
Recycling of Rice Straw in or near the Field

Agronomical and Technical Aspects

December 12, 2011, Willem Hoogmoed and Rob Bakker



The problem

- Large amounts of straw left after harvest
- Need for minimizing the turn-over period between rice and next crop
- Straw is an obstacle

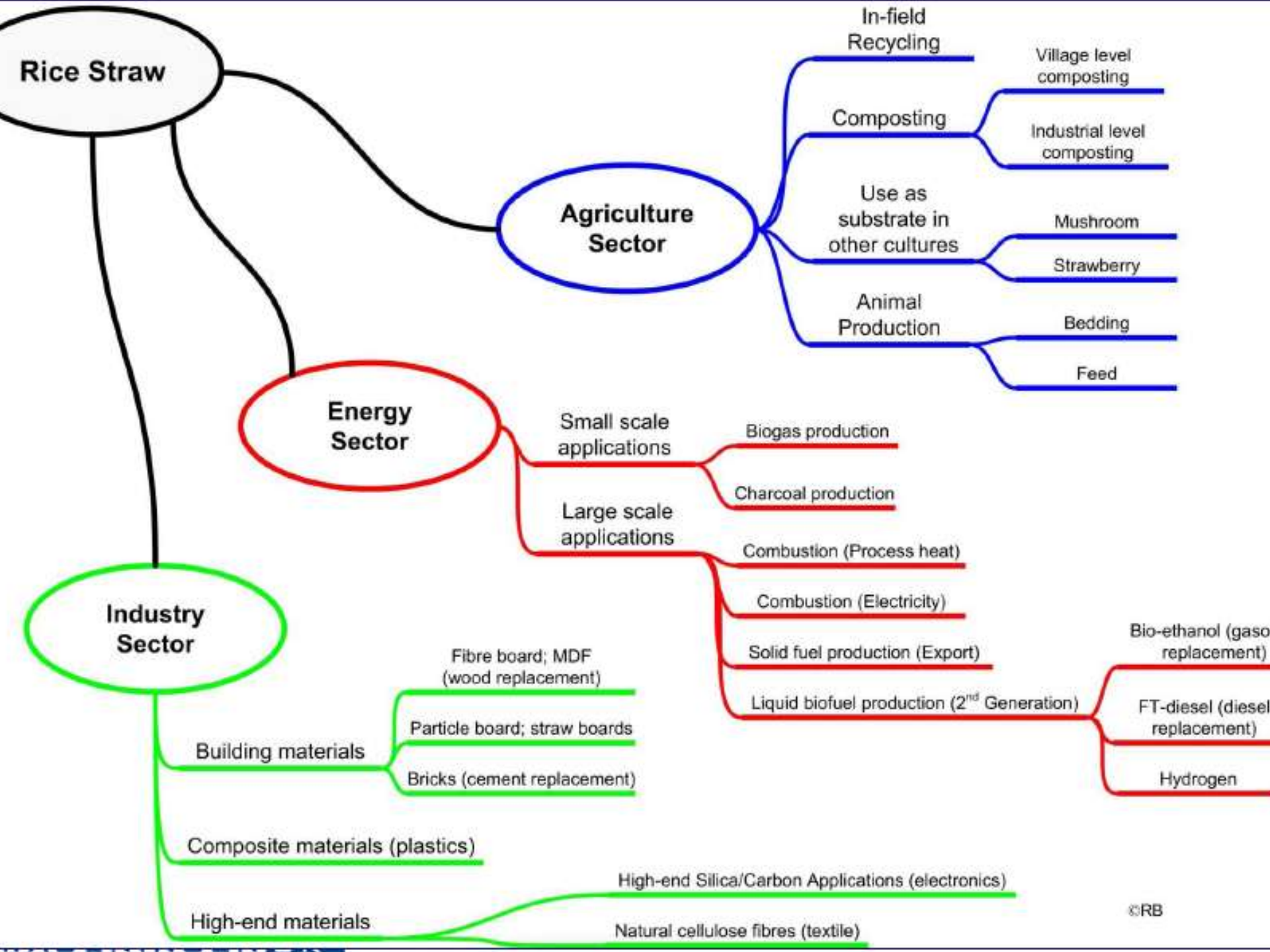
- CAN STRAW BE LEFT ON THE FIELD?

In this presentation

- In-field recycling as one of the options to process straw
- Agronomic consequences of leaving straw on the field
- A review of options
- Technical aspects, logistics
- Economical and social factors
- Conclusions

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Rice Straw

Agriculture Sector

In-field Recycling

Composting

Use as substrate in other cultures

Animal Production

Village level composting

Industrial level composting

Mushroom

Strawberry

Bedding

Feed

Energy Sector

Small scale applications

Large scale applications

Biogas production

Charcoal production

Combustion (Process heat)

Combustion (Electricity)

Solid fuel production (Export)

Liquid biofuel production (2nd Generation)

Bio-ethanol (gasoline replacement)

FT-diesel (diesel replacement)

Hydrogen

Industry Sector

Building materials

Composite materials (plastics)

High-end materials

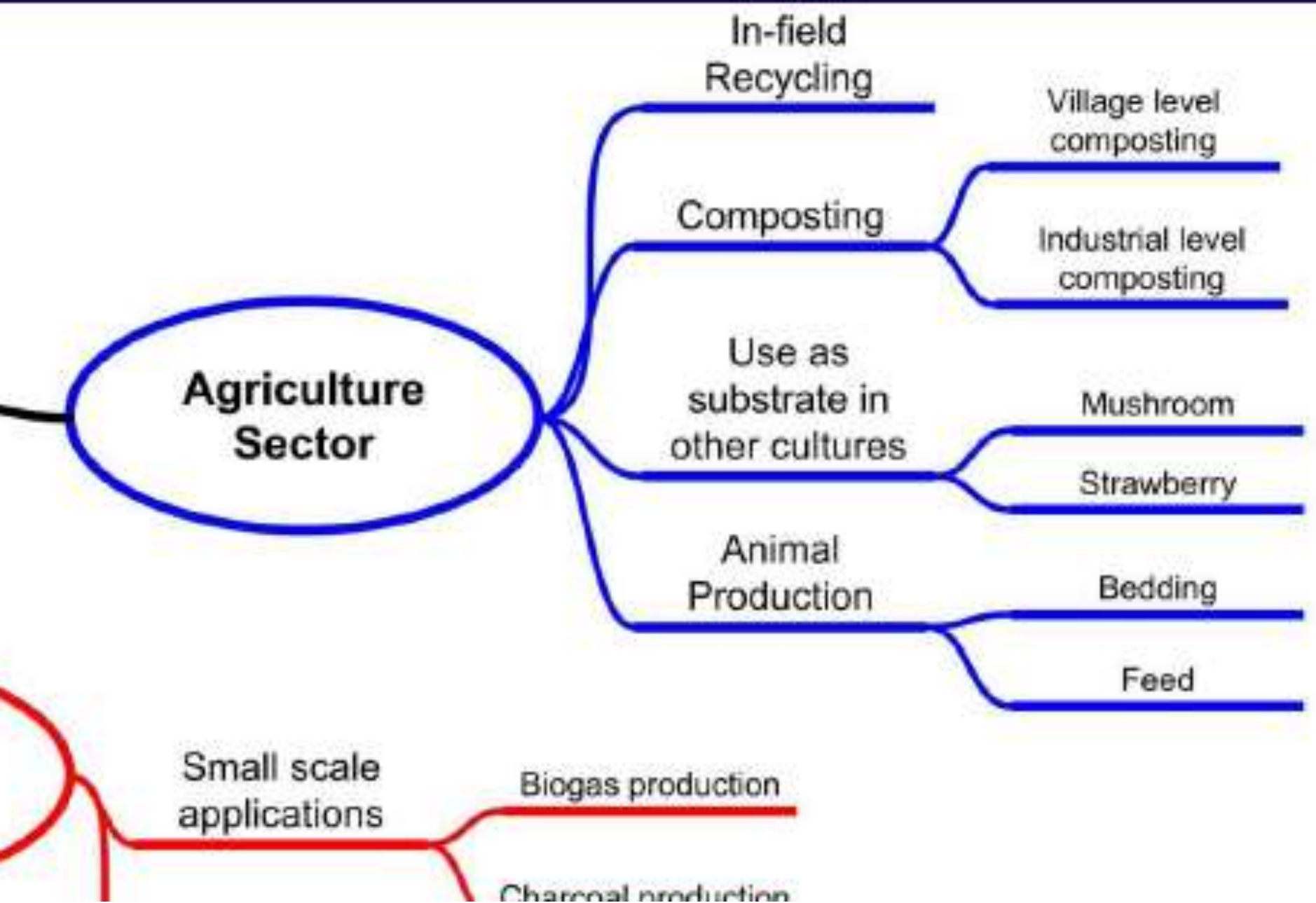
Fibre board; MDF (wood replacement)

Particle board; straw boards

Bricks (cement replacement)

High-end Silica/Carbon Applications (electronics)

Natural cellulose fibres (textile)



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Agronomic consequences

- Crop establishment
 - Quality of seedbed
 - Moisture
- Nutrient availability
 - P and K in straw
 - N needed for decomposition
- Weeds
 - Less or no tillage: poorer weed control
- Diseases
 - Trash-borne pathogens

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Very difficult to make a good, fine seedbed when soil is mixed with straw

You do not want (you are not able) to have an extra irrigation to bring soil in workable condition

So: poorer crop establishment

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■ Weeds

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Straw supplies N, P and K (3-7 kg N, 1.5 kg P, 15 kg K per ton of straw)

- BUT much larger amount of N is needed for decomposition of the straw (10-15 kg N per ton), comes back eventually

- So a shortage of N in the period of establishment of the new crop.

- Even an N-fixing crop (clovers etc.) needs N to start!

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Tillage is a very effective weed control system
Good plowing gives a clean start
Hoeing or harrowing with straw is impossible
Use of herbicides required

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Under dry conditions: problems are limited

Agronomic consequences

- Crop establishment

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- P and K in straw
- N needed for

Straw increases or stabilizes the organic matter content of the soil!

- Weeds

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Options for in-field recycling

option	advantages	constraints
1. leave straw in field after harvest, spread evenly, use no-till planter for following crop	Simple, although good spreading is necessary	need for no-till drill or planter N-deficit during emergence/ crop establishment phase
2. as 1, but chop straw (cut it in smaller pieces)	simple, better sowing quality than 1, quicker decomposition	more energy and equipment needed for chopping, need adapted sowing machine
3. leave straw in field, spread evenly, incorporate deep (15-20 cm) with primary tillage	can be done with existing equipment (plow) better weed control	energy needed for tillage, incorporation difficult
4. leave straw in field, spread evenly, incorporate but shallow depth (5 cm) with reduced tillage (harrow, rotavator)	simple existing planter / drill can be used	crop establishment can be poor





VENCE TUDO

SA 11500

Source: FAO report CA in Egypt

Option 1



Option 2



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For quality of life

Using a flail mower: approx. 35 hp per m working width; at 9-12 km/hr, 0.8-1.0 ha/hr



Option 2



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Option 4

Same principle as flail mower: different tines



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Asian rice combine harvesters: very efficient, only heads (ears) pass through thresher





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For quality of life

Straw remains undisturbed



Drum-type combine harvesters: straw passes through thresher and is partly chopped



Chopping and spreading straw behind
large combine harvester





The "Happy Seeder" in another model



Chopping and spreading straw behind large combine harvester

Technical aspects

- Reducing size of straw on the harvester (chopper and/or spreader) consumes a lot of power and reduces capacity of machine. Engine on Asian machines not strong enough
- Use of a chopper or mower in a separate pass is preferable
- Machinery is expensive and needs maintenance
- In most cases the conventional sowing machine cannot be used, berseem and wheat require different machines

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Economic and social factors

- Price of straw is extremely volatile, depends strongly on external factors
- Difficult to make reliable economical predictions
- The system of “conservation tillage” is NOT simple, farmers need to understand what must be done, how, when
- It requires a change in mindset of farmers
- Risks are higher, certainly in the beginning
- Advantages in terms of improving (soil) quality not always visible

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Concluding:

- Choice for in-field management strongly depends on external factors (alternative off-field use)
- Technical solutions are available (machinery and know-how)
- Benefits for farmers not clearly visible
- Financial support (subsidies or other) is probably needed in the introductory phase
- Carbon Credits ??

Thanks for your
attention,
suggestions
welcome!

