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Quality aspects of fibre hemp harvest procedure

Three years of field and laboratory investigations form the basis for this evaluation of the influences on fibre quality of harvest procedure and field lying period. Clear from results is that crop lying period after harvest, depending on weather, can have the biggest influence on fibre quality. According to respective preparation requirements and the product, the quality characteristics can, within certain limits, also be influenced by the harvesting technique.

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Keywords

Fibre hemp, harvesting procedures, field period after mowing, fibre quality

Literature

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Following the reform of the common market regulations for flax and hemp [1] as well as the associated clear reduction in area support there has been a growing financial pressure on the producer. To ensure especially a long-term perspective for homegrown fibre crops, cost reductions in all production phases and high exploitation of added value aspects through consistent fibre quality has to be realised [2, 7]. Suitable procedures for harvesting and field preparation of fibre hemp are admittedly available but unknown to a large extent is their effect on fibre quality and length of required field lying period.

Material und methods

Field investigations 1997 [4] to 1999 in the Potsdam area were devoted to harvesting procedures with differing effect principles and preparation intensities. Standard machinery such as single and double stage double-knife mowers, self-propelled hemp harvesters (multiple straw cut) as well as mobile field delignification (field preparation) [6] were used. The hemp straw samples from different field processing and lying periods were inspected for quality characteristics, degree of retting, fibre bundle fineness and tensile strength [6].

Results

The results in 1998 emphasised the strong weather influence on discolouration by lower fungi. Frequent rain led to a rapid rise in retting degree (*fig. 1*). At the end of the field lying period higher retting degrees with an A1000 value of up to 1.97 could be measured in the non-field prepared variants as opposed to 1997.

The retting degrees found in the variants field preparation showed a comparable development in the first phase of the field lying period [5]. In the second phase there was a substantially smaller degree of retting degree compared with the non-prepared variants.

With similar weather in 1999 the degree of retting was at a comparable level. By the end of the field lying period an A1000 value of 1.8 was determined for both variants whereby the larger scatter of A1000 values was determined in the variant hemp harvester. The clear development of retting in 1998 led, following mechanical processsing, to finer fibre bundles in the case of all variants (*fig. 2*).

This influence was very clearly shown by hemp straw harvested by double-knife mowers, hemp harvesters as well as dual-level double-knife mowers. Thus the average value of the FBAI index [8] for the respective fibre bundle at the end of the field lying period lay more than five units lower than af-

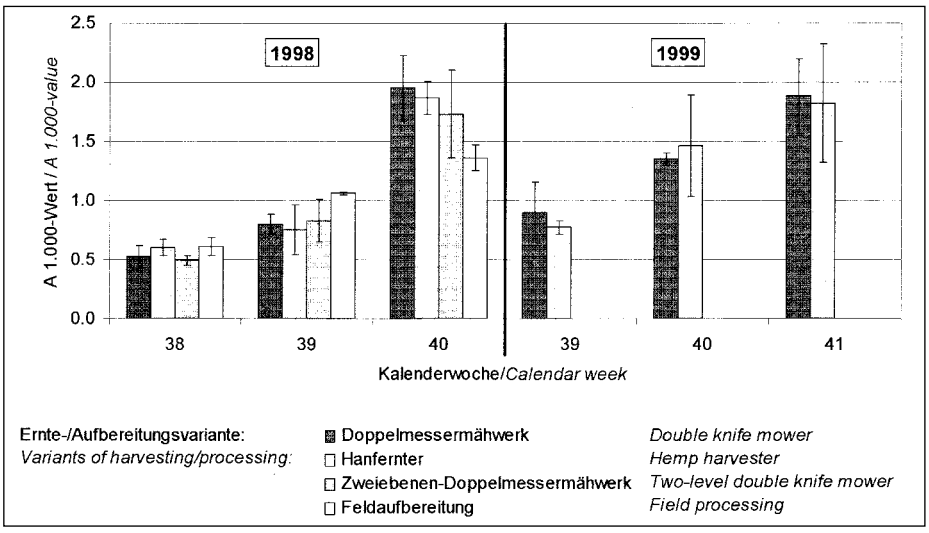

Fig. 1: Retting degree during selected days of investigation

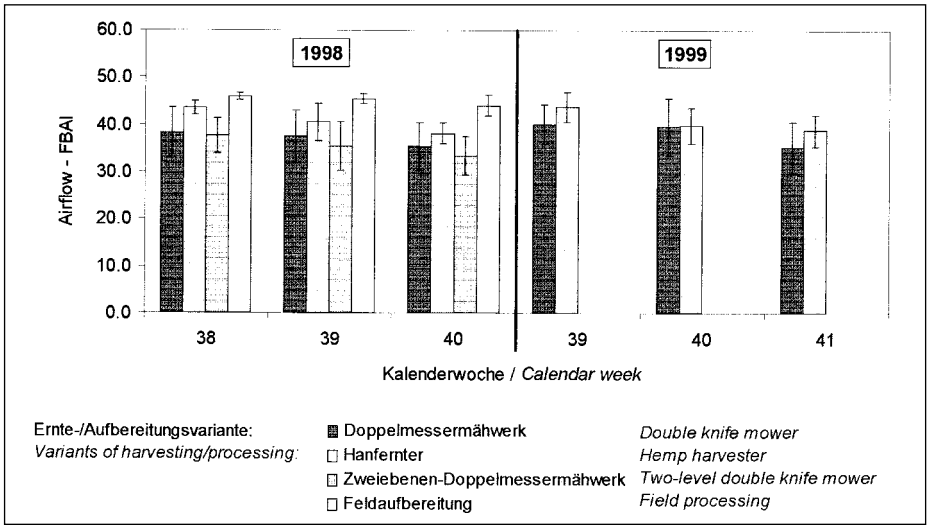

Fig. 2: FBAI-values of processed fibre bundles during field lying period after mowing.

ter mowing. The hemp fibre bundles from the variant field preparation showed, even right after mowing, the highest fineness index. Even after longer field lying periods they could not be processed any finer. In the following year too, the close relationship between biological degradation of non-fibre substance during retting and the better refining of the fibre bundles through mechanical treatment was confirmed.

The fibre bundles from the variant hemp harvester showed relatively higher fineness index values. However, the greater scatter range led to this result giving no clear conclusion regarding the influence of the harvesting procedure.

For all investigated variants no field lying period/retting influence on fibre strength (*fig. 3*) could be established. All non-processed variants showed, with a large scatter range of values, tensile strengths from 40...45 cN tex^{-1}. On the fibre bundles from the variant field preparation a substantially lower strength could be determined even at the beginning of the field lying period.

The tensile strength values determined in 1999 lay on average 10 cN tex^{-1} over those of the previous year.

Discussion and conclusions

Length of time and intensity of field retting had an important effect on the qualitative characteristics of the hemp straw and the fibres won from it. Compared with 1997 [4] higher degrees of retting were shown. Choice of harvest technique apparently had only a small influence on retting performance with hemp straw. What can be achieved is that the retting organisms in the hemp straw can spread in a consistent way after the mowing and subsequent processes for speeding up drying. A conditioning of the harvested material and as well as broad distribution of the swath can support this process.

The fineness of the hemp fibres is in relationship to intensity of field retting. Underretted material allows no clear separation of fibres, e.g. refining of the fibre bundle, where a conventional mechanical primary preparation is applied. This tendencially confirms the results of the investigation.

An important influence of field lying period on fibre strength was not able to be determined. The influence of the harvest technique is, on the other hand, very clear. Thus the relatively aggressive processing of the harvest material by the mobile field processing led to a reduction of fibre bundle collective strength.

Should the advantage of this harvest procedure be used for minimising weather-related processing risk [5] as well as for an optimised harvested material logistics, application areas must be chosen where there are appropriately low quality requirements. To ensure full value from the crop, the flax shavings should also be collected.

Outlook

Currently the choice of harvesting technique is not oriented to any great extent towards quality. Straw shortening, harvest material moisture and retting determine harvest requirements. In most cases recording programmes are down without. The inaccessibility of available preparation methods often „force“ the application of harvesting techniques which, although satisfying the functional requirements, are characterised by high procedural costs. Innovative preparation techniques [3] and new processing possibilities for material which has been poorly retted, or retted only to an average standard, enable the application of harvest techniques characterised by lower procedural risk and less input.

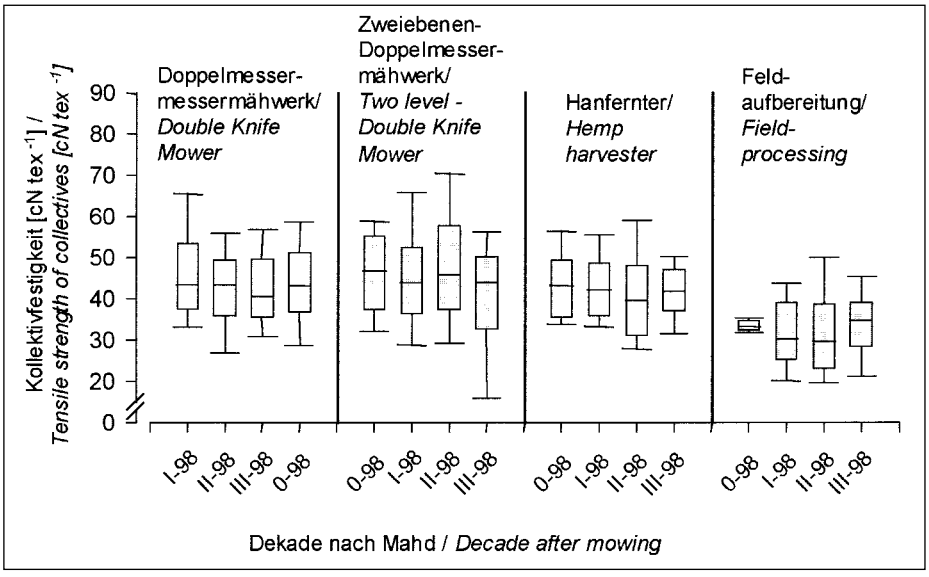

Fig. 3: Tensile strength of fibre bundle collectives during field period after mowing 1998.