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207 Diversifying dairy farm income through

agrivoltaics. Brad J. Heins¹, Kirsten Sharpe¹,
Sabrina Florentino¹, Eric Buchanan¹,
Michael Reese¹, ¹*University of Minnesota*

Abstract: The dairy industry consumes an immense amount of fossil-fuel in the production of food, feed, fiber, and energy. From the electricity that cools milk, to the fuel that is burned in tractors in fields, to the trucks that bring goods to market, and to the nitrogen fertilizer that nourishes plants; the agricultural industry is captive to large and constant supplies of a wide range of fossil energy. Using an agrivoltaic system in a pasture, which is the integration of solar photovoltaics and agriculture, could boost land efficiency up to 75%. Potential on-site renewable electric generation could also supply some or the entire electric load allowing dairy farms to approach net-zero. Agrivoltaics is one-way producers might be able to become less dependent on fossil fuels, lower production costs, increase land efficiency, improve forages and crops for use by dairy cattle, and increase milk production and health in dairy cows. The University of Minnesota West Central Research and Outreach Center dairy herd in Morris, MN has evaluated agrivoltaics as a method to reduce heat stress, as well as evaluate forage biomass and nutritive value of crops, grasses and legumes grown under different agrivoltaic conditions. Crossbred cows were assigned to one of two treatments: shade from solar PV or no shade. Respiration rates for shade and no shade cows were similar during the morning hours, but during the afternoon, shade cows had lower respiration rates (66 breaths/min) than no shade cows (78 breaths/min). Milk, fat, and protein production were not different for cows whether they had shade or no shade. Hourly body temperature results show that no shade cows had greater internal body temperatures (+0.6°C) than shade cows from 13:00 h to 24:00 h. Forage biomass and nutrient values varied based on the solar array design and amount of sun exposure. Based on the results of this study, cows may have sacrificed grazing time to stand in the protection of the shade. Future research with solar panels will investigate the reproductive performance of the cows, and long-term effects on milk, fat, and protein production, body weight, body condition, and animal health and well-being. Agrivoltaics in the form of forage production grown underneath ground-mounted photovoltaic systems may provide a suitable feed source for livestock production and a renewable energy source for farms and economic opportunity for farmers.

Keywords: agrivoltaics, forages, pasture

