



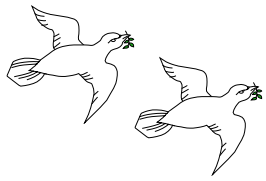
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Sustainable development embedded in agronomy of sugar beet cultivation

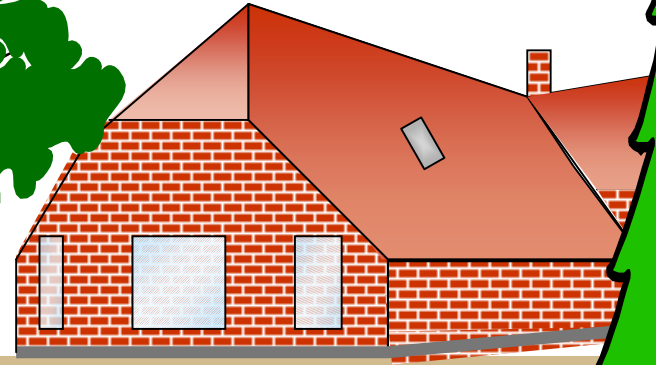
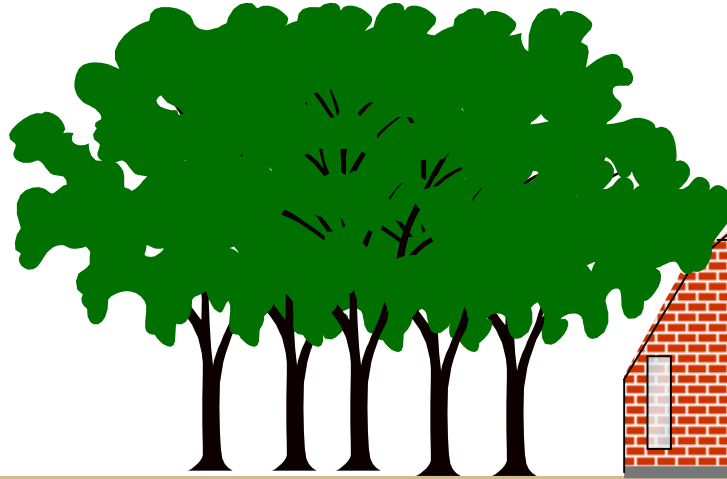
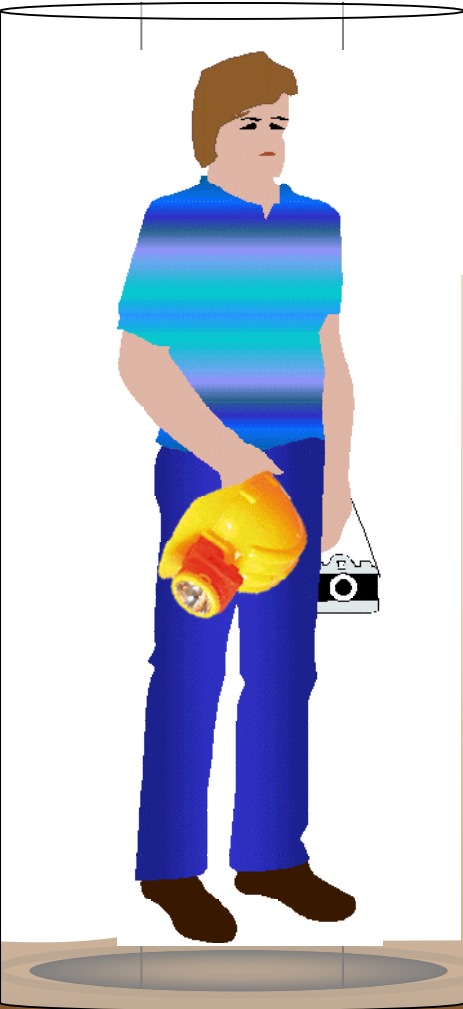
Frans Tijink

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs.”

The Brundtland Commission, 1987



digging at home



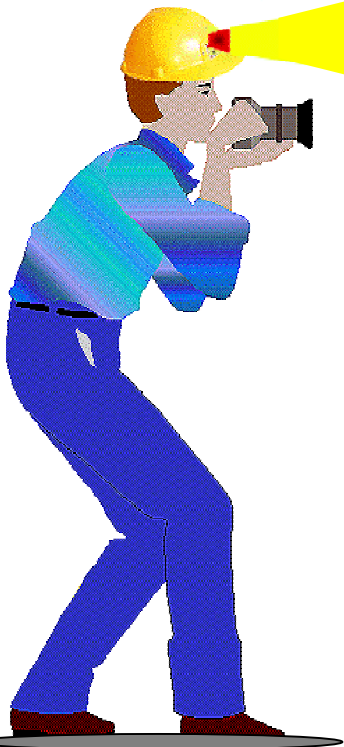
after 1 meter digging

1000 years farming



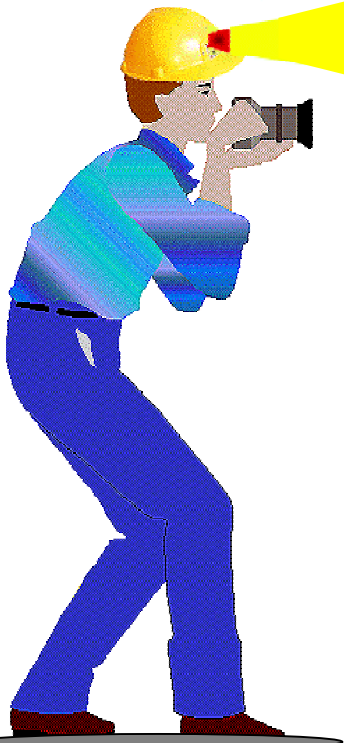
after 3 meters digging

**stones deposited in the
latest glacial period**



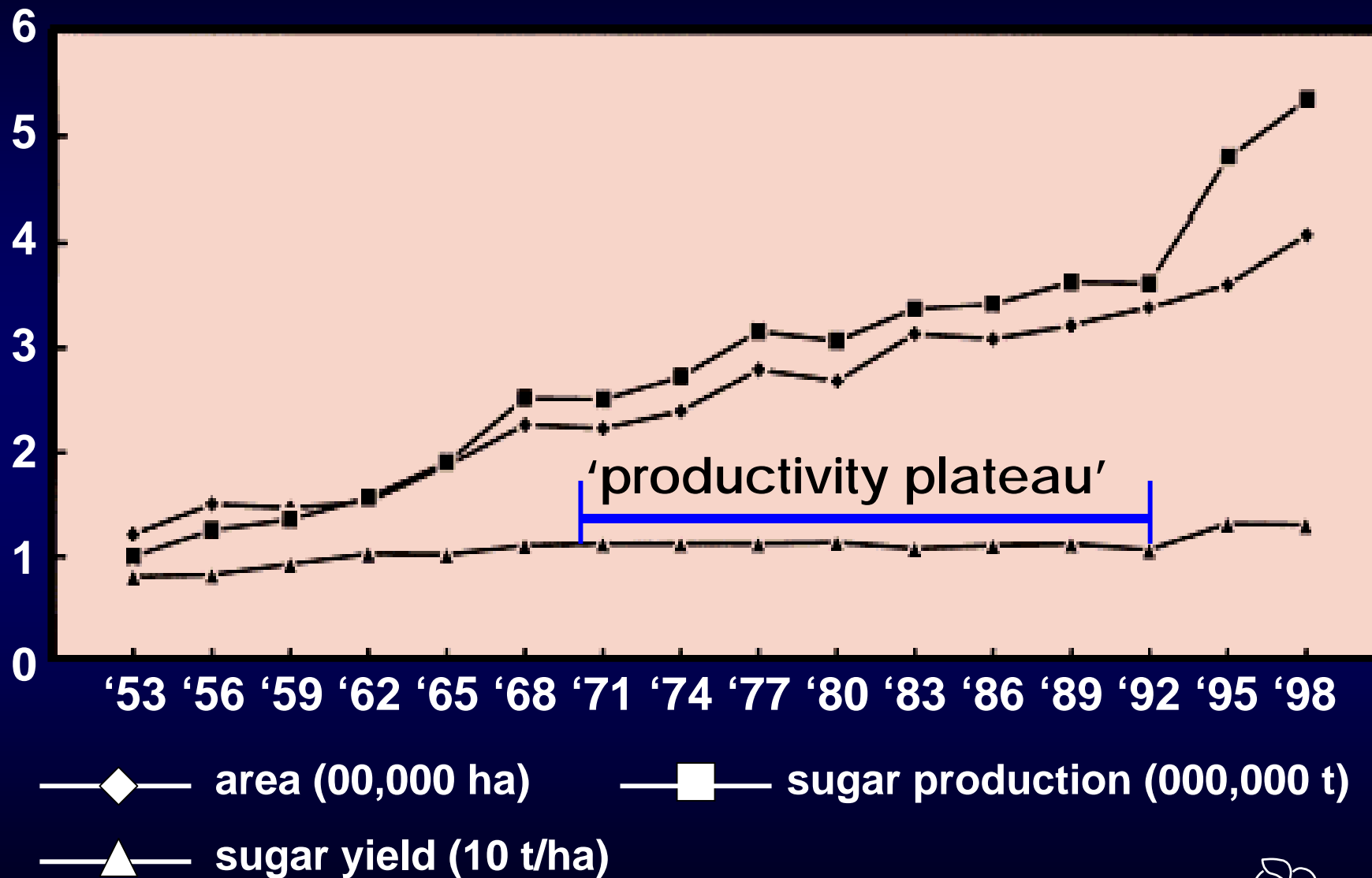
after 400 meters digging

**salt deposit
200 million years old**



criteria for sustainability are not stable in
time  sustainable development

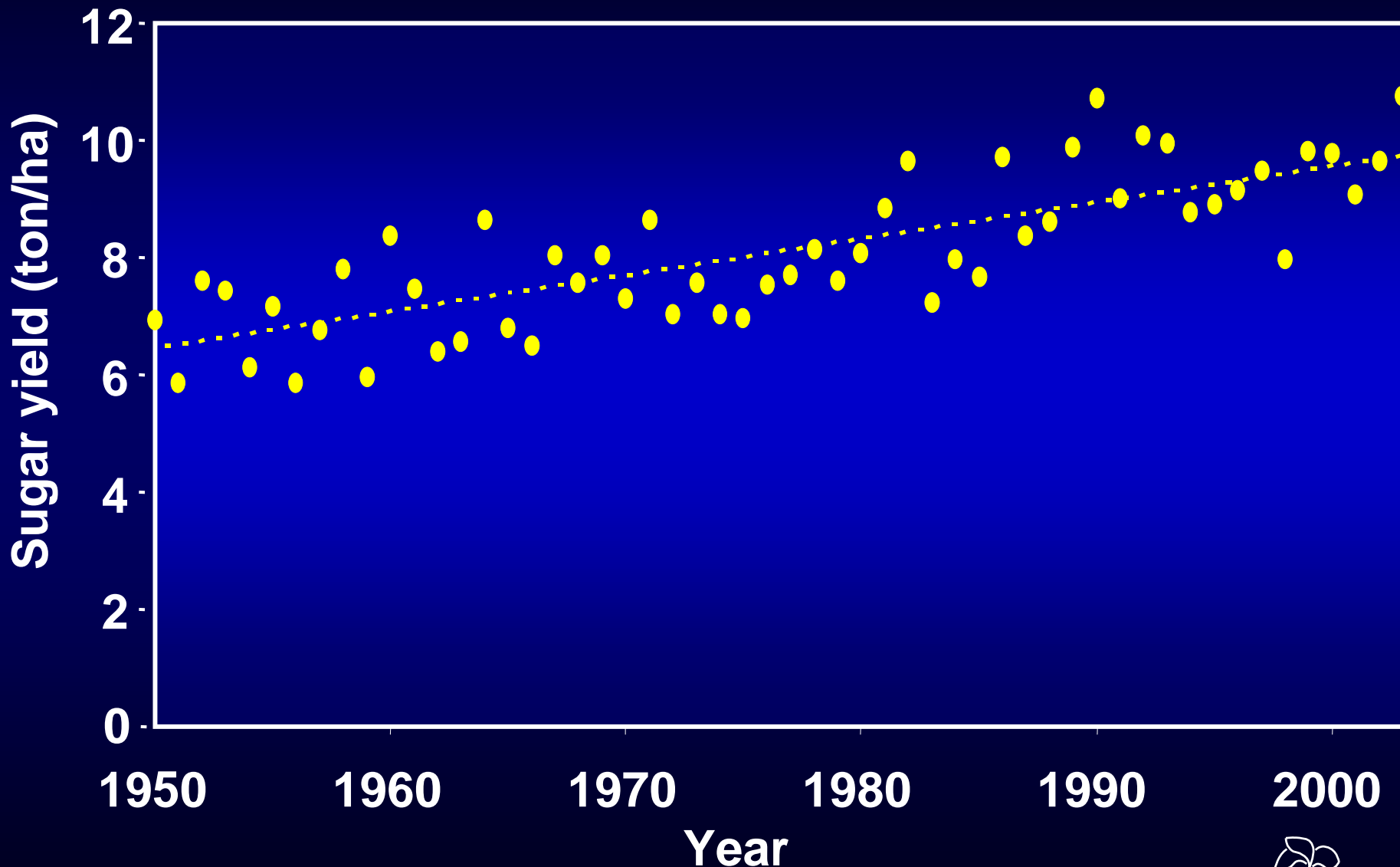
Trends in Australian sugar production (1951-1998)



(source: SRDC, 1999)



Sugar yield 1950 - 2003

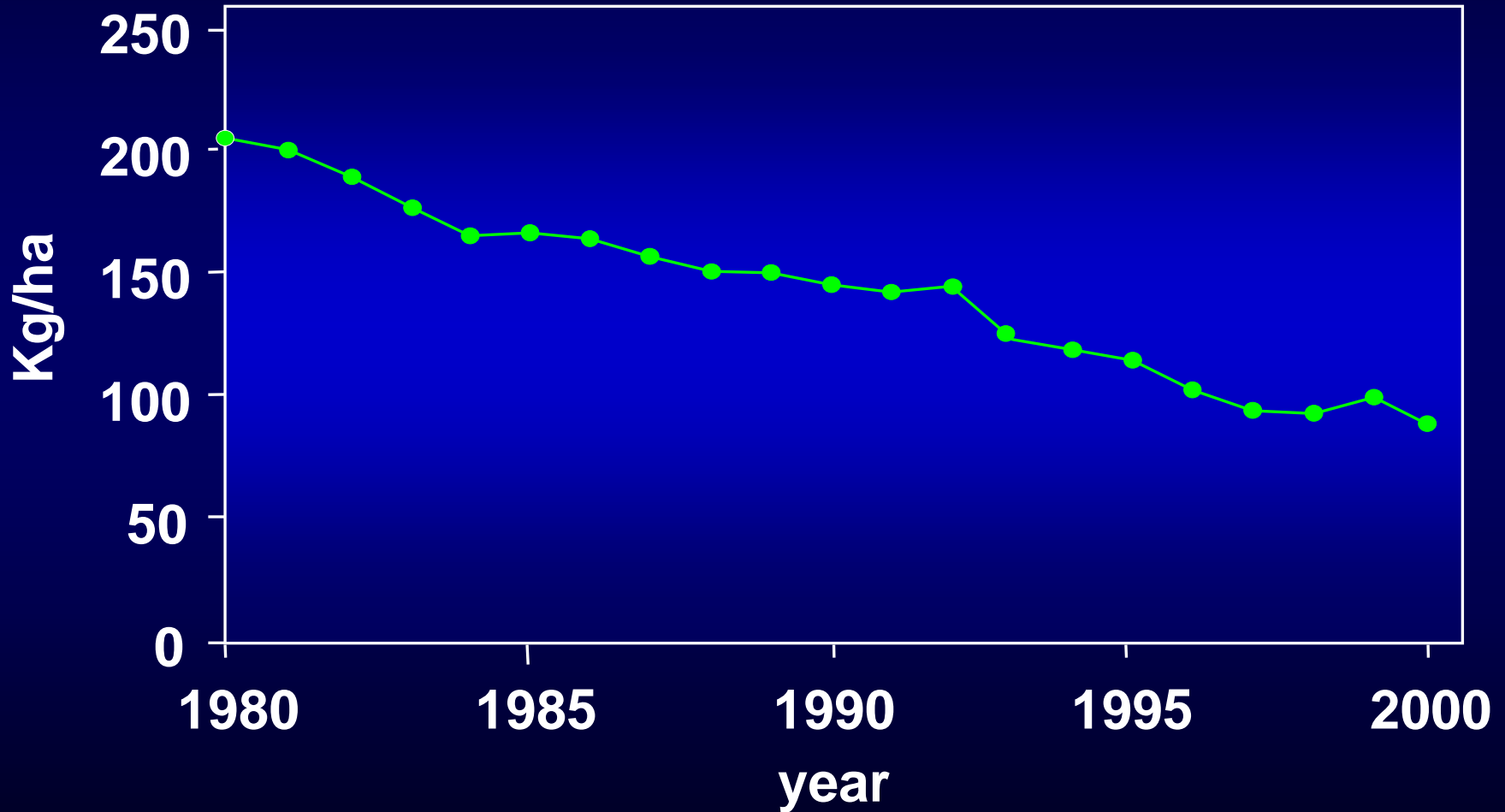


Characteristics sugar beet

- ☀ efficient at accumulating photosynthate in useful form
- ☀ efficient in recovering residual soil nitrogen
- ☀ deep (2 m) and dense network of root fibres
 - ➔ efficient use of water and nutrients
 - ➔ leave a clean soil profile
 - ➔ high dry matter yield

Nitrogen supply 1980-2000

(example from Germany)



(Source: WVZ 2004)

Water

- ✱ basic need for growth of every plant
- ✱ beet has better water efficiency than cane
- ✱ more important at higher temperatures
(+ 1 °C = + 5% evaporation)
- ✱ climate change: drought stress more important
- ✱ need to improve water management;
regulated by local covenants/
agreements and laws

Soil husbandry

- ✱ soil erosion
- ✱ soil compaction
- ✱ soil tare
- ✱ soil contamination
- ✱ soil organic matter

erosion !



Soil erosion

- ✱ regulated by local covenants/ agreements and laws
- ✱ prevention, including wind erosion, by **Good Agricultural Practice**

Erosion control



Source: Brunotte, FAL, Germany



Soil compaction

- ✱ regulated by soil protection law (D)
- ✱ prevention by
Good Agricultural Practice

Soil compaction



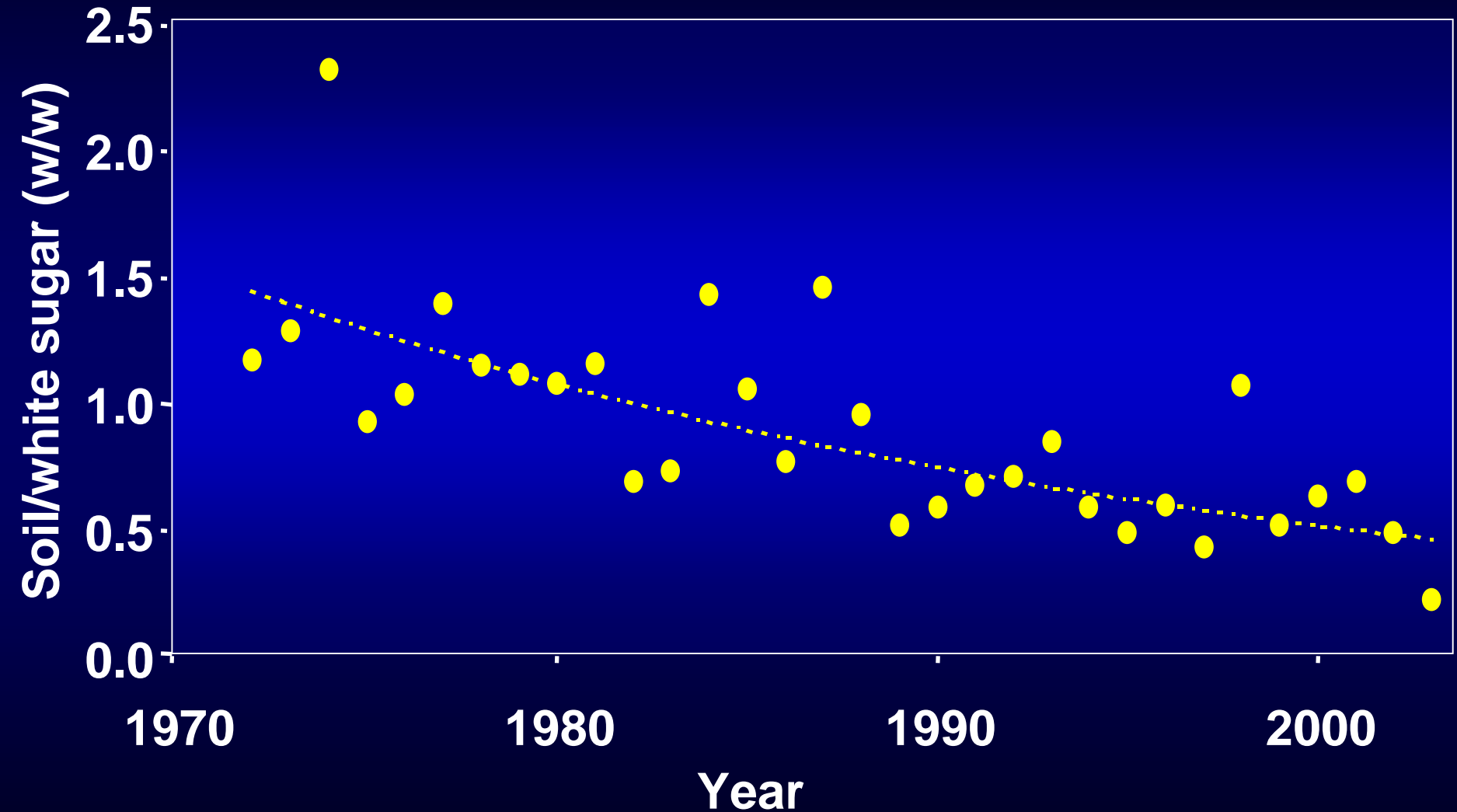
1974

Harvest 2003





Soil tare 1972 - 2003







Beet tops (leaves and scalps) left in the field

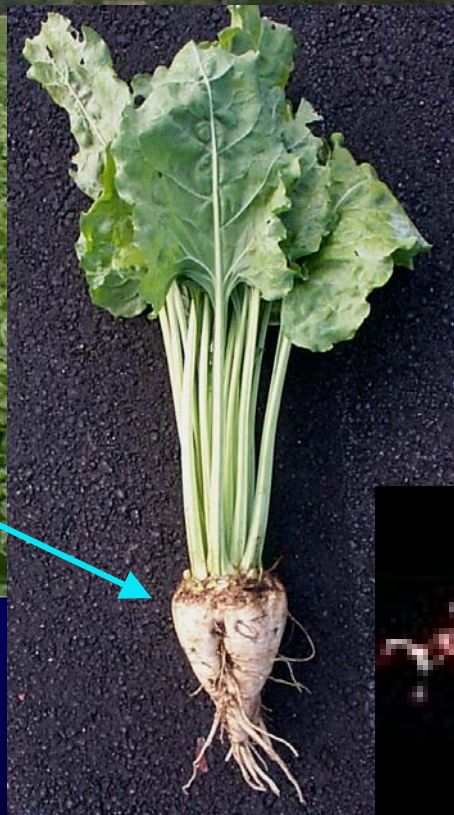
- ☀ low amount of nitrates (0 - 7 kg NO₃-N/ha)
- ☀ negligible risk of nitrate leaching (good C/N balance)
- ☀ food and habitat for birds and many other species
- ☀ valuable organic matter

What is biodiversity?

“It has become a widespread practise to define biodiversity in terms of genes, species and ecosystems, corresponding to three fundamental and hierarchically-related levels of biological organization.”

Global Biodiversity:

Status of the Earth's Living Resources (1992)



Agricultural biodiversity (1)

- ☀ not only the result of human activity**
- ☀ human life is dependent on it**
- ☀ contributes to: nutrient cycling, yield efficiency, pest control and soil and water conservation**

(FAO, 1999)

Agricultural biodiversity (2)

- ✿ suitable indicators?
- ✿ most soil micro-organisms are not known to science



Sturcott

Sustainable development

- ✿ environmental aspects were included in beet research and beet cultivation long before the concept of “sustainability” was introduced
- ✿ future challenge: sustainable development (resources, ecology, economy and society) of the beet sugar production chain from seed to table (including co-products)

Recommendation

develop in an international effort
indicators for sustainable development
that can be integrated in

**Good Agricultural Practices and
Guidelines for Sugar Beet Cultivation**



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All areas of interest


[How the area of interest works.](#)

The sugar beet site of The Netherlands

Since 1930 the IRS has been the research and knowledge centre for the sugar beet growth in The Netherlands. This site contains information for farmers and knowledge providers.

This presentation can be found on:

The screenshot shows the IRS website layout. At the top left is a search bar with the text "Search >>". Below it is a weather widget titled "weather" with a small icon of a person and a dog, containing the text "Bewolkt en van het westen uit perioden met regen. In de avond geleidelijk ...". To the right of the search bar is a "news only in Dutch version" link and a "More news >>" link. Further right is a "Current modules" section with a list of links: "Betakwik N-, P-, K- nutrition", "Betakwik lime dressing", and "Betakwik development of white beet cyst nematode infections". A "More modules >>" link is at the bottom right of this section.

www.irs.nl  **English version**

 **publications**  **presentations**

 **Sustainable development embedded in agronomy of sugar beet cultivation.**

Frans Tijink
Oral presentation

**Sustainable development embedded in agronomy for
sugar beet cultivation
IIRB Congress
Brussels 11 February 2004**

Slide 1 (Title)

Mr. Chairman, Ladies and gentlemen,
Many thanks for your invitation to speak today about
sustainable development in agronomy of sugar beet production.

Slide 2 (Sust. Development)

The Brundtland Committee of the United Nations defined the
concept of sustainable development.
There are many other definitions. A simple one is the triple
bottom line approach of People, Planet, and Profit.

Please, join me on a tour through sustainability.

Slide 3/4/5/6

I like to start at the farm where I was born. When we dig a soil
pit we find:

Slide 4 (after 1 meter ..)

first 1 meter of black sandy soil. This is the result of about
1.000 years of farming by my family. It must be a sustainable
system if they still can earn money by farming on that spot.

Slide 5 (after 3 meters of ..)

If we go deeper we find stones that originate from Sweden. It is
clear that criteria for sustainability are different for such
conditions.

Let go deeper.

Slide 6 (after 400 meters ..)

Here we find salt deposited in a sea. That was a in period with
again a completely different climate.

What can we conclude from this small trip at my birthplace?

Slide 7 (criteria for ..)

See slide.

Criteria for sustainability are not stable in time. Consequently, it may be preferred to speak about sustainable development.

The concept of sustainable development is embedded in global, EU and national agreements.

Let's look first in some details to sugar cane and sugar beet.

Slide 8 (AU sugar production)

I have chosen cane sugar production of Australia, a highly developed country that exports 85% of the produced sugar.

Total sugar production and the acreage with sugar cane strongly increased in the past 50 years.

However sugar yield per hectare was rather stable.

[Click]

Australian agronomists speak about a productivity plateau between 1970 and 1991. Australian experts give 3 major causes for this yield decline problem:

- First: the monoculture of cane causing severe soil degradation problems, especially soil born diseases;
- Second: excessive soil tillage for plant cane establishment;
- Third: sever soil compaction mainly caused by mis-matched row and wheel spacing.

In fact Australian experts say that their cane sugar production has a sustainability problem.

Despite the better climate, sugar yield is even lower than in most EU-countries.

Slide 9 (sugar yield NL)

Beet sugar yield increased with 50% in the last 50 years in the Netherlands. Similar developments are reported from most of the EU-countries.

Maybe, sugar yield is a suitable indicator for sustainable development.

Slide 10 (characteristics sugar beet)

Sugar beet can be characterized by:

- Efficient conversion of solar energy into energy stored in sugars;
- Efficient in recovering nitrogen from the soil;
- A dense rooting system that goes deep into the soil, up to 2 meter.

[*Click*]

This makes that the sugar beet is efficient in use of water and nutrient, leaves a clean soil profile, so a negligible risk of leaching, and has high yield potentials

Let's look more in detail to some relevant environmental aspects.

Slide 11 (Nitrogen supply)

The use of Nitrogen fertilisers strongly decreased during the past 20 years. This is an example from Germany. Nitrogen supply decreased about 50%. Similar figures can be found in many other countries. In the Netherlands we have in addition a replacement of fertilisers by animal manure, resulting in mutual benefits for arable and dairy farming.

Slide 12 (Water)

See slide

Sugar cane needs about 3 times more water for the same yield.

Slide 13 (Soil Husbandry)

See slide

Slide 14 (Erosion, 1)

Do you like this picture? [*Click*] It is real erosion, a natural process that is strongly appreciated by most people.

The real discussion is unnatural erosion caused by human activity. That must be controlled.

Slide 15 (Erosion, 2)

Within the framework of the EU thematic soil strategy, an activity of EU DG Environment, it was concluded: "in general terms, good progress for soil conservation has been made in the agricultural sector through agri-environmental schemes and the introductions of Codes of Good Practices".

Slide 16 (Erosion, 3)

Here we see a good example of erosion control by mulch seeding. This offers efficient protection against erosion. This technique is widely practised in the EU countries, particularly in the areas with slopes where the risk is higher.

Slide 17 (Soil Compaction, 1)

Soil compaction is considered as a secondary threat in the EU thematic soil strategy. Harvesting sugar beet has a potential risk of subsoil compaction from heavy harvesting and transport machinery, especially in wet conditions. Beet growers are particularly aware of this risk because of its potential yield effects on the next crop and for the long run. Prevention is the best solution. Prevention strategies have been developed within a recent EU concerted action, and are currently transferred into guidelines for beet cultivation in Germany.

Slide 18 (Soil compaction, 2)

This was 30 years ago in an extreme wet autumn. Soil is at risk here. Mainly because of too high ground pressures of the machinery, repeated passing of the same tracks, and the extreme wet conditions. You also can see that harvesting is not the problem. In fact it is a transport problem.

Slide 19 (Soil compaction, 3)

This is close to the home of our chairman.

Technical solutions are now available with low ground pressures and less passes on the field. The increased size and capacity of current machinery is not necessarily a higher risk. This is because faster work rates allow the work to be completed under better soil moisture conditions.

Slide 20 (Beet field)

Sugar beet is a root crop growing partly in the soil.

[*Click*]

Uprooting will always result in some adhering soil. Our ideal is to keep the soil in the field.

Slide 21 (soil tare NL 1950/2003)

Impressive reductions in removal and transport of soil tare have been achieved. In this example: a reduction of more than 50%. This was strongly encouraged by inter professional agreements and better technology. Similar trends are reported from many EU countries.

Slide 22 (soil tare)

Further reductions are possible by improved techniques for uprooting and cleaning, and by new varieties that have less deep grooves.

Slide 23 (Rene Magritte)

This looks solid. But feels conflicting with what we expect.

Slide 24 (beet tops)

The wild swans in this field really like the beet tops left in the field.

See slide.

Slide 25 (what is biodiversity)

See slide

Slide 26 (3 levels of biodiversity)

Here we see the 3 levels: an ecosystem with a beet field, the species level with in this case a sugar beet, and the gene level.

Slide 27 (biodiversity, 1)

Since a few years we also speak about agricultural biodiversity.

See slide.

Slide 28 (biodiversity, 2)

The big question is: which indicators are suitable? In literature you can find several hundreds. I was recently in a EU meeting of the Soil Advisory Forum. A professor said that the number of nematodes could be a good indicator for biodiversity. You can imagine that I responded with another view, referring to beet cyst nematodes.

See further slide. We do not know what we do not know.

Slide 29 (Rene Margritte)

Ladies and gentlemen, do you have a clear view now? It's time to conclude.

Slide 30 (sust. Dev.)

The fundamental principle in sugar beet research has always remained the same: only a healthy crop can guarantee a profitable cultivation and processing of sugar beet in the future. In fact this is a sustainable principle that is much older than the definition of sustainable development.

See further slide.

Slide 31 (recommendation)

We need better indicators for sustainable development. That can be developed on EU-level. But problems and their solutions are specific to ecosystems. That means that measures for sustainable development of agriculture can only be performed on a regional basis, not on a national and certainly not on a European basis. Good Agricultural Practises and Guidelines for Sugar Beet Cultivation are **the** measures for sustainable development on a regional basis.