



Life+ Environment Policy and Governance  
**LIFE CarbOnFarm**  
progetto: LIFE12 ENV/IT/000719

## B.3 Set-up of project sites

Sito Azienda Università di Napoli Castel Volturno

Compost 10 ton/ha CMP-A      20 ton/ha CMP-B  
CO 27% Ntot 2.10 % P 7.70‰

Concimazione TRAD: N 150 kg/ha (urea); P<sub>2</sub>O<sub>5</sub> 122 kg/ha

Ferro Porfirina Fe-P 0.5 g/m<sup>2</sup> + TRAD

Mais      varietà INDACO Classe 600

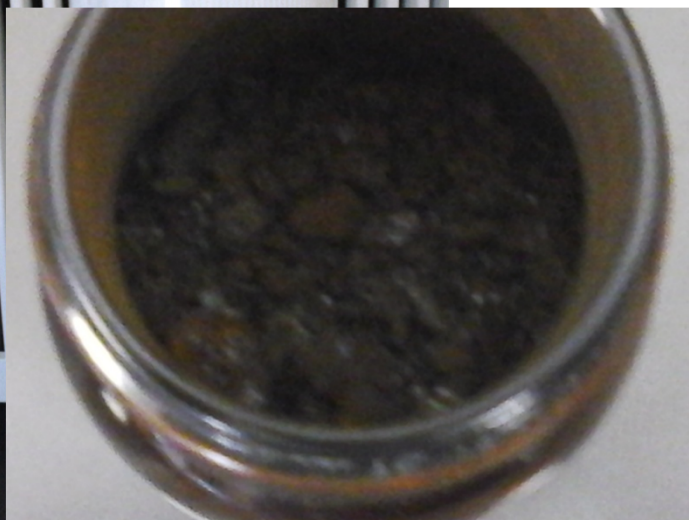
Semina Mais Giugno 2015

Campionamento analisi produttività (C3) 15 Ottobre 2015

Deliverable: Report on C.3 action: second year 1/02/2016

## B.3 Set-up of project sites Azienda Univ. di Napoli Castel Volturno







Campionamento suolo  
rizosferico PLFA luglio 2015





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**LIFE CarbOnFarm**  
progetto: LIFE12 ENV/IT/000719

## C.2 Analisi SOM

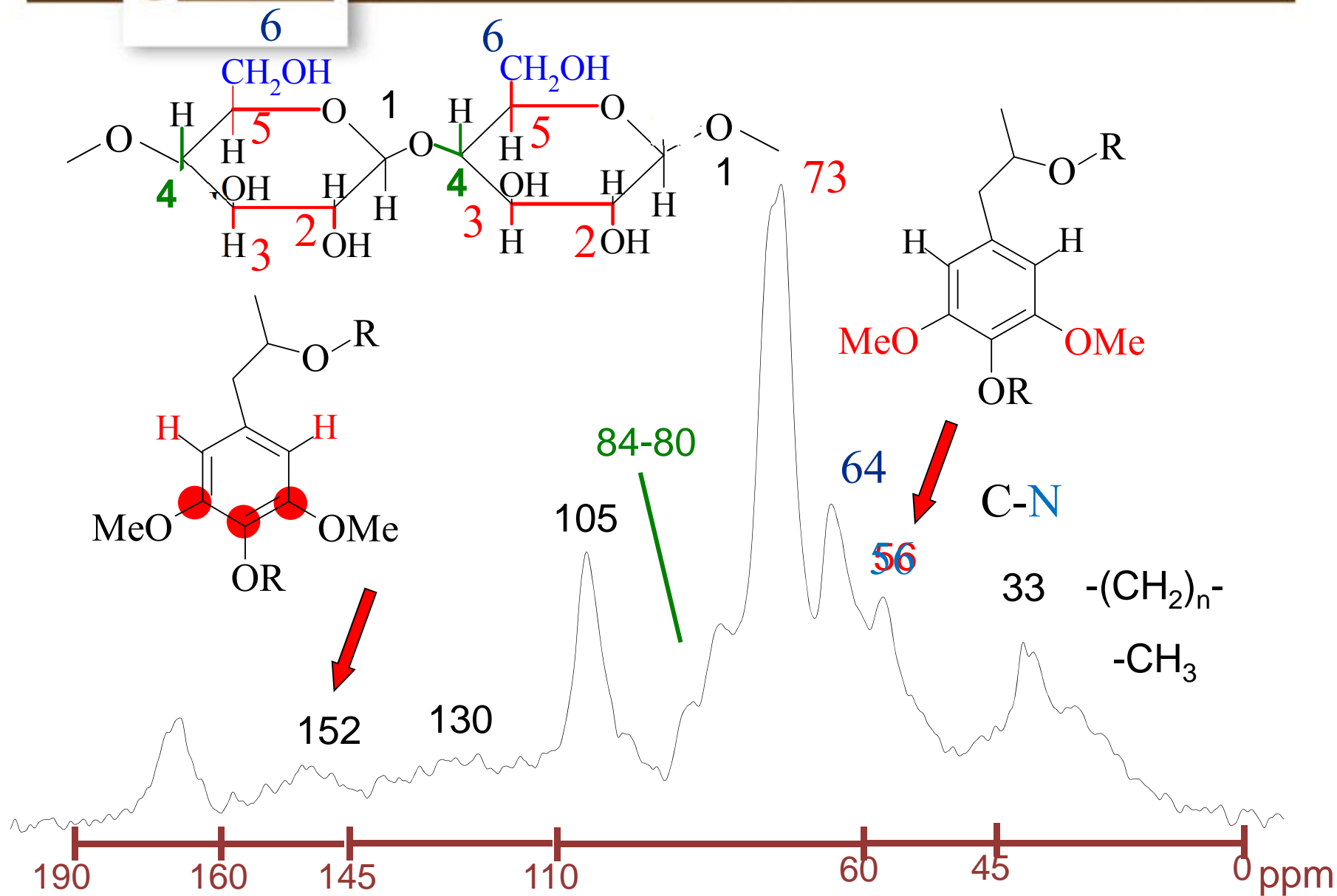
Analisi; stabilità degli aggregati, TOC & tot N (bulk soil e aggregati), PLFA, 13C-OC, termochemolisi-GC-MS

Deliverable: Report for C.2 action: initial condition , Report for C.2 action: first year 30/01/2015 Annesso con il Progress report

➤ **Analisi parziali o mancanti: SOC , PLFA e termochemolisi, 13C-OC, fine primo ciclo culturale Tetto Frati, Grandi, Castel Volturno**

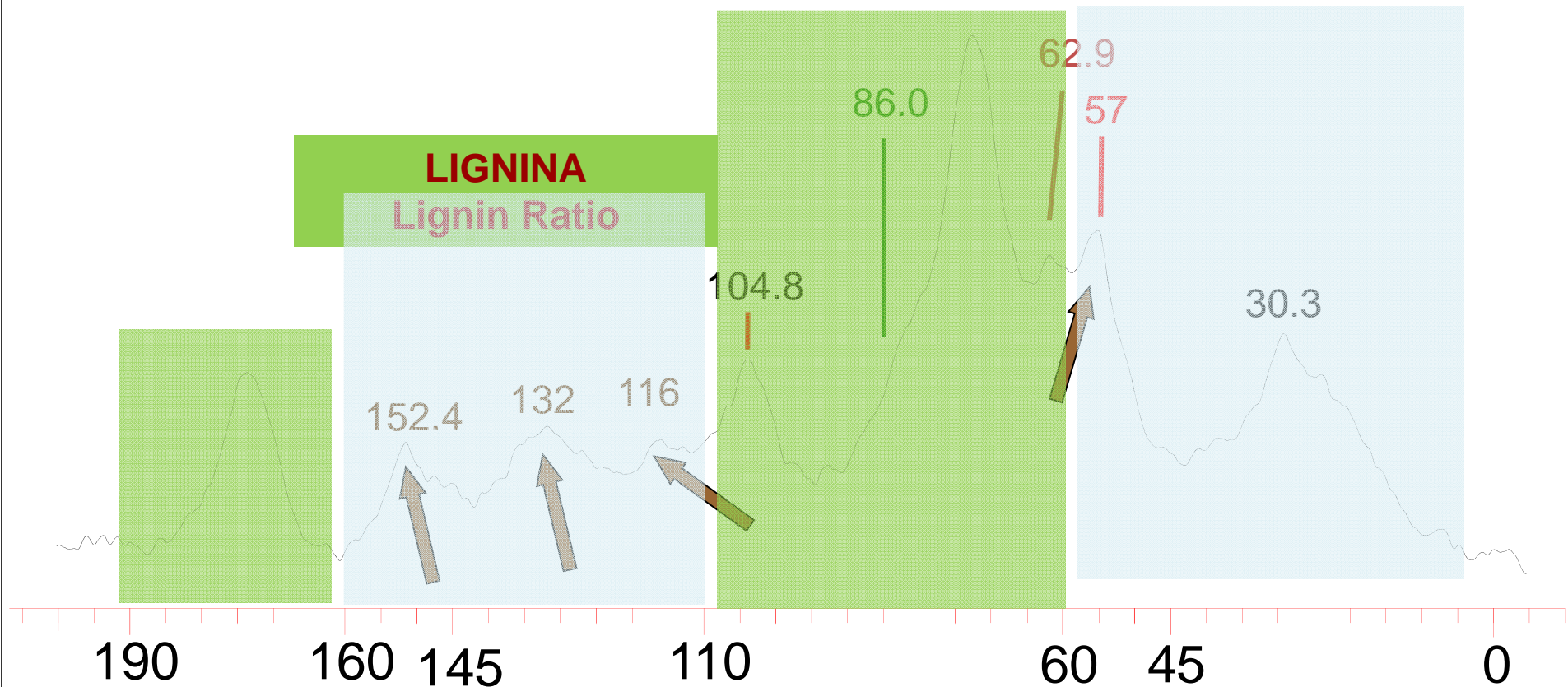
Deliverable: Report for C.2 action: II year 1/02/2015

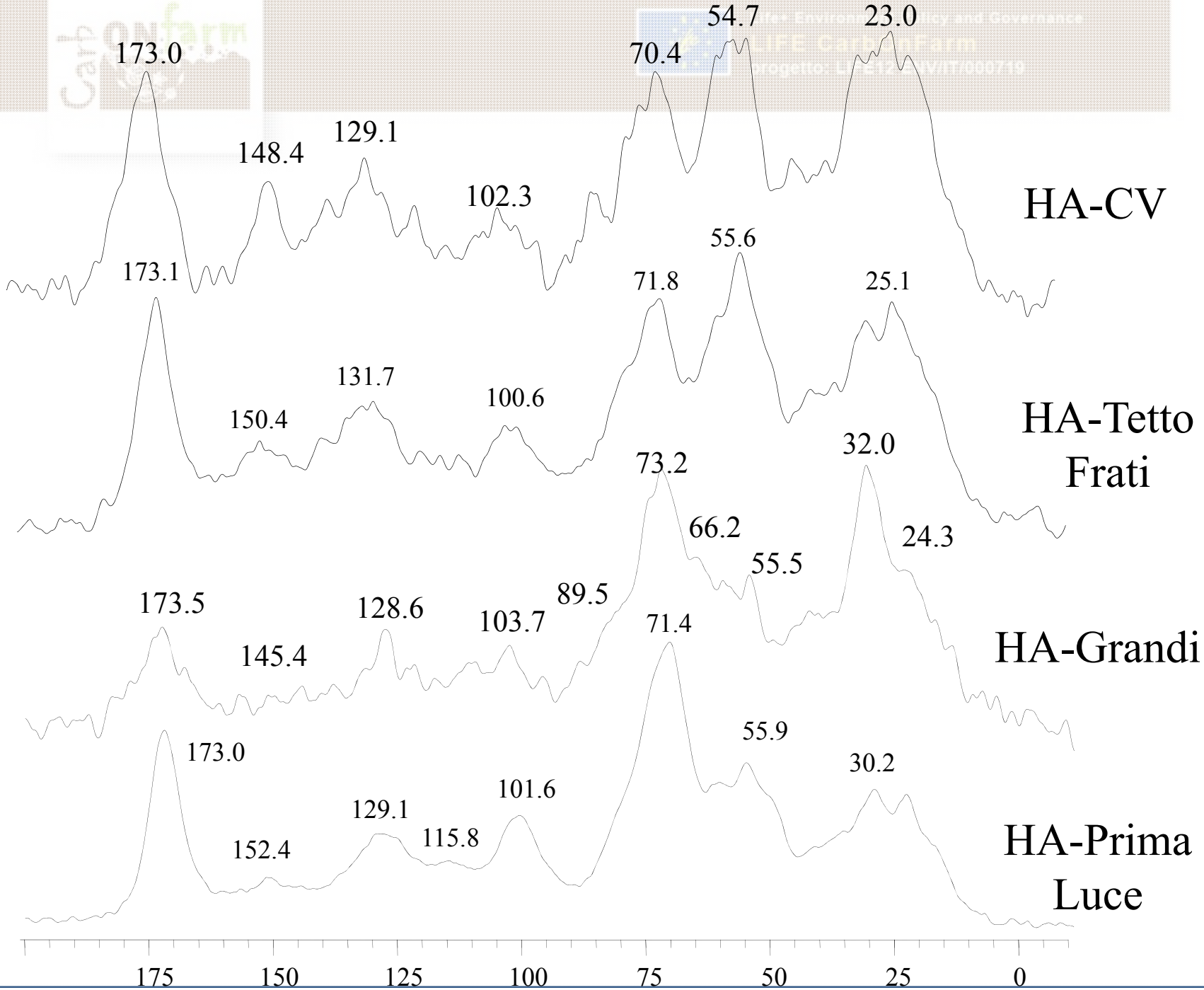
- ✓ Analisi in corso: Prima Luce (fine I ciclo culturale) aggregati, SOC, termochemolisi , analisi microbiologiche e attività enzimatiche del suolo
- ✓ Tetto Frati, Grandi, Castel Volturno, (fine II ciclo culturale) aggregati, SOC, PLFA, termochemolisi



Indice di IDROFOBICITA'

Direttamente correlato alla stabilità biochimica della sostanza organica







Distribuzione (%) dei segnali nelle regioni di chemical shift (ppm) degli spettri  $^{13}\text{C}$ -CPMAS-NMR

COOH  
O-Aromatic-C  
Aromatic-C  
O-alkyl-C  
CH<sub>3</sub>O/C-N  
Alkyl-C

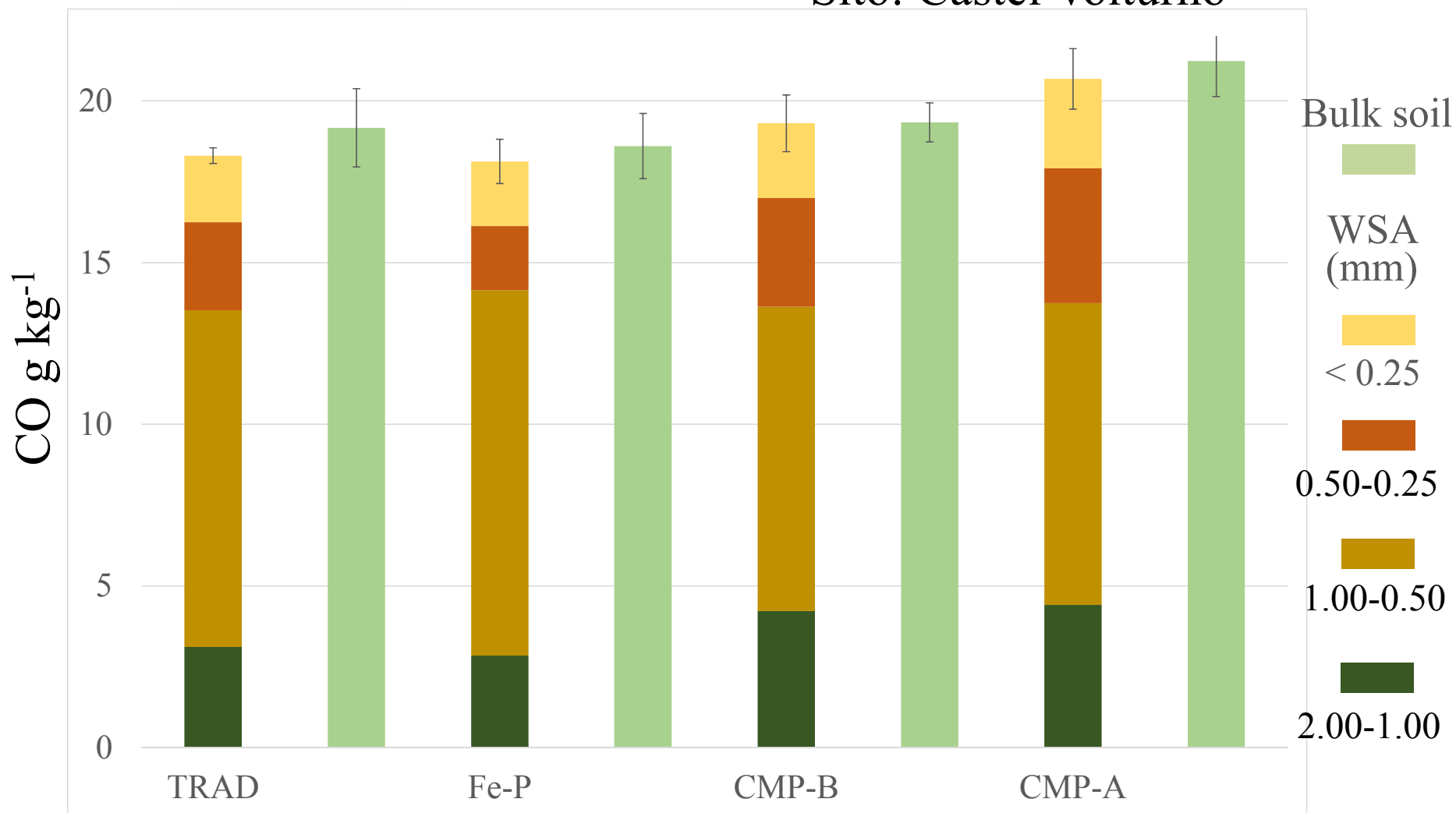
	190-160	160-145	145-110	110-60	60-45	45-0	LR	HB
CV	12.4	4.6	13.2	23.3	18.0	28.5	3.9	1.24
TF	10.9	4.4	13.3	29.3	15.8	26.3	3.6	1.08
Gr	6.9	2.2	10.7	37.3	11.3	31.5	5.1	1.00
PL	11.3	2.8	12.7	42.1	12.5	18.7	4.5	0.68

HB= Indice di IDROFOBICITA correlato alla stabilità biochimica della SOM

LR= Lignin Ratio correlato alla effettiva presenza di lignina

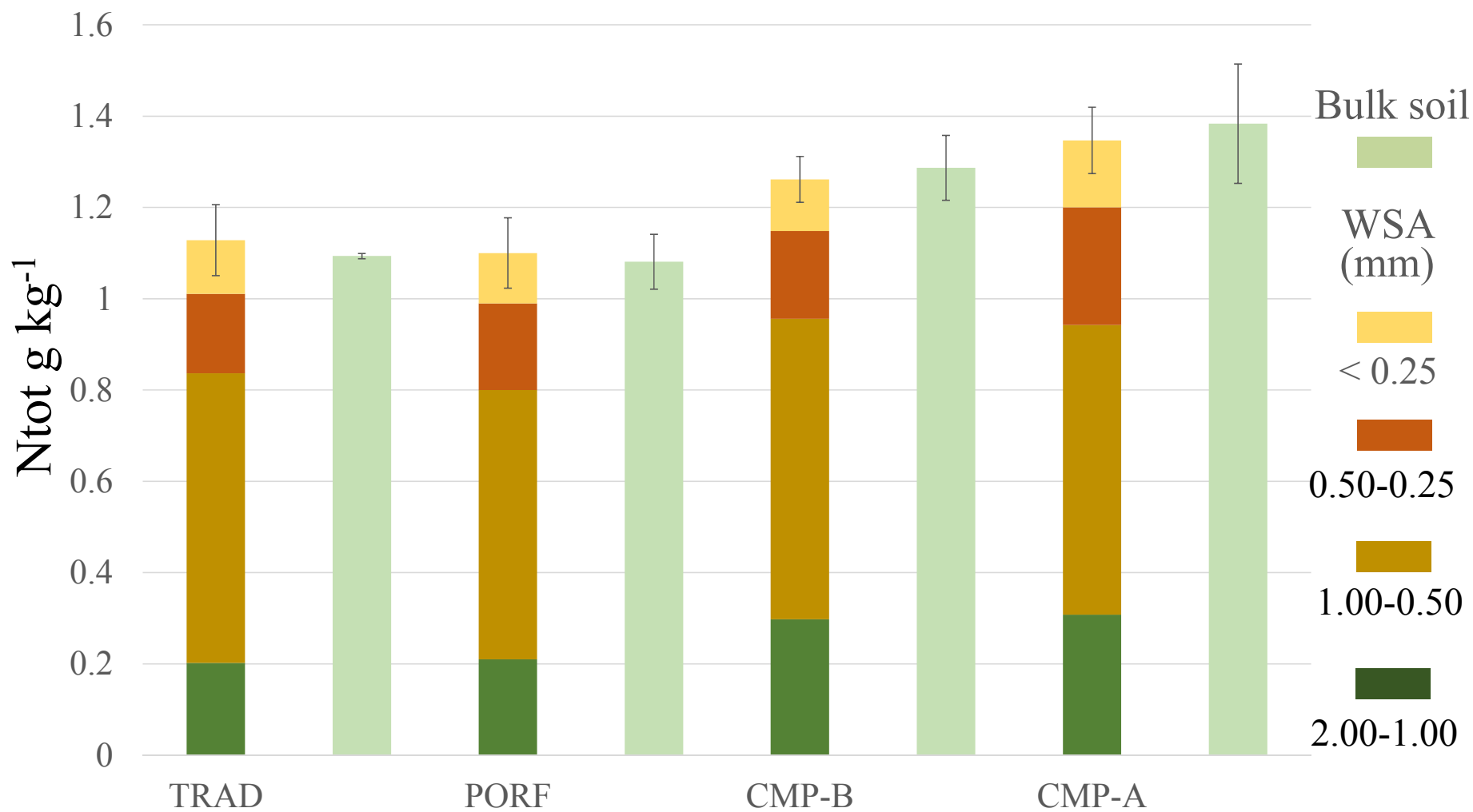
## C.2 analisi SOM

Sito: Castel Volturno



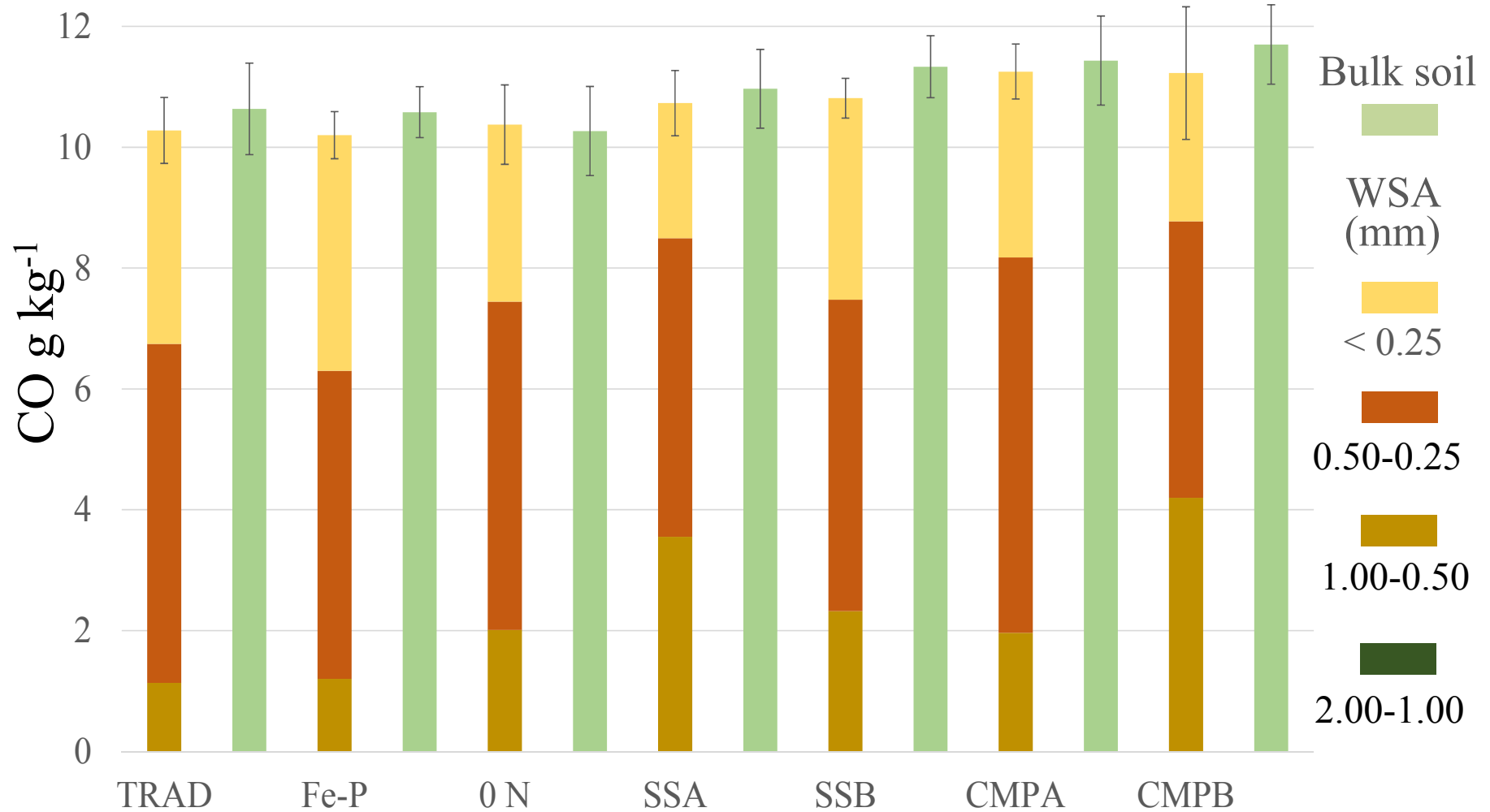
C.2 analisi SOM

Sito: Castel Volturno



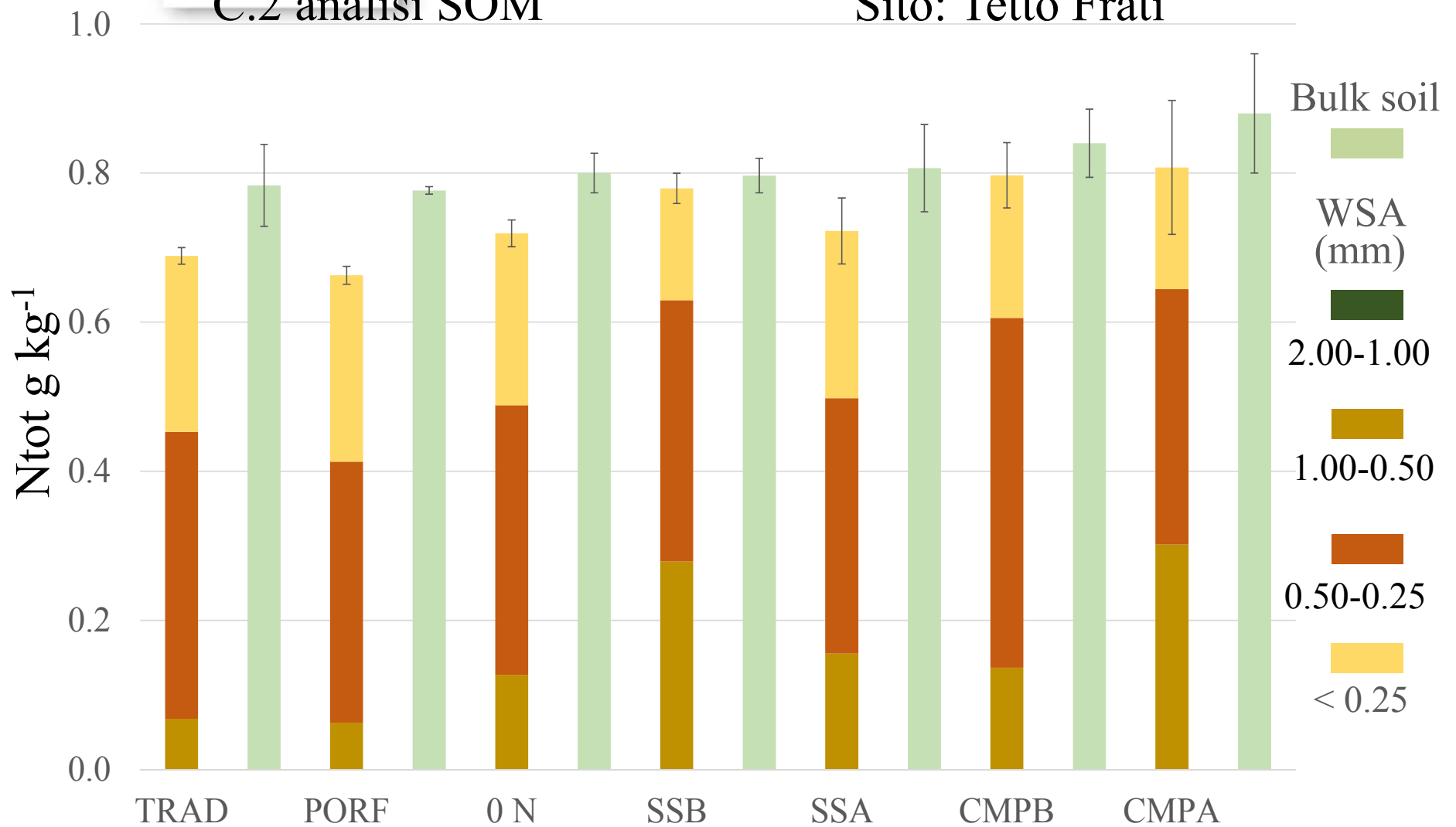
## C.2 analisi SOM

## Sito: Tetto frati



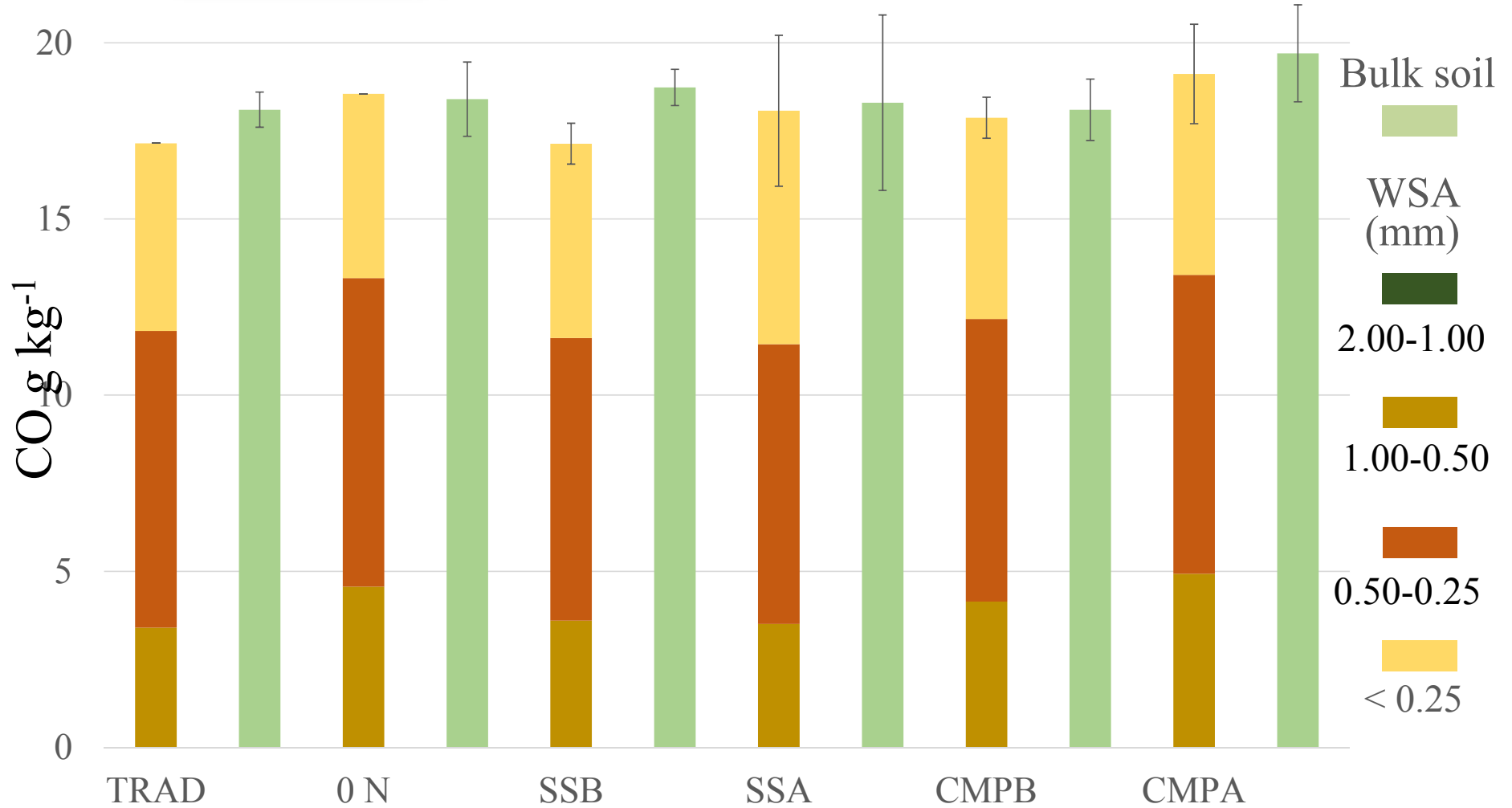
## C.2 analisi SOM

## Sito: Tetto Frati



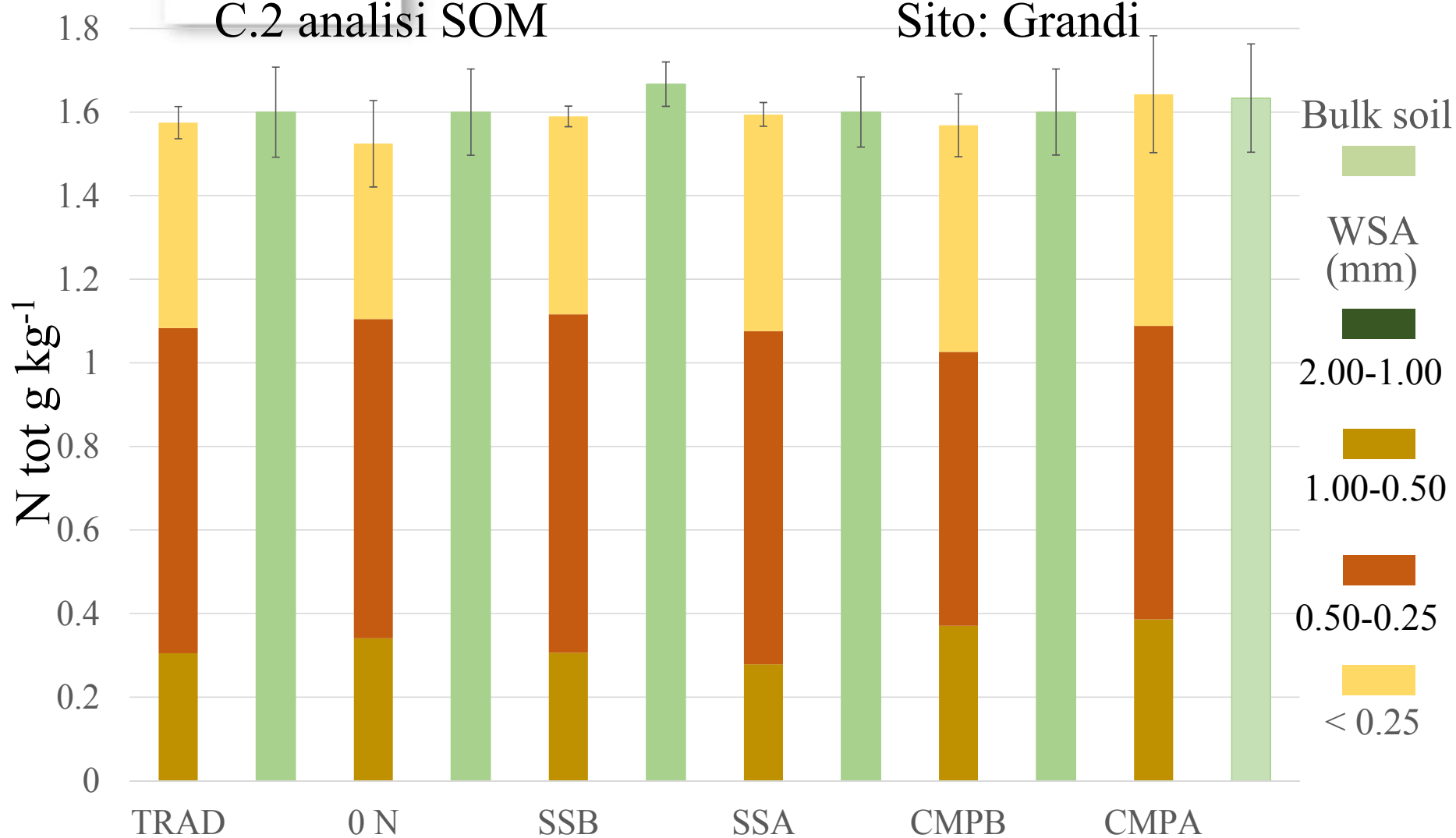
## C.2 analisi SOM

## Sito: Grandi



C.2 analisi SOM

Sito: Grandi





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## C.2 analisi SOM $^{13}\text{C}$ -OC

L'analisi del contenuto di isotopo  $^{13}\text{C}$  rappresenta un mezzo per lo studio della dinamica e decomposizione/accumulo della SOM

Il contenuto di  $^{13}\text{C}$  nella sostanza organica dei vegetali è determinato dal processo fotosintetico: i sistemi enzimatici coinvolti nella fissazione del C nella fotosintesi discriminano il  $^{13}\text{C}$  contenuto nella  $\text{CO}_2$  a favore dell'isotopo più abbondante  $^{12}\text{C}$

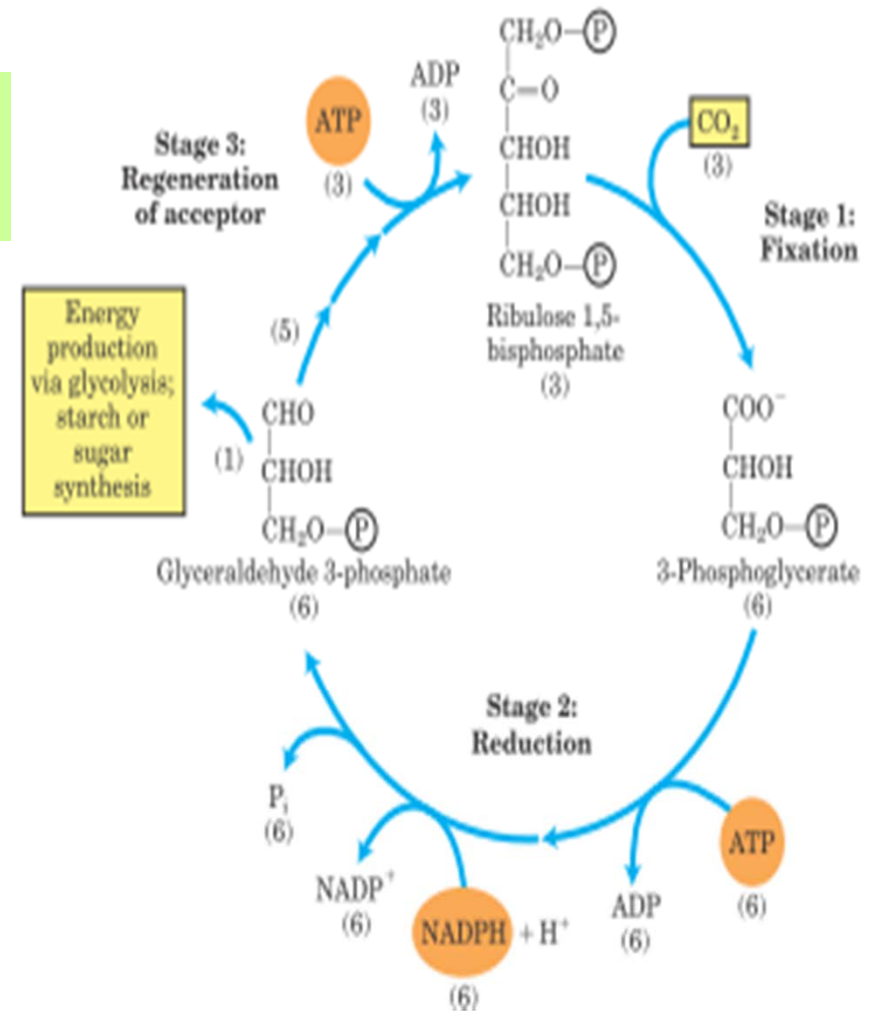
Questo processo porta ad una riduzione del contenuto di  $^{13}\text{C}$  nei tessuti vegetali il quantitativo di  $^{13}\text{C}$  viene indicato con il simbolo  $\delta$  e viene determinato tramite spettroscopia di massa ad analisi isotopica (IR-MS) confrontando il rapporto  $^{13}\text{C}/^{12}\text{C}$  della sostanza con quello di uno standard di riferimento

$$\delta = \left[ \frac{(^{13}\text{C}/^{12}\text{C})_{\text{sample}} - (^{13}\text{C}/^{12}\text{C})_{\text{reference}}}{(^{13}\text{C}/^{12}\text{C})_{\text{reference}}} \right] \times 1000$$

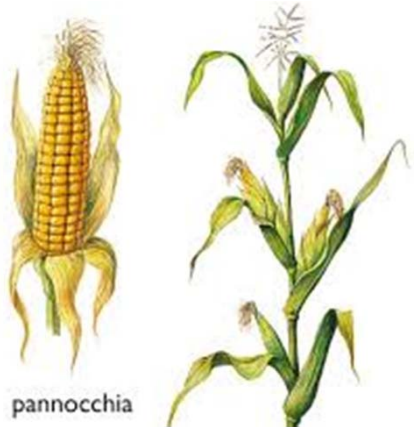


Il contenuto medio di  $^{13}\text{C}$  nelle diverse specie di piante differisce in base al tipo di ciclo fotosintetico:

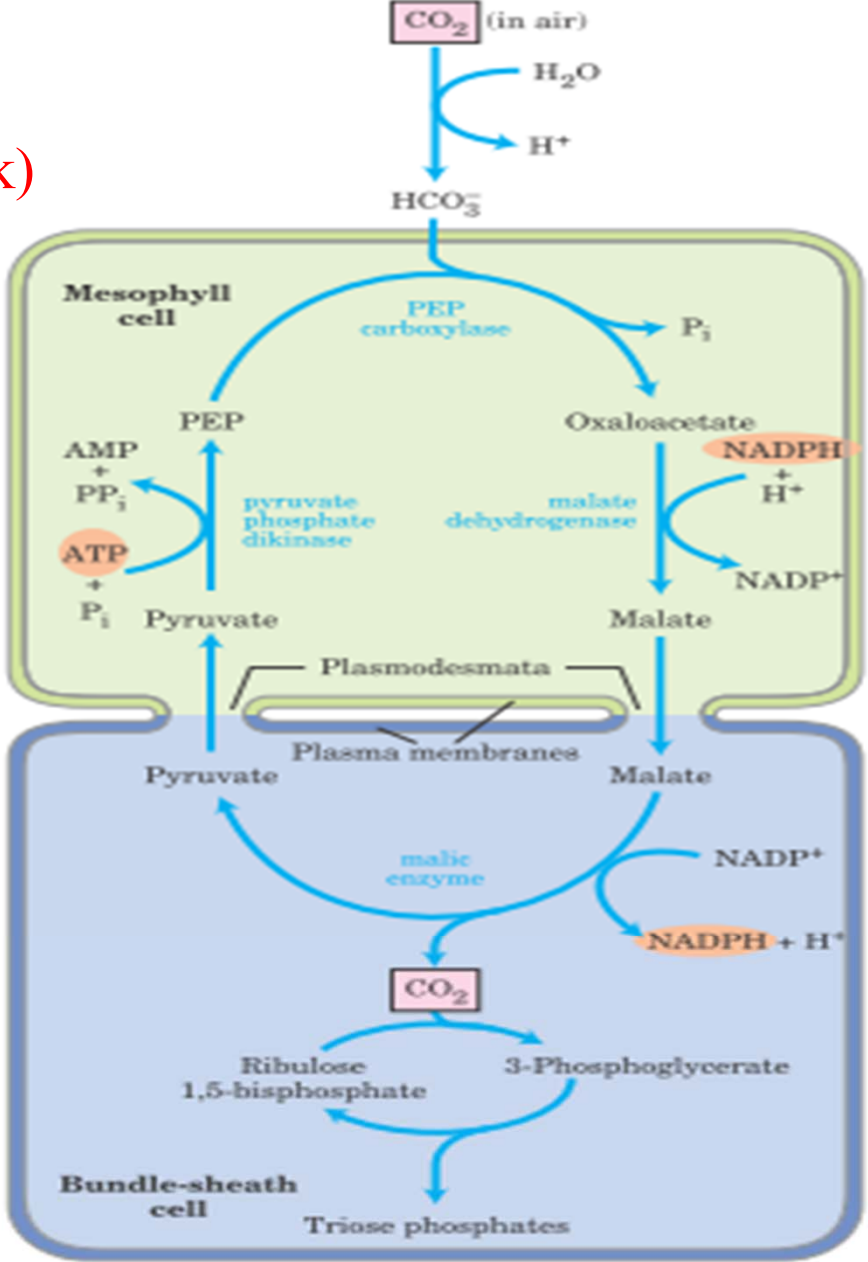
piante C3 (grano) (ciclo di *Calvin*)  
 contenuto medio  $^{13}\text{C}$   $\delta = -27\text{‰}$



piante C4 (mais) (ciclo Hatch & Slack)  
 contenuto medio  $^{13}\text{C}$   $\delta = -14\text{‰}$   
 piante CAM contenuto medio  
 $\delta^{13}\text{C} \cong \text{C4plants}$

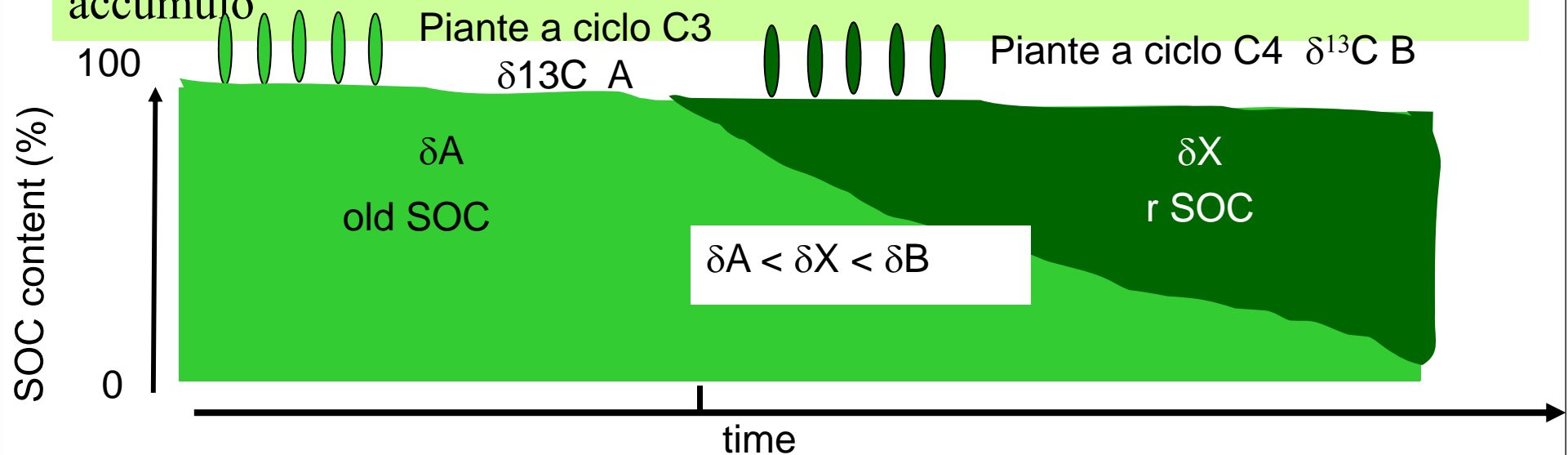


pannocchia



Il contenuto di  $^{13}\text{C}$  della sostanza organica dei suoli riflette la composizione isotopica delle specie vegetali che sussistono sul suolo e/o degli input

Cambiando il tipo di vegetazione (o input) con un contenuto di  $^{13}\text{C}$  diverso è quindi possibile **marcare la nuova sostanza organica che giunge al suolo (rSOC)** e differenziarla rispetto alla SOM preesistente (oSOC), e quindi analizzare contemporaneamente i processi di mineralizzazione ed accumulo



La quantità di rSOC può essere valutata in % del totale

$$\% \text{ SOC}_{\text{recent}} = \left[ \frac{(\delta X - \delta A)}{(\delta B - \delta A)} \right] \times \text{TOC}(\%)$$

## C.2 analisi SOM <sup>13</sup>C-OC

### Castel Volturno

	CMP-B				CMP-A				Trad
	OC g kg <sup>-1</sup>	δ13 C‰	C-CMP %	C-CMP g	OC g kg <sup>-1</sup>	δ13C ‰	C-CMP %	C-CMP g	δ13C ‰
bulk	<b>19.33</b>	<b>-25.03</b>	<b>3.56</b>	<b>0.69</b>	<b>21.23</b>	<b>-24.98</b>	<b>7.05</b>	<b>1.50</b>	<b>-25.08</b>
2.00-1.00	<b>4.23</b>	<b>-25.13</b>	<b>3.15</b>	<b>0.13</b>	<b>4.42</b>	<b>-25.02</b>	<b>10.04</b>	<b>0.44</b>	<b>-25.18</b>
1.00-0.50	<b>9.41</b>	<b>-25.04</b>	<b>3.88</b>	<b>0.37</b>	<b>9.33</b>	<b>-25.02</b>	<b>5.53</b>	<b>0.52</b>	<b>-25.10</b>
0.50-0.25	<b>3.36</b>	<b>-25.04</b>	<b>5.88</b>	<b>0.20</b>	<b>4.17</b>	<b>-25.01</b>	<b>7.49</b>	<b>0.31</b>	<b>-25.12</b>
< 0.25	<b>2.31</b>	<b>-25.07</b>	<b>0.81</b>	<b>0.02</b>	<b>2.76</b>	<b>-25.01</b>	<b>5.10</b>	<b>0.14</b>	<b>-25.08</b>
Tot WSA	<b>19.31</b>			<b>0.71</b>	<b>20.68</b>			<b>1.41</b>	

$$\delta^{13}\text{C}\text{‰ CMP} = -23.70$$

## C.2 analisi SOM <sup>13</sup>C-OC

### Tetto Frati

	SS-B				SS-A				Trad
	OC g kg <sup>-1</sup>	δ13 C‰	C-CMP % g		OC g kg <sup>-1</sup>	δ13C ‰	C-CMP % g		δ13C ‰
bulk	<b>10.97</b>	<b>-20.41</b>	<b>2.35</b>	<b>0.26</b>	<b>11.33</b>	<b>-20.50</b>	<b>4.54</b>	<b>0.52</b>	<b>-20.25</b>
2.00-1.00	/	/	/	/	/	/	/	/	/
1.00-0.50	<b>3.55</b>	<b>-20.22</b>	<b>8.32</b>	<b>0.30</b>	<b>2.32</b>	<b>-20.56</b>	<b>8.35</b>	<b>0.19</b>	<b>-19.62</b>
0.50-0.25	<b>4.94</b>	<b>-20.22</b>	<b>0.29</b>	<b>0.01</b>	<b>5.15</b>	<b>-20.37</b>	<b>6.73</b>	<b>0.35</b>	<b>-20.20</b>
< 0.25	<b>2.23</b>	<b>-20.70</b>	<b>0.06</b>	<b>0.00</b>	<b>3.33</b>	<b>-20.68</b>	/	/	<b>-20.69</b>
Tot WSA	<b>10.73</b>			<b>0.31</b>	<b>10.81</b>			<b>0.53</b>	

$$\delta^{13}\text{C}\text{‰ CMP} = -26.80$$



## C.2 analisi SOM <sup>13</sup>C-OC

### Tetto Frati

	CMP-B				CMP-A				Trad
	OC g kg <sup>-1</sup>	δ13C ‰	C-CMP %	C-CMP g	OC g kg <sup>-1</sup>	δ13C ‰	C-CMP %	C-CMP g	δ13C ‰
bulk	<b>11.43</b>	<b>-20.38</b>	<b>2.55</b>	<b>0.29</b>	<b>11.70</b>	<b>-20.51</b>	<b>5.16</b>	<b>0.60</b>	<b>-20.25</b>
2.00-1.00									
1.00-0.50	<b>1.96</b>	<b>-19.86</b>	<b>4.19</b>	<b>0.08</b>	<b>4.20</b>	<b>-20.06</b>	<b>7.78</b>	<b>0.33</b>	<b>-19.62</b>
0.50-0.25	<b>6.21</b>	<b>-20.36</b>	<b>3.24</b>	<b>0.20</b>	<b>4.58</b>	<b>-20.47</b>	<b>5.36</b>	<b>0.25</b>	<b>-20.20</b>
< 0.25	<b>3.08</b>	<b>-20.56</b>	<b>0.00</b>	<b>0.00</b>	<b>2.45</b>	<b>-20.73</b>	<b>0.00</b>	<b>0.00</b>	<b>-20.69</b>
Tot WSA	<b>11.25</b>			<b>0.28</b>	<b>11.23</b>			<b>0.57</b>	

$$\delta^{13}\text{C}\text{‰ CMP} = - 25.3$$

## C.2 analisi SOM <sup>13</sup>C-OC

### Grandi

	SS-B				SS-A				Trad
	OC g kg <sup>-1</sup>	δ13C ‰	C-CMP % g		OC g kg <sup>-1</sup>	δ13C ‰	C-CMP % g		δ13C ‰
bulk	<b>18.30</b>	<b>-24.65</b>	<b>2.31</b>	<b>0.42</b>	<b>18.73</b>	<b>-24.70</b>	<b>4.80</b>	<b>0.90</b>	<b>-24.60</b>
2.00-1.00									
1.00-0.50	<b>3.50</b>	<b>-24.84</b>	<b>2.09</b>	<b>0.07</b>	<b>3.60</b>	<b>-25.04</b>	<b>12.30</b>	<b>0.44</b>	<b>-24.79</b>
0.50-0.25	<b>7.94</b>	<b>-24.61</b>	<b>3.94</b>	<b>0.31</b>	<b>8.02</b>	<b>-24.59</b>	<b>2.98</b>	<b>0.24</b>	<b>-24.52</b>
< 0.25	<b>6.63</b>	<b>-24.57</b>	<b>1.41</b>	<b>0.09</b>	<b>5.51</b>	<b>-24.60</b>	<b>3.01</b>	<b>0.17</b>	<b>-24.53</b>
Tot WSA	<b>18.07</b>			<b>0.48</b>	<b>17.13</b>			<b>0.85</b>	

δ13C‰ CMP = - 26.8

## C.2 analisi SOM <sup>13</sup>C-OC

### Grandi

	CMP-B				CMP-A				Trad
	OC g kg <sup>-1</sup>	δ13C ‰	C-CMP %	C-CMP g	OC g kg <sup>-1</sup>	δ13C ‰	C-CMP %	C-CMP g	δ13C ‰
bulk	<b>18.10</b>	<b>-24.61</b>	<b>2.38</b>	<b>0.43</b>	<b>19.7</b>	<b>-24.63</b>	<b>3.97</b>	<b>0.78</b>	<b>-24.60</b>
2.00-1.00									
1.00-0.50	<b>4.14</b>	<b>-24.80</b>	<b>2.15</b>	<b>0.09</b>	<b>4.93</b>	<b>-24.81</b>	<b>3.41</b>	<b>0.17</b>	<b>-24.79</b>
0.50-0.25	<b>8.02</b>	<b>-24.54</b>	<b>2.91</b>	<b>0.23</b>	<b>8.49</b>	<b>-24.55</b>	<b>4.39</b>	<b>0.37</b>	<b>-24.52</b>
< 0.25	<b>5.71</b>	<b>-24.55</b>	<b>1.79</b>	<b>0.10</b>	<b>5.70</b>	<b>-24.56</b>	<b>3.83</b>	<b>0.22</b>	<b>-24.53</b>
Tot WSA	<b>17.87</b>			<b>0.42</b>	<b>19.11</b>			<b>0.76</b>	

$$\delta^{13}\text{C}\text{‰ CMP} = -25.3$$





Azione C.2

Soil (1-2 g)



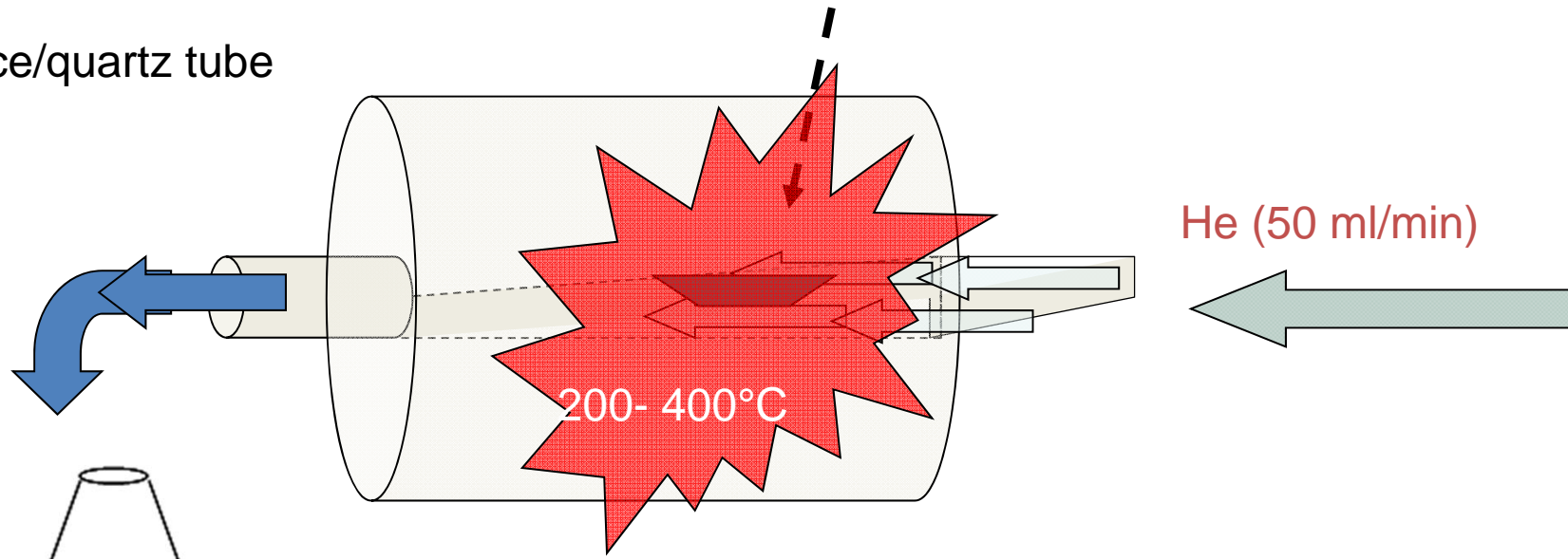
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+ TMAH (25% w/vmethanol)



Furnace/quartz tube



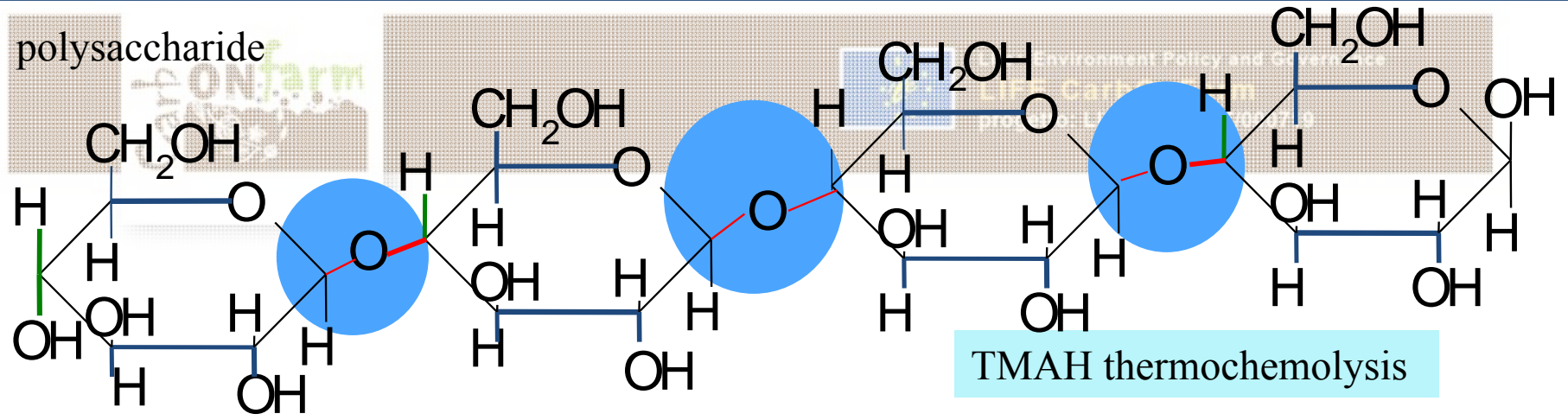
200- 400°C

He (50 ml/min)

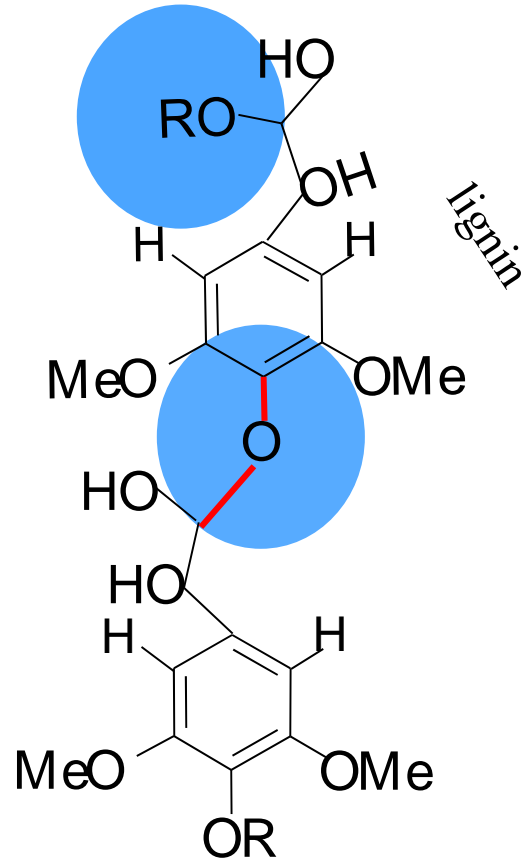
Cooled organic solvent

Gas Chromatography-Mass Spectrometry

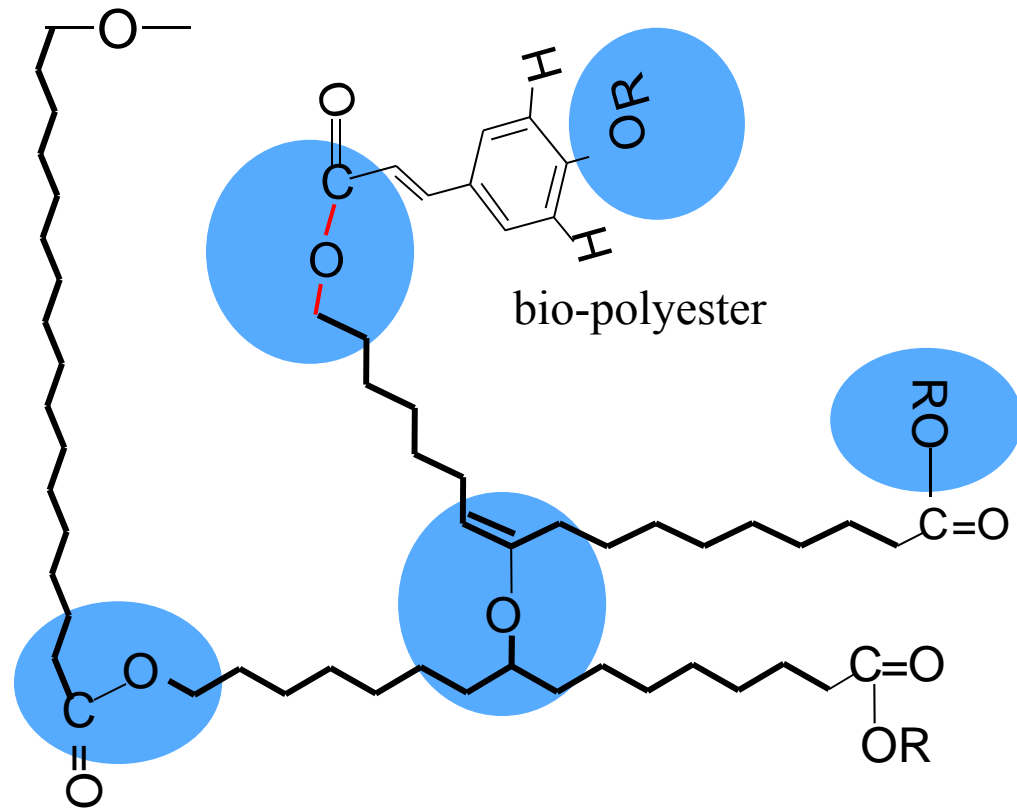
polysaccharide



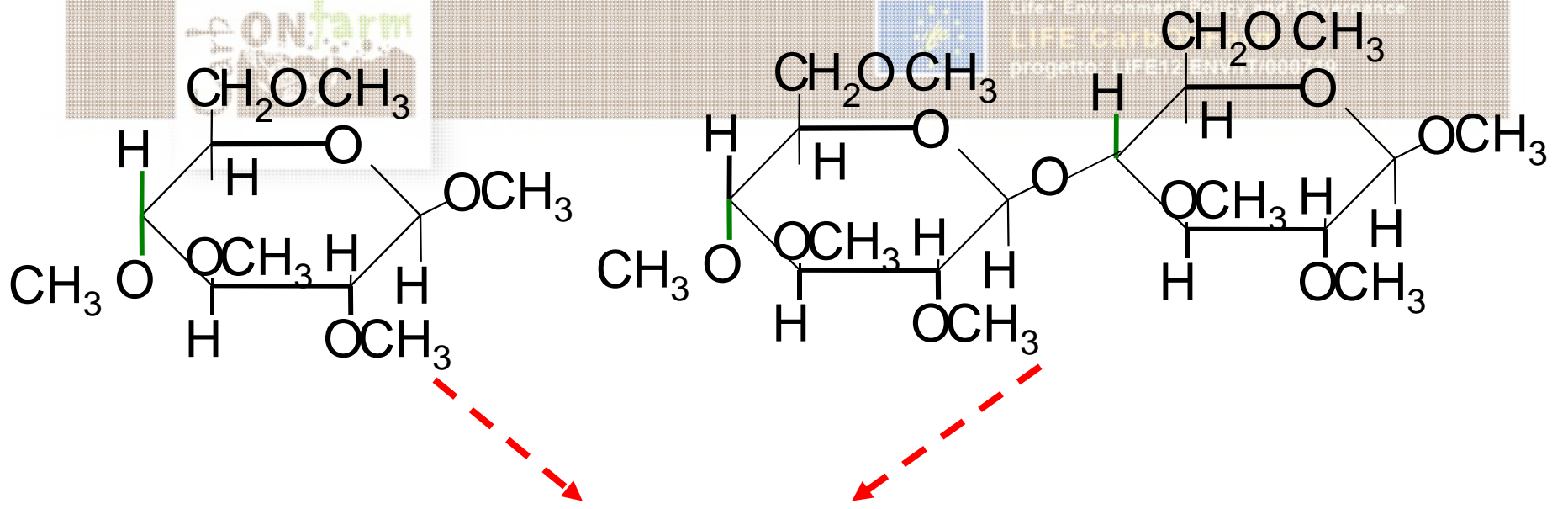
TMAH thermochemolysis



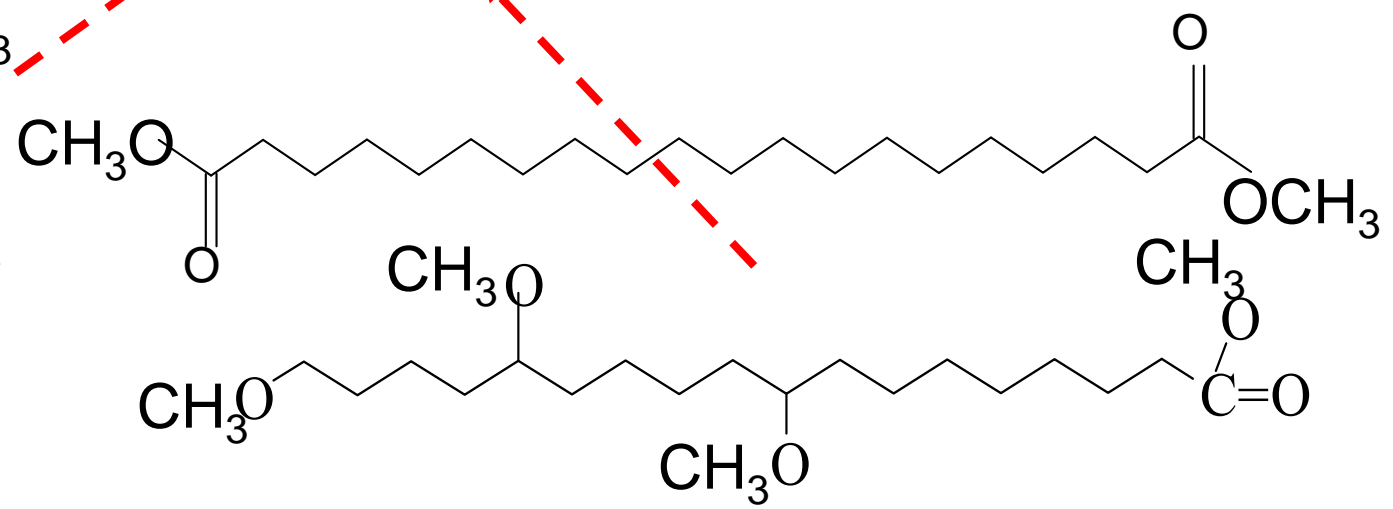
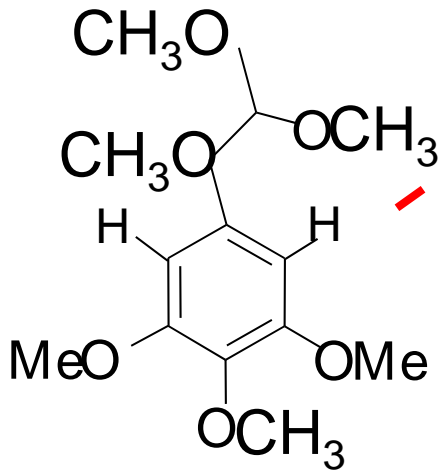
*lignin*



bio-polyester



GC-MS

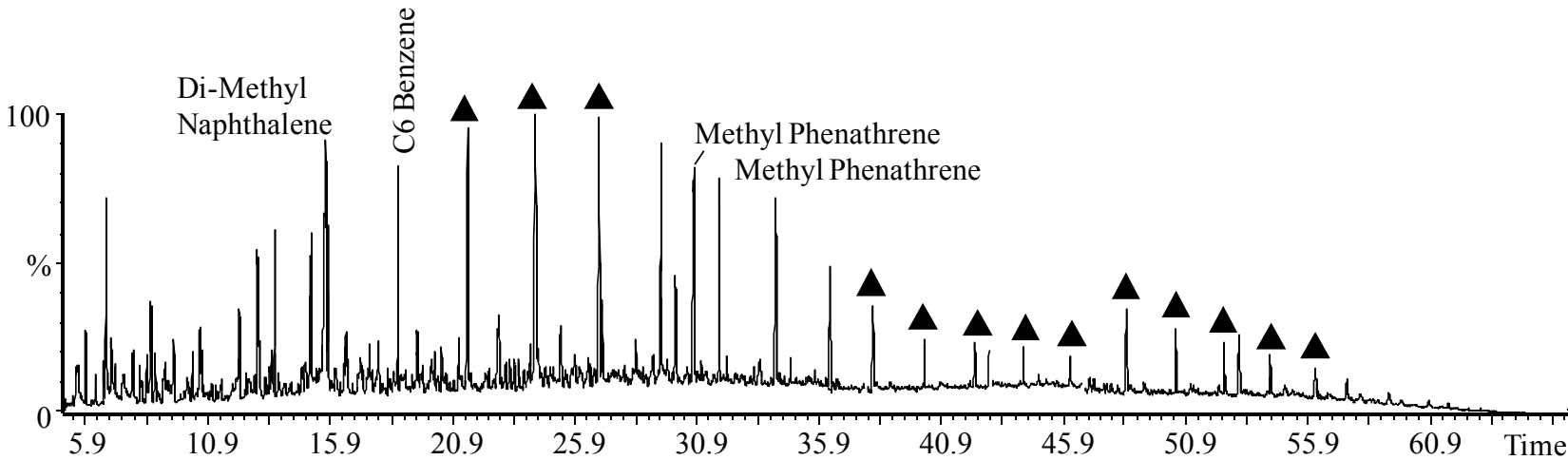
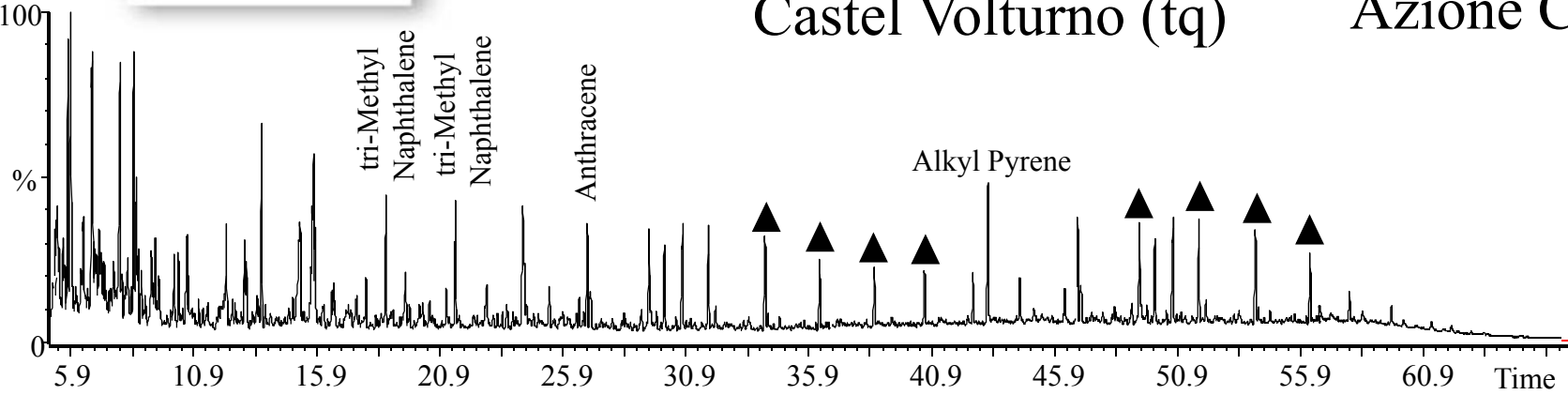




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# Castel Volturno (tq)

# Azione C.2



Molecole rilasciate dalla termochemolisi da Castel Volturno (tq)

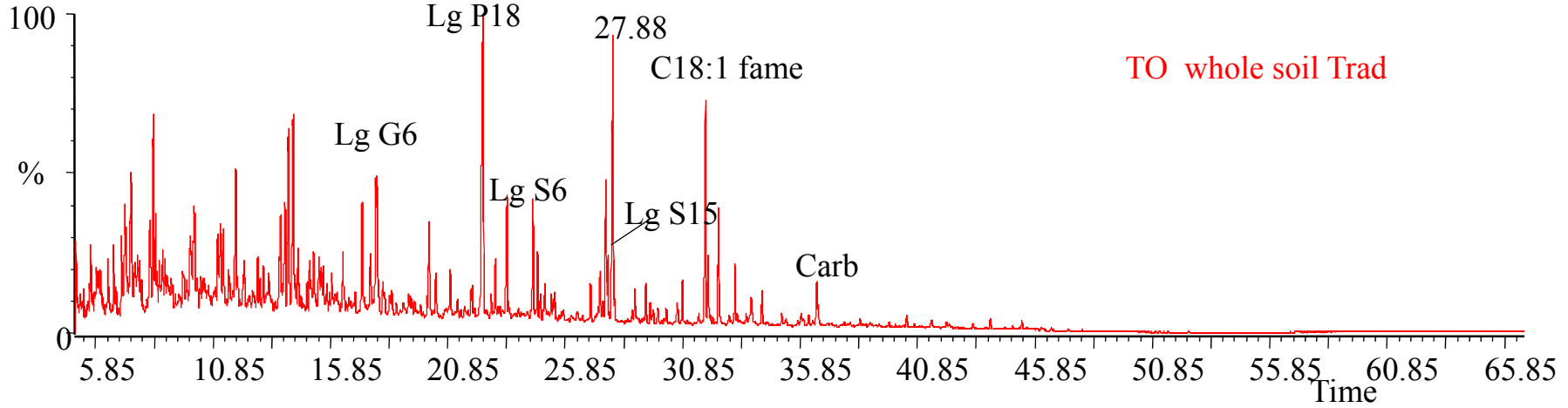
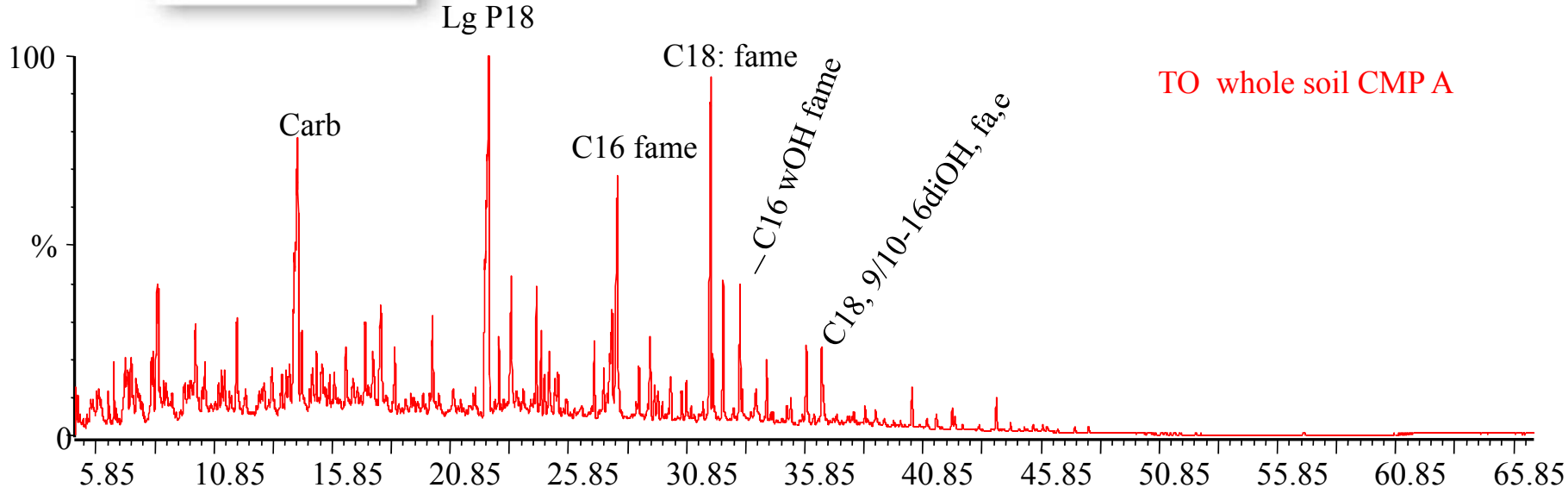
<u>RT<sup>a</sup></u>	<u>composto<sup>b</sup></u>	<u>m/z</u>	<u>RT</u>	<u>composto<sup>b</sup></u>	<u>m/z</u>
5.7	Benzene, 1-CH <sub>3</sub> O 4(C)	77, 107 M <sup>+</sup> 122	20.4	Naphthalene -(C) <sub>3</sub>	128, 155 M <sup>+</sup> 170
5.9	Benzene-(C) <sub>3</sub>	77, 91, 105 M <sup>+</sup> 120	21.1	Fluorene	82, 139 M <sup>+</sup> 166
6.4	Benzene-(C) <sub>3</sub>	77, 91, 105 M <sup>+</sup> 120	21.5	Alkene/Alkane	M <sup>+</sup> 224/226
7.9	Benzene, 1-(C <sub>2</sub> ) 4- CH <sub>3</sub> O	77, 121 M <sup>+</sup> 136	21.6	Naphthalene, -(C) <sub>3</sub>	128, 155 M <sup>+</sup> 170
8.4	C8 FAME	74, 87 M <sup>+</sup> 158	22.2	Indole (C) <sub>4</sub>	115, 158, M <sup>+</sup> 173
9.3	Indene, 3-Methyl	77, 115 M <sup>+</sup> 130	23.0	3(C)-Hexadecane	57,71, 211 M <sup>+</sup> 240
9.4	di CH <sub>3</sub> O Benzene	95, 123 M <sup>+</sup> 138	23.2	4(C)-Hexadecane	57,71, 197 M <sup>+</sup> 240
9.6	di CH <sub>3</sub> O Benzene	95, 123 M <sup>+</sup> 138	23.4	Naphthalene, -(C) <sub>4</sub>	141, 169 M <sup>+</sup> 184
10.1	Naphthalene	77, 102 M <sup>+</sup> 128	23.8	Naphthalene, -(C) <sub>4</sub>	141, 169 M <sup>+</sup> 184
10.2	Methyl-Undecane	57, 71, 85 M <sup>+</sup> 170	24.2	Alkene/Alkane	M <sup>+</sup> 238/240
10.6	N Compound	98	24.9	C14 FAME	74, 87 M <sup>+</sup> 242
12.4	Alkyl (C5) Benzene	119, 133 M <sup>+</sup> 148	25.3	Anthracen	89, 152 M <sup>+</sup> 178
12.9	Methyl Dodecane	57, 71, 155 M <sup>+</sup> 184	26.4	Phenanthren	89, 152 M <sup>+</sup> 178
13.0	Indene, 1-Ethylidene	115, 141 M <sup>+</sup> 142	26.5	Alkene/Alkane	M <sup>+</sup> 252/254
13.4	Naphthalene, 1(C)	115, M <sup>+</sup> 142	28.9	(C)-Octadecane	57,71, 239 M <sup>+</sup> 268
13.6	C10 FAME.	74, 87, M <sup>+</sup> 186	29.4	Nonadecane	57,71, M <sup>+</sup> 268
14.9	Indole, 1,4-(C) <sub>2</sub>	130, 144 M <sup>+</sup> 145	30.0	C16 FAME	74, 87 M <sup>+</sup> 270
15.2	Alkyl (C6) Benzene	91, 147 M <sup>+</sup> 162	30.7	Phenanthrene 3(C)	96. 191 M <sup>+</sup> 192
15.7	N Compound	98	31.8	Eicosane	57,71, M <sup>+</sup> 282
15.8	Tetradecane	57, 71 M <sup>+</sup> 198	34.1	Heneicosane	57,71, M <sup>+</sup> 296
16.1	Naphthalene, -(C) <sub>2</sub>	115, 141 M <sup>+</sup> 156	34.7	C18 FAME	74, 87 298
16.5	Naphthalene, -(C) <sub>2</sub>	115, 141 M <sup>+</sup> 156	36.3	Docosane	57,71, 197 M <sup>+</sup> 310
16.6	Pyrido[D]Pyrimidine 4-CH <sub>3</sub> O	104, 131 M <sup>+</sup> 161	38.4	Alkene/Alkane	M <sup>+</sup> 322/324
17.3	Alkyl (C7) Benzene	77, 161 M <sup>+</sup> 176	40.5	Alkene/Alkane	M <sup>+</sup> 336/338
17.5	Naphthalene, -(C) <sub>2</sub>	115, 141 M <sup>+</sup> 156	42.4	Alkyl Pyrene	M <sup>+</sup> 350/352
17.6	Methyl Tetradecane	57, 71, 183 M <sup>+</sup> 212	44.3	Alkene/Alkane	M <sup>+</sup> 364/366
17.9	Methyl Tetradecane	57, 71,155 M <sup>+</sup> 212	46.2	Alkene/Alkane	M <sup>+</sup> 378/380
18.3	Naphthalen, (C), (C <sub>2</sub> )	128, 155 M <sup>+</sup> 170	47.9	Alkene/Alkane	M <sup>+</sup> 392/394
18.7	Alkene/Alkane	M <sup>+</sup> 210/212	49.6	Alkene/Alkane	M <sup>+</sup> 406/408
19.3	Dibenzofuran	84, 139, M <sup>+</sup> 168	51.3	Alkene/Alkane	M <sup>+</sup> 420/422
19.5	Indole, 1,2,3-(C) <sub>3</sub>	115,144, 158 M <sup>+</sup> 159	53.1	Alkene/Alkane	M <sup>+</sup> 434/436
19.6	Naphthalene, -(C) <sub>3</sub>	115,128, 155 M <sup>+</sup> 170	55.9	Alkene/Alkane	M <sup>+</sup> 448/450
20.2	Naphthalene, -(C) <sub>3</sub>	115,128, 155 M <sup>+</sup> 170	58.0	Alkene/Alkane	M <sup>+</sup> 462/464

a. RT = Retention Time (minutes)

b. (C)=methyl; (C<sub>2</sub>)=ethyl; (C<sub>3</sub>)=propyl; FAME= fatty acid methyl ester

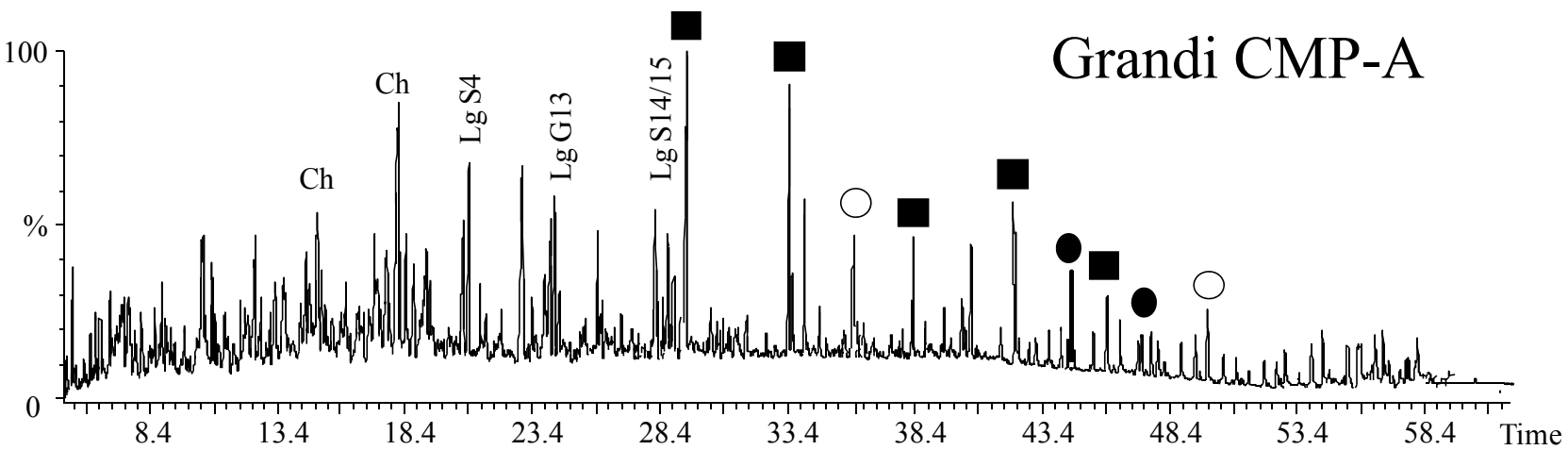
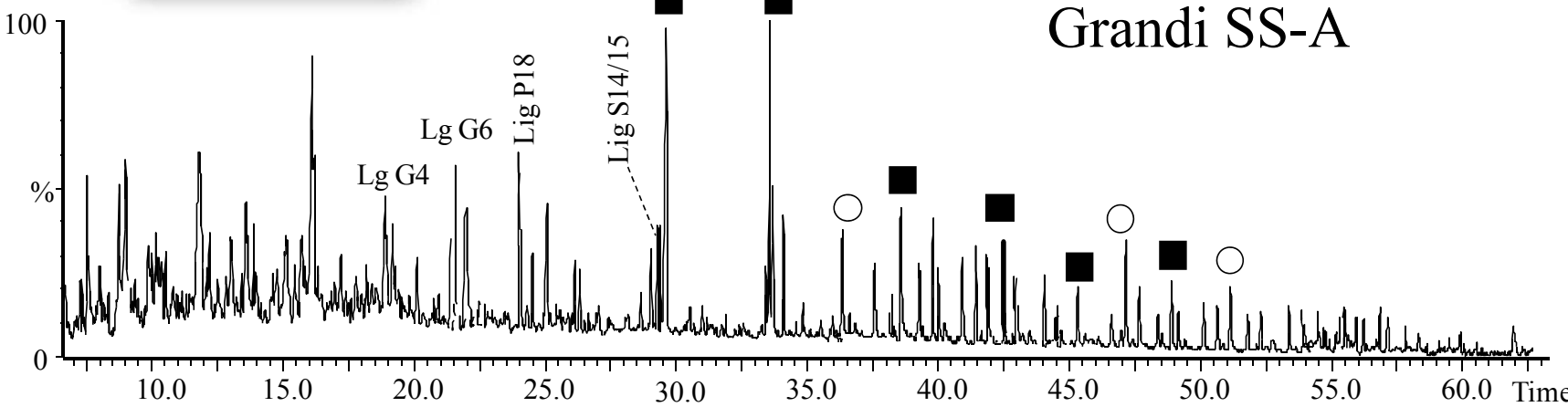


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RT <sup>b</sup>	Compound	RT	Compound
5.5	Benzene, 1-CH <sub>3</sub> O <i>Lg P1</i>	23.6	N Compound M/z 98
5.8	1H-Pyrrole, 2-Ethyl-4-Methyl-	24.0	3,4,5-tri CH <sub>3</sub> O Benzoic acid ME <i>Lg S6</i>
6.0	Benzene, 1-Methoxy-4-Methyl <i>Lg P2</i>	24.2	C14 FAME
8.0	Methoxy Pyridine	24.5	Cis-1-(3,4-di CH <sub>3</sub> O phenyl)-1- CH <sub>3</sub> O-1-Propene <i>Lg G10</i>
8.7	Benzene, 1-Ethenyl-4-CH <sub>3</sub> O <i>Lg P3</i>	25.1	Trans -1-(3,4-di CH <sub>3</sub> O phenyl)-3- CH <sub>3</sub> O-1-Propene <i>Lg G13</i>
9.0	1,2 di-CH <sub>3</sub> O Benzene <i>Lg G1</i>	25.4	Cis-1-(3,4,5-tri CH <sub>3</sub> O phenyl)-2-CH <sub>3</sub> O ethylene <i>Lg S7</i>
9.9	CH <sub>3</sub> O Benzaldehyde <i>Lg P4</i>	25.8	Threo/Erythro-1-(3,4-di CH <sub>3</sub> O phenyl) -1,2,3-tri CH <sub>3</sub> O propane <i>Lg G14</i>
11.3	Benzoic Acid, 4-CH <sub>3</sub> O, ME <i>Lig P6</i>	25.9	Trans 1-(3,4,5-tri CH <sub>3</sub> O phenyl)-2-CH <sub>3</sub> O ethylene <i>Lg S8</i>
11.6	1h-Indole, 2-Methyl-	26.0	C15 Iso-FAME <i>Mic</i>
11.9	Carbohydrate derivative	26.2	Threo/Erythro-1-(3,4-di CH <sub>3</sub> O phenyl) -1,2,3-tri CH <sub>3</sub> O propane <i>Lg G15</i>
12.4	Carbohydrate derivative	26.5	Cis-1-(3,4,5-tri CH <sub>3</sub> O phenyl)- 1-CH <sub>3</sub> O prop-1-ene <i>Lg S10</i>
14.3	1,2,3-tri- CH <sub>3</sub> O Benzene <i>Lg S1</i>	26.8	C15 Anteiso FAME <i>Mic</i>
14.8	1,5-Anhydro-6-O-Acetyl-2,3,4-Tri-O-Methyl-D-Glucitol	28.1	Trans-1-(3,4,5-tri CH <sub>3</sub> O phenyl)-3- CH <sub>3</sub> O-1-Propene <i>Lg S13</i>
15.0	D-Galactose, 2,3,4,5-Tetra-O-Methyl-	28.2	Trans-3-(3,4-di CH <sub>3</sub> O phenyl)-3-Propenoic acid ME <i>Lg G18</i>
15.8	Glycine, N-[(1,3-Dihydro-1,3-Dioxo-2h-Isoindol-2)Acetyl]-	28.2	Cis-1-(3,4-di CH <sub>3</sub> O phenyl)-1,3-di CH <sub>3</sub> O-1-Propene <i>Lg G16</i>
16.4	4- CH <sub>3</sub> O-1-Methylindole	28.4	C16 iso FAME <i>Mic</i>
17.1	Carbohydrate derivative.	28.6	Threo/Erythro-1-(3,4,5-tri CH <sub>3</sub> O phenyl)-1,2,3-tri CH <sub>3</sub> O propane <i>Lg S14</i>
17.5	3,4- di CH <sub>3</sub> O Benzaldehyde <i>Lg G4</i>	28.7	C16: 1 FAME <i>Mic</i>
18.0	Carbohydrate derivative	28.8	Threo/Erythro-1-(3,4,5 tri CH <sub>3</sub> O phenyl)-1,2,3-tri CH <sub>3</sub> O propane <i>Lg S15</i>
18.3	Carbohydrate derivative	29.0	C16:1 FAME
18.7	C12 FAME	29.3	C16 FAME
19.3	Nonanedioic Acid, DIME	30.1	C17iso FAME <i>Mic</i>
19.8	3,4-di CH <sub>3</sub> O Acetophenone <i>Lg G5</i>	30.5	C17 Anteiso FAME <i>Mic</i>
20.6	Benzoic Acid, 3,4-di CH <sub>3</sub> O ME <i>Lg G6</i>	31.0	Trans-3-(3,4,5-tri CH <sub>3</sub> O phenyl)-3-Propenoic acid ME <i>Lg S18</i>
20.8	3,4,5-tri CH <sub>3</sub> O -Benzaldehyde, <i>Lg S4</i>	31.3	C17 cy FAME <i>Mic</i>

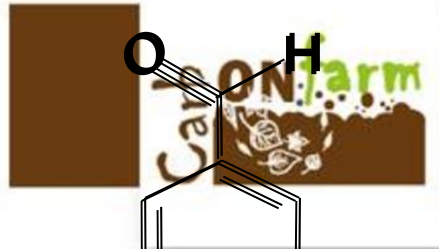


RT	compound	RT	Compound
34.2	C16:1, 16 CH <sub>3</sub> O, FAME	46.3	C23, 2-CH <sub>3</sub> O, FAME <i>Mic</i>
34.6	C16, 16 CH <sub>3</sub> O, FAME	46.5	C22, 22-CH <sub>3</sub> O, FAME
35.4	Carbohydrate derivative	47.0	squalene
36.0	cy C19 FAME <i>Mic</i>	47.7	C26-OMe
36.2	C19 FAME	47.9	C24, 2-CH <sub>3</sub> O, FAME <i>Mic</i>
36.7	C16 dioic acid DIME	48.5	C22 dioic acid DIME
37.4	C16, 8(9,10) 16 diCH <sub>3</sub> O, FAME	48.6	Podocarpa 8 11 13triene 3,13 diol 14 isopropyl OMe
37.8	C23 alkane	48.8	Phytosterol (tetracyclcic)
38.0	Carbohydrate derivative	49.1	C29 alkane
38.2	C18:1, 18 CH <sub>3</sub> O, FAME	49.4	C26 FAME
38.6	C20 FAME	49.7	C25, 2-CH <sub>3</sub> O, FAME <i>Mic</i>
39.0	Carbohydrate derivative	50.0	C24, 24-CH <sub>3</sub> O, FAME
39.8	C24 alkane	50.6	Phytosterol (tetracyclcic)
40.1	C18:1 dioic acid DIME	50.9	C28-CH <sub>3</sub> O
40.4	Carbohydrate derivative	51.2	Phytosterol (tetracyclcic)
40.8	C18 dioic acid DIME	51.5	C24 dioic acid DIME
41.2	Abiet 7 en 18 oic acid ME	51.8	Phytosterol (tetracyclcic)
41.6	C25 alkane	52.1	C31 alkane
42.3	C22 FAME	52.2	C28 FAME
42.8	C20, 20CH <sub>3</sub> O, FAME	52.6	Phytosterol (pentacyclcic)
43.4	C26 alkane	54.0	C30-CH <sub>3</sub> O
44.1	C18, triCH <sub>3</sub> O, FAME	54.4	C33 alkane
44.8	C22, 2-CH <sub>3</sub> O, FAME <i>Mic</i>	55.8	C30 FAME
45.4	C27 alkane	56.7	Phytosterol (pentacyclcic)
45.7	Dehydro abietyl alcohol CH <sub>3</sub> O	57.1	Phytosterol (pentacyclcic)
46.0	C24 FAME		

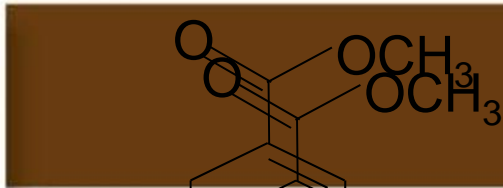
a. cy=cyclopropane; DIME = dimethyl ester CH<sub>3</sub>O = Methoxy; FAME= fatty acid methyl

Prodotti della termochemolisi ( $\mu\text{g g}^{-1}$ ) del sito di Castel Volturno

	TRA	FePh	CMP A	CMP B
	Lignin			
<i>p</i> -OH phenyl	95.8	112.5	130	175.5
Guaiacyl	120	110	159	186
(Ad/Al)G	4.9	4.6	4.0	3.8
$\Gamma$ G	6.1	6.2	4.9	5.0
Syringyl	62.5	60	78.5	112
(Ad/Al)S	5.3	5.5	4.3	4.1
$\Gamma$ S	5.9	6.1	4.8	4.9
	Lipid			
$\omega$ -OH acids ( $C_{16}$ - $C_{22}$ )	91.9	96.3	99.5	121.6
Mid-chain OH acids ( $C_{16}$ , $C_{18}$ )	101.4	100.2	104.0	117.7
<i>n</i> -Alkanes ( $C_{23}$ - $C_{31}$ )	95.5	99.3	91.6	95.1
Fatty acids ( $C_{16}$ - $C_{28}$ )	662.0	702.3	689.9	706.0
Microbial (%)	3.7	4.4	4.8	5.5
Alcohols ( $C_{20}$ - $C_{26}$ )	61.2	65.6	59.6	59.5
Sterol	/	/	/	/



aldehydic form = Al



acidic form = Ad

Le strutture aldeidiche (G4, S4) e acide (G6, S6) derivano da un **progressivo processo di ossidazione**

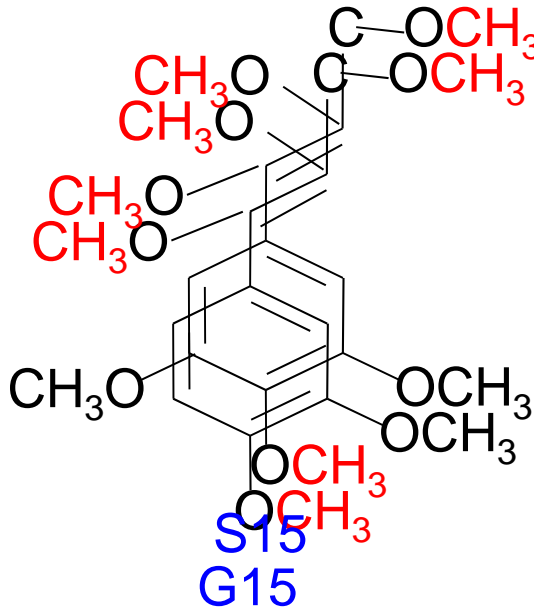
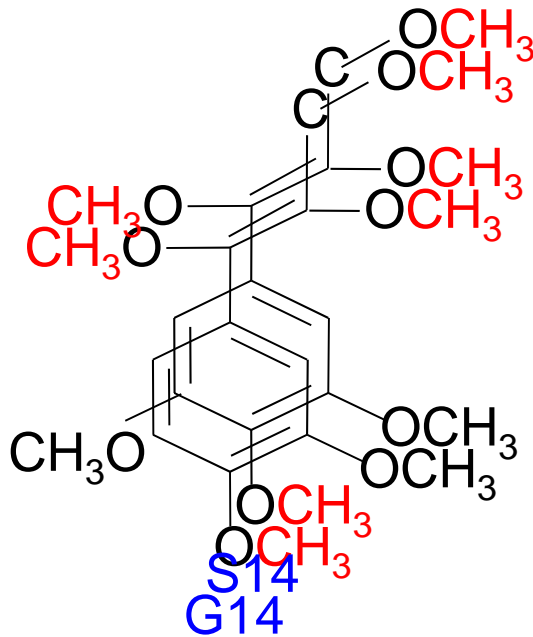
Il rapporto tra le **forme acide** in riferimento a le componenti **aldeidiche**

$Ad/AIG = G6/G4$ ,  $Ad/AIS = S6/S4$   
e le strutture indecomposte

$$\Gamma G = G6/[G14 + G15]$$

$$\Gamma S = S6/[S14 + S15]$$

Sono utilizzati come indicatori del grado di degradazione/persistenza della lignina



Gli isomeri che mostrano la catena laterale propilica intatta (G14/15, S14/15) indicano la presenza di lignina non **degradata**, che mantiene il tipico legame etere intermolecolare ( $\beta$ -O-4) SOM fresca/indecomposta

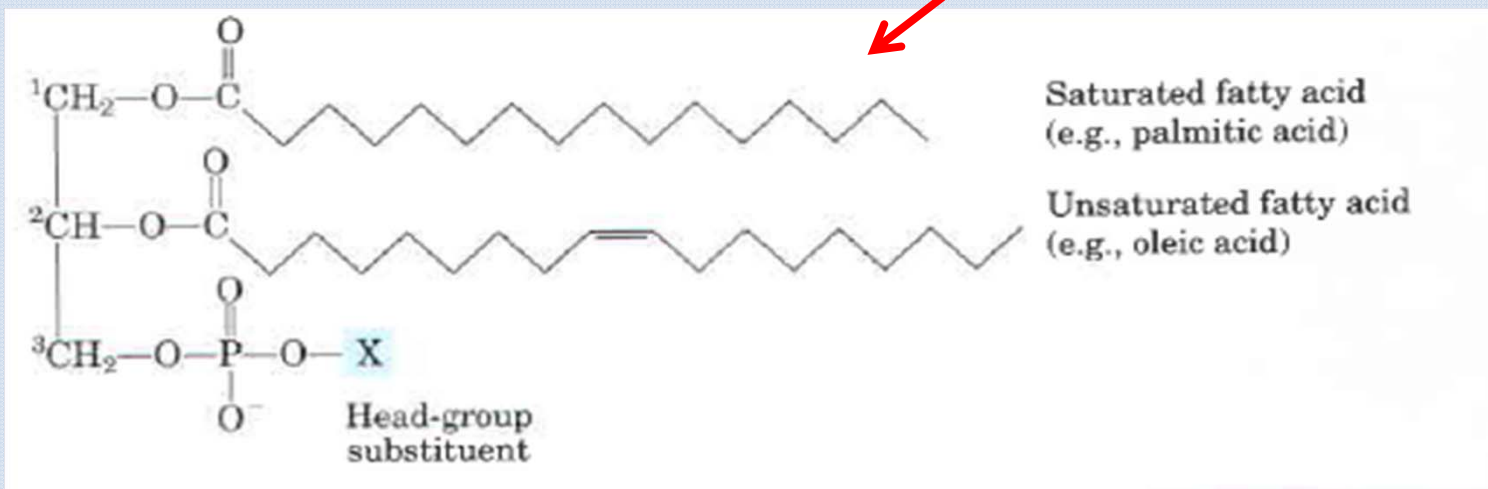
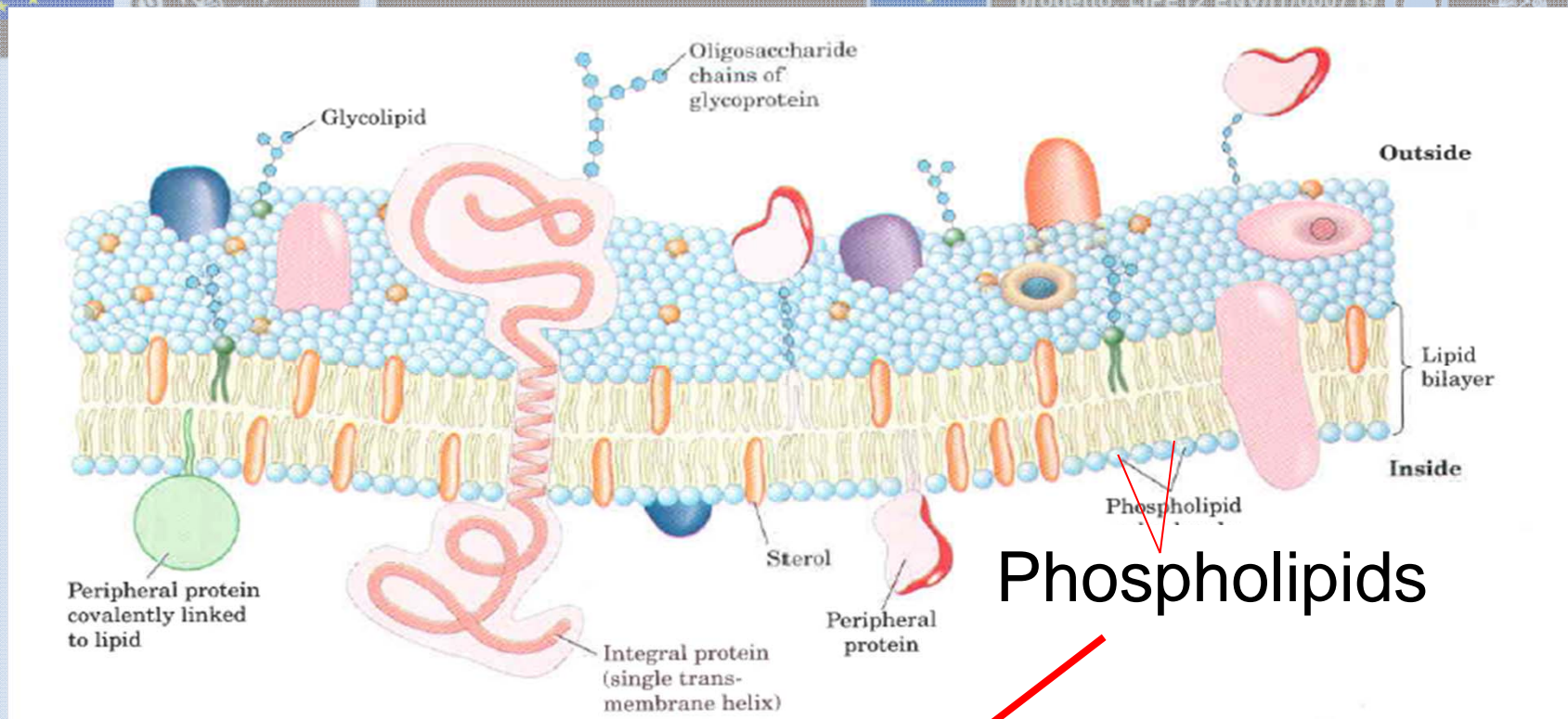
## Prodotti della termochemolisi ( $\mu\text{g g}^{-1}$ ) del sito di Tetto Frati

	TRA	0 N	CMP A	CMP B	SS A	SS B	FePh
	Lignin						
<i>p</i> -OH phenyl	71.9	62.5	84.9	66.0	61.6	97.2	61.7
Guaiacyl	55.7	47.9	50.6	41.7	42.1	37.2	35.3
(Ad/Al)G	4.0	4.2	3.7	3.8	5.2	4.0	4.3
$\Gamma$ G	5.0	5.1	4.4	4.5	4.3	4.7	5.0
Syringyl	31.4	26.7	35.7	30.2	22.6	33.0	28.6
(Ad/Al)S	4.8	4.4	4.2	4.3	4.3	4.0	4.4
$\Gamma$ S	5.4	5.0	4.7	4.2	4.5	4.6	4.8
	Lipid						
$\omega$ -OH acids ( $C_{16}$ - $C_{22}$ )	182.9	166.7	177.5	209.3	168.2	175.1	160.3
Mid-chain OH acids ( $C_{16}$ , $C_{18}$ )	173.6	136.4	119.7	139.8	107.9	121.9	130.9
<i>n</i> -Alkanes ( $C_{19}$ - $C_{31}$ )	51.4	62.0	61.2	53.9	47.5	54.0	56.2
Fatty acids ( $C_{16}$ - $C_{28}$ )	680.0	689.8	592.6	659.3	632.5	773.8	601.1
Microbial (%)	4.9	4.1	4.2	5.1	5.3	4.8	4.0
Alcohols ( $C_{20}$ - $C_{26}$ )	81.4	80.2	74.1	79.4	96.4	71.6	89.6
Sterol	/	/	/	/	/	/	/

## Prodotti della termochemolisi ( $\mu\text{g g}^{-1}$ ) del sito Grandi



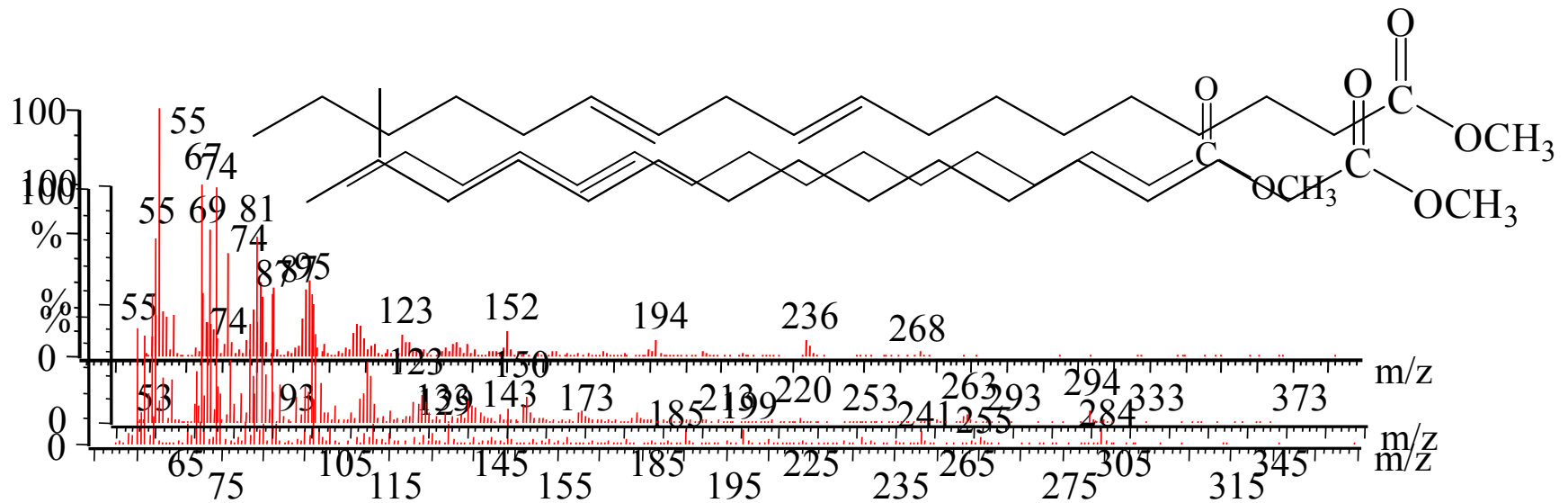
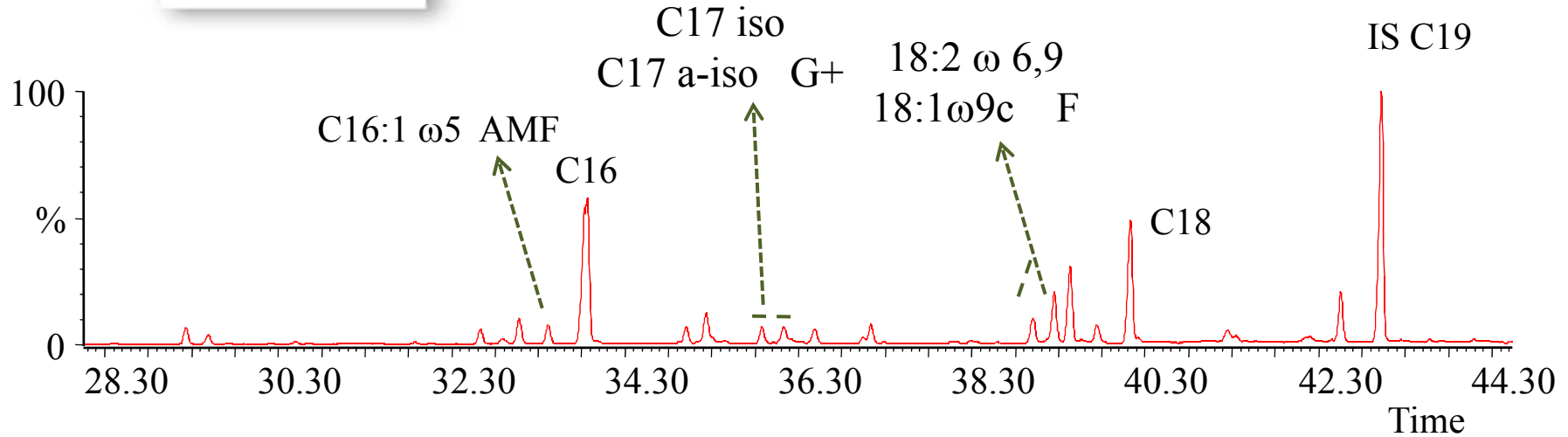
	TRA	0 N	CMP A	CMP B	SS A	SS B
Lignin						
<i>p</i> -OH phenyl	56.8	45.9	52.3	58.6	56.8	45.9
Guaiacyl	42	29.3	81.8	68.8	42	29.3
(Ad/Al)G	4.4	5.2	3.4	4.4	4.4	5.2
ΓG	7.4	6.1	4.6	4.7	7.4	6.1
Syringyl	25.6	29.5	37.2	31.1	25.6	29.5
(Ad/Al)S	4.6	11.3	4	4.3	4.6	11.3
ΓS	5.5	5	4.7	4.5	5.5	5
Lipid						
$\omega$ -OH acids (C <sub>16</sub> -C <sub>22</sub> )	410.2	386.4	519.3	841.5	400.8	670.0
Mid-chain OH acids (C <sub>16</sub> , C <sub>18</sub> )	170	190	236	338	182	287
<i>n</i> -Alkanes (C <sub>19</sub> -C <sub>31</sub> )	191	167	422	310	479	510
Fatty acids (C <sub>16</sub> -C <sub>28</sub> )	1200	1330	1551	1757	1195	1308
Microbial (%)	6.0	6.2	5.8	6.3	5.8	6.5
Alcohols (C <sub>20</sub> -C <sub>26</sub> )	137.5	98.8	170	180	112.5	155
Sterol/Diterpenoid	160	190	214	320	235	280





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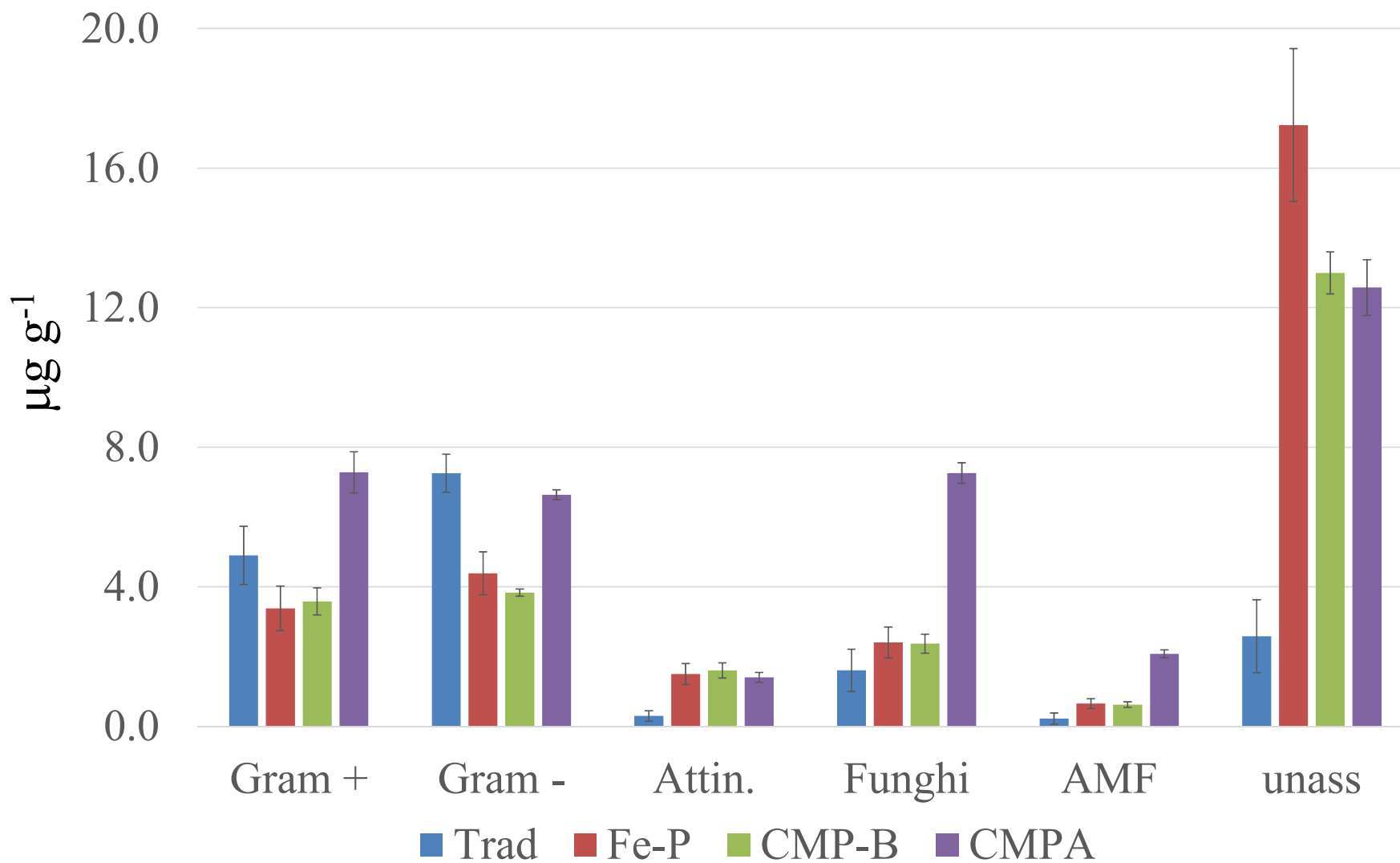
PLFA CV CMPA-4 (I anno)



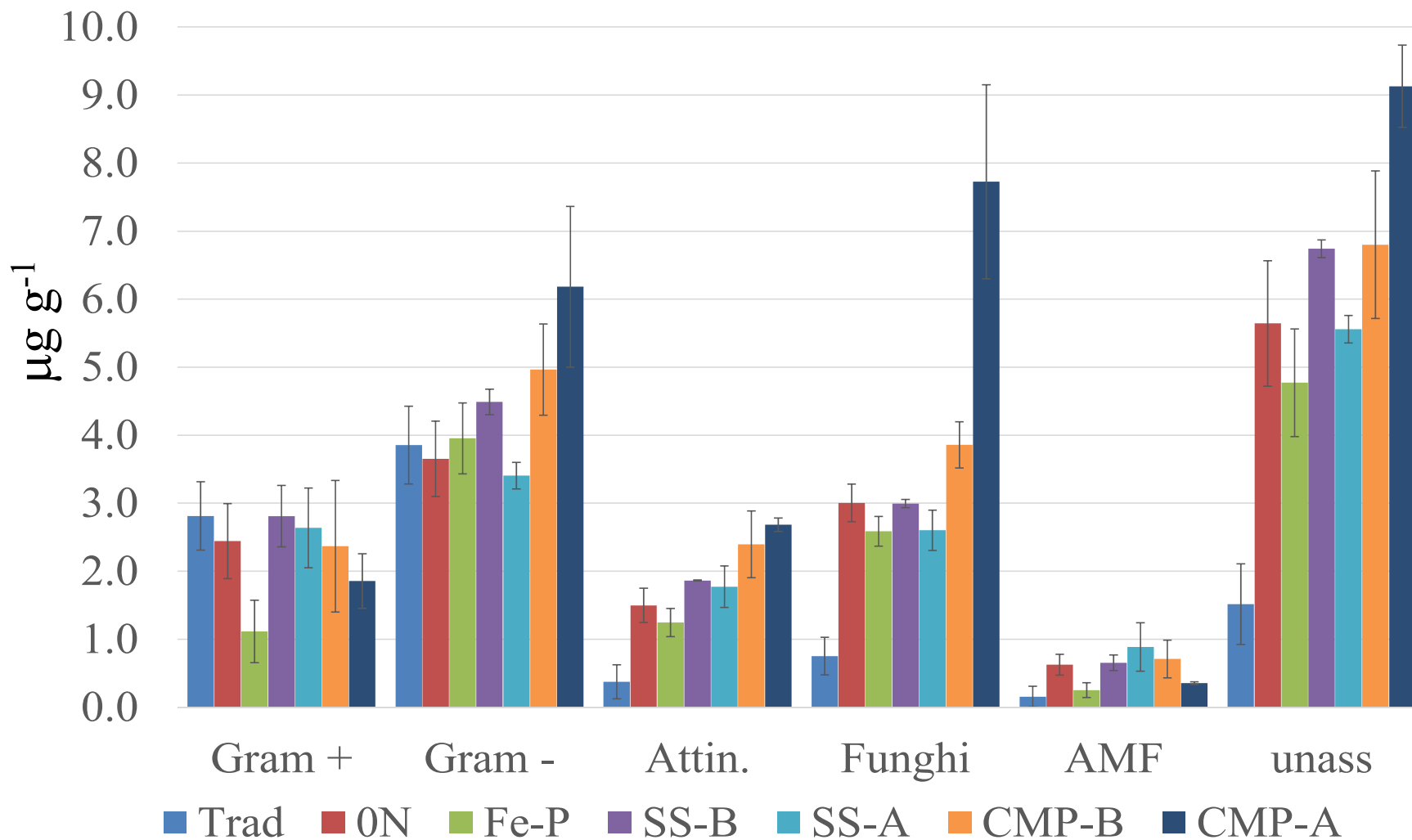
Fatty acid	source	area	ppm	$\mu\text{g g}^{-1}$
<b>i15:0</b>	<b>GRAM +</b>	35972292	3.07	0.61
<b>a15:0</b>	<b>GRAM +</b>	18983290	1.62	0.32
<b>15:00</b>	<b>GRAM +</b>	5193121	0.44	0.09
<b>a16:0</b>	<b>GRAM +</b>	28661834	2.44	0.49
<b>16:1 <math>\omega</math>7c</b>	GRAM-/FUNGHI	39435624	3.36	0.67
<b>16:1 <math>\omega</math>5c</b>	AFM	32854800	2.80	0.56
<b>16:00</b>	multiple	399812704	34.10	6.82
<b>10Me16:0</b>	ATTINOMICETI	51742324	4.41	0.88
<b>i17:0</b>	<b>GRAM+</b>	26003850	2.22	0.44
<b>a17:0</b>	<b>GRAM+</b>	25129852	2.14	0.43
<b>cy 17:0</b>	<b>GRAM-</b>	23225656	1.98	0.40
<b>17:00</b>	<b>GRAM+</b>	7630398	2.22	0.44
<b>10 Me17:0</b>	ATTINOMICETI	34033068	2.14	0.43
<b>18:2 <math>\omega</math> 6,9</b>	FUNGHI	30902670	2.64	0.53
<b>18:1<math>\omega</math>9c</b>	FUNGHI	69447448	5.92	1.18
<b>18:1<math>\omega</math>7c</b>	<b>GRAM -</b>	88810600	7.57	1.51
<b>18:1<math>\omega</math>5</b>	<b>GRAM -</b>	21715464	1.85	0.37
<b>18:0</b>	multiple	195861552	16.71	3.34
<b>19: 0</b>	IS	351739776		



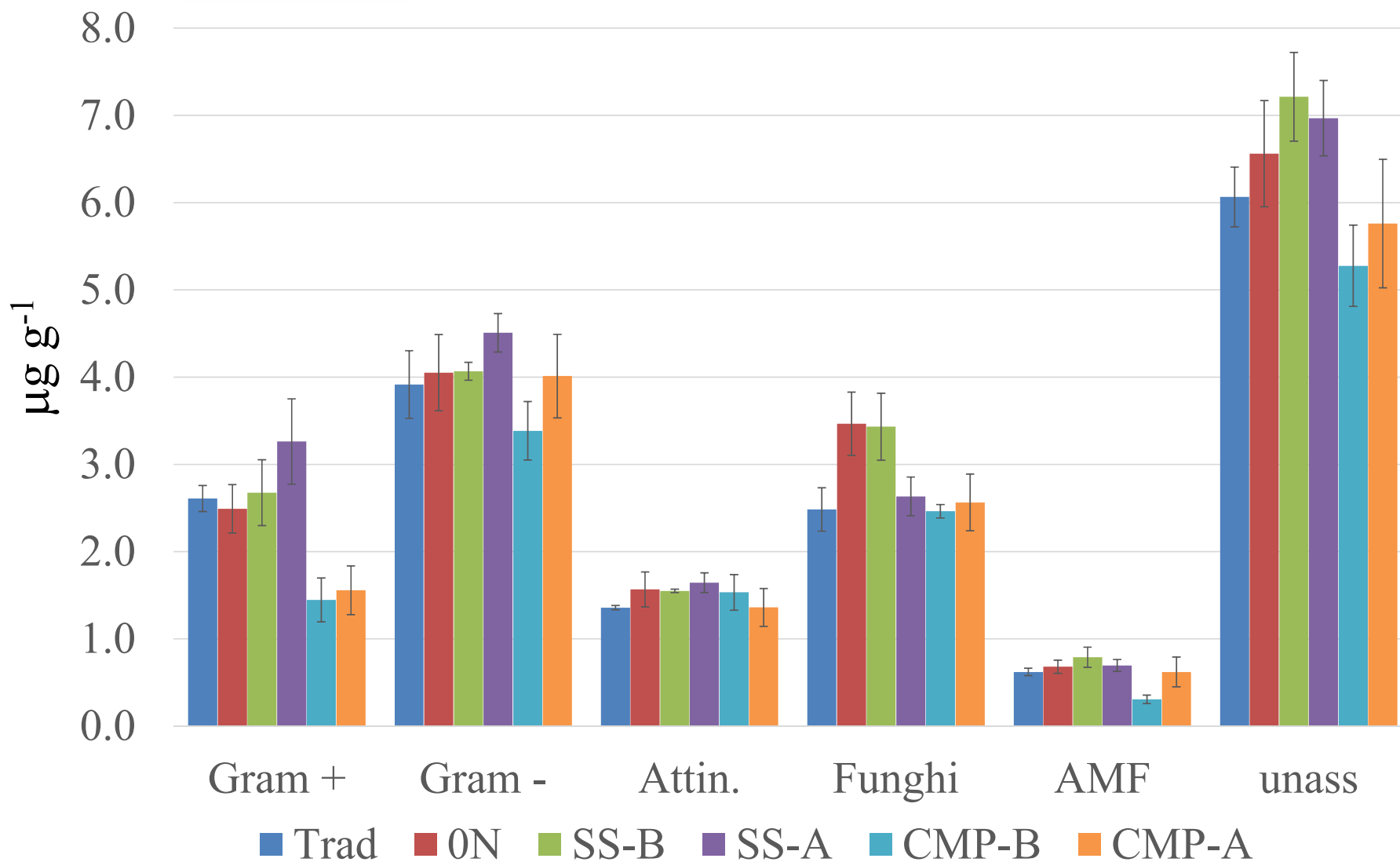
## Castel Volturno



## Tetto Frati



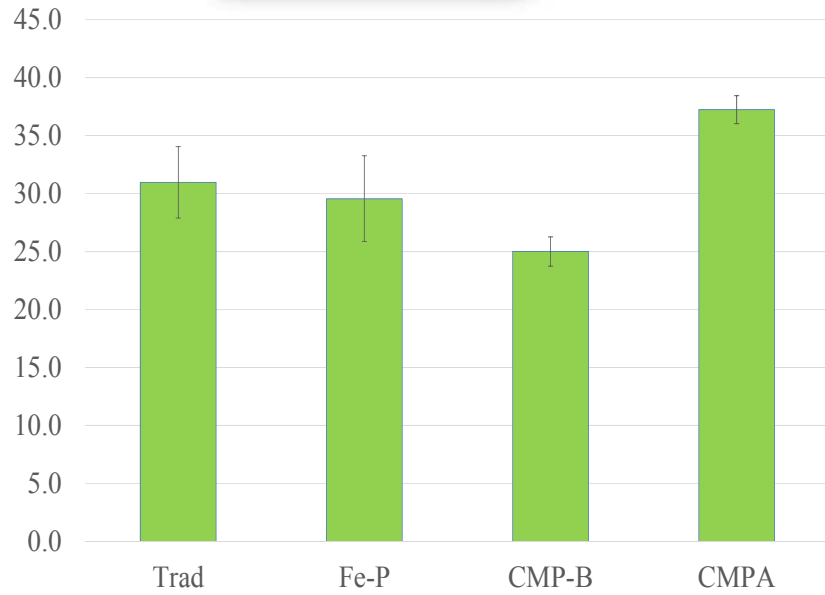
## Grandi



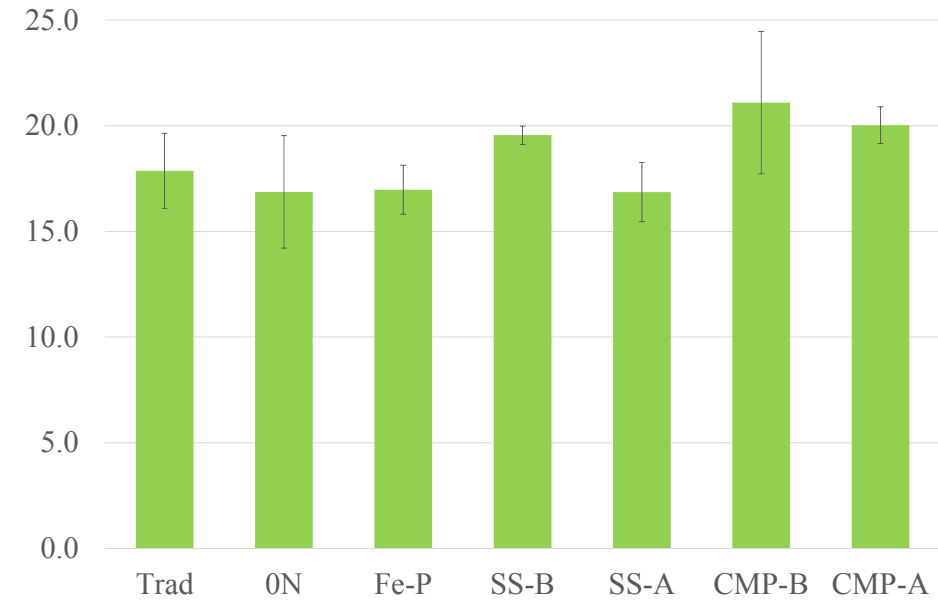


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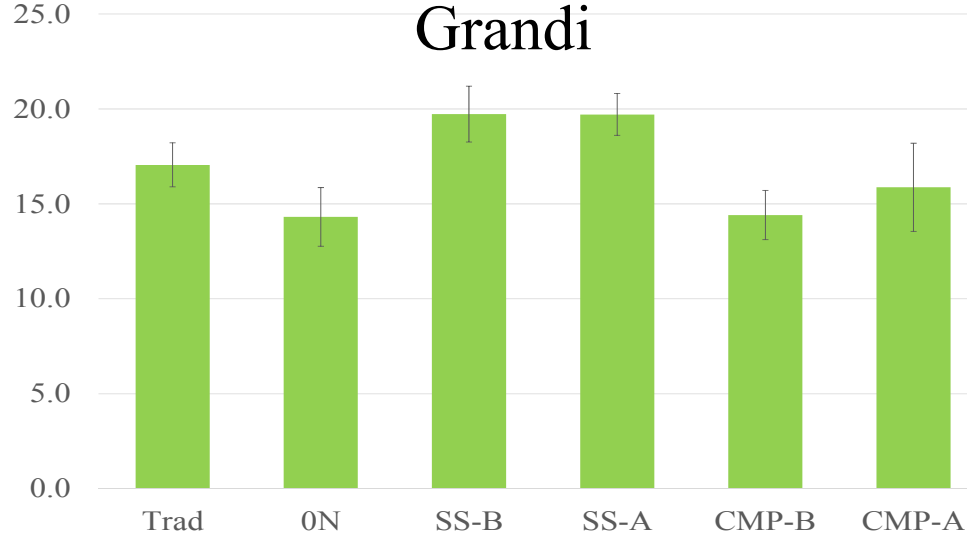
## Castel Volturno



## Tetto Frati



## Grandi



## Analisi/elaborazioni in corso

### Azione C.2

- Stabilità aggregati: Prima Luce (I ciclo); Torino, Grugliasco , Castel Volturno (II ciclo)
- TOC totN Prima Luce, Castel Volturno, Torino, Grugliasco ,
  - elaborazione dati GHG
  - analisi PLFA (Prima Luce,)
    - rese produttive e colturali
    - SOM pirolisi



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## Azioni di comunicazione e divulgazione (D3) Giornata dimostrativa azienda Università di Napoli Castel-Volturno 15 settembre 2015



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**Giornata dimostrativa  
"LIFE CarbOnFarm"**

**Il Compost ricco di sostanza organica umificata idrofobica è capace di sequestrare efficacemente il carbonio labile nel suolo e ridurre la sua mineralizzazione a CO<sub>2</sub>.  
La foto-polimerizzazione catalizzata *in situ* della sostanza organica del suolo impedisce la sua mineralizzazione e diminuisce l'emissione di CO<sub>2</sub>.  
Ambedue queste tecnologie innovative di sequestro di carbonio organico nei suoli agrari sono applicate in campo nel progetto LIFE CarbOnFarm.**

**Tecnologie per stabilizzare il carbonio organico e migliorare la produttività dei suoli agrari, promuovere il valore delle biomasse e mitigare i cambiamenti climatici**

**PROGRAMMA**

**Ore 10.30-Saluti**  
Prof. Gaetano Manfredi – Rettore Università di Napoli Federico II  
Prof. Matteo Lorito – Direttore Eletto Dipartimento di Agraria  
Rappresentante Regione Campania-Settore Ambiente  
Sindaco di Castel Volturno  
Sindaco di Canello Amone

**Ore 10.50**  
Prof. Alessandro Piccolo - Direttore del CERMANU  
Dott. Vincenzo Di Meo – Responsabile Azienda Pilota CastelVolturno

**Ore 11.10**  
Progetto LIFE CarbOnFarm  
Prof. Riccardo Spaccini - Coordinatore (CERMANU)

**Ore 11.30**  
Visita Azienda Sperimentale:  
Impianto compostaggio on farm;  
Sistema rilevamento emissione gas serra dal suolo agrario (climate change);  
Prove di campo

**Ore 12.15**  
Colazione

**Coordinatore**  
Centro di Ricerca Interdipartimentale sulla Risonanza Magnetica Nucleare per l'Ambiente, l'Agroalimentare e I Nuovi Materiali CERMANU

**Beneficiari Associati**

-  Centro di Ricerca Interdipartimentale sulla Risonanza Magnetica Nucleare per l'Ambiente, l'Agroalimentare e I Nuovi Materiali CERMANU
-  Dipartimento di Scienze Agrarie, Forestali e Alimentari, Università di Torino AGROSELVIT
-  Consiglio per la Ricerca e la Sperimentazione in Agricoltura, Centro di Ricerca per l'Orticoltura CRA-ORT
-  Agenzia Lucana per lo Sviluppo e l'Innovazione in Agricoltura - Regione Basilicata ALSIA
-  Regione Campania – Assessorato Agricoltura
-  Società Agricola PRIMA LUCE
-  DICEM Università degli Studi della Basilicata

Martedì 15 settembre 2015 – Azienda Sperimentale Castel Volturno (via Pagliuca Canello Amone CA) [www.carbonfarm.eu](http://www.carbonfarm.eu)



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## Azioni di comunicazione e divulgazione (D3)

Giornata dimostrativa azienda Università di Napoli Castel-Volturno 15  
settembre 2015



## Azioni di comunicazione e divulgazione (D3) Presentazione attività progettuali Convegno OrtMed Ottobre 2015



### 12.45-13.45 Pausa pranzo

**Il Sessione: Chairman MICHELE PISANTE** *Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Università degli Studi di Teramo*

### 13.45-16.30 Le innovazioni dalla ricerca nell'ambito del quadro finanziario pluriennale 2007-2013

**13.45** Innovazioni dalla ricerca presso il Volcani Centre  
**YORAM KAPULNIK** *ARO, Volcani Centre, Bet Dagan, Israele*

**14.15** Genomica ed innovazione varietale: il Laboratorio pubblico-privato GENOPOM  
**LUIGI FRUSCIANTE** *UNINA-DiA, Portici, Italia*

**14.35** Materiali innovativi: il Laboratorio pubblico-privato MAREA  
**MARIO MALINCONICO** *CNR-IPCB, Napoli, Italia*

**14.55** Tracciabilità e sostenibilità: il Laboratorio pubblico-privato M2Q  
**PAOLO MASÌ** *UNINA-DiA, Portici, Italia*

**15.15** Cibo "pronto per l'uso" ed aspetti in post-raccolta: i progetti Ofraiser e Quafety  
**GIANCARLO COLELLI** *UNIFG-SAFE, Foggia, Italia*

**15.35** Riciclaggio di biomasse agricole e gestione sostenibile della materia organica del suolo: il progetto CarbOnFarm  
**RICCARDO SPACCINI** *UNINA-CERMANU, Portici, Italia*

### 15.55-16.15 Pausa caffè

**16.15** Attuazione in Campania della Misura 124 del PSR 2007-2013 e le opportunità della Misura 16.1 del PSR Campania 2014-2020  
**EMIDDIO DE FRANCISCIS DI CASANOVA** *Regione Campania, Napoli, Italia*

**16.35-17.45 Tavola Rotonda: "Il futuro della orticoltura italiana: maggiore dialogo tra le imprese e il mondo della ricerca"**

Coordinamento e Conclusioni  
**GIANDOMENICO CONSALVO**  
*Confagricoltura, Roma, Italia*

**ANNARITA POLI, BARBARA NICOLAUS**  
*CNR-ICB, Pozzuoli, Italia*

**12.15-12.45** Discussione





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Azioni di comunicazione e  
divulgazione (D4)

Visita didattica Agraria Università degli  
Studi di Napoli (Novembre 2014)





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## Azioni di comunicazione e divulgazione (D4)

Ciclo di seminari per dottorandi e studenti presso il Dipartimento di Agraria Università degli Studi di Napoli (Novembre 2015- Febbraio 2016)



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### Seminari Progetto LIFE CarbOnFarm



*I seminari si terranno presso l'Aula della Sezione di Scienze Chimico Agrarie*

Data	Ora	Relatore	Tema del seminario
11/11	12.00	Prof. Alessandro Piccolo	The supramolecular structures of humic substances: facts and myths
18/11	12.00	Dr. Antonio Nebbioso	Potential of the bioactivity by chemical modifications of waste biomasses via Click Chemistry
25/11	12.00	Dr. Marios Drosos	Humeomics: A molecular zoom into Soil Organic Matter
2/11	12.00	Dr. Piehugi Mazzei	Weak interactions between SOM and relevant enzymes involved in nutrient cycles.
9/12	12.00	Hiarhi Monda	An insight into Dna-based fingerprinting techniques to reveal relationship between microbial community and SOM
16/12	12.00	Prof. Riccardo Spaccini	Analytical approaches for the molecular characterization of natural organic matter
13/01	12.00	Giovanni Vinci	Metabolomic approach to investigate the plant-soil interaction
20/01	12.00	Dr. Davide Savy	Plant biostimulants from integrated biorefinery wastes
27/01	12.00	Dr. Assunta Nuzzo	Oxidative polymerization of soil organic matter by TiO2 and heterogeneous biomimetic catalysis
03/02	12.00	Dr. Vincenza Cozzolino	The littlest farmhands: how soil microbes can help farmers while improving soil quality.
10/02	12.00	Dr. Filomena Sannino	Remediation of highly contaminated soils from an industrial site by employing a combined treatment with exogenous humic substances and oxidative biomimetic catalysis