

# **International Material Flow Management (IMAT) Master Degree Program**

## **ANIMAL PRODUCTION AND GLOBAL HEAT**

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# Global heat

Heat increment due to greenhouse effect caused by gasses released into the atmosphere

Gasses hold and prevent reflection of sunlighth

# Global temperature increased

0.5 to 0.8 °C since 1860

0.45 °C since the industrial revolution  
(1760-1829)

If it is not stopped, the increase in temperature will reach up to 2-2.5 °C at the end of this century.

# The global heat

- ✓ melted the polar glaciers
- ✓ will increase sea level (increased 20-25 cm in 20 th century; will increase 17-26 cm till 2030)
- ✓ will cause land loss at shores
- ✓ increases number and severity of floods and cyclones
- ✓ will change the migration periods of animals

- ✓increases number and severity of infectious and allergic, coronary and pulmonary diseases
- ✓Changes in climatic condition will result loss of some plant and animal species
- ✓Severe droughts,new deserts,dried streams and rivers, shot down power plants,more forest fires,warmers winters,early springs-delayed falls,changed seasons are ahead

## In Turkey

- ✓ Average temperature increased  $0.2^{\circ}\text{C}$  per 10 years during the last century; while precipitation (rains) decreased 10 %
- ✓ It is expected that the temperature will increase  $3-4^{\circ}\text{C}$  at the western half,  $4-5^{\circ}\text{C}$  at the eastern half of the country during the first quarter of the present century
- ✓ Depending on such expectations, it can be estimated that rains and water resources will be narrowed, as well as droughts, forest fires and soil erosion will become widespread

# Greenhouse gasses

H<sub>2</sub>O vapore (The most abundant)

CO<sub>2</sub>

CH<sub>4</sub>

N<sub>2</sub>O

Chlorofluorocarbons (CFCs)

DDT ,

Dioxins

Hg ve Pb compounds,

Vynilchlorides

Sodium nitrate

Polychlorinated biphenyls (*PCBs*)

SO<sub>2</sub>

Various polimers

Others than water evaporated can be controlled; CO<sub>2</sub> (49%) and CH<sub>4</sub> (18%) are most important in terms of global heat increment

# Atmospheric CO<sub>2</sub> from human activities

100-200 years ago:  
280-290 ppm



Today 368 ppm,  
(31% increase)

Since 1958



9 % increase

Today annual  
increase



1%

Increased fossil  
fuels



Increased CO<sub>2</sub>  
emission

Water, wind,  
electric,  
sunlight, H<sub>2</sub> et



Decrease CO<sub>2</sub>  
emission



# Methane

Heat increasing potential      During last 100 →      21 times of CO<sub>2</sub>  
potential                      years

Heat increasing potential      During last 20 →      56 times of CO<sub>2</sub>  
potential                      years

**Most effective in global heat increment**

Methane emission last 100 years → Doubled (2 ppm)

Methane emission next 50 years → Will share 15% of global heating

Methane emission Today's human activity → 360-500 mil t/year

Methane emission Since 1958 → Annually 1 % increase



Heat increasing potential during last 100 years has been  $\rightarrow$  310 times of CO<sub>2</sub>

Emission from human activities  $\longrightarrow$  10-17.5 mil t/year

Still, its share in greenhouse gasses  
is smaller than the others

# Responsibility of Animals

Digestive and metabolic gass production is

- Higher (10 times) in ruminants than nonruminants
- Higher in roughages than concentrate feeds
- 18 % of total gass, 9 %  $\text{CO}_2$ , 37 % methane and 65% of  $\text{N}_2\text{O}$  emission (from human activity) belong to animals

# Gass production

- Sheep  $\xrightarrow{\text{max}}$  50 l/d
- Cattle  $\xrightarrow{\text{max}}$  400 l/d
- Beef cattle  $\xrightarrow{\text{av}}$  60 kg (90 l)/d
- Dairy cattle  $\xrightarrow{\text{av}}$  120 kg (175 l)
- Plus : decomposition of residues ( manura. etc.)

# Composition of ruminal gass,%

CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> +NH <sub>3</sub>	O <sub>2</sub>	H <sub>2</sub>	H <sub>2</sub> S
24.8-69.0	18.8-40.5	3.1-36.2	0.2-6.5	0.01-4.3	0.09-0.7

**CO<sub>2</sub> takes first, CH<sub>4</sub> takes second place in digestive gasses**

In methane emission,  
ruminants are most  
effective (responsible for  
more than 70% of all  
animals' release)

# **Annual methane production of animals all around the World (million ton)**

<b>Cattle</b>	<b>54.6</b>
<b>Sheep</b>	<b>6.9</b>
<b>Goat</b>	<b>2.4</b>
<b>Camel</b>	<b>1.0</b>
<b>Pig</b>	<b>0.9</b>
<b>Wild ruminants</b>	<b>2-6</b>
<b>Total</b>	<b>67.8-71.8</b>





$\text{O}_2$   $\longrightarrow$  Drinking water and aerobic m.o.

$\text{N}_2, \text{NH}_3$   $\longrightarrow$  Air in feeds and water, protein degr.

$\text{H}_2\text{S}$   $\longrightarrow$  Feed organic and inorganics

**Animal release digestive gass through eructation**

- 1 kg beef = Gass emission equivalent to 36.5 kg CO<sub>2</sub>  $\cong$  3h car driving + lights on

**Suggestion (!?):**

Maximum daily meat consumption per person should be limited at 90 g

# PREVENTIVE APPLICATIONS

- **Roughage/concentrate ratio of diet**

Roughage, lignin, low quality forages may increase gas release 30 %

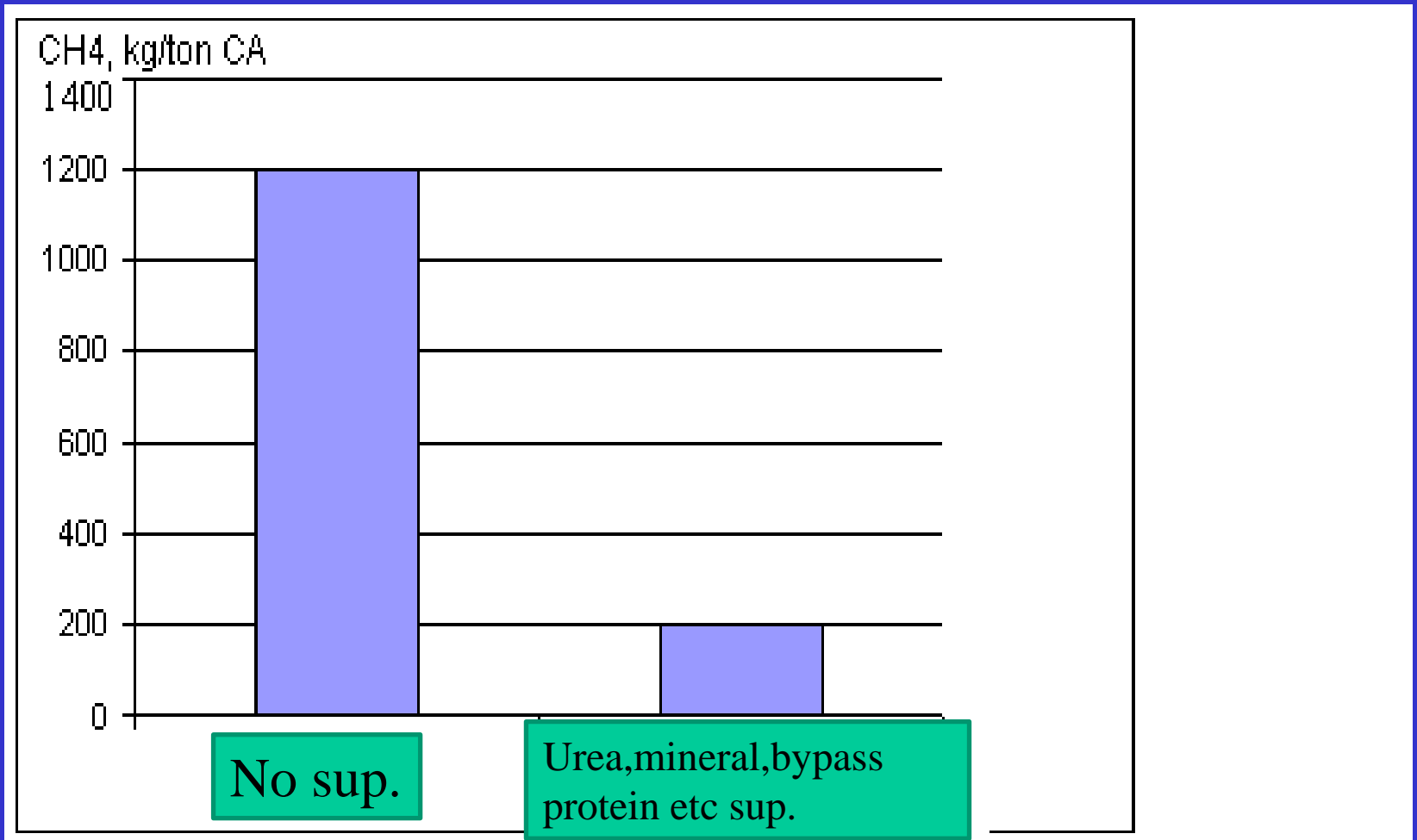
- **Processing the roughage**

Acid or alkali, urea solution, celluloid bacteria, enzymes, grinding, pelleting may decrease CH<sub>4</sub> production 40%.

- **Supplementation of the diets**

Minerals, urea, bypass protein, protected fats (oils ) decrease  $\text{CH}_4$  production effectively (protected long chain polyunsaturated fatty acids are most effective)

# CH<sub>4</sub> production of cattle fed straw



- **Feed additives (monensin and lasalocid)**

25% reduction of CH<sub>4</sub> (effective for 2 weeks, banned by EU); malic and fumaric acids can replace them effectively

- **Increasing feed consumption**

Consumption at twice of maintenance level: 1-1.5 % less CH<sub>4</sub> production

- **Animal breeding**

Selecting animals better in feed conversion: 1/3 less CH<sub>4</sub>

- **Controlling the manure**

Covering-closing, composting, biogas: Lowers CH<sub>4</sub> and N<sub>2</sub>O emissions.

# RESULTS

- Responsibility of the ruminants in greenhouse gas emissions is significantly high.
- **Emission can be reduced by 60 % with...**
  - ✓ High yielding animals with a high feed conversion
  - ✓ Diets high in concentrates and high in digestibility,
  - ✓ High quality and palatable diets supplemented by bypass protein, minerals, protected oils, organic acids
  - ✓ Ad libitum feeding