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Production and Characterisation of ZESPRI™ Gold Kiwifruit Vinegar

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A thesis present in partial fulfilment of the requirements for the degree of
Master of Technology in Food Technology

Massey University
Palmerston North, New Zealand

2005
Abstract

Gold kiwifruit (Hort 16A) is a relatively new entrant into the international fresh fruit market and is a controlled variety only marketed by Zespri™. Zespri™ gold and the traditional green ‘Hayward’ kiwifruit are mainly marketed as fresh whole fruit; however there is interest in extending the range of processed products for gold fruit to provide further opportunities to utilize the increasing volumes now becoming available. Vinegar was selected for investigation as it plays an important role in food processing as a condiment, acidulant and preservative, and has also been identified to have various health benefits.

The aims of the project were:

1. To evaluate the effect of juice extraction techniques and conditions on juice yield and quality.
2. To evaluate the effects of pre-fermentation treatment and fermentation conditions on the fermentation behaviour and quality of Zespri™ gold kiwifruit mashes.
3. To identify suitable conditions for acetification of Zespri™ gold kiwifruit wines and investigate the effect of the vinegar elaboration technique on the quality of the resultant kiwifruit vinegars.

Ripe peeled or unpeeled gold kiwifruit was processed in a hammer mill and the juice was extracted using a laboratory scale hydraulic press. Yield was measured for four pressurization cycles, to a maximum pressure of 250MPa. Press aid, and pre-(cellulase) and post-pressing (pectinase) enzymes were used to improve juice yield and quality. Juice yield increased through the first three pressing cycles, but there was little gain in the fourth cycle. A juice of suitable clarity and consistency, and yield of 3.8 L.(5 kg pulp)⁻¹ was obtained with the recommended process conditions of: 2 or 3%(w/w) press aid, 0.15mL.kg⁻¹ pre-press enzyme held at 50 °C for 2h, 0.035mL.kg⁻¹ post-press enzyme.

Repeated pressing was found to increase total phenolics but reduced colour intensity in juice. The free-run juice was superior in colour and TP; other physico-chemical parameters were not affected by repeated pressing. Hand peeling and holding pomace at 30-50°C for 2-6h slightly reduced total acidity and significantly (P<0.05) reduced vitamin C. Skin contact and temperature (30-50°C, 2-6h) significantly (P<0.05) increased total phenolics. The character impacting aromatic compounds, ethyl butanoate, hexanal and trans-2-hexanal, were identified in the juice at 10.8, 4.2 and 9.8mg.L⁻¹, respectively. Proteolytic activity attributed to actinidin was about 45% of that observed in ‘Hayward’ green kiwifruit juice.

Alcoholic fermentation behaviour was evaluated at 20, 30 and 37°C for natural juice and juice supplemented with sucrose to 18°Brix using a wine yeast strain of Saccharomyces cerevisiae. Juices obtained from peeled and unpeeled fruit, filtered and unfiltered, were fermented. With sucrose enrichment, wines with 8.1%w/v or 8.0%w/v were obtained at efficiencies of 88% and 87% and productivities of 1.3 and 1.6g.L⁻¹h⁻¹ at 20 and 30°C, respectively. Natural juice at 20°C gave a similar yield but efficiency and productivity
varied from 84-96% and 1.1-0.8g.L⁻¹ h⁻¹, respectively. Both sucrose enrichment and high fermentation temperature reduced total vitamin C and total acidity in wine. Many esters which impact positively were identified by GC-MS in the gold kiwifruit wines. These included isoamyl acetate, ethyl acetate, ethyl butanoate, 1-hexy hexanoate, ethyl decanoate and ethyl octanoate.

Gold kiwifruit wines with up to 7.5% w/v ethanol were subjected to acetic acid fermentation using a commercial cider vinegar as the inoculum. A start up protocol for a simple semi-continuous fermentation system was developed. The best fermentation conditions identified were 29±2°C with flow rate of 0.8L.min⁻¹ of oxygen enriched (40%) air. A yield of up to 5.8% w/v acetic acid was obtained at an efficiency of 85% and productivity of 1.2g.L⁻¹ h⁻¹. A sensory panel described the gold kiwifruit vinegar as having stronger wine character than commercial cider vinegar, and equal to cider vinegar in terms of fruity aroma, ethyl acetate aroma and overall impression. The vinegar was found to have a meat tenderizing effect comparable to commercial papain enzyme and left the meat in good eating condition. Gold kiwifruit vinegar could find a niche market as marinating vinegar.
Acknowledgement

Firstly, I would like to thank God whom by his grace, love and compassion enabled me to carry out this Research.

I wish to sincerely thank my supervisors, Assoc. Prof. John Mawson, and Michael Parker for all valuable advice, guidance, and time.

Special thanks go to the NZ Commonwealth Scholarship and Fellowship Committee, who funded my studies at Massey University.

Also, thanks are extended to Aragorn Ltd, NZ, who sponsored this project and supplied the fruit used in this project.

Special thanks also go to Warwick Johnson for his help with the use of HPLC, and Karl Fraser of AgResearch, Palmerston North for his assistance in the use of GC-MS for analysis of volatiles.

I wish also to extend my gratitude to all academic and technical staff of the Institute of Food Nutrition and Human Health for all their support and encouragement.

I also appreciate moral support given by Ernest Ley Okorly and his family, and all fellow postgraduates.

Lastly, I remain indebted to my beloved wife Verdiana, and my children, Guyton, Emmanuel, Joyce and Elienezer, for their patience, inspiration and moral support during the course of this project.
# TABLE OF CONTENTS

1. Introduction and background  
   1.1 History of kiwifruit and development of ZespriTM gold kiwifruit  
   1.2 Justification for the research  

2. Literature review  
   2.1 Introduction  
   2.2 Kiwifruit and its diversity  
   2.3 Kiwifruit properties and composition  
      2.3.1 Gross characteristics  
      2.3.2 General Composition  
      2.3.3 Proteolytic activity  
      2.3.4 Volatile compounds in kiwifruit  
      2.3.5 Summary of kiwifruit chemical characteristics  
   2.4 Kiwifruit products  
   2.5 Processing of kiwifruit to juice and related products  
      2.5.1 Flow chart  
      2.5.2 Peeling  
      2.5.3 Crushing or comminution and pressing  
      2.5.4 Use of press aid and enzymes in juice processing  
      2.5.5 Juice filtration and clarification  
   2.6 Alcoholic fermentation  
      2.6.1 Biochemical pathway  
      2.6.2 Factors affecting fermentation of wine must  
      2.6.3 Effect of temperature, must composition and pH on the rate of fermentation and wine quality  
      2.6.4 Malolactic fermentation  
      2.6.5 Kiwifruit wine  
      2.6.6 Summary for alcoholic fermentation  
   2.7 Vinegar Production  
      2.7.1 Introduction  
      2.7.2 Biochemistry and substrate  
      2.7.3 Micro-organisms  
      2.7.4 Factors affecting vinegar production  
      2.7.5 Industrial Processes  
      2.7.6 Factors that affect the quality of vinegar  
      2.7.7 Volatiles compounds in vinegar  
      2.7.8 Fruit vinegars  
   2.8 Overall conclusion  

3. Materials and methods  
   3.1 Materials  
      3.1.1 Fruit  
      3.1.2 Enzymes  
      3.1.3 Press aid  
      3.1.4 Wine yeast  
      3.1.5 Vinegar culture  
      3.1.6 Chemicals  
   3.2 Processing Methods
3.2.1. Juice extraction
3.2.2 Alcoholic fermentation
3.2.3 Acetic acid fermentation
3.3.0 Analytical methods
3.3.1 Determination of insoluble cloud matter, alcohol insoluble solids and total pectin in kiwifruit juice
3.3.2 Total soluble solids, pH, and titratable acidity and dissolved oxygen
3.3.3 Determination of total phenolics (TP)
3.3.4 Determination of sulphur dioxide in gold kiwifruit wine
3.3.5 HPLC analysis of methanol, ethanol and acetic acid
3.3.6 HPLC Analysis of sugars
3.3.7 HPLC Analysis of vitamin C and carboxylic acids
3.3.8 Colour measurement
3.3.9 GC and GC-MS analysis of volatile compounds in Zespri TM gold kiwifruit juice, wine and vinegar
3.3.10 Determination of proteolytic activity
3.4 Statistical analysis

4 Effect of extraction techniques on juice yield and quality
4.1. Introduction
4.2 Effect of different pressing and enzyme treatments on juice yield and quality.
4.2.1 Introduction
4.2.2 Material and methods
4.2.2.1 Material
4.2.2.2 Methods
4.2.3 Results and discussion
4.2.3.1 Effect of PA and repeated pressing on juice yield
4.2.3.2 Effect of repeated pressing on juice quality
4.2.3.3 Effect of repeated pressing on juice colour
4.2.3.4 Effect of repeated pressing on total phenolics
4.2.3.5 Effect of repeated pressing on physico-chemical properties of Zespri TM gold kiwifruit juice
4.2.3.6 Effect of pre-pressing enzymes on juice yield
4.2.3.7 Effect of pre-and-post pressing enzyme on physico-chemical properties of Zespri TM gold kiwifruit juice
4.2.3.8 Effect of pre-and post-pressing on total phenolics
4.2.3.9 Effect of pre-pressing and clarifying enzymes on juice colour attributes
4.3 Effect of skin contact on juice yield and quality
4.3.1 Material and methods
4.3.2 Material
4.3.3 Methods
4.3.4 Results and discussion
4.3.4.1 Effect of skin contact, temperature time regime on juice yield
4.3.4.2 Effect of skin contact time –temperature regime on total soluble solids, reducing sugars, titratable acidity and total acidity
4.3.4.3 Effect of skin contact and time temperature regime on total phenols in Zespri Gold kiwifruit juice

4.3.4.4 Effect of skin contact and time temperature regime on colour attributes in Zespri Gold kiwifruit juice

4.3.4.5 Volatile compounds

4.3.4.6 Amount of proteases activity in Zespri Gold kiwifruit juice

4.4. Overall Discussion and Conclusion

5. Alcoholic fermentation behaviour and wine quality

5.1. Introduction

5.2 Effect of fermentation temperature and sucrose addition

5.2.1 Introduction

5.2.2 Material and methods

5.2.3 Results and discussion

5.2.3.1 Effect of temperature and sucrose enrichment on fermentation behaviour

5.3. Effect of juice Pressing technique

5.3.1 Introduction

5.3.2 Material and methods

5.3.3 Results and discussion

5.4 Skin contact effect on fermentation behaviour and quality of the finished wine

5.4.1 Introduction

5.4.2 Material and methods

5.4.3 Results and discussion

5.4.3.1 Ethanol yield, efficiency and productivity

5.4.3.2 Effect of skin contact time and temperature on physico-chemical properties of ZespriTM gold kiwifruit wine

5.5 Juice filtration and reactor fraction volume effects on the fermentation behaviour and wine quality

5.5.1 Introduction

5.5.2 Material and methods

5.5.3 Results and discussion

5.5.3.1 Effect of filtration and fraction volume on the fermentation behaviour

5.6. Volatile compounds identified and/ or quantified in ZespriTM gold wine

5.7 Overall discussion and conclusion

6. Acetic fermentation of ZespriTM gold kiwifruit

6.1 Introduction

6.2. Material and methods

6.2.1 Material

6.2.2 Equipment set up.

6.2.3 Start up protocol

6.2.3 Protocol performance evaluation

6.2.4 Production of various vinegars

6.2.5 Meat tenderisation

6.2.6 Sensory evaluation

6.3 Results and discussion

6.3.1 Protocol for acetic fermentation
6.3.2. Zespri™ gold kiwifruit vinegars effect of juice extraction techniques 125
6.3.3. Carboxylic acids and vitamin C, effect of juice extraction techniques on resultant vinegars 126
6.3.4 Volatile aroma compounds identified in Zespri™ gold kiwifruit vinegar 129

6.4 Tenderising effect of Zespri™ Gold kiwifruit vinegars compared with cider vinegar and commercial Papain 132
6.5. Sensory evaluation 134
6.5.1 Triangle test 134
6.5.2. Descriptive analysis 135
6.6 Overall discussion and conclusion 137

7. Overall discussion and conclusion 138
7.1 Juice extraction and quality 138
7.2 Alcoholic fermentation 139
7.3 Acetic acid fermentation 139

REFERENCES 142
LIST OF FIGURES

Fig 2.1: Kiwifruit diversity 7
Fig 2.2 ‘Hayward’ and Hort 16a 8
Fig 2.3: Flow chart for processing kiwifruit juice and wine 15
Fig 2.4 Glycolytic pathway and ethanol 22
Fig 2.5 Aclosed system of acetification equipment 32
Fig 2.6 Schematic representation of two basic techniques of wine vinegar elaboration, surface and submerged culture 34
Fig 2.7 Typical submerged systems for vinegar elaboration 35
Fig 3.1 Laboratory hydraulic press 46
Fig 3.2: Set up for acetic fermentation 48
4.1: Effect of pa on mean total juice yield per 5kg pulp mass 65
Fig 4.2: Effect of repeated pressing on juice yield at each level of press aid 66
Fig 4.3: Effect of repeated pressing on total phenolics 68
Fig 4.3: Effect of pre and post pressing enzymes on juice viscosity at 50oc for up to 2h 72
Fig 4.4: Effect of pre-and post-pressing enzymes on total pectin in Zespri™ gold kiwifruit juice 74
Fig 4.5: Effect of pre and post pressing enzymes on TP in Zespri™ gold kiwifruit juice 77
Fig 4.6 Effect of skin contact and time temperature regime on yield 80
Fig 4.7 Effect skin contact time-temperature regime on total phenols in Zespri gold kiwifruit juice 86
Fig 5.1 Fermentation profiles for Zespri™ gold kiwifruit mashes 96
Fig 5.3: Photos of wines fermented at 200c, 30oc and 37oc with or without sucrose enrichment 99
Fig 5.4: Fermentation profile for free-run and press juice 102
Fig 5.5 Fermentation profile for samples held at 30o for up to 6h before pressing 105
fig 5.6: Fermentation profile for samples held at 50o for up to 6h before pressing 106
Fig 6.1: Acetic acid fermentation profile for Zespri™ gold kiwifruit wine 124
Fig 6.2: Effect of pre-treatments on juice extraction on the total phenols of the resultant vinegar 127
Fig 6.3 Tenderising effect of Zespri™ gold kiwifruit vinegar compared to cider vinegar and commercial papain 132
LIST OF TABLES

Table 1.1 New Zealand kiwifruit sector profile for the period of (1993-2003) 2
Table 2.1: An overview of NZ kiwifruit production, export and consumption over the past three years 6
Table 2.2 Variation of vitamin C in kiwifruit (‘Hayward’) 9
Table 2.3: Composition of peeled ‘Hayward’ (green) kiwifruit 10
Table 2.5: Distribution of actinidin in different portions of green kiwifruit ‘Hayward’) 12
Table 2.6: Chemical composition of typical green kiwifruit juice and wines 14
Table 2.7 Typical data for acetic fermentation parameters for laboratory, pilot plant 36
Table 2.8: Major volatile compounds identified in conventional and traditional vinegars 41
Table 4.1 Effect of Press Aid and repeated pressing on Juice Yield 65
Table 4.2: Effect of repeated pressing on juice colour attributes 67
Table 4.3: Effect of repeated pressing on physico-chemical properties 69
Table 4.4: Effect of pre-pressing enzyme and press aid on juice yield 70
Table 4.5: Effect of enzymes concentration on juice consistency and clarity 71
Table 4.6: Effect of pre and post pressing enzymes on physico-chemical properties of Zespri kiwifruit juice 76
Table 4.7: Effect of enzyme on the change of Hunter colour parameters at 50oC for 2h 78
Table 4.8 Skin contact (at 30 or 50oC for 2 or 6h) effect on physico-chemical properties 83
Table 4.9 Skin contact (at 30, 50 or 70oC for 6 or 12h) effect on physico-chemical properties 84
Table 4.10: Effect of skin contact time –temperature regime on Hunter colour values 87
Table 4.11 volatile compounds in gold kiwifruit juice 88
Table 4.12 Protease activity (Actinidin) Gold TM Kiwifruit, Kiwifruit (Green) Hayward and Commercial papain 89
Table 5.1: Effect of temperature and sucrose enrichment on ethanol production, yield, efficiency and productivity of ZespriTM Gold kiwifruit must 94
Table 5.2 Effect of temperature and addition of glucose on the physico-chemical properties of Zespri Gold kiwifruit finished wine 98
Table 5.3 Ethanol production yield, efficiency and productivity for free run and press juice 101
Table 5.4 Physico-chemical properties of free run versus total juice wine of ZespriTM gold kiwifruit

Table 5.5 Effect of skin contact, holding time and temperature on fermentation of ZespriTM gold kiwifruit must

Table 5.6 Effect of skin contact, longer holding time and higher temperature on fermentation of ZespriTM gold kiwifruit must

Table 5.7: Analytical data for Zespri gold kiwifruit wine from juice extracted with skin on or off and held at 30 or 50°C for 2 or 6 hours

Table 5.8: Analytical data for Zespri gold kiwifruit wine from juice extracted with skin on or off and held at 30, 50, or 70°C for 6 or 12 hours

Table 5.9: Analytical data for Zespri gold kiwifruit wine from juice extracted with skin on or off and held at 30 or 50°C for 2 or 6 hours

Table 5.10 Filtration and reactor fraction volume effect on yield, efficiency and productivity

Table 5.11: Analytical data for Zespri gold kiwifruit wine from juice extracted with skin on or off and held at 30, 50, or 70°C for 6 or 12 hours

Table 5.12: Analytical data for Zespri gold kiwifruit wine from juice extracted with skin on or off and held at 30 or 50°C for 2 or 6 hours

Table 5.13 Filtration and reactor fraction volume effect on physico-chemical properties during fermentation of Zespri Gold kiwifruit

Table 5.14 Filtration and reactor fraction volume effect on physico-chemical properties during fermentation of Zespri Gold kiwifruit

Table 5.15 Volatile compounds identified and or quantified in ZespriTM gold kiwifruit wine using GC and CG-MS

Table 6.1: Mass balance for start up protocol

Table 6.2: Acetification performance of ZespriTM gold kiwifruit

Table 6.3: Composition of ZespriTM gold kiwifruit vinegars made from different juice treatments

Table 6.4: Carboxylic acids and vitamin C

Table 6.5: Volatile compounds in ZespriTM gold kiwifruit vinegar by GC-MS

Table 6.6: Results for triangle test for skin on versus skin off and free run versus presswine vinegars

Table 6.7: Descriptive sensory analysis results for ZespriTM gold kiwifruit vinegars compared to commercial cider vinegar