Supporting Information

Reaction products of drought stressed bioenergy crops inhibit microbial biofuel production

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Fig. S1: Enriched Gene Ontology (GO) terms for highly susceptible yeast mutants in all hydrolysates. Susceptible mutants were chosen that had a fitness <-2.5 (n=65). P-values were Bonferroni corrected with a cutoff of p=0.05.

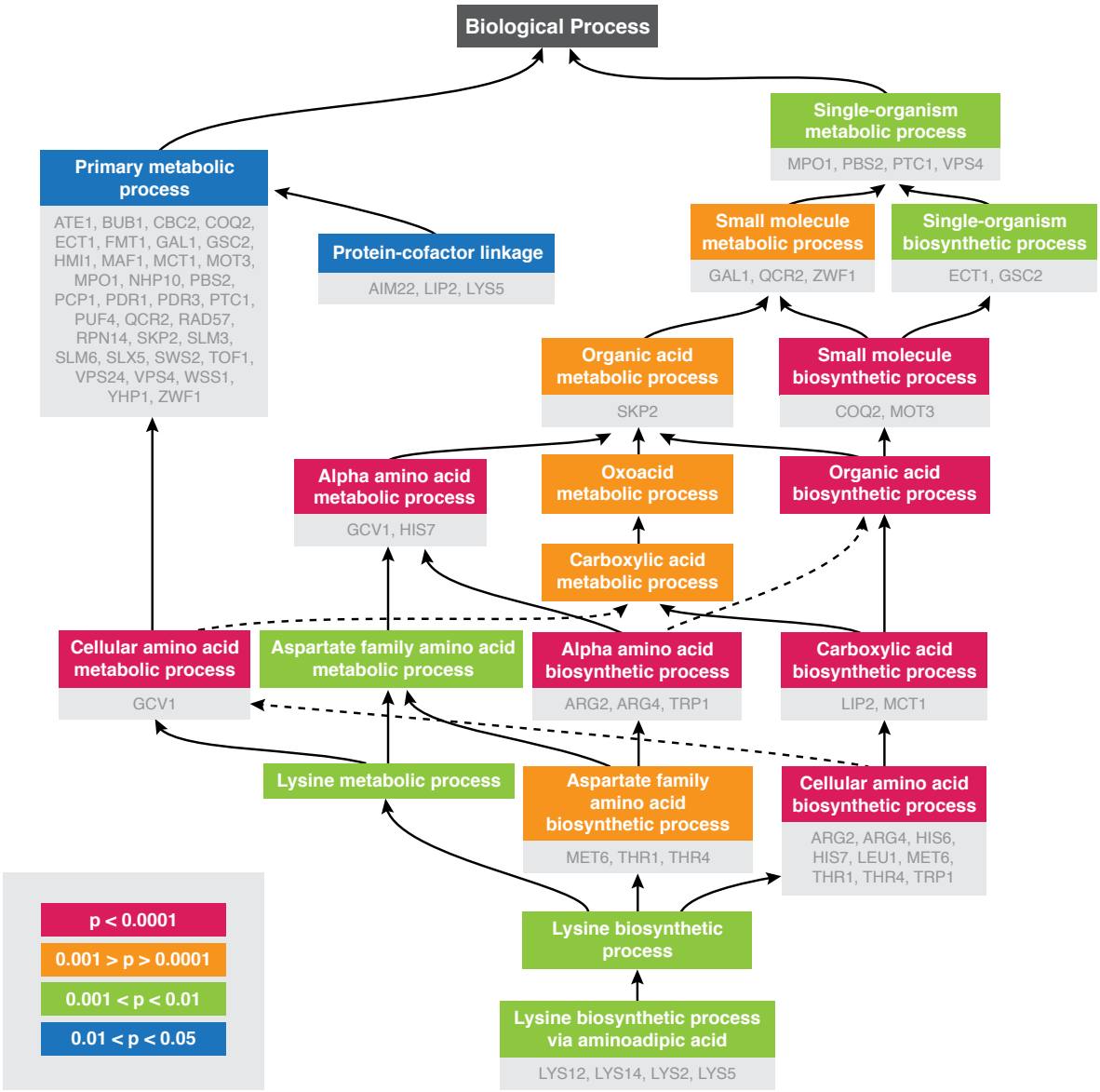
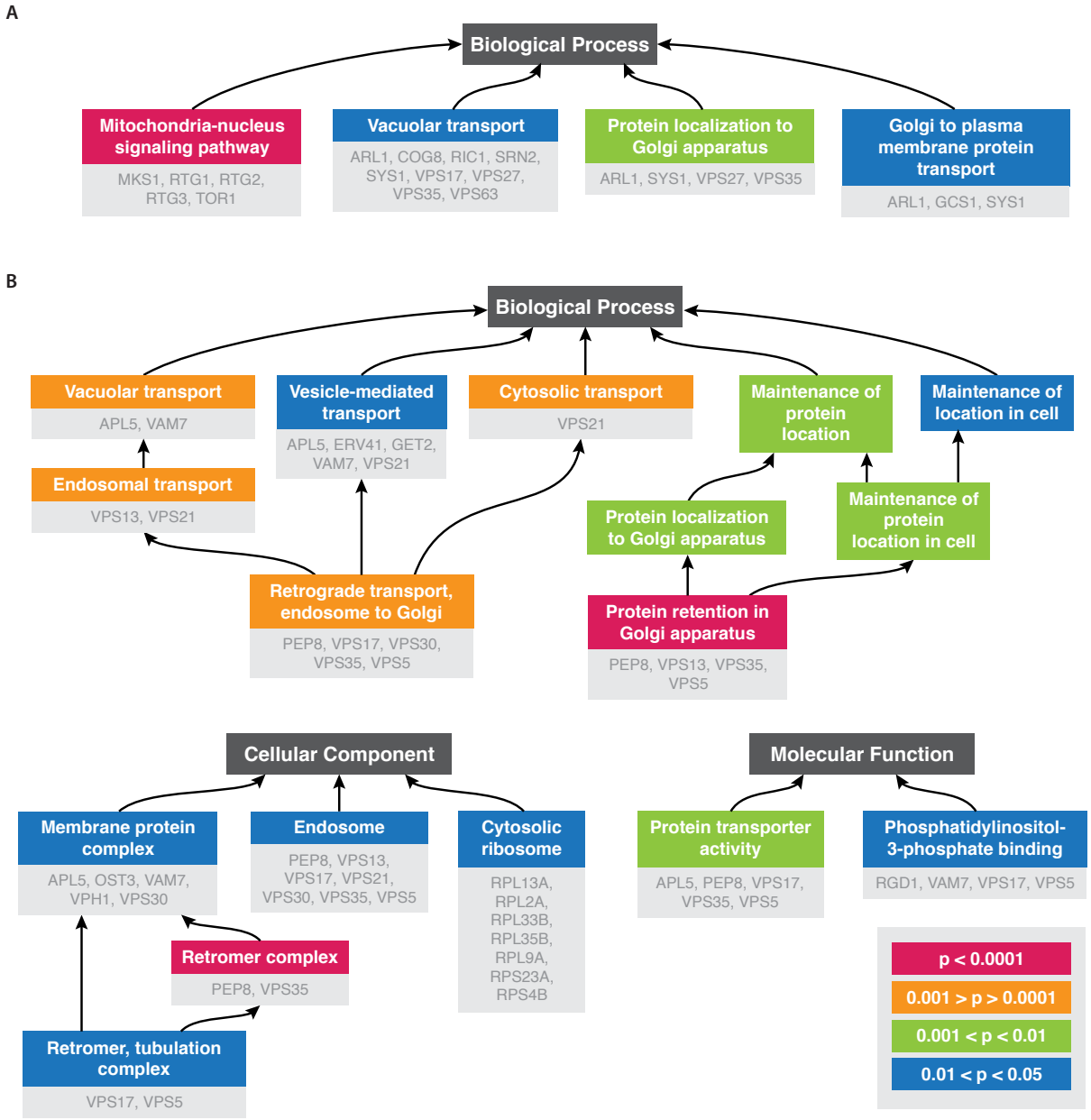


Fig. S2: Enriched GO terms for select hydrolysates. A) Enriched GO terms For highly susceptible yeast mutants in hydrolysates 2010 ACSH, 2012 ACSH-PO448R, 2013 ACSH, and 2013 ASGH; Mutants were chosen that had fitness <-2.5 in all four hydrolysates and >-2.5 in 2012 ASGH, and were statistically different between the two groups ($p<0.001$, n=56). P-values for the GO terms were Bonferroni corrected with a cutoff of $p = 0.05$. **B)** Enriched GO terms for highly resistant yeast mutants in only 2012 ASGH. Mutants were chosen that had fitness >2.5 in the 2012 ASGH, <2.5 in the other four hydrolysates and a statistically significant difference between the two groups ($p<0.001$, n=42). P-values for the GO terms were Bonferroni corrected with a cutoff of $p=0.05$.



Tables

Table S1: Untreated biomass composition (% of total dry biomass). Values are reported as the mean ± s.d. (n=3).

		Corn Stover				Switchgrass		
		36H56		P0448R		Shawnee		CIR
		2010	2012	2012	2013	2010	2012	2013
Total Ash		13.39 ± 0.16	6.48 ± 0.09	4.75 ± 0.30	5.26 ± 0.04	5.56 ± 0.16	5.47 ± 0.08	4.68 ± 0.04
Total Extractives		16.00 ± 0.04	15.29 ± 0.09	18.87 ± 0.11	16.51 ± 0.36	14.90 ± 0.26	22.14 ± 0.21	10.86 ± 0.65
Water Extractives	**Sucrose**	0.57 ± 0.02	0.08 ± 0.01	0.00 ± 0.00	0.00 ± 0.00	0.43 ± 0.01	2.40 ± 0.07	0.14 ± 0.02
	Fructose	1.11 ± 0.04	0.88 ± 0.01	2.25 ± 0.04	1.80 ± 0.02	0.51 ± 0.01	2.33 ± 0.02	0.33 ± 0.01
	Glucose	0.93 ± 0.03	1.18 ± 0.04	2.04 ± 0.04	0.95 ± 0.01	0.62 ± 0.01	2.57 ± 0.03	0.61 ± 0.03
	Xylose	0.00 ± 0.00	0.16 ± 0.01	0.08 ± 0.00	0.03 ± 0.01	ND	0.04 ± 0.00	0.01 ± 0.01
	Galactose	0.20 ± 0.00	0.00 ± 0.00	0.04 ± 0.00	0.02 ± 0.00	ND	0.06 ± 0.00	0.03 ± 0.00
	Arabinose	0.00 ± 0.00	0.04 ± 0.00	0.06 ± 0.00	0.04 ± 0.00	ND	0.04 ± 0.00	0.00 ± 0.01
	Mannose	NM*	NM	ND†	ND	NM	ND	ND
	Glucan	0.75 ± 0.01	0.44 ± 0.01	1.05 ± 0.04	0.67 ± 0.01	0.62 ± 0.02	0.98 ± 0.38	0.49 ± 0.02
	Xylan	0.25 ± 0.00	0.20 ± 0.01	0.26 ± 0.00	0.22 ± 0.01	0.06 ± 0.00	0.07 ± 0.01	0.08 ± 0.01
	Galactan	0.19 ± 0.00	0.22 ± 0.01	0.24 ± 0.00	0.20 ± 0.01	0.05 ± 0.00	0.31 ± 0.02	0.19 ± 0.01
	Arabinan	0.17 ± 0.01	0.12 ± 0.01	0.12 ± 0.01	0.09 ± 0.01	0.18 ± 0.01	0.07 ± 0.01	0.05 ± 0.01
	Mannan	NM	NM	0.17 ± 0.01	0.09 ± 0.01	NM	ND	ND
Ethanol Extractives		2.59 ± 0.06	2.95 ± 0.06	2.85 ± 0.15	2.66 ± 0.01	2.08 ± 0.19	2.61 ± 0.03	1.97 ± 0.08
Extracted Protein		1.74 ± 0.07	2.50 ± 0.04	2.40 ± 0.17	1.25 ± 0.08	1.16 ± 0.09	1.89 ± 0.41	0.85 ± 0.18
Total Protein		4.79 ± 0.07	6.29 ± 0.01	5.55 ± 0.15	2.93 ± 0.08	3.19 ± 0.09	4.65 ± 0.08	2.63 ± 0.18
Total Structural Sugars‡		53.43 ± 0.21	58.04 ± 0.34	56.86 ± 0.28	61.57 ± 0.14	59.50 ± 0.18	52.28 ± 0.09	62.49 ± 0.27
Glucan		30.67 ± 0.16	30.98 ± 0.32	31.74 ± 0.24	36.47 ± 0.10	34.24 ± 0.11	29.36 ± 0.07	35.90 ± 0.23
Xylan		18.47 ± 0.13	20.88 ± 0.10	20.49 ± 0.16	21.41 ± 0.09	21.54 ± 0.13	18.91 ± 0.04	23.15 ± 0.13
Galactan		1.17 ± 0.05	2.57 ± 0.03	1.47 ± 0.01	1.07 ± 0.01	1.43 ± 0.03	1.31 ± 0.02	0.98 ± 0.03
Arabinan		3.12 ± 0.02	3.62 ± 0.01	3.16 ± 0.02	2.62 ± 0.02	2.30 ± 0.03	2.69 ± 0.01	2.45 ± 0.05
Mannan		NM	NM	ND	ND	NM	ND	ND
Acetyl Groups		2.22 ± 0.06	2.62 ± 0.00	2.38 ± 0.31	2.91 ± 0.15	2.58 ± 0.11	2.15 ± 0.06	2.38 ± 0.20
Total Lignin		14.31 ± 0.03	14.70 ± 0.26	14.39 ± 0.18	14.76 ± 0.02	18.59 ± 0.11	15.38 ± 0.06	18.95 ± 0.12
Acid Insoluble Lignin		13.08 ± 0.02	13.18 ± 0.26	13.13 ± 0.16	13.55 ± 0.02	17.87 ± 0.10	14.31 ± 0.06	17.94 ± 0.11
Acid Soluble Lignin		1.23 ± 0.01	1.52 ± 0.04	1.27 ± 0.07	1.21 ± 0.01	0.73 ± 0.03	1.07 ± 0.01	1.01 ± 0.03
Mass Balance Closure		102.39	100.93	100.40	102.69	102.44	100.17	101.13

*NM = not measured
†ND = not detected
‡Total structural sugars does not include acetyl groups

Table S2: Hydrolysate composition data: Carbohydrates, organic acids, and aromatics. Values are reported as the mean ± s.d. (n=3). In each row, values with different superscripts are statistically different based on Tukey's HSD Test (95% CI).

	Corn Stover				Switchgrass		
	36H56		P0448R		Shawnee		CIR
	2010	2012	2012	2013	2010	2012	2013
Major Carbohydrates, Acids, and Amides (mM)							
Glucose	$355.5^{abc} \pm 7.9$	$355.0^{bc} \pm 5.8$	$369.2^{ab} \pm 5.6$	$375.1^{a} \pm 11.3$	$328.7^{d} \pm 4.2$	$334.8^{cd} \pm 11.4$	$329.8^{d} \pm 4.3$
Xylose	$182.2^{c} \pm 2.5$	$211.2^{ab} \pm 3.6$	$192.5^{bc} \pm 11.6$	$204.1^{bc} \pm 11.1$	$208.0^{bc} \pm 2.5$	$204.5^{bc} \pm 16.6$	$235.3^{a} \pm 9.1$
Glycerol	$7.0^{a} \pm 2.5$	$5.5^{abc} \pm 0.7$	$6.2^{ab} \pm 0.2$	$4.0^{bc} \pm 0.6$	$3.6^{bc} \pm 0.4$	$4.7^{abc} \pm 0.1$	$3.0^{c} \pm 0.2$
Formate	$3.6^{c} \pm 0.6$	$2.8^{c} \pm 2.4$	$5.0^{bc} \pm 0.4$	$5.3^{bc} \pm 1.5$	$7.6^{ab} \pm 2.0$	$11.3^{a} \pm 0.6$	$8.5^{ab} \pm 0.5$
Lactate	$0.1^{c} \pm 0.0$	$1.4^{b} \pm 0.1$	$1.7^{a} \pm 0.0$	$0.0^{c} \pm 0.0$	$0.0^{c} \pm 0.0$	$0.1^{c} \pm 0.0$	$0.0^{c} \pm 0.0$
Succinate	$1.0^{bc} \pm 0.0$	$0.6^{cd} \pm 0.1$	$1.4^{a} \pm 0.3$	$1.0^{b} \pm 0.2$	$0.4^{d} \pm 0.1$	$0.6^{cd} \pm 0.0$	$0.9^{bc} \pm 0.1$
Acetate	$31.3^{c} \pm 2.7$	$31.4^{c} \pm 2.7$	$36.5^{bc} \pm 3.0$	$33.9^{c} \pm 1.5$	$42.1^{ab} \pm 1.6$	$46.7^{a} \pm 3.4$	$42.9^{ab} \pm 2.2$
Acetamide	77.6 ± 8.6	71.1 ± 29.5	82.8 ± 10.2	83.1 ± 10.2	88.9 ± 2.5	113.7 ± 32.6	89.8 ± 17.1
Coumaric Acid	$1.3^{a} \pm 0.1$	$0.5^{c} \pm 0.1$	$0.8^{b} \pm 0.1$	$0.9^{b} \pm 0.1$	$0.2^{d} \pm 0.0$	$0.3^{cd} \pm 0.0$	$0.3^{cd} \pm 0.0$
Coumaroyl Amide	$5.0^{a} \pm 0.6$	$3.2^{c} \pm 0.4$	$3.8^{bc} \pm 0.3$	$4.5^{ab} \pm 0.6$	$1.6^{d} \pm 0.4$	$1.8^{d} \pm 0.3$	$1.9^{d} \pm 0.4$
Feruloyl Amide	$2.0^{a} \pm 0.1$	$1.5^{b} \pm 0.2$	$2.2^{a} \pm 0.1$	$2.2^{a} \pm 0.2$	$0.6^{d} \pm 0.1$	$1.2^{bc} \pm 0.2$	$0.8^{cd} \pm 0.2$
Aliphatic and Aromatic Acids (mM)							
Azelaic Acid	$24.1^{b} \pm 0.3$	$21.4^{bc} \pm 0.9$	$27.9^{a} \pm 1.0$	$18.0^{d} \pm 1.5$	$19.1^{cd} \pm 0.8$	$21.9^{bc} \pm 1.4$	$17.7^{d} \pm 1.1$
Benzoic Acid	$132.3^{c} \pm 8.3$	$168.2^{bc} \pm 39.7$	$121.3^{c} \pm 5.3$	$123.7^{c} \pm 38.4$	$304.5^{a} \pm 2.8$	$224.6^{b} \pm 6.0$	$299.9^{a} \pm 8.2$
3-Hydroxybenzoic Acid	$0.5^{a} \pm 0.1$	$0.2^{b} \pm 0.1$	$0.6^{a} \pm 0.1$	$0.7^{a} \pm 0.1$	$0.6^{a} \pm 0.2$	$0.6^{a} \pm 0.0$	$0.7^{a} \pm 0.0$
4-Hydroxybenzoic Acid	$28.1^{bc} \pm 3.2$	$48.1^{a} \pm 10.1$	$21.2^{c} \pm 0.5$	$18.0^{c} \pm 2.0$	$36.1^{ab} \pm 6.0$	$18.2^{c} \pm 1.0$	$18.5^{c} \pm 1.5$
2,3-Dihydroxybenzoic Acid	$<1.75^{*c}$	NM	$<1.75^{*c}$	$<1.75^{*c}$	NM	$13.1^{b} \pm 0.4$	$18.5^{a} \pm 0.6$
3,4-Dihydroxybenzoic Acid	$5.8^{cd} \pm 2.2$	$4.6^{d} \pm 1.2$	$6.2^{cd} \pm 0.5$	$5.9^{cd} \pm 0.8$	$10.3^{c} \pm 3.5$	$15.7^{b} \pm 0.5$	$20.9^{a} \pm 1.2$
Ferulic Acid	$39.1^{a} \pm 1.9$	$25.2^{bc} \pm 4.8$	$29.2^{ab} \pm 3.5$	$37.7^{a} \pm 7.9$	$16.5^{c} \pm 1.2$	$18.5^{bc} \pm 2.1$	$19.6^{bc} \pm 2.7$
Sinapic Acid	$3.0^{a} \pm 0.3$	$1.2^{b} \pm 0.2$	$2.3^{a} \pm 04$	$0.7^{*bc} \pm 0.6$	$0.2^{*c} \pm 0.0$	$1.0^{b} \pm 0.2$	$0.8^{bc} \pm 0.0$
Syringic Acid	11.2 ± 0.9	9.6 ± 1.4	10.7 ± 0.7	10.1 ± 1.2	9.4 ± 1.8	9.1 ± 0.5	10.4 ± 0.2
Vanillic Acid	$26.7^{d} \pm 2.5$	$29.0^{cd} \pm 4.2$	$26.5^{d} \pm 1.9$	$19.5^{d} \pm 2.6$	$51.5^{a} \pm 9.6$	$38.9^{bc} \pm 2.5$	$43.1^{ab} \pm 0.2$
Aromatic Alcohols (mM)							
Furfuryl Alcohol	$5.6^{ab} \pm 1.1$	$<3^{*b}$	$7.0^{ab} \pm 1.8$	$5.1^{*ab} \pm 3.6$	$2.1^{*b} \pm 0.0$	$7.5^{a} \pm 1.6$	$2.8^{*ab} \pm 2.5$
4-Hydroxybenzyl Alcohol	$0.4^{bc} \pm 0.0$	$<0.15^{*c}$	$0.3^{c} \pm 0.0$	$0.4^{bc} \pm 0.1$	$0.4^{*bc} \pm 0.5$	$1.1^{a} \pm 0.0$	$0.8^{ab} \pm 0.1$
Vanillyl Alcohol	$<0.25^{*d}$	$0.3^{c} \pm 0.0$	$0.3^{c} \pm 0.0$	$<0.25^{*d}$	$0.6^{b} \pm 0.0$	$0.8^{a} \pm 0.0$	$0.6^{b} \pm 0.0$
Aromatic Aldehydes (mM)							
Furfural	$10.5^{b} \pm 1.7$	$41.1^{a} \pm 3.9$	$37.5^{a} \pm 6.6$	$29.8^{ab} \pm 10.5$	$44.3^{a} \pm 18.0$	$8.9^{b} \pm 4.2$	$27.5^{ab} \pm 4.0$
HMF	0.9 ± 0.3	1.1 ± 0.3	1.2 ± 0.1	1.0 ± 0.1	1.0 ± 0.3	1.3 ± 0.2	1.3 ± 0.0
4-Hydroxybenzaldehyde	$31.7^{a} \pm 4.0$	$21.6^{ab} \pm 3.5$	$17.5^{bc} \pm 2.5$	$31.1^{a} \pm 7.0$	$18.3^{b} \pm 5.7$	$6.0^{c} \pm 0.5$	$16.1^{bc} \pm 2.5$
Syringaldehyde	$10.3^{ab} \pm 0.8$	$7.4^{abc} \pm 1.7$	$8.5^{abc} \pm 1.0$	$11.2^{a} \pm 3.1$	$5.1^{c} \pm 2.3$	$3.8^{c} \pm 1.2$	$6.1^{bc} \pm 1.0$
Vanillin	$180.8^{a} \pm 13.5$	$141.5^{a} \pm 14.5$	$156.4^{a} \pm 13.0$	$145.8^{a} \pm 28.9$	$71.5^{b} \pm 26.5$	$69.4^{b} \pm 12.8$	$85.8^{b} \pm 13.4$
Aromatic Amides (mM)							
4-Hydroxybenzamide	$18.5^{a} \pm 5.0$	$12.0^{bc} \pm 1.3$	$15.4^{ab} \pm 1.3$	$10.5^{bc} \pm 0.9$	$9.6^{bc} \pm 2.2$	$8.0^{c} \pm 0.7$	$12.8^{abc} \pm 1.2$
Benzamide	$3.4^{d} \pm 0.6$	$3.1^{d} \pm 0.3$	$2.4^{d} \pm 0.2$	$2.0^{d} \pm 0.2$	$6.5^{b} \pm 1.0$	$10.0^{a} \pm 0.3$	$4.9^{c} \pm 0.3$
Syringamide	$36.9^{ab} \pm 10.1$	$42.5^{a} \pm 11.1$	$29.8^{ab} \pm 1.4$	$32.6^{ab} \pm 4.6$	$27.0^{ab} \pm 6.6$	$21.3^{b} \pm 2.2$	$35.3^{ab} \pm 2.7$
Vanillamide	$78.3^{ab} \pm 17.0$	$108.0^{a} \pm 31.7$	$73.8^{ab} \pm 4.5$	$57.5^{b} \pm 5.5$	$69.9^{ab} \pm 20.6$	$64.6^{ab} \pm 3.3$	$71.3^{ab} \pm 7.7$
Aromatic Ketones (mM)							
4-Hydroxyacetophenone	1.7 ± 0.2	2.0 ± 0.6	2.2 ± 0.7	2.4 ± 0.6	2.2 ± 0.8	1.2 ± 0.1	2.3 ± 0.4
Acetovanillone	$3.0^{b} \pm 0.5$	$28.1^{a} \pm 21.6$	$4.3^{b} \pm 0.9$	$3.5^{b} \pm 0.6$	$25.3^{ab} \pm 6.1$	$3.7^{b} \pm 0.3$	$4.2^{b} \pm 0.5$
Acetosyringone	$4.3^{ab} \pm 0.8$	$0.2^{*c} \pm 0.1$	$3.7^{ab} \pm 1.0$	$4.8^{a} \pm 0.9$	$1.0^{c} \pm 0.3$	$3.3^{ab} \pm 0.2$	$2.9^{b} \pm 0.2$
Diferulates (mM)							
8-O-4-Diferulic Acid	$1.1^{b} \pm 0.3$	$1.4^{b} \pm 0.2$	$2.4^{a} \pm 0.6$	$1.4^{b} \pm 0.3$	$0.9^{b} \pm 0.2$	$0.9^{b} \pm 0.0$	$1.1^{b} \pm 0.3$
8,5'-Diferulic Acid	$0.6^{ab} \pm 0.0$	$0.3^{bc} \pm 0.1$	$0.6^{a} \pm 0.1$	$0.3^{c} \pm 0.1$	$0.1^{*c} \pm 0.1$	$0.2^{c} \pm 0.0$	$0.2^{*c} \pm 0.1$
8,8'-Diferulic Acid	$2.6^{bcd} \pm 0.2$	$3.9^{ab} \pm 1.0$	$5.1^{a} \pm 0.5$	$3.6^{abc} \pm 0.5$	$2.0^{cd} \pm 1.0$	$1.5^{d} \pm 0.0$	$2.0^{cd} \pm 0.4$

*One or more replicates were below the limit of detection (LOD). Where all replicates were below the limit, the LOD is reported with no standard deviation. When fewer than all were below the limit, the values were recalculated as LOD/√2 [52]. These recalculated values were used to determine the mean, standard deviation, and statistical differences.

Table S3: Hydrolysate composition data: Metals and inorganics. Values are reported as the mean ± s.d. (n=3). In each row, values with different superscripts are statistically different based on Tukey's HSD Test (95% CI).

	Corn Stover				Switchgrass		
	36H56		P0448R		Shawnee		CIR
	2010	2012	2012	2013	2010	2012	2013
Abundant Metals and Inorganics (mM)							
Total N	$237.8^{cd} \pm 7.0$	$252.7^{bc} \pm 6.8$	$263.6^{b} \pm 3.8$	$223.2^{d} \pm 10.5$	$226.4^{d} \pm 8.7$	$307.3^{a} \pm 3.8$	$236.9^{cd} \pm 1.2$
NH_4-N	$39.4^{cd} \pm 1.7$	$49.7^{abc} \pm 3.8$	$42.1^{bcd} \pm 0.7$	$33.0^{d} \pm 1.5$	$51.2^{ab} \pm 9.0$	$56.2^{a} \pm 1.4$	$43.5^{bc} \pm 1.9$
K	$41.3^{b} \pm 6.9$	$39.6^{b} \pm 1.0$	$44.4^{b} \pm 0.8$	$41.4^{b} \pm 1.4$	$52.3^{a} \pm 1.6$	$39.9^{b} \pm 1.8$	$26.3^{c} \pm 0.6$
P	$11.4^{c} \pm 0.5$	$17.4^{a} \pm 1.0$	$11.0^{c} \pm 0.1$	$8.6^{d} \pm 1.1$	$12.5^{c} \pm 0.9$	$14.8^{b} \pm 0.6$	$15.2^{ab} \pm 0.6$
Mg	$19.3^{b} \pm 0.1$	$11.7^{d} \pm 0.3$	$10.5^{d} \pm 0.1$	$8.4^{e} \pm 0.4$	$14.8^{c} \pm 0.8$	$24.4^{a} \pm 1.0$	$15.1^{c} \pm 0.5$
Ca	$7.2^{a} \pm 0.5$	$4.5^{b} \pm 0.2$	$3.5^{c} \pm 0.0$	$3.4^{c} \pm 0.5$	$0.6^{d} \pm 0.0$	$6.4^{a} \pm 0.2$	$0.8^{d} \pm 0.0$
S	$3.9^{de} \pm 0.2$	$4.3^{cd} \pm 0.2$	$3.6^{e} \pm 0.1$	$2.8^{f} \pm 0.2$	$4.8^{b} \pm 0.1$	$5.4^{a} \pm 0.2$	$4.6^{bc} \pm 0.1$
Na	$2.4^{e} \pm 0.1$	$1.7^{f} \pm 0.0$	$2.3^{e} \pm 0.0$	$2.7^{d} \pm 0.1$	$3.0^{c} \pm 0.1$	$3.7^{b} \pm 0.1$	$4.4^{a} \pm 0.1$
$Cl^{\dagger}$	$63.8^{c} \pm 11.9$	$59.3^{c} \pm 3.6$	$66.6^{bc} \pm 3.3$	$64.3^{c} \pm 0.8$	$80.6^{b} \pm 1.1$	$96.6^{a} \pm 5.1$	$56.6^{c} \pm 2.0$
Trace Metals and Inorganics (mM)							
Al	$25.8^{a} \pm 10.8$	$9.9^{b} \pm 3.6$	$<3.7^{*b}$	$3.9^{*b} \pm 2.6$	$8.8^{*b} \pm 5.4$	$<3.7^{*b}$	$<3.7^{*b}$
B	$<3.7^{*c}$	$19.1^{a} \pm 2.8$	$<3.7^{*c}$	$<3.7^{*c}$	$6.8^{b} \pm$	$<3.7^{*c}$	$<3.7^{*c}$
Co	$0.5^{a} \pm 0.2$	$<0.1^{*b}$	$<0.1^{*b}$	$0.2^{b} \pm 0.0$	$<0.1^{*b}$	$<0.1^{*b}$	$<0.1^{*b}$
Cr	$6.6^{ab} \pm 5.6$	$4.8^{ab} \pm 0.7$	$0.4^{b} \pm 0.0$	$6.9^{a} \pm 0.7$	$5.4^{ab} \pm 1.2$	$2.8^{ab} \pm 2.6$	$1.4^{ab} \pm 0.3$
Cu	$1.3^{ab} \pm 1.4$	$2.5^{a} \pm 0.7$	$1.6^{ab} \pm 0.2$	$0.5^{*b} \pm 0.4$	$0.9^{ab} \pm 0.1$	$1.4^{ab} \pm 0.2$	$0.4^{b} \pm 0.1$
Fe	$358.1^{b} \pm 202.8$	$23.8^{c} \pm 3.5$	$14.9^{c} \pm 4.2$	$1234.5^{a} \pm 176.1$	$16.9^{c} \pm 2.4$	$23.0^{c} \pm 5.2$	$4.4^{c} \pm 1.4$
Ni	2.7 ± 3.4	2.6 ± 0.3	0.3 ± 0.0	$0.1^{*} \pm 0.0$	1.4 ± 0.4	0.9 ± 0.7	0.2 ± 0.1
Li	$1.4^{b} \pm 0.2$	$0.4^{*c} \pm 0.3$	$0.8^{bc} \pm 0.1$	$2.9^{a} \pm 0.1$	$0.4^{*c} \pm 0.3$	$3.2^{a} \pm 0.3$	$0.7^{c} \pm 0.0$
Mn	$195.5^{a} \pm 11.1$	$88.8^{c} \pm 14.1$	$56.4^{d} \pm 3.4$	$136.7^{b} \pm 9.1$	$38.9^{d} \pm 3.5$	$45.9^{d} \pm 5.3$	$34.3^{d} \pm 1.7$
Mo	$1.1^{a} \pm 0.4$	$0.3^{b} \pm 0.1$	$<0.1^{*b}$	$0.9^{a} \pm 0.1$	$0.3^{b} \pm 0.1$	$0.3^{b} \pm 0.1$	$0.1^{*b} \pm 0.1$
Zn	$16.8^{a} \pm 1.7$	$15.6^{a} \pm 0.6$	$9.9^{bc} \pm 1.1$	$16.0^{a} \pm 2.1$	$7.1^{cd} \pm 0.2$	$11.4^{b} \pm 1.1$	$4.7^{d} \pm 0.3$

*One or more replicates were below the limit of detection (LOD). Where all replicates were below the limit, the LOD is reported with no standard deviation. When fewer than all were below the limit, the values were recalculated as LOD/√2 [52]. These recalculated values were used to determine the mean, standard deviation, and statistical differences.

Table S4: Hydrolysate composition data: Amino acids. Values are reported as the mean ± s.d. (n=3). In each row, values with different superscripts are statistically different based on Tukey's HSD Test (95% CI).

	Corn Stover				Switchgrass		
	36H56		P0448R		Shawnee		CIR
	2010	2012	2012	2013	2010	2012	2013
Amino Acids* (mM)							
Glycine	723 ± 123	740 ± 64	657 ± 72	828 ± 43	586 ± 145	754 ± 54	642 ± 156
Alanine	759^{b} ± 237	1391^{a} ± 143	1327^{a} ± 118	650^{b} ± 49	643^{b} ± 56	1236^{a} ± 74	558^{b} ± 71
Valine	174^{d} ± 25	462^{a} ± 25	331^{c} ± 14	143^{d} ± 11	153^{d} ± 5	388^{b} ± 27	168^{d} ± 14
Leucine	259^{cd} ± 19	392^{a} ± 12	320^{b} ± 13	180^{e} ± 9	227^{de} ± 34	387^{a} ± 11	281^{bc} ± 11
Isoleucine	97^{c} ± 11	241^{a} ± 5	183^{b} ± 10	77^{c} ± 1	77^{c} ± 8	178^{b} ± 10	87^{c} ± 3
Phenylalanine	175^{bc} ± 8	198^{ab} ± 6	182^{bc} ± 8	110^{d} ± 2	159^{c} ± 19	226^{a} ± 9	185^{bc} ± 17
Tryptophan	17^{cd} ± 3	26^{b} ± 4	25^{b} ± 1	12^{d} ± 1	21^{bc} ± 3	43^{a} ± 4	23^{bc} ± 1
Proline	357^{c} ± 55	980^{b} ± 39	1045^{b} ± 18	116^{d} ± 8	373^{c} ± 22	1465^{a} ± 86	138^{d} ± 21
Serine	310^{c} ± 16	442^{ab} ± 59	359^{bc} ± 9	258^{c} ± 35	281^{c} ± 90	565^{a} ± 18	312^{c} ± 32
Threonine	750^{bc} ± 67	1543^{a} ± 95	1158^{ab} ± 95	546^{c} ± 38	884^{bc} ± 137	1115^{b} ± 143	754^{bc} ± 170
Tyrosine	168^{bcd} ± 26	250^{a} ± 9	204^{abc} ± 24	113^{d} ± 13	137^{cd} ± 41	211^{ab} ± 15	193^{abc} ± 38
Asparagine	476^{a} ± 145	495^{a} ± 144	384^{ab} ± 54	196^{b} ± 49	434^{ab} ± 95	352^{ab} ± 47	232^{ab} ± 103
Lysine	192^{b} ± 31	303^{ab} ± 29	223^{b} ± 10	144^{b} ± 19	159^{b} ± 28	475^{a} ± 174	177^{b} ± 29
Arginine	200^{b} ± 27	214^{ab} ± 21	174^{b} ± 38	111^{b} ± 26	176^{b} ± 22	415^{a} ± 192	118^{b} ± 15
Histidine	49^{bc} ± 6	88^{a} ± 9	66^{abc} ± 8	42^{c} ± 2	55^{bc} ± 12	71^{ab} ± 15	55^{bc} ± 7
Aspartic Acid	856^{c} ± 85	1414^{a} ± 17	1093^{b} ± 61	384^{e} ± 31	578^{d} ± 32	708^{cd} ± 100	554^{d} ± 31
Glutamic Acid	413^{cd} ± 47	879^{a} ± 15	726^{b} ± 15	308^{e} ± 33	341^{de} ± 20	343^{de} ± 54	439^{c} ± 11

*The amino acids cysteine and methionine are unable to be quantified in hydrolysate samples using the analytical method. Although glutamine could be quantified, it was not observed for most samples. This amino acid is notoriously unstable and may have degraded during storage.

References

52. Croghan C, Egeghy PP. Methods of dealing with values below the limit of detection using SAS. Southern SAS User Group; St. Petersburg, FL; 2003.