

FIBRE RAW MATERIAL ISSUES ARE CRITICAL TO THE SUCCESS OF NONWOOD PULP & PAPER MILLS

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INTRODUCTION

When properly cleaned and prepared nonwood fibre raw material enters the digester, many of the hurdles of producing pulp and paper from nonwoods have been overcome.

In many instances, economic problems encountered by nonwood-based pulp and paper mills are related to the supply, collection, transportation, storage and preparation of the fibre raw material.

There is a wide range of nonwood fibre raw materials in terms of physical and chemical characteristics as well as forms of delivery. As such, there are some differing requirements for processing various groupings of nonwood raw materials. I will focus on cereal straws; however, many of the same considerations apply to other nonwoods.

The topics which I will cover include:

- losses before the digester
- national, regional and local availability
- securing long term supply
- harvesting, baling and transportation
- storage
- raw material cost components

Although this is a logistics session, I have included losses before the digester as they can significantly affect the amount of the nonwood fibre raw material required which in turn affects the logistics.

LOSSES BEFORE THE DIGESTER

Losses from the field to the digester have a significant impact on the amount of the nonwood fibre raw material required and the cost of the fibre raw material per ton of pulp produced.

These losses generally can be classified as:

- fibre preparation losses
- transportation and storage losses

Fibre preparation losses depend on the type of nonwood raw material being processed and the selected fibre preparation system. For example,

- a) for cereal straws which are chopped and then wet cleaned, fibre preparation losses typically can range from 10 - 15%.
- b) for bagasse, moist depithing will remove 30 - 35% of the whole bagasse before storage
- c) for seed flax straw, decorticating to extract bast fibre will reduce the pulpable material to 40 - 50% of the original straw weight.

Added to the above losses, one must consider transportation and storage losses. In the case of cereal straws, this can typically add another 2.5 - 5% losses on the weight of material harvested.

Once you have determined how much prepared raw material is needed to feed the digester, the next step is to develop a clear understanding of the fibre preparation, transportation and storage losses which are critical to establishing how much nonwood fibre raw material must be harvested and delivered to the mill.

NATIONAL, REGIONAL & LOCAL AVAILABILITY

At the TAPPI Nonwood Short Course last year (1), I noted that the estimated amount of cereal straws produced in North America are about:

- 95 million bone dry metric tons in the U.S.
- 48 million bone dry metric tons in Canada

This appears, at a first glance, to be a vast potential fiber resource for the pulp and paper industry. However, a number of factors including low bulk density and transportation costs limit the economic collection radius for cereal straws. Combining these factors with the fact that available straw yield is only about 1.8 - 3.5 bone dry metric tons per hectare makes the following questions very important to selecting a mill site.

- a) Where are the regional concentrations of cereal straws?

In which states or provinces are there sufficient quantities of these materials to justify a pulp and paper project?

- b) Where are the concentrations of the fibre raw material within the region, state or province?

For example, straw availability can change substantially from district to district depending on soil types - black,

dark brown or brown, geographical location, growing conditions etc.

- c) How can farming practices and tillage requirements impact on straw availability within a district?

If tillage requirements in a particular district are 750 kg straw per hectare or 1500 kg, this will have a large impact on straw availability.

- d) What are other uses for the straw in the district and how does this affect availability for a new pulp mill?

For example, the cattle industry in Alberta already consumes a large portion of the available wheat straw. Also, one may not want to locate near another large industrial user such as the Isoboard mill in Ely, Manitoba which consumes about 200,000 tons/year of wheat straw.

- e) What is your fall-back position to account for year-to-year growing conditions, rotational crop practices or a drought?

Responses to these questions will establish several areas which have sufficient straw within a reasonably economic collection radius.

The next step is to determine how the straw will be harvested, transported and stored until it is needed, and how the farmers will be paid for the straw. These issues raise numerous other questions which will affect either the operating and/or capital costs of the mill. And, before these issues can be addressed, the method of securing the straw supply must be established.

SECURING LONG TERM STRAW SUPPLY

There are many methods which the mill can use to contract for the straw supply such as:

- a) direct purchasing from farmers
- b) purchasing through farmer coops
- c) purchasing through an intermediary such as a custom baler

There are pros and cons for each method. For example, for direct purchasing from farmers, the mill will require a large purchasing department which has an extensive knowledge of the farm community. Purchasing through an organized coop may lessen the demands on the mill's purchasing department. And, purchasing through an intermediary will add costs.

The next general issue will be the form and term of the contract. This depends largely on the method of contracting used; however, the contracts should be as long as possible to ensure long term supply.

HARVESTING, BALING & TRANSPORTATION

Harvesting typically takes place over a 6 - 8 week period. This short time frame raises some additional questions:

- a) Who will do the harvesting and baling?

In some instances, this will be done entirely by the farmer. In other instances, custom balers may be used and, in other instances, the mill itself may own the equipment to bale the straw.

- b) Is there enough farm equipment and balers of the type required to bale the straw during the harvesting season?

If not, the mill may have to include additional equipment in its capital costs.

- c) Are there enough trucks locally to transport the baled straw to the mill as it is harvested?

- d) Can the local infrastructure (roads) support the truck traffic for moving all of the required fibre raw material to the mill as it is harvested?

- e) Will all of the baled straw be stored at the mill or will off-site storage be used for the bulk of the straw with only about 2 - 4 weeks supply on-site?

The answer to this questions affects many issues such as:

- when the farmers would be paid fully for the straw which can affect working capital requirements
- storage conditions and quality control
- land requirements for storage at the mill which affects capital costs

STORAGE

Straw piles may contain 500 to 3,000 tons. Since the straw on the bottom and outside layers of the piles deteriorates with time, deterioration will be less if larger piles are used. Large straw piles are usually about 12 m high, 20-22 m wide and about 160 m in length, tapering toward the top for stability.

Piles are spaced 20 to 30 m apart to reduce the fire hazard and to permit access for fire fighting equipment.

If rainfall is moderate to high, it is preferable to protect the top of the piles with metal or plastic covers. Some mills go to the extent of piling straw in open-sided or semi-open sheds for protection from the weather; however, the substantial capital cost and high degree of manual labor is rarely justified.

Chemical preservatives, such as borax, can be used to reduce straw deterioration; however, the cost rarely justifies their use.

Straw bale handling and storage losses are usually in the order of 2.5-5%.

Long Term Mill Storage Versus Off-Site Storage

a) Long Term Mill Storage

The advantages of having all of mill's annual requirements for straw stored on-site are:

- the mill has effective control of its raw material supply

The disadvantages of having all of mill's annual requirements for straw stored on-site are:

- intense pressure on the collection and transportation system may increase costs
- large amount of working capital is tied up in inventory
- a large area is required for straw storage - for a 200 bdmt/day (70,000 bdmt/year) bleached wheat straw pulp mill with dry cleaning only and assuming large 3,000 ton piles, the on-site storage area would be in the order of 45-50 hectares.
- the large storage area substantially increases material handling requirements
- very large on-site straw storage area increases the fire hazard

b) Long Term Off-Site Storage

The advantages of using off-site storage at farms and/or intermediate collection depots:

- less pressure on the transportation system during harvesting
- lower amount of working capital is tied up in inventory if farmers are fully or partially paid as the straw is delivered to the mill
- small short term storage area required at the mill

The disadvantages of using off-site storage are:

- the mill has less control of its raw material supply
- maintaining straw quality at numerous locations becomes more difficult - establishing requirements and monitoring by the mill will be necessary
- delivery of straw to the mill on a daily basis must be well organized in advance.

RAW MATERIAL COST COMPONENTS

Hurter (2) identified that the cost nonwood fiber raw material charged to the digesters is composed of several components:

- base price paid to the farmer
- cost of harvesting and baling
- cost of collection and transportation,
- cost of storage, and
- cost of fiber preparation.

The cost distribution will vary depending on circumstances, contractual arrangements and the fiber raw material. For cereal straw, the base price, harvesting and baling often are lumped together as they are within the farmer's control, and collection and transportation may be by the farmer or by the mill.

It is critical however that none of the cost components is overlooked regardless of how they are distributed.

SUMMARY

The foregoing highlights a few of the critical issues which must be addressed regarding the long term supply of nonwood fibre raw material to a pulp and paper mill.

The goal is to create a win-win situation between farmers and the mill to ensure that the farmers are adequately compensated for their fibre raw material and that the mill receives the material at a reasonable cost which makes the project economically viable over the long term.

While the challenges are large, they are not insurmountable as they have been addressed successfully at many mills around the world.

References

1. Hurter, Robert W., "Agricultural Residues", 1997 TAPPI Nonwood Fibers Short Course Notes.
2. Hurter, A.M., "Some Economic Considerations in the Implementation of a Non-Wood Pulp and Paper Project", Nonwood Plant Fiber Pulping Progress Report #19, TAPPI Press, pp. 217-230.