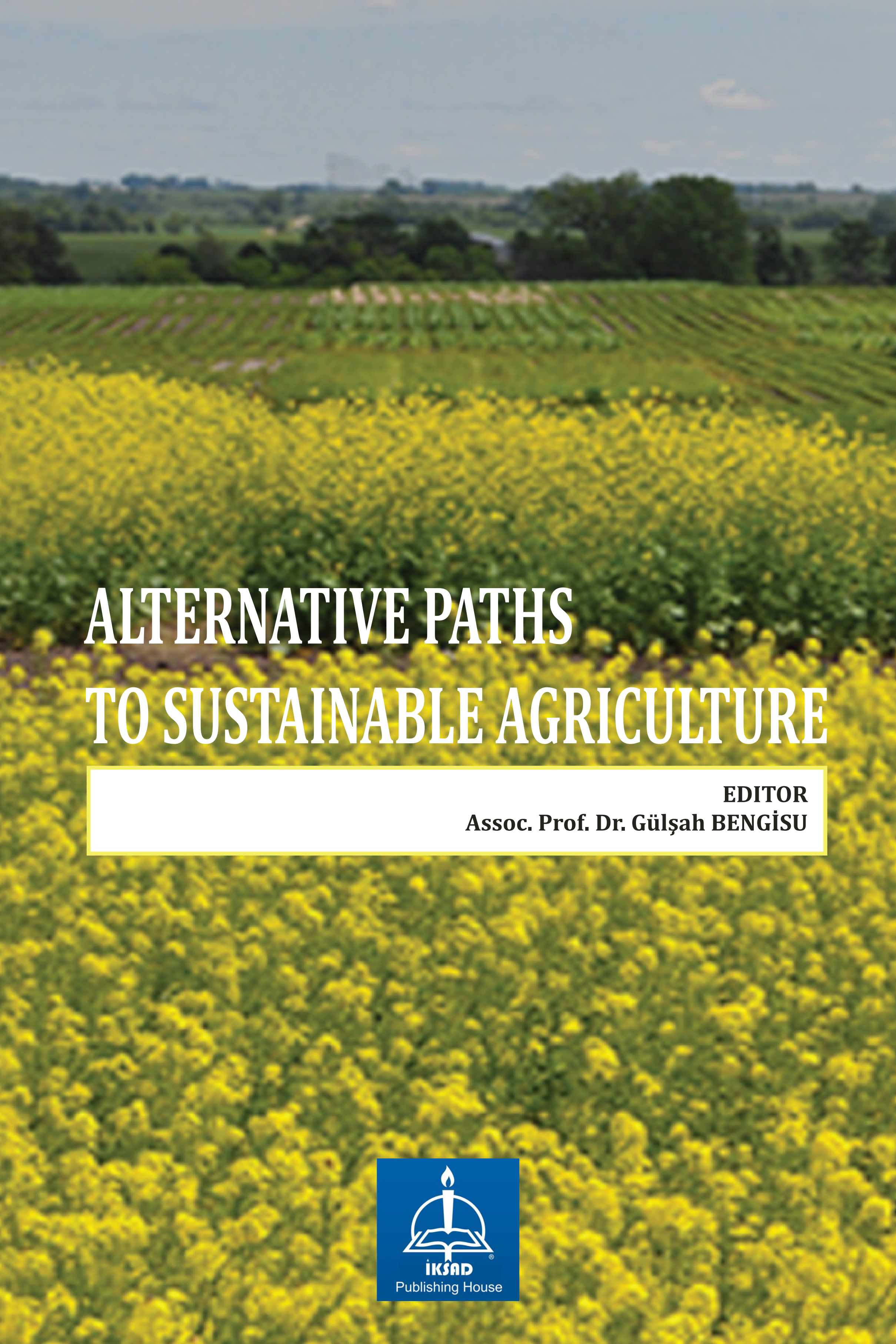

ALTERNATIVE PATHS TO SUSTAINABLE AGRICULTURE

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PREFACE

Agricultural ecosystems have a variety of properties and strategies towards agricultural intensification differ. For a sustainable intensification, agricultural yields increase without negative environmental results and without additional land after application of a process. Some of alternative pathway for sustainable intensification of agriculture are breeding insect resistant crops to increase crop health, utilising agro-ecological approaches to pest management, mixing plant species in cropping and livestock farming systems, benefiting from functions of secondary metabolites, reducing contamination of food and fodder and using physiological and behavioral response dynamics to pheromones, which all are valuable solutions. Solution fitting to smallholder farmers, diversifed types of livestock, integrated pest management techniques and precision agriculture (to fit future smart applications) are more eligible. Here in this chapter, reader may find some of these approaches from different sub-categories.

Assoc. Prof. Dr. Gülşah BENGİSU

CHAPTER 10

A MACRO LOOK TO CANOPY TEMPERATURE & LEAF TEMPERATURE: A REVIEW

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INTRODUCTION

Canopy temperature is a driver of plant function emerging as a result of interacting biotic and abiotic factors. Plant canopy temperature is partly regulated by evaporation and transpiration and is an indirect measure of transpiration rate and stomatal conductance. The determination of crop water status has positive effects on irrigation decisions. Infrared thermal imaging cameras are effective tools to monitor the spatial distribution of canopy temperature. Canopy temperature is often related to potential yield and is a possible yield indicator in breeding programs.

Plants must regulate leaf temperature to optimize photosynthesis, control water loss and prevent damage caused by overheating or freezing. Leaf temperature changes with incident light intensity. There is general concern that the rapid increase in atmospheric CO2 concentration will lead to reduced stomatal conductance and subsequent increases in leaf temperature.

Here in this review, a macro look to canopy temperature and leaf temperature is presented by the help of new data from international articles.

Plant functional diversity is strongly connected to photosynthetic carbon assimilation in terrestrial ecosystems. However, many of the plant functional traits regulating photosynthetic capacity, including foliar nitrogen concentration and leaf mass per area, vary significantly between and within plant functional types and vertically through plant canopies (Kamoske et al., 2021). Canopy structure explains the relationship between photosynthesis and sun-induced chlorophyll fluorescence in crops (Dechant et al., 2020). Ecological research heavily relies on coarse-gridded climate data based on standardized temperature measurements recorded at 2 m height in open landscapes. However, many organisms experience environmental conditions that differ substantially from those captured by these macroclimatic temperature grids (Haesen et al., 2021). Water is a crucial element for plant growth, metabolic processes, and general health. Water-deficit, typically simplified by drought stress, is the most critical photosynthetic source of stress that restricts plant growth, crop yield, and food product quality (Awais et al., 2021).

1. Canopy temperature

Canopy temperature is a key driver of plant function that emerges as a result of interacting biotic and abiotic processes and properties. However, understanding controls on canopy temperature and forecasting canopy responses to weather extremes and climate change are difficult due to sparse measurements of canopy temperature at appropriate spatial and temporal scales (Still et al., 2021).

Canopy temperature is an indirect measure of transpiration rate and stomatal conductance and may be valuable in distinguishing differences among genotypes in response to drought (Bazzer & Purcell, 2020). Canopy temperature has been related to water-use and yield formation in crops. However, sun illumination angle, ambient temperature as well as rapidly changing clouds or other environmental conditions make it difficult to compare measurements taken even at short time intervals.

This poses a great challenge for high-throughput field phenotyping (Perich et al., 2020).

Canopy temperature is an important variable directly linked to a plant's water status. Recent advances in Unmanned Aerial Vehicle and sensor technology provides a great opportunity to obtain high-quality imagery for crop monitoring and high-throughput phenotyping applications (Chang et al., 2020).

2. Canopy temperature & water relation

The determination of crop water status has positive effects on irrigation decisions. Drought can decrease the production of crops, whereas over-irrigation can waste water. It is desirable to schedule irrigation when the crop suffers from water stress (Yang et al., 2021). The ability to avoid dehydration is a drought resistance mechanism becoming increasingly more important even in temperate regions. In wheat, dehydration avoidance can be associated with a maintained canopy cooling during dry periods. However, in an average year under temperate conditions, drought periods are rather short which makes it difficult to routinely screen for drought avoidance using canopy temperature (Anderegg et al., 2021).

Drought-stressed plants display reduced stomatal conductance, which results in increased leaf temperature by limiting transpiration (Melandri et al., 2020). Normalized crop canopy temperature, termed crop water stress index, was proposed over 40 years ago as an irrigation management tool but has experienced limited adoption in production agriculture (King et al., 2020). The crop water stress index is a reliable indicator of water status in plants and has been utilized for stress monitoring, yield prediction, and irrigation scheduling. Despite this, however, its use is limited because its estimation requires baseline temperatures under similar environmental conditions, which can be problematic (Kumar et al., 2021). Canopy water use efficiency (above-ground biomass over lifetime water loss) can influence yield in wheat and other crops. Breeding for canopy water use efficiency is difficult because it is influenced by many component traits (Sexton et al., 2021).

Plant canopy temperature is partly regulated by evaporation and transpiration from the canopy surface and can be used to infer changes in stomatal regulation and vegetation water stress (Javadian et al., 2022). Crop canopy temperature measurement is necessary for monitoring water stress indicators such as the Crop Water Stress Index. Water stress indicators are very useful for irrigation strategies management in the precision agriculture context. For this purpose, one of the techniques used is thermography, which allows remote temperature measurement. However, the applicability of these techniques depends on being affordable, allowing continuous monitoring over multiple field measurement (Gimenez-Gallego et al., 2021).

As the drought conditions persist and water continues to become less available, the development of methods to reduce water inputs is extremely important (Haghverdi et al., 2021). Infrared thermal imaging cameras are effective tools to monitor the spatial distribution of canopy temperature, which is the basis of the crop water stress index (CWSI) calculation (Luan et al., 2021).

Continuous measurement of canopy temperature is an important indicator of plant water status of crops and the ability to predict canopy temperature will assist in the implementation of this technology for guiding crop irrigation scheduling. By noting that canopy temperature is related to its environmental weather variables which change over time of the day and have different effect or contribution to canopy temperature (Shao et al., 2019).

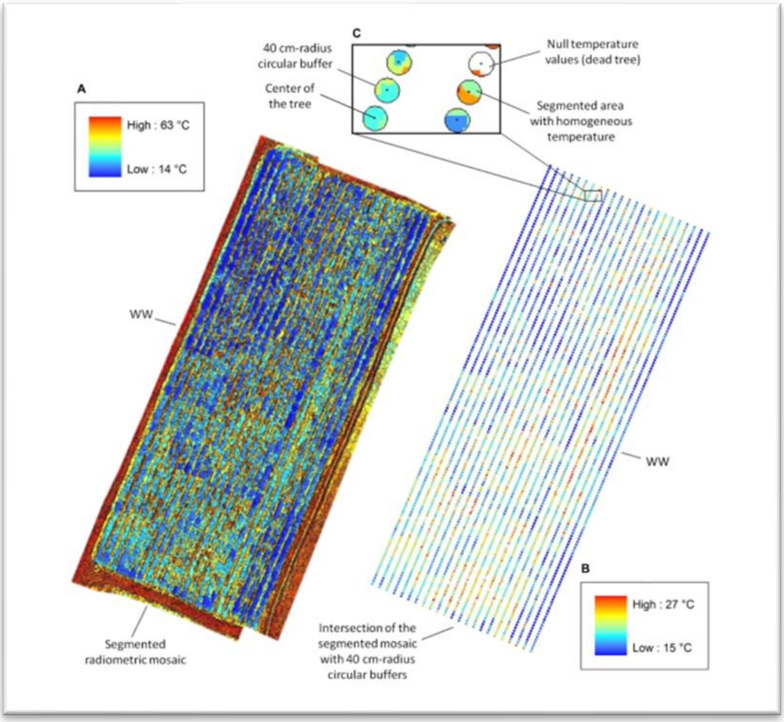

Fig 1. Canopy temperature extracted from segmented radiometric mosaics. (A) segmentation of the radiometric mosaic with temperature range between 14 and 63◦C. (B) Intersection of the segmented mosaic with 40 cm-radius circular buffers centered on the trees with Canopy temperature ranging between 15 and 27◦C (C) View of the intersection for six trees (Ludovisi et al., 2017).

3. Canopy temperature & crop yield relation

Canopy temperature depression (CTD = canopy temperature – air temperature), transpiration and canopy greenness have much to do with crop yields, and they have been widely used to estimate crop yields. However, the issues relating to the best measurement time to predict crop yields have seldom been addressed (Hou et al., 2019). To identify drought-tolerant crop cultivars or achieve a balance between water use and yield, accurate measurements of crop water stress are needed (Zhang et al., 2019). Canopy temperature is often related to potential yield and is a possible yield indicator in breeding programs. However, it is difficult to evaluate genetic variations of canopy temperature accurately in large-scale investigations, such as breeding programs, because canopy temperature is strongly affected by environmental conditions (Ohnishi et al., 2021).

Changes in leaf anatomy and ultrastructure are associated with physiological performance in the context of plant adaptations to climate change (Habermann et al., 2019). For potatoes, canopy temperature as a surrogate of stomatal conductance has been highlighted as an essential physiological indicator for optimizing irrigation timing. However, assessing how this trait could help improve yield prediction will help develop future decision support tools. In the future, the incorporation of Canopy temperature combining low-cost infrared devices/sensors with spatial crop models, satellite image information, and telemetry technologies, an adequate decision support system could be implemented for water requirement determination and yield prediction in potatoes (Ninanya et al., 2021).

The seed yield of oilseed rape (*Brassica napus*), an important edible and industrial oil source, is derived mainly from the photosynthetic products of siliques. High temperatures in the pod-development stage threaten the oilseed rape production. Potassium fertilization reduces silique canopy temperature variation in Brassica napus to enhance seed yield (Hu et al., 2021).

4. Leaf temperature

Leaf temperature changes with incident light intensity (Kang et al., 2020). High temperatures alter the thermal sensitivities of numerous physiological and biochemical processes that impact plant growth and productivity (Dewhirst et al., 2021). Leaf optical properties impact leaf energy balance and thus leaf temperature (Richardson et al., 2021).

There is general concern that the rapid increase in atmospheric CO2 concentration will lead to reduced stomatal conductance and subsequent increases in leaf temperature. Such an increase in leaf temperature is expected to adversely impact a plethora of processes connected to leaf metabolism and microbial/fungal communities on leaves (Konrad et al., 2021). Leaf temperature is a key variable governing plant physiological processes, such as photosynthesis and respiration. Further, very high temperatures can lead to leaf necrosis (Fauset et al., 2019). A stable leaf temperature provides plants with a suitable microenvironment for photosynthesis. With global warming, extreme temperatures have become more frequent and severe;

therefore, it is increasingly important to understand the fine regulation of leaf temperature under heat stress (Song et al., 2020). Leaf temperatures of water-stressed plants were 6 to 8°C higher than those well-watered, with differences among species in the study of Graf et al., (2021).

A growing number of leaf traits can be estimated from hyperspectral reflectance data. These include structural and compositional traits, such as leaf mass per area and nitrogen and chlorophyll content, but also physiological traits such a Rubisco carboxylation activity, electron transport rate, and respiration rate (Khan et al., 2021).

Biogenic Volatile Organic Compounds are reactive hydrocarbons emitted by living organisms, mainly by vegetation, in numerous physiological processes. Biogenic Volatile Organic Compounds interact with the atmosphere in various ways, and are important for the regional air quality and climate because they can contribute to tropospheric ozone, prolong the lifetime of methane, and enhance aerosol formation and growth. Production and emission of biogenic Volatile Organic Compounds from plant leaves is highly regulated by temperature (Simin et al., 2019).

Trichomes are epidermal structures with a large variety of ecological functions and economic applications. Glandular trichomes produce a rich repertoire of secondary metabolites, whereas non-glandular trichomes create a physical barrier on the epidermis: both operate in tandem against biotic and abiotic stressors. A deeper understanding of trichome development and function would enable the breeding of more resilient crops. a single monogenic mutation that modifies trichome density, a desirable trait for crop breeding, concomitantly improves leaf gas exchange and reduces leaf temperature (Gasparini et al., 2021).

Calcite-silicon mediated particle film could enhance the resilience of crops to adverse environmental conditions and may contribute to preserve terroir elements in highly reputed growing areas. The study of Amato et al., (2020) showed that foliar application of calcite silicon-mediated processed particles films can be used in arid regions to mitigate leaf temperatures in grapevines.

Plants must regulate leaf temperature to optimize photosynthesis, control water loss and prevent damage caused by overheating or freezing. Physical models of leaf energy budgets calculate the energy fluxes and leaf temperatures for a given set leaf and environmental parameters. These models can provide deep insight into the variation in leaf form and function (Muir, 2019).

5. Conclusions

For winter cereals, under temperate conditions, drought periods are rather short which makes it difficult to routinely screen for drought avoidance using canopy temperature.

Most of the canopy temperature studies are on high temperature effects. Very limited study subject the low temperature effect on canopy.

Canopy temperature measurements is not well accepted and standartised. Instead, leaf temperature measurements are more valuable for stress determination and escape management and genotype selection activities.

Literatures

Amato, D., Montanaro, G., Summerer, S., Briglia, N., Attia, F., Challet, E., & Nuzzo, V. (2020). The effects of calcite silicon-mediated particle film application on leaf temperature and grape composition of Merlot (Vitis vinifera L.) vines under different irrigation conditions: This article is published in cooperation with the XIIIth International Terroir Congress November 17-18 2020, Adelaide, Australia. Guest editors: Cassandra Collins and Roberta De Bei. OENO One, 54(4), 1007-1020.

Anderegg, J., Aasen, H., Perich, G., Roth, L., Walter, A., & Hund, A. (2021). Temporal trends in canopy temperature and greenness are potential indicators of late-season drought avoidance and functional stay-green in wheat. Field Crops Research, 274, 108311.

Awais, M., Li, W., Cheema, M. J. M., Hussain, S., AlGarni, T. S., Liu, C., & Ali, A. (2021). Remotely sensed identification of canopy characteristics using UAV-based imagery under unstable environmental conditions. Environmental Technology & Innovation, 22, 101465.

Bazzer, S. K., & Purcell, L. C. (2020). Identification of quantitative trait loci associated with canopy temperature in soybean. Scientific Reports, 10(1), 1-11.

Chang, A., Jung, J., Maeda, M. M., Landivar, J. A., Carvalho, H. D., & Yeom, J. (2020). Measurement of cotton canopy temperature using radiometric thermal sensor mounted on the unmanned aerial vehicle (UAV). Journal of Sensors, 2020.

Dechant, B., Ryu, Y., Badgley, G., Zeng, Y., Berry, J. A., Zhang, Y., ... & Moya, I. (2020). Canopy structure explains the relationship between photosynthesis and sun-induced chlorophyll fluorescence in crops. Remote Sensing of Environment, 241, 111733.

Dewhirst, R. A., Handakumbura, P., Clendinen, C. S., Arm, E., Tate, K., Wang, W., ... & Jardine, K. J. (2021). High Temperature Acclimation of Leaf Gas Exchange, Photochemistry, and Metabolomic Profiles in Populus trichocarpa. ACS Earth and Space Chemistry, 5(8), 1813-1828.

Fauset, S., Lin, H., Kitudom, N., & Zhou, Y. (2019). The importance of tree species traits for leaf temperature regulation-measurements and modelling in three forest ecosystems. In AGU Fall Meeting Abstracts (Vol. 2019, pp. B31D-06W).

Gasparini, K., da Silva, M. F., Costa, L. C., Martins, S. C., Ribeiro, D. M., Peres, L. E., & Zsögön, A. (2021). The Lanata trichome mutation increases stomatal conductance and reduces leaf temperature in tomato. Journal of Plant Physiology, 260, 153413.

Gimenez-Gallego, J., González-Teruel, J. D., Soto-Valles, F., Jiménez-Buendía, M., Navarro-Hellín, H., & Torres-Sánchez, R. (2021). Intelligent thermal image-based sensor for affordable measurement of crop canopy temperature. Computers and Electronics in Agriculture, 188, 106319.

Graf, M., Immitzer, M., Hietz, P., & Stangl, R. (2021). Water-stressed plants do not cool: Leaf surface temperature of living wall plants under drought stress. Sustainability, 13(7), 3910.

Habermann, E., San Martin, J. A. B., Contin, D. R., Bossan, V. P., Barboza, A., Braga, M. R., ... & Martinez, C. A. (2019). Increasing atmospheric CO2 and canopy temperature induces anatomical and physiological changes in leaves of the C4 forage species Panicum maximum. PloS one, 14(2), e0212506.

Haesen, S., Lembrechts, J. J., De Frenne, P., Lenoir, J., Aalto, J., Ashcroft, M. B., ... & Van Meerbeek, K. (2021). ForestTemp–Sub-canopy microclimate temperatures of European forests. Global Change Biology, 27(23), 6307-6319.

Haghverdi, A., Reiter, M., Singh, A., & Sapkota, A. (2021). Hybrid Bermudagrass and Tall Fescue Turfgrass Irrigation in Central California: II. Assessment of NDVI, CWSI, and Canopy Temperature Dynamics. Agronomy, 11(9), 1733.

Hou, M., Tian, F., Zhang, T., & Huang, M. (2019). Evaluation of canopy temperature depression, transpiration, and canopy greenness in relation to yield of soybean at reproductive stage based on remote sensing imagery. Agricultural Water Management, 222, 182-192.

Hu, W., Lu, Z., Meng, F., Li, X., Cong, R., Ren, T., & Lu, J. (2021). Potassium fertilization reduces silique canopy temperature variation in Brassica napus to enhance seed yield. Industrial Crops and Products, 168, 113604.

Javadian, M., Smith, W. K., Lee, K., Knowles, J. F., Scott, R. L., Fisher, J. B., ... & Behrangi, A. (2022). Canopy temperature is regulated by ecosystem structural traits and captures the ecohydrologic dynamics of a semiarid mixed conifer forest site. Journal of Geophysical Research: Biogeosciences, e2021JG006617.

Kamoske, A. G., Dahlin, K. M., Serbin, S. P., & Stark, S. C. (2021). Leaf traits and canopy structure together explain canopy functional diversity: an airborne remote sensing approach. Ecological Applications, 31(2), e02230.

Kang, H. X., Zhu, X. G., Yamori, W., & Tang, Y. H. (2020). Concurrent Increases in Leaf Temperature With Light Accelerate Photosynthetic Induction in Tropical Tree Seedlings. Frontiers in plant science, 1216.

Khan, H. A., Nakamura, Y., Furbank, R. T., & Evans, J. R. (2021). Effect of leaf temperature on the estimation of photosynthetic and other traits of wheat leaves from hyperspectral reflectance. Journal of Experimental Botany, 72(4), 1271-1281.

King, B. A., Shellie, K. C., Tarkalson, D. D., Levin, A. D., Sharma, V., & Bjorneberg, D. L. (2020). Data-driven models for canopy temperature-based irrigation scheduling. Transactions of the ASABE, 63(5), 1579-1592.

Konrad, W., Katul, G., & Roth-Nebelsick, A. (2021). Leaf temperature and its dependence on atmospheric CO2 and leaf size. Geological Journal, 56(2), 866-885.

Kumar, N., Shankar, V., Rustum, R., & Adeloye, A. J. (2021). Evaluating the performance of self-organizing maps to estimate well-watered canopy temperature for calculating crop water stress index in Indian Mustard (Brassica juncea). Journal of Irrigation and Drainage Engineering, 147(2), 04020040.

Luan, Y., Xu, J., Lv, Y., Liu, X., Wang, H., & Liu, S. (2021). Improving the performance in crop water deficit diagnosis with canopy temperature spatial distribution information measured by thermal imaging. Agricultural Water Management, 246, 106699.

Ludovisi, R., Tauro, F., Salvati, R., Khoury, S., Mugnozza Scarascia, G., & Harfouche, A. (2017). UAV-based thermal imaging for high-throughput field phenotyping of black poplar response to drought. Frontiers in plant science, 8, 1681.

Melandri, G., Prashar, A., McCouch, S. R., Van Der Linden, G., Jones, H. G., Kadam, N., ... & Ruyter-Spira, C. (2020). Association mapping and genetic dissection of drought-induced canopy temperature differences in rice. Journal of experimental botany, 71(4), 1614-1627.

Muir, C. D. (2019). tealeaves: an R package for modelling leaf temperature using energy budgets. AoB Plants, 11(6), plz054.

Ninanya, J., Ramírez, D. A., Rinza, J., Silva-Díaz, C., Cervantes, M., García, J., & Quiroz, R. (2021). Canopy Temperature as a Key Physiological Trait to Improve Yield Prediction under Water Restrictions in Potato. Agronomy, 11(7), 1436.

Ohnishi, S., Kasuya, M., Sonoda, T., & Jinno, H. (2021). Normalization method for canopy temperature as an indirect indicator of yield potential in wheat breeding programs. Breeding Science, 71(5), 520-527.

Perich, G., Hund, A., Anderegg, J., Roth, L., Boer, M. P., Walter, A., ... & Aasen, H. (2020). Assessment of multi-image unmanned aerial vehicle based high-throughput field phenotyping of canopy temperature. Frontiers in plant science, 11, 150.

Richardson, A. D., Aubrecht, D. M., Basler, D., Hufkens, K., Muir, C. D., & Hanssen, L. (2021). Developmental changes in the reflectance spectra of temperate deciduous tree leaves and implications for thermal emissivity and leaf temperature. New Phytologist, 229(2), 791-804.

Sexton, T. M., Steber, C. M., & Cousins, A. B. (2021). Leaf temperature impacts canopy water use efficiency independent of changes in leaf level water use efficiency. Journal of Plant Physiology, 258, 153357.

Shao, Q., Bange, M., Mahan, J., Jin, H., Jamali, H., Zheng, B., & Chapman, S. C. (2019). A new probabilistic forecasting model for canopy temperature with consideration of periodicity and parameter variation. Agricultural and Forest Meteorology, 265, 88-98.

Simin, T., Holst, T., & Rinnan, R. (2019). Coupling of biogenic volatile organic compound emission with leaf surface temperature, phenology and species characteristics in tundra shrubs. In Geophysical Research Abstracts (Vol. 21).

Song, Y., Xuan, A., Bu, C., Liu, X., & Zhang, D. (2020). Identification of a transcriptional regulatory module that reduces leaf temperature in poplar under heat stress. Tree Physiology, 40(8), 1108-1125.

Still, C. J., Rastogi, B., Page, G. F., Griffith, D. M., Sibley, A., Schulze, M., ... & Helliker, B. R. (2021). Imaging canopy temperature: shedding (thermal) light on ecosystem processes. New Phytologist, 230(5), 1746-1753.

Yang, M., Gao, P., Zhou, P., Xie, J., Sun, D., Han, X., & Wang, W. (2021). Simulating Canopy Temperature Using a Random Forest Model to Calculate the Crop Water Stress Index of Chinese Brassica. Agronomy, 11(11), 2244.

Zhang, L., Niu, Y., Zhang, H., Han, W., Li, G., Tang, J., & Peng, X. (2019). Maize canopy temperature extracted from UAV thermal and RGB imagery and its application in water stress monitoring. Frontiers in plant science, 1270.