COOPERATIVE EXTENSION
UNIVERSITY OF HAWAI'I AT MĀNOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

Yield and Quality of Turmeric Grown on Maui

Kylie Tavares, Emilie Kirk, Justin Calpito, Jon-Paul Bingham, Sharon Wages, Amjad Ahmad, Jensen Uyeda, Eric Collier and Ted Radovich
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Introduction

Field trials were conducted on Maui Island as part of the UHM-CTAHR Sustainable and Organic Agriculture Program's statewide turmeric research and extension project. The trials were conducted to assess the commercial value of turmeric (*Curcuma longa*) varieties at two sites with differing environmental and climatic conditions (Table 1) by examining yield and curcuminoid content, which is responsible for turmeric's medicinal qualities.

Table 1. Maui turmeric trial locations and design

	Kula Agricultural Park (KAP)	**Maui Agricultural Research Center (MARC)**
Growing Season	2018-2019	2019-2020
Elevation	1,400 ft	3,247 ft
Average Annual Rainfall	22 in	24 in
Average Min. and Max. Temperature	61° F, 81° F	56° F, 73° F
Soil Series	Keahua Series	Kula Series
Date Planted	May 2018	July 2019
Date Harvested	February 2019	June 2020

Map of Trial Locations

Methods

The first trial conducted between 2018-2019 trial was conducted at the Kula Agricultural Park (KAP) where the elevation is approximately 1,400 ft and the average annual rainfall is 22 inches. This area of Maui is known to be dry and relatively hot, despite its higher elevation. The subsequent trial conducted between 2019-2020 was conducted in an upper terrace of at the Maui Agricultural Research Center (MARC) at approximately 3,247 ft elevation where the average annual rainfall is 24 inches. The *C. longa* varieties included in these trials were Hawaiian Red, ʻOlena, BKK, and Joy. For each of the 4 varieties that were assessed, the experimental design included 4 replicates and 5 plants per block. Both trials were grown using synthetic fertilizers applied as pre-plant applications and by fertigation to meet the nutritional requirements of turmeric. Weed pressure was managed using 15-ft wide weed mat and hand removal. To measure yield, fresh weights of clean rhizomes were collected in the field. Laboratory analyses of curcuminoid concentration were conducted using high-performance liquid chromatography (HPLC) by the Bingham Laboratory of the Department of Molecular Biosciences and Bioengineering.

Top: KAP Trial 5 months after planting (October 2018) Bottom: MARC Trial 6 months after planting (January 2019)

Results and Discussion

No significant differences among the *C. longa* varieties (Hawaiian Red, BKK, Mystic, Joy) were found in the KAP trial, but significant differences in rhizome yield per plant were seen between Joy and BKK in the MARC trial. Despite low yields, the turmeric harvested from the MARC trial exhibited similar patterns in yield among varieties as seen on O'ahu and *Kaua'i* (Fig.1). While it was expected that the yields from the MARC harvest would be lower than the KAP and statewide trials (Fig.1) due to overall poorer performance at this climate, this trial also experienced additional challenges.

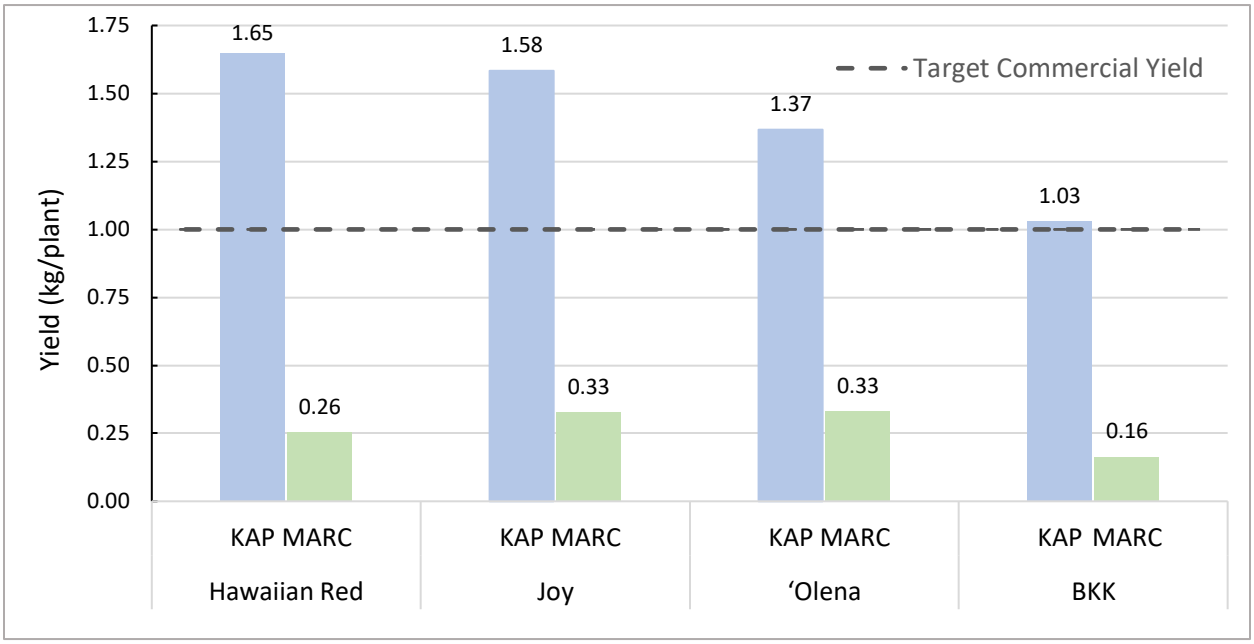

Figure 1. Yield expressed as average rhizome fresh weight (kg) per plant by variety and trial location

It is important to note that the 2019-2020 trial at the MARC was also impacted by delayed harvest due to Covid-19 restrictions, heavy root knot nematode infestation and pathogen issues. At harvest, considerable amounts of rot and symptoms of nematode pressure were observed. Turmeric samples were sent to the Agricultural Diagnostic Service Center in Hilo.

Nematode and pathogen damage on turmeric rhizomes and starch tubers harvested from MARC trial

Nematode and pathogen damageon turmeric rhizomes and starch tubers harvested from MARC trial

Diagnostician Brian Bushe recovered root knot nematode, as well as *Rhizoctonia* spp. and *Pythium* spp. which are known disease causing pathogens of turmeric that can be promoted by cool, moist environmental conditions.

Curcuminoid analyses by HPLC indicated that BKK had the highest total curcuminoid concentration, among all varieties at both trial sites (Fig.2). Statistical differences were observed in the KAP HPLC results, indicating that the BKK curcuminoid concentration was significantly greater than all other varieties. There were no significant differences among Joy, Hawaiian Red and Mystic, but these did have a statistically greater curcuminoid concentration than Olena. Few statistical differences were seen among the MARC varieties. HPLC lab analyses determined that all varieties, with the exception of 'Olena, grown at both sites produced acceptable curcuminoid concentrations (≥4%). Although the MARC trial experienced considerable losses to nematodes, plant pathogens, and an atypical production climate, total curcuminoid concentrations were similar to the KAP trial in all varieties except BKK.

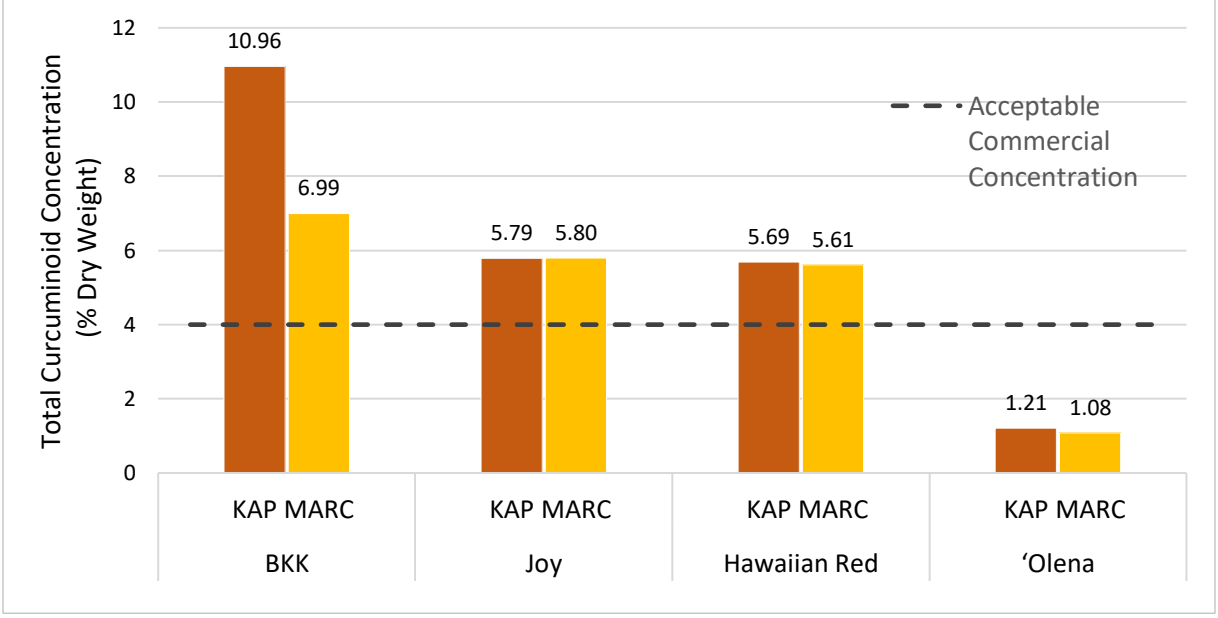

Figure 2. HPLC total curcuminoid concentrations expressed as percent dry weight by variety and trial location

While the results of the 2019-2020 trial at the Maui Agricultural Research Center (MARC) demonstrated the environmental effects of turmeric at the one of the highest elevations for agricultural production in the state, the results also demonstrated the susceptibility of turmeric to root-knot nematode and other pathogens, highlighting the need for clean seed protocols, recommendations for integrated pest management for turmeric production in Hawaiʻi.

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