



## Evaluation of Romaine Lettuce Varieties for Commercial Production in Hawai'i 2011–2014

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In recent years, dark greens such as Romaine lettuce have gained popularity because of their health benefits, providing essential vitamins and nutrients. Due to the demand, Hawai'i's importation of Romaine was estimated at 9 million pounds in 2008 (HDOA HASS, 2011). Acreage under Romaine lettuce production in Hawai'i increased from 90 acres to 110 acres between 2008 and 2011. Local crop yields increased from 1 million pounds to 1.7 million pounds. The Romaine lettuce industry saw an increase in value from \$590,000 to \$1 million over the same 4-year period, yet there is still much room for expansion.

Lettuce typically grows well in cool climates or during cool seasons. When exposed to high temperatures, lettuce has a tendency to bolt (flower), become bitter in taste, and form loose heads. Many of the operations that grow lettuce in Hawai'i are located in cooler areas such as Kula and Kamuela or grow in hydroponic/greenhouse systems.

Observational field trials were conducted over several growing seasons on Moloka'i and at the Poamoho Research Station on O'ahu in 2011. Dr. Hector Valenzuela and Ted Goo evaluated the growth, horticultural traits, and yield of about 40 Romaine lettuce varieties. A summary of the varieties is outlined in the Fall 2011 *Hanai'ai Sustainable and Organic Newsletter*: "Romaine Lettuce Variety Trials in Hawaii: Winter, Spring, and Summer Trials" (Valenzuela et al. 2011).

Due to industry requests to identify Romaine varieties that could be adapted for fresh-cut processing

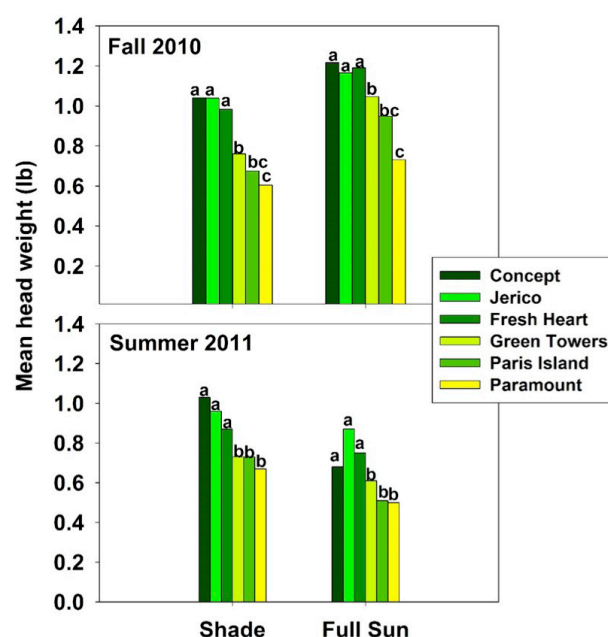
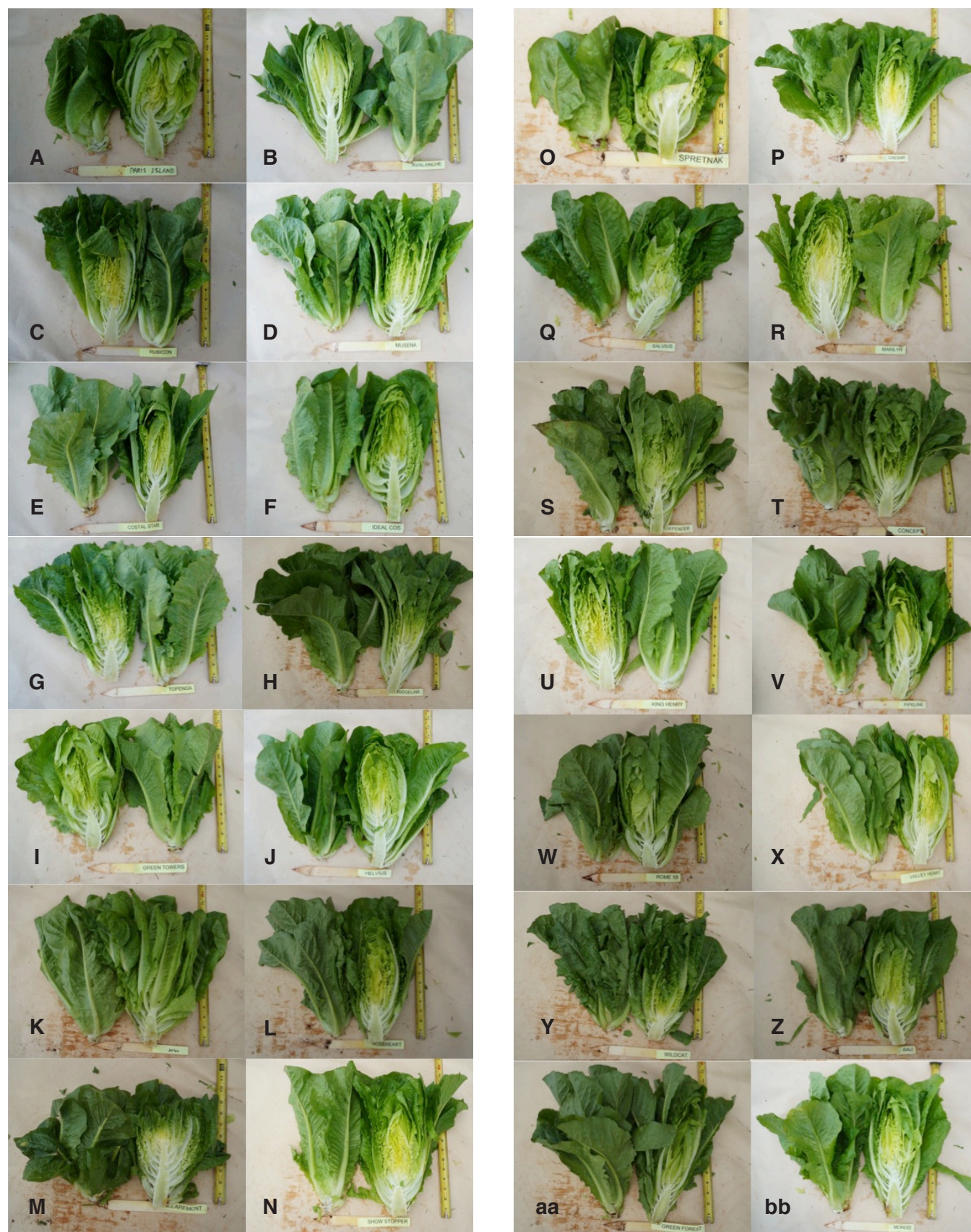


Figure 1. Data from replicated field trials at Poamoho to evaluate the effect of shade on selected Romaine varieties for O'ahu production.

Figure 2 (following page). Cross-sections of Romaine lettuce varieties: A. 'Paris Island', B. 'Avalanche', C. 'Rubicon', D. 'Musena', E. 'Costal Star', F. 'Ideal Cos', G. 'Topenga', H. 'Ridgeline', I. 'Green Towers', J. 'Helvius', K. 'Jerico', L. 'Fresh Heart', M. 'Claremont', N. 'Show Stopper', O. 'Spretnak', P. 'Caesar', Q. 'Salvius', R. 'Marilyn', S. 'Defender', T. 'Concept', U. 'King Henry', V. 'Pipeline', W. 'Rome 59', X. 'Valley Heart', Y. 'Wildcat', Z. 'Bali', aa. 'Green Forest', bb. 'Mondo'.



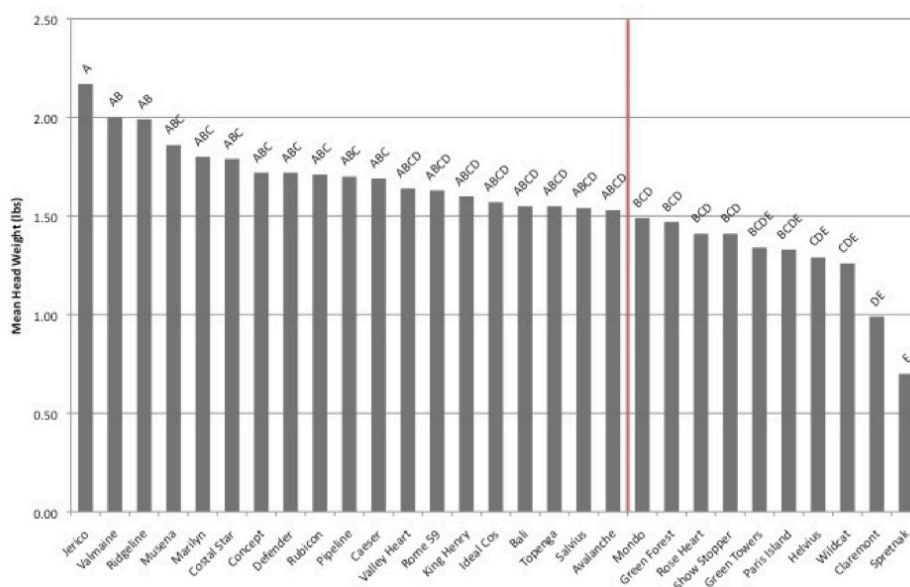


operations on O‘ahu, Jari Sugano and co-workers narrowed down the approximately 40 cultivars to 6 with potential for O‘ahu commercial production. Replicated field trials were installed to provide shade (30% shade) to selected Romaine varieties during fall and summer conditions. Row spacing was set at 30 inches, with plant spacing at 10–12 inches. Eight plants were planted per treatment. The 6 inner plants were selected for harvest and data collection. Four replications were conducted in fall 2010 and summer 2011. ‘Concept’, ‘Paris Island’, ‘Jerico’, ‘Fresh Heart’, ‘Green Towers’, and ‘Paramount’ were selected as the top candidates for commercial production. ‘Paris Island’ and ‘Jerico’, commercial standard varieties, served as industry controls. Data were analyzed using Tukey’s HSD.

Field data showed higher fresh-weight-per-head yields outside the shade compared to under shade during fall/spring seasons on O‘ahu. ‘Fresh Heart’, ‘Jerico’, and ‘Concept’ were significantly higher producers than the remaining 3 varieties. Results suggest that 30% shade is not beneficial in the fall but is beneficial during the summer (Fig. 1).

A similar trial was replicated at Poamoho during summer 2011 to study the potential of promising Romaine varieties for O‘ahu production and evaluate the effect of shade on them. Contrary to fall production, in summer, there were higher fresh-weight-per-head yields inside the shade compared to outside. Crop quality (blemishes, softness of leaves, etc.) were also elevated under shade. As in the spring/fall, ‘Fresh Heart’, ‘Jerico’, and ‘Concept’ had significantly higher yields as compared to ‘Green Towers’, ‘Paramount’, and ‘Paris Island’. Implications from this study suggest that shade is only needed for summer cultivation on O‘ahu. The use of 30% shade can improve lettuce yields and crop quality during the summer months on O‘ahu; however, the yield differences were not significant (Fig. 1)

Previously conducted CTAHR field trials demonstrated select varieties of Romaine lettuce can be grown successfully at low elevations on O‘ahu. Additional work is still needed to evaluate the acceptability of Romaine lettuce for commercial processors and various production systems (soils, soilless media, and hydroponic and aquaponic systems).



**Figure 3: Mean head weight per variety of Romaine lettuce planted November 2013 and harvested January 2014 at the Poamoho Research Station. Letters represent mean separation using Tukey's HSD. Means with the same letter are not significantly different. The varieties to the left of the red line show potential for commercial production, while the varieties on the right may not be adequate, based on yield.**

Twenty-nine varieties of Romaine lettuce were selected for field evaluation in November 2013 (Fig. 2). ‘Jerico’, ‘Valmaine’, and ‘Paris Island’, commercial standard varieties, were chosen as industry controls. Row spacing was set at 30 inches, with plant spacing at 10–12 inches. Nine plants were planted per treatment and replicated three times. Plants were transplanted in December 2013. Plants were fertilized with 16-16-16 plus minors at a standardized fertilizer rate and treated with one application of *Bacillus thuringiensis* early in the season to control caterpillar damage. Lettuce was harvested in January 2014. The 6 inner plants were selected for harvest and data collection. Statistical analysis was conducted using the Statistical Analysis Software, SAS 9.1.

Data suggest that ‘Jerico’ remains a high-yielding variety (Fig. 3). However, ‘Jerico’ is not significantly higher producing than varieties such as ‘Valmaine’, ‘Ridgeline’, ‘Musena’, ‘Marilyn’, ‘Costal Star’, ‘Concept’, ‘Defender’, ‘Rubicon’, ‘Pipeline’, ‘Caesar’, ‘Valley Heart’, ‘Rome 59’, ‘King Henry’, ‘Ideal Cos’, ‘Bali’, ‘Topenga’, ‘Salvius’, and ‘Avalanche’. Varieties ‘Claremont’ and ‘Spretnak’ were numerically the lowest-yielding varieties. However, these varieties are considered baby Romaine varieties and do not produce large heads.

While nineteen Romaine varieties were statistically equivalent in production yield, yield data alone is not a

good indicator of producer and processor suitability and acceptance. For example, ‘Jerico’ and ‘Valmaine’ are consistently top-producing varieties, yet the color has not been deemed acceptable for commercial processing operations (Fig. 4). Varieties such as ‘Mondo’, ‘Green Forest’, ‘Bali’, and ‘Pipeline’ were prone to stem splitting. ‘Ideal Cos’, ‘Marilyn’, and ‘Salvius’ appeared to be more susceptible to leaf spotting and discoloration. A field day was organized and hosted in January 2013 at the Poamoho Research Station. Testimonials from growers and processors confirmed selection and acceptability of Romaine varieties vary between agri-business organizations. Horticultural characteristics such as leaf color, heart density, core size, head density, post-harvest handling, etc. are all key factors in the decision-making process. Implications from these trials suggest varieties such as ‘Caesar’, ‘Concept’, ‘Costal Star’, ‘Defender’, ‘Jerico’, ‘King Henry’, ‘Musena’, ‘Ridgeline’, ‘Rome 59’, ‘Rubicon’, ‘Topenga’, ‘Valley Heart’, and ‘Valmaine’ may be ideal for the home gardener.

Continuous identification of promising new Romaine lettuce varieties for commercial production could result in the increase of local lettuce production at low-elevation locations around the state. Acceptability of these new varieties by agricultural producers and fresh-cut processing operations could improve the overall sustainability of Hawai‘i’s diversified agriculture industry by reducing our dependence on mainland imports.

## References

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**Figure 4: Color differences between outer leaves of ‘Jerico’ (left) and ‘Ridgeline’ (right)**