

Online Resource S3

Moritz Hallama

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Interactions of cover crops and soil microorganisms increase phosphorus availability in conservation agriculture

Online Resource S3: Fitted models and ANOVA tables

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Fig 2 Characterisation of P pools

Fig. 2.1: inorganic P

```
## log(Pi) ~ Block + Block:Date + Block:Depth + Block:Date:Depth +  
##      CoverCrop * Depth * Date + (1 | mainplot) + (1 | subplot) +  
##      (1 | subplot:Depth)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0012081	0.0006041	2	3.039687	0.3070310	0.7560483
CoverCrop	0.0036770	0.0036770	1	5.104612	1.8689631	0.2287223
Depth	0.0000522	0.0000522	1	7.803092	0.0265344	0.8747413
Date	0.1078510	0.1078510	1	15.222573	54.8186728	0.0000020
Block:Date	0.0022316	0.0011158	2	15.208349	0.5671308	0.5786959
Block:Depth	0.0206901	0.0103451	2	7.798937	5.2581990	0.0358226
Depth:CoverCrop	0.0000203	0.0000203	1	7.803092	0.0103129	0.9216730
Date:CoverCrop	0.0011439	0.0011439	1	15.222573	0.5814383	0.4574028
Date:Depth	0.0093453	0.0093453	1	15.222573	4.7500668	0.0453984
Block:Date:Depth	0.0445210	0.0222605	2	15.208349	11.3145955	0.0009771
Date:Depth:CoverCrop	0.0165217	0.0165217	1	15.222573	8.3976623	0.0109113

Fig. 2.2: inorganic P

```
## enzyme_stable_MUP ~ Block + CoverCrop + Tillage + Depth + Date +  
##      (1 | Date:Depth:mainplot) + (1 | subplot:Depth) + Block:Date +  
##      Block:Depth + CoverCrop:Tillage + CoverCrop:Depth + Tillage:Depth +  
##      CoverCrop:Date + Tillage:Date + Depth:Date + Block:Depth:Date +  
##      CoverCrop:Tillage:Depth + CoverCrop:Tillage:Date + CoverCrop:Depth:Date +  
##      Tillage:Depth:Date + CoverCrop:Tillage:Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	6.418831	3.209416	2	6.938260	0.0059717	0.9940512
CoverCrop	31.097234	31.097234	1	6.733690	0.0578622	0.8170659
Tillage	603.831654	603.831654	1	6.794801	1.1235414	0.3253750
Depth	129.047287	129.047287	1	6.902529	0.2401165	0.6393114
Date	56.965004	56.965004	1	5.972420	0.1059940	0.7558555
Block:Date	2502.261581	1251.130791	2	5.471614	2.3279621	0.1855568
Block:Depth	1108.436620	554.218310	2	6.938260	1.0312265	0.4054123

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
CoverCrop:Tillage	258.554341	258.554341	1	6.761926	0.4810886	0.5110442
CoverCrop:Depth	284.023887	284.023887	1	6.733690	0.5284794	0.4917395
Tillage:Depth	4.893590	4.893590	1	6.794801	0.0091054	0.9267323
CoverCrop:Date	1069.100072	1069.100072	1	18.613769	1.9892600	0.1749114
Tillage:Date	66.049532	66.049532	1	5.212150	0.1228975	0.7396388
Depth:Date	23.539664	23.539664	1	5.972419	0.0437999	0.8411821
Block:Depth:Date	653.494419	326.747210	2	5.471614	0.6079741	0.5775212
CoverCrop:Tillage:Depth	193.081460	193.081460	1	6.761926	0.3592641	0.5684449
CoverCrop:Tillage:Date	1254.211387	1254.211387	1	18.424164	2.3336941	0.1435870
CoverCrop:Depth:Date	2358.463849	2358.463849	1	18.613769	4.3883617	0.0501110
Tillage:Depth:Date	196.803248	196.803248	1	5.212150	0.3661891	0.5704702
CoverCrop:Tillage:Depth:Date	2581.383007	2581.383007	1	18.424164	4.8031444	0.0414810

Fig. 2.2: enzyme-stable organic P

```
## enzyme_stable_MUP ~ Block + CoverCrop + Tillage + Depth + Date +
## (1 | Date:Depth:mainplot) + (1 | subplot:Depth) + Block:Date +
## Block:Depth + CoverCrop:Tillage + CoverCrop:Depth + Tillage:Depth +
## CoverCrop:Date + Tillage:Date + Depth:Date + Block:Depth:Date +
## CoverCrop:Tillage:Depth + CoverCrop:Tillage:Date + CoverCrop:Depth:Date +
## Tillage:Depth:Date + CoverCrop:Tillage:Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	6.418831	3.209416	2	6.938260	0.0059717	0.9940512
CoverCrop	31.097234	31.097234	1	6.733690	0.0578622	0.8170659
Tillage	603.831654	603.831654	1	6.794801	1.1235414	0.3253750
Depth	129.047287	129.047287	1	6.902529	0.2401165	0.6393114
Date	56.965004	56.965004	1	5.972420	0.1059940	0.7558555
Block:Date	2502.261581	1251.130791	2	5.471614	2.3279621	0.1855568
Block:Depth	1108.436620	554.218310	2	6.938260	1.0312265	0.4054123
CoverCrop:Tillage	258.554341	258.554341	1	6.761926	0.4810886	0.5110442
CoverCrop:Depth	284.023887	284.023887	1	6.733690	0.5284794	0.4917395
Tillage:Depth	4.893590	4.893590	1	6.794801	0.0091054	0.9267323
CoverCrop:Date	1069.100072	1069.100072	1	18.613769	1.9892600	0.1749114
Tillage:Date	66.049532	66.049532	1	5.212150	0.1228975	0.7396388
Depth:Date	23.539664	23.539664	1	5.972419	0.0437999	0.8411821
Block:Depth:Date	653.494419	326.747210	2	5.471614	0.6079741	0.5775212
CoverCrop:Tillage:Depth	193.081460	193.081460	1	6.761926	0.3592641	0.5684449
CoverCrop:Tillage:Date	1254.211387	1254.211387	1	18.424164	2.3336941	0.1435870
CoverCrop:Depth:Date	2358.463849	2358.463849	1	18.613769	4.3883617	0.0501110
Tillage:Depth:Date	196.803248	196.803248	1	5.212150	0.3661891	0.5704702
CoverCrop:Tillage:Depth:Date	2581.383007	2581.383007	1	18.424164	4.8031444	0.0414810

Fig. 2.3: enzyme-labile organic P

```
## enzyme_labile_P ~ Block + CoverCrop + Depth + Date + (1 | Date:Depth:mainplot) +
## (1 | Analysis) + Block:Date + Block:Depth + CoverCrop:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	483.685573	241.842787	2	32.08305	1.2458403	0.3012455
CoverCrop	431.659278	431.659278	1	31.71142	2.2236700	0.1457911
Depth	33.856615	33.856615	1	32.71890	0.1744106	0.6789494
Date	6.813447	6.813447	1	17.68961	0.0350991	0.8535202
Block:Date	163.047742	81.523871	2	32.08443	0.4199659	0.6606290
Block:Depth	178.501763	89.250881	2	31.97223	0.4597712	0.6355378
CoverCrop:Date	1384.852752	1384.852752	1	32.72377	7.1339958	0.0116892

Fig. 2.4: fungal phytase-labile organic P

```
## sqrt(InsP6_F) ~ Block + CoverCrop + Tillage + Depth + Date +
## (1 | Analysis) + Block:Date + Block:Depth + CoverCrop:Tillage +
## Depth:Date + Block:Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0861057	0.0430529	2	44.45329	0.1158069	0.8909150
CoverCrop	1.3357486	1.3357486	1	42.50820	3.5929995	0.0648361
Tillage	2.5697086	2.5697086	1	42.31102	6.9122003	0.0118835
Depth	0.0438281	0.0438281	1	44.61331	0.1178922	0.7329448
Date	0.0010837	0.0010837	1	16.62303	0.0029150	0.9575864
Block:Date	0.9349659	0.4674830	2	44.27279	1.2574717	0.2943301
Block:Depth	0.3665845	0.1832923	2	43.22749	0.4930337	0.6141633
CoverCrop:Tillage	2.4049715	2.4049715	1	43.26360	6.4690777	0.0146311
Depth:Date	0.5943996	0.5943996	1	44.83031	1.5988620	0.2125990
Block:Depth:Date	0.0326374	0.0163187	2	43.23569	0.0438953	0.9570967

Fig. 2.5: phosphomonoesterase-labile organic P

```
## GP ~ Block + CoverCrop + Depth + Date + (1 | Date:Depth:mainplot) +
## (1 | Analysis) + Block:Date + Block:Depth + CoverCrop:Depth +
## CoverCrop:Date + Depth:Date + Block:Depth:Date + CoverCrop:Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	31.5148314	15.7574157	2	12.81130	0.4564168	0.6434636
CoverCrop	4.5805657	4.5805657	1	59.75048	0.1326770	0.7169583
Depth	25.6387767	25.6387767	1	19.32289	0.7426324	0.3993874
Date	23.7766256	23.7766256	1	26.09151	0.6886948	0.4141375
Block:Date	97.2071623	48.6035812	2	12.83091	1.4078127	0.2800527
Block:Depth	100.2244981	50.1122490	2	12.83352	1.4515116	0.2702147
CoverCrop:Depth	148.2638501	148.2638501	1	64.24771	4.2944929	0.0422539
CoverCrop:Date	110.4795900	110.4795900	1	59.81342	3.2000640	0.0786993
Depth:Date	0.2056223	0.2056223	1	18.75955	0.0059559	0.9393020
Block:Depth:Date	2.2821035	1.1410518	2	12.82158	0.0330508	0.9675716
CoverCrop:Depth:Date	184.4120634	184.4120634	1	64.92362	5.3415333	0.0240083

Fig. 2.6: phosphodiesterase-labile organic P

```
## DNA ~ Block + Depth + Date + (1 | Depth:mainplot) + Block:Date +
```

Block:Depth + Depth:Date + Block:Depth:Date

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	135.18795	67.59398	2	5.817160	1.8228865	0.2428701
Depth	38.57120	38.57120	1	5.986783	1.0401950	0.3472079
Date	63.36215	63.36215	1	50.666348	1.7087619	0.1970476
Block:Date	22.81976	11.40988	2	50.558507	0.3077037	0.7365000
Block:Depth	37.39766	18.69883	2	5.817160	0.5042734	0.6281133
Depth:Date	50.51295	50.51295	1	50.666347	1.3622424	0.2486130
Block:Depth:Date	324.98146	162.49073	2	50.558507	4.3820793	0.0175773

Fig. 2: Soil P pools, full figure

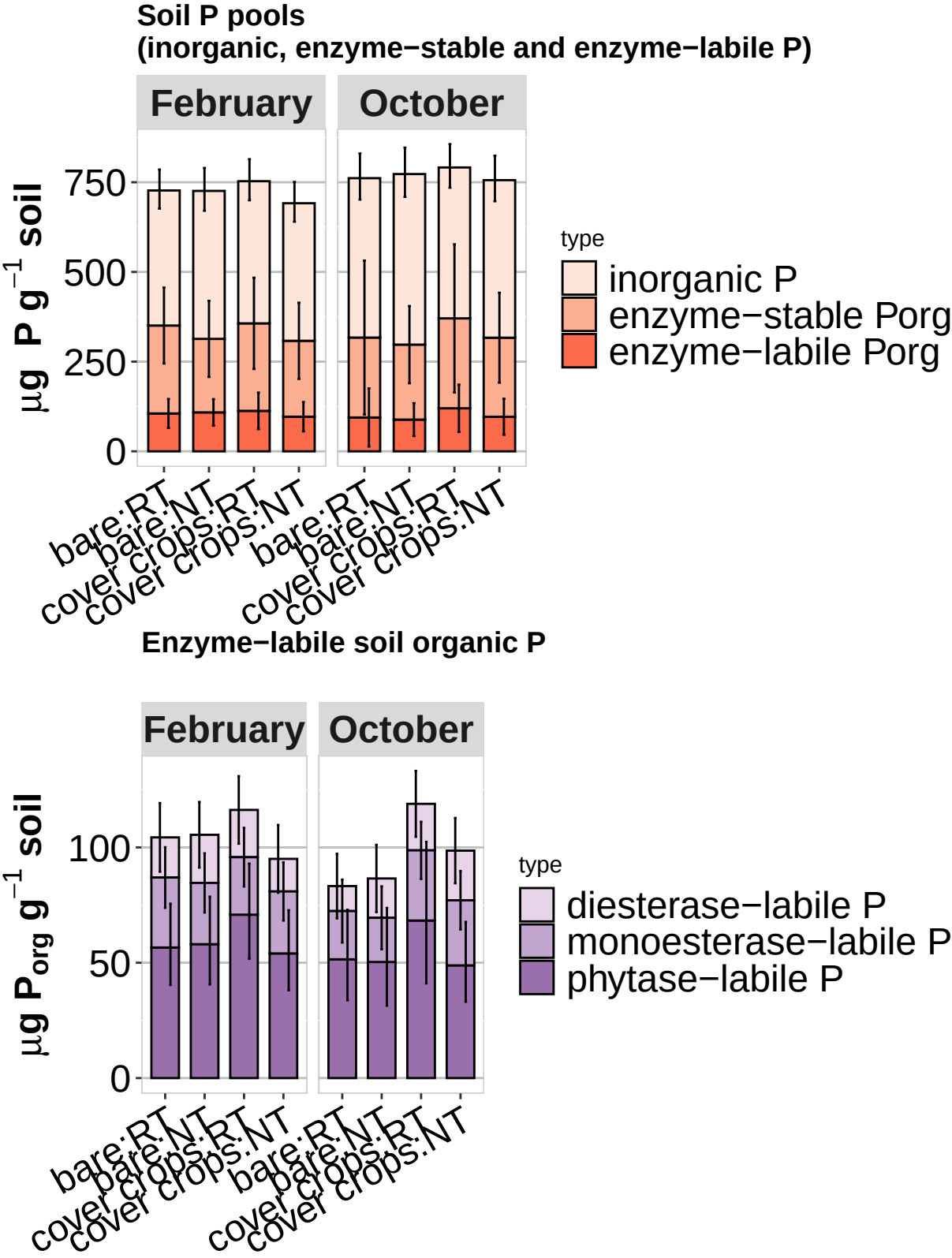
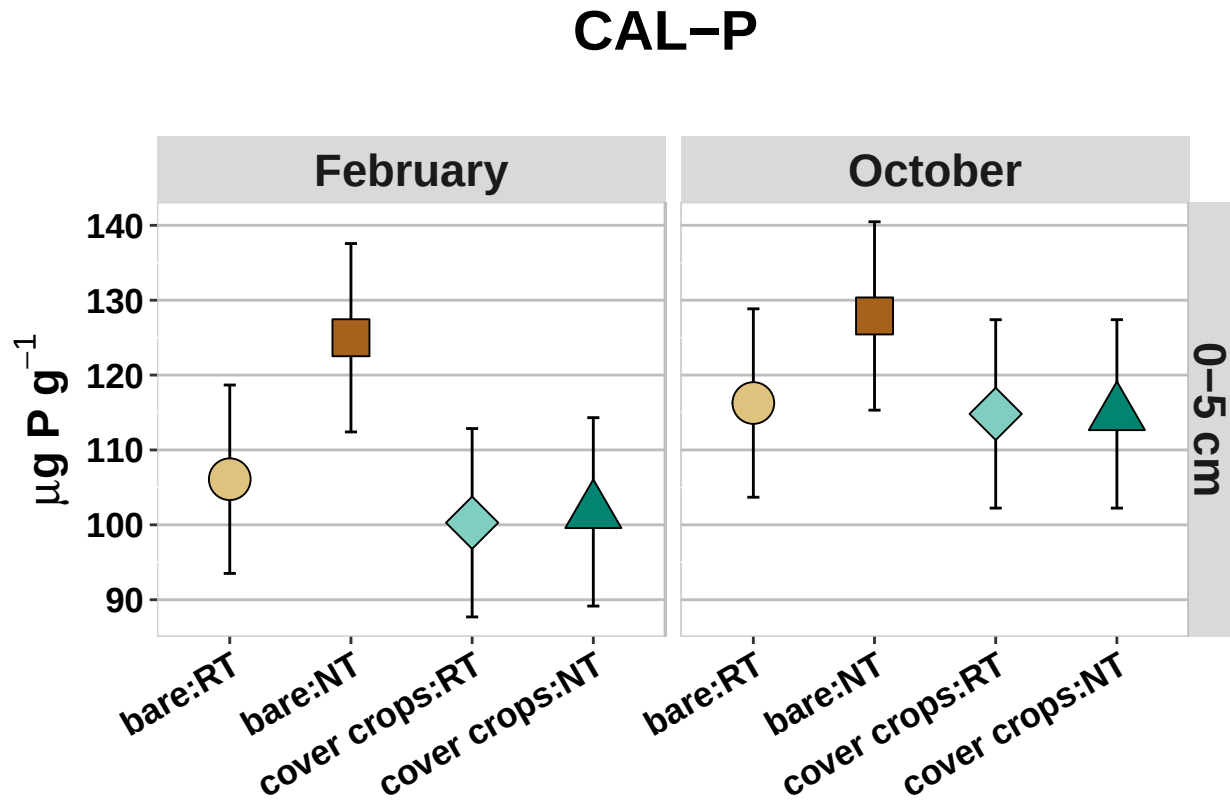


Fig 3: CAL-P

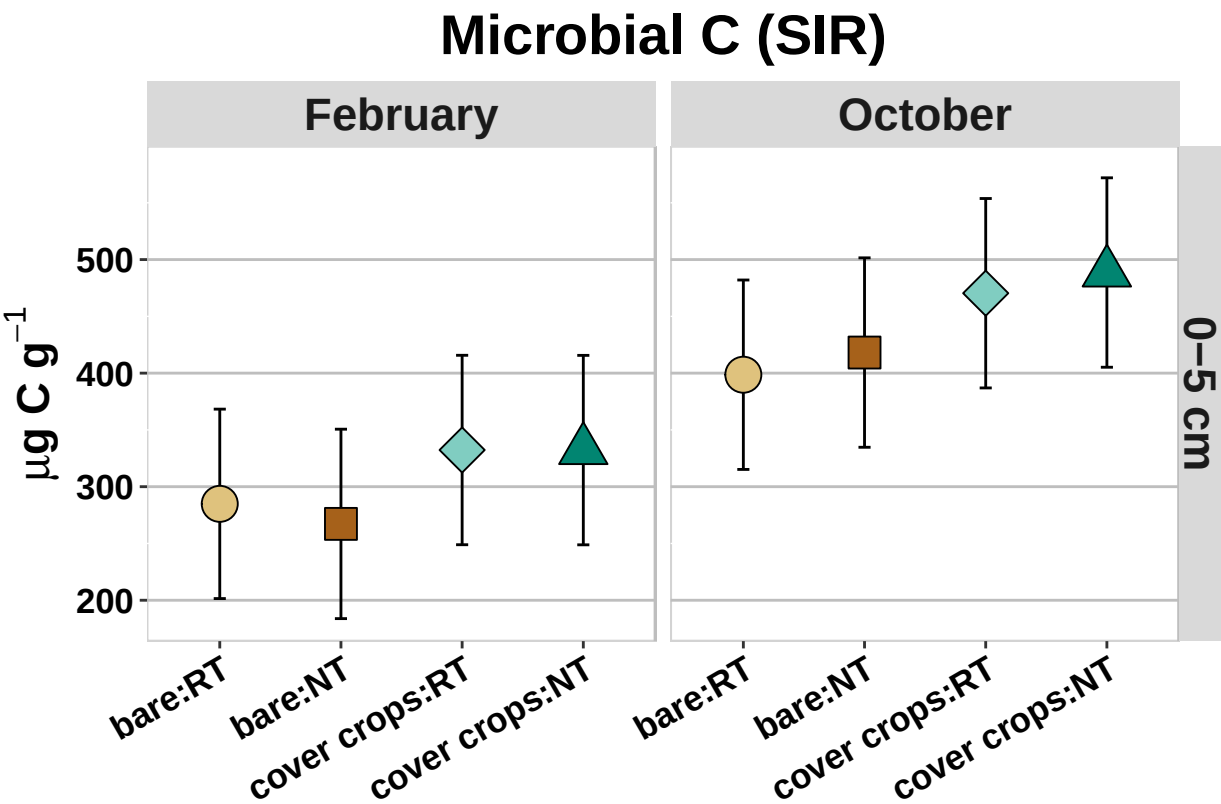


CAL_P ~ Block + CoverCrop + Tillage + Date + Block:Date + CoverCrop:Tillage

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	2	133.06720	66.53360	1.3235294	0.2955575
CoverCrop	1	712.86000	712.86000	14.1806723	0.0018698
Tillage	1	383.36027	383.36027	7.6260504	0.0145448
Date	1	620.98027	620.98027	12.3529412	0.0031279
Block:Date	2	82.37493	41.18747	0.8193277	0.4595129
CoverCrop:Tillage	1	316.82667	316.82667	6.3025210	0.0240038
Residuals	15	754.04747	50.26983	NA	NA

Fig 4: Microbial abundance

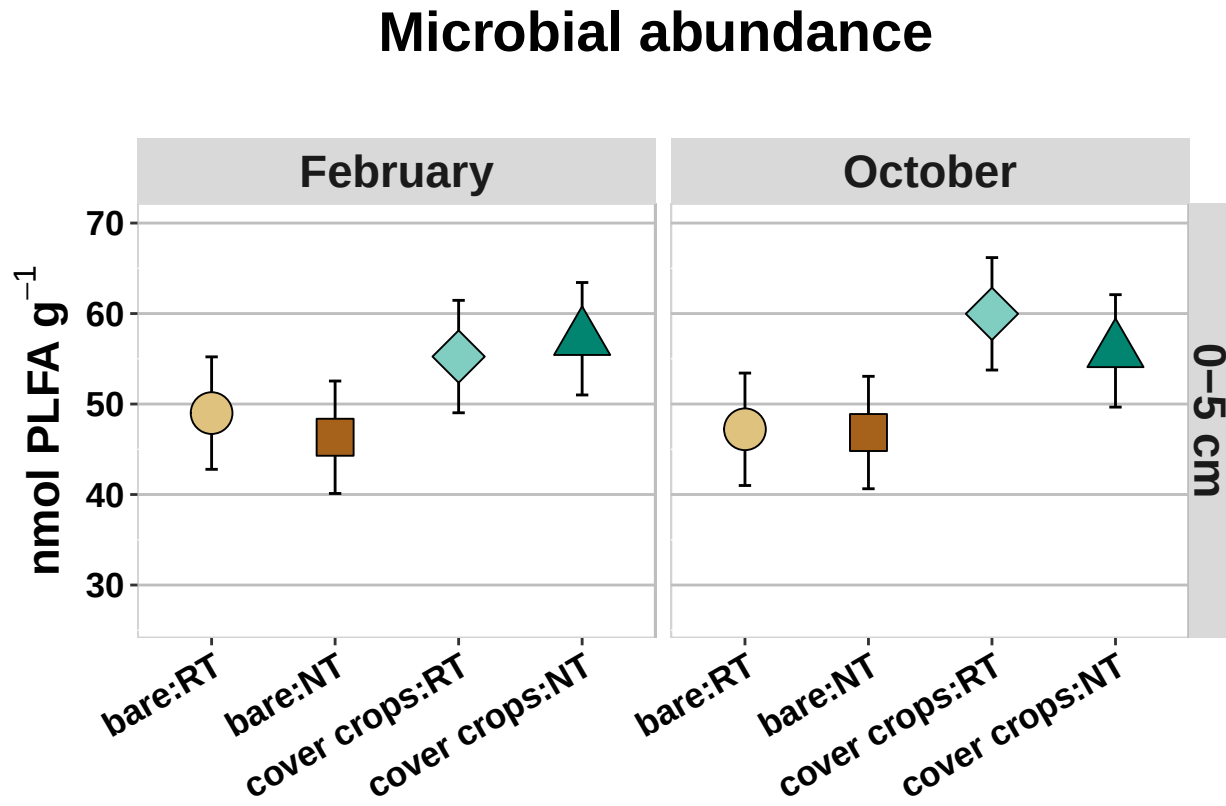
Fig. 4a: Microbial C (SIR)



```
## Cmic ~ Block + CoverCrop + Depth + Date + (1 | subplot) + (1 |  
## subplot:Date) + (1 | subplot:Depth) + Block:Date + Block:Depth +  
## Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	1460.667	730.3337	2	15.898805	0.8133138	0.4610058
CoverCrop	6942.248	6942.2483	1	15.898805	7.7310225	0.0134287
Depth	72340.481	72340.4805	1	12.780667	80.5597639	0.0000007
Date	22137.017	22137.0167	1	14.173010	24.6522117	0.0002002
Block:Date	2482.800	1241.4002	2	14.173010	1.3824474	0.2828275
Block:Depth	2404.775	1202.3873	2	12.780667	1.3390019	0.2965100
Depth:Date	60625.708	60625.7077	1	9.617662	67.5139654	0.0000119

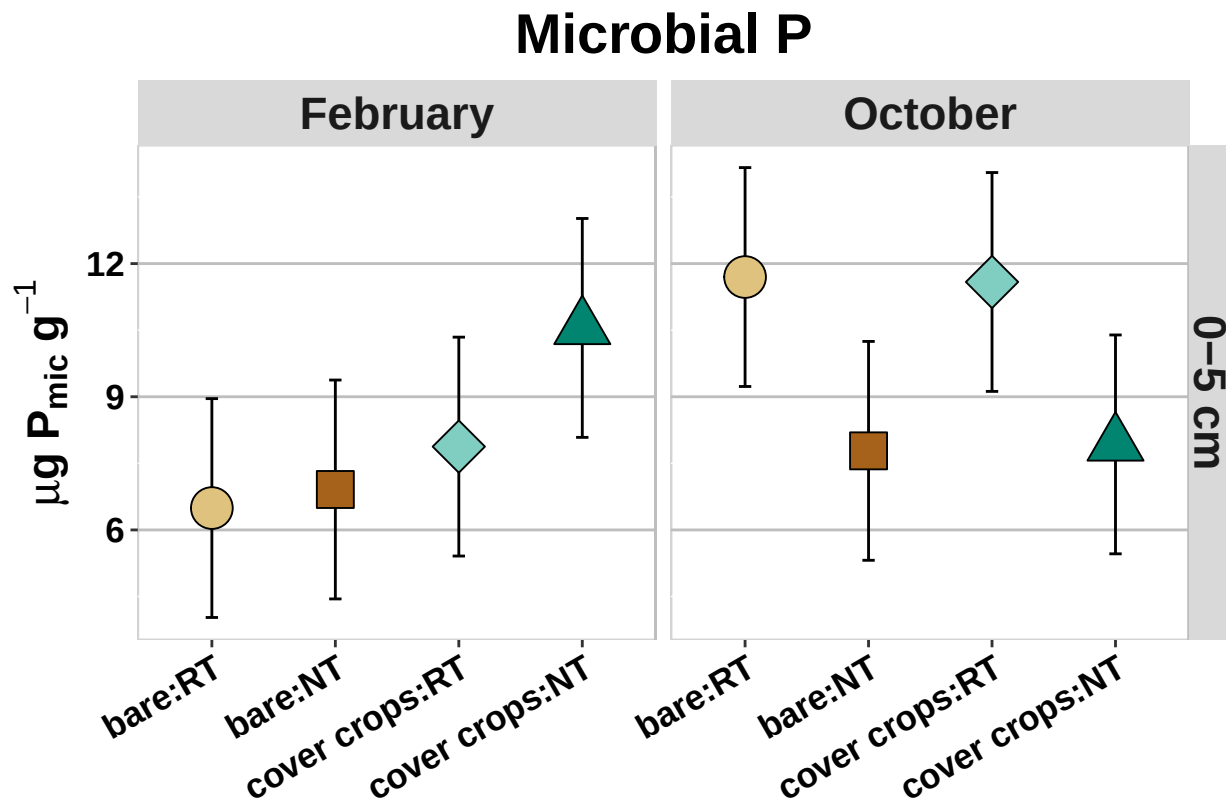
Fig. 4b Microbial PLFA



```
## Microbial ~ Block + CoverCrop + Depth + Date + (1 | Date:Depth:mainplot) +
## (1 | subplot) + Block:Date + Block:Depth + CoverCrop:Depth +
## Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	49.57901	24.78951	2	5.335885	1.937811	0.2330056
CoverCrop	335.31041	335.31041	1	7.513674	26.211416	0.0011019
Depth	2595.24887	2595.24887	1	13.609025	202.872160	0.0000000
Date	40.30338	40.30338	1	13.609025	3.150539	0.0982607
Block:Date	120.56126	60.28063	2	13.609025	4.712173	0.0278587
Block:Depth	93.83248	46.91624	2	13.609025	3.667471	0.0532081
CoverCrop:Depth	217.17521	217.17521	1	16.033573	16.976716	0.0007985
Depth:Date	65.23666	65.23666	1	13.609025	5.099589	0.0409234

Fig. 4c: P_{mic}

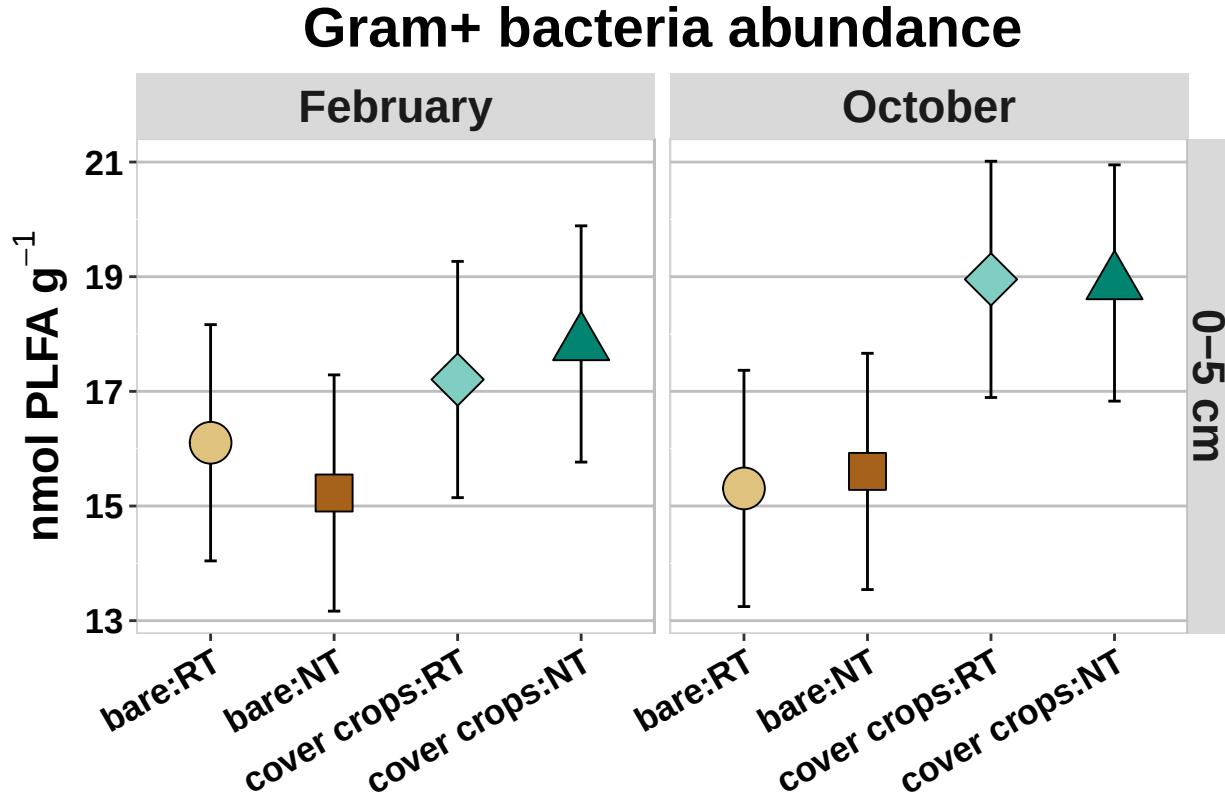


```
## Pmic ~ Block + CoverCrop + Tillage + Depth + Date + Block:Date +
## Block:Depth + CoverCrop:Depth + Tillage:Depth + CoverCrop:Date +
## Tillage:Date + Depth:Date + Block:Depth:Date + CoverCrop:Depth:Date +
## Tillage:Depth:Date
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	2	1.7909879	0.8954939	0.4231226	0.6591168
CoverCrop	1	11.4342500	11.4342500	5.4027055	0.0275823
Tillage	1	0.0363054	0.0363054	0.0171544	0.8967319
Depth	1	130.4304951	130.4304951	61.6286641	0.0000000
Date	1	14.1415797	14.1415797	6.6819241	0.0152421
Block:Date	2	5.4351430	2.7175715	1.2840578	0.2927191
Block:Depth	2	3.6936643	1.8468322	0.8726318	0.4289068
CoverCrop:Depth	1	0.9994356	0.9994356	0.4722353	0.4976135
Tillage:Depth	1	13.6317124	13.6317124	6.4410108	0.0169995
CoverCrop:Date	1	0.0025549	0.0025549	0.0012072	0.9725301
Tillage:Date	1	11.9929976	11.9929976	5.6667148	0.0243344
Depth:Date	1	5.9548073	5.9548073	2.8136581	0.1045954
Block:Depth:Date	2	6.2495430	3.1247715	1.4764606	0.2456911
CoverCrop:Depth:Date	1	18.2392510	18.2392510	8.6180818	0.0065825
Tillage:Depth:Date	1	33.3501811	33.3501811	15.7580258	0.0004558
Residuals	28	59.2590139	2.1163934	NA	NA

Fig 5: Microbial community structure

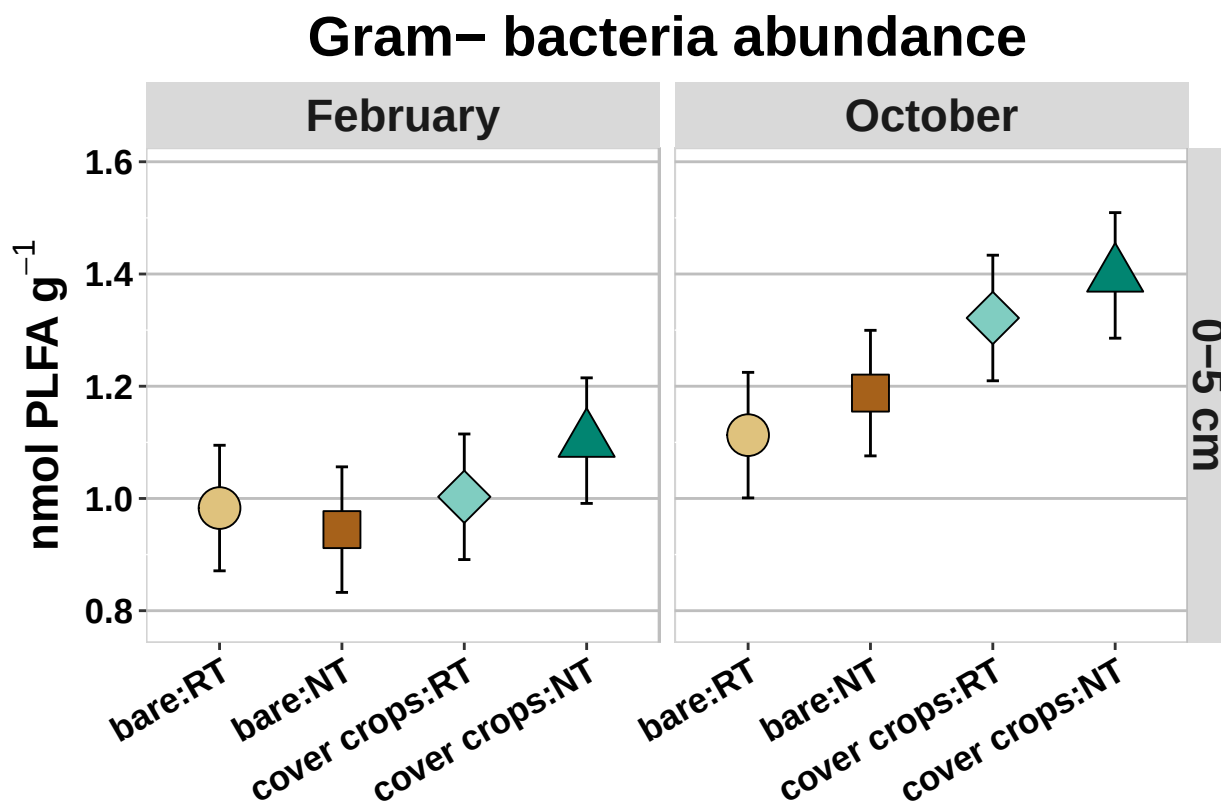
Fig. 5a: Gram+ Bacteria



```
## Gpos ~ Block + Block:Date + Block:Depth + Block:Date:Depth +
##      CoverCrop * Depth * Date + (1 | mainplot) + (1 | subplot)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	1.3651935	0.6825968	2	2.999927	0.6754795	0.5725394
CoverCrop	25.4660080	25.4660080	1	5.000042	25.2004805	0.0040350
Depth	100.8910275	100.8910275	1	23.999955	99.8390631	0.0000000
Date	0.7129711	0.7129711	1	23.999955	0.7055371	0.4092193
Block:Date	11.3117625	5.6558813	2	23.999955	5.5969088	0.0101144
Block:Depth	9.6759542	4.8379771	2	23.999955	4.7875328	0.0177964
Depth:CoverCrop	14.6633521	14.6633521	1	23.999955	14.5104611	0.0008520
Date:CoverCrop	5.1548521	5.1548521	1	23.999955	5.1011038	0.0332756
Date:Depth	8.4924170	8.4924170	1	23.999955	8.4038687	0.0078797
Block:Date:Depth	4.8731625	2.4365813	2	23.999955	2.4111757	0.1111174
Date:Depth:CoverCrop	0.2775521	0.2775521	1	23.999955	0.2746581	0.6050308

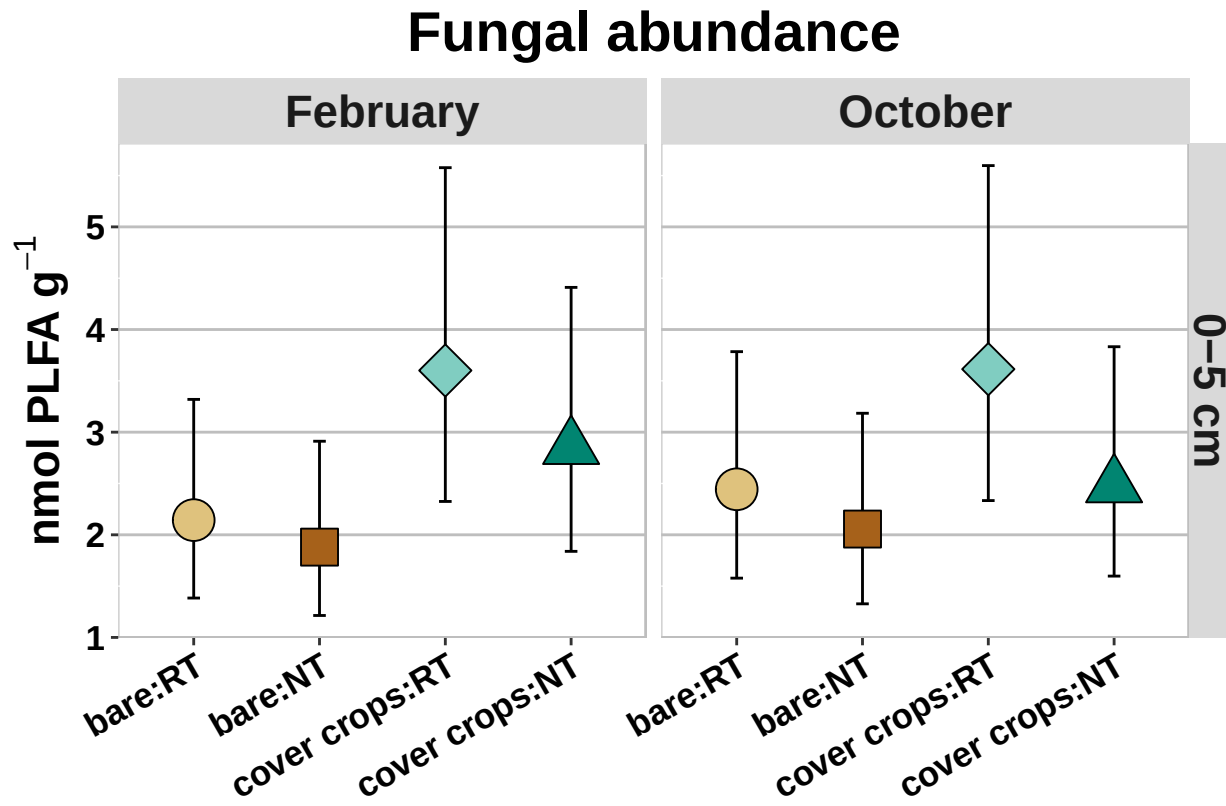
Fig. 5b: Gram- Bacteria



```
## log(Gneg) ~ Block + Block:Date + Block:Depth + Block:Date:Depth +
##   CoverCrop * Depth * Date + Tillage:Depth + Tillage:Date:Depth +
##   Tillage + (1 | Date:Depth:mainplot) + (1 | subplot)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0100129	0.0050065	2	6.102892	1.4445993	0.3064541
CoverCrop	0.1067423	0.1067423	1	5.408108	30.8000869	0.0020314
Depth	0.0742948	0.0742948	1	7.625762	21.4374976	0.0019150
Date	0.1518352	0.1518352	1	7.625762	43.8114965	0.0002056
Tillage	0.0151829	0.0151829	1	6.102892	4.3809576	0.0804696
Block:Date	0.0098611	0.0049305	2	7.625762	1.4226857	0.2984877
Block:Depth	0.0122057	0.0061029	2	7.625762	1.7609581	0.2350994
Depth:CoverCrop	0.0349731	0.0349731	1	15.521338	10.0913708	0.0060400
Date:CoverCrop	0.0285377	0.0285377	1	15.521338	8.2344445	0.0113846
Date:Depth	0.0160148	0.0160148	1	7.625762	4.6210218	0.0654682
Depth:Tillage	0.0016633	0.0016633	1	7.625762	0.4799406	0.5089923
Block:Date:Depth	0.0039936	0.0019968	2	7.625762	0.5761704	0.5847450
Date:Depth:CoverCrop	0.0015027	0.0015027	1	15.521338	0.4336040	0.5198748
Date:Depth:Tillage	0.0053217	0.0026609	2	7.625762	0.7677825	0.4968304

Fig. 5c: Fungi



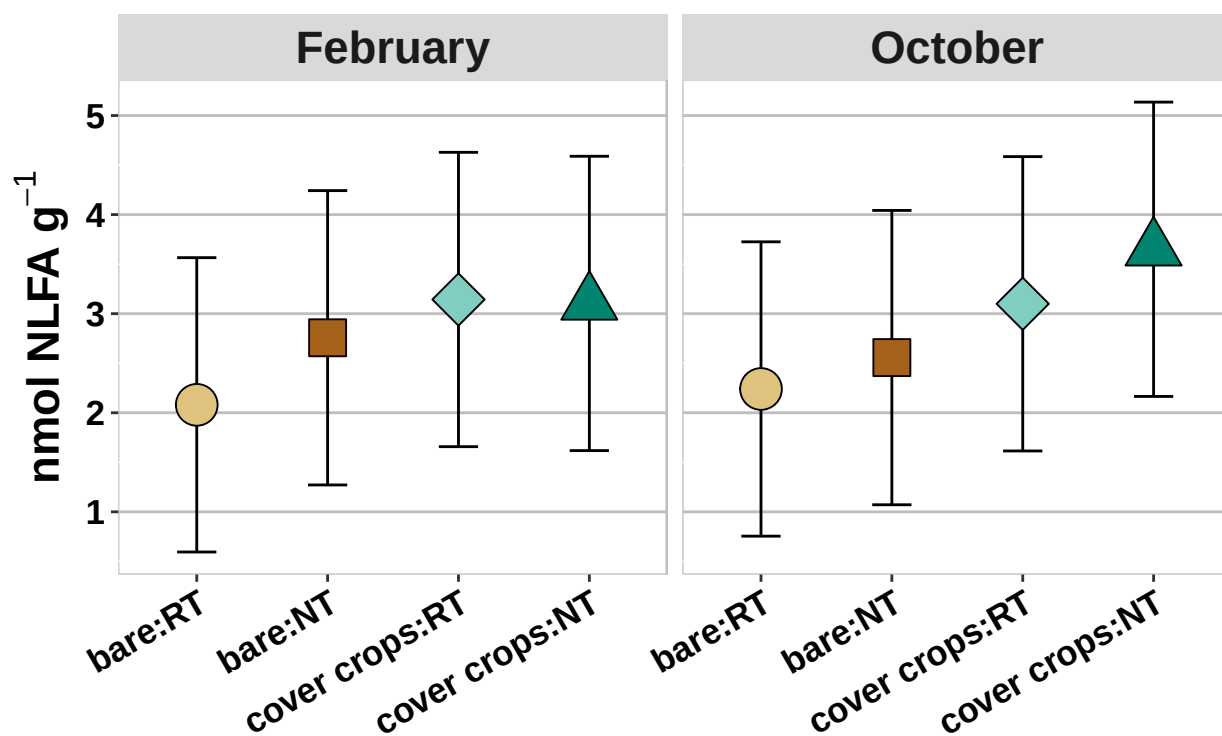
```
## log(Fungi) ~ Block + CoverCrop + Depth + Date + (1 | Depth:mainplot) +
## (1 | Date:Depth:mainplot) + (1 | subplot) + (1 | subplot:Date) +
## (1 | subplot:Depth) + Block:Date + Block:Depth + CoverCrop:Depth +
## Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0022051	0.0011025	2	8.024561	0.1274363	0.8820960
CoverCrop	0.0790233	0.0790233	1	4.687218	9.1337922	0.0318640
Depth	0.6826374	0.6826374	1	3.509002	78.9016745	0.0015838
Date	0.0336222	0.0336222	1	10.167638	3.8861763	0.0764991
Block:Date	0.0094222	0.0047111	2	10.167638	0.5445232	0.5961341
Block:Depth	0.0100467	0.0050233	2	3.509002	0.5806149	0.6055782
CoverCrop:Depth	0.0768420	0.0768420	1	5.301490	8.8816678	0.0286426
Depth:Date	0.0728333	0.0728333	1	6.891773	8.4183381	0.0233378

Fig. 5d: AMF

Heterogeneity of variance made a separate analyse for both depths necessary. 5-20 layer is in Supplementary 3.4 AMF-S

Arbuscular mycorrhiza abundance

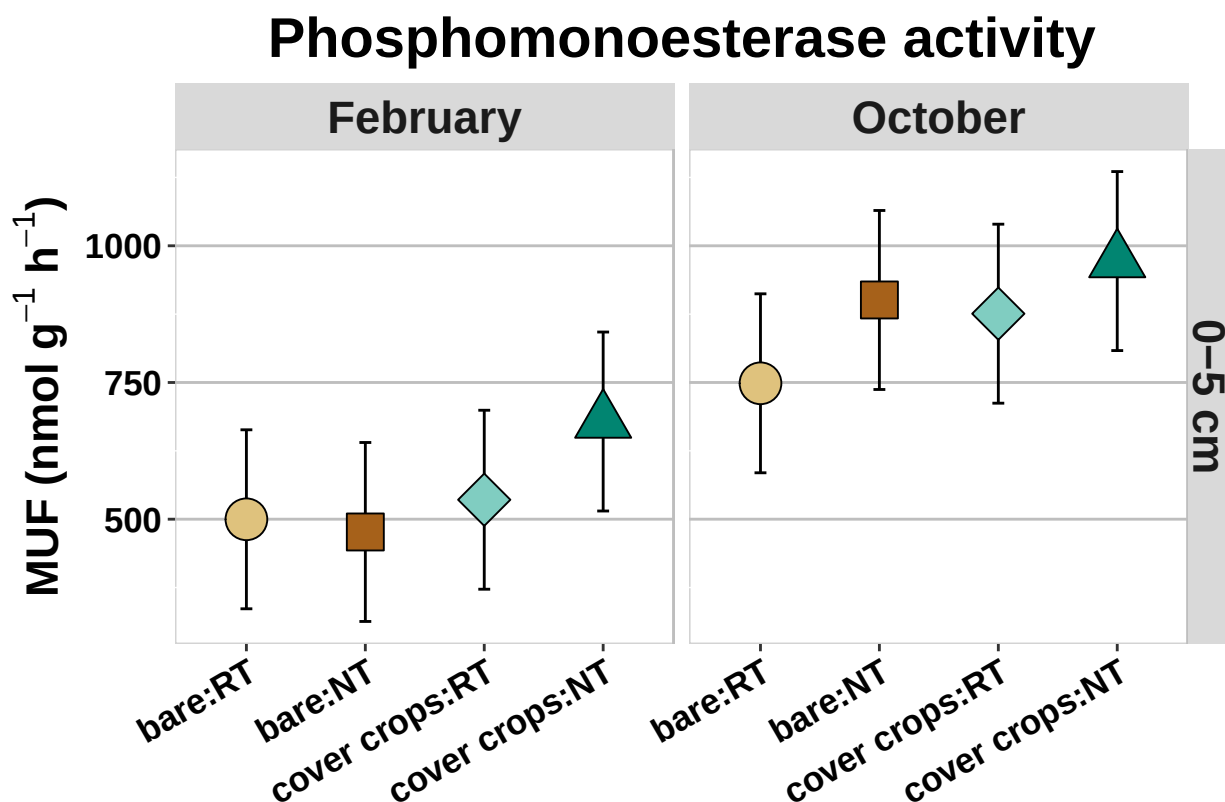


```
## AMF ~ Block + Block:Date + CoverCrop + Tillage + Date + (1 |
##      subplot) + (1 | mainplot)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.4359837	0.2179918	2	2.000000	1.0732420	0.4823364
CoverCrop	1.1876262	1.1876262	1	5.000002	5.8470553	0.0602608
Tillage	0.1591755	0.1591755	1	2.000000	0.7836706	0.4694115
Date	0.0805041	0.0805041	1	9.000000	0.3963470	0.5446302
Block:Date	0.3693083	0.1846542	2	9.000000	0.9091102	0.4369081

Fig. 6: Enzyme activity

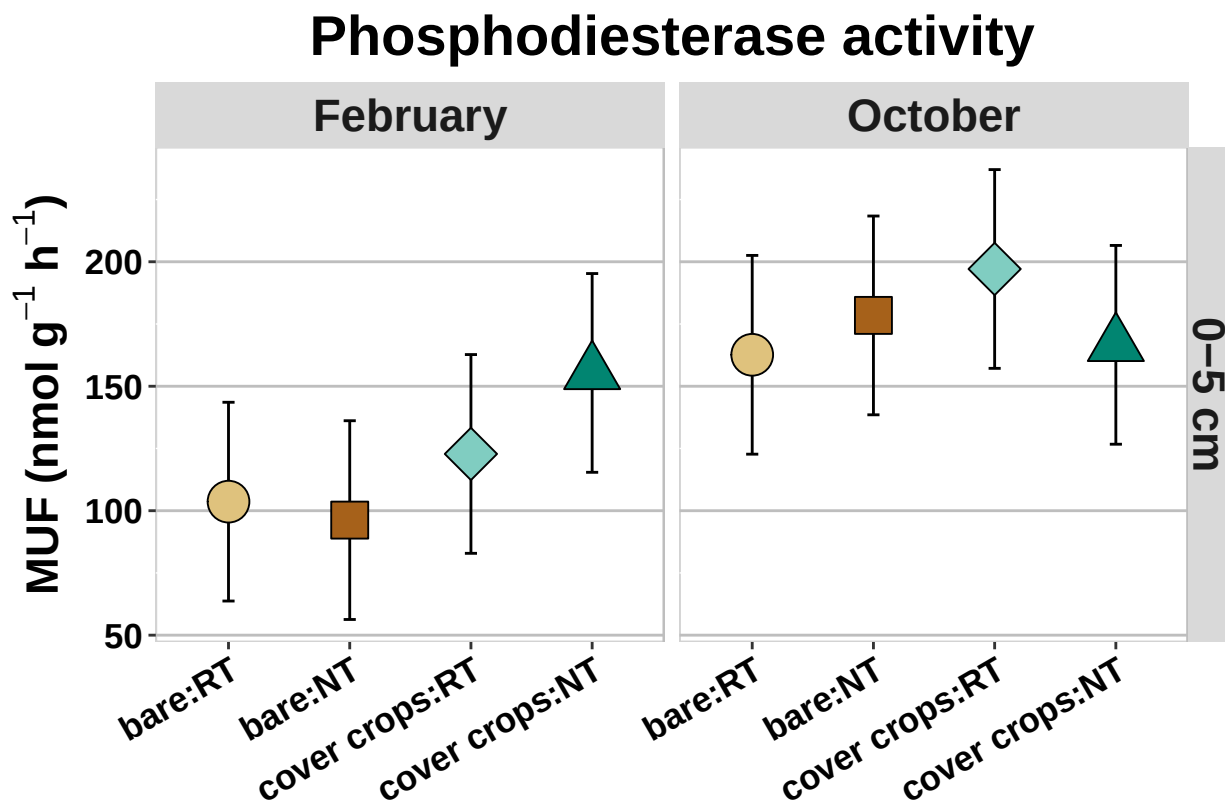
Fig. 6a: Phosphomonoesterase activity



```
## Mphos ~ Block + Block:Date + Block:Depth + Block:Date:Depth +
##      CoverCrop * Tillage * Depth * Date + (1 | mainplot) + (1 |
##      Date:Depth:mainplot) + (1 | subplot:Depth)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	2.748631e+03	1.374316e+03	2	2.003026	0.5286446	0.6540966
CoverCrop	1.746382e+04	1.746382e+04	1	8.461125	6.7176384	0.0305915
Tillage	9.377260e+03	9.377260e+03	1	2.003026	3.6070589	0.1977441
Depth	9.026639e+04	9.026639e+04	1	8.844126	34.7218882	0.0002475
Date	1.104520e+05	1.104520e+05	1	4.935219	42.4864948	0.0013347
Block:Date	8.184420e+03	4.092210e+03	2	4.935218	1.5741104	0.2959487
Block:Depth	2.177154e+03	1.088577e+03	2	8.844126	0.4187323	0.6702691
CoverCrop:Tillage	1.105565e+03	1.105565e+03	1	8.461125	0.4252669	0.5316336
Depth:CoverCrop	6.882695e+03	6.882695e+03	1	8.461125	2.6474988	0.1403032
Depth:Tillage	8.164828e+02	8.164828e+02	1	8.844126	0.3140685	0.5891065
Date:CoverCrop	1.016151e+03	1.016151e+03	1	7.991933	0.3908730	0.5492717
Date:Tillage	5.634138e+02	5.634138e+02	1	4.935218	0.2167229	0.6613681
Date:Depth	4.392141e+04	4.392141e+04	1	4.935219	16.8948210	0.0095190
Block:Date:Depth	6.502967e+03	3.251483e+03	2	4.935219	1.2507163	0.3635719
Depth:CoverCrop:Tillage	4.421948e+02	4.421948e+02	1	8.461125	0.1700947	0.6902804
Date:CoverCrop:Tillage	7.100560e+03	7.100560e+03	1	7.991933	2.7313028	0.1370385
Date:Depth:CoverCrop	4.652594e+00	4.652594e+00	1	7.991933	0.0017897	0.9672938
Date:Depth:Tillage	8.795328e+02	8.795328e+02	1	4.935219	0.3383213	0.5863529
Date:Depth:CoverCrop:Tillage	1.173773e+04	1.173773e+04	1	7.991933	4.5150396	0.0663558

Fig. 6b: Phosphodiesterase activity

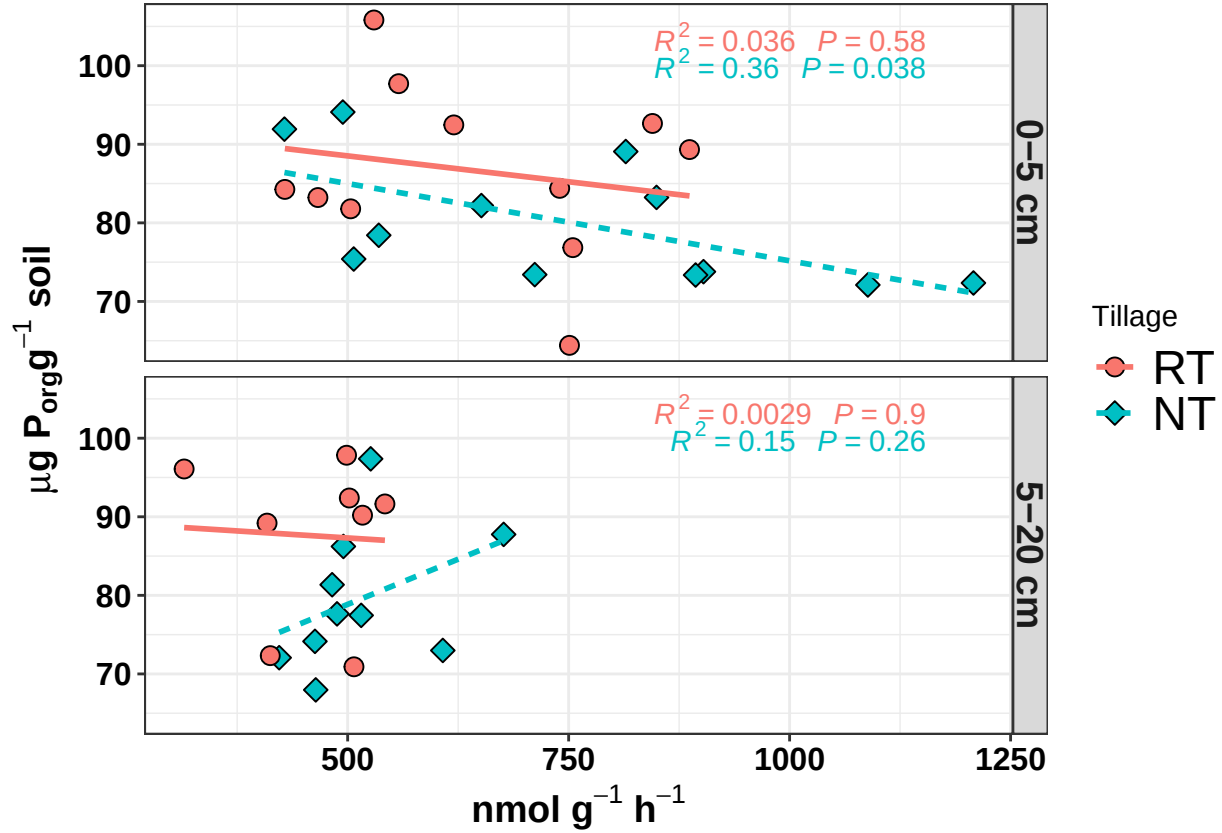


```
## Diphos ~ Block + Block:Date + Block:Depth + Block:Date:Depth +
##       CoverCrop * Tillage * Depth * Date + (1 | Depth:mainplot) +
##       (1 | subplot) + (1 | subplot:Date) + (1 | subplot:Depth)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	3.363482e+02	1.681741e+02	2	3.883832	0.7305370	0.5378929
CoverCrop	4.749757e+02	4.749757e+02	1	5.571955	2.0632624	0.2045685
Tillage	8.161069e-01	8.161069e-01	1	3.883832	0.0035451	0.9554584
Depth	3.282458e+03	3.282458e+03	1	3.401688	14.2587765	0.0260936
Date	1.762660e+04	1.762660e+04	1	5.999922	76.5687849	0.0001233
Block:Date	2.062217e+03	1.031109e+03	2	5.999922	4.4790671	0.0645397
Block:Depth	4.121775e+01	2.060888e+01	2	3.401688	0.0895236	0.9164506
CoverCrop:Tillage	1.559068e+01	1.559068e+01	1	5.571955	0.0677249	0.8040258
Depth:CoverCrop	1.039743e+03	1.039743e+03	1	2.916990	4.5165731	0.1261382
Depth:Tillage	1.356672e+01	1.356672e+01	1	3.401688	0.0589329	0.8221071
Date:CoverCrop	1.701106e+03	1.701106e+03	1	5.999922	7.3894891	0.0347187
Date:Tillage	1.086122e+02	1.086122e+02	1	5.999922	0.4718042	0.5178115
Date:Depth	3.632597e+03	3.632597e+03	1	5.999898	15.7797597	0.0073472
Block:Date:Depth	6.337302e+02	3.168651e+02	2	5.999898	1.3764409	0.3221083
Depth:CoverCrop:Tillage	4.033665e+00	4.033665e+00	1	2.916990	0.0175220	0.9032919
Date:CoverCrop:Tillage	7.423590e+02	7.423590e+02	1	5.999922	3.2247580	0.1226710
Date:Depth:CoverCrop	3.466558e+01	3.466558e+01	1	5.999898	0.1505849	0.7113714
Date:Depth:Tillage	5.646453e+02	5.646453e+02	1	5.999898	2.4527813	0.1683582
Date:Depth:CoverCrop:Tillage	2.185636e+03	2.185636e+03	1	5.999898	9.4942569	0.0216282

Fig. 7 Enzyme activity vs Enzyme-labile Porg

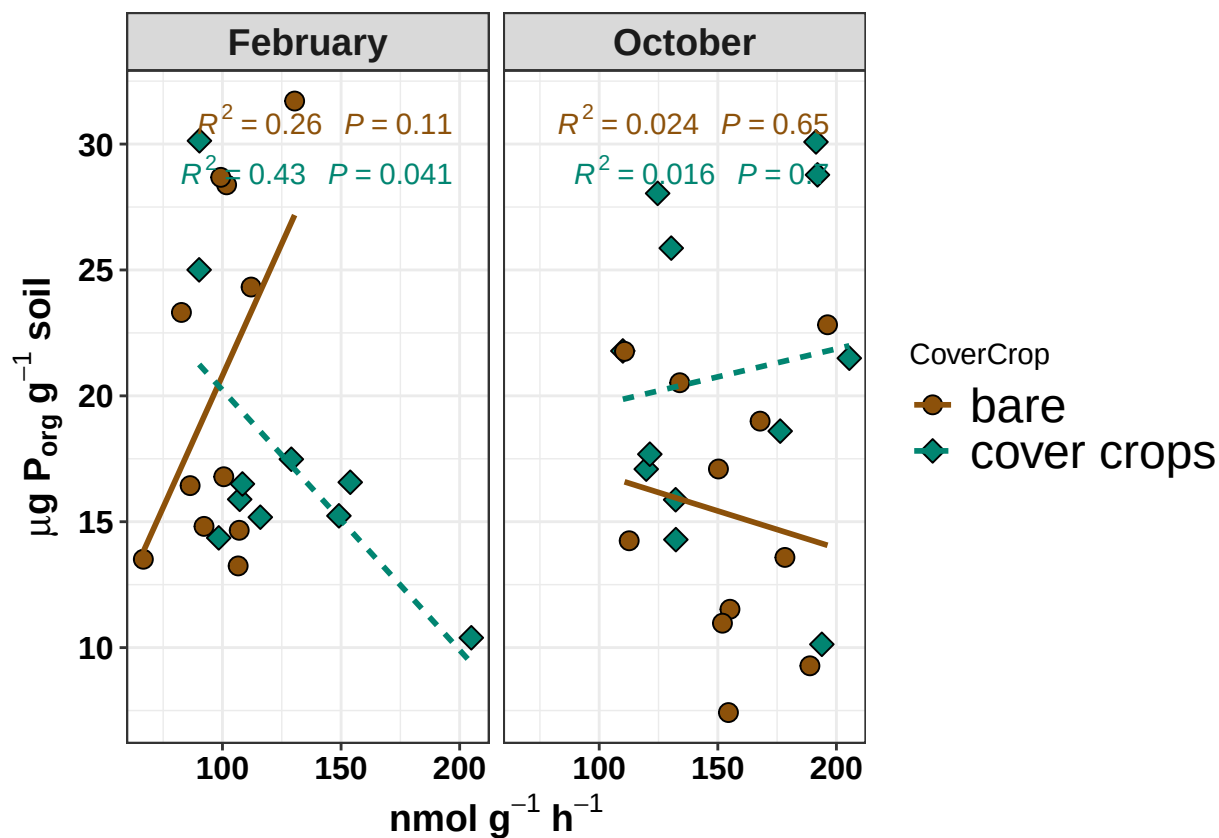
Fig. 7a: Phosphomonoesterase activity vs monoesterase-labile Porg



```
## GPPHYF ~ Block + CoverCrop + Depth + Date + Tillage + Mphos +
## (1 | Date:Depth:mainplot) + Block:Date + Block:Depth + CoverCrop:Depth +
## CoverCrop:Date + Depth:Date + Depth:Tillage + Date:Tillage +
## Tillage:Mphos + CoverCrop:Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	40.034509	20.017255	2	8.921423	0.7484273	0.5006319
CoverCrop	125.682602	125.682602	1	12.081930	4.6991601	0.0508517
Depth	10.627237	10.627237	1	20.918619	0.3973429	0.5352908
Date	38.993920	38.993920	1	20.695238	1.4579478	0.2408762
Tillage	275.161564	275.161564	1	18.093123	10.2880449	0.0048570
Mphos	67.358113	67.358113	1	14.044671	2.5184596	0.1347724
Block:Date	7.940771	3.970385	2	9.547400	0.1484492	0.8639955
Block:Depth	68.742431	34.371216	2	9.071371	1.2851090	0.3225573
CoverCrop:Depth	23.303978	23.303978	1	10.699971	0.8713149	0.3711772
CoverCrop:Date	604.993154	604.993154	1	10.402785	22.6201531	0.0006930
Depth:Date	134.217784	134.217784	1	13.146836	5.0182829	0.0429716
Depth:Tillage	166.683464	166.683464	1	16.415017	6.2321457	0.0235309
Date:Tillage	157.382772	157.382772	1	17.019953	5.8844011	0.0266808
Tillage:Mphos	367.114442	367.114442	1	16.648704	13.7260808	0.0018133
CoverCrop:Depth:Date	167.580710	167.580710	1	11.038146	6.2656929	0.0292760

Fig. 7b: Phosphodiesterase activity vs diesterase-labile Porg



```
## DNA ~ Block + CoverCrop + Diphos + Tillage + Date + Depth + Block:Date +
## Block:Depth + CoverCrop:Diphos + Diphos:Tillage + Diphos:Date +
## Date:Depth + Diphos:Depth + CoverCrop:Date + CoverCrop:Depth +
## Tillage:Depth + CoverCrop:Tillage + Block:Date:Depth + Diphos:Date:Depth +
## CoverCrop:Diphos:Date + CoverCrop:Diphos:Depth + CoverCrop:Tillage:Depth +
## CoverCrop:Date:Depth
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	2	125.2664555	62.6332277	3.2685826	0.0645306
CoverCrop	1	23.8358928	23.8358928	1.2439018	0.2811924
Diphos	1	59.3905369	59.3905369	3.0993593	0.0974218
Tillage	1	17.0082617	17.0082617	0.8875945	0.3601387
Date	1	0.3404278	0.3404278	0.0177656	0.8956279
Depth	1	12.8908347	12.8908347	0.6727221	0.4241553
Block:Date	2	24.5973913	12.2986957	0.6418207	0.5393589
Block:Depth	2	156.1282354	78.0641177	4.0738602	0.0371493
CoverCrop:Diphos	1	50.0575692	50.0575692	2.6123083	0.1255807
Diphos:Tillage	1	4.9112355	4.9112355	0.2562981	0.6195791
Diphos:Date	1	35.0988110	35.0988110	1.8316693	0.1947433
Date:Depth	1	3.9917510	3.9917510	0.2083138	0.6542268
Diphos:Depth	1	38.0168531	38.0168531	1.9839505	0.1781106
CoverCrop:Date	1	62.0778730	62.0778730	3.2396008	0.0907614
CoverCrop:Depth	1	75.2136302	75.2136302	3.9251045	0.0650253
Tillage:Depth	1	11.2529682	11.2529682	0.5872483	0.4546435
CoverCrop:Tillage	1	4.2549547	4.2549547	0.2220494	0.6438438

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block:Date:Depth	2	149.8883388	74.9441694	3.9110424	0.0414116
Diphos:Date:Depth	1	34.0989110	34.0989110	1.7794885	0.2008903
CoverCrop:Diphos:Date	1	263.5568722	263.5568722	13.7539998	0.0019073
CoverCrop:Diphos:Depth	1	0.5827282	0.5827282	0.0304103	0.8637500
CoverCrop:Tillage:Depth	1	126.4196017	126.4196017	6.5973433	0.0206156
CoverCrop:Date:Depth	1	125.6834570	125.6834570	6.5589268	0.0209306
Residuals	16	306.5951739	19.1621984	NA	NA

Fig. 8 Linear Discriminant Analysis (LDA)

Fig. 8.1: Microbial community structure 0-5 cm (February)

```
## Call:
## lda(Treat ~ cy17.OP_Gneg + cy19.OP_Gneg + i15.OP_Gpos + a15.OP_Gpos +
##      i16.OP_Gpos + i17.OP_Gpos + P15.OP_Bacteria + P16.1n7P_Bacteria +
##      P18.2n6.9P_Fungi + AMF + P16.1n5P_Microbial, data = dataTII)
##
## Prior probabilities of groups:
##      bare:RT      bare:NT cover crops:RT cover crops:NT
##      0.25        0.25        0.25        0.25
##
## Group means:
##      cy17.OP_Gneg cy19.OP_Gneg i15.OP_Gpos a15.OP_Gpos i16.OP_Gpos
## bare:RT      -0.5065104 -0.14475643  0.5287619  0.4388262  0.042219180
## bare:NT      -0.6867771 -0.46643740 -0.1647558  0.1679931 -0.002814612
## cover crops:RT -0.3811074 -0.08042024  0.9063841  0.9907124  0.659825474
## cover crops:NT  0.2615827  0.62727788  0.7756687  1.4659478  1.303165362
##      i17.OP_Gpos P15.OP_Bacteria P16.1n7P_Bacteria P18.2n6.9P_Fungi
## bare:RT      -0.6171795 -0.01501443      0.9105721  0.15951601
## bare:NT      -0.8070809 -0.08365184      0.4927222 -0.02777642
## cover crops:RT -0.2532018  0.73999701      1.3338020  1.60071539
## cover crops:NT  0.2057265  1.28909623      1.6799180  0.77853337
##      AMF P16.1n5P_Microbial
## bare:RT      -0.8564471      0.7842975
## bare:NT      -0.6775800      0.5937619
## cover crops:RT -0.5753703      1.3736283
## cover crops:NT -0.5859437      1.5198533
##
## Coefficients of linear discriminants:
##      LD1      LD2      LD3
## cy17.OP_Gneg  0.1223750  0.7749488  1.8919239
## cy19.OP_Gneg  0.0357591  3.7730563 -5.1583230
## i15.OP_Gpos   -2.0032714  2.4337384 -2.8181645
## a15.OP_Gpos   3.4443556  3.2704686 -2.9881738
## i16.OP_Gpos   15.0297311 -1.1754193  1.8155746
## i17.OP_Gpos   -7.4963139 -9.5553487  9.4081577
## P15.OP_Bacteria  2.1185116  2.1992872 -3.1541387
## P16.1n7P_Bacteria  0.3383515 -1.0534888  2.6890548
## P18.2n6.9P_Fungi -2.7116281 -2.6701675 -0.2870373
## AMF           0.3057314 -10.0982401  1.4509589
## P16.1n5P_Microbial -5.5634190  2.9107692 -2.2266956
##
## Proportion of trace:
##      LD1      LD2      LD3
## 0.8565 0.1081 0.0354
```

	LD1	LD2	LD3
cy17.OP_Gneg	0.1223750	0.7749488	1.8919239
cy19.OP_Gneg	0.0357591	3.7730563	-5.1583230
i15.OP_Gpos	-2.0032714	2.4337384	-2.8181645
a15.OP_Gpos	3.4443556	3.2704686	-2.9881738

	LD1	LD2	LD3
i16.0P_Gpos	15.0297311	-1.1754193	1.8155746
i17.0P_Gpos	-7.4963139	-9.5553487	9.4081577
P15.0P_Bacteria	2.1185116	2.1992872	-3.1541387
P16.1n7P_Bacteria	0.3383515	-1.0534888	2.6890548
P18.2n6.9P_Fungi	-2.7116281	-2.6701675	-0.2870373
AMF	0.3057314	-10.0982401	1.4509589
P16.1n5P_Microbial	-5.5634190	2.9107692	-2.2266956

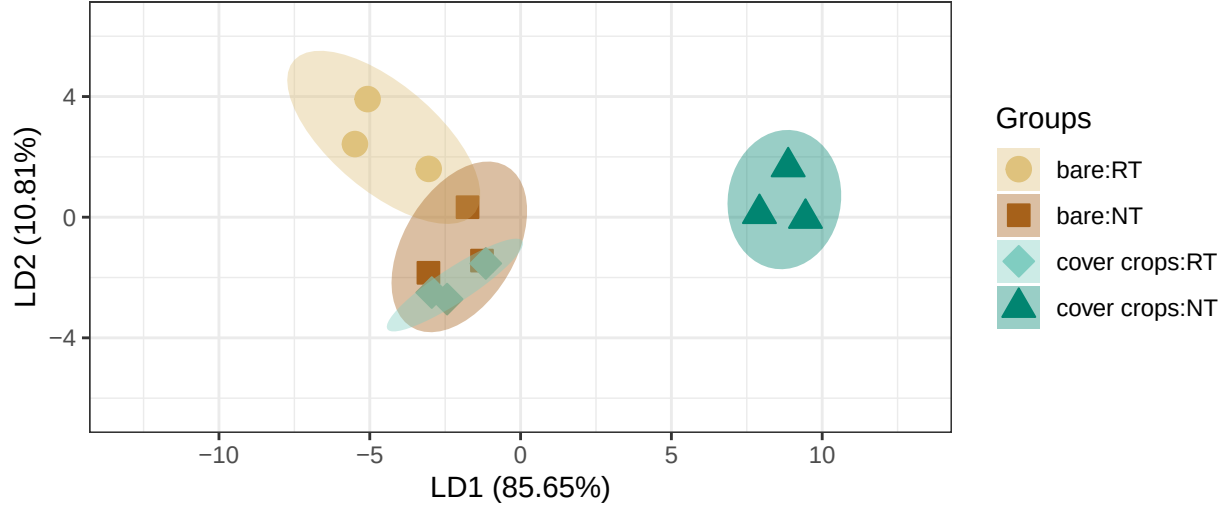


Fig. 8.2: Microbial community structure 0-5 cm (October)

```
## Call:
## lda(Treat ~ cy17.0P_Gneg + cy19.0P_Gneg + i15.0P_Gpos + a15.0P_Gpos +
##     i16.0P_Gpos + i17.0P_Gpos + P15.0P_Bacteria + P16.1n7P_Bacteria +
##     P18.2n6.9P_Fungi + AMF + P16.1n5P_Microbial, data = dataTX)
##
## Prior probabilities of groups:
##      bare:RT      bare:NT cover crops:RT cover crops:NT
##      0.25      0.25      0.25      0.25
##
## Group means:
##      cy17.0P_Gneg cy19.0P_Gneg i15.0P_Gpos a15.0P_Gpos i16.0P_Gpos
## bare:RT      0.2929335  0.4342693  0.002269364 -0.4758741  0.2609547
## bare:NT      0.7710322  1.0776312 -0.012254567 -0.2663618  0.4217897
## cover crops:RT 1.8056065  1.6566570  1.654366579  1.2359952  1.6377021
## cover crops:NT 2.4561343  2.1713465  1.454662520  1.1133538  1.8049705
##      i17.0P_Gpos P15.0P_Bacteria P16.1n7P_Bacteria P18.2n6.9P_Fungi
## bare:RT      0.1899014  0.3281726  0.150192833  0.4960075
## bare:NT      0.6171795  0.3281726  0.006725052  0.2515750
## cover crops:RT 1.6141617  1.5979645  1.190334240  1.8070545
## cover crops:NT 2.1522156  1.7695581  0.675643578  0.5341009
##      AMF P16.1n5P_Microbial
## bare:RT     -0.8141534     -0.29244990
## bare:NT     -0.7304471     -0.06203483
## cover crops:RT -0.5868248     0.70010733
```

```
## cover crops:NT -0.4414403      0.75328004
##
## Coefficients of linear discriminants:
##          LD1      LD2      LD3
## cy17.0P_Gneg      4.76397004  4.3252291  1.5186596
## cy19.0P_Gneg      2.77614199  2.3662873 -2.6753910
## i15.0P_Gpos     -11.28396841  3.9225327  0.5000590
## a15.0P_Gpos      7.24218292 -1.6575902  0.5344734
## i16.0P_Gpos      3.98415915 -1.3460715 -0.2297898
## i17.0P_Gpos      7.59904604 -7.9494555 -0.4452662
## P15.0P_Bacteria  -0.99631341 -0.5884337  1.7597082
## P16.1n7P_Bacteria -7.48850016 11.0561864 -1.5021146
## P18.2n6.9P_Fungi -0.09164074 -1.2764954 -0.6240628
## AMF              2.50486925 -5.5387965 -3.8058428
## P16.1n5P_Microbial -4.50507091 -0.2754807  0.5630644
##
## Proportion of trace:
##      LD1      LD2      LD3
## 0.8298 0.1683 0.0019
```

	LD1	LD2	LD3
cy17.0P_Gneg	4.7639700	4.3252291	1.5186596
cy19.0P_Gneg	2.7761420	2.3662873	-2.6753910
i15.0P_Gpos	-11.2839684	3.9225327	0.5000590
a15.0P_Gpos	7.2421829	-1.6575902	0.5344734
i16.0P_Gpos	3.9841591	-1.3460715	-0.2297898
i17.0P_Gpos	7.5990460	-7.9494555	-0.4452662
P15.0P_Bacteria	-0.9963134	-0.5884337	1.7597082
P16.1n7P_Bacteria	-7.4885002	11.0561864	-1.5021146
P18.2n6.9P_Fungi	-0.0916407	-1.2764954	-0.6240628
AMF	2.5048693	-5.5387965	-3.8058428
P16.1n5P_Microbial	-4.5050709	-0.2754807	0.5630644

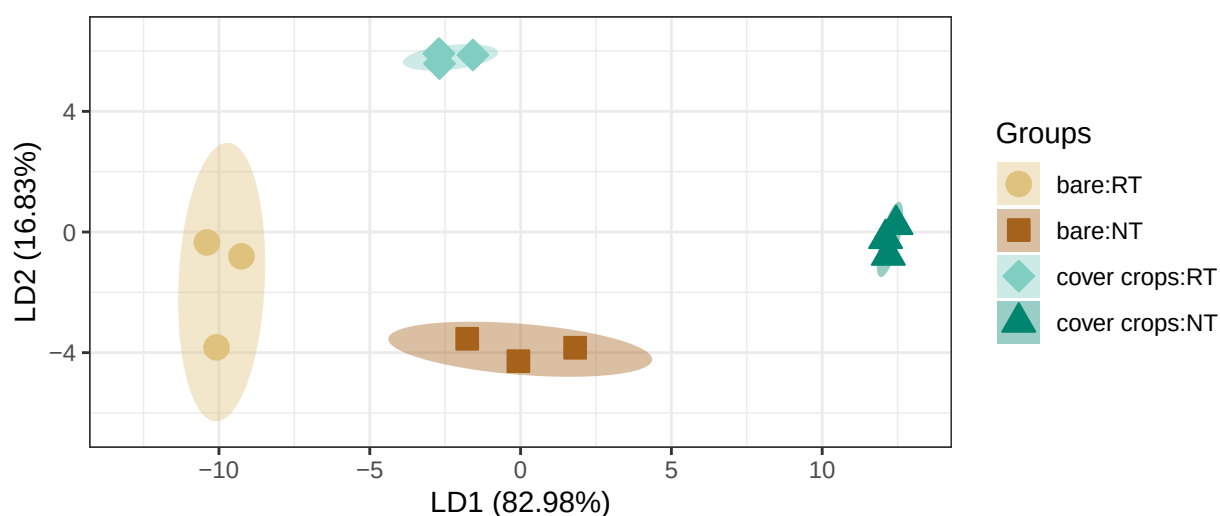


Fig. 8.3: Microbial community activity 0-5 cm (February)

```
## Call:
## lda(Treat ~ Mphos + Diphos + bGlu + biolog_carbohydrates + biolog_carboxylic_ac +
##      biolog_polymers + biolog_amines + biolog_amino_ac, data = dataTII)
##
## Prior probabilities of groups:
##      bare:RT      bare:NT cover crops:RT cover crops:NT
##      0.25        0.25        0.25        0.25
##
## Group means:
##      Mphos      Diphos      bGlu biolog_carbohydrates
## bare:RT      -0.5284887 -0.8056943 -0.4308231      -0.03627653
## bare:NT      -0.6497352 -1.0131246 -1.1028034      -0.56172459
## cover crops:RT -0.3414785 -0.2696387  0.2063230      0.80692786
## cover crops:NT  0.4063357  0.6405371  0.4259784      1.76601031
##      biolog_carboxylic_ac biolog_polymers biolog_amines
## bare:RT      0.6743729      0.1649351 -0.08910392
## bare:NT      -0.4502852      -0.6988896  0.06295127
## cover crops:RT  0.4558226      1.0916709  0.07954103
## cover crops:NT  1.4963530      1.4970415  0.78434167
##      biolog_amino_ac
## bare:RT      0.9152254
## bare:NT      -0.2202510
## cover crops:RT  0.1757784
## cover crops:NT  0.2829247
##
## Coefficients of linear discriminants:
##      LD1      LD2      LD3
## Mphos      27.993617 -17.455987  9.3097795
## Diphos     -15.069058  10.779632 -5.2157585
## bGlu       -6.213436  -4.955290 -0.9558805
## biolog_carbohydrates -0.813842  2.948645  1.4914694
## biolog_carboxylic_ac -5.331354 -3.701228 -1.0195931
## biolog_polymers      2.845468  4.389296  0.3594514
## biolog_amines       -2.448331 -2.412706 -0.4501856
## biolog_amino_ac     -3.733346 -1.542571 -0.8978747
##
## Proportion of trace:
##      LD1      LD2      LD3
## 0.7950 0.1782 0.0268
```

	LD1	LD2	LD3
Mphos	27.993617	-17.455987	9.3097795
Diphos	-15.069058	10.779632	-5.2157585
bGlu	-6.213436	-4.955290	-0.9558805
biolog_carbohydrates	-0.813842	2.948645	1.4914694
biolog_carboxylic_ac	-5.331354	-3.701228	-1.0195931
biolog_polymers	2.845468	4.389296	0.3594514
biolog_amines	-2.448331	-2.412706	-0.4501856
biolog_amino_ac	-3.733346	-1.542571	-0.8978747

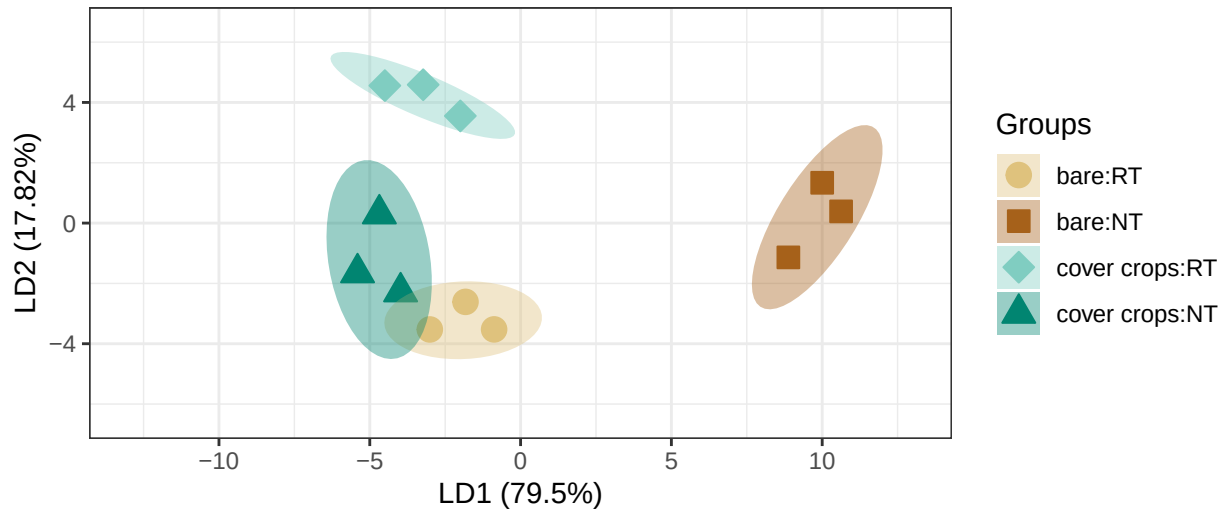


Fig. 8.4: Microbial community activity 0-5 cm (October)

```
## Call:
## lda(Treat ~ Mphos + Diphos + bGlu + biolog_carbohydrates + biolog_carboxylic_ac +
##     biolog_polymers + biolog_amines + biolog_amino_ac, data = dataTX)
##
## Prior probabilities of groups:
##      bare:RT      bare:NT cover crops:RT cover crops:NT
##      0.25      0.25      0.25      0.25
##
## Group means:
##           Mphos      Diphos      bGlu biolog_carbohydrates
## bare:RT      0.7717596 0.8443105 1.3432609      0.30800375
## bare:NT      1.5683613 1.2866928 1.2707193     -0.01922742
## cover crops:RT 1.4373673 1.8083935 1.6730589      0.82794578
## cover crops:NT 1.9403924 0.9562002 0.6777498      0.58766509
##           biolog_carboxylic_ac biolog_polymers biolog_amines
## bare:RT           -0.1965213      0.27554947      0.03399844
## bare:NT           -0.3168438     -0.08900436     -0.04451233
## cover crops:RT      0.6157197      0.72661489      0.45254647
## cover crops:NT     -0.1489155      0.20611064     -0.50300259
##           biolog_amino_ac
## bare:RT          -0.6663506
## bare:NT           0.1231668
## cover crops:RT      0.1554480
## cover crops:NT      0.3097113
##
## Coefficients of linear discriminants:
##           LD1      LD2      LD3
## Mphos      4.7281644 0.99009041 -0.48029489
## Diphos     -3.1455616 0.11837339 -2.51975685
## bGlu       -1.1818453 -2.04586840  1.20164485
## biolog_carbohydrates -0.4073519 4.60345304 -0.51170005
## biolog_carboxylic_ac -1.7952475 0.01275856 -0.05233076
## biolog_polymers     -2.5769470 0.66792290  0.07866846
## biolog_amines       -0.4863235 -1.36642950  0.14732065
```

```
## biolog_amino_ac      3.6428856 -3.50865189  0.83415266
##
## Proportion of trace:
##   LD1   LD2   LD3
## 0.8532 0.1263 0.0205
```

	LD1	LD2	LD3
Mphos	4.7281644	0.9900904	-0.4802949
Diphos	-3.1455616	0.1183734	-2.5197568
bGlu	-1.1818453	-2.0458684	1.2016449
biolog_carbohydrates	-0.4073519	4.6034530	-0.5117001
biolog_carboxylic_ac	-1.7952475	0.0127586	-0.0523308
biolog_polymers	-2.5769470	0.6679229	0.0786685
biolog_amines	-0.4863235	-1.3664295	0.1473206
biolog_amino_ac	3.6428856	-3.5086519	0.8341527

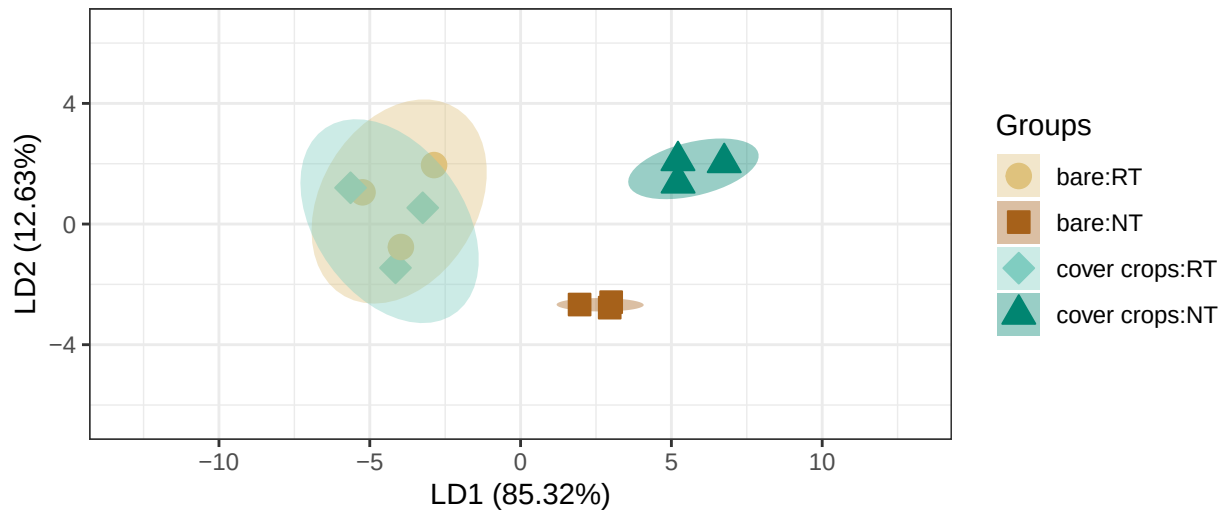
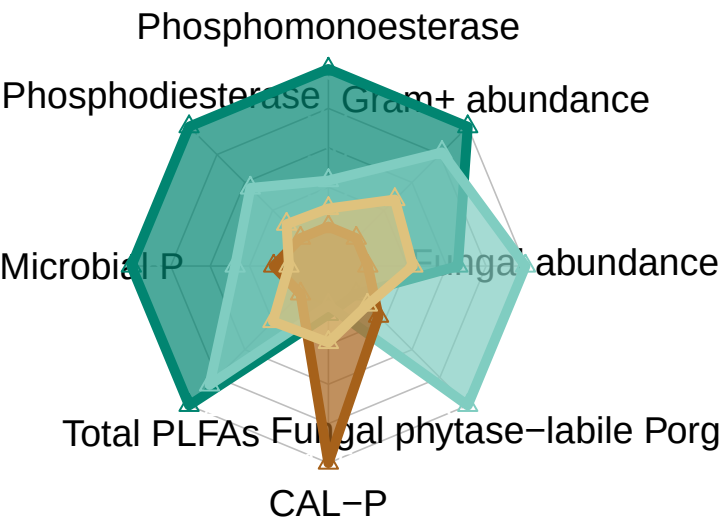
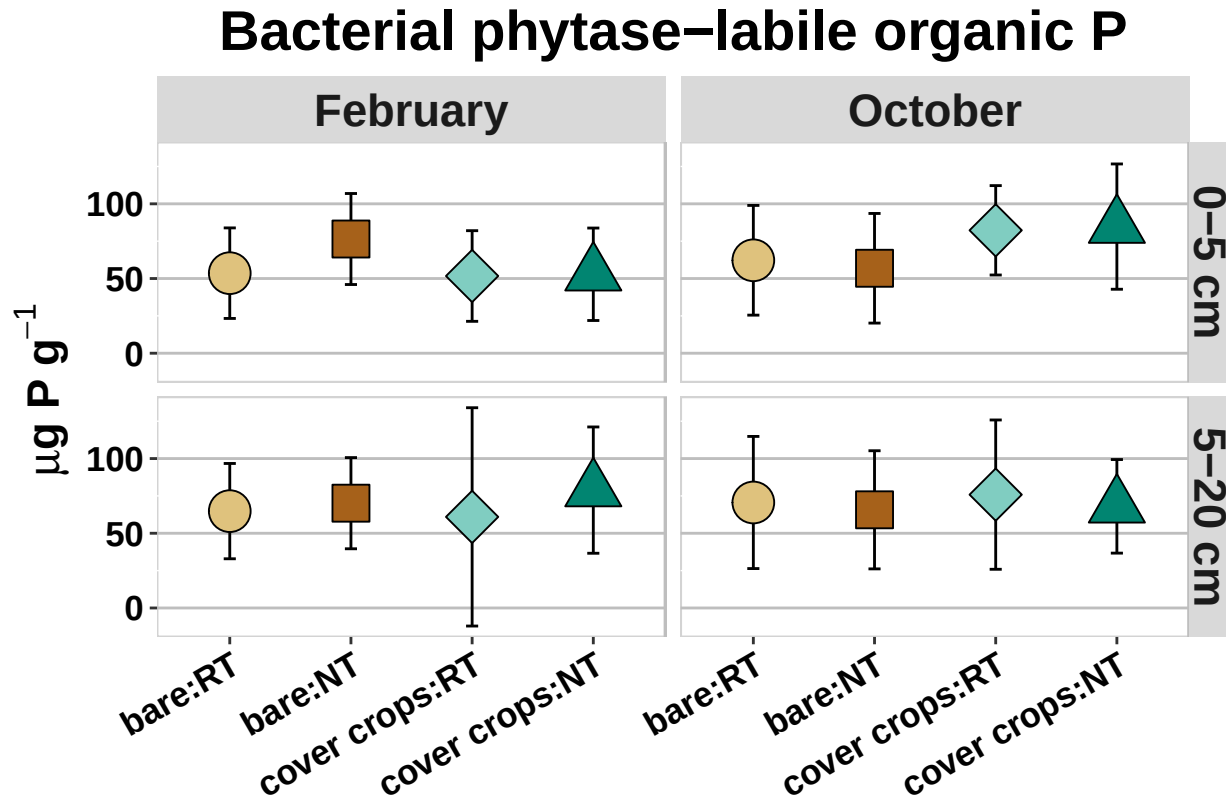


Fig. 9: Radar chart



Supplementary Figures

Fig. S5: Bacterial phytase-labile organic P



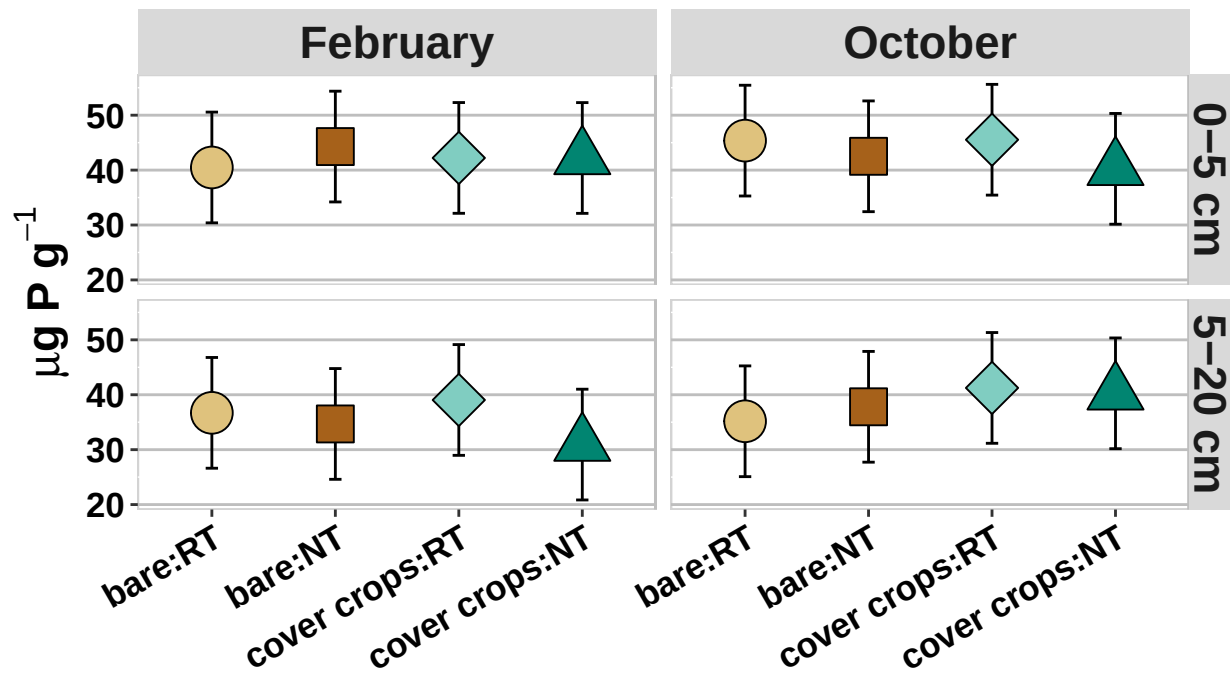
```
## InsP6_B ~ Block + CoverCrop + Depth + Date + (1 | mainplot) +
## (1 | Depth:mainplot) + (1 | Analysis) + (1 | subplot) + (1 |
## subplot:Date) + (1 | subplot:Depth) + Block:Date + Block:Depth +
## CoverCrop:Depth + CoverCrop:Date + Depth:Date + Block:Depth:Date +
## CoverCrop:Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	78.8896396	39.4448198	2	19.63841	0.3050018	0.7405511
CoverCrop	97.0512137	97.0512137	1	18.57852	0.7504355	0.3973882
Depth	123.5981419	123.5981419	1	16.65027	0.9557060	0.3422624
Date	36.3652643	36.3652643	1	20.39797	0.2811895	0.6016482
Block:Date	283.7341309	141.8670654	2	15.28507	1.0969680	0.3587795
Block:Depth	43.8992139	21.9496070	2	14.68824	0.1697224	0.8455306
CoverCrop:Depth	0.8522051	0.8522051	1	15.23624	0.0065896	0.9363586
CoverCrop:Date	322.7587527	322.7587527	1	15.33827	2.4956887	0.1345566
Depth:Date	393.7224875	393.7224875	1	49.91010	3.0444063	0.0871709
Block:Depth:Date	1327.2131572	663.6065786	2	46.96553	5.1312488	0.0096491
CoverCrop:Depth:Date	711.8687978	711.8687978	1	46.90382	5.5044299	0.0232463

Fig. S6: Resin-P

(no treatment effects)

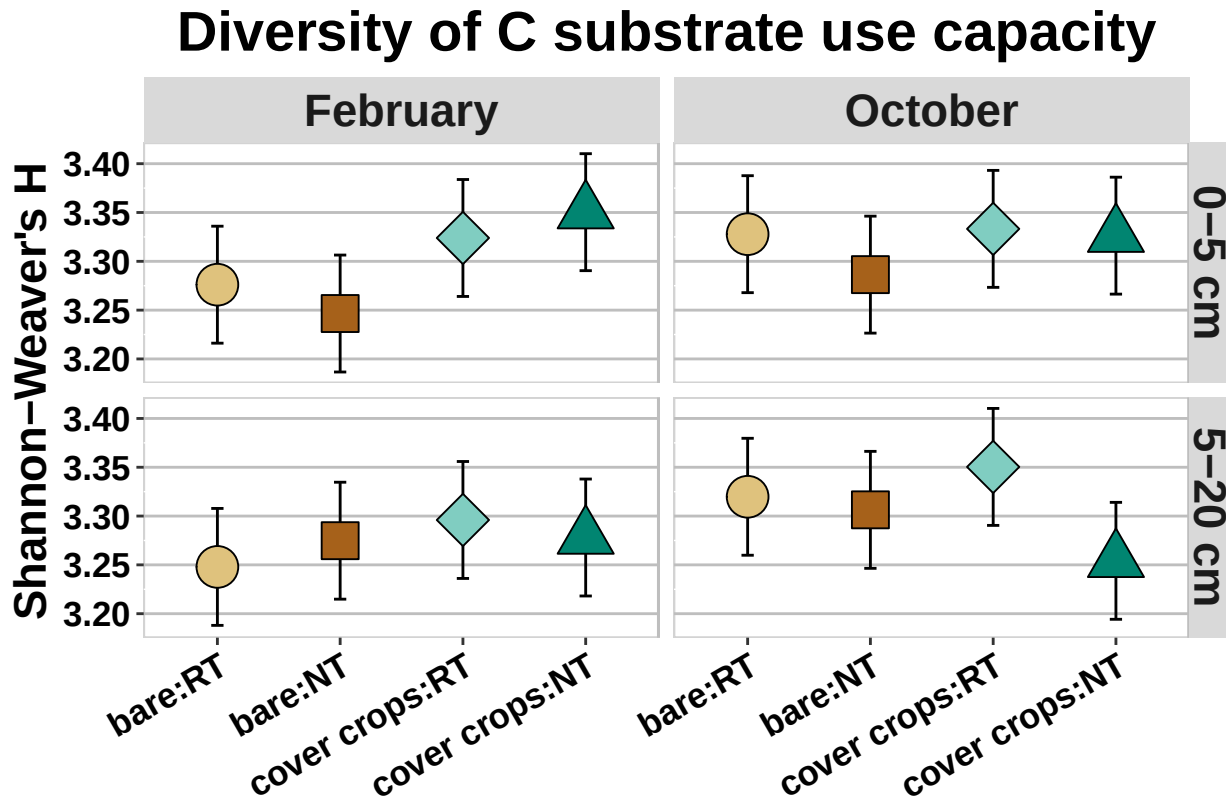
Resin-P



```
## Paqua ~ Block + Depth + Date + (1 | Depth:mainplot) + (1 | Date:Depth:mainplot) +
## (1 | subplot:Depth) + Block:Date + Block:Depth
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	43.80182	21.900912	2	15.73835	1.2513940	0.3130712
Depth	137.68239	137.682393	1	15.73835	7.8670200	0.0128666
Date	29.21391	29.213911	1	11.72564	1.6692506	0.2212428
Block:Date	26.50034	13.250172	2	11.72564	0.7571002	0.4906350
Block:Depth	10.76297	5.381485	2	15.73835	0.3074921	0.7396069

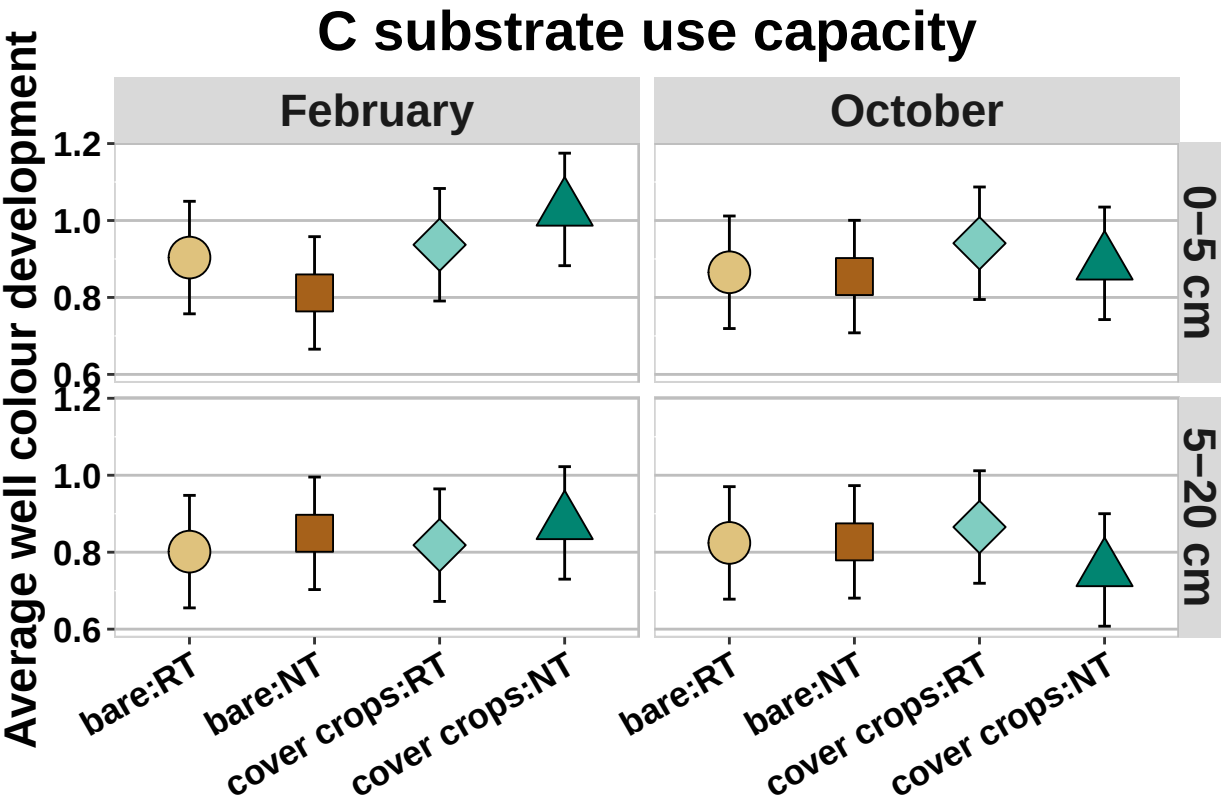
Fig. S7: Biolog Shannon-Weaver H



```
## biolog_H ~ Block + CoverCrop + Tillage + Depth + Date + (1 |
##   Date:Depth:mainplot) + (1 | subplot) + Block:Date + Block:Depth +
##   CoverCrop:Tillage + CoverCrop:Depth + Tillage:Depth + CoverCrop:Date +
##   CoverCrop:Tillage:Depth
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0009156	0.0004578	2	9.069579	0.8042449	0.4769338
CoverCrop	0.0029192	0.0029192	1	5.233916	5.1283522	0.0705655
Tillage	0.0008825	0.0008825	1	9.069579	1.5502725	0.2443037
Depth	0.0014654	0.0014654	1	11.941562	2.5743077	0.1347162
Date	0.0031764	0.0031764	1	11.941562	5.5802559	0.0359979
Block:Date	0.0010853	0.0005427	2	11.941562	0.9533496	0.4129288
Block:Depth	0.0000500	0.0000250	2	11.941562	0.0438885	0.9572143
CoverCrop:Tillage	0.0000785	0.0000785	1	5.233916	0.1379624	0.7248794
CoverCrop:Depth	0.0052506	0.0052506	1	14.708474	9.2241232	0.0084713
Tillage:Depth	0.0001731	0.0001731	1	11.941562	0.3040784	0.5915059
CoverCrop:Date	0.0060269	0.0060269	1	14.708474	10.5878838	0.0054574
CoverCrop:Tillage:Depth	0.0089167	0.0089167	1	14.708474	15.6646759	0.0013081

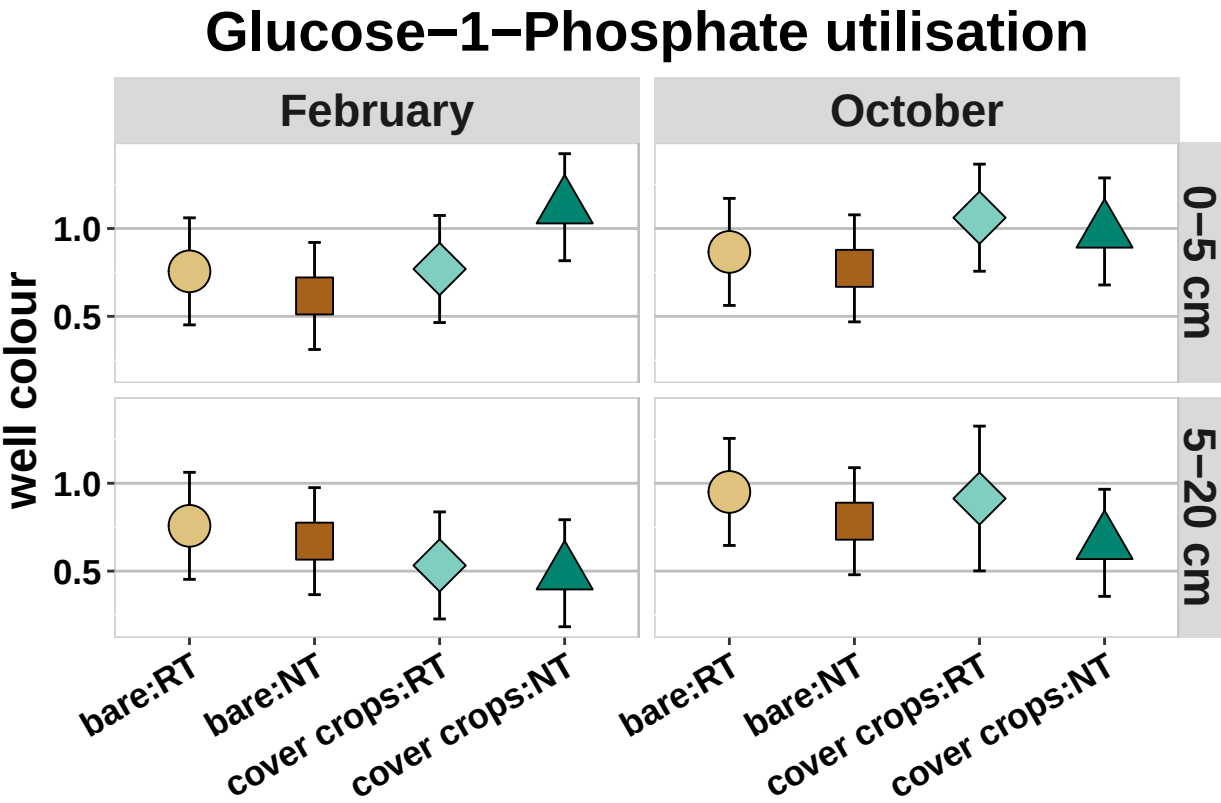
Fig. S8: Biolog average well colour development (AWCD)



```
## biolog_AWCD ~ Block + Date + Depth + (1 | subplot:Depth) + Block:Date +  
## Block:Depth + Date:Depth + Block:Date:Depth
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0093111	0.0046555	2	18	0.6356461	0.5410720
Date	0.0080035	0.0080035	1	18	1.0927641	0.3096955
Depth	0.0497905	0.0497905	1	18	6.7981739	0.0178225
Block:Date	0.0122711	0.0061356	2	18	0.8377210	0.4488819
Block:Depth	0.0029277	0.0014638	2	18	0.1998645	0.8206344
Date:Depth	0.0006096	0.0006096	1	18	0.0832280	0.7762655
Block:Date:Depth	0.0046996	0.0023498	2	18	0.3208293	0.7296114

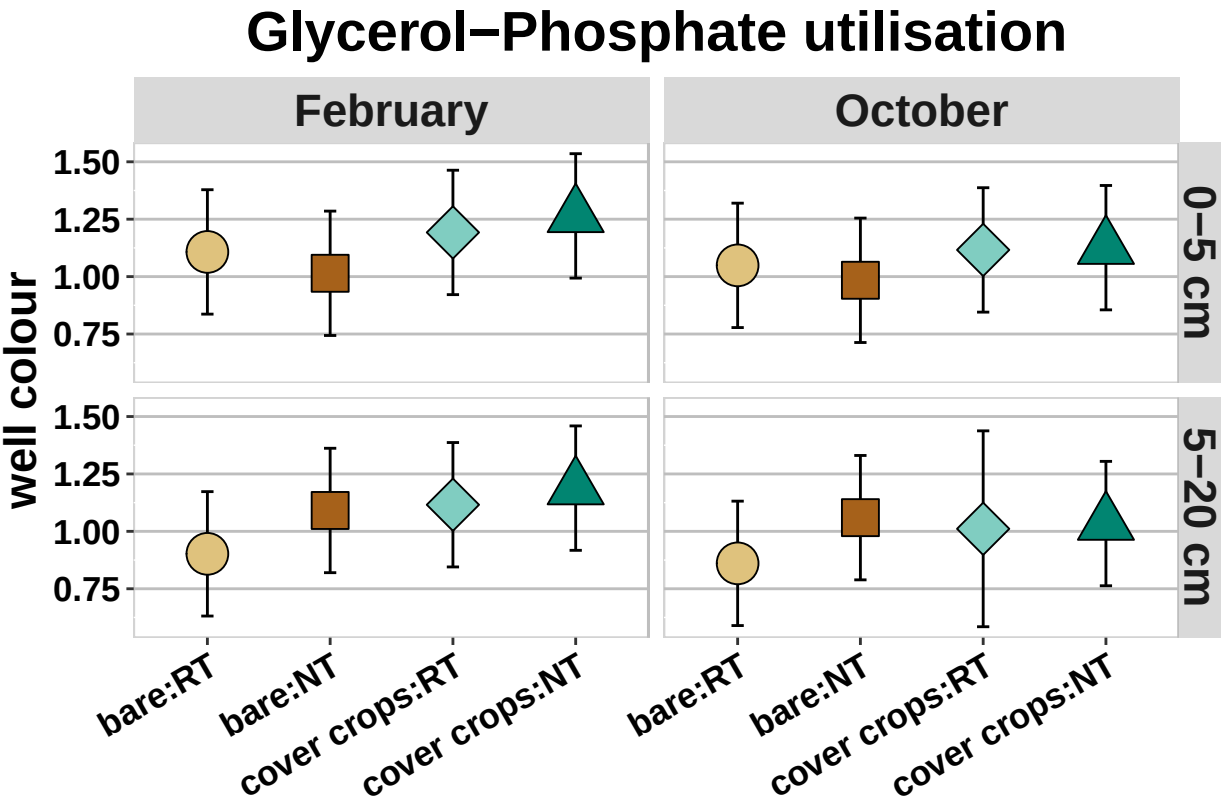
Fig. S9: Biolog Glucose-1-Phosphate utilisation



```
## Gluc_1_P ~ Block + Block:Date + Block:Depth + Block:Date:Depth +  
##   CoverCrop * Depth + Date + (1 | subplot:Date) + (1 | subplot:Depth)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0405799	0.0202900	2	21.360005	1.3998752	0.2683577
CoverCrop	0.0038418	0.0038418	1	17.333727	0.2650617	0.6131665
Depth	0.1044079	0.1044079	1	11.811475	7.2034636	0.0201297
Date	0.1261004	0.1261004	1	11.417240	8.7001060	0.0127472
Block:Date	0.0672810	0.0336405	2	17.297420	2.3209753	0.1279625
Block:Depth	0.0626681	0.0313340	2	16.932043	2.1618442	0.1458274
Depth:CoverCrop	0.1602705	0.1602705	1	11.811475	11.0576204	0.0061736
Block:Date:Depth	0.1234928	0.0411643	3	8.905686	2.8400663	0.0987397

Fig. S10: Biolog DL-a-Glycerol_Phosphate utilisation

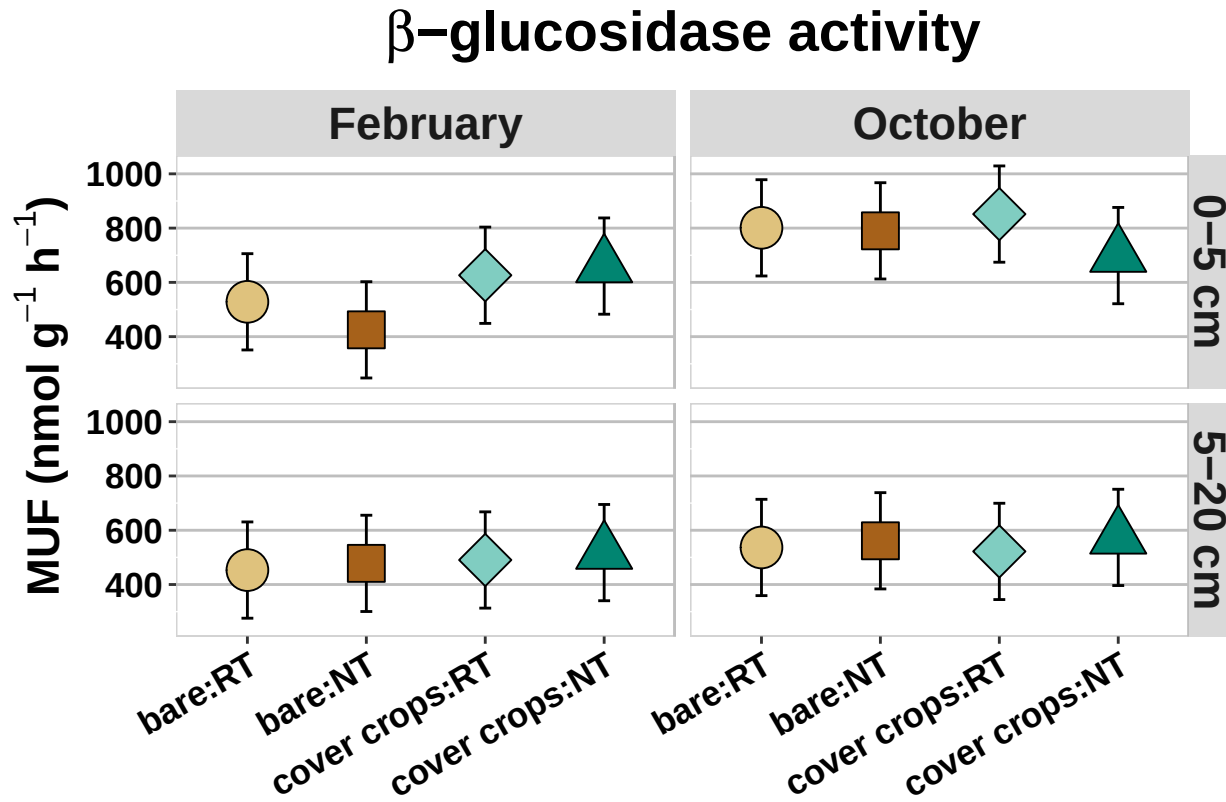


```
## Glycerol_P ~ Block + CoverCrop + Date + Depth + (1 | subplot:Depth) +  
## Block:Date + Block:Depth + Date:Depth + Block:Date:Depth
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0073186	0.0036593	2	16.43136	0.1518340	0.8603225
CoverCrop	0.1731066	0.1731066	1	16.44587	7.1826252	0.0161476
Date	0.0687654	0.0687654	1	17.38831	2.8532493	0.1090395
Depth	0.0561401	0.0561401	1	16.44587	2.3293934	0.1459527
Block:Date	0.0312289	0.0156144	2	17.37323	0.6478823	0.5353367
Block:Depth	0.0179895	0.0089947	2	16.43136	0.3732139	0.6942069
Date:Depth	0.0000100	0.0000100	1	17.38831	0.0004157	0.9839654
Block:Date:Depth	0.0657423	0.0328712	2	17.37323	1.3639059	0.2817132

Supplementary models

Supplementary 3.1: Enzyme activity (beta-glucosidase)



```
## bGlu ~ Block + CoverCrop + Depth + Date + (1 | mainplot) + (1 |
## Depth:mainplot) + (1 | subplot) + (1 | subplot:Depth) + Block:Date +
## Block:Depth + CoverCrop:Date + Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	20132.961	10066.481	2	3.000006	1.3982846	0.3723275
CoverCrop	24140.914	24140.914	1	5.000234	3.3532940	0.1265694
Depth	125821.718	125821.718	1	3.000014	17.4772673	0.0249358
Date	250408.223	250408.223	1	25.000289	34.7829572	0.0000037
Block:Date	15381.364	7690.682	2	25.000289	1.0682743	0.3587710
Block:Depth	8038.449	4019.225	2	3.000014	0.5582904	0.6221237
CoverCrop:Date	38346.604	38346.604	1	25.000289	5.3265355	0.0295609
Depth:Date	78578.261	78578.261	1	25.000289	10.9149142	0.0028782

Supplementary 3.2: Enzyme activity (N-acetyl-glucosaminidase)

```
## Nac ~ Block + Depth + Date + (1 | Date:mainplot) + (1 | Depth:mainplot) +
## (1 | subplot) + Block:Date + Block:Depth
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	4843.0011	2421.5006	2	6.769254	1.8844951	0.2235537
Depth	211.0065	211.0065	1	4.880792	0.1642125	0.7024568

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Date	22647.6685	22647.6685	1	26.696387	17.6251951	0.0002664
Block:Date	11618.6735	5809.3367	2	26.696387	4.5210258	0.0203709
Block:Depth	1147.9820	573.9910	2	4.880792	0.4466996	0.6635123

Supplementary 3.3: Fungi:Bacteria ratio (PLFA)

```
## log(Fungi/Bacteria) ~ Block + CoverCrop + Depth + Date + (1 |
##   Depth:mainplot) + (1 | Date:Depth:mainplot) + (1 | subplot) +
##   (1 | subplot:Date) + (1 | subplot:Depth) + Block:Date + CoverCrop:Date +
##   Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0010027	0.0005013	2	10.756709	0.0649125	0.9375137
CoverCrop	0.0257201	0.0257201	1	2.629121	3.3302172	0.1783353
Depth	0.3808357	0.3808357	1	2.935435	49.3103384	0.0063675
Date	0.0327341	0.0327341	1	7.773146	4.2383827	0.0745261
Block:Date	0.0051436	0.0025718	2	7.773146	0.3329951	0.7265153
CoverCrop:Date	0.0506396	0.0506396	1	5.977501	6.5567788	0.0430160
Depth:Date	0.0533737	0.0533737	1	6.430058	6.9107930	0.0366869

Supplementary 3.4: AMF abundance (5-20 cm)

```
## log(AMF) ~ Block + Block:Date + CoverCrop * Tillage * Date +
##   (1 | subplot) + (1 | mainplot)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0031897	0.0015949	2	2.000039	0.0837617	0.9227120
CoverCrop	0.0397472	0.0397472	1	4.000010	2.0874995	0.2220187
Tillage	0.0204594	0.0204594	1	2.000039	1.0745142	0.4088208
Date	4.7095275	4.7095275	1	5.999942	247.3415570	0.0000042
Block:Date	0.0783634	0.0391817	2	5.999942	2.0577984	0.2086799
CoverCrop:Tillage	0.0053328	0.0053328	1	4.000010	0.2800739	0.6246605
Date:CoverCrop	0.0167102	0.0167102	1	5.999942	0.8776087	0.3850156
Date:Tillage	0.0081549	0.0081549	1	5.999942	0.4282925	0.5370917
Date:CoverCrop:Tillage	0.4047330	0.4047330	1	5.999942	21.2563352	0.0036518

Supplementary 3.5: Total PLFAs

```
## log(SumPLFA) ~ Block + CoverCrop + Depth + Date + (1 | Date:Depth:mainplot) +
##   (1 | subplot) + (1 | subplot:Date) + Block:Date + Block:Depth +
##   CoverCrop:Depth + Depth:Date
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	0.0181471	0.0090736	2	36	1.486842	0.2396397
CoverCrop	0.1604904	0.1604904	1	36	26.298783	0.0000101
Depth	1.4124894	1.4124894	1	36	231.457713	0.0000000
Date	0.0104622	0.0104622	1	36	1.714384	0.1987131

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block:Date	0.0598565	0.0299282	2	36	4.904192	0.0130748
Block:Depth	0.0493158	0.0246579	2	36	4.040569	0.0261153
CoverCrop:Depth	0.0667672	0.0667672	1	36	10.940815	0.0021411
Depth:Date	0.0569022	0.0569022	1	36	9.324293	0.0042366

Supplementary 3.6: Total P

(no treatment effects)

```
## Pt ~ Block + Depth + Date + (1 | Date:Depth:mainplot) + (1 |
## subplot) + (1 | subplot:Depth) + Block:Date + Block:Depth
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	1256.9084	628.4542	2	9.341268	0.4042175	0.6786335
Depth	366.9947	366.9947	1	4.120614	0.2360485	0.6517831
Date	5472.4822	5472.4822	1	11.069829	3.5198634	0.0872361
Block:Date	14567.8927	7283.9464	2	11.058665	4.6849848	0.0335916
Block:Depth	295.4108	147.7054	2	4.115411	0.0950031	0.9113072

Supplementary 3.7: Organic P

```
## Porg ~ Block + Block:Date + Block:Depth + Block:Date:Depth +
## CoverCrop * Depth * Tillage * Date + (1 | Date:Depth:mainplot) +
## (1 | mainplot) + (1 | subplot)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	456.8953286	228.4476643	2	7.004788	0.2299327	0.8003549
CoverCrop	19.2881872	19.2881872	1	5.109806	0.0194136	0.8945130
Depth	197.0732226	197.0732226	1	7.855119	0.1983543	0.6680703
Tillage	1187.6894067	1187.6894067	1	7.009356	1.1954102	0.3103862
Date	892.0758850	892.0758850	1	7.855119	0.8978750	0.3715865
Block:Date	9263.0238611	4631.5119305	2	7.848573	4.6616200	0.0463066
Block:Depth	4226.9015002	2113.4507501	2	7.848573	2.1271897	0.1827424
Depth:CoverCrop	226.5806993	226.5806993	1	10.947052	0.2280536	0.6423634
CoverCrop:Tillage	51.4830756	51.4830756	1	5.109806	0.0518178	0.8287587
Depth:Tillage	44.5503732	44.5503732	1	7.855119	0.0448400	0.8376893
Date:CoverCrop	781.8846869	781.8846869	1	10.947052	0.7869675	0.3940909
Date:Depth	0.9007605	0.9007605	1	7.855119	0.0009066	0.9767302
Date:Tillage	41.7368259	41.7368259	1	7.855119	0.0420081	0.8428154
Block:Date:Depth	4299.5425612	2149.7712806	2	7.848573	2.1637463	0.1784739
Depth:CoverCrop:Tillage	42.9936662	42.9936662	1	10.947052	0.0432732	0.8390313
Date:Depth:CoverCrop	8506.2942991	8506.2942991	1	10.947052	8.5615912	0.0138526
Date:CoverCrop:Tillage	1400.8361712	1400.8361712	1	10.947052	1.4099426	0.2601924
Date:Depth:Tillage	756.8056948	756.8056948	1	7.855119	0.7617255	0.4086746
Date:Depth:CoverCrop:Tillage	4858.3345395	4858.3345395	1	10.947052	4.8899171	0.0492183

Supplementary 3.8: P_limitation

(not presented)

```
## P_limitation ~ Block + Block:Date + Block:Depth + Block:Date:Depth +  
## Tillage * Depth * Date + (1 | mainplot) + (1 | subplot:Date)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	4466.503	2233.252	2	2.000000	1.1494016	0.4652458
Tillage	4670.320	4670.320	1	2.021469	2.4037030	0.2599095
Depth	17722.409	17722.409	1	14.340487	9.1213027	0.0089742
Date	10158.999	10158.999	1	12.580128	5.2285957	0.0402509
Block:Date	17924.410	8962.205	2	12.479363	4.6126340	0.0316395
Block:Depth	7646.383	3823.191	2	14.221271	1.9677058	0.1760253
Depth:Tillage	6499.359	6499.359	1	13.826626	3.3450655	0.0890534
Date:Tillage	1959.624	1959.624	1	12.307583	1.0085717	0.3345821
Date:Depth	11301.961	11301.961	1	14.340486	5.8168509	0.0298085
Block:Date:Depth	8436.560	4218.280	2	14.221271	2.1710484	0.1503727
Date:Depth:Tillage	1263.342	1263.342	1	13.826626	0.6502121	0.4336878

Supplementary 3.9: Soybean yield

(not presented)

```
## log(yield) ~ Block + CoverCrop + Tillage
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	2	0.1820485	0.0910242	2.157866	0.1861890
CoverCrop	1	0.6270899	0.6270899	14.866105	0.0062465
Tillage	1	1.1243736	1.1243736	26.654959	0.0013054
Residuals	7	0.2952777	0.0421825	NA	NA

Supplementary 3.10: Soybean grain P concentration

(not presented)

```
## Seed_P ~ Block + CoverCrop + Tillage + CoverCrop:Tillage
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	2	0.0013167	0.0006583	6.405405	0.0324512
CoverCrop	1	0.0060750	0.0060750	59.108108	0.0002535
Tillage	1	0.0070083	0.0070083	68.189189	0.0001706
CoverCrop:Tillage	1	0.0006750	0.0006750	6.567568	0.0427515
Residuals	6	0.0006167	0.0001028	NA	NA

Supplementary 3.11: Soybean plant cover

(not presented)

```
## cover_soybean ~ Block + CoverCrop * Tillage + (1 | mainplot)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	158.66694	79.33347	2	2	2.455891	0.2893610
CoverCrop	80.60083	80.60083	1	4	2.495124	0.1893477
Tillage	48.34999	48.34999	1	2	1.496749	0.3457522
CoverCrop:Tillage	22.14083	22.14083	1	4	0.685404	0.4542668

Supplementary 3.12: Weed cover

(not presented)

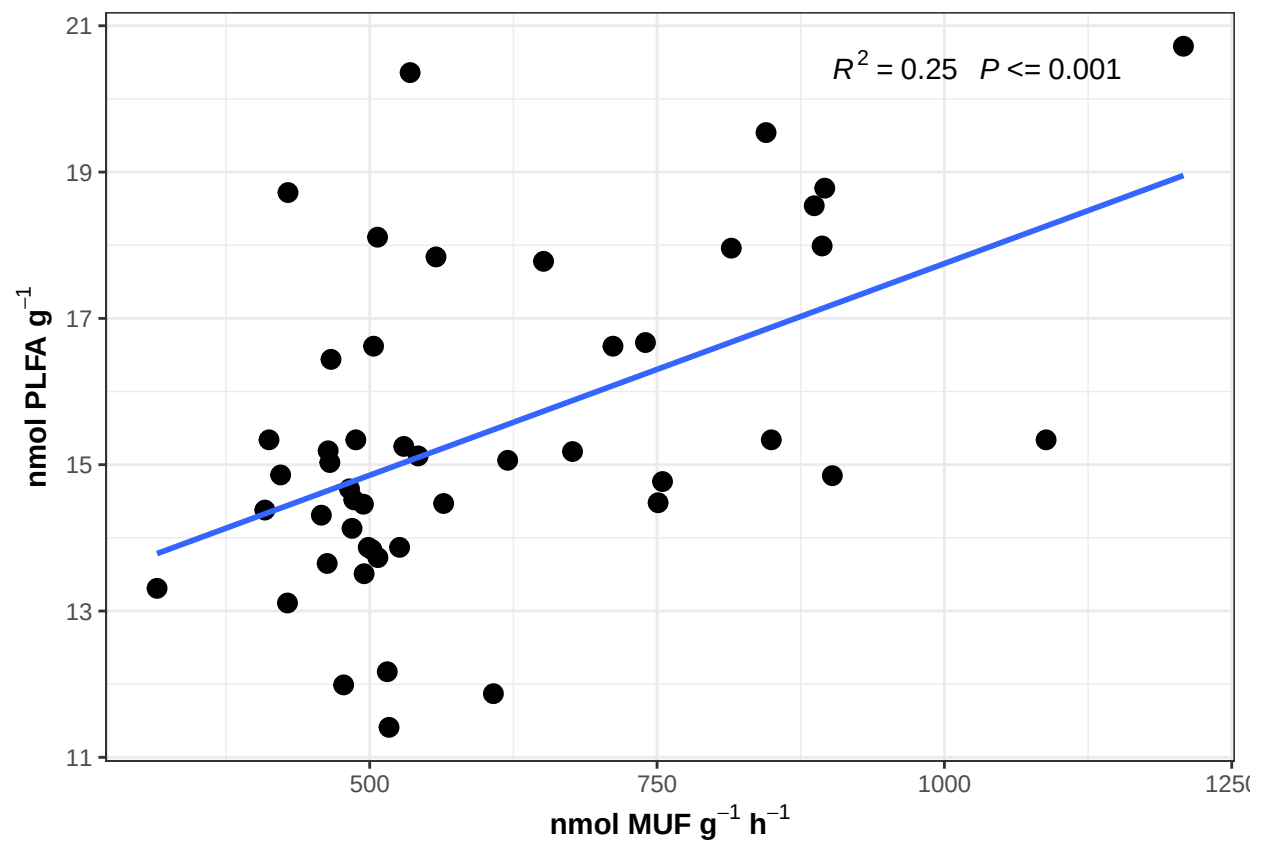
```
## cover_weeds ~ Block + CoverCrop * Tillage + (1 | mainplot)
```

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Block	492.81783	246.40892	2	2	2.8897531	0.2570857
CoverCrop	290.90336	290.90336	1	4	3.4115603	0.1384635
Tillage	96.60781	96.60781	1	2	1.1329652	0.3986456
CoverCrop:Tillage	23.75391	23.75391	1	4	0.2785733	0.6255600

Correlations: Microbial abundance vs enzymatic activity

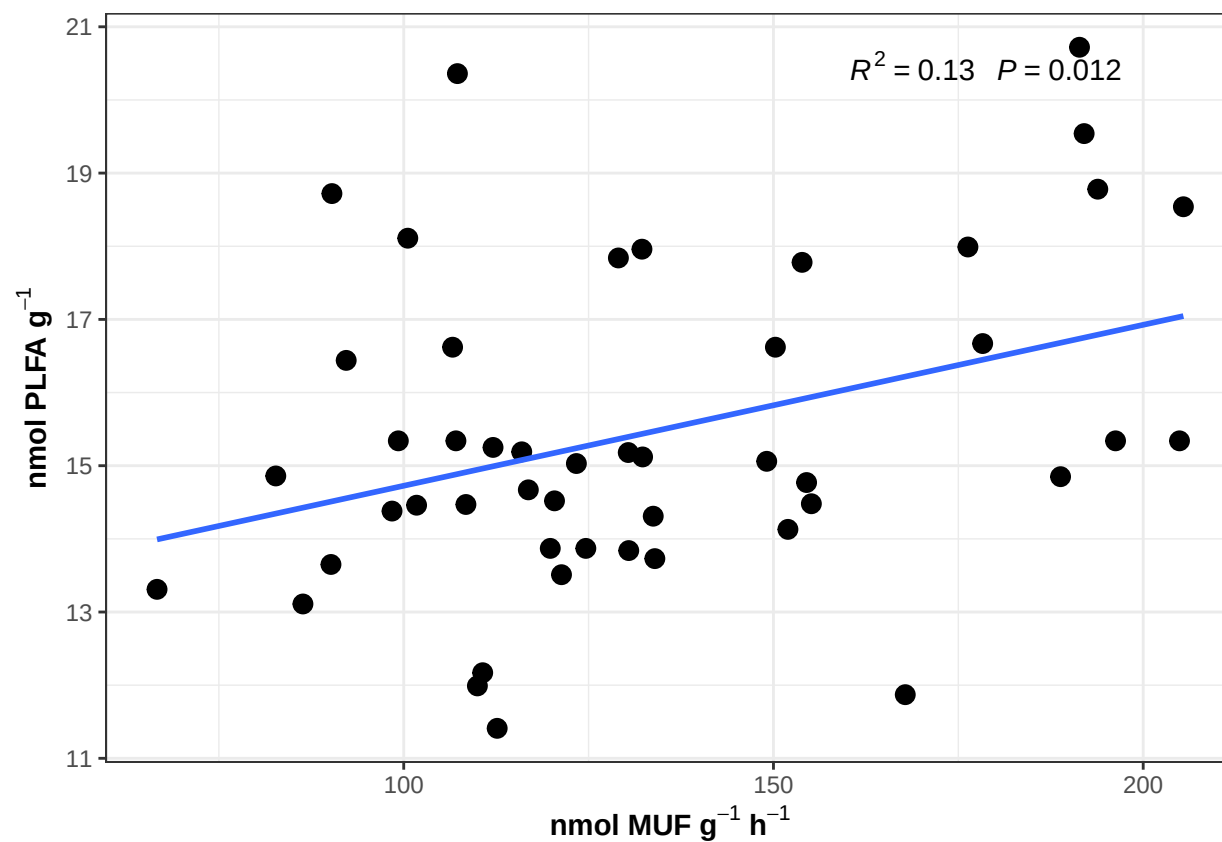
Gram+ vs phosphomonoesterase

```
##  
## Pearson's product-moment correlation  
##  
## data: WP2$Gpos and WP2$Mphos  
## t = 3.9673, df = 46, p-value = 0.0002524  
## alternative hypothesis: true correlation is not equal to 0  
## 95 percent confidence interval:  
## 0.2577575 0.6900511  
## sample estimates:  
## cor  
## 0.5049135
```



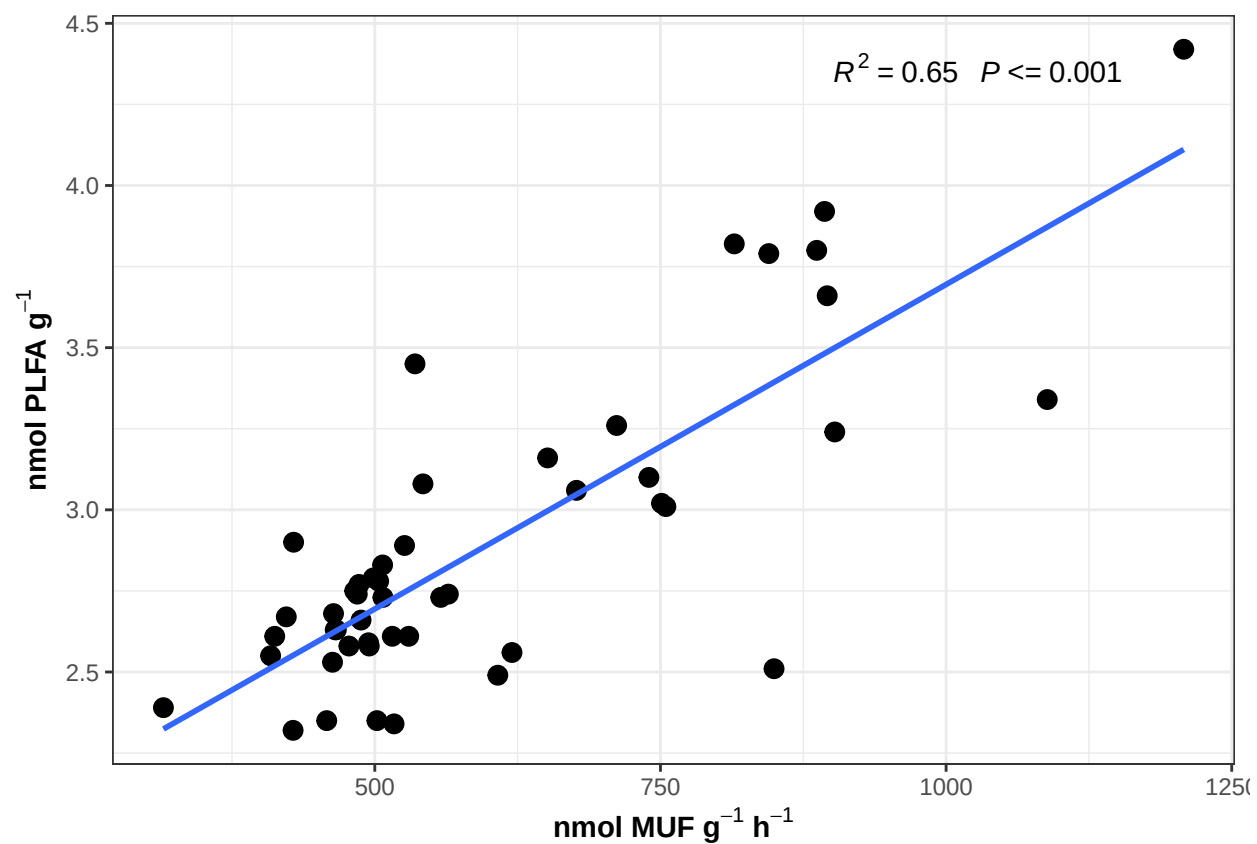
Gram+ vs phosphodiesterase

```
##
## Pearson's product-moment correlation
##
## data: WP2$Gpos and WP2$Diphos
## t = 2.6066, df = 46, p-value = 0.01228
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.08307242 0.58340730
## sample estimates:
##      cor
## 0.3587395
```



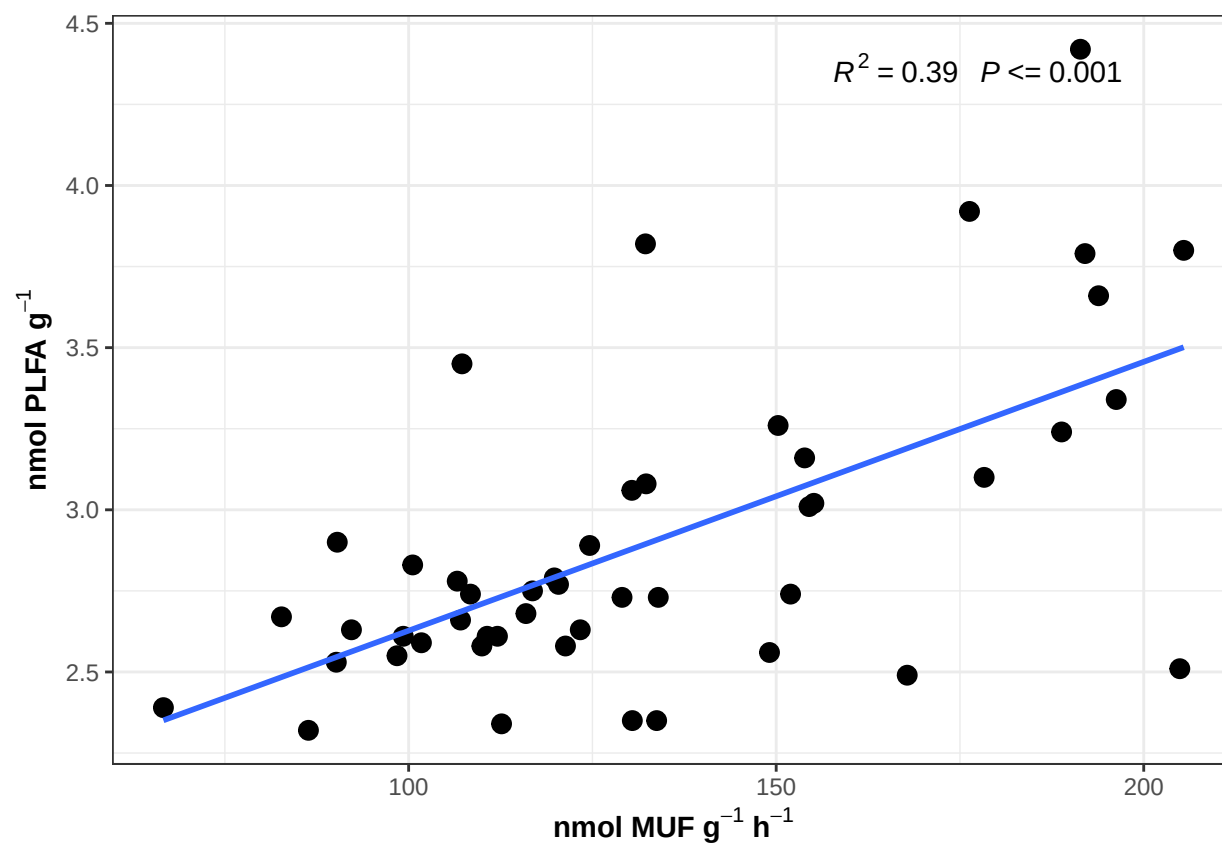
Gram- vs phosphomonoesterase

```
##
## Pearson's product-moment correlation
##
## data: WP2$Gneg and WP2$Mphos
## t = 9.2872, df = 46, p-value = 4.05e-12
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.6793197 0.8879600
## sample estimates:
##      cor
## 0.8075772
```



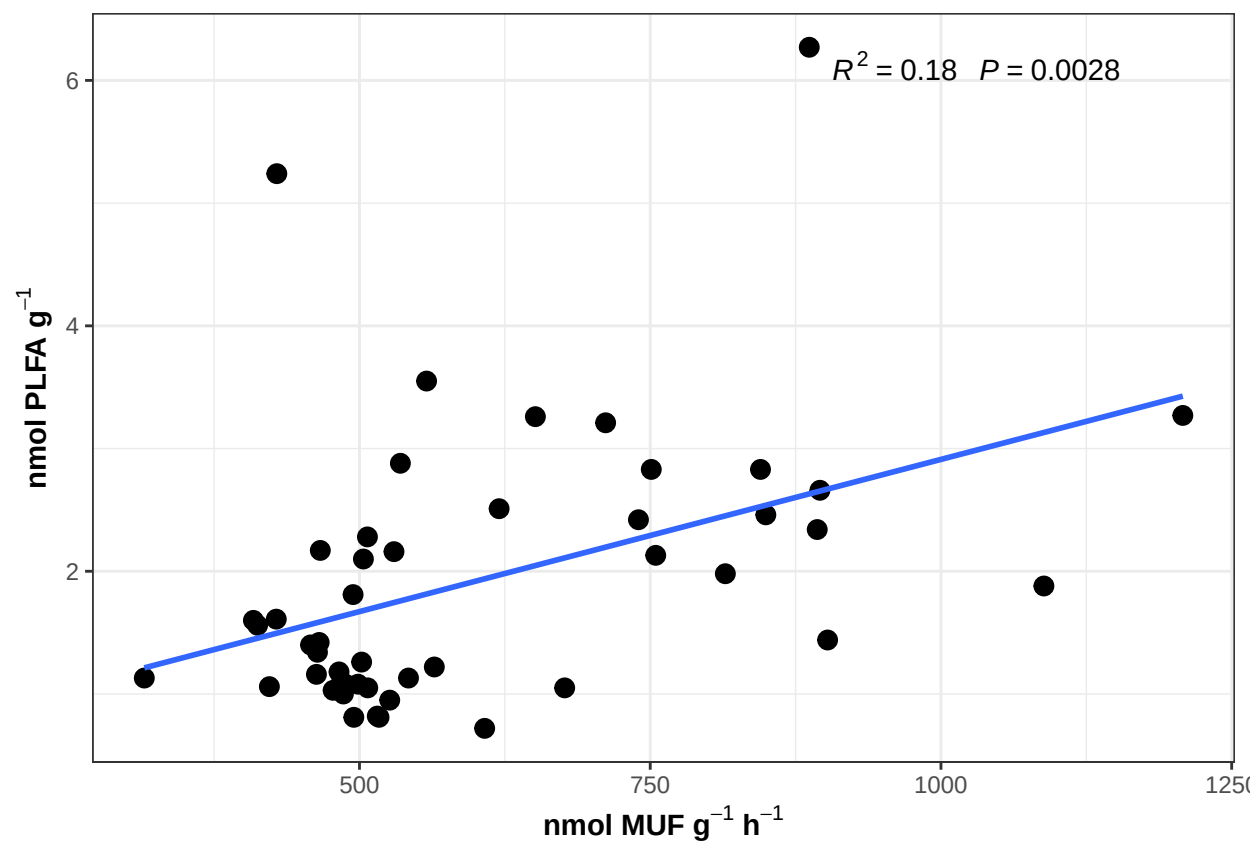
Gram- vs phosphodiesterase

```
##
## Pearson's product-moment correlation
##
## data: WP2$Gneg and WP2$Diphos
## t = 5.4351, df = 46, p-value = 2.015e-06
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.4149340 0.7722608
## sample estimates:
##      cor
## 0.6253426
```



Fungi vs phosphomonoesterase

```
##
## Pearson's product-moment correlation
##
## data: WP2$Fungi and WP2$Mphos
## t = 3.164, df = 46, p-value = 0.002758
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
## 0.1575531 0.6310896
## sample estimates:
## cor
## 0.4227623
```



Fungi vs phosphodiesterase

```
##  
## Pearson's product-moment correlation  
##  
## data: WP2$Fungi and WP2$Diphos  
## t = 2.7803, df = 46, p-value = 0.007844  
## alternative hypothesis: true correlation is not equal to 0  
## 95 percent confidence interval:  
## 0.1066544 0.5988870  
## sample estimates:  
## cor  
## 0.3792948
```

