Myanmar’s Emerging Tobadee (Avocado) Industry

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Myanmar is located in Southeast Asia and is bordered by Bangladesh, China, India, Laos, and Thailand. The terrain varies from sea level lowlands to mountainous regions up to 5800 ft (1768 m). Seedling avocados were initially introduced to the Pyin Oo Lwin area (northeast of Mandalay) during the 1940s. Currently, the major producing regions are Shan, Chin and Kaya States and the Mandalay Division; Shan State is the leading producer. During the past 10 to 15 years there has been an effort by the government and more recently by the Avocado Sector of the Myanmar Fruit, Flower, and Vegetable Producer and Exporter Association (MFFVPEA) to expand commercial production. During September–October 2014, Tropical Research and Education Center (TREC) faculty advised Winrock International [a United States Agency for International Development (USAID)-supported non-governmental organization] on avocado production in Southern Shan State. After surveying production areas and presenting training workshops for producers, recommendations were made to improve cultural practices and manage diseases and pests. Currently, the industry is based on seedling trees with Guatemalan (G), Mexican (M), and hybrid (G × M) backgrounds. The industry has good potential to develop both internal and export markets if several constraints can be overcome. Most importantly, superior seedlings with high yields, good quality fruit and resistance to significant diseases should be selected and clonally propagated to enhance market development. A description of the status of and challenges faced by this emerging industry are discussed.

Avocados were introduced into the Philippines and Indonesia as early as the 1500s and 1600s (Papademetriou, 2000). However, most introductions to Asian countries such as Taiwan (1918), China (1925), India (early 1900s), Myanmar (1940s), Sir Lanka (1927), Thailand (~1910), and Vietnam (1940) were made much later (Bost et al., 2013; Papademetriou, 2000). The first avocado trees planted in Myanmar were in Pyin Oo Lwin, which is east of Mandalay. Avocado consumption is increasing throughout Asia, and the potential for domestic production within Asian countries (e.g., China and Thailand) destined for domestic markets and exports to neighboring countries (e.g., Myanmar, Vietnam, and Thailand) is expected to increase dramatically (Öffner, 2014; Dorantes et al., 2004). In 2014, the Avocado Sector of the Myanmar Fruit, Flower, and Vegetable Producer and Exporter Association (MFFVPEA) requested assistance from the United States Agency for International Development (USAID) Farmer-to-Farmer Program and Winrock International [a USAID-supported non-governmental organization (NGO)], specifically for advice on cultural practices (e.g., fertilizer and irrigation management) and disease and pest management were given for producers in Taw Kyae and Ywangan. The status of and recommendations for the industry are described below.

Location, Area, and General Climate of Avocado Production Regions

The major avocado-producing regions of Myanmar include Shan [~8899 acres (~3600 ha)], Chin [~87 acres (~35 ha)] and Kayah [~551 acres (~223 ha)] States and the Mandalay Division [~383 acres (~155 ha)] (Fig. 1; Soe, 2000). During the past 10 to 15 years, a government-sponsored program has increased avocado production by providing seedling trees to interested farmers, hundreds of which have taken advantage of the program. Thus, although the area under cultivation in Myanmar is not known, it has probably increased.

Shan State is a cool, subtropical, mountainous region with elevations from 820 ft to 5413 ft (250 m to 1650 m) and a monsoon rainfall pattern (dry season from October to May and wet season from June to September). Generally the warmest months are March through May (~72 °F to 93 °F (~22 °C to 34 °C)), with moderate temperatures between June and October (~50 °F to 61 °F (~10 °C to 16°C)) and low temperatures from November to January (~45 °F to 50 °F (~7° to 10°C)). Brief freezing
temperatures are experienced in some locations (especially at higher elevations) from November through January. Chin and Kyah States have similar climatic conditions to Shan State. In contrast, the elevations in the Mandalay Division range from 500 to 2625 ft (150 to 800 m) and the mean high [~95 °F to 100 °F; (~35 °C to 38 °C)], average [~81°F (~27°C)], and low [~55 °F to 57 °F (~13°C to 14 °C)] temperatures are higher than in Shan State (Anonymous, 2015). The Mandalay Division also has a monsoon rainfall pattern but lower rainfall than the Shan, Chin, and Kayah States.

Germplasm

Three types of avocado fruit are recognized in Myanmar: Anyo Myo types with dark coppery-colored fruits; Sein Myo types with round, green colored fruits and; Buthi Pon Myo types with oval to pear-shaped fruit with small necks (Soe, 2000; Fig. 1). During the survey, seedling avocado trees predominated. There was a great diversity of avocado fruit shapes (pear-shaped to round to oval), colors (dark to light green to dark purple-black), and peel characteristics (smooth, leathery, wavy to rough and pebbled) (Fig. 2), and some fruit had pronounced lenticels. Most fruit had characteristics of Guatemalan, Mexican, or Guatemalan-Mexican race hybrids (i.e., wavy to rough peel, green to dark green or purplish-black peel color). The pulp texture of most of the avocados observed appeared smooth, dense, with the pulp color changing from yellow, yellow-green near the seed to light green near the peel. In general, the pulp had a rich, nutty flavor.

The diversity of seedling avocados that are grown in Myanmar represents a significant resource from which exceptional types could be selected and vegetatively propagated. Desirable traits for selection would include high quality fruit and insect and disease resistance. In addition, the MFFVPEA plans to introduce superior cultivars from the United States and perhaps other countries to widen the selection of export quality fruit that could be produced in the country, and introduction and selection of avocado cultivars adapted to hot, humid climates could potentially expand production in Myanmar to the southern states (e.g., Mon and Tanintharyi).

Plant Nutrition and Irrigation

Many well-drained soil types with low to moderately fertile soils are suitable for avocado production (Wolstenholme, 2013). Avocados have been successfully grown with the use of organic composts (e.g., of animal and/or vegetative origin) and inorganic fertilizers, and many producers utilize both nutrient sources (Lahav et al., 2013). Soils that were observed in Taw Kyae Village, Nwar Ban Gyi Village, and Ywangan Township appeared to be clay-loam types, fertile and well-drained. The soil pH ranged from 5.0 to 7.0 and no obvious plant nutrient deficiencies were observed. Most producers apply composted
animal manure to their trees one to two times per year, although some chemical fertilizers (e.g., 15–15–15, 46–0–0) were used. Composted vegetative matter was also used.

In most avocado-production areas of the world, rainfall amounts and distribution throughout the year are not optimum for avocado production. Rainfall in the avocado production areas of Myanmar appeared to be relatively abundant from April through November. Although supplemental irrigation was not observed, it may be beneficial irrigate during the December to March dry period. However, the costs of establishing, maintaining and managing irrigation systems would need to be evaluated against potential increases in yields and returns that would result (Lahav et al., 2013).

**Tree Spacing and Size Control**

The appropriate in-row and between-row spacing of avocado trees depends upon the climate of the production area, the inherent vigor of the trees (i.e., cultivar and rootstock), terrain, size of equipment to be used in the orchard, and tree size control and management skills of the producer (Whiley et al., 2013). Avocado tree growth and production is optimum when trees are exposed to full sunlight. In general, the cooler the climate the closer trees may be planted, due to reduced rates and durations of plant growth. In contrast, greater spacing is needed among trees in warmer production areas to allow for more annual growth.

Plant spacings observed in Shan State ranged from 20–30 ft in- and between-rows to 30 ft in- and between-rows; intermediate distances were also observed, e.g., 25 ft x 25 ft and 25 ft x 30 ft. These spacings appear appropriate, especially since the orchards are not irrigated. Most of the avocado orchards are relatively recent and tree size management is usually not practiced. In the coffee-producing region of Shan State avocado trees are used as shade trees and spacing among avocado trees is much more distant and variable. Avocado production is of secondary importance to the coffee crop and no tree size control is generally practiced.

**Disease and Insect Pests and Control**

The major diseases and insect pests of avocado were reviewed recently and therefore will only be briefly mentioned here (Ploetz et al., 2015). The potentially most important avocado disease observed in Myanmar is laurel wilt which is caused by *Rafaelea lauricola*. Symptoms include leaf necrosis, dead stems with desiccated/dead leaves, stem dieback and tree death. Its ambrosia beetle vector or vectors was not observed, but bore holes and sawdust (symptoms of beetle boring) was evident on holes and sawdust (symptoms of beetle boring) was evident on plant parts of avocado. The most important insect pest disease observed was scab (*Sphaceloma persea*), which causes a cracking of the peel, reducing marketability. Selection of avocado germplasm that is not susceptible to this disease is the most cost-effective method of avoiding this disease; however, effective fungicides are available. Other fruit diseases that were observed included anthracnose (*Colletotrichum* spp.) and postharvest disease stem-end rot (*C. gloeosporioides* and *Botryosphaeria* spp.). Algal leaf spot (*Cephalurus virescens*) and cercospora leaf spot (*Psuedocercospora purpurea*), were observed infrequently.

The most important insect pest observed was an unidentified stem-borer and sawfly that was associated with significant dieback in some trees. However, affected trees reportedly regrew from the base and production eventually resumed. Other less significant insect pests included whiteflies, Lepidopteraan leaf feeders and stinkbugs. Fruit pulp damage with an unclear etiology was also observed.

**Challenges and Potential**

**Development of avocado cultivars.** In order to compete in the avocado export market, large volumes of high quality fruit of uniform shape and size would be required. This is most easily accomplished by planting clonally identical avocado trees with known tree growth and fruit characteristics that are harvested during a defined time-period (e.g., fruit of a particular clone are all at a harvestable stage at about the same time). The challenge is to identify superior types that would be vegetatively propagated, and establish solid plantings of clonal avocado types (i.e., cultivars). High quality, productive, and pest-resistant avocado cultivars are essential for the development of a vibrant domestic and export avocado industry. Although the industry is currently based on seedling avocado trees which exhibit a wide range of tree and fruit characteristics, this diversity provides a great opportunity for the industry to select superior avocado types that are adapted to local climatic and edaphic conditions. In addition, well-known avocado cultivars from outside Myanmar may perform well and should be introduced for evaluation.

**Development of monocultures of avocado trees.** Avocado production in monocultures has advantages and disadvantages. Advantages include efficient application of cultural practices (wherein the same fertilizer, foliar sprays, and harvesting windows would be used), and reduced conflict in cultural practices (e.g., one crop requires frequent sprays, the other does not) among different fruit crops or an understory vegetable crop, and applying specific practices detrimental for high avocado yields (i.e., removing the lower tree canopy for coffee production). Potential disadvantages mainly relate to disease and pest issues, as these constraints are usually most damaging in monocultures.

**Implementation of tree size control.** Optimum and efficient fruit production and harvest requires the maintenance of canopies from near the ground to the top of the tree. Although tree-size management is uncommon in Myanmar, it should be adopted to limit tree height and lateral spread and maintain sufficient light penetration and fruit production along the entire tree canopy. In addition, tree-size management increases the efficiency of harvest and orchard maintenance operations. A general rule is that trees should not be taller than 2/3 the distance between rows. Fruit production can be optimized if producers implement an annual or biannual selective pruning program to maintain tree height at this recommended size.

**Pest identification and control.** Disease identification and control is an essential component of successful avocado production. For example, laurel wilt may be a significant constraint to avocado production in the Ywangan area, unless disease resistant avocado germplasm can be identified. Likewise, control of scab and anthracnose on fruit will be important as the markets for avocado increase and the demand for clean fruit increases. Identification and control of significant insect pests that affect avocado tree growth and fruit production is also essential for optimum production of high quality, marketable fruit. However, the potential for improved pest control with an increased collabora-
tion among the avocado producers (Avocado Sector–MFFVPEA) and government scientists is good.

**Development of Postharvest Packinghouse Facilities.** Constructing well-designed facilities (i.e., packinghouses) whereby harvested avocado fruit can be cleaned, graded (sorted), stored and sold in bulk will facilitate the development of domestic and export markets for Myanmar producers. Location of packinghouses near avocado production areas will reduce postharvest losses and potentially enhance returns for local growers.

**Summary**

Myanmar’s diverse topography and geography, warm to cool subtropical and tropical climates and diverse avocado germplasm provide the potential to select a range of avocado clones each adapted to specific ecological and climatic niches, and thus develop a thriving avocado industry. The Avocado Sector of the MFFVPEA along with international and national collaborators have the potential to make significant progress in developing avocado culture within Myanmar.

**Literature Cited**


