Project title: Using Sudangrass as cover crop in rotation with leafy greens to mitigate water and soil related issues in the Imperial Valley.

Principal investigator: Ali Montazar, Irrigation and Water Management Advisor, University of California Cooperative Extension, Imperial County, Holtville, CA; email: amontazar@ucanr.edu

Cooperating personnel: Michael Cahn, Irrigation and Water Resources Advisor, UCCE Monterey County, Salinas, CA 93901: Email: mdcahn@ucanr.edu. (2) Richard Smith, Vegetable Crops and Weed Science Advisor, UCCE Monterey County, Salinas, CA 93901: Email: rifsmith@ucanr.edu.

Abstract. This study aimed at assessing sudangrass as a cover crop (CC) following lettuce crop to mitigate soil and water related issues in the Imperial Valley. The experiment was conducted in one organic and one conventional lettuce field. The plants were germinated using sprinklers in early April 2023 and left with no irrigation after germination. The cover crop was grown during summer, and then chopped at about 40% flowering and incorporated with the soil one month before planting subsequent head lettuce crop in October 2023. The cover crop treatments were periodically evaluated for above ground biomass and dry matter, nitrogen accumulation, and stand count and canopy cover percent. Marketable yields of the subsequent lettuce crops were recorded at harvest. A high sudangrass biomass yield (10.4 -10.9 t ac^{-1}) was observed applying 8.5-10.0 inches of water during the first three weeks after planting. The mean sudangrass plant height varied from 70.6 to 72.7 inches across the CC trials. A clear contribution of sudangrass CC on organic matter %, K soil availability (the top 8'') and lettuce K uptake was found within the following lettuce crop season. No significant impact of CC was found on the lettuce biomass, N and P uptake. The first-year study provided some basic information on sudangarss biomass yield expectations, crop water needs, plant survival under drought conditions, and the impacts sudangrass CC on soil health measures in the desert environment.

Objectives. The overall purpose of this study was to assess the use of sudangrass cover crop in leafy green organic and conventional fields and applicability of this practice in the low desert production systems. The study aimed at developing data and information on the potential benefits of sudangrass cover crops following lettuce crop in the Imperial Valley.

Procedures. The study was conducted in two experimental sites (UC DREC and commercial field) from April 2023 through February 2024. In both sites, sudangrass was planted in early April 2023 and was irrigated the first three weeks after planting. Two treatments, fallow as control treatment vs. sudangrass CC were arranged in a randomized complete block design. Along with germination water, an additional irrigation event was scheduled to ensure the plants were uniformly established at an average height of 12 inches. No further irrigation occurred over the spring-summer period. Sudangrass crop was grown during summer, chopped at about 40% flowering, and incorporated with the soil one month before planting head lettuce crop in fall.

Soil moisture was monitored at the top 4 ft. on a continuous basis in each treatment. For analyses of all soil related parameters, composite soil samples were collected from the top 8-ins (two locations from each treatment replication, totaling 8 sample locations per treatment) before cover crop planting, at the time of lettuce planting, and after post-termination of lettuce crops. Lab

analysis was conducted to determine soil nitrate, organic matter, sodium, calcium, magnesium, soil pH, ECe, phosphorus, potassium, and soil texture (only early season). The cover crop treatments were periodically evaluated for above ground dry matter and nitrogen accumulation and stand count and canopy cover percent. Marketable yields of the lettuce crop were recorded at harvest (as subsequent cash crops).

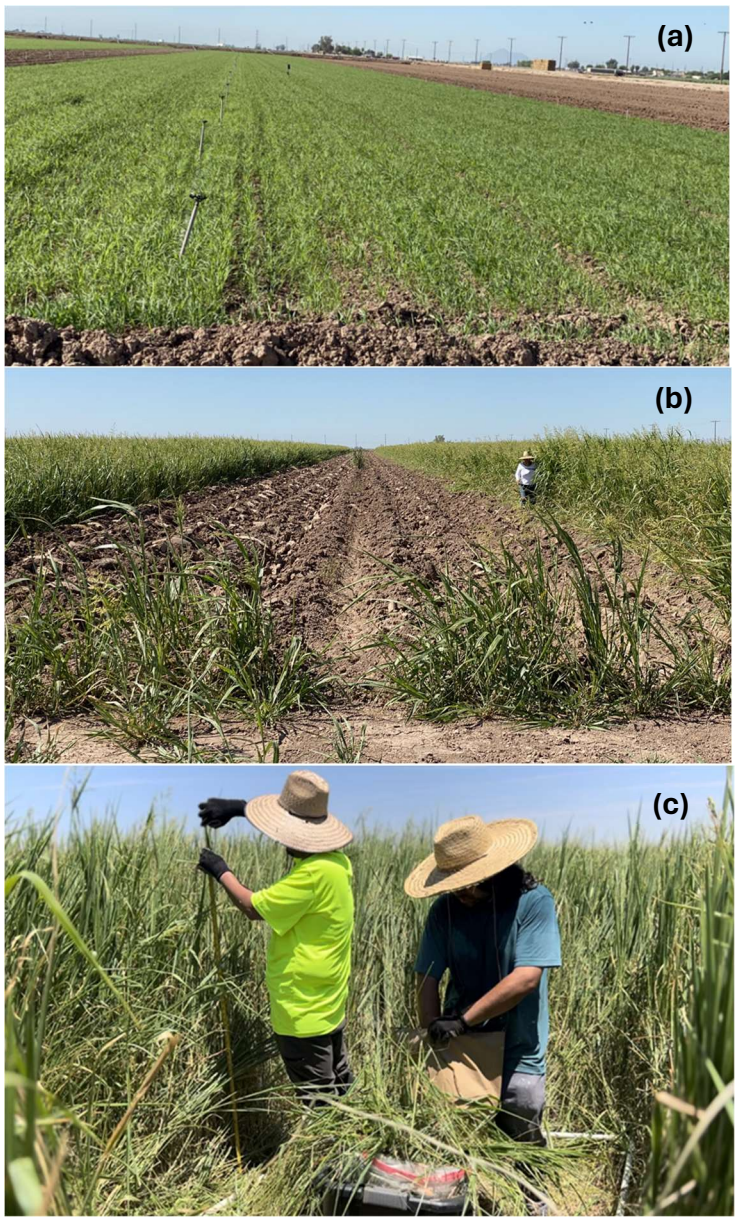

Figure 1. Summer sudangrass CC conducted in a commercial field the Imperial Valley. The trial's first irrigation was March 31, 2023. It was irrigated only by April 20, 2023, to ensure good plant establishment. No irrigation event was occurred during the spring-summer period. The pictures demonstrate healthy well-grown sudangrass CC on April 28, 2023 (a) and June 13, 2023 (b); and the research staff during plant sampling and plant height measurements on June 9, 2023 (c).

Results and discussion. The water applied was 10.0 and 8.6-in for the grower field CC trial and the UCDER CC trial, respectively. We could grow good sudangrass cover crop with considerable biomass applying only 6-in water, while as the first-year cover crop experiment we needed to ensure good germination and evaluate how the plants survive in extreme summer heat and water stress conditions.

The sudangrass plants grew well in both trials with a mean plant height of 72.7 and 70.6-in in the grower field trial and the DREC trial in mid-June, respectively (Fig. 2). Considerable CC biomass and dry matter yields were observed the day before chopping cover crops as well (Fig. 3).

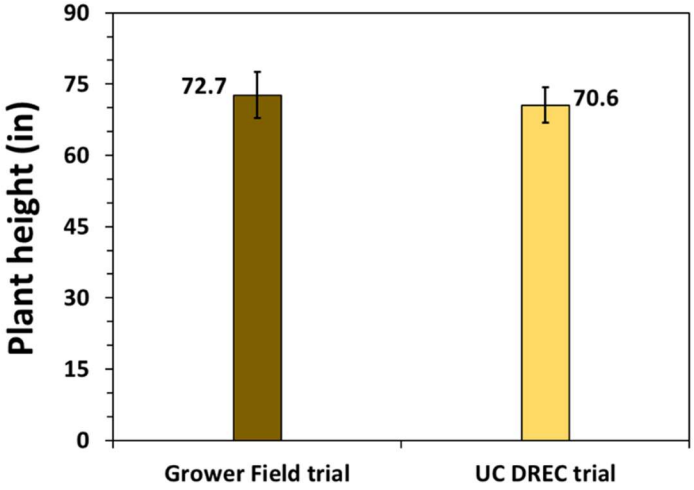

Fig.2. CC plant height mean (and standard deviation) in grower field and DREC trials in mid-June 2023.

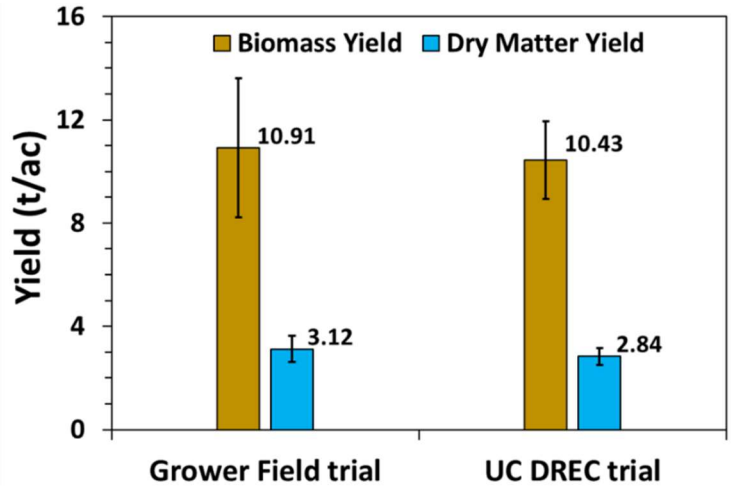

Fig. 3. CC biomass and dry matter yields (and standard deviation) in grower field and DREC trials in mid-June 2023.

A clear and significant impact on lettuce K uptake ($p < 0.05$) was found from sudangrass CC (Fig. 4). The first-year data didn't demonstrate a significant lettuce biomass yield, N and P uptake from sudangrass CC (Fig. 4). The data also showed a clear contribution of sudangrass CC on organic matter % (an average of 0.22% increase) and K soil availability (an average of 99 ppm greater at the top 8-in) within the following lettuce crop season. The comparisons were conducted for lettuce treatments under summer fallow (F-lettuce) and lettuce treatment under summer cover crop (CC-lettuce) at the lettuce harvest.

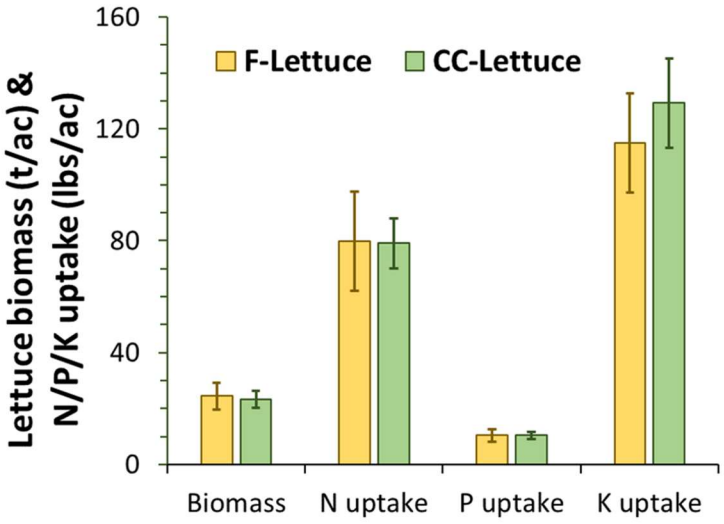

Fig. 4. Lettuce biomass yield and lettuce N/P/K uptake in grower field trial at harvest. The comparisons are demonstrated between lettuce under fallow summer (F-lettuce) and lettuce under sudangrass CC (CC-lettuce).

The first-year study provided some basic information on sudangarss biomass yield expectations, crop water needs, and plant survival under drought conditions in the desert environment. Overall, the results revealed that sudangrass is an appropriate cover crop choice for the desert region. The practice could be a new tool to improve soil drainage and address water quality and water conservation objectives in the low desert region, however, more data is required to comprehensively evaluate the benefits of sudangrass as a cover crop.

Fig. 5. Head lettuce was germinated on October 6, 2023, following sudangrass CC trial, and was harvested on December 18, 2023.