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Drought Tolerant Plants for the Southwestern United States in Response to Climate Change

Emily Rice

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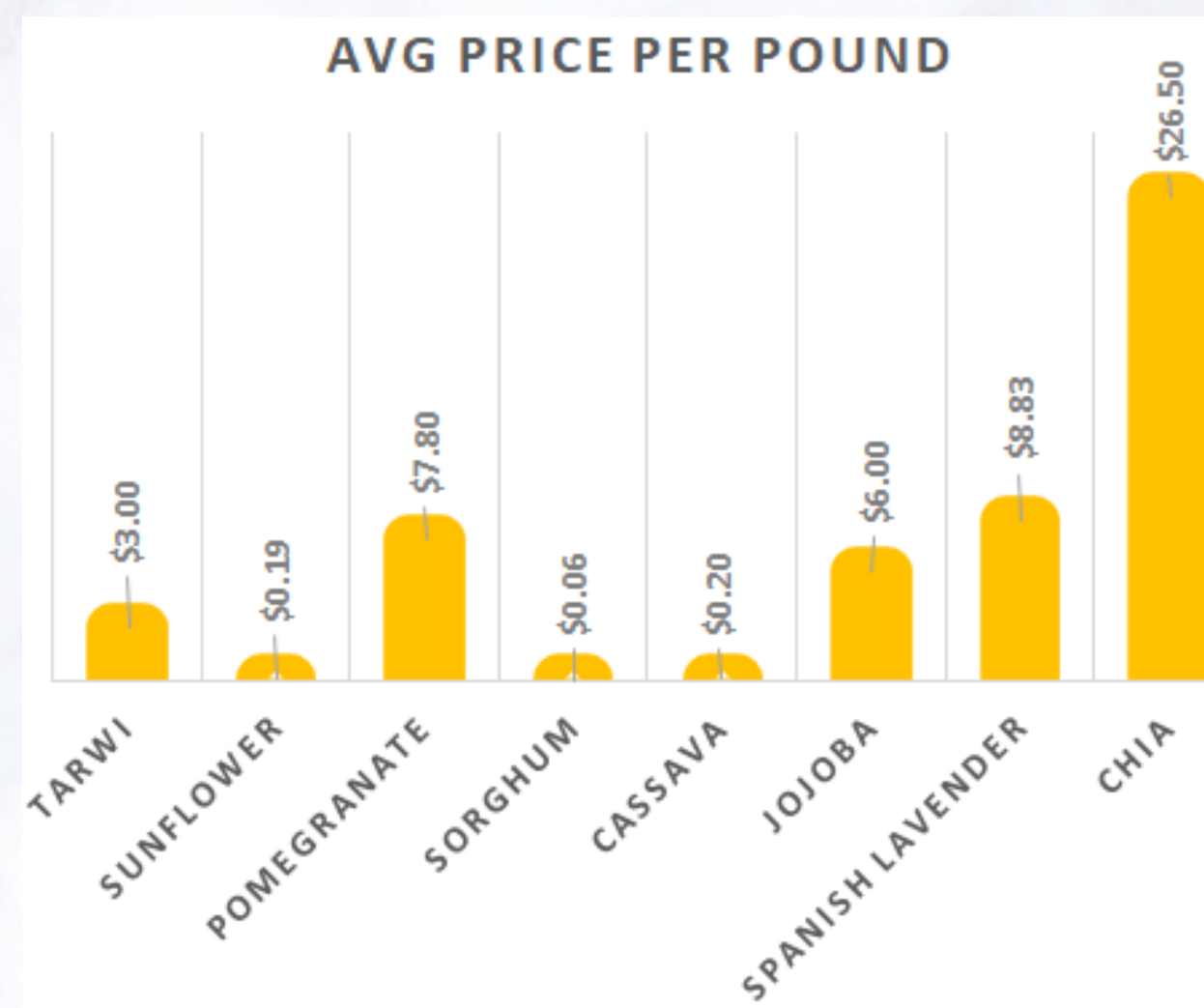
Overview

The Southwest United States has been severely impacted by climate change. Already the driest region of the US, temperatures in the area have risen approximately 2 degrees Fahrenheit in the previous century ("Climate Impacts in the Southwest", 2017). Those temperatures are expected to rise by 3.5 to 9.5 degrees before the end of the current century ("Climate Impacts in the Southwest", 2017). The Southwest is populated by approximately 56 million people, and that population is on the rise ("Climate Impacts in the Southwest", 2017). It is expected to almost double by the year 2050 ("Climate Impacts in the Southwest", 2017).

In a region already considered to have many drought areas, this temperature increase will stress water sources, making the competition between farmers, urban areas, and native groups to become more intense. The same temperature increases that cause severe drought in inland areas will also contribute to rising seas in coastal areas ("Southwest", 2014). The following crops all possess unique characteristics which enable them thrive, not merely survive, in these discouraging conditions. The drought resistant features of these crops are discussed in relation to soil preferences, growing conditions, and profitability.

Tarwi

- *Lupinus mutabilis*
- Tolerant of cool summer temperatures, drought tolerant, highly resistant to pests, able to grow in marginal soils, and nitrogen fixing (New Scientist, 1988).
- Suitable as a cover crop and food crop; can handle small amounts of frost (New Scientist, 1988).
- Requires either acidic or neutral soils ("*Lupinus mutabilis*", n.d.).
- Hardy from zones 8-11. Can tolerate strong winds (*Lupinus mutabilis*, n.d.).
- Can produce roughly 30 tons per acre; sells for approximately \$3 per pound (Cohen & Routledge, 2014).



Sunflower

- *Helianthus annuus*
- Native to North America (USDA, n.d.).
- Needs full sun and irrigation until well established (Iannotti, 2019).
- Well-drained soil rich in organic matter (Delate, 2013).
- Hardy in zones 4-9 (Nardozzi, n.d.).
- Yields approx. 2,000 pounds of seed per acre.
- Oil seed sold for \$16 per cwt, confection-type seeds sold for \$22 per cwt (2019 USDA Sunflower, 2019).
- Domestic oil consumption is on the rise, meaning the market looks healthy and can support new entrants (2019 USDA Sunflower, 2019).

Pomegranate

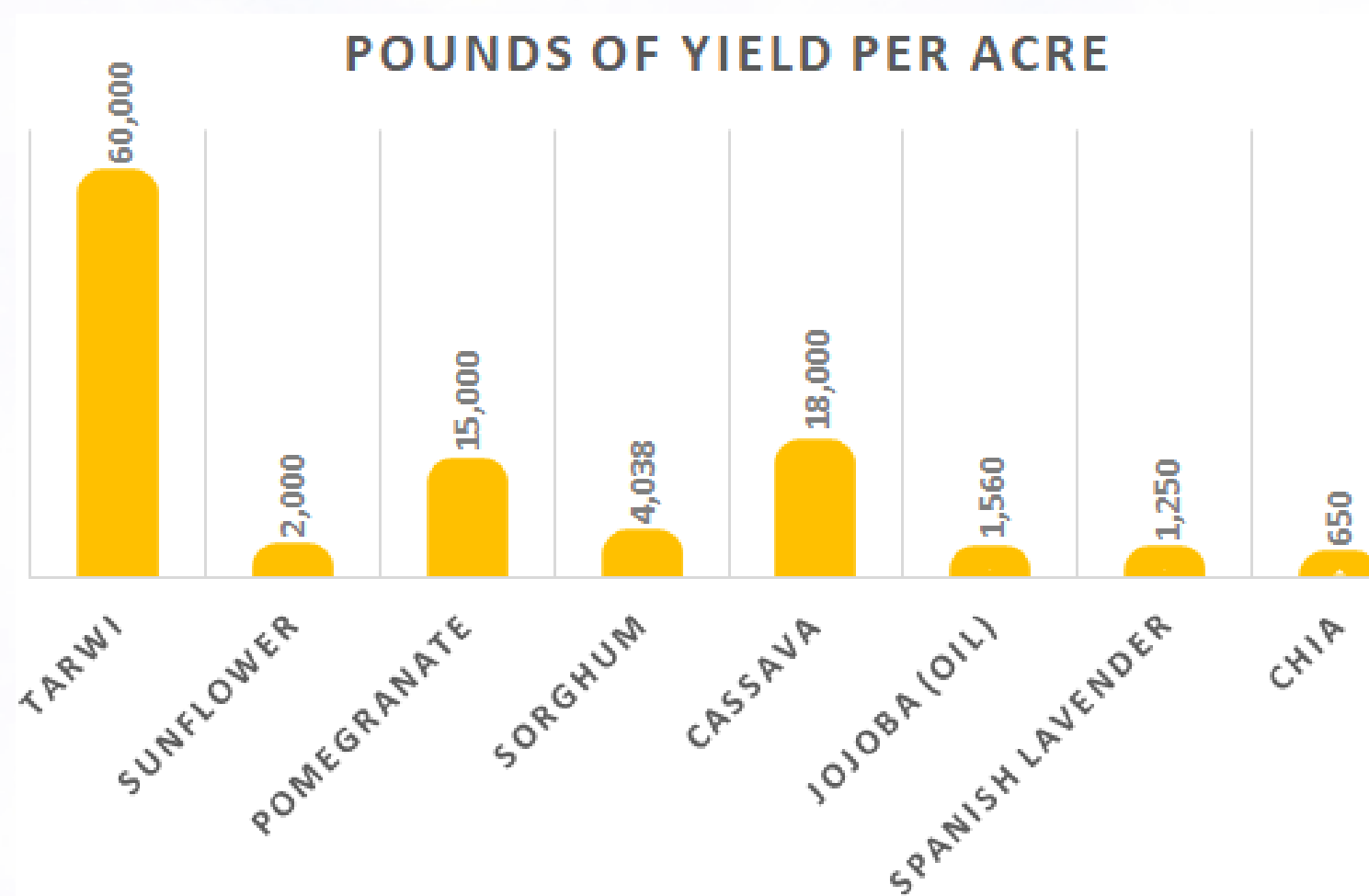
- *Punica granatum*
- Increased market potential in the past decade (Hawkins et al., 2010).
- Extremely drought and heat tolerant, enjoying temperatures over 85 degrees Fahrenheit for 120 days per year or more.
- Moderately salt tolerant, prefers a soil with a pH between 5.5 and 7.2 (Hawkins et al., 2010).
- Bushes take four years to establish themselves prior to fruit production.
- Average yield per bush is 200-250 fruits, approx. 75 pounds of fruit per tree (Stein et al., 2015).
- Average US sale price from farmers to wholesalers is approx. \$7.80 per pound (Pomegranate wholesale, 2020).

Sorghum

- *Sorghum bicolor* (L.) Moench
- Grain crop, uses water more efficiently than corn (Scott & Dreiling, 2019).
- Drip irrigation is recommended when occasional watering is required (Scott & Dreiling, 2019).
- Good export crop; 1 billion bushels shipped to China by the US in 2018 (Begemann, 2018).
- Average yield in the Sorghum Belt (North Dakota to Texas) is approx. 72.1 bushels per acre (United Sorghum Checkoff Program, 2016).
- As of May 2020, sold for between \$5.00 and \$6.50 per cwt in US grain auctions (USDA-MO Dept of Ag Market News, 2020).

Cassava

- *Manihot esculenta*.
- Can be utilized for human or animal feed.
- One fourth of worldwide production is used as an ingredient in the feed of pigs, poultry, and cattle ("III. WORLD CASSAVA SITUATION", n.d.).
- Does well in arid areas, adaptable to periods of heat and drought (RIPE, 2017).
- 6 to 12 tons of root per acre; the third highest crop yield worldwide (Ritchie & Roser, 2013).
- As of 2018, cassava chips have an average selling price of \$252 per ton, but if modified starch is sold, it averages \$540 per ton (Bangkok Post, 2018).

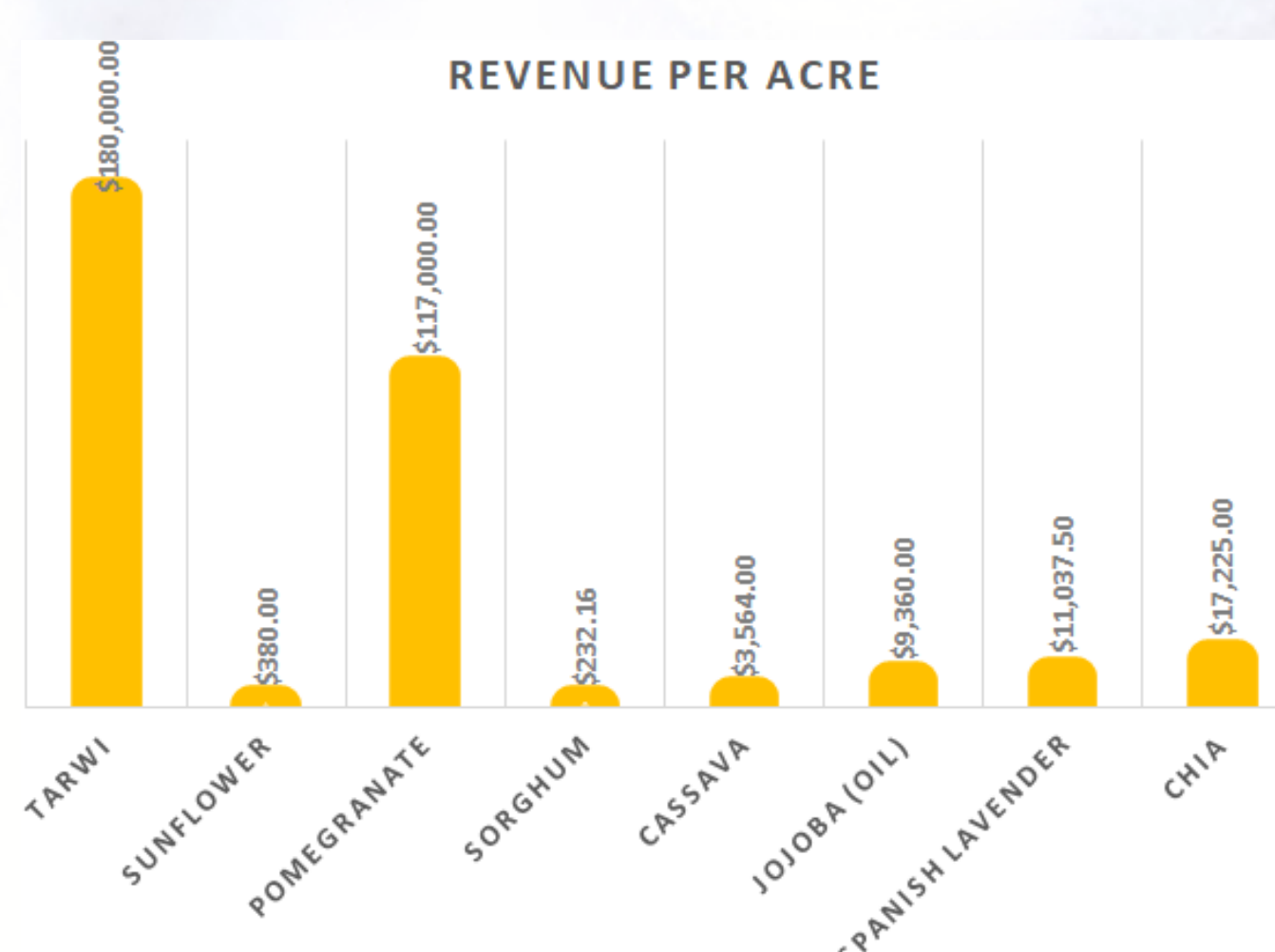


Jojoba

- *Simmondsia chinensis*
- Grows wild in southern California, Arizona, and sections of Mexico (Spengler, 2018).
- Extremely drought tolerant, requiring only three inches of irrigation per year ("Jojoba", n.d.).
- Cosmetic industry uses the oil as a lubricating agent in moisturizers, lipsticks, shampoos, etc. (Jojoba, n.d.)
- Grows best in sandy soils.
- Plants reach full production potential between the ages of 8 and 10 (Jojoba, n.d.).
- One acre yields about 3,000 pounds of seed, and each seed has an average of 52% oil content (Jojoba, n.d.).
- Prices, when purchased by commercial cosmetic producers, vary from \$2 to \$10 per pound for the oil (Jojoba", n.d.).

Spanish Lavender

- *Lavandin*.
- Well-drained and low fertility soils (Ellis, 2020).
- Hardy to zone 8 (Ellis, 2020).
- One acre yields between 1,000 and 1,500 pounds of buds per year, or 15,000 to 25,000 flower bundles (Adam, 2018).
- The price between \$6 and \$10 per pound or bundle (Adam, 2018).
- The sale of lotions, soaps, and other lavender scented value-added products can result in 500% markups when compared to the cost of ingredients (Wallin, 2019).
- Lavandin oil priced \$10.50 per pound, with a yield of 35 to 180 pounds per acre (Adam, 2018).



Chia

- *Salvia hispanica* L.
- Cultivated for centuries by the Aztecs of ancient Mexico (Baginsky et al., 2016).
- Can be harvested up to three times per year (Oyugi, 2020).
- Yields 650 pounds per acre; wholesale price of \$26.50 per pound (Oyugi, 2020)
- Desert Chia, or *Salvia columbariae*, can be found in California, Nevada, Arizona, and New Mexico.
- Desert Chia has adapted to arid conditions and soils with low fertility. Requires full sun, good drainage, and only enough water to become established.
- Thrives in zones 8-11 (Gardening Know How, 2020).
- Chia seed has recently become popular as a dietary supplement due to its omega 3, vitamin, mineral, and fiber content (Baginsky et al., 2016).