Infrared Heater Arrays for Warming Grazingland Field Plots

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In order to study the likely effects of global warming on rangeland and other ecosystems in the future , we developed arrays of infrared heaters that can produce uniform warming across 3-m-diameter field plots (Figure 1 ; Kimball *et al* . , 2008) . The efficiency of the heaters was higher than that of the heaters used in most previous infrared heater experiments . Operating costs can be predicted from knowing this efficiency , desired degrees of warming , type of plant canopy , and site weather data , especially windiness . Four such arrays were deployed over plots of grass at Haibei , Qinghai , China and another at Cheyenne , Wyoming , USA , along with corresponding reference plots with dummy heaters . PID (proportional-integral-derivative) systems with infrared thermometers to sense canopy temperatures of the heated and reference plots were used to control the heater outputs . Over month-long periods at both sites , about 75% of canopy temperature observations were within 0 .5℃ of the setpoint temperature differences between heated and reference plots . Electrical power consumption per 3-m-diameter plot averaged 58 and 80 kW-hr per day for Haibei and Cheyenne , respectively . However , the desired temperature differences were set lower at Haibei (1 .2℃ daytime , 1 .7℃ night) than Cheyenne (1 .5℃ daytime , 3 .0℃ night) , and Cheyenne is a windier site . Thus , we conclude that these hexagonal arrays of ceramic infrared heaters can be a successful T-FACE (temperature free-air controlled enhancement) system for warming field plots of grazingland and other ecosystems .

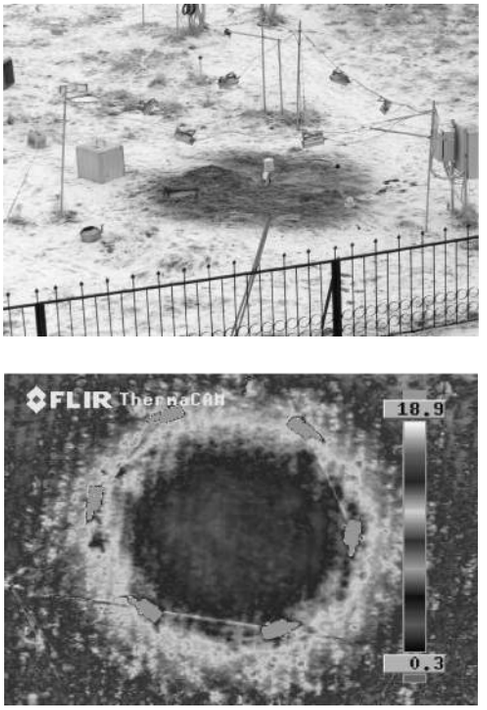

Figure 1 *(Left) Hexagonal array of infrared heaters over grazingland at Haibei , Qinghai , China on 3 April 2007 . (Right) Thermal image of 25-cm-tall wheat under a similar heater array at Maricopa , Arizona , USA before dawn on 7 November 2007 .*

Reference

Kimball , B .A . , Conley , M .M . , Wang , S . , Lin , X . , Luo , C . , Morgan , J . , Smith , D . , (2008) . Infrared heater arrays for warming ecosystem field plots . *Global Change Biology* (in press) .