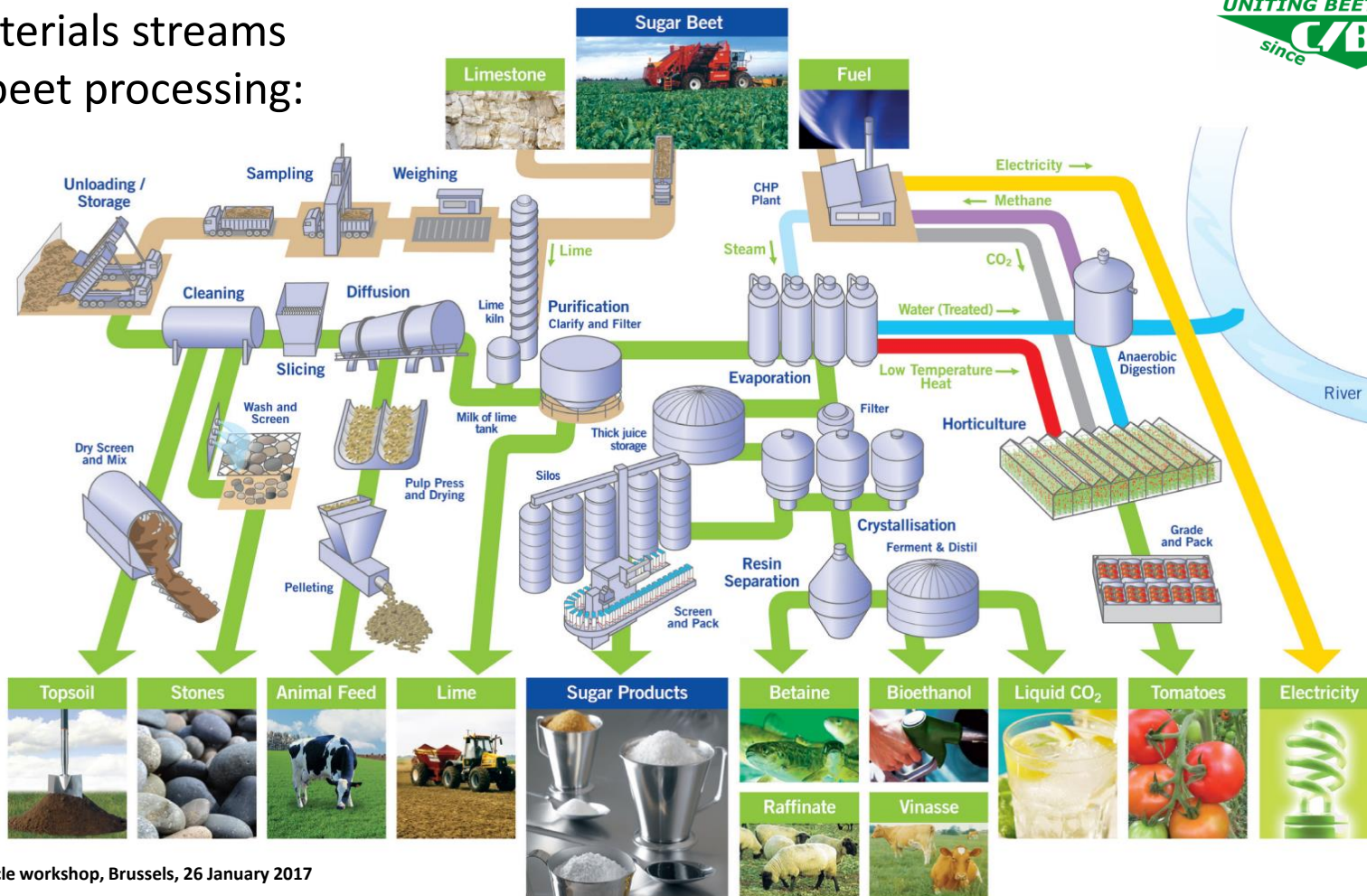


AWCB innovation in sugar beet industry










ALEX KRICK, DEPUTY GENERAL SECRETARY, CIBE

AgroCycle workshop, Brussels, 26 January 2017

Materials streams in beet processing:



Zero waste/ resource efficiency/ circular economy

PRODUCT	PROCESS	UTILISATION/ VALORIZATION
Soil		returned to field/ concentrated in settling ponds to form high quality soil used for a range of applications (land improvement, sports amenities, garden centres, land reclamation,...)
Stones		returned to field/ road building & construction industry
Sugar Factory Lime		soil conditioner
Beet leaves, tails & roots		feed for ruminants, compost, biomass for co-fermentation in biogas plants
Beet pulp		animal feed, feedstock for biogas, food applications (sugar beet fibre)
Molasses		animal feed supplement, feedstock for fermentation industries (pharmaceuticals, yeast, ethanol, biochemicals,...)
Vinasse		fertiliser, animal feed, substrate for distillation & fermentation
Heat		reused in processing, greenhouses, electricity grid
Water		reused in processing, fermented for biogas, returned to source

In the sugar beet sector, valorisation of AWCBs is well-established (e.g. “Die Aufbewahrung der Zuckerrübenblätter als Winterfutter” (storage of sugar beet leaves as winter feed), 1862)

In the EU, the three principal AWCBs are now well-established & recognised products in their own right:

1. sugar beet pulp: around 6 million tonnes (dry matter)
2. sugar beet molasses: around 3 million tonnes (dry matter)
3. sugar factory lime: around 3 million tonnes (fresh weight)

However, the sector also strives to:

- valorise all its AWCBs (soil, stones, tops & tails, vinasse)
- further improve valorisation of its AWCBs

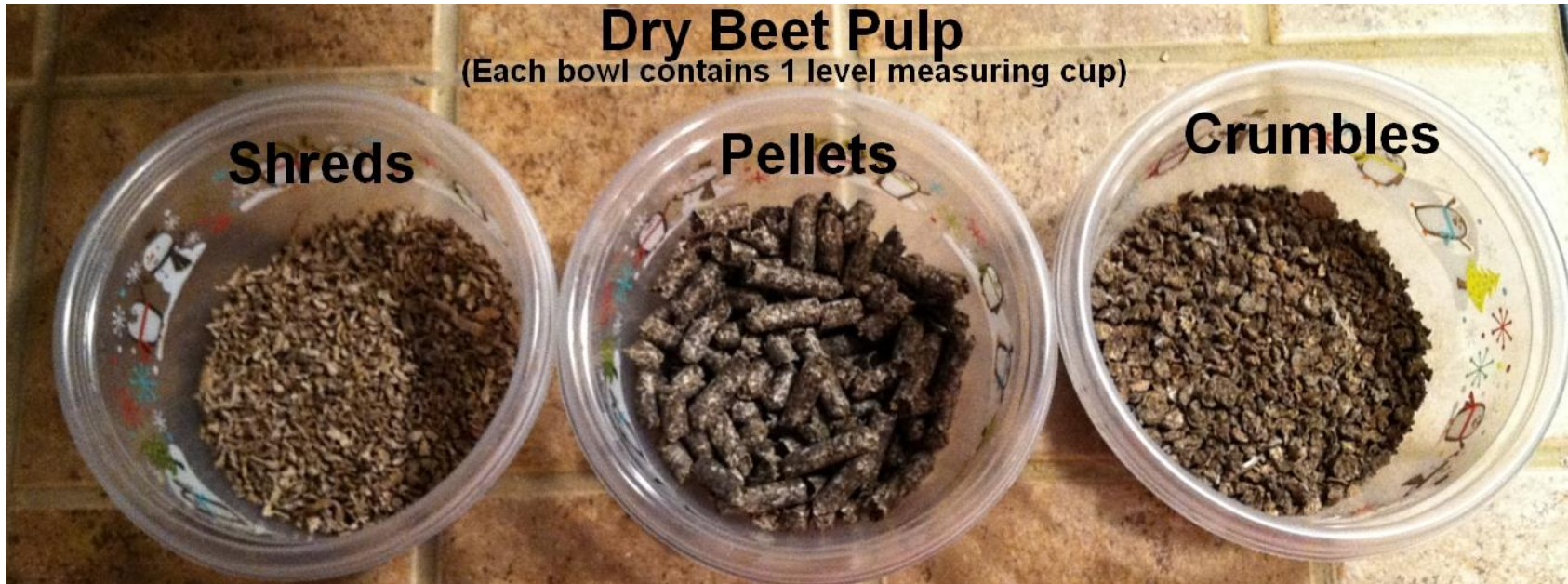
Sugar beet pulp: mostly valorised as animal feed

Pressed (18-35% DM) beet pulp: 2.1-2.5 million tonnes DM/year



Sugar beet pulp: mostly valorised as animal feed

Dried (88-91% DM) beet pulp: 3.3 to 3.7 million tonnes DM/year



Examples of valorisation of dried sugar beet pulp as animal feed



Niche valorisation of beet pulp – biogas

Biogas from sugar beet pressed pulp as substitute for fossil fuel in Kapsovar sugar factory in Hungary.

2005 Motivation for alternative energy sourcing and arguments for biogas plant site in Kaposvar

2006 & 2007 Biotechnological and economic studies

2007 Biogas facility installed, which
- produces **110 000 m³ biogas/day** (from 860 t beet pulp), which in turn
- represents **40%** of the Kaposvar's **daily energy requirement** (DER)

2015 Biogas from beet pulp meets 56% of Kaposvar's (DER) and newly installed biogas upgrading plant refines biogas into **750,000 m³ biomethane**, fed into the natural gas grid & equivalent to **annual heating requirement** of about **300 single-family homes**.

Niche valorisation of beet pulp – dietary fibre

Fibrex[®], or sugar beet fibre, is:

- a natural product made from sugar beet after the sugar has been extracted (i.e. pulp).
- highly functional dietary fibre, with an optimum ratio of soluble & insoluble fibres.
- useful ingredient in baking, meat & other food applications.
- water-holding capacity of 3-4 times its own weight.
- good potential in health applications (gluten free) as a concentrated dietary fibre.
- different fractions available for optimum results.

After 30 years, production of Fibrex[®] (and its pet food equivalent Finpec[®]) is being phased out.



Niche valorisation of beet pulp – dietary fibre



Cosun Biobased Products (a Royal Cosun subsidiary) produces **several products from beet pulp**:



- **Betafib[®] MCF**, microfibers used in household and I & I detergents (structurants), paints & coatings (flow modifiers) and by oil & gas industries (thickeners);
- **Betawell organic acids** (D-galacturonic & galactaric/mucic), pectin-derived natural ingredients for use in cosmetics and chemical industries;
- **Betawell special sugars** (L-arabinose in powder & syrup form), used in flavour and sweetener applications;
- **BetaBind-A[®]**, material with physical (free-flowing dry powder) & functional (water holding capacity, binding of transition metals & divalent hardness ions) properties allowing a wide range of applications in solid detergent formulations.

2006-2009

Beet Pulp Project (FP6 - COLL-CT-2006-030340)

Use of micronised bleached **beet pulp as additive** (filler) in white boards and paper to make them more resistant, more economical & more recyclable than mineral fillers.

The addition of (up to 8%) of beet pulp particles in board:

- does not impair board strength properties;
- leads to an increase in the board's bulk and air permeability.

Not yet adopted by paper/board industry:

- Industrial trials in 2011 gave positive results but were not followed up
-

Ongoing:

2016-2019 **PULP2VALUE** (Horizon2020 No 669105) – **P**rocessing
Underutilised **L**ow value sugar beet **P**ulp into **VALUE** added
products, such as:

- microcellulose fibres;
- arabinose;
- galacturonic acid.

May 2016 **COSUN & Akzo Nobel Partnership** to develop novel products
from cellulose side streams resulting from sugar beet processing.

Molasses (aka residual syrups): remains after sugar has been crystallised



Around 3 million tonnes/yr

- Mainly used as feed supplement (added to silage)
- Also used as feedstock to produce:
 - alcohols, yeast, citric acid and other organic substances

Can also be divided into three products streams:

- sugar (increased sucrose recovery)
- betaine (ingredient in feed, personal care products)
- raffinates (aka de-sugarised molasses) used as animal feed supplement, fertiliser or beet pulp coating).



MELASA drink Tofi

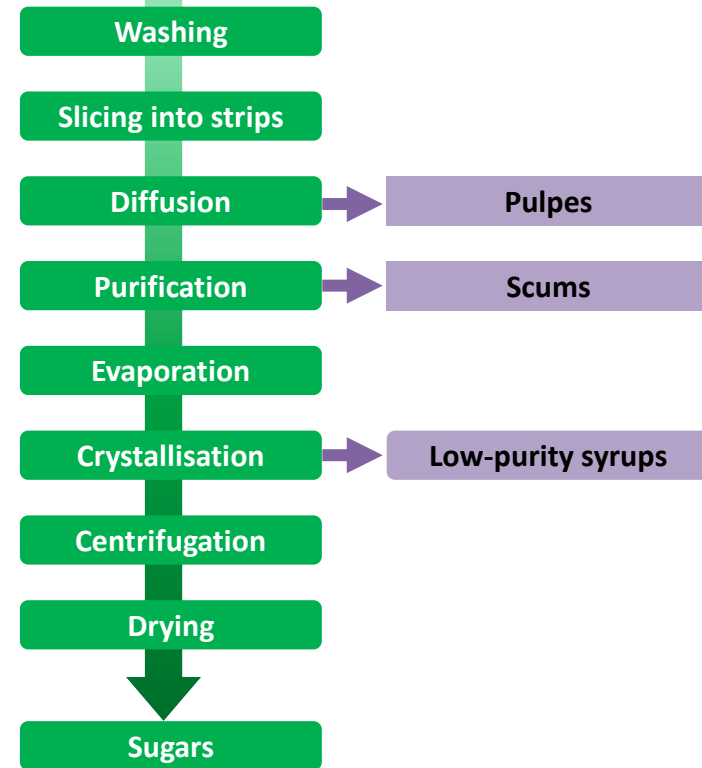
Low-purity syrups (LPS)

- about 95 kg/t of beet processed
- 70% dry matter
- 58% average sugar content
- pH 9

Relatively high sugar content (55 to 65%) compared to standard molasses (45 to 45%).

An excellent substrate for various industrial applications:

- Distilleries for alcohol production
- Fermentation industries (yeast, amino acids)



Sugar factory lime: 3 million tonnes/yr

Sold primarily as a fertiliser/soil improver

- corrects soil pH (liming),
- improves soil structures,
- provides nutrients (Ca, P, Mg, N),
- impacts positively on nutrient uptake by plants,
- promotes activity of OM digesting bacteria and inhibits certain harmful bacteria & fungi.



Used mainly in agriculture (grasslands, cereals, oilseeds, sugar beet), but also in brownfield restoration, viticulture, mushroom growing.

Valorisation of sugar factory lime

LIMEX45

LIMEX70

Carbocal

Mejora el suelo y la cosecha del viñedo. Naturalmente.



CARBOKALK

ZIEHEN SIE ALLE REGISTER BEI DER DÜNGUNG



GVO-frei

CARBOKALK IST IHR TRUMPF
AUCH IM BIOLOGISCHEN LANDBAU

Other AWCBs: valorisation of “beet soil”

Around 5 million tonnes/yr

- Inevitable when sugar beet are delivered to factory (cost & quality factors)
- Currently around 40 kg/t of beet, with efforts to decrease further (development of varieties as well as harvesting, loading & storage techniques)
- Highly variable between years (size of crop, harvesting conditions)

In most countries, recovered and ultimately returned to the field.

In some countries, marketed principally in agriculture, but also in:

- garden & landscape horticulture
- restoration,
- civil engineering projects,
- sports ground construction.

Niche valorisation of “beet soil”



Niche valorisation of “beet soil”



External Product of the Year at the
Housebuilder Product Awards 2015



Niche valorisation of beet soil: requires good marketing approach

FEATURES	BENEFITS
A Perfect Blend of Sand, Silt and Clay	<ul style="list-style-type: none">• Holds moisture in summer but free-draining in winter• Easy-to-handle
Valuable Horticultural Properties	<ul style="list-style-type: none">• Good rates of growth when turfing and planting
Regular Independent Analysis	<ul style="list-style-type: none">• Confidence for regulators and clients• Compliant to BS3882:2015
No Chemical Contamination or Sharps	<ul style="list-style-type: none">• Totally safe
Available All-Year Around	<ul style="list-style-type: none">• No downtime during major projects
Low Stone Content	<ul style="list-style-type: none">• Eliminates expensive stone picking
One Source	<ul style="list-style-type: none">• Consistent product and growth rates



Vinasse is used as a fertilizer, primarily for arable crops. It is not advised to exceed a dose of 3.5 tons per hectare for this product. It is particularly recommended for growing beet and rapeseed with spreading in autumn or spring, as well as for potatoes and maize with application in spring.



Vinasse: an AWBC resulting from the processing of an AWBC

- results from fermentation of molasses in the production of alcohols, yeast, citric acid and other organic substances

Used:

- as source of **energy** (pyrogasification)
- as **fertiliser** (first recommendations date from 1845):
 - high potash content (equivalent to inorganic fertiliser),
 - significant levels of P & N,
 - important source of trace elements such as Mn, Fe & B
- as feedstock to produce **potassium sulphate**, organic fertiliser with very low chlorine (=low salinity index) and comparatively high sulphur content
- as **ingredient in feed mix** (4-5% for ruminants, 2% for pigs & poultry)

Niche valorisation: Vinasse-based gardening products

Organic liquid compound fertiliser, made from organic materials and a natural by-product of processing sugar beet (100% sugar beet vinasse)



Niche valorisation of CO₂ & heat from sugar factory

British Sugar's horticultural business: Cornerways' Nurseries
Supplied with CO₂ & heat from nearby Wisington Sugar Factory's Combined Heat & Power (CHP) plant

- | | |
|----------------|---|
| 2001 | 5 hectare greenhouse, around 36 million tomatoes/year |
| 2007 | 11 hectares greenhouse, 80 million tomatoes/year |
| 2011 | 18 hectares = UK's largest tomato greenhouse <ul style="list-style-type: none">- supplied by 400 miles of piping (260 miles heat, 140 miles CO₂)- 115 million litres water- 250 000 bee-pollinated (170 bumble bee hives) tomato plants- 140 million tomatoes/year (UK imports 80% of its tomatoes) |
| 2016/17 | tomato production phased out to make way for medical cannabis |

Thank you for your attention!



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