NUMERICAL DATA

Effect of elevated atmospheric CO_2 concentration on growth and physiology of wheat and sorghum under cadmium stress (2018)

Effect of [CO_2] and [Cd] treatments on leaf area, shoot and root DW (dry weight) of wheat and sorghum plants.

Shoot/Root ratio	RDW (g)	SDW (g)	SLA	LA (cm^2)	C_{Cd} (mg/kg)	[CO_2]	Plant species
2.20b	1.62j	3.54f	228.2h	435.8g	0	Ambient	**Wheat**
1.94e	1.76b	3.42g	214.1l	383.2i	10		
2.00de	1.22m	2.44k	226.1i	343.7k	20		
1.66f	1.13n	1.90n	234.8f	284.1n	40		
2.43a	1.84h	4.50d	210.1m	506.3e	0	Elevated	
2.05cd	2.06f	4.23e	200.1n	442.1f	10		
2.11bc	1.40l	2.90i	216.7k	390.1h	20		
1.74f	1.26m	2.20l	231.9g	326.9l	40		
1.97de	2.75b	5.42b	214.8l	569.4c	0	Ambient	**Sorghum**
2.04cd	2.26d	4.63c	246.2d	551.6d	10		
1.42g	1.91g	2.72j	217.9k	300.7m	20		
1.25h	1.46k	1.83n	256.6c	241.2o	40		
2.02cde	3.04a	6.17a	237.7e	715.5a	0	Elevated	
2.20b	2.45c	5.40b	265.8b	693.9b	10		
1.50g	2.16e	3.22h	221.6j	361.2j	20		
1.30h	**1.60j**	**2.03m**	**274.7a**	**285.7n**	**40**		

*C_{Cd} : Cd concentration, LA: leaf area, SLA: specific leaf area, SDW: shoot dry weight, RDW: root dry weight in each column different letters show significant differences ($P < 0.05$) between treatments

For wheat and sorghum at both CO_2 levels, increases in Cd concentration ([Cd]) decreased all the indices of plant growth, i.e. leaf area, and shoot and root DW, whereas at the same [Cd], e[CO_2].

Source: https://www.tandfonline.com/doi/full/10.1080/00103624.2018.1547388

Atmospheric CO_2 enrichment effect on the Cu-tolerance of the C_4 cordgrassT Spartinadensiflora (2018)

Photosynthetic pigments concentrations (μg/g) and DES state in randomly selected, fully expanded penultimate leaves of Spartinadensiflora in response to treatment with a range of Cu concentrations at 400 and 700 ppm CO_2 after 30 d of treatment. Values represent mean ± SE, n = 5. Different letters indicate means that are significantly different from each other (LSD, $P < 0.05$).

[Cu] (mM)	[CO_2] (ppm)	Chl a	Chl b	Phe a	b-carotene	Lutein	Neoxanthin	Violaxanthin	Zeaxanthin	DES
0	400	242.5± 19.2^a	91.5± 6.7^a	14.1± 2.3^a	5.8± 0.5^a	20.1± 4.1^a	8.9± 1.4^a	3.8± 1.1^a	6.4± 0.9^a	0.60± 0.05^a
	700	200.4± 17.4^a	82.6± 5.1^a	15.5± 2.5^a	5.6± 0.4^a	17.8± 2.4^a	7.1± 1.2^a	4.5± 0.9^a	5.9± 1.1^a	0.52± 0.04^a
15	400	162.6± 6.5^b	51.4± 1.9^b	5.7 ± 0.2^b	4.5± 0.2^a	15.3± 0.8^a	7.1± 0.4^a	3.6± 0.2^a	4.7± 0.3^a	0.42± 0.01^a
	700	174.2± 11.5^b	44.4± 1.6^b	8.8± 2.4^b	5.9± 1.4^a	15.4± 2.9^a	5.5± 1.1^a	6.7± 2.2^a	5.9± 1.2^a	0.49± 0.06^a
45	400	167.3± 8.7^b	54.0± 3.1^b	4.9± 0.5^b	5.1± 0.3^a	15.9± 0.9^a	6.8± 0.6^a	3.6± 1.2^a	5.1± 0.3^a	0.41± 0.07^a
	700	166.5± 7.4^b	58.3± 4.5^b	7.8± 1.2^b	5.1± 0.4^a	15.3± 1.8^a	6.6± 0.2^a	5.4± 1.3^a	5.5± 0.4^a	0.51± 0.04^a

De-Epoxidation State (DES)

DES = [Antheraxantin] + [Zeaxanhin]/[Violaxanthin] + [Antheraxantin] + [Zeaxanthin]

Chl a, Chl b and Phe a concentrations decreased in presence of Cu in similar degree in both atmospheric CO2 concentrations treatment (Twoway ANOVA: Cu, $p < 0.05$), but without statistical differences between Cu treatments. Contrarily the concentrations of each specific carotenoids and DES state did not vary with Cu and CO2 concentrations treatments.

Source: https://www.sciencedirect.com/science/article/pii/S0176161717302808

Atmospheric CO_2 enrichment effect on the Cu-tolerance of the C_4 cordgrassT Spartinadensiflora (2018)

Total Cu, Ca, K, Mg and P concentrations for leaves and roots of Spartinadensiflora in response to treatment with a range of Cu concentrations at 400 and 700 ppm CO_2 for 30d.

Tissue	[Cu] (mM)	[CO_2] (ppm)	Cu (mg Kg^{-1})	Ca (mg g^{-1})	K (mg g^{-1})	Mg (mg g^{-1})	P (mg g^{-1})
Leaves	0	400	4.9 ± 1.0^{a}	3.4 ± 0.3^{a}	25.4 ± 0.2^{a}	3.3 ± 0.2^{a}	2.6 ± 0.1^{a}
		700	5.4 ± 0.2^{a}	3.1 ± 0.2^{a}	24.3 ± 0.3^{a}	2.9 ± 0.1^{a}	2.9 ± 0.1^{a}
	15	400	179.6 ± 2.0^{b}	3.1 ± 0.2^{a}	17.8 ± 0.4^{b}	2.9 ± 0.1^{a}	1.6 ± 0.2^{b}
		700	248.9 ± 6.3^{bc}	3.1 ± 0.2^{a}	19.2 ± 0.4^{b}	2.7 ± 0.1^{a}	1.9 ± 0.2^{b}
	45	400	737.5 ± 4.0^{d}	3.6 ± 0.1^{a}	22.1 ± 0.6^{ab}	3.4 ± 0.4^{a}	2.6 ± 0.2^{a}
		700	291.4 ± 4.9^{c}	2.9 ± 0.4^{a}	19.6 ± 1.1^{b}	3.0 ± 0.2^{a}	2.1 ± 0.1^{ab}
Roots	0	400	7.6 ± 0.5^{a}	2.4 ± 0.1^{a}	10.5 ± 0.3^{a}	1.4 ± 0.1^{a}	1.9 ± 0.2^{a}
		700	8.2 ± 1.4^{a}	2.2 ± 0.1^{a}	15.3 ± 1.0^{a}	1.7 ± 0.3^{a}	2.7 ± 0.1^{b}
	15	400	715.8 ± 11.0^{b}	1.9 ± 0.1^{b}	7.8 ± 0.5^{b}	1.1 ± 0.2^{a}	1.3 ± 0.2^{a}
		700	581.3 ± 9.0^{c}	1.6 ± 0.2^{b}	6.0 ± 0.3^{b}	1.0 ± 0.2^{a}	1.0 ± 0.5^{a}
	45	400	588.5 ± 3.0^{c}	1.5 ± 0.2^{b}	7.3 ± 0.4^{b}	1.2 ± 0.2^{a}	1.5 ± 0.2^{a}
		700	627.7 ± 12.0^{c}	1.5 ± 0.3^{b}	8.6 ± 0.5^{a}	1.1 ± 0.2^{a}	1.8 ± 0.4^{a}

Values represent mean ± SE, n = 6. Different values indicate means that are significantly different from each other (Two-way ANOVA, $p < 0.05$)

Source: https://www.sciencedirect.com/science/article/pii/S0176161717302808

Effect of elevated atmospheric CO_2 concentration on growth and leaf litter decomposition of Quercus acutissima and Fraxinus rhynchophylla (2017)

Comparison of the growth parameters of Q. acutissima and F. rhynchophylla in the ambient air (380 ppm) and elevated CO_2 (700 ppm) chambers.

	Q. acutissima			*F. rhynchophylla*		
Plant growth parameters	**Ambient air**	**Elevated CO_2**	***p***	**Ambient air**	**Elevated CO_2**	***p***
Total dry weight (g)	14.77±2.06	15.35±3.59	0.892	29.5±4.60	28.9±1.71	**0.914**
S/R	0.51±0.009	0.35±0.031	0.003	1.16±0.06	0.98±0.16	**0.307**
LWR	0.16±0.002	0.14±0.004	0.001	0.11±0.02	0.13±0.008	**0.028**
Thickness (mm)	0.09±0.002	0.11±0.003	0.002	0.13±0.002	0.15±0.01	**<0.001**
Leaf area (cm^2)	34.90±2.30	32.23±3.14	0.518	34.74±2.48	24.23±2.79	**0.030**
SLA ($cm^2\ g^{-1}$)	**235.1±8.79**	**176.7±5.93**	**0.001**	**241.1±5.96**	**181.9±2.19**	**<0.001**

Values are means ± SE.

* Shoot - root ratio (g g-1) = total shoot weight (g) / total root weight (g)

* Leaf weight ratio (g g-1) = total leaf weight (g)/ total plant weight (g)

* Specific leaf area (cm2 g -1) = total leaf area (cm2)Þ = total leaf weight

The growth of Q. acutissima and F. rhynchophylla did not statistically differ between the ambient air and elevated CO_2 chambers . However, the shoot/root (S/R) ratio differed between the two species. The S/R ratio of Q. acutissima was significantly lower in elevated CO_2 chamber. Leaf growth conspicuously differed between the conditions. The thickness of the leaf blade was significantly higher (22% for Q. acutissima and 15% for F. rhynchophylla) in the elevated CO_2 chamber. The leaf area of F. rhynchophylla litter was significantly lower in elevated CO_2 chamber. And the specific leaf area (SLA) of the leaf litter of Q. acutissima and F. rhynchophylla were significantly lower at the higher CO_2 concentration.

Source: https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0171197&type=printable

Effects of elevated atmospheric CO_2 on tree mycorrhiza associations (2016)

Species	Growing conditions	%Info	Total	Other effects on mycorrhizae	Root response
Betula alleghaniensis	Mesocosms (700 ll l−"), growing in competition with *Betula papyrifera*	↑			**Mass ↑ , length ↑**
Betula papyrifera	Mesocosms (700 ll l−"), growing in competition with *Betula alleghaniensis*	↑	↑		**Mass =↑, length =**
Betula papyrifera	Pots in GC (700 ll l−")			Altered morphotype assemblages, extraradical hyphal length	**Mass ↑**
Betula pendula	OTC (700 lll−"), no fertilizer	↑		Altered species composition	**Mass**
Liriodendron tulipifera	24 weeks, pots in GC (•150 and-300 µ l−")	¯=			**Mass**
Liriodendron tulipifera	OTC (•150 and •300 µl−")	=			**Mass ↑**
Pinus caribaea	49 weeks, pots in GC (660 ll l−")	=			
Pinus echinata	41 weeks, pots in GC	¯=		Signif. # in % Inf. at 34	**Mass ↑**
	(double CO#), no fertilizer		weeks, not at ®nal harvest ↑		
Pinus echinata	24 weeks, pots in GC (double CO#)	=	Signif. In % Inf. at 6 weeks, not at ®nal harvest		**Mass**

Pinus palustris	Pots in OTC (720 ll l−")	↑	No changes in morphotype assemblages, effect larger at low N and adequate water	**Length**
Pinus ponderosa	OTC (•175 and •350 ll l−")		↑ Extraradical fungal hyphae↑,, Mycorrhizal turnover	**Area density** ↑
Pinus ponderosa	Pots in GC (700 ll l−")	↑	↑ Density ↑	
Pinus radiata	49 weeks, pots in GC (660 ll l−")	=		
Pinus strobus	Pots in GC (700 ll l−")	↑	Altered morphotype assemblages	**Mass** ↑
Pinus syl.estris	Pots in GC (700 ll l−")	↑	Altered morphotype assemblages	↑
Pinus syl.estris	120 d, pots in GC (double CO#)	=	No effect on total fungal mass	
Pinus taeda	Open bottom pots in OTC (700 ll l−")	=		↑
Populus tremuloides	Open bottom pots in OTC (700 ll l−")	=	Extraradical mycorrhizal hyphal	**Mass**
length # under N-poor conditions, $ under N-rich conditions				
Populus hybrids	2 years, OTC (-350 ll l−")	AM =		**Mass**↑
Quercus alba	24 weeks, pots in GC (double CO#)	Increased↑ mycorrhizal infection before increase in root mass, alterations in species abundance		**Mass** ↑
Quercus alba	OTC (•150 and •300 ll l−")	↑		**Mass** ↑
Tsuga canadensis	**Pots in GC (700 ll l−")**	**EM = AM** ↑		**Mass** ↑

Experimental (growing) conditions, response of the percentage of mycorrhizal infection (%Inf), of total amount of mycorrhizae, as well as ®ne root response are reported for each study. EM, ectomycorrhizae; AM, arbuscular mycorrhizae; ¯, no signi®cant changes (*P*!0±05); , signi®cantly enhanced (*P*!0±05).

Source: R. Ceulemans at al. (2016), Effects of CO2 Enrichment on Trees and Forests: Lessons to be Learned in View of Future Ecosystem Studies, Annals of Botany

Effects of elevated CO_2 on tree litter decomposition (2016)

Tree species and tissue	Plant growth conditions	Decomposition conditions	Response of litter quality	Response of decomposition
***Acer pseudoplatanus*, senesced leaves**	1 season, 600 µ l−", pots in solar domes	8 months, chambers	C / N , lignin / N	=
***Betula pubescens*, senesced leaves**	1 season, 600 µ l−", pots in solar domes	5 months, chambers	C / N , lignin / N	↓
Betula	1 season, 600 µ	3 months,		=
pubescens, live roots <2 mm	l−", pots in solar domes:	Chambers with soil		
Castanea sati.a, senesced leaves	non-fertilized 2 years, 700 ll l−", pots in GC	6 months, chambers: Incomplete decomposer community complex decomposer community	C / N C / N C / N , lignin = C / N , lignin =	↓
Fraxinus excelsior, senesced leaves	1 season, 600 ll l−", pots in solar domes		C / N , lignin /N	
Liriodendron tulipifera, senesced leaves	1 season, •300 ll l−", pots in GC, exposed to ozone		N , lignin	↓
Liriodendron tulipifera, senesced leaves	2 years, •150 and -300 ll l−", OTC		C / N , lignin /N	↓
Picea sitchensis, senesced needles	1 season, 600 ll l−", pots in solar domes		C / N , lignin /N	=
Picea sitchensis, live roots !2 mm	**1 season, 600 ll l−", pots in solar domes: 3 months, chambers with soil fertilized non-fertilized**	**3 months, chambers with soil**	**C / N C / N**	=

Tree species and tissue, fumigation conditions and duration, decomposition conditions and duration, and changes in litter chemistry anddecomposition rates are reported for every study.OTC, Open top chambers; GC, growth chambers; ¯, no signi®cant changes (P!0±05); #, signi®cantly enhanced (P!0±05); $, signi®cantlydecreased (P!0±05).

Source: R. Ceulemans at al. (2016), Effects of CO2 Enrichment on Trees and Forests: Lessons to be Learned in View of Future Ecosystem Studies, Annals of Botany