

# Intercropping: A Sustainable Strategy for Hawaii's Small Farm Holders

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# Introduction:

Intercropping is the growing of two or more crops simultaneously on the same field (Okonji, et al. 2012). It's a strategy suitable for small farm holders to increase the diversity of the farm product and the stability of the farm annual output through effective use of land and other resources. Intercropping is used in many parts of the world to increase the production of food, feed, and industrial crops. Since most crops are harvested manually in Hawaii, intercropping, if well established, would not have any impact on the harvest's quality and quantity, and would greatly increase the total production of same area.



Fig. 1. Intercropping Sweet Corn & Cowpea



Fig. 2. Intercropping Mamaki & Sudex

Legumes (such as, Cowpea and Sunn Hemp) are known to fix atmospheric nitrogen, enrich soil fertility, help the other crops in the same area to meet nitrogen needs (Jensen, et al., 2020; Belane and Dakora, 2010; Manna, et al., 2003), and they are well adapted to Hawaii's condition. Sudex (hybrid of Sorghum and Sudan-grass) is a good cover crop known to produce high biomass and suppress the harmful root-knot nematode. Below are two examples of intercropping models tested in Hawaii:



## **Intercropping Sweet Corn and Cowpea:**

Successful intercropping of corn and soybean has been reported since the early1900s in North America. Soybean meal is often used to increase the typically low (6-9%) protein content of corn silage. Much work has been done on the corn/soybean model (Geren et al. 2008). However, in Hawaii, other legumes, including cowpea, grow well compared to soybean and produce higher biomass, which also provides good weed suppression.



Fig. 3. Intercropping Sweet Corn & Cowpea

Intercropping sweet corn and cowpea (Figure 1 & 3) was conducted to evaluate the benefits of cowpea's nitrogen fixing capability on sweet corn yield. Corn was planted with a 1 ft spacing between plants and 2.5 ft spacing between rows. Two cowpea seedlings were planted, after corn seeds were germinated, in the 1 ft spacing between the corn plants. Corn ears and cowpea pods were harvested manually. We found that intercropped sweet corn yield was higher by 25% compared to sweet corn alone. The biomass harvested from the intercropping model was double (200%) compared to the corn alone model. Weed population was reduced by more than 50% under the corn/cowpea model compared to corn alone.

### **Intercropping Mamaki and Sudex:**

The natural suitable habitat for Mamaki is below the foliage of trees or shrubs (Herring, 2018). It grows well under shade of 40-60%. Mamaki seedlings were transplanted at 7 ft spacing and Sudex seeds were planted between the Mamaki seedlings. The experimental plot was conducted at the Oahu Urban Garden Center in Pearl City.



Fig. 4. Sudex as mulch to suppress weeds



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Pearl City is relatively warm for Mamaki, however, providing shade using Sudex allowed the Mamaki to grow well. We noticed, between the months of July-September, that Mamaki plants were not growing as fast as they were in the cooler weather months.

#### **Benefits of Sudex:**

Sudex is a hybrid of Sorghum and Sudan-grass, and is known to produce biomass more than either of its crop parents. It is ideal for providing shade for Mamaki. Sudex grows back after each cut/mow, so no reseeding is needed. Sudex can be cut back during relatively low temperature months and used as mulch, while left to grow during the high temperature months, to provide the needed shade for Mamaki.



Fig. 5. Sudex Plants & Biomass.

### **Benefits of Cowpea:**

Cowpea, a legume, is one of the widely grown crops in many countries. It contains about 30% protein and it is rich with vitamins and minerals. It is also used as green manure and animal feed. Cowpea pods and seeds are consumed as food worldwide. Cowpea grows well in Hawaii and can fix the atmospheric nitrogen in a symbiotic relation with rhizobium bacteria (provide additional nitrogen). Cowpea, if established well, can suppress weeds as well.



Fig. 6. Cowpea Plants & Pods.

## **Conclusions:**

Based on the two examples presented above, intercropping practices can be very beneficial for Hawaii's small farm holders. However, selection of the crops in an intercropping system is very important. The main selection criteria are: 1) crops that will benefit each other; 2) crops with different growth patterns (roots and shoots) to optimize the use of space above ground and below ground while minimizing competition; 3) crops that are best adapted to the growing environment (soil type, temperature, elevation ...etc) and require similar amounts of water; and 4) crops where the same pest management tools can be used if needed (for example, pesticide labeling considerations). Crops selected based on these criteria and others, as they relate to each specific farm, would have the most positive effect on the overall intercropping system performance.

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