

ASSOCIATION OF APPLIED BIOLOGISTS

ASPECTS OF APPLIED BIOLOGY 111

Advances in Cider and Fruit Wine Technology

Pershore College, Worcs, UK

7 April 2011

Produced by the Association of Applied Biologists

**Copies available from: The AAB Office
Warwick Enterprise Park, Wellesbourne,
Warwick CV35 9EF, UK
<http://www.aab.org.uk>**

REFERENCES

The correct form of reference for this publication, which is based on a meeting of the Association of Applied Biologists, is:

Aspects of Applied Biology III, Advances in Cider and Fruit Wine Technology, pp. xx–xx

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Warwick Enterprise Park, Wellesbourne, Warwick CV35 9EF, UK.

Printed in the UK

Published by the Association of Applied Biologists
Warwick Enterprise Park, Wellesbourne, Warwick CV35 9EF, UK

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ISSN 0265-1491

*Full reference: *Aspects of Applied Biology III, Advances in Cider and Fruit Wine Technology*, published by the Association of Applied Biologists, Warwick Enterprise Park, Wellesbourne, Warwick CV35 9EF, UK.

Advances in Cider and Fruit Wine Technology

Introduction and Conference Overview

The Advances in Cider and Fruit Wine Technology meeting held on the 7th April 2011 brought together representatives from the cider and wine industry, academics in universities and research institutes and retailers. The conference was particularly fortunate in being hosted by the cider making facility at Pershore college.

The conference focused on the major issues for small scale production and benefited greatly from the college having cider production on site. Award winning samples from the college press were popular tasting aids and provided an ideal illustration of what can be achieved.

Attendance at the session was predominantly from small scale producers who brought a wide range of concerns. These grouped into the following areas covering both general topics and specific questions:

1. Fruit

- What are the recommended methods for cleaning and sterilizing fruit?
- What is the effect of using different selective varieties and mixes of apples?
- Requirements to establish an orchard.
- Approaches to broaden the harvest window and allow more manageable use of fruit.
- Novel apple varieties.
- Differences between pears and apples for processing.

2. Microbiology

- Yeast selection and characteristics.
- Yeast selection – natural or cultured.
- What factors influence the development film yeasts?
- Effect of natural bacteria.

3. Fermentation

- What are the essentials to monitor and control fermentation ?
- How to deal with stuck fermentations.
- The value of yeast nutrients.

4. Maturation

- Secondary malo-lactic fermentation – is it controllable?
- Product quality and flavour problems.
- What factors influence the achievement of a standard product?
- Development of hydrogen sulphide.
- The value and use of preservatives – particularly sulphur dioxide.

5. Analysis and Quality Control

- What laboratory equipment is required to test pH, alcohol by volume.
- What features require testing to maintain quality.
- How to not make bad cider.

Although a relatively informal event the conference followed a pattern reflecting the cider and wine making process from fruit production to packaging. The presenters provided specific inputs on each of the major areas of production but were flexible to address particular problems and questions raised by the attendees. Many of these were specific and practical issues as noted above.

A detailed contribution from Chantelle Jay of East Malling Research Centre provided a wealth of background for those producers looking to establish their own fruit stock and to orchard managers. An increased interest in varietal products is providing strong support for specialist cider production but there is inevitably a long lead time before an investment may be realised. A major investigation to assist selection of suitable varieties has focused on identifying suitability to modern methods of harvesting particularly machine shaking. This method has the advantage that shaken fruit may be collected in nets so avoiding contact with the ground and minimising damage and disease. However, not all varieties respond well to shaking and be damaged. Comparison of 30 different varieties with combinations of rootstock and interstocks indicated clear differences when assessed for growth, yield and disease resistance. Assessment is continuing but will provide direct advice of choice for establishing novel orchards.

A second major input to wine and cider production is yeast and may arise naturally from fruit and equipment and by addition from selected cultures. Keith Thomas from the University of Sunderland presented details on the progression of natural microbial flora in cider making and illustrated the change in species apparent between early, middle and late fermentation. A major issue for discussion was the merits of natural succession by indigenous yeasts compared to the consistency offered by pure yeast inoculation. The use of pure culture requires selection for management as well as for flavour but inevitably loses characteristics resulting from local microorganisms. An example study of the features of indigenous fruit yeasts and bacteria was used to illustrate a typical community and details of how this could be selected to best combination discussed.

The management of cider fermentation was presented by Chris Holliland from Brewlab Ltd who discussed the standard yeast growth profile and how this may be managed to control flavour by keeving to restrict nutrients. Difficulties in fermentation due to low nutrient and oxygen restrictions were highlighted and the influence of bacteria in conducting malo-lactic fermentations outlined. The management of this maturation reaction is important as its contribution may be desired in some products but not in others depending on other components present.

The overall cider production process was outlined by Richard Toft of Pershore College with an emphasis on how fruit control is essential in producing quality products. Richard outlined production control with clear guidance on how to achieve best quality from variable input with many examples of specialist knowledge. A good example being not to use apples larger than your fist as spoilage moulds penetrate into the core which cracks as apples grow too large.

The action of bacteria in conducting maturation reactions was covered in detail by Belinda Kemp from Plumpton College Wine Centre with specific advice on the production of sparkling wines. The use of *Torulosporia delbrukki* and *Schizosaccharomyces pombe* are currently under investigation for use in production of sparkling wines have shown good promise in their flavour profiles.

A brief workshop allowed demonstrations of microscopy to illustrate yeast species and contaminants and the session was completed by an informative visit to the college cider plant managed by Richard Toft.

Posters were also presented at the conference and covered the following titles:

Cetobacteracea: Acetic Acid Bacteria

Thomas Bartlett, Plumpton College

This poster summarises the origins of acetic acid contamination of wines and ciders and provides suggestions for avoidance including lowering fermentation temperature and pH, sulphating, reverse osmosis filtration, limiting oxygen during processing and, possibly, bacteriophage treatment.

Methods of Preventing, Monitoring and Correcting Unwanted Volatile Sulphur Compounds

Matthew Standing, Plumpton College

This poster summarises the origins of volatile sulphur compounds in wines, particularly hydrogen sulphide, mercaptans and disulphides such as dimethyl sulphide. Yeast metabolism, residual solids and vineyard treatment may all be major contributors and require assessment to minimise the levels. Copper sulphate is one treatment which is commonly used but avoidance is desirable where possible.

Identifying and Tackling Film Yeast and Production

Danielle Whitehead, Plumpton College

This poster reported on the types of yeast responsible for forming films on ciders and wines and on their management. Film yeast accumulate on the surface of fermented wine and ciders and convert ethanol into acetaldehyde so reducing alcohol strength and producing objectionable flavour. The surface layer results from the presence of hydrophobic proteins which keep the yeast away from the aqueous liquid. Treatment requires careful dosing of sulphite compounds, scrupulous hygiene and maintenance of anaerobic conditions.

Identification and quantification of Bacteria in Beverages Using Multiplex qPCR

John Cossey and Keith Thomas, University of Sunderland.

This poster reported a study on methods to detect *E.coli* and *Salmonella* in juices, beers and ciders and indicated that levels of these bacteria were significantly reduced when incubated in these products.

Many of the questions raised by the attendees were addressed progressively through the session and a number of specific issues discussed in detail. A summary of answers to the major areas of interest is shown below.

Fruit

Good quality fruit is important to obtain good quality cider and wine. Infected and damaged fruit should be discarded and soiled fruit cleaned. Fruit variety has a major impact on product flavour and should be chosen and blended carefully to achieve a standard result.

Orchards are a desirable investment for a cider maker and new varieties are offering advantages in yield and ease of harvesting including broadening the harvest time and minimising infection.

Microbiology

Wine and cider made with indigenous and purified strains of yeast and bacteria differ greatly. However, the indigenous microbial community is varied and may result in inconsistency from batch to batch and year to year. A purified strain cultured in advance offers a number of advantages but precludes the unique character and marketing opportunity of using only local species. However, the technology of selective isolation can allow desirable yeast and bacteria to be used and to provide the unique identity of the product and also exclude undesirable spoilage microbes.

Fermentation

Fermentation may be monitored readily using simple assessments of density and pH and microbial activity may be tracked using microscopy. Control of ingredients and of yeast collection can greatly affect the product character and is easy to manage. Rectification of problem fermentations requires a knowledge of yeast physiology but the use of vitamins and yeast aids may protect against serious difficulties.

Maturation

The maturation process is now more fully understood and can be accelerated by environmental control and by selective addition of microorganisms. Off flavours may arise from poor management and this may relate to hygiene as storage may require months in tank. Sulphur dioxide is one controlling method but application of microbiology testing may allow more informed management.

Analysis and Quality Control

Laboratory analysis is desirable and need not require extensive apparatus. pH is a useful indicator of ingredient quality and of fermentation progress and warrants an investment in a suitably robust and accurate instrument. Similarly a microscope has many applications in both yeast management and fermentation assessment. Both of these are relatively basic pieces of apparatus which can be a valuable addition to the quality assurance of the overall operation. Incorporation into a quality assurance scheme is equally important so that long term quality and consistency are managed.

Many of today's UK commercial cider producers are relatively small in size, often due to the advantages provided by the duty allowance of producing 700 litres for sale duty free. As such this precludes a large investment in expensive equipment or laboratory apparatus. However, basic tests are still possible and good management and awareness of microbiology can help obtain high quality and consistent products.

For more extensive production quality assurance will require a greater investment and more attention to yeast selection and management as well as some laboratory analysis.

The topics covered by this conference relate to both small and medium scales of production and provide at least the basis of establishing an understanding of how technical advances may aid commercial production.

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