

Supporting information

Influence of biochar and nitrogen on fine root morphology, physiology, and chemistry of *Acer mono*

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Table S1. Root Length of first-fifth order roots after Biochar and Nitrogen combine addition. B stands for Biochar levels (B1-B4); N stands for Nitrogen levels (N1-N4). Different letter show the level of significance. \pm represent the standard error of the mean.

Treatment	RL order 1 st	RL order 2 nd	RL order 3 rd	RL order 4 th	RL order 5 th
B1N1	78.3 \pm 3.2g	50.0 \pm 2.7e	NS	NS	NS
B1N2	83.3 \pm 3.0fg	60.3 \pm 2d	NS	NS	NS
B1N3	82.6 \pm 4.9 f	65.0 \pm 3.1c	NS	NS	NS
B1N4	88.6 \pm 5.5ef	67.6 \pm 3.1bc	NS	NS	NS
B2N1	87.0 \pm 4.2ef	67.3 \pm 3.1bc	NS	NS	NS
B2N2	89.6 \pm 4.4de	68.6 \pm 3.7bc	NS	NS	NS
B2N3	93.0 \pm 4.2cd	68.3 \pm 3.3bc	NS	NS	NS
B2N4	97.0 \pm 5.6bc	69.6 \pm 3.6b	NS	NS	NS
B3N1	93.0 \pm 2.2cd	76.6 \pm 3.9a	NS	NS	NS
B3N2	97.0 \pm 5bc	79.0 \pm 3.9a	NS	NS	NS
B3N3	95.6 \pm 4.9bc	77.6 \pm 2.3a	NS	NS	NS
B3N4	93.0 \pm 5.5cd	78.6 \pm 3.9a	NS	NS	NS
B4N1	98.3 \pm 4.2a	76.6 \pm 3.9a	NS	NS	NS
B4N2	89.6 \pm 5.4de	77.3 \pm 4.1a	NS	NS	NS
B4N3	96.6 \pm 4.2bc	79.0 \pm 4.1a	NS	NS	NS
B4N4	102 \pm 5.6a	80.3 \pm 4.7a	NS	NS	NS

Table S2. Root diameter of first-fifth order roots after Biochar and Nitrogen combine addition. B stands for Biochar levels (B1-B4); N stands for Nitrogen levels (N1-N4). Different letter show the level of significance. \pm represent the standard error of the mean.

	RD order 1 st	RD order 2 nd	RD order 3 rd	RD order 4 th	RD order 5 th
B1N1	0.274 \pm 0.01g	0.364 \pm 0.02l	0.556 \pm 0.02h	NS	NS
B1N2	0.298 \pm 0.01fg	0.386 \pm 0.02kl	0.580 \pm 0.02fgh	NS	NS
B1N3	0.314 \pm 0.02def	0.401 \pm 0.02jk	0.577 \pm 0.02efg	NS	NS
B1N4	0.320 \pm 0.01bcde	0.407 \pm 0.03ijk	0.590 \pm 0.04e	NS	NS
B2N1	0.323 \pm 0.02cde	0.403 \pm 0.02fghi	0.565 \pm 0.02ef	NS	NS
B2N2	0.336 \pm 0.01cde	0.405 \pm 0.03hij	0.583 \pm 0.02de	NS	NS
B2N3	0.343 \pm 0.04cde	0.408 \pm 0.02hij	0.579 \pm 0.02ef	NS	NS
B2N4	0.343 \pm 0.05cde	0.412 \pm 0.04ghij	0.607 \pm 0.03efgh	NS	NS
B3N1	0.348 \pm 0.04def	0.427 \pm 0.03def	0.573 \pm 0.02cd	NS	NS
B3N2	0.351 \pm 0.03bcd	0.428 \pm 0.05cde	0.559 \pm 0.03ef	NS	NS
B3N3	0.352 \pm 0.02bcd	0.424 \pm 0.04defg	0.600 \pm 0.03cd	NS	NS
B3N4	0.352 \pm 0.02bcd	0.433 \pm 0.04bcd	0.619 \pm 0.04bc	NS	NS
B4N1	0.365 \pm 0.04bcde	0.418 \pm 0.04efgh	0.581 \pm 0.03cd	NS	NS
B4N2	0.366 \pm 0.03bcd	0.439 \pm 0.05bc	0.570 \pm 0.04ef	NS	NS
B4N3	0.382 \pm 0.05ab	0.442 \pm 0.07b	0.603 \pm 0.06ab	NS	NS
B4N4	0.395 \pm 0.06a	0.456 \pm 0.07a	0.626 \pm 0.07a	NS	NS

Table S3. Specific root length (SRL) of first-fifth order roots after Biochar and Nitrogen combine addition. B stands for Biochar levels (B1-B4); N stands for Nitrogen levels (N1-N4). Different letter show the level of significance. \pm represent the standard error of the mean.

	SRL order 1 st	SRL order 2 nd	SRL order 3 rd	SRL order 4 th	SRL order 5 th
B1N1	81.6 \pm 2g	54.3 \pm 2e	NS	NS	NS
B1N2	84.3 \pm 3fg	60.3 \pm 2d	NS	NS	NS
B1N3	83.6 \pm 2fg	64 \pm 3cd	NS	NS	NS
B1N4	89.6 \pm 4de	66.6 \pm 3bc	NS	NS	NS
B2N1	88 \pm 4ef	66.3 \pm 3bc	NS	NS	NS
B2N2	90.6 \pm 4de	67.6 \pm 3bc	NS	NS	NS
B2N3	94 \pm 5cd	67.3 \pm 3bc	NS	NS	NS
B2N4	98 \pm 5bc	68.6 \pm 3b	NS	NS	NS
B3N1	94 \pm 4cd	75.6 \pm 4a	NS	NS	NS
B3N2	98 \pm 5bc	78 \pm 4a	NS	NS	NS
B3N3	96.6 \pm 5bc	76.6 \pm 4a	NS	NS	NS
B3N4	94 \pm 4cd	77.6 \pm 4a	NS	NS	NS
B4N1	99 \pm 5b	75.6 \pm 4a	NS	NS	NS
B4N2	90.6 \pm 5de	76.3 \pm 4a	NS	NS	NS
B4N3	97.6 \pm 5bc	78 \pm 4a	NS	NS	NS
B4N4	104 \pm 7a	79.3 \pm 4a	NS	NS	NS

Table S4. Root tissue N concentration of first-fifth order roots after Biochar and Nitrogen combine addition. B stands for Biochar levels (B1-B4); N stands for Nitrogen levels (N1-N4). Different letter show the level of significance. \pm represent the standard error of the mean.

Treatment	TNC order 1 st	TNC order 2 nd	TNC order 3 rd	TNC order 4 th	TNC order 5 th
B1N1	1.90 \pm 0.1f	1.70 \pm 0.1f	1.30 \pm 0.05d	0.83 \pm 0.03d	0.58 \pm 0.03d
B1N2	1.96 \pm 0.3f	1.76 \pm 0.2f	1.36 \pm 0.05d	0.94 \pm 0.03d	0.54 \pm 0.02d
B1N3	2.20 \pm 0.2ef	2.04 \pm 0.2ef	1.64 \pm 0.05d	1.11 \pm 0.03d	0.91 \pm 0.03c
B1N4	2.82 \pm 0.3bcd	2.42 \pm 0.3bcd	2.22 \pm 0.05abc	1.19 \pm 0.03abcd	1.00 \pm 0.04bc
B2N1	2.31 \pm 0.4e	2.31 \pm 0.3e	2.22 \pm 0.05abc	1.05 \pm 0.04d	0.75 \pm 0.02d
B2N2	2.79 \pm 0.4bcd	2.59 \pm 0.2bcd	2.19 \pm 0.06abc	1.66 \pm 0.04abc	1.36 \pm 0.03abc
B2N3	2.84 \pm 0.4bcd	2.64 \pm 0.3bcd	2.24 \pm 0.06abc	1.71 \pm 0.05abc	1.41 \pm 0.04abc
B2N4	2.87 \pm 0.4bcd	2.67 \pm 0.3abcd	2.27 \pm 0.06abc	1.74 \pm 0.05abc	1.44 \pm 0.04abc
B3N1	2.82 \pm 0.4bcd	2.62 \pm 0.2bcd	2.22 \pm 0.06abc	1.69 \pm 0.04abc	1.39 \pm 0.04abc
B3N2	2.96 \pm 0.4bcd	2.76 \pm 0.2abc	2.36 \pm 0.06abc	1.83 \pm 0.05abc	1.43 \pm 0.05abc
B3N3	2.77 \pm 0.4cd	2.57 \pm 0.3cd	2.17 \pm 0.06abc	1.84 \pm 0.05abc	1.44 \pm 0.04abc
B3N4	3.09 \pm 0.5ab	2.79 \pm 0.2ab	2.49 \pm 0.06ab	1.86 \pm 0.04abc	1.58 \pm 0.05ab
B4N1	2.63 \pm 0.4a	2.83 \pm 0.3d	2.03 \pm 0.06c	1.77 \pm 0.04abc	1.60 \pm 0.05ab
B4N2	3.04 \pm 0.5abc	2.84 \pm 0.3abc	2.44 \pm 0.06ab	1.95 \pm 0.04ab	1.66 \pm 0.05a
B4N3	3.15 \pm 0.5a	2.95 \pm 0.2a	2.55 \pm 0.06a	2.01 \pm 0.05a	1.68 \pm 0.06a
B4N4	3.16 \pm 0.5a	2.96 \pm 0.3a	2.56 \pm 0.06a	2.02 \pm 0.05a	1.71 \pm 0.06a

Table S5. C: N ratio of first-fifth order roots after Biochar and Nitrogen combine addition. B stands for Biochar levels (B1-B4); N stands for Nitrogen levels (N1-N4). Different letter show the level of significance. \pm represent the standard error of the mean.

	N: C order 1 st	N: C order 2 nd	N: C order 3 rd	N: C order 4 th	N: C order 5 th
B1N1	16. \pm 0.3h	21 \pm 0.4h	22.6 \pm 0.4h	28.7 \pm 0.7h	30.8 \pm 0.5g
B1N2	17.5 \pm 0.2ef	21.3 \pm 0.4gh	23.8 \pm 0.4g	29.9 \pm 0.7g	32 \pm 0.5f
B1N3	19 \pm 0.2de	21.7 \pm 0.4fg	24.2 \pm 0.5g	30.3 \pm 0.7fg	32.3 \pm 0.5ef
B1N4	19 \pm 0.2cd	22.6 \pm 0.4de	24.4 \pm 0.5fg	30.5 \pm 0.7fg	32.6 \pm 0.6ef
B2N1	17.90 \pm 0.2efg	22.3 \pm 0.5de	24.5 \pm 0.6fg	30.6 \pm 0.7fg	32.7 \pm 0.6ef
B2N2	18.5 \pm 0.2ef	22 \pm 0.5ef	24.7 \pm 0.7efg	30.8 \pm 0.9efg	32.9 \pm 0.6def
B2N3	18.5 \pm 0.3ef	22.6 \pm 0.5de	24.7 \pm 0.6efg	30.8 \pm 0.9efg	32.9 \pm 0.7def
B2N4	19.9 \pm 0.4c	22.4 \pm 0.5de	24.7 \pm 0.7efg	30.8 \pm 0.9efg	32.9 \pm 0.7def
B3N1	17.6 \pm 0.3gh	23.4 \pm 0.5cd	25.3 \pm 0.7def	31.4 \pm 0.9def	33.4 \pm 0.7cde
B3N2	18.2 \pm 0.3fg	23.6 \pm 0.5cd	25.7 \pm 0.7cde	31.8 \pm 0.8cde	33.9 \pm 0.7cd
B3N3	19.7 \pm 0.4cd	23.8 \pm 0.6cd	26 \pm 0.7bcd	32.1 \pm 0.9bcd	34.2 \pm 0.7bc
B3N4	19.8 \pm 0.3c	23.5 \pm 0.5cd	26 \pm 0.7bcd	32.1 \pm 0.9bcd	34.2 \pm 0.7bc
B4N1	18.3 \pm 0.4efg	24 \pm 0.6bc	26.1 \pm 0.7bcd	32.2 \pm 0.8bcd	34.3 \pm 0.7bc
B4N2	20.7 \pm 0.3b	24.3 \pm 0.6bc	26.4 \pm 0.9bc	32.5 \pm 0.9bc	34.6 \pm 0.9bc
B4N3	20.2 \pm 0.5bc	24.8 \pm 0.6b	26.9 \pm 0.9b	33 \pm 0.9b	35.1 \pm 0.9ab
B4N4	21.7 \pm 0.6a	25.8 \pm 0.7a	27.9 \pm 0.9a	34 \pm 0.9a	35.9 \pm 0.9a

Table S6. Root respiration of first-fifth order roots after Biochar and Nitrogen combine addition. B stands for Biochar levels (B1-B4); N stands for Nitrogen levels (N1-N4);

(Mean \pm standard error). Different letter show the level of significance. \pm represent the standard error of the mean.

Treatment	Rep order 1 st	Rep order 2 nd	Rep order 3 rd	Rep order 4 th	Rep order 5 th
B1N1	15 \pm 0.5g	13.2 \pm 0.6f	9.3 \pm 0.4f	4.3 \pm 0.3f	2.4 \pm 0.2g
B1N2	18.4 \pm 0.5f	16.4 \pm 0.6e	12.4 \pm 0.4e	7.4 \pm 0.3e	5.5 \pm 0.3f
B1N3	18.5 \pm 0.5f	16.5 \pm 0.6e	12.5 \pm 0.4e	7.5 \pm 0.3e	5.5 \pm 0.2f
B1N4	19.4 \pm 0.5ef	17.4 \pm 0.6de	13.4 \pm 0.3de	8.4 \pm 0.4de	6.4 \pm 0.2ef
B2N1	19.6 \pm 0.5ef	17.6 \pm 0.6de	13.6 \pm 0.4de	8.6 \pm 0.4de	6.6 \pm 0.3ef
B2N2	19.6 \pm 0.5def	17.6 \pm 0.6de	13.6 \pm 0.4de	8.6 \pm 0.4de	6.6 \pm 0.3ef
B2N3	19.7 \pm 0.5def	17.7 \pm 0.7de	13.7 \pm 0.3de	8.7 \pm 0.4de	6.7 \pm 0.2def
B2N4	19.9 \pm 0.5cdef	17.9 \pm 0.7cde	13.9 \pm 0.4cde	8.9 \pm 0.4cde	6.9 \pm 0.3cdef
B3N1	20 \pm 0.6cdef	18 \pm 0.7cde	14 \pm 0.4cde	9 \pm 0.4cde	7 \pm 0.3cdef
B3N2	20.2 \pm 0.6cdef	18.2 \pm 0.7cde	14.2 \pm 0.4cde	9.2 \pm 0.4cde	7.2 \pm 0.3cdef
B3N3	20.9 \pm 0.6bcde	18.9 \pm 0.7bcd	14.9 \pm 0.4bcd	9.9 \pm 0.3bcd	7.9 \pm 0.4bcde
B3N4	20.9 \pm 0.6bcde	18.9 \pm 0.7bcd	14.9 \pm 0.4bcd	9.9 \pm 0.3bcd	7.9 \pm 0.4bcde
B4N1	21.6 \pm 0.6bcd	19.6 \pm 0.7bc	15.6 \pm 0.4bc	10.6 \pm 0.3bc	8.6 \pm 0.4bcd
B4N2	21.7 \pm 0.6bc	19.7 \pm 0.7bc	15.7 \pm 0.5bc	10.7 \pm 0.4bc	8.7 \pm 0.4bc
B4N3	22.3 \pm 0.6b	20.3 \pm 0.7b	16.3 \pm 0.5b	11.3 \pm 0.4b	9.3 \pm 0.4b
B4N4	24.6 \pm 0.6a	20.6 \pm 0.7a	18.6 \pm 0.5a	13.3 \pm 0.4a	11.6 \pm 0.4a