EFFECTS OF THE APPLICATION OF CHEMICAL ADDITIVES TO DESICCATED FLAX ON RETTING

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SUMMARY Application of chemical additives to alter the rate of retting of desiccated flax stems was successful. Treatment with ethylenediaminetetraacetic acid (EDTA) and urea increased the rate of retting. Increases in the population of fungal colonisers were observed on urea-treated stems but not after EDTA treatment. Enhanced PG activities were detected in stems treated with EDTA and maximum PL and xylanase activities were detected in stems treated with urea. Urea treated stems produced relatively finer fibres compared to fibres from EDTA treated stems or controls.

INTRODUCTION

Courtney and Robinson (1982) showed that an application of glyphosate (M-phosphonomethyl glycine) to flax at the mid-point of flowering in Northern Ireland accelerated desiccation and improved fibre separation. Cell wall-degrading enzymes produced by filamentous fungi are largely responsible for retting of glyphosate-treated flax stems (Brown and Sharma 1984; Sharma 1986). Attempts to alter flax stem colonization by applying chemical additives (urea and sucrose) was first reported by Brown and Sharma (1984). However the treatments did not speed up the retting process and the effects on fibre tenacities are not known. Metal-chelating agents such as EDTA and CaCl₂ were reported to enhance the rate of retting of glyphosate-treated flax (Brown and Black 1986) but the effects on fibre tenacities were not investigated. The present study was designed to detect any change in fibre tenacities after scutching the flax stems treated with chemical additives. Possible effects on fungal colonization and enzyme activities were also investigated.

MATERIALS AND METHODS

Growing and glyphosate treatment of flax. Seeds of flax cv Natajsa were sown on 2 May 1984 in 3 blocks each containing a randomised distribution of 3 plots (1 x 3m). On 10 July all the blocks were sprayed with glyphosate (Roundup, Monsanto Ltd) at a rate of 1.4 kg/h. The details of the growth and glyphosate treatments are reported elsewhere (Sharma 1986).

Chemical application on desiccated flax. Two weeks after glyphosate treatment 2 plots from each of the 3 blocks were sprayed with solutions of EDTA (2% w/v) and urea (3% w/v) and the control plots in each of the 3 blocks were sprayed with
sterile distilled water until run-off. Flax stem samples (200g fwt) were taken every week from all the treatments.

Isolation of fungal colonists Fungal colonists were isolated from stems of each treatment and identified (Brown and Sharma, 1984). The number of colonies of each species isolated from both unsterilized and surface-sterilized (10% v/v Chloros, ICI for 5 min) stem sections (4 pieces of stem/plate, 15-20 min in length) were counted and expressed as a number of fungal colonies per piece of stem section.

Degree of Retting Thirty stem sections from each plot were tested for degree of retting on a scale of 30-0 (non-retted to retted) using the mechanical device described by Seaby and Mercer (1984) and expressed as percentage loss of stem strength.

Tissue extraction and enzyme assay. Polysaccharide-degrading enzymes were extracted from stem tissue (5g) by homogenisation in 0.3 M KCl (150 m) then clarified and dialysed overnight in cool tap water. The release of reducing groups from the substrate sodium polypectate (0.5 w/v), carboxymethyl cellulose (0.1 w/v) and xylan (0.1% w/v) by pectinase, cellulase and xylanase respectively was determined colorimetrically with 3,5 dinitrosalicylic acid reagent (Miller 1959).

Fibre Fineness and Strength Tests. Stem samples were scutched mechanically and the inner woody shive separated and finely combed. The flax fibre samples were conditioned for at least 4h, at 20°C ± 2 and 65% ± 2 RH (Anon 1974). Fibre fineness was determined on 2.5g samples by the British Standard Institute (BSI) procedures (Anon.1974) using a Wool Industrial Research Association fineness meter (Reynolds and Brandson Ltd). The tensile strength of the fibre was measured as the mean of 50 individual fibres of 1 cm test length according to the method of BSI (Anon 1974) using an Instron Tensiometer (Model 1026).

Caustic Weight Loss. Caustic weight loss was determined by treating fibres (3g) with 2% NaOH solution (100 ml) at 100°C for 4h. After redrying to constant weight, the loss in weight was calculated from a mean of 3 samples.

RESULTS (Table 1)

Fungal Colonists. The common colonists were Cladosporium herbarum, Epicoccum nigrum, Fusarium culmorum, and yeasts including Aureobasidium pullulans and Botrytis cineria (Brown and Sharma, 1984). The populations of fungi were highest in all the samples 3 weeks after all treatments. However, only urea-treated stems showed a significant (P<0.001) increase in the total fungal population of the stem surface (Brown and Sharma 1984). The differences in the numbers of fungal colonists present inside the stems were not significant (Table 1).