Tithonia for green manure; Seed saving workshop

Tim Motis

Figure 6. Flower and foliage of *Tithonia diversifolia*. *Source: Tim Motis*

Tithonia (*Tithonia diversifolia*), also known as Mexican sunflower or tree marigold, is a perennial shrub that is native to Mexico and Central America. Often introduced for its attractive flowers, it is now found in humid and sub-humid parts of Africa, Asia, and South America. It grows on most soils, can reach 3 meters (m) in height, and is moderately resistant to drought (Heuzé *et al.* 2016; Orwa *et al.* 2009).

Tithonia is often considered a weed. However, it can be used for animal fodder, compost, fuelwood, and insect control. Here we focus on its potential as a soil fertility amendment. According to an extensive review of tithonia's use as a green manure in Kenya (Jama *et al.* 2000), nutrients are most concentrated in the tender green leaves and stems. Green leaves, collected before they fall to the ground as leaf litter, contain about 3.5% nitrogen, 0.37% phosphorus, and 4.1% potassium. Leaves of a tithonia plant on ECHO's Global Demonstration Farm in Florida contained even higher levels of nitrogen (5.7%) and phosphorus (0.52%), with nutrient concentrations comparable to those of moringa and lablab (Table 3). After green leaf/stem tissue is worked into the soil, these nutrients quickly become available for uptake by plant roots.

Table 3. Nitrogen (N), phosphorus (P) and potassium (K) in plant tissue of Tithonia diversifolia, Moringa oleifera, and Lablab purpureus that had not received any soil fertility inputs.

Tithonia diversifolia on sandy, ECHO Florida soil	% N	% P	% K
Leaves (new growth)	5.70	0.52	2.83
Stems (new growth)	1.96	0.46	3.08
Mix of leaves and stems (new growth)	5.66	0.52	2.58
Old, decaying leaves (leaf litter)	2.67	0.38	0.58
Moringa oleifera (green leaves, 4-month regrowth)*	5.11	0.53	1.82
Lablab purpureus (mix of green leaves and stems)**	3.85	0.21	2.23

* Leaves harvested Dec 1-2, 2016, from trees grown at ECHO Florida. This harvest followed a pruning and harvest event conducted four months earlier.

**Above-ground biomass sampled six months after seeding into dry, sandy soil in South Africa. Data are the highest values measured over 4 seasons.

Data for *T. diversifolia* are from 1 sample; data for *M. oleifera* and *L. purpureus* are the average of 3 and 4 samples, respectively.

To supply enough potassium and phosphorus for most crops, a farmer would need to apply 13 to 26 metric tonnes per hectare (t/ha) of fresh tithonia biomass. Since tithonia has a moisture content of 85%, this is the equivalent of 2 to 4 t/ha of dry matter. It takes closer to 33 t/ha fresh biomass (the equivalent of 5 t/ha of dry matter) to alleviate phosphorus deficiencies. Collecting this much biomass is laborious. Also, even though it has no thorns, tithonia is unpleasant to handle, due to its stickiness and strong smell. Consequently, it is mostly used to improve the soil on smaller plots of land devoted to high-value crops such as vegetables. Two ways to reduce the amounts of biomass needed are to 1) combine it with other fertility inputs and 2) apply it in close proximity to crop roots. If you have applied it in planting basins/stations, we would like to know of your experience.

If you are interested in exploring tithonia as a green manure, you may not need to look far for plants. Tithonia reproduces from stem and root cuttings, as well as through numerous, small seeds that are light enough to be dispersed by wind (Muoghalu and Chuba 2005). It quickly colonizes disturbed areas and is frequently found around farmers' fields and homesteads, along roadsides, and in ditches. Our

seed bank has trial packets of seed available for special requests, but we caution against planting tithonia where it does not already exist.

If it is already present locally, and you simply want to establish some plants for better accessibility, the best option is to plant soft/green stem cuttings, 20 to 40 cm-long (Jama *et al*. 2000; findings of an ECHO observation trial shown in Figure 7), spaced 0.5 to 0.75 X 0.75 m (Heuzé *et al.* 2016). To keep them from drying out, place stem cuttings—at any angle-- into moist soil soon after collecting them (Jama *et al.* 2000).

Planted cuttings will likely grow well without fertilizer. Once established, plants tolerate heavy pruning. Tithonia biomass can be harvested as often as every four months (Sosef and van der Maesen 1997). We at ECHO welcome information about ways that you have used this multi-purpose plant.

Figure 7. *Tithonia diversifolia* stem cuttings in a non-replicated tithonia propagation experiment at ECHO in Florida. Twenty days after planting into commercial potting soil (with no rooting hormones used), the percentage of cuttings that produced shoots was 100% for green stems, 80% for woody stems, and 10% for roots. Twenty days after sowing, on the same day cuttings were planted, shoot emergence had occurred with 40% of the planted seeds.

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Seed Saving: A Practical Overview for Small-Scale Seed Banking

This is a course to be held at ECHO Florida from May 9 to 11, 2017. ECHO offers over 350 varieties from its Florida seed bank, requiring diverse approaches to growing, processing, and storing seeds. This three-day course will begin in ECHO's seed production plots to help participants better understand how crops are managed and harvested. Techniques related to both wet and dry processing of seeds will be practiced, as well as essential tasks such as germination testing. We will explore long-term seed storage approaches, including vacuum sealing and cold storage; emphasis will be placed on seed saving technologies and approaches for challenging tropical locations. See ECHOcommunity (https://www.echocommunity.org/resources/0ea050b1-0fdd-4cf6-9ec1-73229ec606ce) for registration information.