A preliminary investigation into the use of *Torulaspora delbrueckii* for wine production at lower and higher temperatures

P0656

V. Van Breda[1,2], N. P. Jolly[1]* and Dr. J. van Wyk[2]

*[1]Post-Harvest and Wine Technology Division, ARC Infruitec-Nietvoorbij, Private Bag X5026, Stellenbosch 7599, South Africa. *E-mail: jollyn@arc.agric.za*

[2]Department of Food Technology, Cape Peninsula University of Technology, PO Box 1906, Bellville 7535, South Africa.

INTRODUCTION

Increased local and global competition leading to the ever increasing need for improved wine quality, high alcohols unacceptable to consumers and current resistance by consumers to GMO products are some of the ongoing problems faced by the South African wine industry. With the current worldwide interest in the positive role played by non-*Saccharomyces* yeasts in wine production, the aim of this study was to investigate the potential of *Torulaspora delbrueckii*. Consequently, 49 *T. delbrueckii* yeast strains were selected and used in laboratory-scale fermentations at 15ºC and 22ºC and compared to a *Saccharomyces cerevisiae* (strain VIN 13) wine yeast reference.

MATERIALS AND METHODS

Forty nine *T. delbrueckii* yeasts were screened in laboratory-scale fermentations using a previously frozen grape must. The fermentations were conducted in duplicate in 450ml aliquots at 15ºC and 22ºC and monitored by CO_2 weight loss for 26 days. Volatile acidity (VA), titratable acidity (TA), pH, residual sugar, total SO_2 (TSO_2), alcohol (%v/v) & glycerol analyses were performed on the resultant wines. The sugar analyses and SO_2 were done according to the methods of SAWLA (2002) and the other analyses were done by winescan (Chemical Laboratory, IWBT, University of Stellenbosch, Stellenbosch). The chemical data were subjected to a principle component analysis (PCA) (F. Calitz, Biometry Unit, ARC Infruitec-Nietvoorbij, 2009).

RESULTS & DISCUSSION

Monitoring of the laboratory-scale fermentations by CO_2 weight loss showed that although all the *T. delbrueckii* yeasts fermented slower than the *S. cerevisiae* (VIN 13) reference, a few appeared to be able to finish the fermentation within 20 and 26 days respectively (Figures 1 & 2). The *T. delbrueckii* yeasts could also broadly be grouped as those that fermented almost as well as VIN 13, those that were intermediate and those that fermented poorly.

The residual sugar analyses (Table 1) tended to support the fermentation curve trends with six *T. delbrueckii* yeasts that fermented to below 10 g L^{-1}, nine with residual sugar between 10 and 30 g L^{-1} and the remainder with residual sugar above 30 g L^{-1}. Only one isolate (strain 654) was able to ferment the must to dryness at both 15ºC & 22ºC (<5 g L^{-1} residual sugar), but had a higher TSO_2 level than the reference strain.

The PCA plots (Figures 3 & 4) showed the spatial relationship between better and poorer performing yeasts with regards to the chemical analyses. The yeasts that grouped close to the reference strain (VIN 13) showed more acceptable wine chemical profiles, while those further away displayed less acceptable profiles.

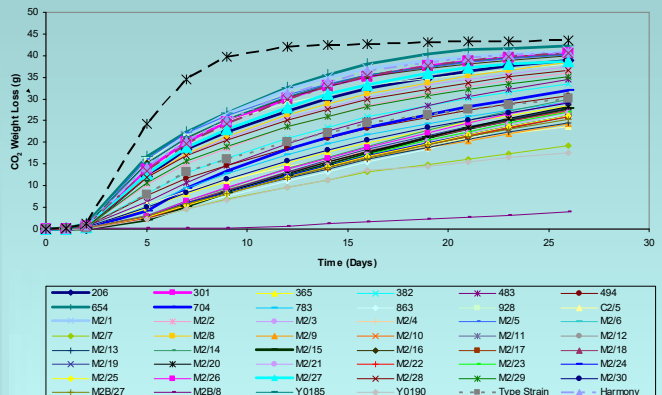

Figure 1: Average fermentation curves of laboratory-scale fermentations of *T. delbrueckii* yeasts and reference strains at 15ºC.

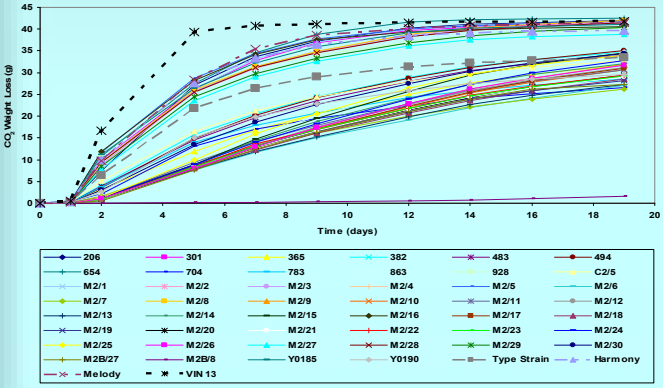

Figure 2: Average fermentation curves of laboratory-scale fermentations of *T. delbrueckii* yeasts and reference strains at 22ºC.

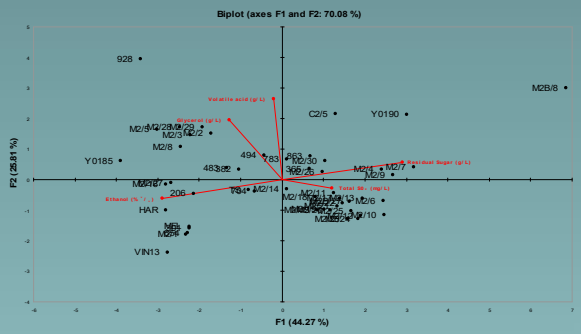

Figure 3: Average PCA plot of chemical analyses of laboratory-scale fermentations of *T. delbrueckii* yeasts and reference strains at 15ºC.

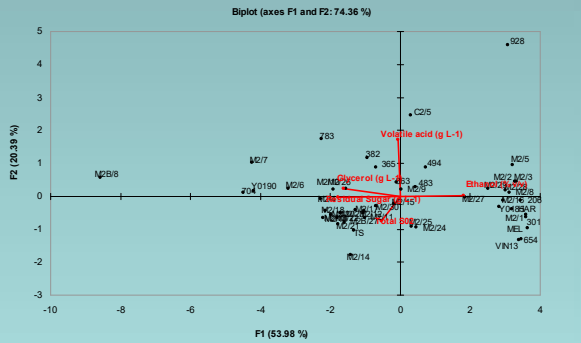

Figure 4: Average PCA plot of chemical analyses of laboratory-scale fermentations of *T. delbrueckii* yeasts and reference strains at 22ºC.

Table 1: Average chemical analyses of laboratory-scale fermentations by *T. delbrueckii* yeasts and reference strains at 15º and 22ºC.

Yeast Id	Volatile acidity (g L-1)		Ethanol (% v/v)		Glycerol (g L-1)		Residual Sugar (g L-1)		Total SO2 (g L-1)	
	15°C	22°C	15°C	22°C	15°C	22°C	15°C	22°C	15°C	22°C
206	0.4	0.4	11.6	12.9	6.6	6.2	18.4	8.0	44.7	32.3
301	0.3	0.4	12.6	13.0	5.9	5.7	8.6	6.2	49.3	41.0
365	0.4	0.6	8.9	10.3	6.4	8.6	67.0	51.0	51.6	40.0
382	0.5	0.6	10.5	9.3	6.3	5.0	42.0	41.4	40.5	31.9
483	0.4	0.4	10.7	10.7	6.6	7.7	35.2	44.8	45.7	31.0
494	0.5	0.5	9.6	10.8	6.7	7.5	55.6	38.8	43.6	32.4
654	0.3	0.3	12.7	13.1	5.8	5.9	2.0	4.8	54.0	50.6
704	0.4	0.4	10.1	8.5	6.7	13.1	51.6	76.0	42.0	32.7
783	0.5	0.6	9.1	9.2	5.9	10.1	64.0	67.2	35.0	28.1
863	0.4	0.5	8.7	10.5	7.9	7.9	71.4	41.2	69.6	47.4
928	0.7	1.0	11.5	12.7	7.9	6.9	23.8	6.0	29.1	25.5
C2/5	0.6	0.7	7.5	10.6	6.2	7.8	88.4	45.8	35.9	27.8
M2/1	0.4	0.4	12.8	12.9	5.5	5.7	5.8	5.6	46.7	39.4
M2/2	0.5	0.5	10.8	13.0	7.5	6.1	34.2	7.4	51.1	39.1
M2/3	0.5	0.5	11.7	13.0	7.4	6.2	22.2	6.6	56.1	41.4
M2/4	0.4	0.5	7.8	9.1	6.5	8.9	86.0	56.2	75.8	66.5
M2/5	0.6	0.6	12.3	12.9	6.8	6.5	11.4	7.2	40.3	35.5
M2/6	0.4	0.5	8.3	8.9	5.6	10.1	79.3	72.8	73.5	56.1
M2/7	0.5	0.6	6.1	8.3	5.6	11.7	108.4	79.4	44.5	40.7
M2/8	0.5	0.5	11.9	12.9	7.2	6.2	16.0	8.0	53.2	45.4
M2/9	0.5	0.6	7.7	10.8	5.8	7.2	88.4	44.2	70.2	57.9
M2/10	0.4	0.6	8.7	9.9	5.0	9.5	71.4	53.4	75.6	60.4
M2/11	0.4	0.4	8.3	9.7	6.1	8.1	76.4	59.4	47.5	43.0
M2/12	0.3	0.4	8.2	9.9	5.5	8.6	78.0	55.8	55.0	42.0
M2/13	0.4	0.4	7.7	8.7	5.9	8.7	84.4	71.6	51.8	44.5
M2/14	0.4	0.4	9.3	10.2	6.5	8.2	61.8	54.2	45.5	76.1
M2/15	0.3	0.4	8.6	11.0	5.9	9.0	66.2	40.6	44.3	39.4
M2/16	0.4	0.4	12.3	12.7	6.6	6.6	11.6	10.6	39.5	34.9
M2/17	0.3	0.4	8.1	9.9	6.2	8.2	80.8	61.0	47.3	44.6
M2/18	0.4	0.4	8.6	9.2	6.2	9.5	71.0	62.6	43.9	43.9
M2/19	0.3	0.4	8.9	9.1	6.0	8.8	69.8	68.0	50.6	44.6
M2/20	0.3	0.4	8.6	9.2	5.8	8.6	69.2	62.4	49.7	45.4
M2/21	0.3	0.4	8.5	9.4	5.9	8.5	77.2	65.2	48.6	51.2
M2/22	0.4	0.4	8.3	9.6	5.7	9.2	79.8	62.0	44.6	47.1
M2/23	0.4	0.4	8.5	9.3	5.1	7.8	75.2	65.4	45.4	44.1
M2/24	0.4	0.4	8.3	9.0	5.2	5.3	78.2	47.0	50.4	45.5
M2/25	0.4	0.4	8.4	10.9	5.4	7.4	75.0	42.4	52.1	49.3
M2/26	0.5	0.6	9.2	10.2	6.3	9.0	62.2	51.0	68.2	64.5
M2/27	0.4	0.4	11.9	12.3	6.4	7.8	17.0	16.4	31.8	37.1
M2/28	0.5	0.5	11.4	12.8	7.8	6.3	24.2	8.0	49.9	46.1
M2/29	0.5	0.5	11.2	12.7	7.2	6.5	29.6	12.6	49.9	52.1
M2/30	0.5	0.5	9.1	10.5	6.0	8.1	63.6	46.2	64.2	62.9
M2B/27	0.4	0.4	8.1	9.3	5.8	8.3	82.2	65.4	47.4	48.4
M2B/8	0.6	0.5	1.5	3.7	5.2	10.1	191.2	179.2	27.7	34.3
Y0185	0.4	0.4	12.5	12.8	7.5	7.4	5.2	4.6	29.1	33.7
Y0190	0.4	0.6	5.7	7.3	8.0	10.0	110.0	57.6	72.8	82.1
CBS1146(Type Strain)	0.3	0.3	9.6	10.1	7.4	10.0	57.0	49.8	38.1	36.1
HAR (Reference)	0.4	0.4	12.7	12.3	5.5	5.6	6.4	12.6	31.2	36.1
MEL (Reference)	0.4	0.4	12.5	12.8	5.1	5.2	9.6	7.6	36.7	43.4
VIN13(Reference)	0.3	0.3	12.8	13.2	5.7	6.7	2.8	2.0	37.1	36.5

CONCLUSION & FUTURE PROSPECTS

From the results obtained it is evident that there are a few *T. delbrueckii* yeast strains that show potential for wine production, either as single inoculants or in co-inoculated fermentations with a *S. cerevisiae* wine yeast at both 15º and 22ºC. The next phase of the project will be the evaluation of a selection of the *T. delbrueckii* yeasts during the production of cellar-scale wines.

REFERENCES

SAWLA (South African Wine Laboratories Association), 2002. Methods for analysis for wine laboratories. South African Society for Enology and Viticulture, PO Box 2092, Dennesig, 7601.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge:

- The financial support by the Agricultural Research Council (ARC) and CPUT, Bellville.
- ARC Infruitec-Nietvoorbij – The Microbiology Group for technical assistance.
- ARC Infruitec-Nietvoorbij Biometry unit for statistical analyses.