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Effect on harvesting at different stages of growth and long-term storage on phenolics in sorghum stover

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Introduction

Sorghum *(Sorghum bicolor)* is an important food crop in Africa for human (grain) and animal (crop residues) consumption. However, digestion of crop residues by rumen micro-organisms is often limited by the presence of polyphenolic compounds (Reed, Kebede and Fussell, 1988; Butler, 1989; Ford and Hartley, 1990). In Ethiopia, leaf stripping of sorghum for animal feeding during plant growth is common practice as is storing the stover for some months after harvesting, before feeding. Therefore it is essential to know if either practice has any effect on the phenolic content and composition of the plant and hence on nutritional quality.

The aim of the present experiment was to study changes in the concentrations and composition of phenolic compounds in component parts of different sorghum varieties harvested at different growth stages and also after long-time storage.

Material and methods

Sorghum varieties, growing conditions and harvesting

Seredo, X/35:24 or Ikinyaruka (bird resistant) and Dinkamash (non-bird resistant) varieties were grown in triplicated plots in Ethiopia (Melkasa; elevation 1500 m). Sampling was at 50% flowering (50% of the plants have flowered), black layer (most grains have black spot) and harvest (plants are mature and ready for harvest).

Treatment and extraction of sorghum samples

Harvested leaves were fractionated into leaf blade (LB) or leaf sheath (LS), air-dried and ground (1 mm). 50 mg samples were extracted in 2 ml acetone/water (7:3, v/v).

High pressure liquid chromatography (HPLC) analysis

Extracts (20 µl) were injected into HPLC (µ-Bondapack C_{18} column, at 30±1°C); water/acetic acid (975:25, v/v) and methanol were used as solvents at 1·3 ml/min. A 990 photodiode array detector was used to record spectra between 230 and 600 nm.

Results

There were large differences in the shape of chromatograms indicating differences in phenolic components both in composition and concentration between LB and LS of each of the varieties used. The difference between varieties appeared to be larger in LS than in LB (Figure 1). Additionally, in LS, differences between replicates were noticed at the 50% flowering and black layer stages, whereas in LB the differences were apparent at 50% flowering stage only. These findings indicate that the biosynthesis of phenolics is completed (stabilized) in LB before LS.

From the chromatograms of X/35:24 or Seredo varieties (Figure 1) it can be seen that large differences in phenolics exist between the 50% flowering stage in comparison with the other two stages especially in LS fraction.

Storage of the samples at room temperature (15°C) for 3 months after harvest did not appear to influence either the phenolic content or its composition of either LS or LB.

Conclusion

Beside varietal and fractional effects, phenolic compounds are influenced by growth stages up to black layer stage. However storage did not appear to affect phenolic compound content or composition.

Acknowledgements

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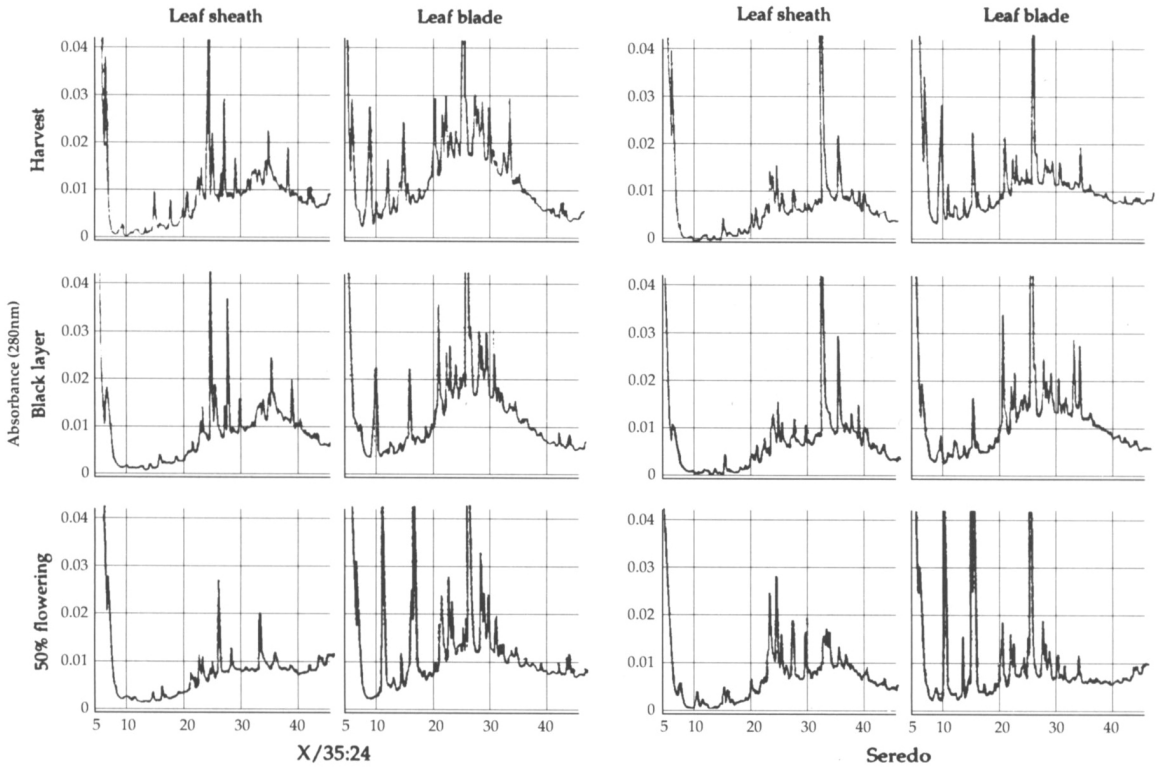

Figure 1 HPLC of aqueous acetone extracts from leaf blade or leaf sheath fractions of the Ethiopian sorghum varieties X/35:24 or Seredo at different growth stages.

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