academicJournals

Vol. 16(2), pp. 65-86, 11 January 2017
DOI: 10.5897/AJB2016.15769
Article Number: 89B45F062376
ISSN 1684-5315

http://www.academicjournals.org/AJB

African Journal of Biotechnology

Full Length Research Paper

Effects of regionally applied heating on the respiration of wild type and transgenic soybean (*Glycine max*) plants grown under ambient and elevated CO_2 environments

Chukwuma Collins Ogbaga

Department of Biological Sciences, Nile University of Nigeria, Abuja, Nigeria.

Received 7 November, 2016; Accepted 30 December, 2016

Nocturnal dark respiration (Rn) in wild type and transgenic soybean plants grown at SoyFACE research facility, Illinois, USA under ambient and elevated CO_2 conditions was examined in this study. Transgenic plants were transformed to overexpress a key Calvin cycle enzyme sedoheptulose-1,7-bisphosphatase (SBP) which is thought to improve yield in the field by at least 11%. Heating was applied using infrared heaters mounted 1.2 m above the plants in the field during the growing season of 2015 summer and Rn measurements taken for wild type and SBP overexpressors at ambient and elevated CO_2 plots from V4 to R6 developmental stages. The objective was to study the effects of elevated CO_2 of approximately 585 µmol mol^{-1} and +3.5 increase in temperature on wildtype and transgenic SBP plants. Measurements were recorded at growth and constant temperature for both varieties. Experimental plants were transferred to a controlled growth chamber at V4 and R6 developmental stages and the temperature responses examined from 15 to 40°C. Specific leaf area (SLA) and its relations to Rn were also determined. Results indicate that SLA decreased significantly relative to control in the wild type and transgenic soybean plants by R6. Differential responses of Rn to ambient and elevated CO_2 treatments were observed in both plants. In addition, results indicate that Rn declined generally in both varieties under elevated temperature. Lower Rn was attributed to temperature acclimation.

Key words: Dark respiration, soybean, ambient CO_2, elevated CO_2, transgenic plant, sedoheptulose-1,7-bisphosphatase (SBP), heating, acclimation.

INTRODUCTION

With changing environmental conditions due to global warming, plants experience variations in photosynthesis. These variations can be short-term or long-term and affect metabolic processes. In the future, the effects of

E-mail: chukwumaogbaga@gmail.com. Tel: +2349030333632.

global warming may become more pronounced due to the continuous rise in greenhouse gases (Meehl et al., 2005). Additionally, the dominant anthropogenic greenhouse gas, atmospheric CO_2 concentrations is expected to rise to 600 ppm by 2050 (IPCC, 2013). The average surface temperature is also projected to increase by 5°C by the end of the 21st century (IPCC, 2013). Compared to the response at current ambient CO_2 concentrations (400 ppm, aCO_2), elevated CO_2 particularly in combination with high temperature has profound effects on the growth and physiology of plants and can lead to abiotic conditions such as drought and ultimately low crop yield (Xu et al., 2015).

Respiration is necessary for the maintenance of biosynthesis and cellular functions (Atkin et al., 2006). These ensure that the energy needed for plant growth and survival during abiotic stresses is available. Respiration lowers the production of harmful reactive oxygen species from these stresses and also contributes to carbon allocation. As a result, the photosynthetic activity in particular, sucrose synthesis is influenced by respiration. In addition, the xanthophyll and glutathione protective cycles are regulated by respiration with ascorbate produced. These ensure that the plant is equipped with strong defense mechanisms against the deleterious effects of abiotic and biotic stresses such as pathogen attack (Atkin et al., 2005).

Transgenic approaches are increasingly being used to improve crop yields for more sustainable food production. For these approaches to be successful, it is pertinent to understand the physiology and cellular function of the plant of interest. The physiology of soybean is well known and understood. Photosynthetic regulation studied in the plant revealed that temperature and elevated CO_2 affect its photosynthesis and yield (Hay, 2012; Rosenthal et al., 2011; Ruiz-Vera et al., 2013). Specifically it was shown that, photosynthesis is limited by ribulose-1,5-bisphosphate (RuBP) regeneration (Zhu et al., 2007; Rosenthal et al., 2011). Theoretically, if photosynthesis is limited by RuBP generation as a result of rise in CO_2 and temperature, attempt to transgenically modify the Calvin cycle in other to increase the rates of RuBP regeneration, should improve photosynthesis (Bernacchi et al., 2003). Recently, a key enzyme involved in RuBP regeneration in the Calvin Cycle Sedoheptulose-1,7-bisphosphatase (SBP) was shown to influence photosynthesis as CO_2 rises (Zhu et al., 2007). There is evidence that, overexpression of the enzyme increases the yield of tobacco and soybean in the field (Hay, 2012; Rosenthal et al., 2011). However, respiration in these transgenic species has not been explored in relation to changes in growth CO_2.

Elevated atmospheric CO_2 is believed to potentially increase temperature thereby increasing respiration (Lewis et al., 1999). Plant respiration is thought to contribute up to 65% of atmospheric CO_2, with the remaining generated from soil respiration (Atkin et al., 2005). The focus of the research presented here is however on leaf respiration.

Respiration is therefore largely affected by temperature. The relationship between plant respiration and temperature response is an exponential curve that involves a constant Q_{10}, that is a proportional change in temperature with 10°C variation (Atkin et al., 2005). In addition, plants can acclimate to temperature upon long-term exposure. This result is in the adjustment of the carbon respired and changes in rate of photosynthesis. This effect termed thermal acclimation, is fully or partly reversible when optimal growth conditions return (Bunce, 2007). From literature, some of the causes of acclimation to temperature include; availability of carbohydrates, nitrogen, decrease in stomatal resistance and evaporative cooling (Baker et al., 1992; Clark and Menary, 1980; Evans and Poorter, 2001; Song et al., 2014; Wolf et al., 1990).

Although many papers have considered leaf respiration in different species, thereby conflicting reports. Respiration has been reported to increase, decrease or remain unchanged in response to various abiotic stresses (Gifford, 1995; Gonzalez-Meler et al., 1996; Leakey et al., 2009b; Lewis et al., 1999; Ziska and Bunce, 1998). Despite the huge literature available, no work has been done to compare the dark respiration of a wild type plant with a transgenic one grown in the field. In particular, there is need to understand the effects of elevated CO_2 and temperature on the dark respiration of field grown plants. Moreover, Specific Leaf Area (SLA) measures leaf area per dry weight which is used to determine resource allocation vis-a-viz respiratory substrates (Reich et al., 1998; Xu et al., 2015). A lower SLA has been interpreted to mean greater allocation of biomass to structural rather than to metabolic components of the leaf (Reich et al., 1998).

The current research presented here focused on dark respiration in relation to SLA, elevated CO_2 and temperature in a wild type soybean plant and transgenic species which have been modified to express SBP. The objective was to study the effects of elevated CO_2 of approximately 585 μmol mol^{-1} and +3.5 increase in temperature on wild type and transgenic SBP plants. These plants were grown in the field at ambient and elevated CO_2 and respiration measured at night (nocturnal respiration). Responses were examined in some experiments in combination with continuous heating, in order to provide a clearer view of the physiological impacts of elevated temperature, which is projected to occur with global change.

MATERIALS AND METHODS

Description of the plant varieties, field site, heating equipment and sample collection

Wild type (Thorne variety) and SBP soybean (*Glycine max*) plants were grown in the field at SoyFACE, Savoy, IL, USA (Ruiz-Vera et al., 2013). They were grown during 2015 summer growing season at different plots separated into: 1) control (ambient CO_2 that is approximately 400 µmol mol^{-1} CO_2 and ambient temperature that is day time temperature); 2) elevated temperature (eT) that is ambient CO_2 and +3.5°C in temperature); 3) elevated CO_2 (eC) that is approximately 585 µmol mol^{-1} CO_2 and ambient temperature), and 4) combined elevated temperature and elevated $CO_{2,}$ (eT +eC) that is approximately 585 µmol mol^{-1} CO_2 and +3.5°C in temperature).

Each experiment consists of a randomized complete block design. Heaters were turned on a start of the growing season for eT and eT+eC treatments. Continuous heating was imposed using infrared (IR) heating technology. Each heated plots contained six infrared heaters mounted 1.2 m above canopy level and positioned 45° angle towards the plot. Heater outputs were regulated using a custom built industrial dimmer system and controlled using a data logger (CR1000 Micro logger, Campbell Scientific) to maintain a 3.5°C temperature increase, relative to ambient temperature for 24 h throughout the growing season. . Full description of the infrared heaters, dimmers and radiometers is given in Ruiz-Vera et al. (2013). Elevated temperature and CO_2 were maintained from sunrise to sunset and applied from emergence to the time plants were harvested. On sample collection days, between DOY 188 to 238, youngest fully expanded soybean leaves were excised for 1 h into sunset with a blade, transferred into Eppendorf tubes filled with distilled water and sealed with parafilm. Measurements were made between 10 pm and 4 am.

Description of experiments

Experiment 1

To investigate the effects of CO_2 on Rn at different growth stages, leaves were collected at 33 days (DOY-188), 41 days (DOY-196), 61 days (DOY-216) and 83 days (DOY- 238) after planting. At the time of collection, plants were at V4, V5, R1 and R6 stages of development.

Before starting the experiment, Rn was examined preliminarily on intact and detached leaves in the field and growth chamber. It was observed that Rn values were unaffected for several hours. However, values were different during the daytime on darkened leaves. Thus, measurements for this experiment were made between 10 pm and 4 am. Leaves collected in the field were kept in a dark box. The leaves were subsequently moved to a growth chamber (Environmental Growth Chambers, Chagrin Falls, Ohio, USA) in the laboratory. The growth chamber was darkened and programmed to match the minimum daytime conditions of temperature and humidity. Temperature was also adjusted according to the experimental plan. Leaf punches (12 mm) were collected at each CO_2 and temperature growing condition for the calculation of SLA. For this, leaves were oven-dried to a constant weight at 70°C and SLA calculated as leaf area, divided by dry weight. Respiration rates measured as net CO_2 efflux in the dark were determined by placing the leaves in a 6x2 Licor 6400 (Nebraska, USA) black-tape covered cuvette. Leaves were positioned in such a way that the cuvette was completely filled. In this experiment, leaves collected from ambient temperature that is day time temperature and ambient CO_2 grown plants grown in approximately 400 µmol mol^{-1} CO_2 plot were measured at: 1) ambient temperature and ambient CO_2 (set using the growth chamber) and 2) elevated temperature that is +3.5°C in temperature and ambient CO_2.

Leaves collected from ambient temperature and elevated CO_2 grown plants that is grown in approximately 585 µmol mol^{-1} CO_2 plot were measured at: 1) ambient temperature and elevated CO_2 conditions (set using the growth chamber), and 2) elevated temperature and elevated CO_2. Leaves collected from elevated temperature and ambient CO_2 grown plants were measured at: 1) elevated temperature and ambient CO_2 conditions and 2) ambient temperature and ambient CO_2 conditions. Leaves collected from elevated CO_2 and elevated temperature were measured at: 1) elevated CO_2 and elevated temperature, 2) elevated CO_2 and ambient temperature. A flow rate of 300 mmol s^{-1} in the Licor 6400 chamber was used for this experiment. After allowing the Licor machine to stabilize for approximately 5 min, four biological replicates were measured for each treatment.

Experiment 2

In this experiment, leaves were collected for the investigation of acclimation of dark respiration to elevated CO_2 and thermal acclimation to temperature. For the former, leaves were excised 35 d (DOY-190) and 75 d (DOY-230) after planting, when plants were at V4 and R6 stages of development. For the latter, plants were collected at 36 d (DOY-191) and 76 d (DOY-231) after planting when leaves were at same stages of development with the former. Leaves were kept in a dark box immediately after collection and subsequently moved to a growth chamber (Conviron, Controlled Environments Limited, Manitoba, Canada). The growth chamber was darkened and temperature adjusted as needed.

Respiration rates measured as net CO_2 efflux in the dark were determined by placing the leaves in a 6x2 Licor 6400 (Nebraska, USA) black-tape covered cuvette. Leaves were positioned in such a way that the cuvette was completely filled. To investigate acclimation of respiration to elevated CO_2, leaves collected from ambient temperature that is day time temperature and ambient CO_2 grown plants, grown in approximately 400 µmol mol^{-1} CO_2 plot were measured at ambient and elevated CO_2 under ambient temperature (set using the growth chamber). Leaves collected from elevated CO_2 that is approximately 585 µmol mol^{-1} CO_2 and ambient temperature grown plants were measured at elevated and ambient CO_2 under ambient temperature (set using the growth chamber).

Leaves collected from elevated CO_2 and elevated temperature that is +3.5°C in temperature grown plants were measured at ambient and elevated CO_2 conditions under elevated temperature (set using the growth chamber). A flow rate of 300 mmol s^{-1} in the Licor 6400 chamber was used for this experiment. After allowing the Licor machine to stabilize for approximately 5 min, four biological replicates were measured for each treatment.

To investigate thermal acclimation to temperature, nocturnal temperature response curves (from 15 to 40°C; heating rate of 1°C min^{-1}) were measured using Licor 6400 on leaves from plants grown at 1) ambient temperature that is day time temperature and ambient CO_2 which is approximately 400 µmol mol^{-1} $CO_{2,}$ 2) elevated temperature that is +3.5°C in temperature, and 3) combined elevated temperature and elevated CO_2 that is +3.5°C in temperature and approximately 585 µmol mol^{-1} CO_2. Leaves collected from ambient CO_2 plots (at control or elevated temperature) were measured at ambient CO_2, whereas those collected from elevated CO_2 plots (control or elevated temperature) were measured at elevated CO_2. After allowing the Licor machine to stabilize for approximately 5 min, three biological replicates were measured for each treatment.

Statistical analysis

Data were analyzed using a mixed – model ANOVA obtained with Kenward-Roger method in SAS System 9.3 (SAS institute). Student t tests were used to compare treatments and means taking into consideration the differences of least square means. Statistical significance was estimated at $P \leq 0.05$. Comprehensive details of the statistical analysis can be found in Supplementary Table 1.

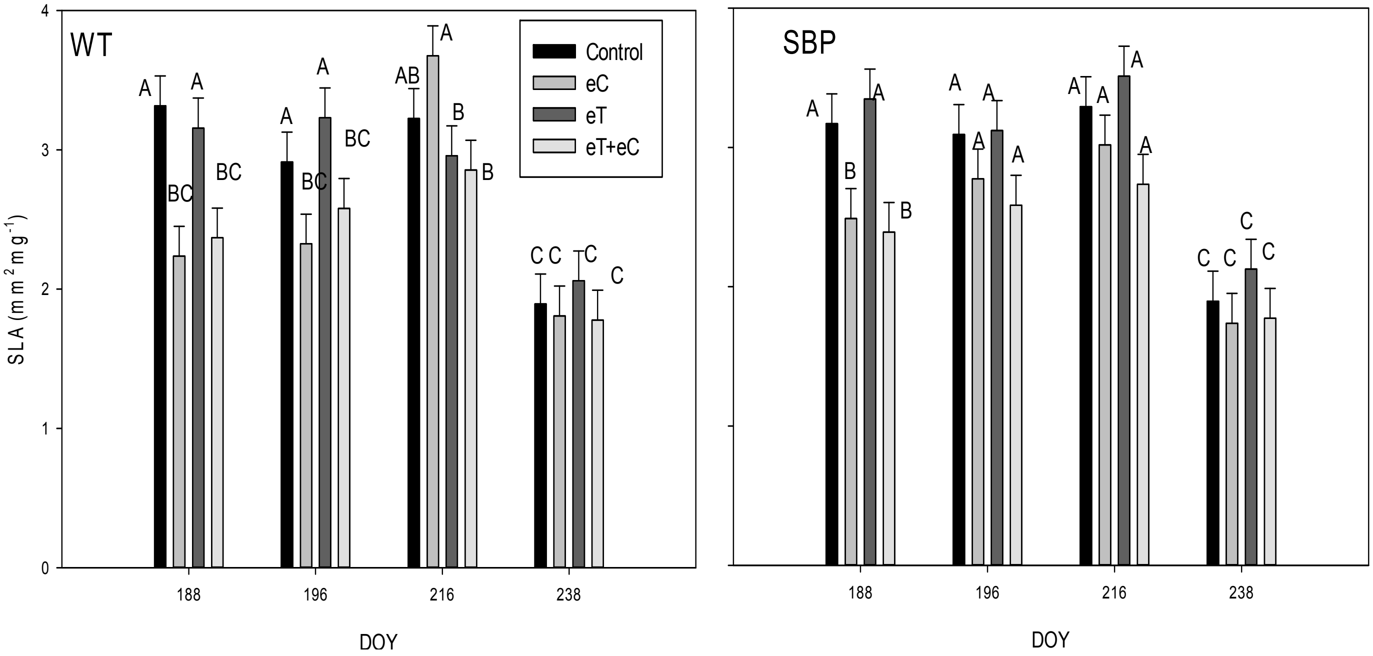

Figure 1. Specific leaf area of wild type (A) and transgenic SBP (B) soybean plants grown at control, elevated CO_2, elevated temperature (eT) and a combination of elevated temperature and CO_2 (eT+eC).

RESULTS AND DISCUSSION

To determine if different growth conditions- eT, eC and eT+eC lead to greater allocation of biomass rather than metabolism (Reich et al., 1998) in soybean grown in the field, specific leaf area (SLA, leaf area per unit dry matter) was measured. The control and eT grown plants had similar SLA in the four developmental stages measured for wild type and SBP varieties. For the SBP variety, SLA for the three treatments was higher on V4, V5 and R1 but dropped significantly on R6 ($P<0.05$) (Figure 1). For wild type, the drop on R6 for the three treatments was significant relative to the treatments on V5. The drop in SLA at R6 could represent a preferential allocation of biomass over metabolism in both varieties (Reich et al., 1998). SLA in eC and eT+eC grown plants was lower, relative to those grown in control and eT for the wild type and SBP varieties at V4. SLA for the treatments at V5 matched the previous V4 data in the wildtype variety. However, for eC grown plants, SLA values were similar at R1 in the wild type and transgenic SBP varieties. SLA measures the leaf area per dry weight of leaf tissues at a particular time. The relationship between SLA and dark respiration showed differential responses at growth and measurement temperatures in both varieties (Figure 2). Thus, suggesting that overall, there was a balance between biomass allocation and metabolism (respiratory substrates) in the plants.

To determine if SLA correlated with dark respiration (Rn) at various developmental stages at growth and measurement temperatures, plants were examined at V4, V5, R1 and R6 developmental stages. There were differential effects of Rn at the various growth and measurement stages in both varieties. Dark respiration (Rd) did not differ significantly in the wild type plants at growth and measurement temperatures on V4. In contrast, in SBP plants, Rd was lower for all the conditions at same measurement temperature on V4 and V5 relative to control ($P<0.05$) (Figure 3). Rn in SBP plants grown and measured at eC and eT+eC, did not decrease significantly relative to control at R1 and R6, respectively (Figure 3). For both varieties, Rd was overall lowest and differed markedly from control in eT and eT+eC grown plants from V5 to R6 in both growth and measurement temperatures (Figure 3). A number of studies have shown that elevated CO_2 stimulates Rd (Leakey et al., 2009a; Leakey et al., 2009b). Other studies showed approximately 14 to 18% reduction when plants were grown in elevated CO_2 relative to ambient CO_2 (Drake et al., 1999; Hamilton et al., 2003). It was hypothesized in this study that growth in elevated temperature will improve respiration in both varieties. Contrary to this hypothesis, this did not occur instead there was overall loss of Rn in both varieties from V5 to R6 (Figure 3). This is consistent with the idea that Rn decrease is general and low stimulation of respiratory substrates occurred under the measured conditions in both the wild type and SBPase plants (Reich et al., 1998; Xu et al., 2015; Ziska and Bunce, 1998). It should also be noted that the CO_2 effects can be artifacts and the lack of biochemical data particularly carbohydrates data limits the interpretation of the data.

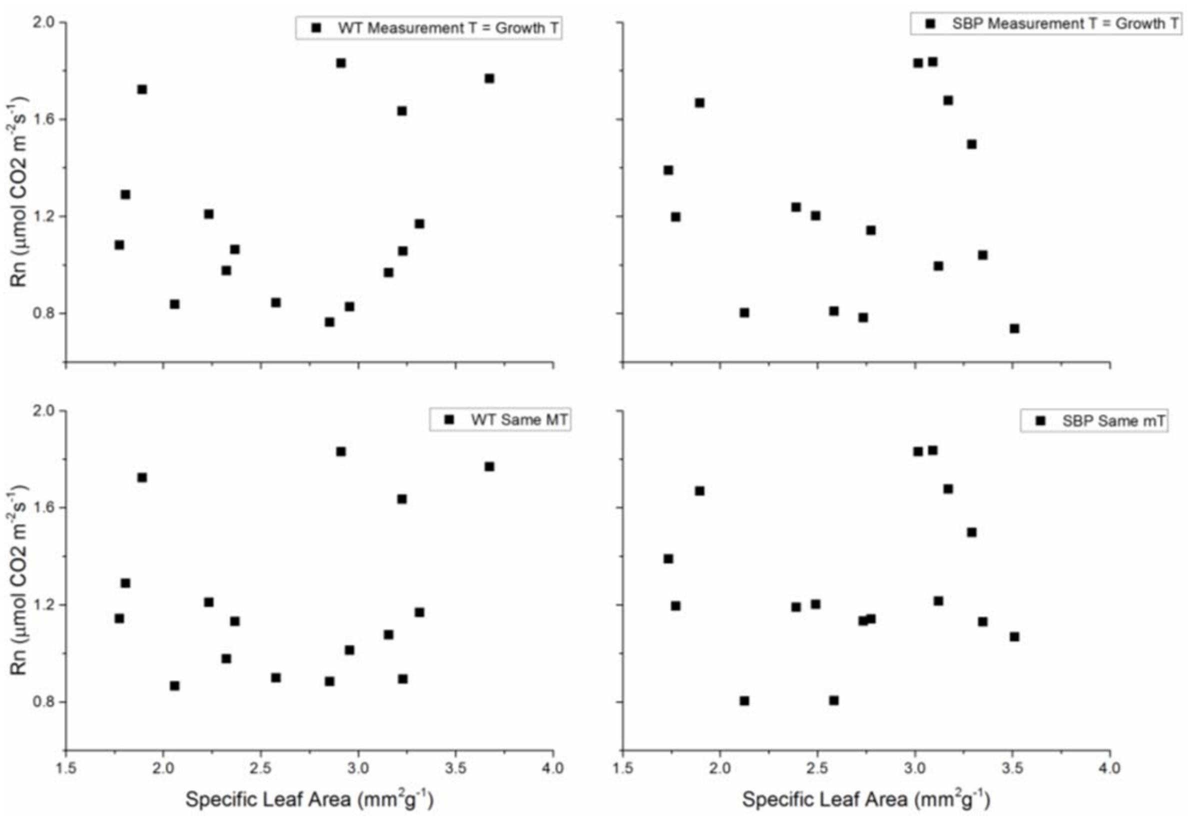

Figure 2. Relationship between dark respiration, Rn (µmol CO_2 m^{-2} s^{-1}) and specific leaf area (mm^2g^{-1}) in wild type and transgenic SBP soybean plants measured at growth temperature and same measurement temperature.

Plants grown at eT and eT+eC consistently had the lowest Rn values as shown in Figure 3. To understand if the low values were due to thermal acclimation, a temperature response experiment was performed when plants were at V4 and R6 stages of development. eT grown plants had a lower Rd with increasing temperature in the two varieties at V4. Compared with eT grown plants, Rn tended to increase when plants were grown at eT+eC at V4 in wild type but not markedly in the transgenic SBP (Figure 4). At R6, a similar response was observed in the wild type where growth in eT+eC resulted in an increase in Rn with increasing temperature. However, there was a less marked decrease when plants were grown at eT for SBP (Figure 4). Thus, the temperature response of dark respiration in the wild type and transgenic SBP plants suggests that there was acclimation to eT at V4 and R6 growth stages in both plants but less so in the transgenic SBP at R6 (Figure 4). With acclimation, low Rn in response to eT might not necessarily indicate more carbon loss as foliar respiration has been reported to contrast with whole plant total nonstructural carbohydrates in response to eT (Zha et al., 2001; Duan et al., 2013). There is also no evidence that respiration directly correlates with substrate availability after long-term exposure to a particular temperature (Bunce, 2007).

Conclusion

Elevated CO_2 did not stimulate nocturnal dark respiration in the wild type and transgenic SBP soybean plants studied. This suggests that unlike photorespiration, an increase in carbon dioxide may not always induce higher dark respiration in the field. Elevated temperature did not also induce higher dark respiration in both varieties. Instead, a lower dark respiration was generally observed at growth temperature with increasing temperature and this was attributed to temperature acclimation.

Conflict of interest

The author has not declared any conflict of interests.

ACKNOWLEDGEMENT

This research was supported in part by an appointment to the Agricultural Research Service (ARS) Research Participation Program administered by the Oak Ridge Institute for Science and Education (ORISE) through an interagency agreement between the U.S. Department of Energy (DOE) and the U.S. Department of Agriculture

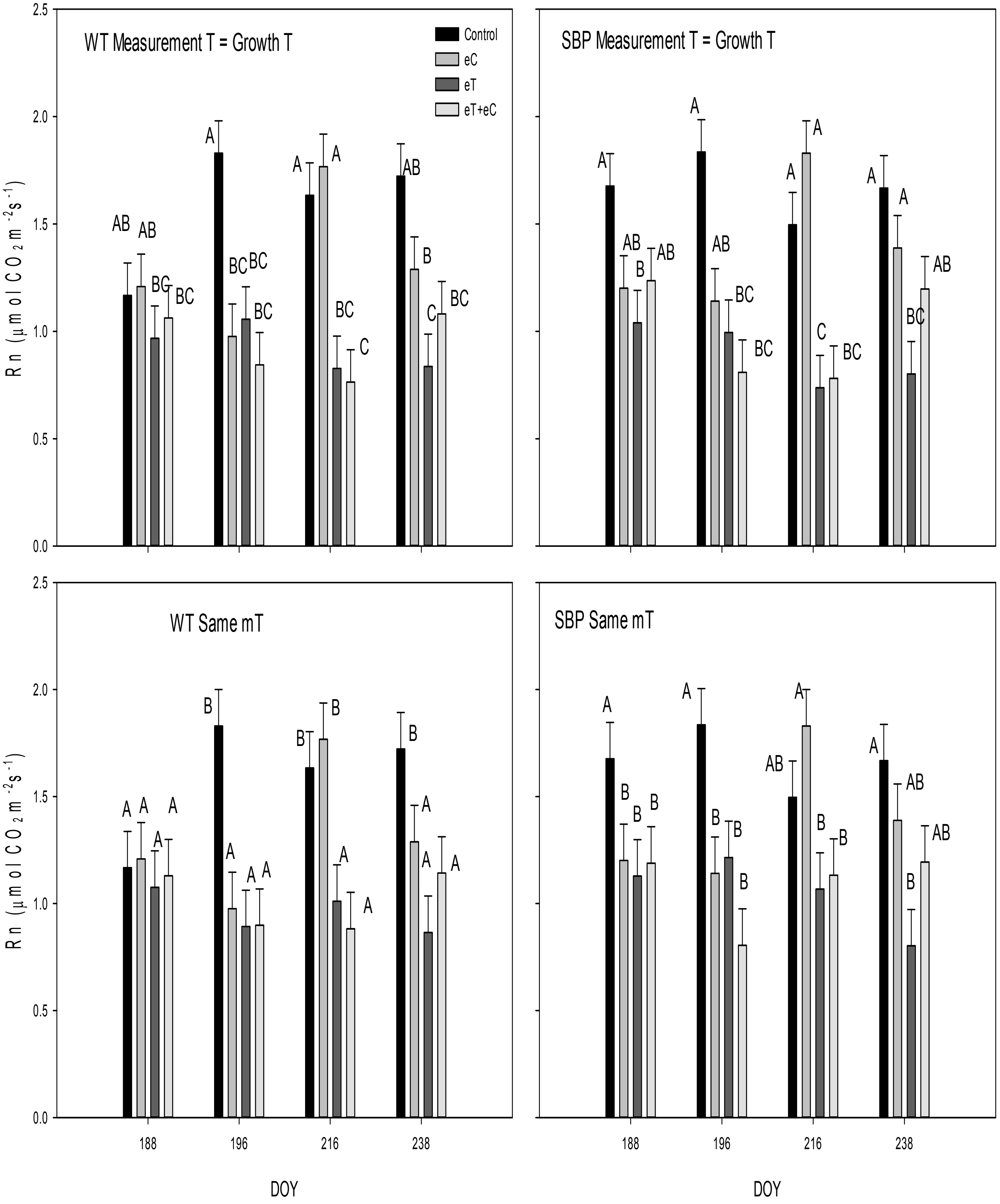

Figure 3. Nocturnal dark respiration (Rn) of wild type and transgenic SBP soybean plants measured at growth and measurement temperatures at control, elevated CO_2 (eC), elevated temperature (eT) and a combination of elevated temperature and CO_2 (eT+eC). mT= measurement temperature.

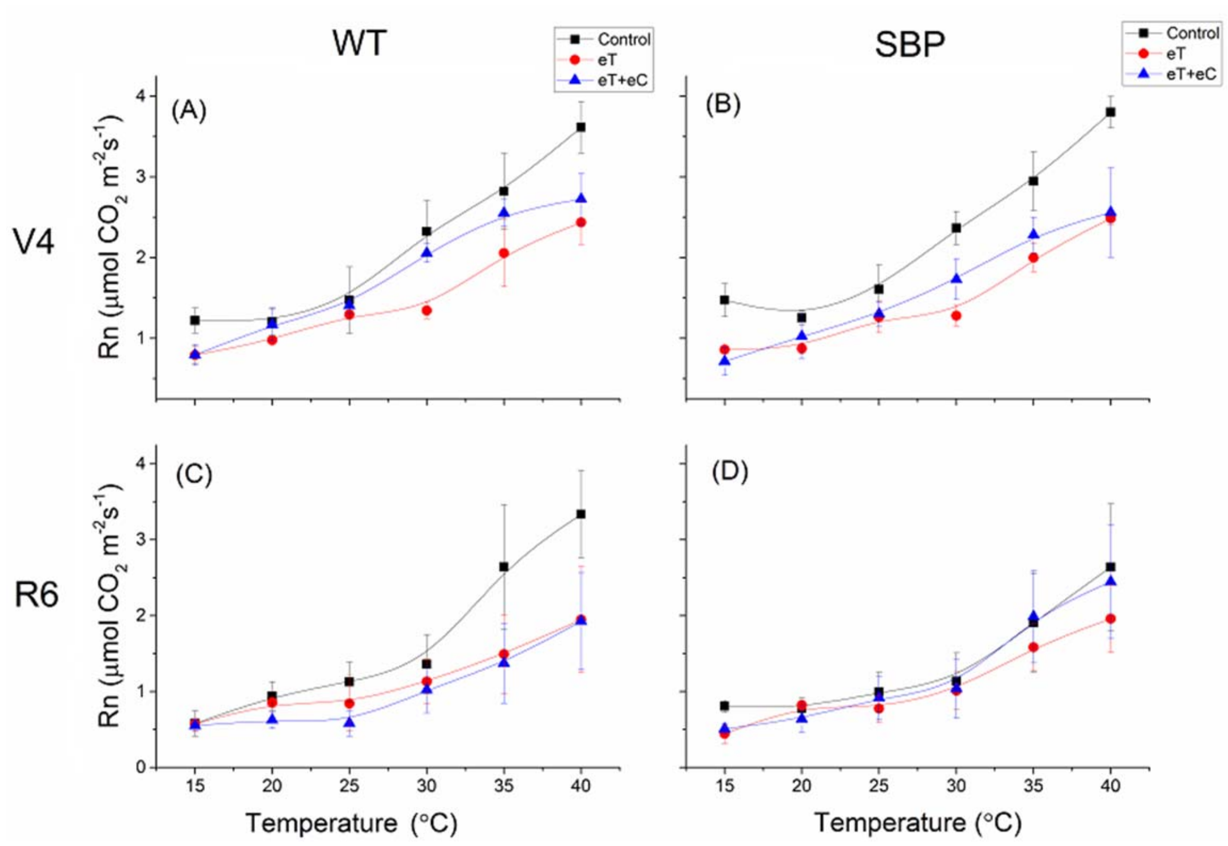

Figure 4. Nocturnal dark respiration (Rn) temperature response curves of wild type and transgenic SBP soybean plants measured at same temperature at control, elevated CO_2, elevated temperature (eT) and a combination of elevated temperature and CO_2 (eT+eC).

(USDA). ORISE is managed by ORAU under DOE contract number DE-SC0014664. All opinions expressed in this paper are the author's and do not necessarily reflect the policies and views of USDA, ARS, DOE, or ORAU/ORISE.

REFERENCES

Atkin O, Loveys B, Atkinson L, Pons T (2006). Phenotypic plasticity and growth temperature: understanding interspecific variability. J. Exp. Bot. 57:267-281.

Atkin OK, Bruhn D, Hurry VM, Tjoelker MG (2005). Evans Review No. 2: The hot and the cold: unravelling the variable response of plant respiration to temperature. Funct. Plant Biol. 32:87-105.

Baker J, Laugel F, Boote K, Allen L (1992). Effects of daytime carbon dioxide concentration on dark respiration in rice. Plant Cell Environ. 15:231-239.

Bernacchi C, Pimentel C, Long S (2003). In vivo temperature response functions of parameters required to model RuBP-limited photosynthesis. Plant Cell Environ. 26:1419-1430.

Bunce JA (2007) Direct and acclimatory responses of dark respiration and translocation to temperature. Ann. Bot. 100:67-73.

Clark R, Menary R (1980). Environmental effects on peppermint (Mentha piperita L.). II. Effects of temperature on photosynthesis, photorespiration and dark respiration in peppermint with reference to oil composition. Funct. Plant Biol. 7:693-697.

Drake B, Azcon-Bieto J, Berry J, Bunce J, Dijkstra P, Farrar J, Gifford R, Gonzalez-Meler MA, Koch G, Lambers H (1999). Does elevated atmospheric CO_2concentration inhibit mitochondrial respiration in green plants? Plant Cell Environ. 22:649-657.

Duan H, Amthor JS, Duursma RA, O'Grady AP, Choat B, Tissue DT (2013). Carbon dynamics of eucalypt seedlings exposed to progressive drought in elevated [CO_2] and elevated temperature. Tree Physiol. tpt061.

Evans J, Poorter H (2001). Photosynthetic acclimation of plants to growth irradiance: the relative importance of specific leaf area and nitrogen partitioning in maximizing carbon gain. Plant Cell Environ. 24:755-767.

Gifford R (1995). Whole plant respiration and photosynthesis of wheat under increased CO_2concentration and temperature: long-term vs. short-term distinctions for modelling. Glob. Change Biol. 1:385-396.

Gonzalez-Meler MA, Ribas-CarbÓ M, Siedow JN, Drake BG (1996). Direct inhibition of plant mitochondrial respiration by elevated CO_2. Plant Physiol. 112:1349-1355.

Hamilton JG, Thomas RB, DeLucia, EH (2001). Direct and indirect effects of elevated CO_2on leaf respiration in a forest ecosystem. Plant Cell Environ. 24:975-982.

Hay W (2012). Engineering cyanobacterial genes into glycine max (soybean) leads to increased photosynthesis and productivity, In. Department of Plant Biology, University of Illinois at Urbana-Chamapign, Urbana. pp. 1-123.

IPCC (2013). Climate change 2013: the physical science basis. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change.

Leakey AD, Ainsworth EA, Bernacchi CJ, Rogers A, Long SP, Ort DR (2009a). Elevated CO_2 effects on plant carbon, nitrogen, and water relations: six important lessons from FACE. J. Exp. Bot. 60(10):2859-2876.

Leakey AD, Xu F, Gillespie KM, McGrath JM, Ainsworth EA, Ort DR (2009b). Genomic basis for stimulated respiration by plants growing under elevated carbon dioxide. Proc. Natl. Acad. Sci. U.S.A. 106:3597-3602.

Lewis J, Olszyk D, Tingey D (1999). Seasonal patterns of photosynthetic light response in Douglas-fir seedlings subjected to elevated atmospheric CO_2 and temperature. Tree Physiol. 19:243-252.

Meehl GA, Washington WM, Collins WD, Arblaster JM, Hu A, Buja LE, Strand WG, Teng H (2005). How much more global warming and sea level rise? Science 307:1769-1772.

Reich PB, Walters MB, Ellsworth DS, Vose JM, Volin JC, Gresham C, Bowman WD (1998). Relationships of leaf dark respiration to leaf nitrogen, specific leaf area and leaf life-span: a test across biomes and functional groups. Oecologia 114:471-482.

Rosenthal DM, Locke AM, Khozaei M, Raines CA, Long SP, Ort DR (2011). Over-expressing the C3 photosynthesis cycle enzyme Sedoheptulose-1-7 Bisphosphatase improves photosynthetic carbon gain and yield under fully open air CO_2 fumigation (FACE). BMC Plant Biol. 11:123.

Ruiz-Vera UM, Siebers M, Gray SB, Drag DW, Rosenthal DM, Kimball BA, Ort DR, Bernacchi CJ (2013). Global warming can negate the expected CO_2 stimulation in photosynthesis and productivity for soybean grown in the Midwestern United States. Plant Physiol. 162:410-423.

Song Y, Yu J, Huang B (2014). Elevated CO_2-mitigation of high temperature stress associated with maintenance of positive carbon balance and carbohydrate accumulation in Kentucky bluegrass. PloS One 9:e89725.

Wolf S, Olesinski A, Rudich J, Marani A (1990). Effect of high temperature on photosynthesis in potatoes. Ann. Bot. 65:179-185.

Xu Z, Jiang Y, Zhou G (2015). Response and adaptation of photosynthesis, respiration, and antioxidant systems to elevated CO_2 with environmental stress in plants. Front Plant Sci. 6.

Zha T, Ryyppö A, Wang K-Y, Kellomäki S (2001). Effects of elevated carbon dioxide concentration and temperature on needle growth, respiration and carbohydrate status in field-grown Scots pines during the needle expansion period. Tree Physiol. 21:1279-1287.

Zhu X-G, de Sturler E, Long SP (2007). Optimizing the Distribution of Resources between Enzymes of Carbon Metabolism Can Dramatically Increase Photosynthetic Rate: A Numerical Simulation Using an Evolutionary Algorithm. Plant Physiol. 145:513-526.

Ziska LH, Bunce JA (1998). The influence of increasing growth temperature and CO_2 concentration on the ratio of respiration to photosynthesis in soybean seedlings. Glob. Change Biol. 4:637-643.

Supplementary Table 1. Differences of Least Squares Means.

Effect	Trt	Var	DOY	_Trt	_Var	_DOY	Estimate	Standard Error	DF	t Value	Pr > |t|
DOY*Trt*Var	control	SBP	188	control	wt	188	0.5088	0.2403	224	2.12	0.0353
DOY*Trt*Var	control	SBP	188	eC	SBP	188	0.475	0.2403	224	1.98	0.0493
DOY*Trt*Var	control	SBP	188	eC	wt	188	0.4675	0.2403	224	1.95	0.0529
DOY*Trt*Var	control	SBP	188	eT	SBP	188	0.5475	0.2403	224	2.28	0.0236
DOY*Trt*Var	control	SBP	188	eT	wt	188	0.6	0.2403	224	2.5	0.0132
DOY*Trt*Var	control	SBP	188	eT+eC	SBP	188	0.4875	0.2403	224	2.03	0.0436
DOY*Trt*Var	control	SBP	188	eT+eC	wt	188	0.5463	0.2403	224	2.27	0.0239
DOY*Trt*Var	control	SBP	188	control	SBP	196	-0.1587	0.2403	224	-0.66	0.5095
DOY*Trt*Var	control	SBP	188	control	wt	196	-0.1537	0.2403	224	-0.64	0.5229
DOY*Trt*Var	control	SBP	188	eC	SBP	196	0.535	0.2403	224	2.23	0.027
DOY*Trt*Var	control	SBP	188	eC	wt	196	0.7	0.2403	224	2.91	0.0039
DOY*Trt*Var	control	SBP	188	eT	SBP	196	0.4613	0.2403	224	1.92	0.0562
DOY*Trt*Var	control	SBP	188	eT	wt	196	0.7838	0.2403	224	3.26	0.0013
DOY*Trt*Var	control	SBP	188	eT+eC	SBP	196	0.8712	0.2403	224	3.63	0.0004
DOY*Trt*Var	control	SBP	188	eT+eC	wt	196	0.7775	0.2403	224	3.24	0.0014
DOY*Trt*Var	control	SBP	188	control	SBP	216	0.18	0.2403	224	0.75	0.4545
DOY*Trt*Var	control	SBP	188	control	wt	216	0.0425	0.2403	224	0.18	0.8598
DOY*Trt*Var	control	SBP	188	eC	SBP	216	-0.1537	0.2403	224	-0.64	0.5229
DOY*Trt*Var	control	SBP	188	eC	wt	216	-0.0913	0.2403	224	-0.38	0.7045
DOY*Trt*Var	control	SBP	188	eT	SBP	216	0.6088	0.2403	224	2.53	0.012
DOY*Trt*Var	control	SBP	188	eT	wt	216	0.665	0.2403	224	2.77	0.0061
DOY*Trt*Var	control	SBP	188	eT+eC	SBP	216	0.5437	0.2403	224	2.26	0.0246
DOY*Trt*Var	control	SBP	188	eT+eC	wt	216	0.7938	0.2403	224	3.3	0.0011
DOY*Trt*Var	control	SBP	188	control	SBP	238	0.00875	0.2403	224	0.04	0.971
DOY*Trt*Var	control	SBP	188	control	wt	238	-0.0463	0.2403	224	-0.19	0.8475
DOY*Trt*Var	control	SBP	188	eC	SBP	238	0.2875	0.2403	224	1.2	0.2327
DOY*Trt*Var	control	SBP	188	eC	wt	238	0.3875	0.2403	224	1.61	0.1082
DOY*Trt*Var	control	SBP	188	eT	SBP	238	0.8736	0.2403	224	3.64	0.0003
DOY*Trt*Var	control	SBP	188	eT	wt	238	0.8113	0.2403	224	3.38	0.0009
DOY*Trt*Var	control	SBP	188	eT+eC	SBP	238	0.4825	0.2403	224	2.01	0.0458
DOY*Trt*Var	control	SBP	188	eT+eC	wt	238	0.5337	0.2403	224	2.22	0.0273
DOY*Trt*Var	control	wt	188	eC	SBP	188	-0.0338	0.2403	224	-0.14	0.8884
DOY*Trt*Var	control	wt	188	eC	wt	188	-0.0413	0.2403	224	-0.17	0.8638
DOY*Trt*Var	control	wt	188	eT	SBP	188	0.03875	0.2403	224	0.16	0.872
DOY*Trt*Var	control	wt	188	eT	wt	188	0.09125	0.2403	224	0.38	0.7045
DOY*Trt*Var	control	wt	188	eT+eC	SBP	188	-0.0213	0.2403	224	-0.09	0.9296

Supplementary Table 1. Contd.

DOY*Trt*Var	control	wt	188	eT+eC	wt	188	0.0375	0.2403	224	0.16	0.8761
DOY*Trt*Var	control	wt	188	control	SBP	196	-0.6675	0.2403	224	-2.78	0.0059
DOY*Trt*Var	control	wt	188	control	wt	196	-0.6625	0.2403	224	-2.76	0.0063
DOY*Trt*Var	control	wt	188	eC	SBP	196	0.02625	0.2403	224	0.11	0.9131
DOY*Trt*Var	control	wt	188	eC	wt	196	0.1913	0.2403	224	0.8	0.4269
DOY*Trt*Var	control	wt	188	eT	SBP	196	-0.0475	0.2403	224	-0.2	0.8435
DOY*Trt*Var	control	wt	188	eT	wt	196	0.275	0.2403	224	1.14	0.2536
DOY*Trt*Var	control	wt	188	eT+eC	SBP	196	0.3625	0.2403	224	1.51	0.1328
DOY*Trt*Var	control	wt	188	eT+eC	wt	196	0.2688	0.2403	224	1.12	0.2645
DOY*Trt*Var	control	wt	188	control	SBP	216	-0.3288	0.2403	224	-1.37	0.1726
DOY*Trt*Var	control	wt	188	control	wt	216	-0.4662	0.2403	224	-1.94	0.0536
DOY*Trt*Var	control	wt	188	eC	SBP	216	-0.6625	0.2403	224	-2.76	0.0063
DOY*Trt*Var	control	wt	188	eC	wt	216	-0.6	0.2403	224	-2.5	0.0132
DOY*Trt*Var	control	wt	188	eT	SBP	216	0.1	0.2403	224	0.42	0.6777
DOY*Trt*Var	control	wt	188	eT	wt	216	0.1563	0.2403	224	0.65	0.5162
DOY*Trt*Var	control	wt	188	eT+eC	SBP	216	0.035	0.2403	224	0.15	0.8843
DOY*Trt*Var	control	wt	188	eT+eC	wt	216	0.285	0.2403	224	1.19	0.2368
DOY*Trt*Var	control	wt	188	control	SBP	238	-0.5	0.2403	224	-2.08	0.0386
DOY*Trt*Var	control	wt	188	control	wt	238	-0.555	0.2403	224	-2.31	0.0218
DOY*Trt*Var	control	wt	188	eC	SBP	238	-0.2213	0.2403	224	-0.92	0.3581
DOY*Trt*Var	control	wt	188	eC	wt	238	-0.1212	0.2403	224	-0.5	0.6143
DOY*Trt*Var	control	wt	188	eT	SBP	238	0.3649	0.2403	224	1.52	0.1303
DOY*Trt*Var	control	wt	188	eT	wt	238	0.3025	0.2403	224	1.26	0.2093
DOY*Trt*Var	control	wt	188	eT+eC	SBP	238	-0.0263	0.2403	224	-0.11	0.9131
DOY*Trt*Var	control	wt	188	eT+eC	wt	238	0.025	0.2403	224	0.1	0.9172
DOY*Trt*Var	eC	SBP	188	eC	wt	188	-0.0075	0.2403	224	-0.03	0.9751
DOY*Trt*Var	eC	SBP	188	eT	SBP	188	0.0725	0.2403	224	0.3	0.7631
DOY*Trt*Var	eC	SBP	188	eT	wt	188	0.125	0.2403	224	0.52	0.6034
DOY*Trt*Var	eC	SBP	188	eT+eC	SBP	188	0.0125	0.2403	224	0.05	0.9586
DOY*Trt*Var	eC	SBP	188	eT+eC	wt	188	0.07125	0.2403	224	0.3	0.7671
DOY*Trt*Var	eC	SBP	188	control	SBP	196	-0.6338	0.2403	224	-2.64	0.0089
DOY*Trt*Var	eC	SBP	188	control	wt	196	-0.6287	0.2403	224	-2.62	0.0095
DOY*Trt*Var	eC	SBP	188	eC	SBP	196	0.06	0.2403	224	0.25	0.803
DOY*Trt*Var	eC	SBP	188	eC	wt	196	0.225	0.2403	224	0.94	0.35
DOY*Trt*Var	eC	SBP	188	eT	SBP	196	-0.0138	0.2403	224	-0.06	0.9544
DOY*Trt*Var	eC	SBP	188	eT	wt	196	0.3088	0.2403	224	1.29	0.2001
DOY*Trt*Var	eC	SBP	188	eT+eC	SBP	196	0.3962	0.2403	224	1.65	0.1005

Supplementary Table 1. Contd.

DOY*Trt*Var	eC	SBP	188	eT+eC	wt	196	0.3025	0.2403	224	1.26	0.2093
DOY*Trt*Var	eC	SBP	188	control	SBP	216	-0.295	0.2403	224	-1.23	0.2208
DOY*Trt*Var	eC	SBP	188	control	wt	216	-0.4325	0.2403	224	-1.8	0.0732
DOY*Trt*Var	eC	SBP	188	eC	SBP	216	-0.6287	0.2403	224	-2.62	0.0095
DOY*Trt*Var	eC	SBP	188	eC	wt	216	-0.5662	0.2403	224	-2.36	0.0193
DOY*Trt*Var	eC	SBP	188	eT	SBP	216	0.1338	0.2403	224	0.56	0.5783
DOY*Trt*Var	eC	SBP	188	eT	wt	216	0.19	0.2403	224	0.79	0.4299
DOY*Trt*Var	eC	SBP	188	eT+eC	SBP	216	0.06875	0.2403	224	0.29	0.775
DOY*Trt*Var	eC	SBP	188	eT+eC	wt	216	0.3188	0.2403	224	1.33	0.186
DOY*Trt*Var	eC	SBP	188	control	SBP	238	-0.4663	0.2403	224	-1.94	0.0536
DOY*Trt*Var	eC	SBP	188	control	wt	238	-0.5212	0.2403	224	-2.17	0.0311
DOY*Trt*Var	eC	SBP	188	eC	SBP	238	-0.1875	0.2403	224	-0.78	0.436
DOY*Trt*Var	eC	SBP	188	eC	wt	238	-0.0875	0.2403	224	-0.36	0.7161
DOY*Trt*Var	eC	SBP	188	eT	SBP	238	0.3986	0.2403	224	1.66	0.0985
DOY*Trt*Var	eC	SBP	188	eT	wt	238	0.3363	0.2403	224	1.4	0.163
DOY*Trt*Var	eC	SBP	188	eT+eC	SBP	238	0.0075	0.2403	224	0.03	0.9751
DOY*Trt*Var	eC	SBP	188	eT+eC	wt	238	0.05875	0.2403	224	0.24	0.8071
DOY*Trt*Var	eC	wt	188	eT	SBP	188	0.08	0.2403	224	0.33	0.7395
DOY*Trt*Var	eC	wt	188	eT	wt	188	0.1325	0.2403	224	0.55	0.5819
DOY*Trt*Var	eC	wt	188	eT+eC	SBP	188	0.02	0.2403	224	0.08	0.9337
DOY*Trt*Var	eC	wt	188	eT+eC	wt	188	0.07875	0.2403	224	0.33	0.7434
DOY*Trt*Var	eC	wt	188	control	SBP	196	-0.6263	0.2403	224	-2.61	0.0098
DOY*Trt*Var	eC	wt	188	control	wt	196	-0.6212	0.2403	224	-2.59	0.0104
DOY*Trt*Var	eC	wt	188	eC	SBP	196	0.0675	0.2403	224	0.28	0.779
DOY*Trt*Var	eC	wt	188	eC	wt	196	0.2325	0.2403	224	0.97	0.3342
DOY*Trt*Var	eC	wt	188	eT	SBP	196	-0.0063	0.2403	224	-0.03	0.9793
DOY*Trt*Var	eC	wt	188	eT	wt	196	0.3163	0.2403	224	1.32	0.1894
DOY*Trt*Var	eC	wt	188	eT+eC	SBP	196	0.4037	0.2403	224	1.68	0.0943
DOY*Trt*Var	eC	wt	188	eT+eC	wt	196	0.31	0.2403	224	1.29	0.1983
DOY*Trt*Var	eC	wt	188	control	SBP	216	-0.2875	0.2403	224	-1.2	0.2327
DOY*Trt*Var	eC	wt	188	control	wt	216	-0.425	0.2403	224	-1.77	0.0783
DOY*Trt*Var	eC	wt	188	eC	SBP	216	-0.6213	0.2403	224	-2.59	0.0104
DOY*Trt*Var	eC	wt	188	eC	wt	216	-0.5588	0.2403	224	-2.33	0.0209
DOY*Trt*Var	eC	wt	188	eT	SBP	216	0.1413	0.2403	224	0.59	0.5572
DOY*Trt*Var	eC	wt	188	eT	wt	216	0.1975	0.2403	224	0.82	0.4119
DOY*Trt*Var	eC	wt	188	eT+eC	SBP	216	0.07625	0.2403	224	0.32	0.7513
DOY*Trt*Var	eC	wt	188	eT+eC	wt	216	0.3263	0.2403	224	1.36	0.1759

Supplementary Table 1. Contd.

DOY*Trt*Var	eC	wt	188	control	SBP	238	-0.4588	0.2403	224	-1.91	0.0575
DOY*Trt*Var	eC	wt	188	control	wt	238	-0.5137	0.2403	224	-2.14	0.0336
DOY*Trt*Var	eC	wt	188	eC	SBP	238	-0.18	0.2403	224	-0.75	0.4545
DOY*Trt*Var	eC	wt	188	eC	wt	238	-0.08	0.2403	224	-0.33	0.7395
DOY*Trt*Var	eC	wt	188	eT	SBP	238	0.4061	0.2403	224	1.69	0.0924
DOY*Trt*Var	eC	wt	188	eT	wt	238	0.3438	0.2403	224	1.43	0.1539
DOY*Trt*Var	eC	wt	188	eT+eC	SBP	238	0.015	0.2403	224	0.06	0.9503
DOY*Trt*Var	eC	wt	188	eT+eC	wt	238	0.06625	0.2403	224	0.28	0.783
DOY*Trt*Var	eT	SBP	188	eT	wt	188	0.0525	0.2403	224	0.22	0.8272
DOY*Trt*Var	eT	SBP	188	eT+eC	SBP	188	-0.06	0.2403	224	-0.25	0.803
DOY*Trt*Var	eT	SBP	188	eT+eC	wt	188	-0.0013	0.2403	224	-0.01	0.9959
DOY*Trt*Var	eT	SBP	188	control	SBP	196	-0.7063	0.2403	224	-2.94	0.0036
DOY*Trt*Var	eT	SBP	188	control	wt	196	-0.7012	0.2403	224	-2.92	0.0039
DOY*Trt*Var	eT	SBP	188	eC	SBP	196	-0.0125	0.2403	224	-0.05	0.9586
DOY*Trt*Var	eT	SBP	188	eC	wt	196	0.1525	0.2403	224	0.63	0.5263
DOY*Trt*Var	eT	SBP	188	eT	SBP	196	-0.0863	0.2403	224	-0.36	0.72
DOY*Trt*Var	eT	SBP	188	eT	wt	196	0.2363	0.2403	224	0.98	0.3265
DOY*Trt*Var	eT	SBP	188	eT+eC	SBP	196	0.3237	0.2403	224	1.35	0.1792
DOY*Trt*Var	eT	SBP	188	eT+eC	wt	196	0.23	0.2403	224	0.96	0.3395
DOY*Trt*Var	eT	SBP	188	control	SBP	216	-0.3675	0.2403	224	-1.53	0.1275
DOY*Trt*Var	eT	SBP	188	control	wt	216	-0.505	0.2403	224	-2.1	0.0367
DOY*Trt*Var	eT	SBP	188	eC	SBP	216	-0.7012	0.2403	224	-2.92	0.0039
DOY*Trt*Var	eT	SBP	188	eC	wt	216	-0.6387	0.2403	224	-2.66	0.0084
DOY*Trt*Var	eT	SBP	188	eT	SBP	216	0.06125	0.2403	224	0.25	0.799
DOY*Trt*Var	eT	SBP	188	eT	wt	216	0.1175	0.2403	224	0.49	0.6253
DOY*Trt*Var	eT	SBP	188	eT+eC	SBP	216	-0.0038	0.2403	224	-0.02	0.9876
DOY*Trt*Var	eT	SBP	188	eT+eC	wt	216	0.2463	0.2403	224	1.02	0.3065
DOY*Trt*Var	eT	SBP	188	control	SBP	238	-0.5388	0.2403	224	-2.24	0.0259
DOY*Trt*Var	eT	SBP	188	control	wt	238	-0.5937	0.2403	224	-2.47	0.0142
DOY*Trt*Var	eT	SBP	188	eC	SBP	238	-0.26	0.2403	224	-1.08	0.2804
DOY*Trt*Var	eT	SBP	188	eC	wt	238	-0.16	0.2403	224	-0.67	0.5061
DOY*Trt*Var	eT	SBP	188	eT	SBP	238	0.3261	0.2403	224	1.36	0.176
DOY*Trt*Var	eT	SBP	188	eT	wt	238	0.2638	0.2403	224	1.1	0.2735
DOY*Trt*Var	eT	SBP	188	eT+eC	SBP	238	-0.065	0.2403	224	-0.27	0.787
DOY*Trt*Var	eT	SBP	188	eT+eC	wt	238	-0.0138	0.2403	224	-0.06	0.9544
DOY*Trt*Var	eT	wt	188	eT+eC	SBP	188	-0.1125	0.2403	224	-0.47	0.6401
DOY*Trt*Var	eT	wt	188	eT+eC	wt	188	-0.0538	0.2403	224	-0.22	0.8232

Supplementary Table 1. Contd.

DOY*Trt*Var	eT	wt	188	control	SBP	196	-0.7588	0.2403	224	-3.16	0.0018
DOY*Trt*Var	eT	wt	188	control	wt	196	-0.7538	0.2403	224	-3.14	0.0019
DOY*Trt*Var	eT	wt	188	eC	SBP	196	-0.065	0.2403	224	-0.27	0.787
DOY*Trt*Var	eT	wt	188	eC	wt	196	0.1	0.2403	224	0.42	0.6777
DOY*Trt*Var	eT	wt	188	eT	SBP	196	-0.1387	0.2403	224	-0.58	0.5642
DOY*Trt*Var	eT	wt	188	eT	wt	196	0.1838	0.2403	224	0.76	0.4452
DOY*Trt*Var	eT	wt	188	eT+eC	SBP	196	0.2712	0.2403	224	1.13	0.2601
DOY*Trt*Var	eT	wt	188	eT+eC	wt	196	0.1775	0.2403	224	0.74	0.4608
DOY*Trt*Var	eT	wt	188	control	SBP	216	-0.42	0.2403	224	-1.75	0.0818
DOY*Trt*Var	eT	wt	188	control	wt	216	-0.5575	0.2403	224	-2.32	0.0212
DOY*Trt*Var	eT	wt	188	eC	SBP	216	-0.7538	0.2403	224	-3.14	0.0019
DOY*Trt*Var	eT	wt	188	eC	wt	216	-0.6913	0.2403	224	-2.88	0.0044
DOY*Trt*Var	eT	wt	188	eT	SBP	216	0.00875	0.2403	224	0.04	0.971
DOY*Trt*Var	eT	wt	188	eT	wt	216	0.065	0.2403	224	0.27	0.787
DOY*Trt*Var	eT	wt	188	eT+eC	SBP	216	-0.0563	0.2403	224	-0.23	0.8151
DOY*Trt*Var	eT	wt	188	eT+eC	wt	216	0.1938	0.2403	224	0.81	0.4209
DOY*Trt*Var	eT	wt	188	control	SBP	238	-0.5913	0.2403	224	-2.46	0.0146
DOY*Trt*Var	eT	wt	188	control	wt	238	-0.6462	0.2403	224	-2.69	0.0077
DOY*Trt*Var	eT	wt	188	eC	SBP	238	-0.3125	0.2403	224	-1.3	0.1947
DOY*Trt*Var	eT	wt	188	eC	wt	238	-0.2125	0.2403	224	-0.88	0.3774
DOY*Trt*Var	eT	wt	188	eT	SBP	238	0.2736	0.2403	224	1.14	0.256
DOY*Trt*Var	eT	wt	188	eT	wt	238	0.2113	0.2403	224	0.88	0.3802
DOY*Trt*Var	eT	wt	188	eT+eC	SBP	238	-0.1175	0.2403	224	-0.49	0.6253
DOY*Trt*Var	eT	wt	188	eT+eC	wt	238	-0.0663	0.2403	224	-0.28	0.783
DOY*Trt*Var	eT+eC	SBP	188	eT+eC	wt	188	0.05875	0.2403	224	0.24	0.8071
DOY*Trt*Var	eT+eC	SBP	188	control	SBP	196	-0.6462	0.2403	224	-2.69	0.0077
DOY*Trt*Var	eT+eC	SBP	188	control	wt	196	-0.6412	0.2403	224	-2.67	0.0082
DOY*Trt*Var	eT+eC	SBP	188	eC	SBP	196	0.0475	0.2403	224	0.2	0.8435
DOY*Trt*Var	eT+eC	SBP	188	eC	wt	196	0.2125	0.2403	224	0.88	0.3774
DOY*Trt*Var	eT+eC	SBP	188	eT	SBP	196	-0.0263	0.2403	224	-0.11	0.9131
DOY*Trt*Var	eT+eC	SBP	188	eT	wt	196	0.2963	0.2403	224	1.23	0.2189
DOY*Trt*Var	eT+eC	SBP	188	eT+eC	SBP	196	0.3838	0.2403	224	1.6	0.1116
DOY*Trt*Var	eT+eC	SBP	188	eT+eC	wt	196	0.29	0.2403	224	1.21	0.2287
DOY*Trt*Var	eT+eC	SBP	188	control	SBP	216	-0.3075	0.2403	224	-1.28	0.2019
DOY*Trt*Var	eT+eC	SBP	188	control	wt	216	-0.445	0.2403	224	-1.85	0.0653
DOY*Trt*Var	eT+eC	SBP	188	eC	SBP	216	-0.6412	0.2403	224	-2.67	0.0082
DOY*Trt*Var	eT+eC	SBP	188	eC	wt	216	-0.5787	0.2403	224	-2.41	0.0168

Supplementary Table 1. Contd.

DOY*Trt*Var	eT+eC	SBP	188	eT	SBP	216	0.1213	0.2403	224	0.5	0.6143
DOY*Trt*Var	eT+eC	SBP	188	eT	wt	216	0.1775	0.2403	224	0.74	0.4608
DOY*Trt*Var	eT+eC	SBP	188	eT+eC	SBP	216	0.05625	0.2403	224	0.23	0.8151
DOY*Trt*Var	eT+eC	SBP	188	eT+eC	wt	216	0.3063	0.2403	224	1.27	0.2038
DOY*Trt*Var	eT+eC	SBP	188	control	SBP	238	-0.4788	0.2403	224	-1.99	0.0475
DOY*Trt*Var	eT+eC	SBP	188	control	wt	238	-0.5337	0.2403	224	-2.22	0.0273
DOY*Trt*Var	eT+eC	SBP	188	eC	SBP	238	-0.2	0.2403	224	-0.83	0.4061
DOY*Trt*Var	eT+eC	SBP	188	eC	wt	238	-0.1	0.2403	224	-0.42	0.6777
DOY*Trt*Var	eT+eC	SBP	188	eT	SBP	238	0.3861	0.2403	224	1.61	0.1094
DOY*Trt*Var	eT+eC	SBP	188	eT	wt	238	0.3238	0.2403	224	1.35	0.1792
DOY*Trt*Var	eT+eC	SBP	188	eT+eC	SBP	238	-0.005	0.2403	224	-0.02	0.9834
DOY*Trt*Var	eT+eC	SBP	188	eT+eC	wt	238	0.04625	0.2403	224	0.19	0.8475
DOY*Trt*Var	eT+eC	wt	188	control	SBP	196	-0.705	0.2403	224	-2.93	0.0037
DOY*Trt*Var	eT+eC	wt	188	control	wt	196	-0.7	0.2403	224	-2.91	0.0039
DOY*Trt*Var	eT+eC	wt	188	eC	SBP	196	-0.0113	0.2403	224	-0.05	0.9627
DOY*Trt*Var	eT+eC	wt	188	eC	wt	196	0.1537	0.2403	224	0.64	0.5229
DOY*Trt*Var	eT+eC	wt	188	eT	SBP	196	-0.085	0.2403	224	-0.35	0.7238
DOY*Trt*Var	eT+eC	wt	188	eT	wt	196	0.2375	0.2403	224	0.99	0.324
DOY*Trt*Var	eT+eC	wt	188	eT+eC	SBP	196	0.325	0.2403	224	1.35	0.1775
DOY*Trt*Var	eT+eC	wt	188	eT+eC	wt	196	0.2312	0.2403	224	0.96	0.3368
DOY*Trt*Var	eT+eC	wt	188	control	SBP	216	-0.3663	0.2403	224	-1.52	0.1288
DOY*Trt*Var	eT+eC	wt	188	control	wt	216	-0.5038	0.2403	224	-2.1	0.0371
DOY*Trt*Var	eT+eC	wt	188	eC	SBP	216	-0.7	0.2403	224	-2.91	0.0039
DOY*Trt*Var	eT+eC	wt	188	eC	wt	216	-0.6375	0.2403	224	-2.65	0.0085
DOY*Trt*Var	eT+eC	wt	188	eT	SBP	216	0.0625	0.2403	224	0.26	0.795
DOY*Trt*Var	eT+eC	wt	188	eT	wt	216	0.1187	0.2403	224	0.49	0.6216
DOY*Trt*Var	eT+eC	wt	188	eT+eC	SBP	216	-0.0025	0.2403	224	-0.01	0.9917
DOY*Trt*Var	eT+eC	wt	188	eT+eC	wt	216	0.2475	0.2403	224	1.03	0.3041
DOY*Trt*Var	eT+eC	wt	188	control	SBP	238	-0.5375	0.2403	224	-2.24	0.0263
DOY*Trt*Var	eT+eC	wt	188	control	wt	238	-0.5925	0.2403	224	-2.47	0.0144
DOY*Trt*Var	eT+eC	wt	188	eC	SBP	238	-0.2588	0.2403	224	-1.08	0.2827
DOY*Trt*Var	eT+eC	wt	188	eC	wt	238	-0.1587	0.2403	224	-0.66	0.5095
DOY*Trt*Var	eT+eC	wt	188	eT	SBP	238	0.3274	0.2403	224	1.36	0.1744
DOY*Trt*Var	eT+eC	wt	188	eT	wt	238	0.265	0.2403	224	1.1	0.2712
DOY*Trt*Var	eT+eC	wt	188	eT+eC	SBP	238	-0.0638	0.2403	224	-0.27	0.791
DOY*Trt*Var	eT+eC	wt	188	eT+eC	wt	238	-0.0125	0.2403	224	-0.05	0.9586

Supplementary Table 1. Contd.

DOY*Trt*Var	control	SBP	196	control	wt	196	0.005	0.2403	224	0.02	0.9834
DOY*Trt*Var	control	SBP	196	eC	SBP	196	0.6938	0.2403	224	2.89	0.0043
DOY*Trt*Var	control	SBP	196	eC	wt	196	0.8588	0.2403	224	3.57	0.0004
DOY*Trt*Var	control	SBP	196	eT	SBP	196	0.62	0.2403	224	2.58	0.0105
DOY*Trt*Var	control	SBP	196	eT	wt	196	0.9425	0.2403	224	3.92	0.0001
DOY*Trt*Var	control	SBP	196	eT+eC	SBP	196	1.03	0.2403	224	4.29	<.0001
DOY*Trt*Var	control	SBP	196	eT+eC	wt	196	0.9363	0.2403	224	3.9	0.0001
DOY*Trt*Var	control	SBP	196	control	SBP	216	0.3388	0.2403	224	1.41	0.16
DOY*Trt*Var	control	SBP	196	control	wt	216	0.2013	0.2403	224	0.84	0.4031
DOY*Trt*Var	control	SBP	196	eC	SBP	216	0.005	0.2403	224	0.02	0.9834
DOY*Trt*Var	control	SBP	196	eC	wt	216	0.0675	0.2403	224	0.28	0.779
DOY*Trt*Var	control	SBP	196	eT	SBP	216	0.7675	0.2403	224	3.19	0.0016
DOY*Trt*Var	control	SBP	196	eT	wt	216	0.8238	0.2403	224	3.43	0.0007
DOY*Trt*Var	control	SBP	196	eT+eC	SBP	216	0.7025	0.2403	224	2.92	0.0038
DOY*Trt*Var	control	SBP	196	eT+eC	wt	216	0.9525	0.2403	224	3.96	<.0001
DOY*Trt*Var	control	SBP	196	control	SBP	238	0.1675	0.2403	224	0.7	0.4864
DOY*Trt*Var	control	SBP	196	control	wt	238	0.1125	0.2403	224	0.47	0.6401
DOY*Trt*Var	control	SBP	196	eC	SBP	238	0.4462	0.2403	224	1.86	0.0646
DOY*Trt*Var	control	SBP	196	eC	wt	238	0.5463	0.2403	224	2.27	0.0239
DOY*Trt*Var	control	SBP	196	eT	SBP	238	1.0324	0.2403	224	4.3	<.0001
DOY*Trt*Var	control	SBP	196	eT	wt	238	0.97	0.2403	224	4.04	<.0001
DOY*Trt*Var	control	SBP	196	eT+eC	SBP	238	0.6412	0.2403	224	2.67	0.0082
DOY*Trt*Var	control	SBP	196	eT+eC	wt	238	0.6925	0.2403	224	2.88	0.0043
DOY*Trt*Var	control	wt	196	eC	SBP	196	0.6887	0.2403	224	2.87	0.0045
DOY*Trt*Var	control	wt	196	eC	wt	196	0.8538	0.2403	224	3.55	0.0005
DOY*Trt*Var	control	wt	196	eT	SBP	196	0.615	0.2403	224	2.56	0.0111
DOY*Trt*Var	control	wt	196	eT	wt	196	0.9375	0.2403	224	3.9	0.0001
DOY*Trt*Var	control	wt	196	eT+eC	SBP	196	1.025	0.2403	224	4.27	<.0001
DOY*Trt*Var	control	wt	196	eT+eC	wt	196	0.9313	0.2403	224	3.88	0.0001
DOY*Trt*Var	control	wt	196	control	SBP	216	0.3337	0.2403	224	1.39	0.1662
DOY*Trt*Var	control	wt	196	control	wt	216	0.1963	0.2403	224	0.82	0.4149
DOY*Trt*Var	control	wt	196	eC	SBP	216	#######	0.2403	224	0	1
DOY*Trt*Var	control	wt	196	eC	wt	216	0.0625	0.2403	224	0.26	0.795
DOY*Trt*Var	control	wt	196	eT	SBP	216	0.7625	0.2403	224	3.17	0.0017
DOY*Trt*Var	control	wt	196	eT	wt	216	0.8188	0.2403	224	3.41	0.0008
DOY*Trt*Var	control	wt	196	eT+eC	SBP	216	0.6975	0.2403	224	2.9	0.0041
DOY*Trt*Var	control	wt	196	eT+eC	wt	216	0.9475	0.2403	224	3.94	0.0001

Supplementary Table 1. Contd.

DOY*Trt*Var	control	wt	196	control	SBP	238	0.1625	0.2403	224	0.68	0.4995
DOY*Trt*Var	control	wt	196	control	wt	238	0.1075	0.2403	224	0.45	0.655
DOY*Trt*Var	control	wt	196	eC	SBP	238	0.4412	0.2403	224	1.84	0.0676
DOY*Trt*Var	control	wt	196	eC	wt	238	0.5413	0.2403	224	2.25	0.0252
DOY*Trt*Var	control	wt	196	eT	SBP	238	1.0274	0.2403	224	4.28	<.0001
DOY*Trt*Var	control	wt	196	eT	wt	238	0.965	0.2403	224	4.02	<.0001
DOY*Trt*Var	control	wt	196	eT+eC	SBP	238	0.6362	0.2403	224	2.65	0.0087
DOY*Trt*Var	control	wt	196	eT+eC	wt	238	0.6875	0.2403	224	2.86	0.0046
DOY*Trt*Var	eC	SBP	196	eC	wt	196	0.165	0.2403	224	0.69	0.493
DOY*Trt*Var	eC	SBP	196	eT	SBP	196	-0.0738	0.2403	224	-0.31	0.7592
DOY*Trt*Var	eC	SBP	196	eT	wt	196	0.2488	0.2403	224	1.04	0.3016
DOY*Trt*Var	eC	SBP	196	eT+eC	SBP	196	0.3362	0.2403	224	1.4	0.163
DOY*Trt*Var	eC	SBP	196	eT+eC	wt	196	0.2425	0.2403	224	1.01	0.3139
DOY*Trt*Var	eC	SBP	196	control	SBP	216	-0.355	0.2403	224	-1.48	0.1409
DOY*Trt*Var	eC	SBP	196	control	wt	216	-0.4925	0.2403	224	-2.05	0.0415
DOY*Trt*Var	eC	SBP	196	eC	SBP	216	-0.6888	0.2403	224	-2.87	0.0045
DOY*Trt*Var	eC	SBP	196	eC	wt	216	-0.6263	0.2403	224	-2.61	0.0098
DOY*Trt*Var	eC	SBP	196	eT	SBP	216	0.07375	0.2403	224	0.31	0.7592
DOY*Trt*Var	eC	SBP	196	eT	wt	216	0.13	0.2403	224	0.54	0.589
DOY*Trt*Var	eC	SBP	196	eT+eC	SBP	216	0.00875	0.2403	224	0.04	0.971
DOY*Trt*Var	eC	SBP	196	eT+eC	wt	216	0.2588	0.2403	224	1.08	0.2827
DOY*Trt*Var	eC	SBP	196	control	SBP	238	-0.5263	0.2403	224	-2.19	0.0295
DOY*Trt*Var	eC	SBP	196	control	wt	238	-0.5812	0.2403	224	-2.42	0.0164
DOY*Trt*Var	eC	SBP	196	eC	SBP	238	-0.2475	0.2403	224	-1.03	0.3041
DOY*Trt*Var	eC	SBP	196	eC	wt	238	-0.1475	0.2403	224	-0.61	0.5399
DOY*Trt*Var	eC	SBP	196	eT	SBP	238	0.3386	0.2403	224	1.41	0.1601
DOY*Trt*Var	eC	SBP	196	eT	wt	238	0.2763	0.2403	224	1.15	0.2515
DOY*Trt*Var	eC	SBP	196	eT+eC	SBP	238	-0.0525	0.2403	224	-0.22	0.8272
DOY*Trt*Var	eC	SBP	196	eT+eC	wt	238	-0.0013	0.2403	224	-0.01	0.9959
DOY*Trt*Var	eC	wt	196	eT	SBP	196	-0.2387	0.2403	224	-0.99	0.3214
DOY*Trt*Var	eC	wt	196	eT	wt	196	0.08375	0.2403	224	0.35	0.7277
DOY*Trt*Var	eC	wt	196	eT+eC	SBP	196	0.1712	0.2403	224	0.71	0.4767
DOY*Trt*Var	eC	wt	196	eT+eC	wt	196	0.0775	0.2403	224	0.32	0.7473
DOY*Trt*Var	eC	wt	196	control	SBP	216	-0.52	0.2403	224	-2.16	0.0315
DOY*Trt*Var	eC	wt	196	control	wt	216	-0.6575	0.2403	224	-2.74	0.0067
DOY*Trt*Var	eC	wt	196	eC	SBP	216	-0.8538	0.2403	224	-3.55	0.0005
DOY*Trt*Var	eC	wt	196	eC	wt	216	-0.7913	0.2403	224	-3.29	0.0012

Supplementary Table 1. Contd.

DOY*Trt*Var	eC	wt	196	eT	SBP	216	-0.0913	0.2403	224	-0.38	0.7045
DOY*Trt*Var	eC	wt	196	eT	wt	216	-0.035	0.2403	224	-0.15	0.8843
DOY*Trt*Var	eC	wt	196	eT+eC	SBP	216	-0.1563	0.2403	224	-0.65	0.5162
DOY*Trt*Var	eC	wt	196	eT+eC	wt	216	0.09375	0.2403	224	0.39	0.6968
DOY*Trt*Var	eC	wt	196	control	SBP	238	-0.6913	0.2403	224	-2.88	0.0044
DOY*Trt*Var	eC	wt	196	control	wt	238	-0.7462	0.2403	224	-3.11	0.0021
DOY*Trt*Var	eC	wt	196	eC	SBP	238	-0.4125	0.2403	224	-1.72	0.0874
DOY*Trt*Var	eC	wt	196	eC	wt	238	-0.3125	0.2403	224	-1.3	0.1947
DOY*Trt*Var	eC	wt	196	eT	SBP	238	0.1736	0.2403	224	0.72	0.4707
DOY*Trt*Var	eC	wt	196	eT	wt	238	0.1113	0.2403	224	0.46	0.6438
DOY*Trt*Var	eC	wt	196	eT+eC	SBP	238	-0.2175	0.2403	224	-0.91	0.3663
DOY*Trt*Var	eC	wt	196	eT+eC	wt	238	-0.1663	0.2403	224	-0.69	0.4897
DOY*Trt*Var	eT	SBP	196	eT	wt	196	0.3225	0.2403	224	1.34	0.1809
DOY*Trt*Var	eT	SBP	196	eT+eC	SBP	196	0.41	0.2403	224	1.71	0.0893
DOY*Trt*Var	eT	SBP	196	eT+eC	wt	196	0.3163	0.2403	224	1.32	0.1894
DOY*Trt*Var	eT	SBP	196	control	SBP	216	-0.2813	0.2403	224	-1.17	0.243
DOY*Trt*Var	eT	SBP	196	control	wt	216	-0.4187	0.2403	224	-1.74	0.0827
DOY*Trt*Var	eT	SBP	196	eC	SBP	216	-0.615	0.2403	224	-2.56	0.0111
DOY*Trt*Var	eT	SBP	196	eC	wt	216	-0.5525	0.2403	224	-2.3	0.0224
DOY*Trt*Var	eT	SBP	196	eT	SBP	216	0.1475	0.2403	224	0.61	0.5399
DOY*Trt*Var	eT	SBP	196	eT	wt	216	0.2038	0.2403	224	0.85	0.3973
DOY*Trt*Var	eT	SBP	196	eT+eC	SBP	216	0.0825	0.2403	224	0.34	0.7316
DOY*Trt*Var	eT	SBP	196	eT+eC	wt	216	0.3325	0.2403	224	1.38	0.1678
DOY*Trt*Var	eT	SBP	196	control	SBP	238	-0.4525	0.2403	224	-1.88	0.061
DOY*Trt*Var	eT	SBP	196	control	wt	238	-0.5075	0.2403	224	-2.11	0.0358
DOY*Trt*Var	eT	SBP	196	eC	SBP	238	-0.1738	0.2403	224	-0.72	0.4703
DOY*Trt*Var	eT	SBP	196	eC	wt	238	-0.0738	0.2403	224	-0.31	0.7592
DOY*Trt*Var	eT	SBP	196	eT	SBP	238	0.4124	0.2403	224	1.72	0.0875
DOY*Trt*Var	eT	SBP	196	eT	wt	238	0.35	0.2403	224	1.46	0.1466
DOY*Trt*Var	eT	SBP	196	eT+eC	SBP	238	0.02125	0.2403	224	0.09	0.9296
DOY*Trt*Var	eT	SBP	196	eT+eC	wt	238	0.0725	0.2403	224	0.3	0.7631
DOY*Trt*Var	eT	wt	196	eT+eC	SBP	196	0.0875	0.2403	224	0.36	0.7161
DOY*Trt*Var	eT	wt	196	eT+eC	wt	196	-0.0063	0.2403	224	-0.03	0.9793
DOY*Trt*Var	eT	wt	196	control	SBP	216	-0.6038	0.2403	224	-2.51	0.0127
DOY*Trt*Var	eT	wt	196	control	wt	216	-0.7412	0.2403	224	-3.09	0.0023
DOY*Trt*Var	eT	wt	196	eC	SBP	216	-0.9375	0.2403	224	-3.9	0.0001
DOY*Trt*Var	eT	wt	196	eC	wt	216	-0.875	0.2403	224	-3.64	0.0003

Supplementary Table 1. Contd.

DOY*Trt*Var	eT	wt	196	eT	SBP	216	-0.175	0.2403	224	-0.73	0.4672
DOY*Trt*Var	eT	wt	196	eT	wt	216	-0.1188	0.2403	224	-0.49	0.6216
DOY*Trt*Var	eT	wt	196	eT+eC	SBP	216	-0.24	0.2403	224	-1	0.3189
DOY*Trt*Var	eT	wt	196	eT+eC	wt	216	0.01	0.2403	224	0.04	0.9668
DOY*Trt*Var	eT	wt	196	control	SBP	238	-0.775	0.2403	224	-3.23	0.0014
DOY*Trt*Var	eT	wt	196	control	wt	238	-0.83	0.2403	224	-3.45	0.0007
DOY*Trt*Var	eT	wt	196	eC	SBP	238	-0.4963	0.2403	224	-2.07	0.04
DOY*Trt*Var	eT	wt	196	eC	wt	238	-0.3962	0.2403	224	-1.65	0.1005
DOY*Trt*Var	eT	wt	196	eT	SBP	238	0.08987	0.2403	224	0.37	0.7087
DOY*Trt*Var	eT	wt	196	eT	wt	238	0.0275	0.2403	224	0.11	0.909
DOY*Trt*Var	eT	wt	196	eT+eC	SBP	238	-0.3013	0.2403	224	-1.25	0.2112
DOY*Trt*Var	eT	wt	196	eT+eC	wt	238	-0.25	0.2403	224	-1.04	0.2992
DOY*Trt*Var	eT+eC	SBP	196	eT+eC	wt	196	-0.0938	0.2403	224	-0.39	0.6968
DOY*Trt*Var	eT+eC	SBP	196	control	SBP	216	-0.6912	0.2403	224	-2.88	0.0044
DOY*Trt*Var	eT+eC	SBP	196	control	wt	216	-0.8287	0.2403	224	-3.45	0.0007
DOY*Trt*Var	eT+eC	SBP	196	eC	SBP	216	-1.025	0.2403	224	-4.27	<.0001
DOY*Trt*Var	eT+eC	SBP	196	eC	wt	216	-0.9625	0.2403	224	-4.01	<.0001
DOY*Trt*Var	eT+eC	SBP	196	eT	SBP	216	-0.2625	0.2403	224	-1.09	0.2758
DOY*Trt*Var	eT+eC	SBP	196	eT	wt	216	-0.2062	0.2403	224	-0.86	0.3916
DOY*Trt*Var	eT+eC	SBP	196	eT+eC	SBP	216	-0.3275	0.2403	224	-1.36	0.1742
DOY*Trt*Var	eT+eC	SBP	196	eT+eC	wt	216	-0.0775	0.2403	224	-0.32	0.7473
DOY*Trt*Var	eT+eC	SBP	196	control	SBP	238	-0.8625	0.2403	224	-3.59	0.0004
DOY*Trt*Var	eT+eC	SBP	196	control	wt	238	-0.9175	0.2403	224	-3.82	0.0002
DOY*Trt*Var	eT+eC	SBP	196	eC	SBP	238	-0.5838	0.2403	224	-2.43	0.0159
DOY*Trt*Var	eT+eC	SBP	196	eC	wt	238	-0.4837	0.2403	224	-2.01	0.0453
DOY*Trt*Var	eT+eC	SBP	196	eT	SBP	238	0.00238	0.2403	224	0.01	0.9921
DOY*Trt*Var	eT+eC	SBP	196	eT	wt	238	-0.06	0.2403	224	-0.25	0.803
DOY*Trt*Var	eT+eC	SBP	196	eT+eC	SBP	238	-0.3888	0.2403	224	-1.62	0.1071
DOY*Trt*Var	eT+eC	SBP	196	eT+eC	wt	238	-0.3375	0.2403	224	-1.4	0.1615
DOY*Trt*Var	eT+eC	wt	196	control	SBP	216	-0.5975	0.2403	224	-2.49	0.0136
DOY*Trt*Var	eT+eC	wt	196	control	wt	216	-0.735	0.2403	224	-3.06	0.0025
DOY*Trt*Var	eT+eC	wt	196	eC	SBP	216	-0.9313	0.2403	224	-3.88	0.0001
DOY*Trt*Var	eT+eC	wt	196	eC	wt	216	-0.8688	0.2403	224	-3.62	0.0004
DOY*Trt*Var	eT+eC	wt	196	eT	SBP	216	-0.1688	0.2403	224	-0.7	0.4832
DOY*Trt*Var	eT+eC	wt	196	eT	wt	216	-0.1125	0.2403	224	-0.47	0.6401
DOY*Trt*Var	eT+eC	wt	196	eT+eC	SBP	216	-0.2338	0.2403	224	-0.97	0.3317
DOY*Trt*Var	eT+eC	wt	196	eT+eC	wt	216	0.01625	0.2403	224	0.07	0.9461

Supplementary Table 1. Contd.

DOY*Trt*Var	eT+eC	wt	196	control	SBP	238	-0.7688	0.2403	224	-3.2	0.0016
DOY*Trt*Var	eT+eC	wt	196	control	wt	238	-0.8237	0.2403	224	-3.43	0.0007
DOY*Trt*Var	eT+eC	wt	196	eC	SBP	238	-0.49	0.2403	224	-2.04	0.0426
DOY*Trt*Var	eT+eC	wt	196	eC	wt	238	-0.39	0.2403	224	-1.62	0.106
DOY*Trt*Var	eT+eC	wt	196	eT	SBP	238	0.09612	0.2403	224	0.4	0.6895
DOY*Trt*Var	eT+eC	wt	196	eT	wt	238	0.03375	0.2403	224	0.14	0.8884
DOY*Trt*Var	eT+eC	wt	196	eT+eC	SBP	238	-0.295	0.2403	224	-1.23	0.2208
DOY*Trt*Var	eT+eC	wt	196	eT+eC	wt	238	-0.2438	0.2403	224	-1.01	0.3114
DOY*Trt*Var	control	SBP	216	control	wt	216	-0.1375	0.2403	224	-0.57	0.5677
DOY*Trt*Var	control	SBP	216	eC	SBP	216	-0.3337	0.2403	224	-1.39	0.1662
DOY*Trt*Var	control	SBP	216	eC	wt	216	-0.2712	0.2403	224	-1.13	0.2601
DOY*Trt*Var	control	SBP	216	eT	SBP	216	0.4288	0.2403	224	1.78	0.0757
DOY*Trt*Var	control	SBP	216	eT	wt	216	0.485	0.2403	224	2.02	0.0447
DOY*Trt*Var	control	SBP	216	eT+eC	SBP	216	0.3637	0.2403	224	1.51	0.1314
DOY*Trt*Var	control	SBP	216	eT+eC	wt	216	0.6138	0.2403	224	2.55	0.0113
DOY*Trt*Var	control	SBP	216	control	SBP	238	-0.1713	0.2403	224	-0.71	0.4767
DOY*Trt*Var	control	SBP	216	control	wt	238	-0.2262	0.2403	224	-0.94	0.3474
DOY*Trt*Var	control	SBP	216	eC	SBP	238	0.1075	0.2403	224	0.45	0.655
DOY*Trt*Var	control	SBP	216	eC	wt	238	0.2075	0.2403	224	0.86	0.3887
DOY*Trt*Var	control	SBP	216	eT	SBP	238	0.6936	0.2403	224	2.89	0.0043
DOY*Trt*Var	control	SBP	216	eT	wt	238	0.6313	0.2403	224	2.63	0.0092
DOY*Trt*Var	control	SBP	216	eT+eC	SBP	238	0.3025	0.2403	224	1.26	0.2093
DOY*Trt*Var	control	SBP	216	eT+eC	wt	238	0.3537	0.2403	224	1.47	0.1423
DOY*Trt*Var	control	wt	216	eC	SBP	216	-0.1963	0.2403	224	-0.82	0.4149
DOY*Trt*Var	control	wt	216	eC	wt	216	-0.1338	0.2403	224	-0.56	0.5783
DOY*Trt*Var	control	wt	216	eT	SBP	216	0.5662	0.2403	224	2.36	0.0193
DOY*Trt*Var	control	wt	216	eT	wt	216	0.6225	0.2403	224	2.59	0.0102
DOY*Trt*Var	control	wt	216	eT+eC	SBP	216	0.5012	0.2403	224	2.09	0.0381
DOY*Trt*Var	control	wt	216	eT+eC	wt	216	0.7513	0.2403	224	3.13	0.002
DOY*Trt*Var	control	wt	216	control	SBP	238	-0.0338	0.2403	224	-0.14	0.8884
DOY*Trt*Var	control	wt	216	control	wt	238	-0.0888	0.2403	224	-0.37	0.7122
DOY*Trt*Var	control	wt	216	eC	SBP	238	0.245	0.2403	224	1.02	0.309
DOY*Trt*Var	control	wt	216	eC	wt	238	0.345	0.2403	224	1.44	0.1524
DOY*Trt*Var	control	wt	216	eT	SBP	238	0.8311	0.2403	224	3.46	0.0006
DOY*Trt*Var	control	wt	216	eT	wt	238	0.7688	0.2403	224	3.2	0.0016
DOY*Trt*Var	control	wt	216	eT+eC	SBP	238	0.44	0.2403	224	1.83	0.0684
DOY*Trt*Var	control	wt	216	eT+eC	wt	238	0.4912	0.2403	224	2.04	0.0421

Supplementary Table 1. Contd.

DOY*Trt*Var	eC	SBP	216	eC	wt	216	0.0625	0.2403	224	0.26	0.795
DOY*Trt*Var	eC	SBP	216	eT	SBP	216	0.7625	0.2403	224	3.17	0.0017
DOY*Trt*Var	eC	SBP	216	eT	wt	216	0.8188	0.2403	224	3.41	0.0008
DOY*Trt*Var	eC	SBP	216	eT+eC	SBP	216	0.6975	0.2403	224	2.9	0.0041
DOY*Trt*Var	eC	SBP	216	eT+eC	wt	216	0.9475	0.2403	224	3.94	0.0001
DOY*Trt*Var	eC	SBP	216	control	SBP	238	0.1625	0.2403	224	0.68	0.4995
DOY*Trt*Var	eC	SBP	216	control	wt	238	0.1075	0.2403	224	0.45	0.655
DOY*Trt*Var	eC	SBP	216	eC	SBP	238	0.4412	0.2403	224	1.84	0.0676
DOY*Trt*Var	eC	SBP	216	eC	wt	238	0.5413	0.2403	224	2.25	0.0252
DOY*Trt*Var	eC	SBP	216	eT	SBP	238	1.0274	0.2403	224	4.28	<.0001
DOY*Trt*Var	eC	SBP	216	eT	wt	238	0.965	0.2403	224	4.02	<.0001
DOY*Trt*Var	eC	SBP	216	eT+eC	SBP	238	0.6362	0.2403	224	2.65	0.0087
DOY*Trt*Var	eC	SBP	216	eT+eC	wt	238	0.6875	0.2403	224	2.86	0.0046
DOY*Trt*Var	eC	wt	216	eT	SBP	216	0.7	0.2403	224	2.91	0.0039
DOY*Trt*Var	eC	wt	216	eT	wt	216	0.7563	0.2403	224	3.15	0.0019
DOY*Trt*Var	eC	wt	216	eT+eC	SBP	216	0.635	0.2403	224	2.64	0.0088
DOY*Trt*Var	eC	wt	216	eT+eC	wt	216	0.885	0.2403	224	3.68	0.0003
DOY*Trt*Var	eC	wt	216	control	SBP	238	0.1	0.2403	224	0.42	0.6777
DOY*Trt*Var	eC	wt	216	control	wt	238	0.045	0.2403	224	0.19	0.8516
DOY*Trt*Var	eC	wt	216	eC	SBP	238	0.3787	0.2403	224	1.58	0.1163
DOY*Trt*Var	eC	wt	216	eC	wt	238	0.4788	0.2403	224	1.99	0.0475
DOY*Trt*Var	eC	wt	216	eT	SBP	238	0.9649	0.2403	224	4.02	<.0001
DOY*Trt*Var	eC	wt	216	eT	wt	238	0.9025	0.2403	224	3.76	0.0002
DOY*Trt*Var	eC	wt	216	eT+eC	SBP	238	0.5737	0.2403	224	2.39	0.0178
DOY*Trt*Var	eC	wt	216	eT+eC	wt	238	0.625	0.2403	224	2.6	0.0099
DOY*Trt*Var	eT	SBP	216	eT	wt	216	0.05625	0.2403	224	0.23	0.8151
DOY*Trt*Var	eT	SBP	216	eT+eC	SBP	216	-0.065	0.2403	224	-0.27	0.787
DOY*Trt*Var	eT	SBP	216	eT+eC	wt	216	0.185	0.2403	224	0.77	0.4421
DOY*Trt*Var	eT	SBP	216	control	SBP	238	-0.6	0.2403	224	-2.5	0.0132
DOY*Trt*Var	eT	SBP	216	control	wt	238	-0.655	0.2403	224	-2.73	0.0069
DOY*Trt*Var	eT	SBP	216	eC	SBP	238	-0.3213	0.2403	224	-1.34	0.1826
DOY*Trt*Var	eT	SBP	216	eC	wt	238	-0.2212	0.2403	224	-0.92	0.3581
DOY*Trt*Var	eT	SBP	216	eT	SBP	238	0.2649	0.2403	224	1.1	0.2715
DOY*Trt*Var	eT	SBP	216	eT	wt	238	0.2025	0.2403	224	0.84	0.4002
DOY*Trt*Var	eT	SBP	216	eT+eC	SBP	238	-0.1263	0.2403	224	-0.53	0.5998
DOY*Trt*Var	eT	SBP	216	eT+eC	wt	238	-0.075	0.2403	224	-0.31	0.7552
DOY*Trt*Var	eT	wt	216	eT+eC	SBP	216	-0.1213	0.2403	224	-0.5	0.6143

Supplementary Table 1. Contd.

DOY*Trt*Var	eT	wt	216	eT+eC	wt	216	0.1288	0.2403	224	0.54	0.5926
DOY*Trt*Var	eT	wt	216	control	SBP	238	-0.6563	0.2403	224	-2.73	0.0068
DOY*Trt*Var	eT	wt	216	control	wt	238	-0.7112	0.2403	224	-2.96	0.0034
DOY*Trt*Var	eT	wt	216	eC	SBP	238	-0.3775	0.2403	224	-1.57	0.1176
DOY*Trt*Var	eT	wt	216	eC	wt	238	-0.2775	0.2403	224	-1.15	0.2493
DOY*Trt*Var	eT	wt	216	eT	SBP	238	0.2086	0.2403	224	0.87	0.3862
DOY*Trt*Var	eT	wt	216	eT	wt	238	0.1463	0.2403	224	0.61	0.5433
DOY*Trt*Var	eT	wt	216	eT+eC	SBP	238	-0.1825	0.2403	224	-0.76	0.4483
DOY*Trt*Var	eT	wt	216	eT+eC	wt	238	-0.1313	0.2403	224	-0.55	0.5854
DOY*Trt*Var	eT+eC	SBP	216	eT+eC	wt	216	0.25	0.2403	224	1.04	0.2992
DOY*Trt*Var	eT+eC	SBP	216	control	SBP	238	-0.535	0.2403	224	-2.23	0.027
DOY*Trt*Var	eT+eC	SBP	216	control	wt	238	-0.59	0.2403	224	-2.46	0.0148
DOY*Trt*Var	eT+eC	SBP	216	eC	SBP	238	-0.2563	0.2403	224	-1.07	0.2873
DOY*Trt*Var	eT+eC	SBP	216	eC	wt	238	-0.1562	0.2403	224	-0.65	0.5162
DOY*Trt*Var	eT+eC	SBP	216	eT	SBP	238	0.3299	0.2403	224	1.37	0.1711
DOY*Trt*Var	eT+eC	SBP	216	eT	wt	238	0.2675	0.2403	224	1.11	0.2668
DOY*Trt*Var	eT+eC	SBP	216	eT+eC	SBP	238	-0.0613	0.2403	224	-0.25	0.799
DOY*Trt*Var	eT+eC	SBP	216	eT+eC	wt	238	-0.01	0.2403	224	-0.04	0.9668
DOY*Trt*Var	eT+eC	wt	216	control	SBP	238	-0.785	0.2403	224	-3.27	0.0013
DOY*Trt*Var	eT+eC	wt	216	control	wt	238	-0.84	0.2403	224	-3.5	0.0006
DOY*Trt*Var	eT+eC	wt	216	eC	SBP	238	-0.5063	0.2403	224	-2.11	0.0362
DOY*Trt*Var	eT+eC	wt	216	eC	wt	238	-0.4062	0.2403	224	-1.69	0.0923
DOY*Trt*Var	eT+eC	wt	216	eT	SBP	238	0.07987	0.2403	224	0.33	0.7399
DOY*Trt*Var	eT+eC	wt	216	eT	wt	238	0.0175	0.2403	224	0.07	0.942
DOY*Trt*Var	eT+eC	wt	216	eT+eC	SBP	238	-0.3113	0.2403	224	-1.3	0.1965
DOY*Trt*Var	eT+eC	wt	216	eT+eC	wt	238	-0.26	0.2403	224	-1.08	0.2804
DOY*Trt*Var	control	SBP	238	control	wt	238	-0.055	0.2403	224	-0.23	0.8191
DOY*Trt*Var	control	SBP	238	eC	SBP	238	0.2788	0.2403	224	1.16	0.2472
DOY*Trt*Var	control	SBP	238	eC	wt	238	0.3788	0.2403	224	1.58	0.1163
DOY*Trt*Var	control	SBP	238	eT	SBP	238	0.8649	0.2403	224	3.6	0.0004
DOY*Trt*Var	control	SBP	238	eT	wt	238	0.8025	0.2403	224	3.34	0.001
DOY*Trt*Var	control	SBP	238	eT+eC	SBP	238	0.4737	0.2403	224	1.97	0.0499
DOY*Trt*Var	control	SBP	238	eT+eC	wt	238	0.525	0.2403	224	2.19	0.0299
DOY*Trt*Var	control	wt	238	eC	SBP	238	0.3337	0.2403	224	1.39	0.1662
DOY*Trt*Var	control	wt	238	eC	wt	238	0.4337	0.2403	224	1.81	0.0724
DOY*Trt*Var	control	wt	238	eT	SBP	238	0.9199	0.2403	224	3.83	0.0002
DOY*Trt*Var	control	wt	238	eT	wt	238	0.8575	0.2403	224	3.57	0.0004

Supplementary Table 1. Contd.

DOY*Trt*Var	control	wt	238	eT+eC	SBP	238	0.5287	0.2403	224	2.2	0.0288
DOY*Trt*Var	control	wt	238	eT+eC	wt	238	0.58	0.2403	224	2.41	0.0166
DOY*Trt*Var	eC	SBP	238	eC	wt	238	0.1	0.2403	224	0.42	0.6777
DOY*Trt*Var	eC	SBP	238	eT	SBP	238	0.5861	0.2403	224	2.44	0.0155
DOY*Trt*Var	eC	SBP	238	eT	wt	238	0.5238	0.2403	224	2.18	0.0303
DOY*Trt*Var	eC	SBP	238	eT+eC	SBP	238	0.195	0.2403	224	0.81	0.4179
DOY*Trt*Var	eC	SBP	238	eT+eC	wt	238	0.2462	0.2403	224	1.02	0.3065
DOY*Trt*Var	eC	wt	238	eT	SBP	238	0.4861	0.2403	224	2.02	0.0442
DOY*Trt*Var	eC	wt	238	eT	wt	238	0.4237	0.2403	224	1.76	0.0792
DOY*Trt*Var	eC	wt	238	eT+eC	SBP	238	0.095	0.2403	224	0.4	0.6929
DOY*Trt*Var	eC	wt	238	eT+eC	wt	238	0.1462	0.2403	224	0.61	0.5433
DOY*Trt*Var	eT	SBP	238	eT	wt	238	-0.0624	0.2403	224	-0.26	0.7954
DOY*Trt*Var	eT	SBP	238	eT+eC	SBP	238	-0.3911	0.2403	224	-1.63	0.105
DOY*Trt*Var	eT	SBP	238	eT+eC	wt	238	-0.3399	0.2403	224	-1.41	0.1586
DOY*Trt*Var	eT	wt	238	eT+eC	SBP	238	-0.3288	0.2403	224	-1.37	0.1726
DOY*Trt*Var	eT	wt	238	eT+eC	wt	238	-0.2775	0.2403	224	-1.15	0.2493
DOY*Trt*Var	eT+eC	SBP	238	eT+eC	wt	238	0.05125	0.2403	224	0.21	0.8313