



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Federal Department of Economic Affairs,  
Education and Research EAER

**Agroscope**

# Innovations for Hillside Farming

**Sepp Knüsel Landmaschinen  
Robert Kaufmann, Agroscope Tänikon**

22 Feb. 2015

[www.agroscope.ch](http://www.agroscope.ch) | good food, healthy environment

# Hillside farming (HSF) has many faces







# Grassland production system as an example



Multifunctional mountain farming – the link between production and landscape

(Source: Agroscope )



# Challenges posed by the grassland production system

- Animal-husbandry/forage-crop production system
  - Forage conservation/storage for winter feeding
  - Transport from field to farmyard (distances, differences in altitude)
  - Greater transport volume (volume, weight)
- Forage quality
  - Management intensity – quality
  - Labour peaks – harvest opportunities
- Structures and topography
  - Slope gradient
  - Structure (farm and plot size, accessibility)
- Mechanisation and manual labour



# From grass to feed – Mechanisation in difficult circumstances: Mowing





# Tedding







# Windrowing: leaf blower or bound haymaker





# Harvesting, transport and unloading: bulk transport







# Harvesting, transport and unloading: Round bales





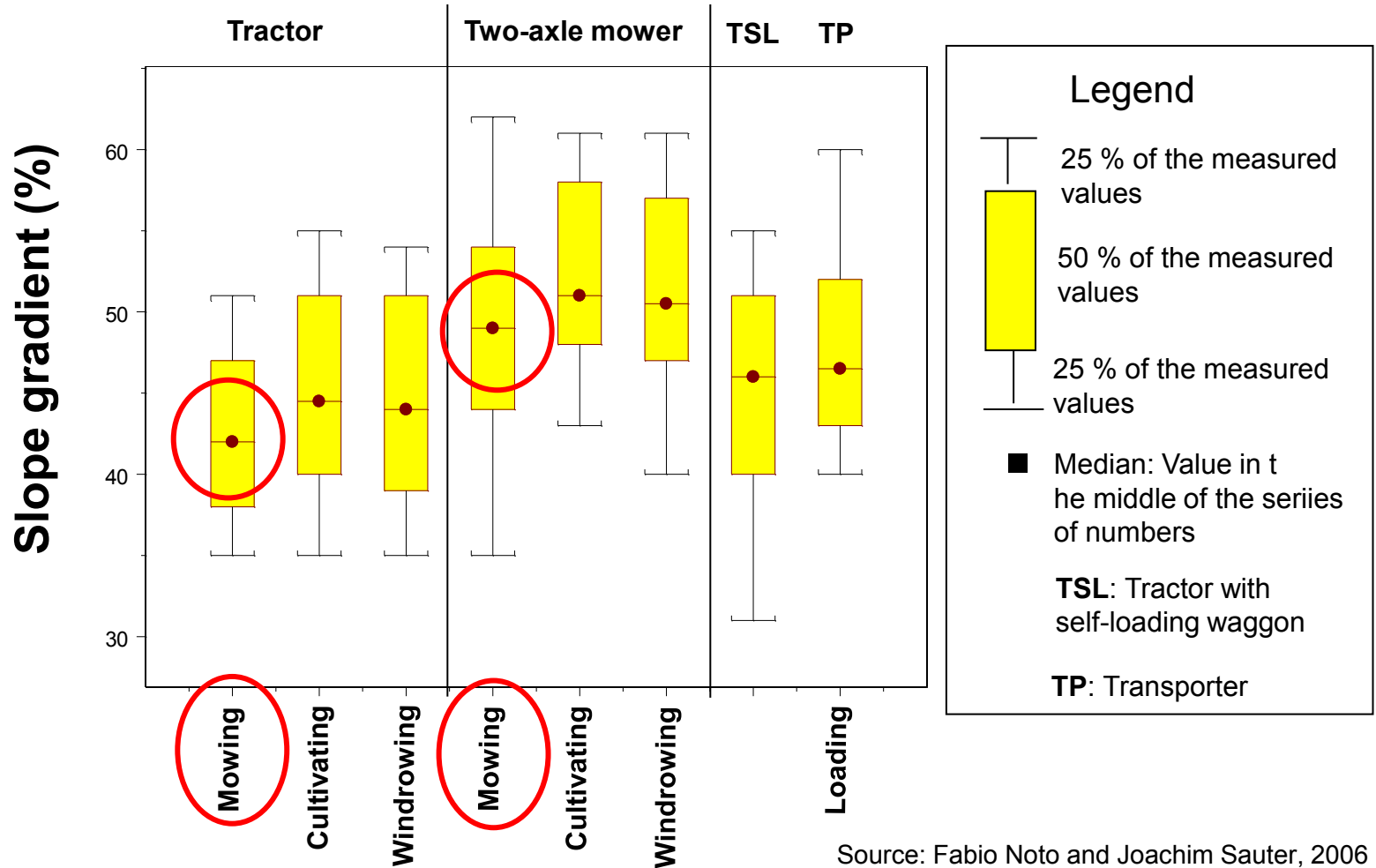
# Manure application







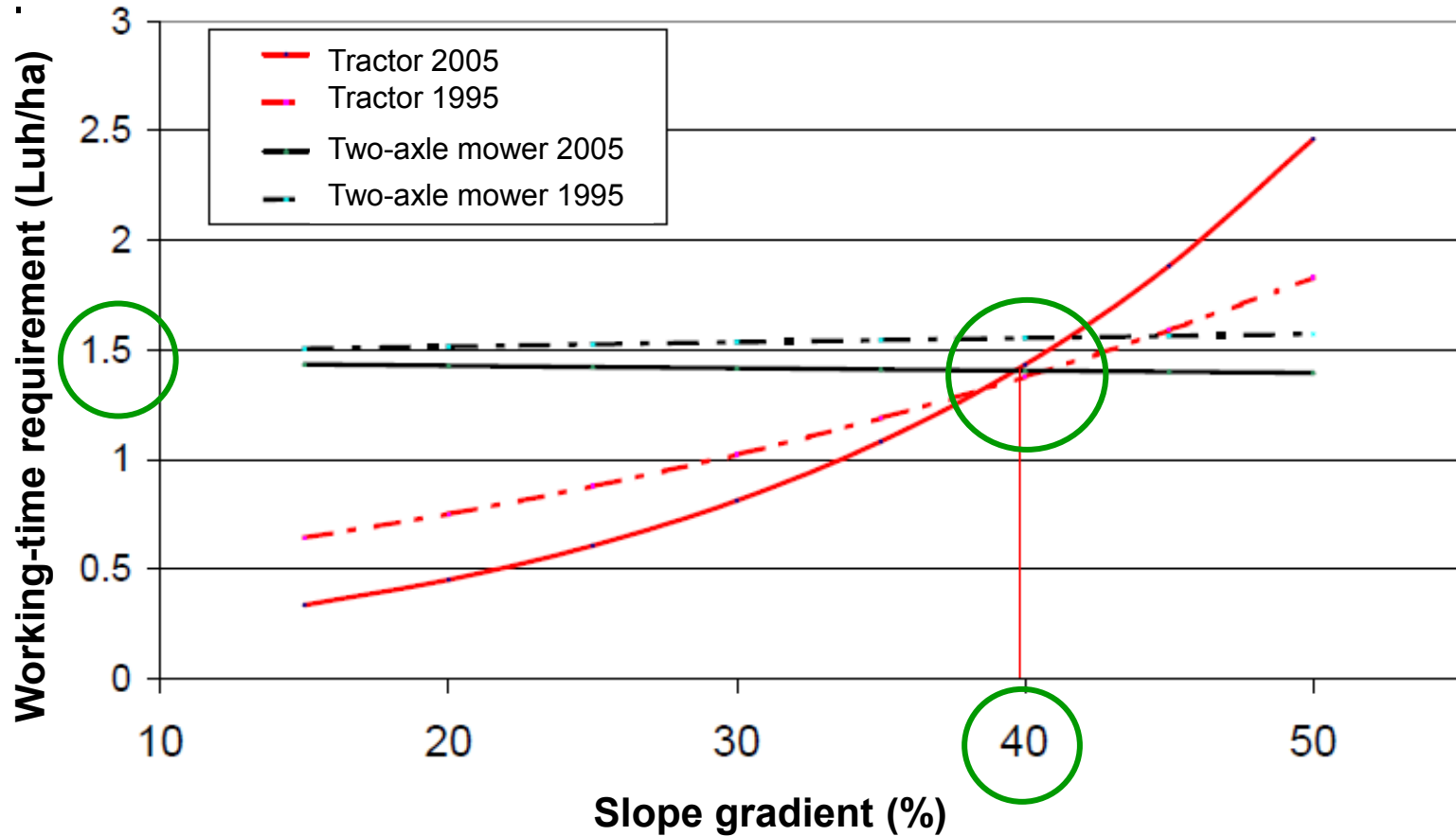
# Mowing on the slope: the critical process



Source: Fabio Noto and Joachim Sauter, 2006



# Working-time requirement (LUh/ha)



Source: Fabio Noto and Joachim Sauter, 2006



# Hillside mechanisation: a challenge for engineering and farmers

- Demands made of hillside mechanisation
  - Performance and manoeuvrability
  - Safety (suitability for slopes – operating limits)
  - Protection of the soil
- Special machinery: small production runs, simple robust technology (use, maintenance, servicing)
- Different towing-vehicle concepts
  - Two-axle mower – light multipurpose tractor – transporter
  - Heavy multipurpose tractor and self-loading waggon (drive axle)

# Rigitrac – an innovative tractor concept

## ***‘Multipurpose tractor’***

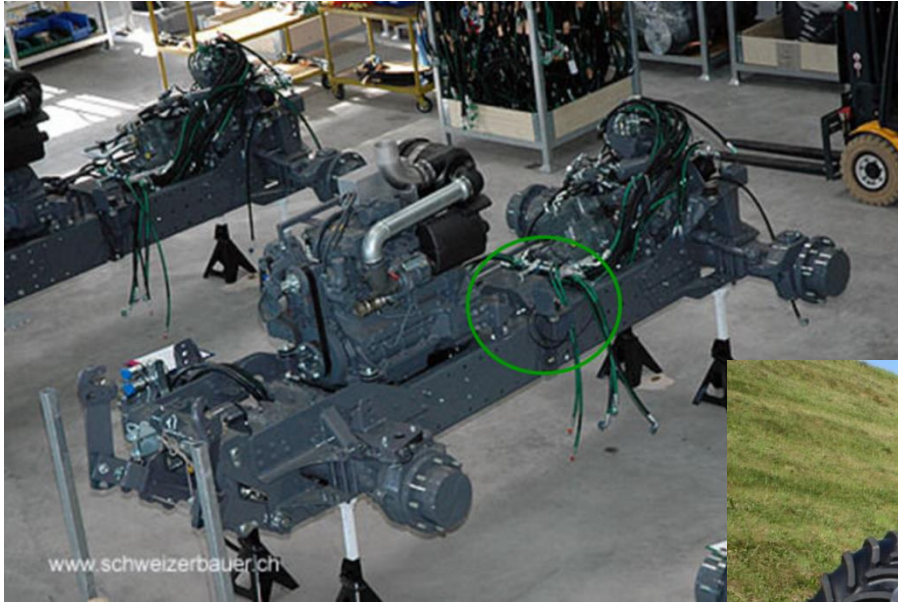
- Tractor chassis with central pivot: low centre of gravity, safety on the slope (front-mounted devices)
- Same wheel diameter front and back: no advance running – protects soil/tyres, saves energy
- All-wheel drive: safety, braking effect, climbing power
- All-wheel steering: manoeuvrability, soil protection
- Telescopic handler axles: no camber – flat wheel support (double wheel)

## ***Fields of application***

- Mowing, tedding, turning, slurry piping
- Towing tasks, wheel loader tasks
- Municipal use (winter road clearance)



# Rigitrac – an innovative tractor concept: Tractor chassis with central pivot: low centre of gravity, safety on the slope





# Strengths when mowing on a steep slope







# Multifunctional use – Wheel loader/ Municipal vehicle



(Source: Rigitrac AG)



(Source: Rigitrac AG)





# Future visions for HSF (I): Optimising human/machine interaction: Power – comfort – safety

## Hayblower





# Future visions for HSF (I): Optimising human/machine interaction: Power – comfort – safety







# Future visions for HSF (II): Giving up the production function: looking after cultivated land, keeping landscape open, nature conservation areas



Schächental, Canton of Uri, Switzerland (Photo: Agroscope)





# Future visions for HSF (II): Giving up the production function: looking after cultivated land, keeping landscape open, nature conservation areas

[www.brielmaier.com](http://www.brielmaier.com)



Source: [www.landwirt.com](http://www.landwirt.com)



# Future visions for HSF (II): Giving up the production function: looking after cultivated land, keeping landscape open, nature conservation areas

Autonomous mower



Source: [www.badische-zeitung.de](http://www.badische-zeitung.de)

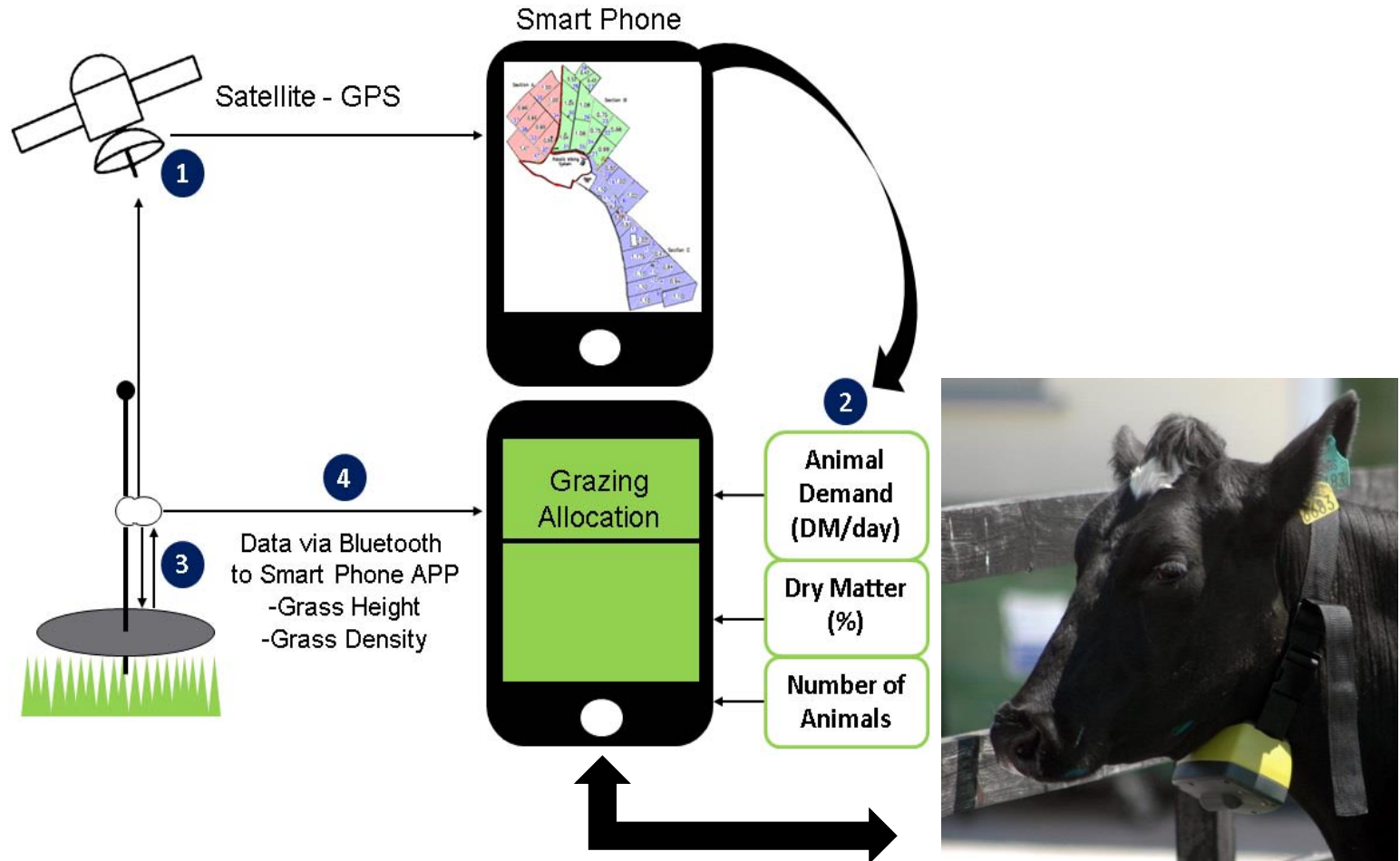


# Future visions for HSF (III): Production alternatives: Extensive animal husbandry





# Future visions for HSF (III): Production alternatives: Extensive animal husbandry



Source: Agroscope, C. Umstätter. 2014



# Thank you for your attention!

Robert Kaufmann

[robert.kaufmann@agroscope.admin.ch](mailto:robert.kaufmann@agroscope.admin.ch)

Tel. +41 52 368 33 11

Dep. Agr. Economics and Engineering  
Institute for Sustainability Sciences ISS  
Tänikon, CH-8356 Ettenhausen



**Agroscope** good food, healthy environment