The potential for using hemp (Cannabis sativa) and flax (Linum usitatissimum) fibre as a reinforcing agent in newsprint manufacture.

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Abstract

Economic and pulping studies with hemp and flax were conducted as part of a multi-disciplinary, integrated study assessing the potential for using the stem fibre of these crops as alternatives to kraft pulp in newsprint reinforcement. Cold caustic soda pulps made from the stem bark fraction produced the strongest pulps but were still inferior to kraft, especially in terms of tensile strength. Based on the current price of kraft and likely cost structures for hemp and flax pulps, kraft replacement with the non-wood pulps is not financially attractive at present.

Keywords: Hemp, flax, pulping, economics.

Introduction

The Tasmanian operation of Australian Newsprint Mills Ltd (ANM) produces approximately 40% of Australia’s newsprint and related paper grade requirements from a blend of locally sourced eucalypt, radiata pine and recycled newsprint (RCF) pulps and a small fraction of imported chemical kraft pulp (~15%), added to reinforce the blend. A project was commenced in 1994 to investigate the feasibility of using locally grown hemp and flax fibres as alternative reinforcing agents in newsprint production. The study adopted an integrated, multi-disciplinary approach with investigations into the key aspects of crop production, pulp and paper manufacture and economic viability. This paper addresses the processing and economic aspects of this study and makes some conclusions regarding the overall viability of a hemp and flax based industry.

Pulping trials were conducted using ANM’s existing mechanical processes, namely a thermomechanical (TMP) process and a cold caustic soda (CCS) process. Pulps were made from the whole stem as well as the separated core and bark fractions of the stem.

The economic assessment involved the preparation of budgets for each crop based on selected production and market scenarios. Flax was assumed to be grown as a dual purpose crop for bark fibre and oilseed (Linola) purposes, sown in autumn and with post flowering irrigation. Hemp was assumed to be grown as a spring sown, irrigated crop for bark fibre only. Estimates of production costs and yields were based on findings from crop management studies (3). Price estimates were obtained from industry contacts and selected references. Gross margins derived from these budgets were subsequently compared with margins for existing crop options within Tasmania (1,2). Sensitivity analyses were performed to investigate the response of gross margin to fluctuations in selected price and cost parameters.

Results and discussion

Pulping potential

The properties and behaviour of hemp and flax CCS bark pulps were similar and could potentially be blended or used interchangeably. The bark fibres of hemp and flax are capable of forming paper of very high tear strength but with lower tensile strength than would be desirable from a softwood kraft pulp. Hemp and flax core and whole stem mechanical pulps were inferior to kraft pulps in terms of both tear and tensile strength properties. This reflects the very short length of core fibres (~0.5 mm) and the high proportion (60-65%) of core material in the whole stem. Whole stem pulp properties were generally intermediate to those of separate core and bark fibre pulps, but weighted more toward the core fibre.
properties. Aside from lower tear strength and scattering coefficient values, the properties of the core CCS pulps were similar to those of the eucalypt CCS pulp currently used at ANM. Although it would be possible to use hemp and flax core CCS pulp as a short fibred supplement to RCF and eucalypt CCS in the existing process at ANM, there is no current demand for additional short fibred pulp, and indeed there is speculation regarding a shift toward newsprint production from TMP pine pulp and RCF only.

Economic potential

Interest from primary producers in growing hemp and flax would require that the gross margins from these crops be at least comparable with a range of crops currently being grown. Irrigated hemp and dual purpose flax grown in the more productive north west area of the state, would require a bark price of about $650/t. This price would give a gross margin comparable with that currently received for green peas and broad beans (2). Rainfed dual purpose flax is a potential production option in the predominantly dryland cropping areas of the central north, midlands and south east areas of Tasmania. Comparisons with existing crop options in these regions suggest a mill gate bark price in the vicinity of $400/t to $450/t would be attractive to farmers, generating margins comparable with malting barley and wheat (1).

The market price for kraft averaged over the period from August 1988 to March 1997 was approximately $880/t (5). An assessment of the costs associated with the production of hemp and flax pulps would need to take into account the mill gate price to the farmers and the variable and fixed costs of pulping the raw material. While it is possible to estimate variable costs relating to chemical and pulping energy requirements, other costs are difficult to estimate. Yield losses associated with the pulping process, and the potential need for a higher proportion of non-wood pulp in the newsprint blend (to account for strength shortfalls relative to kraft), would also need to be factored into the processing costs. While it was not possible to develop an accurate cost structure for hemp and flax pulps, sufficient data was available to make a number of conclusions regarding economic viability in comparisons with kraft.

Conclusion

In the absence of significant limitations to the production of these two crops (3), the viability of a future industry will hinge on being able to produce pulps with properties at least equivalent to the current imported kraft reinforcing pulp and at a price somewhat less than the imported option. Cold caustic soda pulps made from the bark fraction of hemp and flax stems were very strong, especially in terms of their tear strength properties. Shortfalls in tensile strength relative to kraft might be overcome through breeding or modification of the pulp blend used at ANM. Based on the current price of kraft and the known and predicted costs associated with hemp and flax pulp production, the non-wood alternative to kraft is not financially attractive to ANM at present. Future viability would depend on a number of factors, including: fibre yield and quality improvements, elevated kraft pulp prices, and the establishment of strong markets for the stem core fraction and the seed of flax.

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References


