Biodiesel Feedstock Workshop

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Topic Covered

- Soybean Oil
- Distillers Corn Oil
- Other recycled oils and greases
- Palm Oil
- Canola Oil
- Camelina and other dryland crops
- Algae
- Pennycress
- Biodiesel Industry Overview and Summary

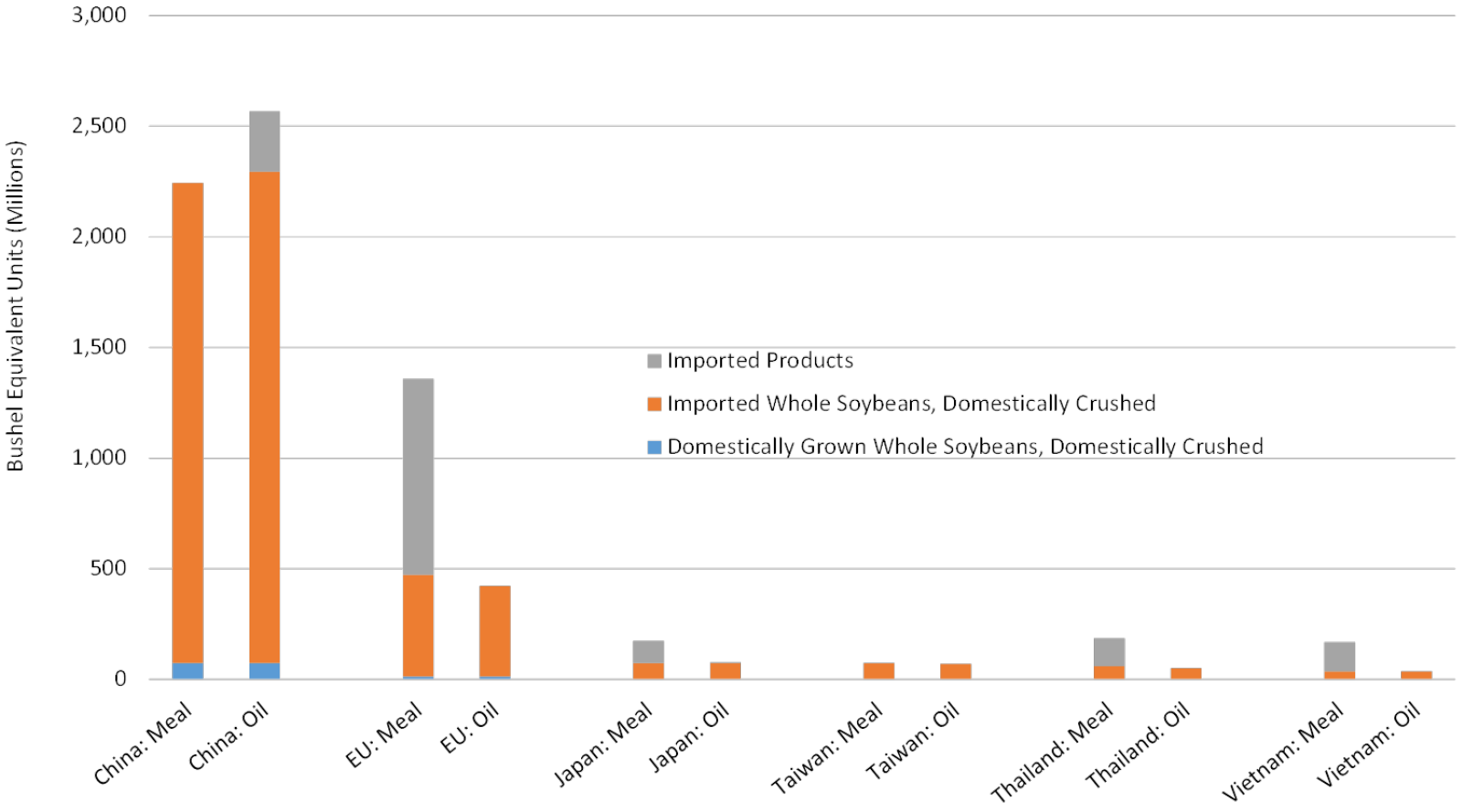
Observations

- Lots of potential feedstock
  - More from existing crops. New crops and new sources of recycled oils and greases.
- Focus on increased utilization of existing land
  - Reducing Summerfallow
  - Multi-cropping
  - Improved agronomic practices

Soybeans

- Soybean demand is growing much faster than the demand for other crops.
  - It produces the most protein/ha and the demand is driven by the protein.
- US industry has lost share of the oil market due to trans fats and needs alternative outlets.
- The international demand for seed, oil, and meal is complicated.

Soybean Trade



Source: USDA/FAS

*Adjusted for changes in ending stocks

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Corn Oil

- Current production rate is 2.5 to 3.0 billion pounds/year.
- 50/50 feed/fuel market.
- Optimization of the extraction process could see supply grow to 4 to 5 billion pounds/year and maybe a shift to more fuel.
- DG and corn oil is a case where the sum of the parts is greater than the whole.
  - Corn oil extraction lowers the induced land use impact due to the higher revenue from the sale of the two products.

Canola

- Canola area tripled over the past 25 years as summerfallow area was reduced.
- Five fold increase in production in that period.
- Industry road map to increase production by 60% by 2025 on same area.
  - Still lower yield that rapeseed in Europe.
  - And less than research trials are currently delivering.
  - 10 million pounds of oil.
- Not the easiest crop to grow, very small seed and prone to shatter during harvest.

Trap Grease

- Big market opportunity.
  - Maybe 3.5 billion pounds/year.
- Maybe even bigger challenges.
- Novozyme's enzymatic process presents some interesting opportunities.
- Never say never.

Palm Oil

- Environmental issues.
  - High GHG emissions from peat drainage.
    - Palm biodiesel GHG emissions of 800 g CO_2eq/MJ on the drained peat soils.
  - Many other environmental challenges, at least the way that some of the industry operates in Indonesia and Malaysia today.
  - PFAD, waste or co-product?

Algae

- DOE working on two themes.
  - Reduce the cost of production
  - Ensuring sustainability and availability of resources
- DOE sees potential of 4.6 billion gallons/year of renewable diesel from several hundred co-located plants (the CO_2 source).

Camelina

- Member of the mustard family.
- Dryland crop, replaces summerfallow in rotations. The same thing that happened in Canada with Canola over the past couple of decades.
- 120 million gallons in the PNW.
  - Others have production targets an order of magnitude higher.

Pennycress

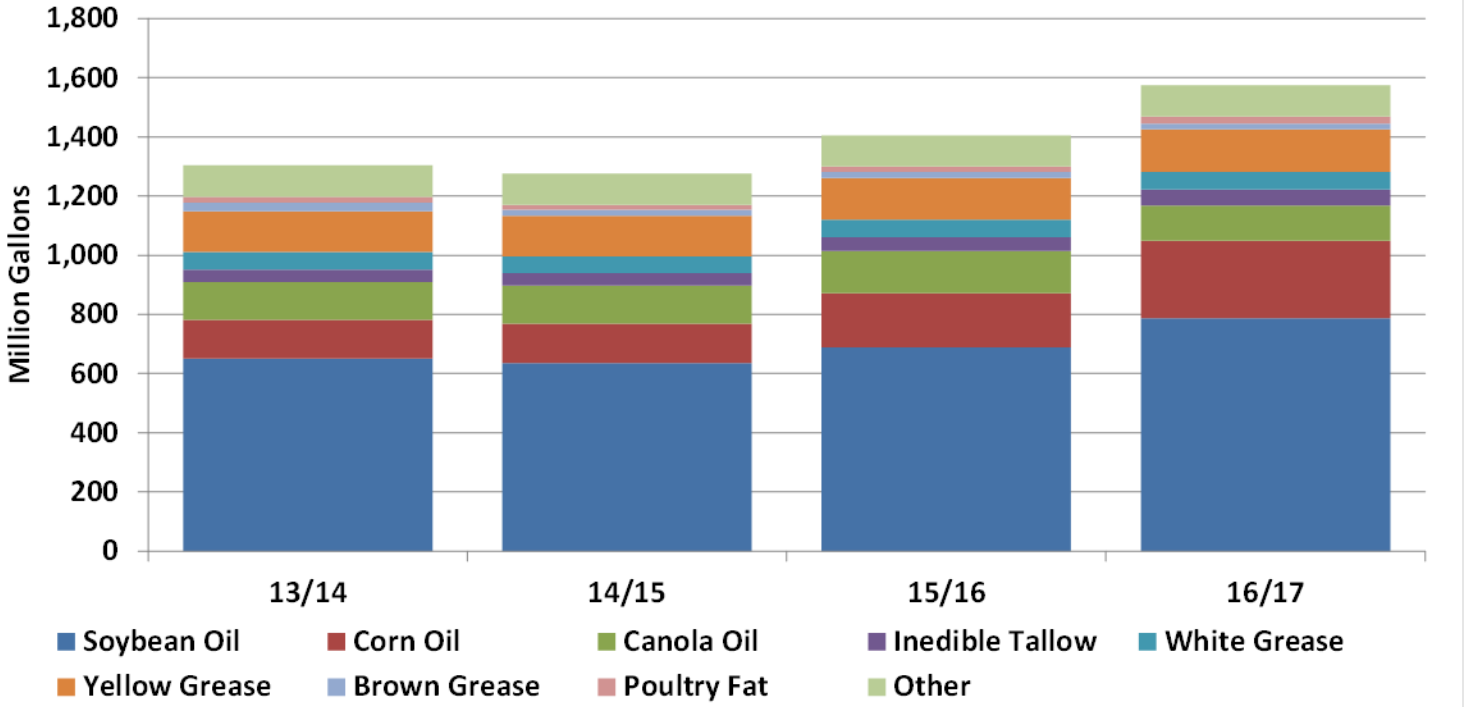
- Winter crop in the corn soy rotation.
- 30 million acre potential and one ton/acre.
- 18 billion pounds/year potential.
- Mustard family, like canola and camelina, very small seed and easily shattered.
- Cover crop environmental benefits.

California

- 500,000 acres of idle land.
- Winter oilseeds like Canola and Camelina have potential.
- Good performance in research trials.
- The very diverse landscape in California provides opportunities that are often missed in national level assessments.
- ILUC free crops at the regional level face a market entry barrier with international ILUC assessments.

The Overview

- Lots of potential for biodiesel RVO growth with the existing commercial feedstocks.



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LCA Modelling Challenges

- A couple of presenters mentioned that they had done some LCA analysis.
  - I would call them prospective LCA reports.
  - They don't have the real world data yet, so they need to do some modelling of system inputs and outputs and make some assumptions.
- Collecting data required for LCA modelling is usually pretty low on the priority list when new crops are being developed.
  - Obviously the agronomic and economic challenges are the first issues to be addressed.
  - If it can't be grown at a profit it doesn't matter what the environmental footprint is.

Oilseed Crops

- Most oilseed crops have a high nitrogen requirement, they produce oil and protein.
- They also have low harvest indexes, they produce a lot of crop residues.
  - This leads to a lot of nitrogen cycling from the soil to the residue to the soil.
  - Each cycle has N_2O implications.
- Crop residues can be high in nitrogen.

Nitrogen Contributions

	Corn	Canola	Soybeans	Palm	Camelina
	(g-N/tonne)				
N in synthetic fertilizer	**17,225**	**46,378**	**1,786**	**18,367**	**50,000**
N applied in animal manure	**1,900**	**2,000**	**0**	**0**	**0**
N in crop residue returned to soil	**5,174**	**20,553**	**22,801**	**5,509**	**54,916**
Total	**24,299**	**68,932**	**24,587**	**23,877**	**104,916**

N_2O Emissions

- The N_2O emissions are a function of the nitrogen added to the system, the category of N (manure, residues, and synthetic fertilizers all have different effective emission rates), soil moisture, soil type, topography and other factors.
  - Crops planted instead of summerfallow will be in regions with low moisture and low N_2O emission factors.
  - Summerfallow areas have some N_2O emissions with no crop produced.
  - High quality data on regional emission factors is available for some regions but not all.

Soil Carbon

- Changes in soil carbon are a function of the quantity of residues returned to the soil, tillage type, soil characteristics, and climate.
- Reduced summerfallow will either reduce soil carbon loss or increase soil carbon gain.
  - The impact can be very significant.
  - The Canadian National GHG Inventory attributes about a 7 megatonne net annual increase in soil carbon (as CO_2) due to the reduction in summerfallow over the past several decades.

New Crop GHG Analysis

- The lack of real world data is a challenge for LCA modelling.
- Often grown in special circumstances with unique contributions of low N_2O emissions and soil carbon increases.
  - Can result in low GHG emission crops.
- Not all of the models have the flexibility to handle the special circumstances.
  - So we may be missing opportunities to produce low GHG biofuels.

Thank You