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## Salt concentration and salty taste perception in ‘Chardonnay’ and ‘Shiraz’ wines from own roots and different rootstocks under saline irrigation

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## Supplementary material

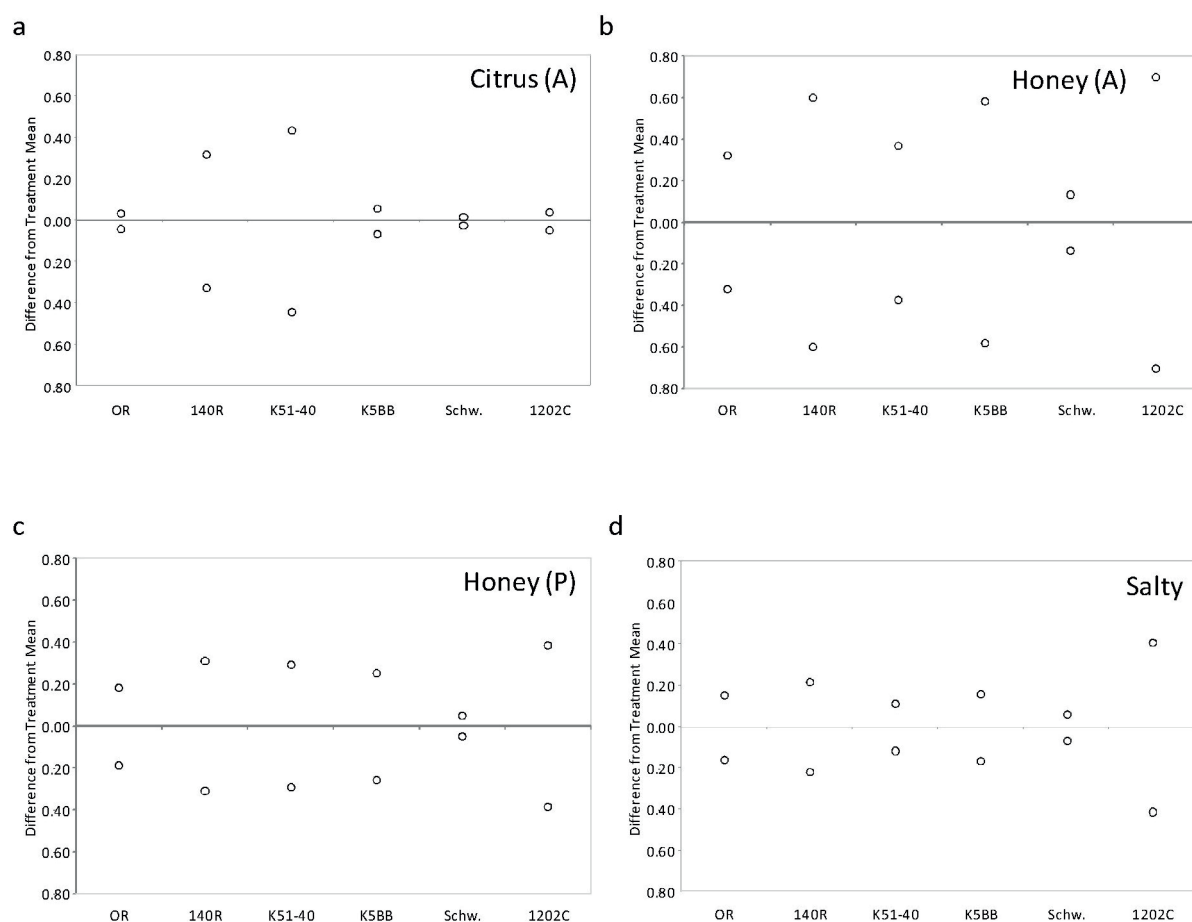


Fig. S1: The relative difference between winemaking replicates for ‘Chardonnay’ sensory attributes for each root system genotype. A = aroma; P = palate; OR = own roots; 140R = 140 Ruggeri; K5BB = Kober 5BB; Schw. = Schwarzmann. The horizontal line at 0.00 represents the mean for winemaking replicates for each root system genotype, with the open circles showing the deviation from the mean for each replicate.

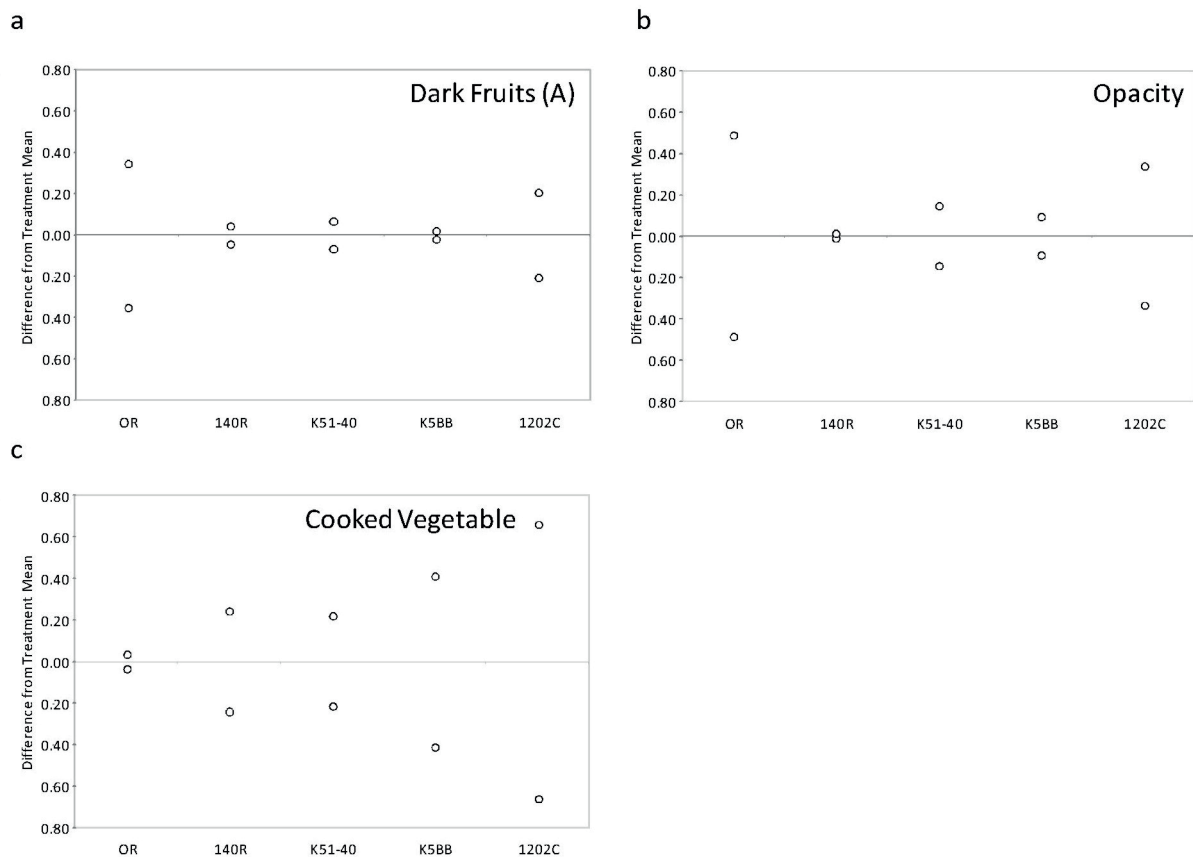


Fig. S2: The relative difference between winemaking replicates for ‘Shiraz’ sensory attributes for each root system genotype. A = aroma; OR = own roots; 140R = 140 Ruggeri; K5BB = Kober 5BB. The horizontal line at 0.00 represents the mean for winemaking replicates for each root system genotype, with the open circles showing the deviation from the mean for each replicate.

Table S1: Soil physical and physicochemical properties at four soil depths at the ‘Chardonnay’ and ‘Shiraz’ sites. Each value is a mean  $\pm$  standard error of measurements obtained for that depth from two soil cores within each site. Samples were taken at the respective depths in year 5 after planting.

Depth (cm)	% clay	% silt	% sand	CEC [cmol (+)/kg]	pH	EC (1:5) dS cm <sup>-1</sup>	SAR (1:5)
<b>Chardonnay</b>							
0-10	24.0 $\pm$ 3.0	11.0 $\pm$ 2.0	65.0 $\pm$ 1.0	99.54 $\pm$ 8.95	8.70 $\pm$ 0.10	0.25 $\pm$ 0.05	5.01 $\pm$ 0.58
10-30	43.5 $\pm$ 1.5	9.0 $\pm$ 0.0	47.5 $\pm$ 1.5	213.22 $\pm$ 20.92	8.65 $\pm$ 0.15	0.45 $\pm$ 0.06	5.09 $\pm$ 0.59
30-60	43.0 $\pm$ 2.0	11.0 $\pm$ 0.0	46.0 $\pm$ 2.0	213.09 $\pm$ 75.00	8.50 $\pm$ 0.40	0.46 $\pm$ 0.09	5.16 $\pm$ 0.59
60-90	51.0 $\pm$ 4.0	11.5 $\pm$ 1.5	37.5 $\pm$ 2.5	193.95 $\pm$ 40.20	8.75 $\pm$ 0.25	0.48 $\pm$ 0.19	5.23 $\pm$ 0.60
<b>Shiraz</b>							
0-10	22.5 $\pm$ 3.5	12.5 $\pm$ 1.5	65.0 $\pm$ 2.0	205.30 $\pm$ 66.35	8.45 $\pm$ 0.05	0.24 $\pm$ 0.05	6.64 $\pm$ 0.38
10-30	52.0 $\pm$ 1.0	7.0 $\pm$ 2.0	41.0 $\pm$ 1.0	176.65 $\pm$ 6.19	8.95 $\pm$ 0.05	0.30 $\pm$ 0.01	6.74 $\pm$ 0.39
30-60	44.0 $\pm$ 9.0	16.5 $\pm$ 4.5	39.5 $\pm$ 4.5	220.99 $\pm$ 114.61	8.75 $\pm$ 0.05	0.44 $\pm$ 0.01	6.83 $\pm$ 0.39
60-90	35.0 $\pm$ 18.0	10.5 $\pm$ 0.5	54.5 $\pm$ 18.5	223.46 $\pm$ 53.66	8.60 $\pm$ 0.10	0.46 $\pm$ 0.07	6.93 $\pm$ 0.40

CEC = cation exchange capacity; EC = electrical conductivity; SAR = sodium adsorption ratio. EC and SAR were determined from 1:5 soil:water extracts.

Table S2: Sensory attributes, definitions and reference standards for the 'Chardonnay' wines.

Attribute	Definition	Standard*
<b>Aroma</b>		
Overall Fruit	The overall intensity of fruit aromas	
Citrus	Aroma associated with fresh lemon and lime	1 × 2 cm piece of: Grapefruit, Lemon, Lime, Orange rind and Lemon rind
Stonefruit	Aroma associated with peaches, apricots, nectarines, plums	1 × 1.5 cm piece of: Apricot and Peach (Goulburn Valley Fruit)
Honey	Aroma of honey	1 tsp Honey (Beechworth)
Yeasty	Aroma associated with yeast, bread, sourdough	1 tsp Yeast (Lallemand DV 10, dried)
Musty/Mouldy	Aroma associated with earthy, damp, wet basements, attics, the smell of mould.	20 µL of a 1.0 mg L <sup>-1</sup> 2,4, 6-Tetrachloroanisole solution in ethanol
Other	Any other significant aromas	
<b>Palate</b>		
Overall Fruit Flavour	Intensity of fruit flavours	
Salty	Taste of salt	5 g L <sup>-1</sup> table salt
Honey	The flavour of honey	
Sweet	The taste of sugar, sucrose.	16 g L <sup>-1</sup> sucrose
Viscosity	The perception of the body, weight or thickness of the wine in the mouth. Low = watery, thin mouth feel. High = oily, thick mouth feel.	
Acidity	The intensity of acid or sour taste perceived in the mouth or after expectorating.	1 g L <sup>-1</sup> tartaric acid
Hotness	The intensity of hotness perceived in the mouth. Low = warm; High = hot, including Hot aftertaste	
Bitter	The intensity of bitter taste perceived in the mouth or after expectorating.	15 mg L <sup>-1</sup> quinine sulfate
Burning AT	Burning in the mouth and on the lips after expectorating, including tingling	
Other	Any other significant flavours	

\* All aroma standards were added to 30 mL of white wine (DeBortoli Verdelho Premium Reserve Cask White, 2L cask) unless otherwise noted. All palate standards were dissolved in reverse osmosis (RO) water.

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| Table S3: Sensory attributes, definitions and reference standards for the ‘Shiraz’ wines.

Attribute	Definition	Standard*
<b>Appearance</b>		
Opacity	Colour intensity, the degree to which light is not allowed to pass through a wine.	
<b>Aroma</b>		
Overall Fruit	Intensity of the fruit aromas	
Red fruits	Aroma of red fruits: raspberries, strawberries, cherries.	1 × fresh raspberry, crushed, + 1 frozen strawberry
Dark fruits	Aroma of dark fruits: blackberries, plums.	10 mL blackcurrant syrup (Ribena), 1 frozen blackberry
Pepper	Aroma of black pepper, cracked pepper.	10 peppercorns
Vanilla	Aroma of vanilla.	¼ tsp vanilla paste
Cooked Vegetable	Aroma of various cooked vegetables, water vegetables have been cooked in.	1 tsp each canned corn and canned green beans juice
Stalky	Aroma of plant stalks, leaves, various fresh herbs.	2 × tomato leaf + two 2 cm pieces of tomato stalk, no base wine
Other	The intensity of any other aromas.	
<b>Palate</b>		
Overall Fruit	Overall intensity of fruit flavour	
Red fruits	Flavour of red fruits: raspberries, strawberries, cherries.	
Dark fruits	Flavour of dark fruits: blackberries, plums.	
Stalky	Flavour of plant stalks, herbal and green flavours.	
Sweet	The intensity of sucrose taste perceived in the mouth or after expectorating.	16 g L <sup>-1</sup> sucrose
Salty	The intensity of salty taste perceived in the mouth or after expectorating.	5 g L <sup>-1</sup> table salt
Acidity	The intensity of acid taste perceived in the mouth or after expectorating.	1 g L <sup>-1</sup> tartaric acid
Viscosity	The perception of the body, weight or thickness of the wine in the mouth. Low = watery, thin mouth feel. High = oily, thick mouth feel.	2 g L <sup>-1</sup> pectin
Hotness	The intensity of heat perceived in the mouth and after expectorating; low = warm, high = hot.	
Astringency	The drying and mouth-puckering sensation in the mouth and after expectorating. Low = coating teeth; Medium = mouth coating & drying; High = puckering, lasting astringency.	
Bitter	The intensity of bitter taste perceived in the mouth or after expectorating.	15 mg L <sup>-1</sup> quinine sulfate
Other	The intensity of any other flavours or mouthfeel characters.	

\* All aroma standards were added to 30 mL of 2010 Lindemans Bin 60 Shiraz unless otherwise noted. All palate standards were added to 2009 Rosemount Diamond Label Shiraz.

Table S4: Berry weight, yield and juice total soluble solids, pH, titratable acidity, Cl<sup>-</sup> and Na<sup>+</sup> concentration at harvest for 'Chardonnay' on own roots and on five different rootstocks at Padthaway, South Australia in season 2011.

Rootstock	Berry wt. (g)	Yield (kg/vine)	Juice				
			TSS (°Brix)	pH	TA (g L <sup>-1</sup> )	Cl <sup>-</sup> (mg L <sup>-1</sup> )	Na <sup>+</sup> (mg L <sup>-1</sup> )
Own roots	1.28 <sup>b</sup>	10.9 <sup>ab</sup>	21.2	3.39	7.81	51.5 <sup>c</sup>	26.3 <sup>b</sup>
140 Ruggeri	1.35 <sup>a</sup>	10.5 <sup>ab</sup>	21.4	3.35	7.59	29.6 <sup>c</sup>	37.3 <sup>b</sup>
K51-40	1.37 <sup>a</sup>	2.8 <sup>c</sup>	21.7	3.39	7.63	272.4 <sup>a</sup>	197.4 <sup>a</sup>
Kober 5BB	1.34 <sup>a</sup>	8.7 <sup>b</sup>	21.6	3.35	8.03	100.0 <sup>b</sup>	109.7 <sup>a</sup>
Schwarzmann	1.33 <sup>ab</sup>	12.7 <sup>a</sup>	21.5	3.41	7.34	42.2 <sup>c</sup>	66.5 <sup>b</sup>
1202C	1.29 <sup>b</sup>	11.7 <sup>ab</sup>	21.2	3.33	7.25	59.8 <sup>bc</sup>	54.5 <sup>b</sup>
LSD <sub>R</sub>	0.05	3.2	n.s.	n.s.	n.s.	40.7	98.5
Significance	*	***				*	*

\* $P \leq 0.05$ ; \*\*\* $P \leq 0.001$ ; different letters in the superscripts indicate significant differences between means; LSD = least significant difference ( $P = 0.05$ ); n.s. = not significant; R = rootstock; TA = titratable acidity; TSS = total soluble solids.

Table S5: Berry weight, yield and juice total soluble solids, pH, titratable acidity, Cl<sup>-</sup> and Na<sup>+</sup> concentration at harvest for 'Shiraz' on own roots and on four different rootstocks at Padthaway, South Australia in season 2011.

Rootstock	Berry wt. (g)	Yield (kg/vine)	Juice				
			TSS (°Brix)	pH	TA (g L <sup>-1</sup> )	Cl <sup>-</sup> (mg L <sup>-1</sup> )	Na <sup>+</sup> (mg L <sup>-1</sup> )
Own roots	1.55	3.6	22.3 <sup>a</sup>	3.49 <sup>c</sup>	6.31 <sup>cd</sup>	47.7 <sup>c</sup>	56.8 <sup>ab</sup>
140 Ruggeri	1.44	4.8	22.1 <sup>a</sup>	3.57 <sup>a</sup>	6.09 <sup>d</sup>	30.4 <sup>c</sup>	33.0 <sup>bc</sup>
K51-40	1.44	3.2	22.1 <sup>a</sup>	3.52 <sup>bc</sup>	6.74 <sup>ab</sup>	111.5 <sup>a</sup>	84.5 <sup>a</sup>
Kober 5BB	1.62	3.9	21.2 <sup>b</sup>	3.53 <sup>b</sup>	6.48 <sup>bc</sup>	30.9 <sup>c</sup>	17.2 <sup>c</sup>
1202C	1.66	4.5	22.6 <sup>a</sup>	3.50 <sup>bc</sup>	6.93 <sup>a</sup>	71.2 <sup>b</sup>	42.2 <sup>bc</sup>
LSD <sub>R</sub>			0.67	0.04	0.36	24.6	35.8
Significance	n.s.	n.s.	*	*	*	**	*

\* $P \leq 0.05$ ; \*\* $P \leq 0.01$ ; different letters in the superscripts indicate significant differences between means; LSD = least significant difference ( $P = 0.05$ ); n.s. = not significant; R = rootstock; TA = titratable acidity; TSS = total soluble solids.

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Table S6: Significant correlation between key traits for ‘Shiraz’. Traits include grape juice total soluble solids, titratable acidity and pH at harvest and Shiraz wine pH, titratable acidity, Ca<sup>2+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>, Na<sup>+</sup>, phosphorus, sulfur and Cl<sup>-</sup> concentrations, colour hue, ionized anthocyanin concentration, total anthocyanin concentration, total phenolics and colour density.

Trait	HTSS	HTA	HpH	WpH	WTA	WCa <sup>2+</sup>	WK <sup>+</sup>	WMg <sup>2+</sup>	WNa <sup>+</sup>	WP	WS	WCl <sup>-</sup>	WCH	WIAn	WTAn	WTPh
WpH			<b>0.81</b>													
WTA			<b>-0.61</b>													
WCa <sup>2+</sup>				<b>-0.68</b>												
WK <sup>+</sup>	<b>0.59</b>				<b>0.59</b>											
WMg <sup>2+</sup>									<b>0.77</b>							
WNa <sup>+</sup>																
WP	<b>0.87</b>				<b>0.77</b>		<b>0.72</b>									
WS				<b>-0.74</b>		<b>0.73</b>										
WCl <sup>-</sup>			<b>-0.66</b>				<b>0.59</b>	<b>0.58</b>	<b>0.87</b>							
WCH		<b>0.69</b>					<b>-0.87</b>		<b>-0.62</b>			<b>-0.60</b>				
WIAn		<b>-0.84</b>					<b>0.71</b>						<b>-0.90</b>			
WTAn	<b>0.59</b>						<b>0.88</b>			<b>0.63</b>			<b>-0.92</b>	<b>0.81</b>		
WTPh		<b>-0.69</b>					<b>0.82</b>			<b>0.58</b>			<b>-0.92</b>	<b>0.92</b>	<b>0.94</b>	
WCD		<b>-0.87</b>					<b>0.59</b>						<b>-0.82</b>	<b>0.97</b>	<b>0.72</b>	<b>0.90</b>

CD = colour density; CH = colour hue; H = harvest; TA = titratable acidity; Ian = ionized anthocyanin concentration; P = phosphorus; S = sulfur; Tan = total anthocyanin concentration; TPh = total phenolics; TSS = total soluble solids; W = wine; values 0.58 to 0.70,  $P \leq 0.05$ ; values 0.71 to 0.81,  $P \leq 0.01$ ; values 0.82 to 0.97,  $P \leq 0.001$ .  $n = 10$ .