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The impact of vine microclimate on the evolution of carotenoids in cv. Nebbiolo.

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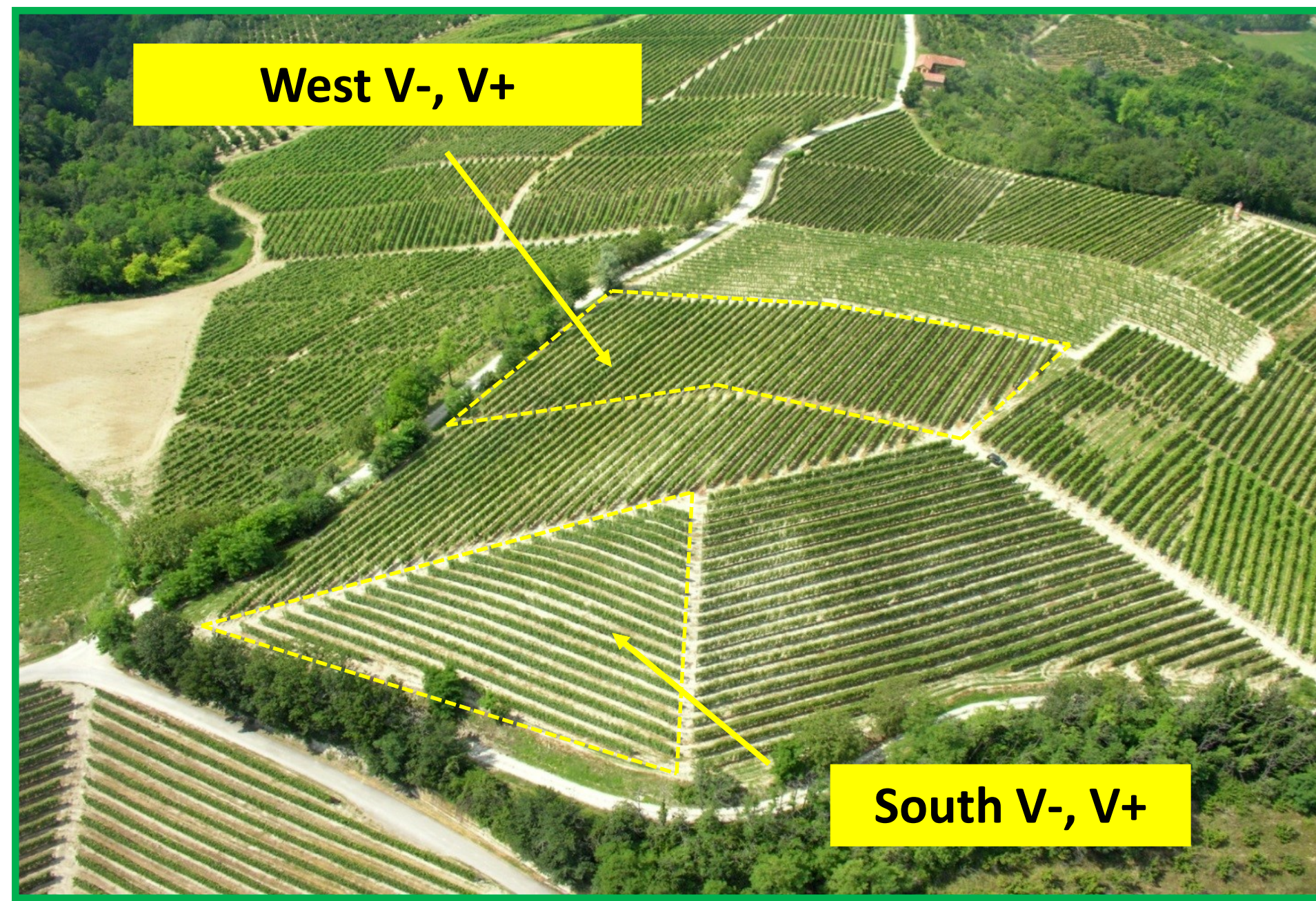
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Grape carotenoids are precursors of low threshold aroma compounds in wine such as the C₁₃-norisoprenoids and their evolution during ripening may be considered an indicator of grapes aromatic potential (Winterhalter & Ebeler, 2013). Environmental conditions, such as climate, light exposure of bunches and soil water deficit may influence the carotenoid content in grape berries, although their concentration has also been shown to differ between cultivars (Oliveira et al., 2014).

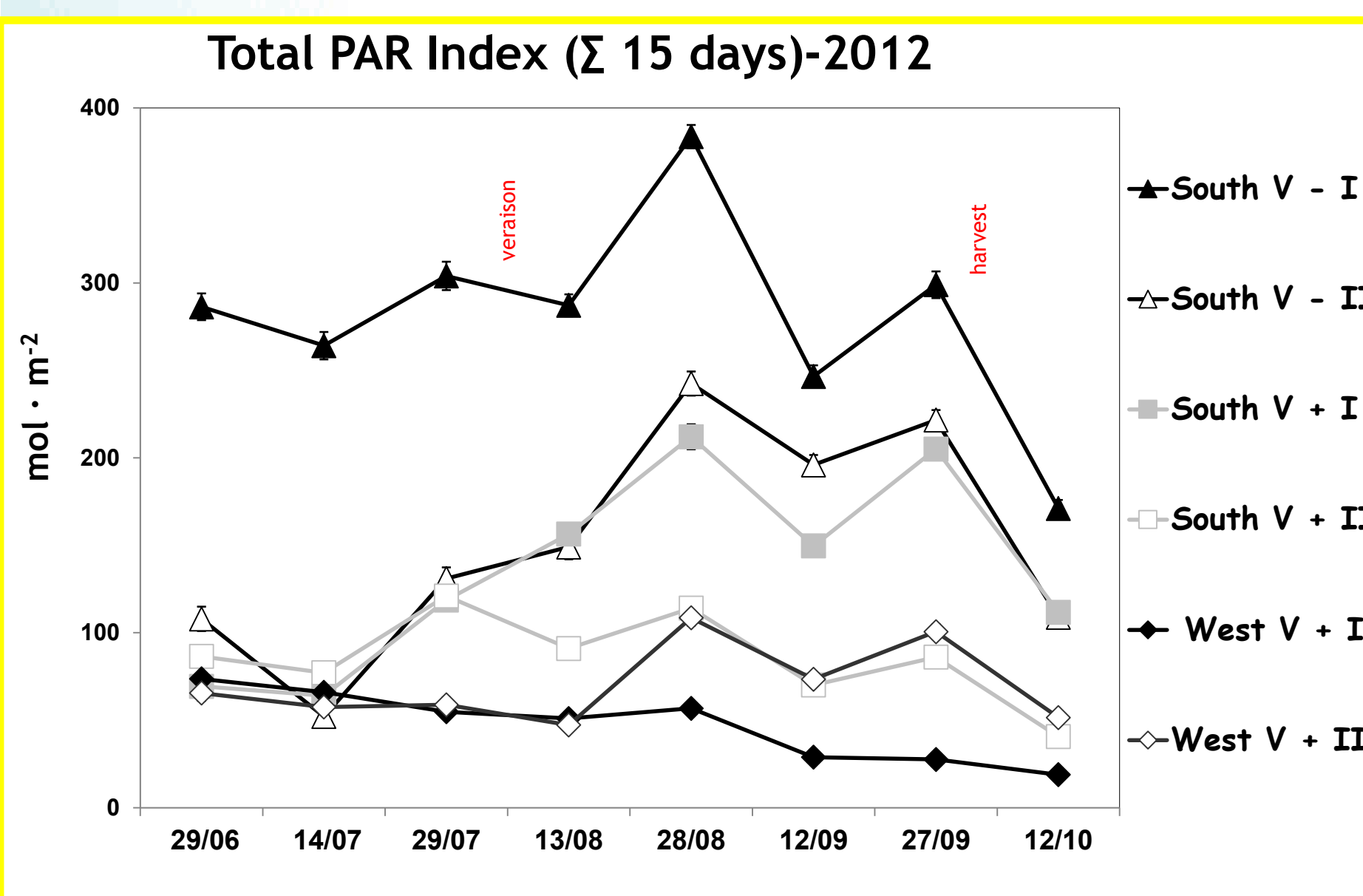


The influence exerted by bunch microclimate on the rate of synthesis/degradation of some relevant carotenoids, was investigated for the first time in Nebbiolo grapes, an Italian variety of high interest for local and international wine market.



The data were collected, during two consecutive seasons, in two nearby Nebbiolo planted vineyards (North-West Italy), characterized by high vigour heterogeneity and by a different aspect (South or West). Each vineyard parcel was sorted in 2 vine vigour classes (V- the less vigorous parcel and V+ the more vigorous) (Asproudi et al., 2016). Berry samplings were collected from 15 days after flowering until harvest. Photosynthetically Active Radiation (PAR) and air temperature (T, °C) inside the bunch zone were measured in continuous from pea size stage to harvest time.

Microclimate characterization



In both seasons, the TPARI value was the highest in the South V- and higher in the South, rather than the West vineyards. In addition, in 2012, the index was higher than in 2013, especially for the South blocks (not reported).

Temperature Index (TI) depends on both the value and the duration of the temperature level. TI values above the threshold of 35 °C, were registered mainly during the post veraison period for all treatments and the most notable differences between the West parcels (milder microclimate) and the South ones (warmer microclimate) were observed in 2013 season.

Class of T	Aspect	Class of vigour	TI [number of hours]									
			2012					2013				
			periods				total	average	periods			total
30/06	30/07	29/08	28/10	30/06	30/07	29/08			28/10			
T < 25 °C	South	V -	417	373	907	1697	1713	421	438	832	1691	1727
		V+	428	382	919	1729	1713	439	445	879	1763	1727
	West	V -	436	404	965	1805	1806	440	466	913	1819	1826
		V+	437	403	966	1806	1806	442	468	922	1832	1826
25 °C ≤ T < 35 °C	South	V -	269	215	147	631	618	246	128	157	531	565
		V+	243	210	152	605	618	267	176	156	599	565
	West	V -	222	218	108	548	582	272	233	161	666	645
		V+	267	238	110	615	582	267	218	138	623	645
T ≥ 35 °C	South	V -	34	132	26	192	189	53	154	91	298	228
		V+	49	128	9	186	189	14	99	45	158	228
	West	V -	62	98	7	167	133	8	21	6	35	50
		V+	16	79	4	99	133	11	34	20	65	50

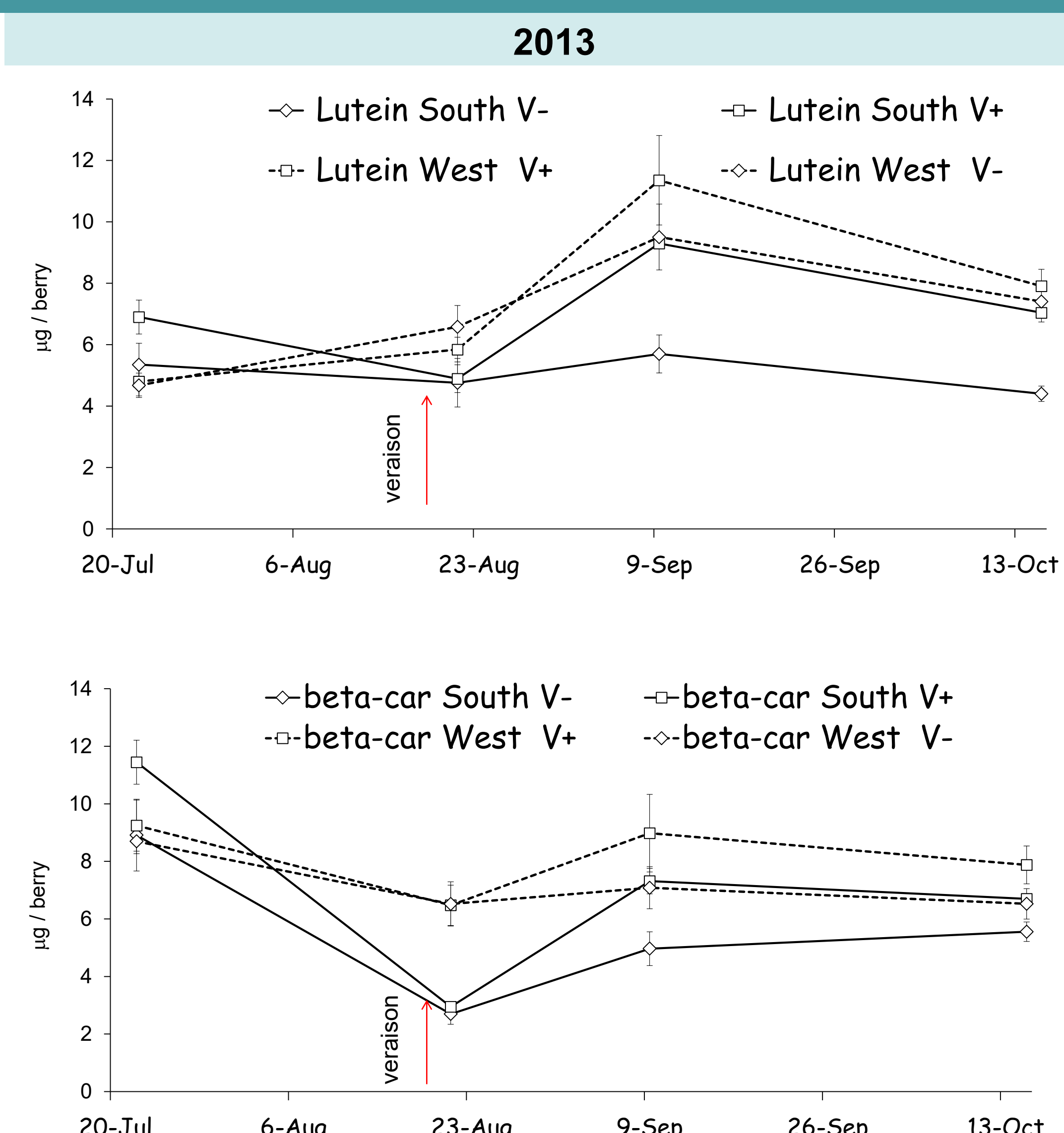
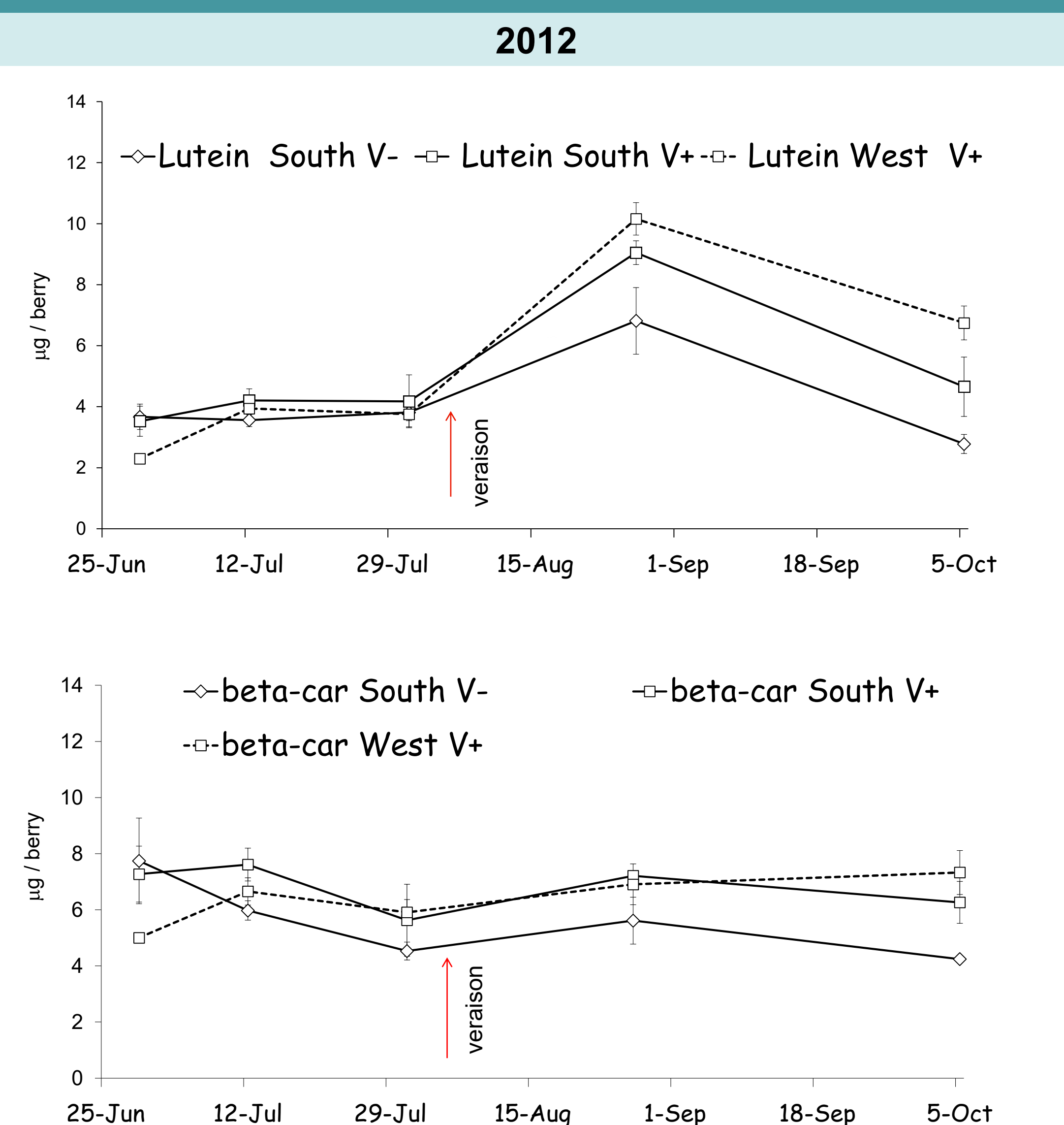
The South plot has always registered higher PAR and temperature values compared to the West exposure in both 2012 and 2013 vintage years, particularly in the post veraison period.

Carotenoid extraction and determination

A liquid-liquid extraction was carried out under both, low temperature and dim yellow light, to minimize degradation, light-induced isomerization and oxidation of carotenoids. A subsequent H.P.L.C. determination was carried out.



RESULTS



• A lutein content peak proportional to the vine vigour was noticed in the post-veraison period;

• A major photodegradation than synthesis of lutein probably occurred in the less vigorous and warmer parcel (South V-);

• Final lutein contents were proportional to the vine vigour: grapes less protected from direct radiation had the lowest lutein content.

• A constant and similar trend was highlighted for β-carotene, in all vigour conditions during 2012;

• A near veraison significant decline of β-carotene in the warmer South parcels was registered in 2013, season when the TI differences (>35°C) between the two aspects were more notable.

Conclusions: High carotenoid contents were found in Nebbiolo berries; the most abundant compounds were lutein and β-carotene. Synthesis and degradation of these carotenoids, were influenced by vine microclimate variability as a consequence of both vigour and aspect. Moreover, a variety effect can be presumed as regards the evolution trend of lutein since the post veraison peak noticed for Nebbiolo grapes was noticed only for few other cultivars in literature, such as Touriga Franca and Merlot (Oliveira et al., 2014; Kamffer et al., 2010).

REFERENCES

Winterhalter, P. & Ebeler, S. In *Carotenoid Cleavage Products* 2013, 1134, 3-9 (ACS); Oliveira, C. et al. *Journal of Agricultural and Food Chemistry* 2004, 52 (13), 4178-4184; Asproudi et al., *Food Chemistry* 2016, 211, 947-956; Kamffer, Z. et al. *Journal of Agricultural and Food Chemistry* 2010, 58 (11), 6578-6586.