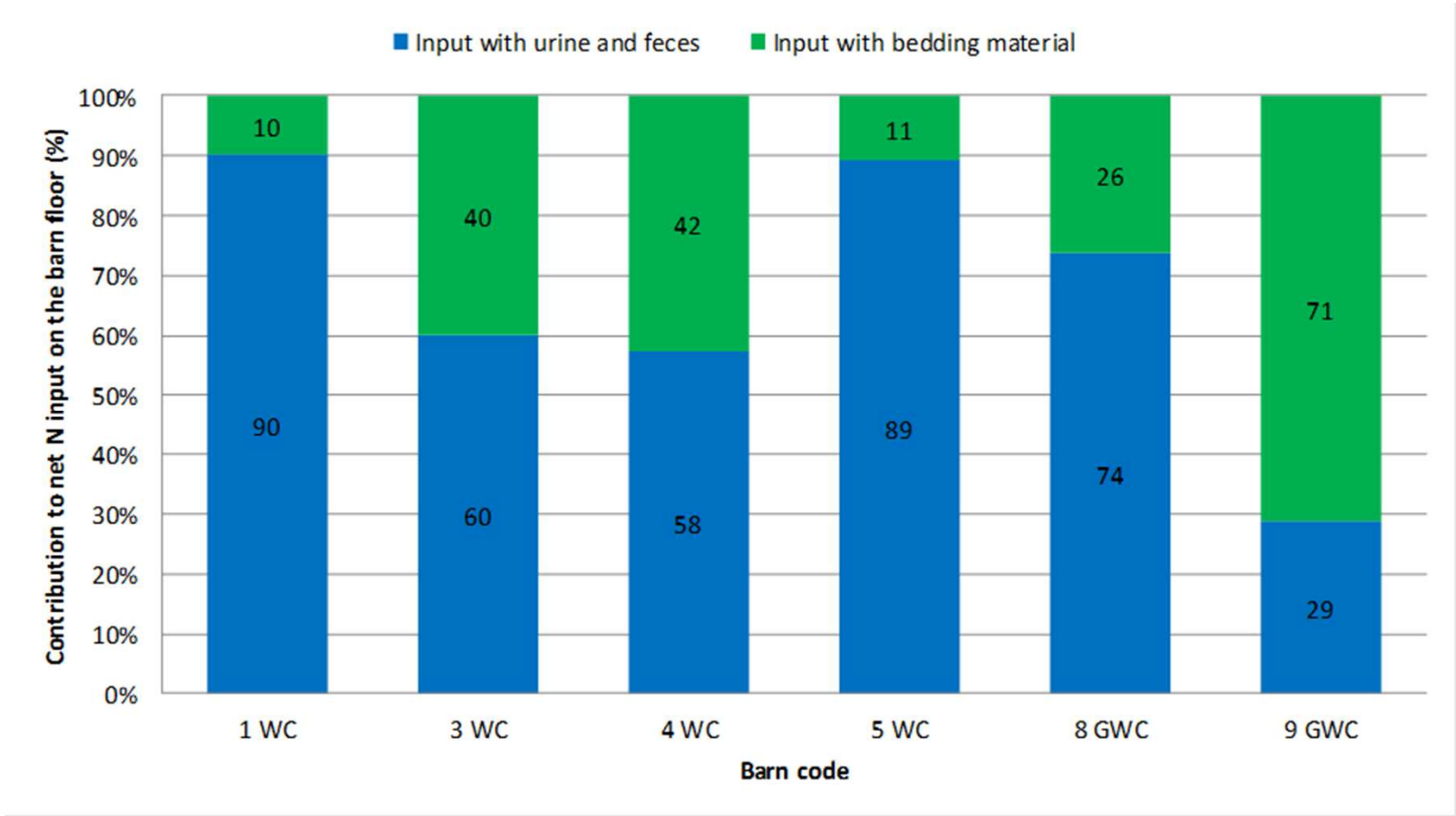
Contribution of bedding material to net N input on the barn floor



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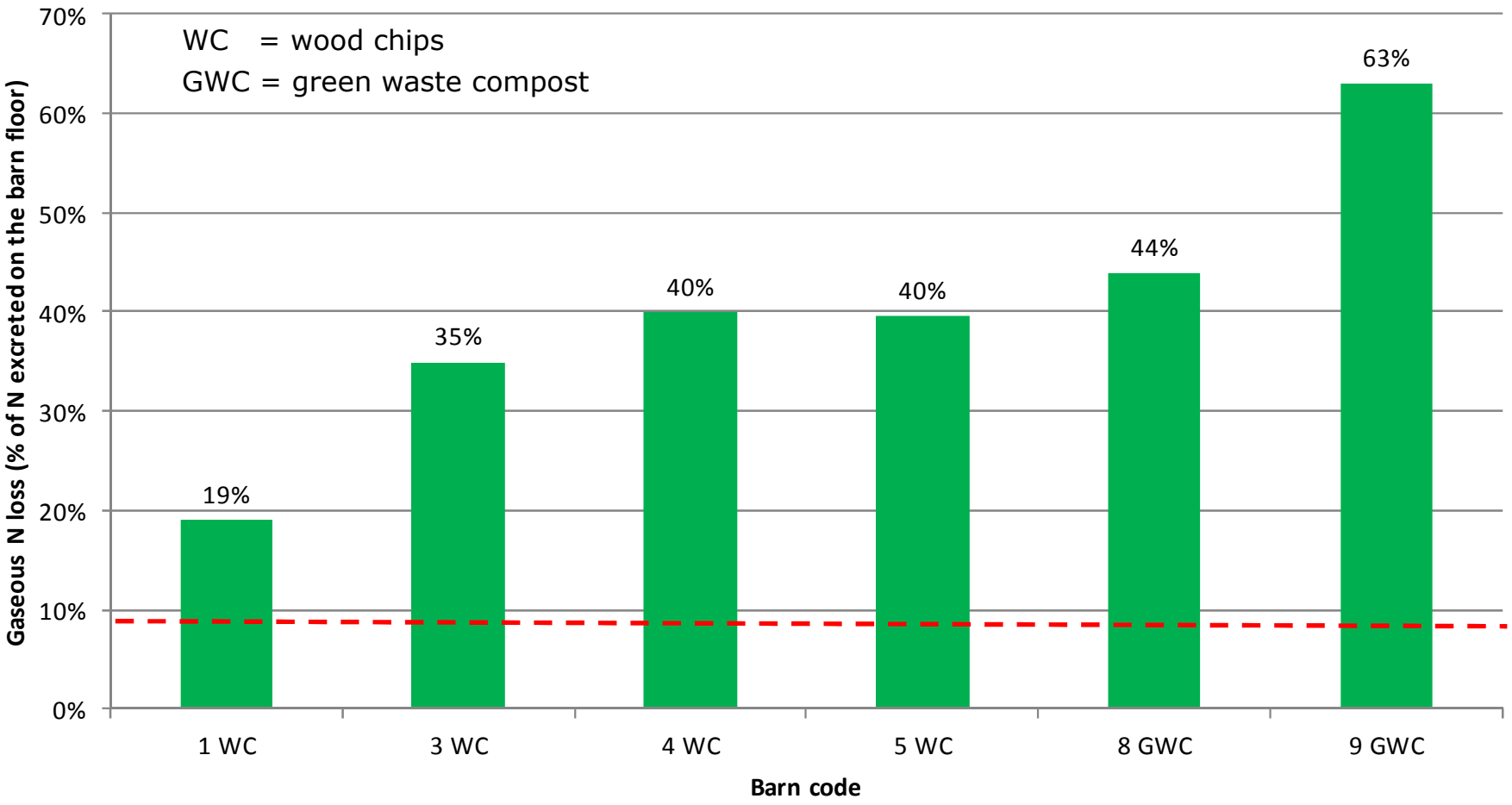
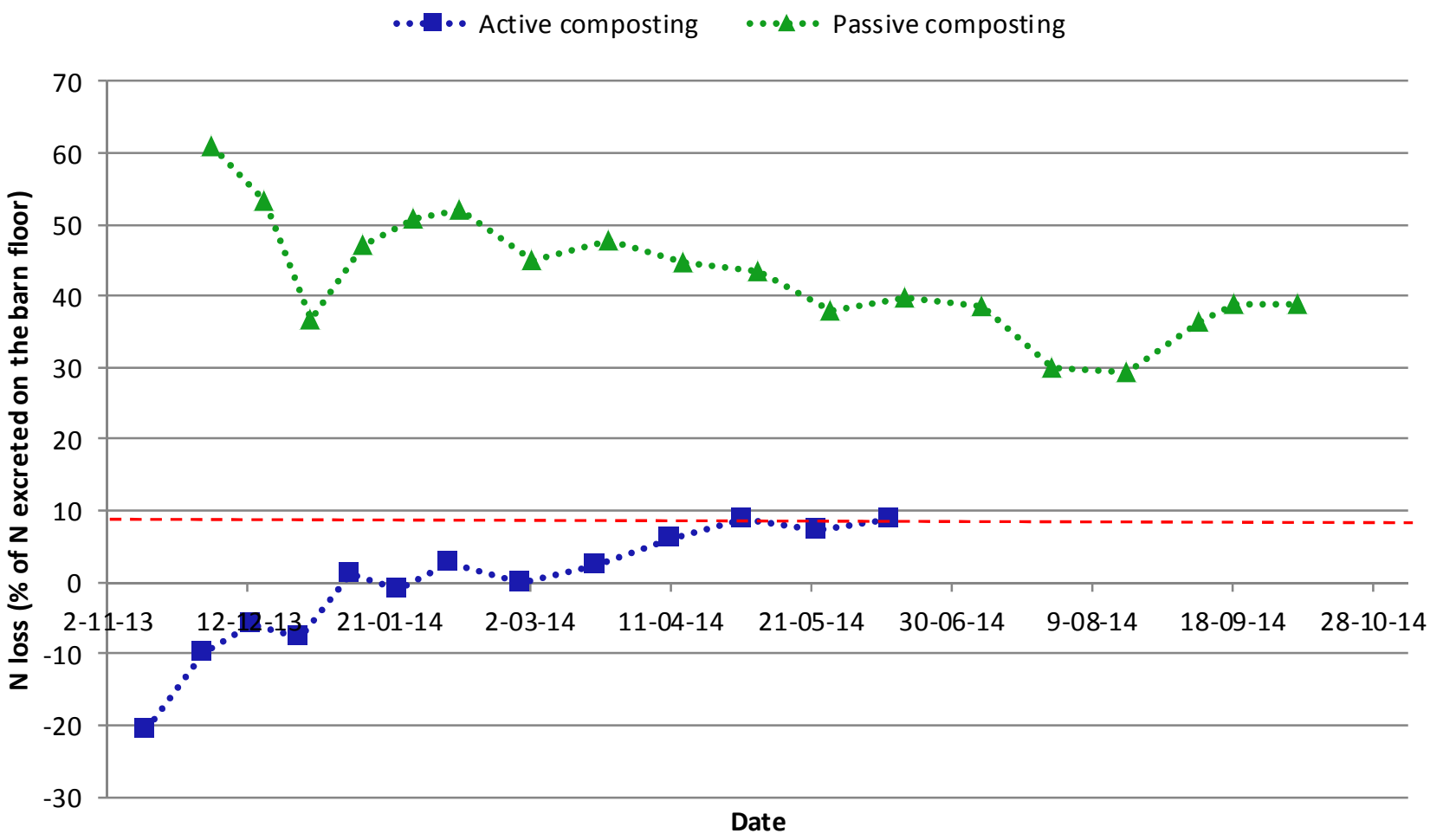
WC = wood chips, GWC = Green Waste Compost

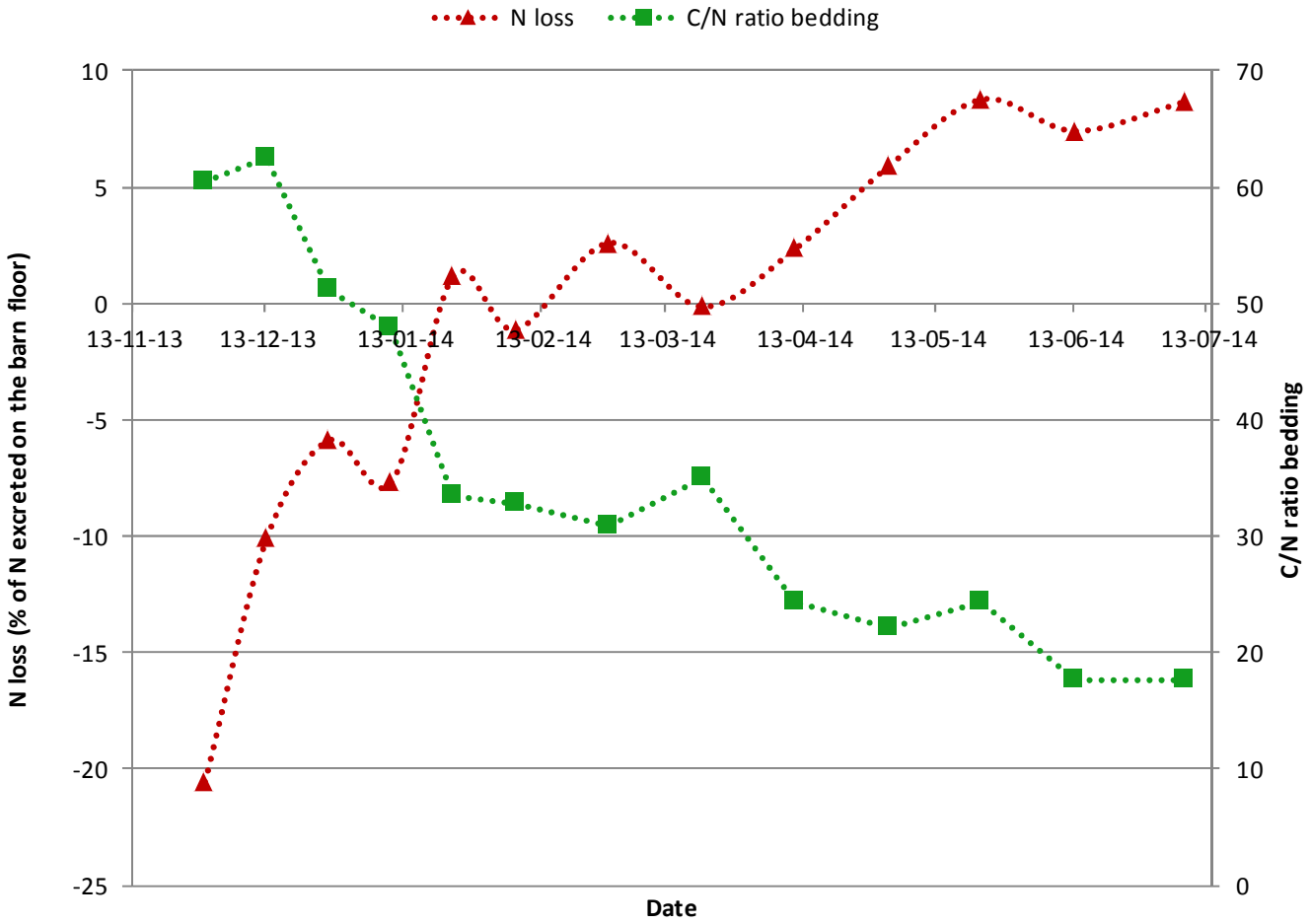
Range in N loss (% of total N-input)



Low N loss with active composting



Intensive composting: strong relationship between development of N loss and C/N ratio (1)



Overall sustainability

Sustainability aspect	**Criteria**	**Wood chips** *5 farms*	**Compost** *4 farms*	**Straw** *1 farm*
Economics	investment			
	Yearly costs			
	longevity			
Cow	Production, health			
	Welfare			
Milk quality	XTAS			
Environment	N losses stable		Prohibited	
	N losses land			
	Ammonia emission stable	2 farms and Dairy Campus		
	Nitrous oxide emission			
Manure Quality	Soil Improver			
	N mineralisation			

	better
	attention needed
	worse

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Change of bedding

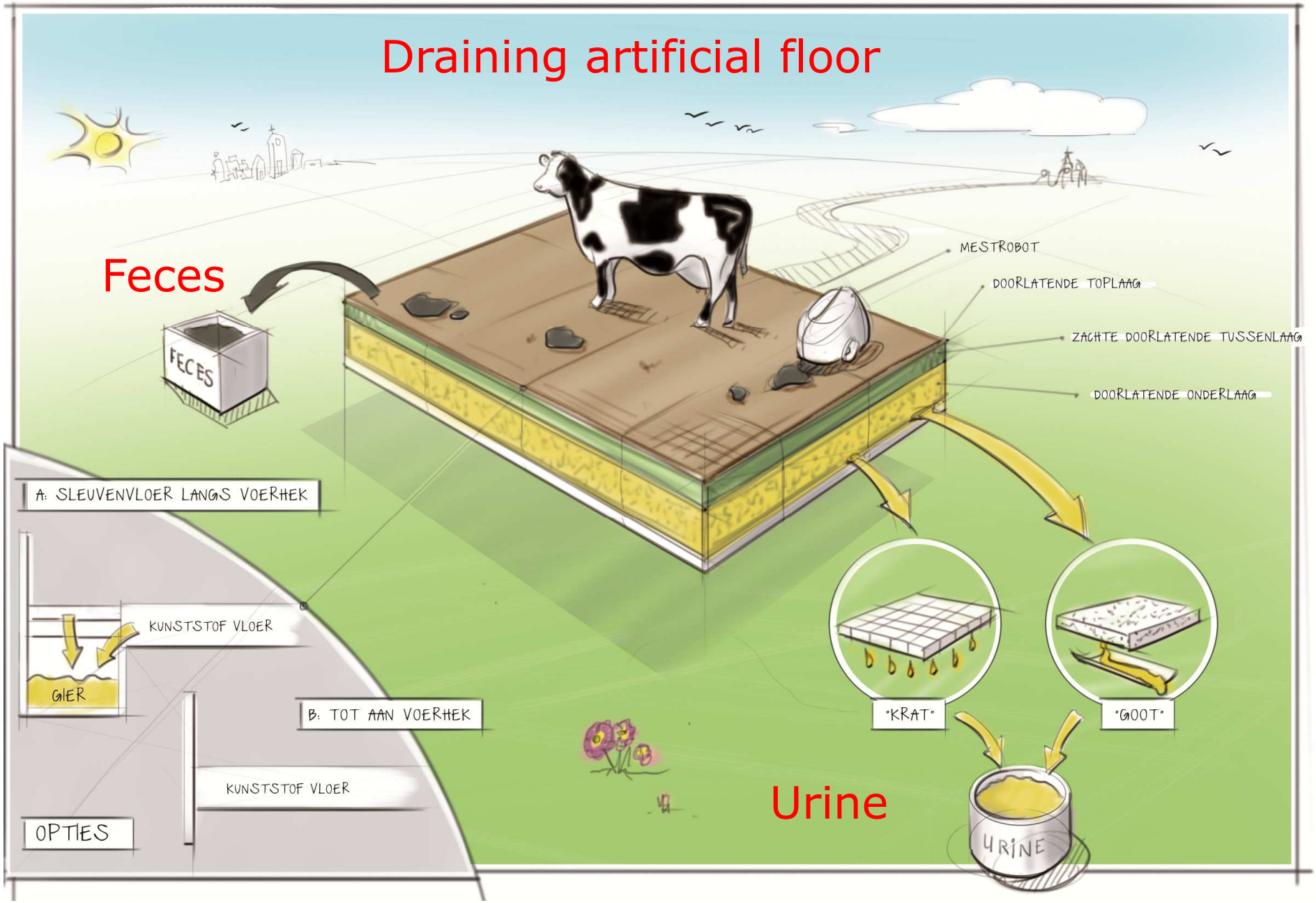
Use of compost is prohibited, now straw

Conclusions

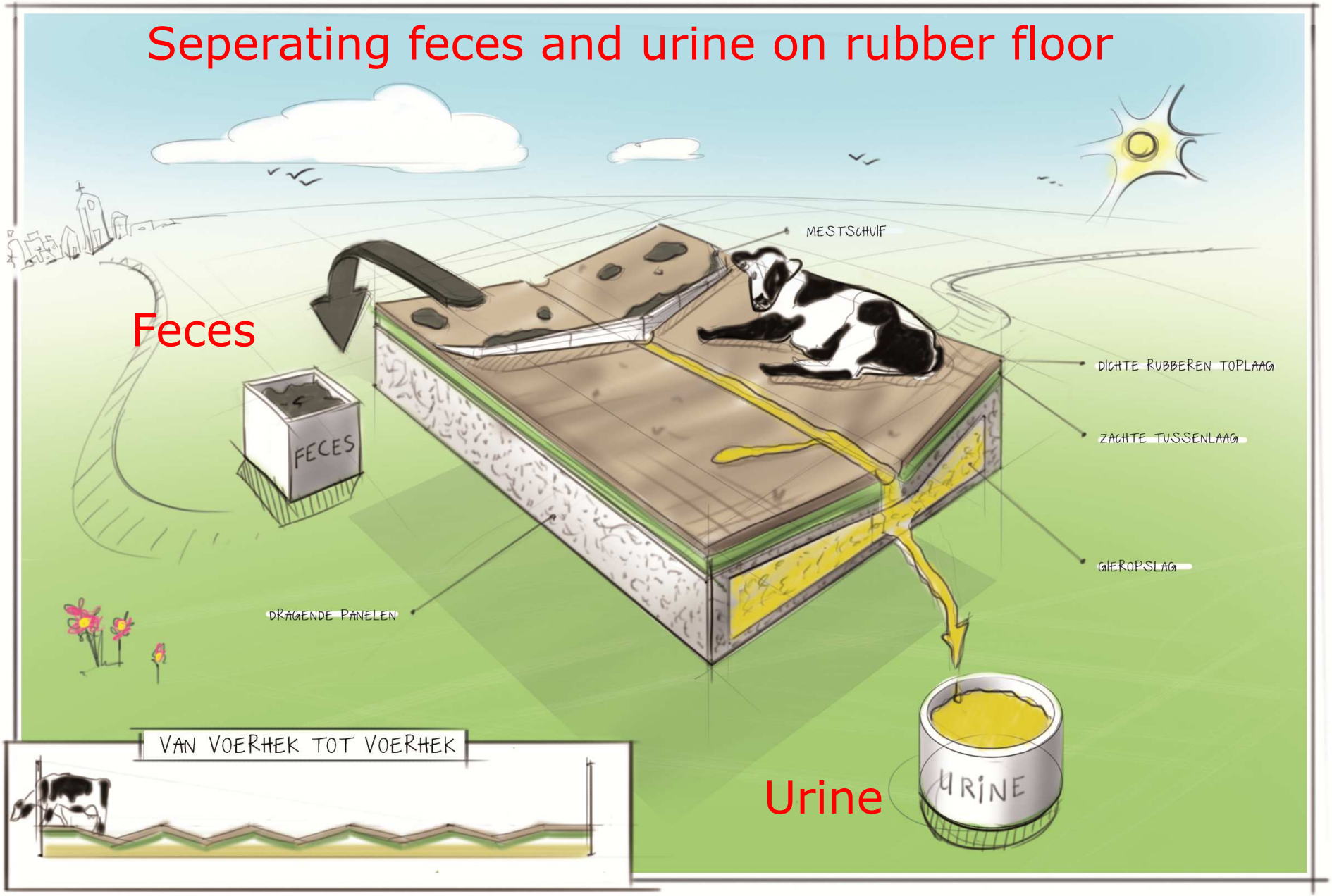
- Free Walk housing can be profitable if bedding material is not too expensive and cow replacement will be reduced
- “Intensive” composting can reduce the N-loss of the bedding by incorperation of excreted N in bacterial biomass
- Ammonia emission in stable uncertain until end of 2017, but emission in the field is lower
- “Composted wood chips / manure” is a good soil improver, but N will release slowly
- (X)TAS bacteria is a point of attention

Points to continue

- Bedding material and management
  - Alternative for Green Waste Compost
  - Control composting process of wood chips
  - Emission factor (kg NH3/cow/year)
- Synthetic floors
  - Hygiëne floor / cow and milk quality
  - Emission factor (kg NH3/cow/year)
- Sustainability of whole farming system
- Multiple use of building


Draining artificial floor
Feces
FECES
MESTROBOT
DOORLATENDE TOPLAAG
ZACHTE DOORLATENDE TUSSENLAAG
DOORLATENDE ONDERLAAG
A: SLEUVENVLOER LANGS VOERHEK
KUNSTSTOF VLOER
GIER
B: TOT AAN VOERHEK
KUNSTSTOF VLOER
OPTIES
"KRAT"
"GOOT"
Urine
URINE

Seperating feces and urine on rubber floor




...artificial floor...

“Cowgarden” and floor cleaning robot

Floor from ID Agro (Netherlands)

Robot from Betebe (Germany)

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Artificial floor

to seperate feces and urine

robot picks up the feces

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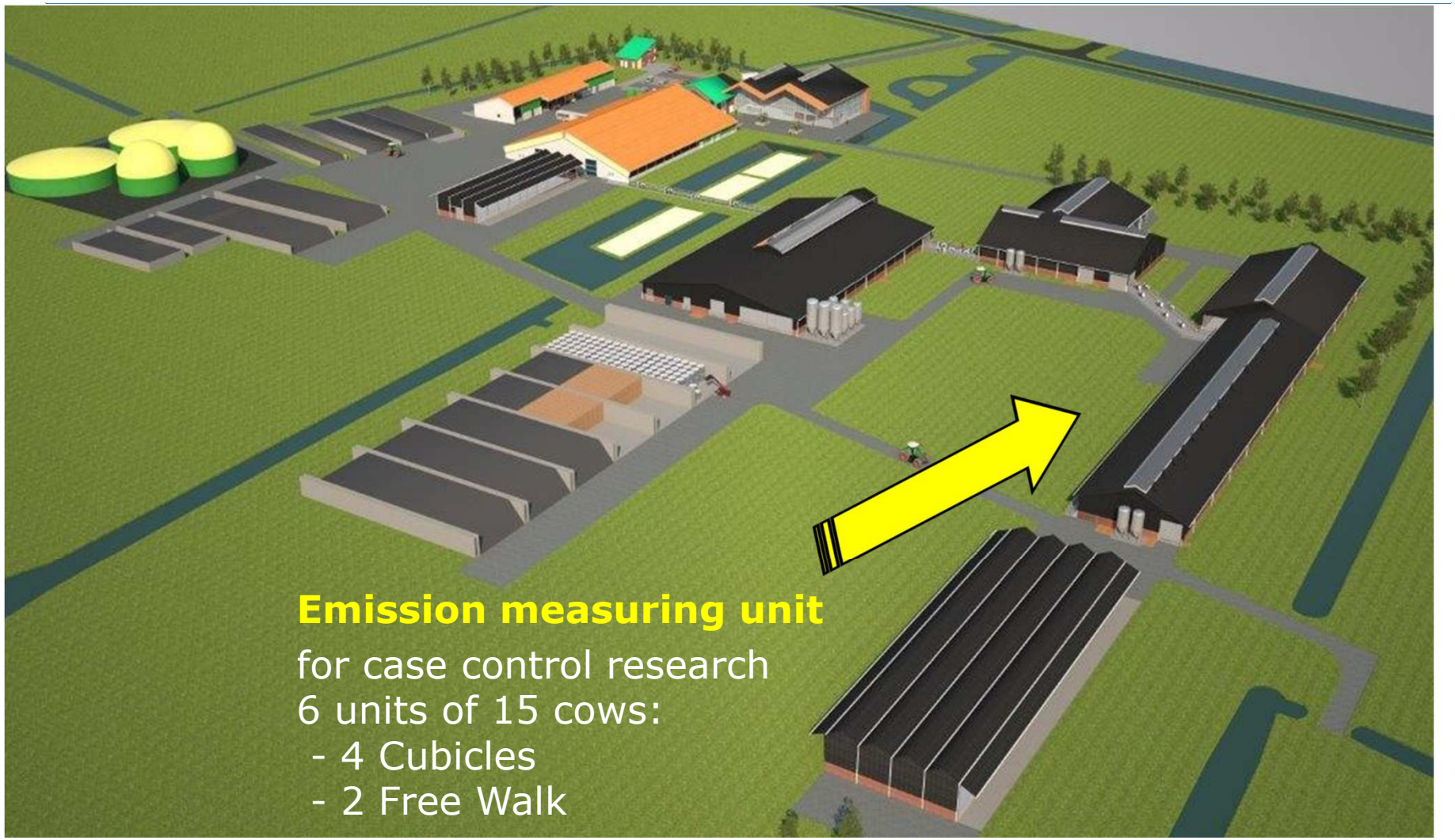
Dairy Campus facilities in Leeuwarden



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Meadow floor

...to reduce ammonia emission while improving cowmobility..

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aerating

...to mix slurry and reduce ammonia emission...

Sustainability

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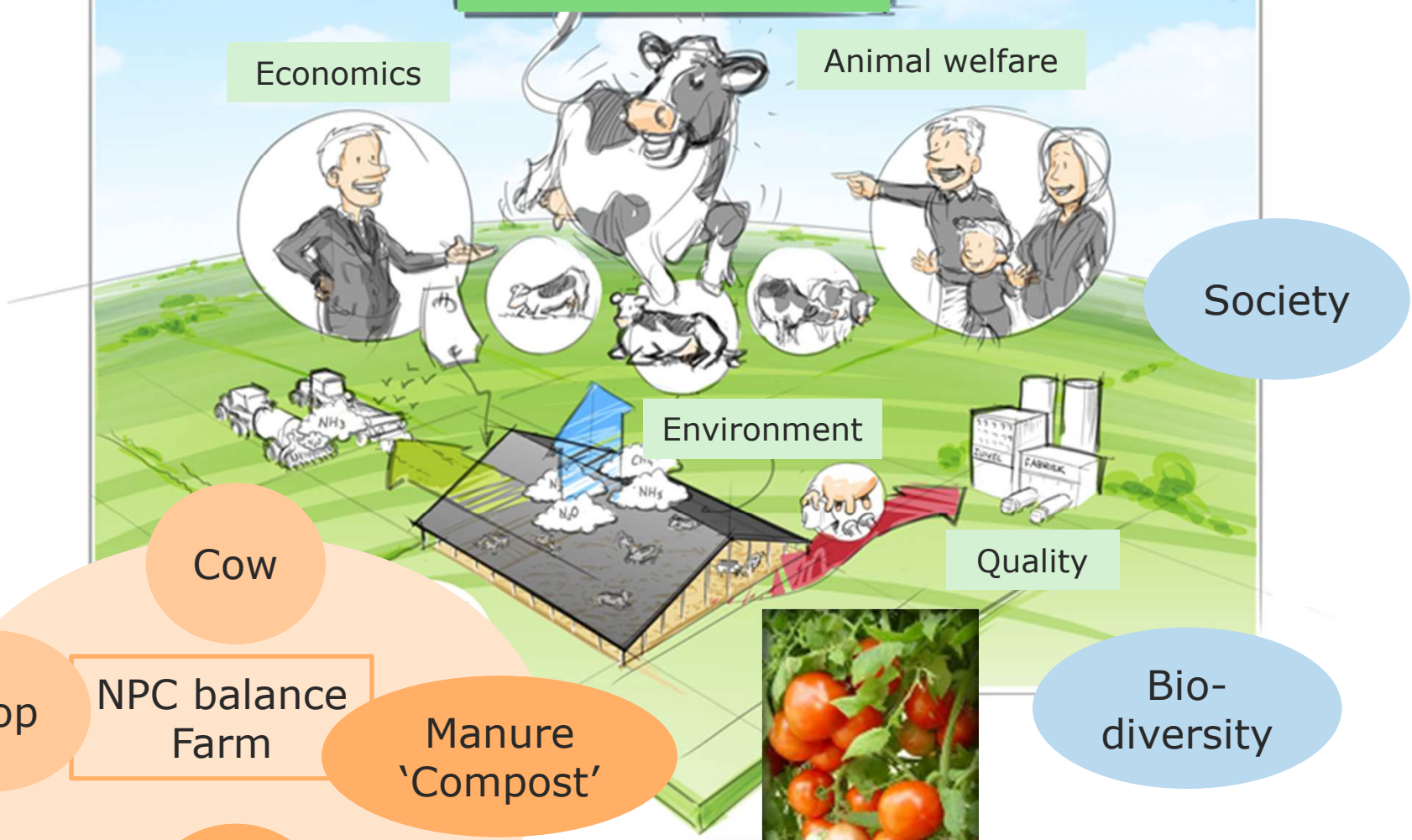
Free Walk
Holistic View

ERANET-Susan project with
8 countries (2017-2020)



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