Taxon: Tagetes patula L. **Family:** Asteraceae

Common Name(s): French marigold **Synonym(s):** Tagetes lunulata Ortega

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 28 Jul 2017

WRA Score: 9.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Naturalized, Annual, Herb, Ornamental, Self-Compatible

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic	y=1, n=0	y
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	y
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans		
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	1
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)		
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	y
704	Propagules adapted to wind dispersal		
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	Gilman, E. F. (1999). Tagetes patula French Marigold. Fact Sheet FPS-571. University of Florida IFAS Extension, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 28 Jul 2017]	"Many cultivars have been developed for flower color and plant size. One or more are usually available at local garden centers." [No evidence that cultivars would be more or less likely to naturalize]
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Not domesticated] "The species is native to the Americas—Central (Mexico and Guatemala) and southwestern United States (Arizona, New Mexico and southwest Texas). It is cultivated and has naturalized elsewhere."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**High**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 26 Jul 2017]	"Native: Northern America Northern Mexico: Mexico - Durango, - Zacatecas Southern Mexico: Mexico - Aguascalientes, - Guanajuato, - Hidalgo, - Jalisco, - Mexico, - Michoacan, - Queretaro"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 26 Jul 2017]	

203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"In its native range, it is found from near sea level up to altitude of 1,350 m." [Elevation range exceeds 1000 m, demonstrating environmental versatility]

Qsn #	Question	Answer
	Missouri Botanical Garden. 2017. Tagetes patula. http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=a611. [Accessed 27 Jul 2017]	"Zone: 2 to 11" [Able to grow in 5+ hardiness zones]

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"The species is native to the Americas—Central (Mexico and Guatemala) and southwestern United States (Arizona, New Mexico and southwest Texas). It is cultivated and has naturalized elsewhere."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"The species is native to the Americas—Central (Mexico and Guatemala) and southwestern United States (Arizona, New Mexico and southwest Texas). It is cultivated and has naturalized elsewhere."

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Parker, J.L. & Parsons, B. 2016. New Plant Records from the Big Island for 2015. Bishop Museum Occasional Papers 118: 17–22	"Marigolds are common in cultivation in gardens of Hawai'i, often because of their natural insecticidal properties. This species, French marigold, was found naturalizing near a garden plot, in a heavily disturbed area. Horticulturists distinguish this species from T. erecta with its shorter, more branched stature and smaller flowers often in deeper shades of orange, or red-brown, or with two-toned ray flowers (Staples & Herbst 2005). This collection represents a new naturalized record for Hawai'i Island. Material examined. HAWAI'I: Puna Distr., Shipman Industrial Park, 2172616N 284889e, sprouting out of roadside corridor, many fruits and seeds. 1.5 ft tall with seeds germinating on mother plant. Corolla reddish-brown with pinnately lobed leaves, 28 mar 2012, J. Parker & R. Parsons BIED166."

Qsn #	Question	Answer
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 26 Jul 2017]	"Naturalized: Africa East Tropical Africa: Kenya; Tanzania Northeast Tropical Africa: Chad; Eritrea; Ethiopia South Tropical Africa: Angola; Zambia; Zimbabwe West-Central Tropical Africa: Rwanda; Zaire Asia-Tropical Indian Subcontinent: India Malesia: Philippines Australasia New Zealand: New Zealand Europe Middle Europe: Czech Republic; Germany Southeastern Europe: Greece; Romania; Slovenia Southwestern Europe: Spain Southern America Caribbean: Cuba; Puerto Rico Central America: Nicaragua"
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"The species is native to the Americas—Central (Mexico and Guatemala) and southwestern United States (Arizona, New Mexico and southwest Texas). It is cultivated and has naturalized elsewhere."

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Potentially weedy, but impacts unclear] "Major Pathway/s: Contaminant, Crop, Herbal, Ornamental Dispersed by: Humans, Escapee"
	Salvesen, A. B. (2006). Escape of Introduced Ornamentals in Asteraceae": with main focus on Tagetes patula L. in Western Ethiopia. MSc Thesis.University of Oslo, Oslo, Norway	[Prefers disturbed areas] "Both associations where T. patula occurs include weedy species, indicating that a certain amount of disturbance has taken place. Thus, T. patula prefers disturbed areas, but is rare in sun exposed and dry areas."

303	Agricultural/forestry/horticultural weed	
	Source(s)	**Notes**
	Salvesen, A. B., Awas, T., & Nordal, I. (2010). Escape and Naturalization of Tagetes patula in Western Ethiopia. SINET: Ethiopian Journal of Science, 33(2), 89-100	"This study was carried out on an introduced ornamental - Tagetes patula L., which has escaped cultivation and has been naturalized in Benishangul-Gumuz National Regional State (BGNRS), western Ethiopia." ... "The result showed that the escaped T. patula has no negative impact on the daily life of people, except weeding in farmlands. T. patula was found associated with species that prefer shade and moisture in semi-natural vegetation."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Potentially. Cited as an agricultural weed in a number of references. Unable to confirm impacts

Qsn #	Question	Answer
304	**Environmental weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence to date

305	**Congeneric weed**	**y**
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Tagetes minuta] "T. minuta is a fast-growing annual weed which competes with crops and interferes with their management or harvest. It has been reported as a weed of 19 crops in 35 countries (Holm et al., 1997). In parts of East Africa, it has been reported as infesting 10% of maize fields, and may be particularly severe in low-growing crops such as beans. Its presence in a crop may also lead to skin irritation to agricultural workers, whilst contamination of milk (this can occur as a result of external contact between the plant and cattle udders) imparts an objectionable flavour. T. minuta is a significant crop seed contaminant in East Africa (especially of wheat and some pasture grass seeds) (Holm et al., 1997), and contaminates wool in South Africa (Wells et al., 1986). It is an alternative host to the bean fungus Ascochyta phaseolorum in Australia (Holm et al., 1997). T. minuta may also leave allelopathic residues in soil (Meissner et al., 1986). The roots exude a polyacetylene derivative which delays germination and reduces the yield of crops grown in soil previously infested with the species."

401	**Produces spines, thorns or burrs**	**n**
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[No evidence] "A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root. Leaves 4–7 cm long, deeply sinuate to the midrib with linear-lanceolate segments with serrated margins (Plates 1 , 2 , 3 , 4 and 5). Capitulum solitary and terminal, 1.5–3 cm across, on 30–15 cm long peduncle. Single flower heads have widely spreading ray florets, but double-flowered head has mounding ray florets in the shape of globular, flabellate button flower heads. Ray florets 5–9 (25+), female, ligulate, flabellate to oval-quadrate, yellow, orange to red or variegated blends of red-brown, yellow/red-brown (Plates 1 , 2 , 3 , 4 and 5). Disc florets numerous, tubular, bisexual. Fruit 6–11 mm black achene, with scaly pappus."

402	**Allelopathic**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Altieri, M. A., & Doll, J. D. (1978). The potential of allelopathy as a tool for weed management in crop fields. Pans, 24(4), 495-502	"The increasing emphasis now placed on weed management as opposed to weed control raises the question of the role of allelopathy in agricultural systems. Evidence of allelopathic interactions between crops and weeds is briefly reviewed and two experiments designed to demonstrate the allelopathic effects of plant residues on seed germination are described. From these experiments it can be seen that Tagetes patula, Amaranthus dubius, bean (Phaseolus vulgaris) and cassava residues have widespread inhibitory effects on the germination of seeds of other species, while maize, Cenchrus brownii, Eleusine indica and Portulaca oleracea show considerable tolerance to the presence of such residues. Suggestions are made as to how the potential of allelopathy in weed management can be investigated and how the process can be exploited. A considerable quantity of research remains to be done in this area."

403	Parasitic	n
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root." [Asteraceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"In Argentina, the plant is used as a forage crop for sheep and goat but not cattle (Neher 1968)."

405	Toxic to animals	y
	Source(s)	**Notes**
	Vetary. 2017. Marigold Poisoning in Dogs. https://www.vetary.com/dog/condition/marigold-poisoning. [Accessed 27 Jul 2017]	"The marigold plant can be mildly toxic to dogs when ingested and can also cause irritation when contact is made with the fur and skin. Though the effects of this plant are not life-threatening in any way, your pet may experience discomfort with exposure." ... "Marigold (Tagetes spp., Tagetes erecta, Tagetes patula) are known to cause stomach upset and skin irritation"

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Gilman, E. F. (1999). Tagetes patula French Marigold. Fact Sheet FPS-571. University of Florida IFAS Extension, Gainesville, FL. http://edis.ifas.ufl.edu. [Accessed 28 Jul 2017]	"Mites are the most frequent pest on marigolds especially during hot weather. The leaves lose their green color and severe infestations cover the plant with fine webbing. Tarnished plant bug causes distorted flowers and leaves. Leafhopper causes cupping and in-rolling of leaf margins. The petioles are twisted and the undersides of infected leaves turn purplish as they are exposed to the sun. The branch tips and leaflets wilt, and the leaflets turn yellow and dry. New shoots develop below the point of attack. Dwarf varieties are more severely infested than taller types. The repeated killing of the branch tips delays flowering. Greenhouse leaf tier webs the leaves or flower buds together. The insect feeds on the undersides of the leaves. Slugs may be detected by the silvery slime trails they leave. Slugs can be controlled with slug baits used according to label directions. Leafminers also can destroy the foliage. Predatory mites and wasps have been used successfully for pest control. Botrytis blight causes the flowers to turn brown and decay, especially in wet weather. A gray mold forms on the fading flowers. Pick off and destroy the infected flowers. The same wilt that attacks China aster may infect marigold, particularly French and dwarf types. Infected plants wilt and die. Remove and destroy infected plants. A leaf spot causes oval to irregular, gray to black spots on the leaflets. The spots may be speckled with black fruiting bodies. The disease starts on the lower leaves and progresses upward. Varieties of African marigolds are most susceptible. Stems infected with wilt and stem rot turn brown and shrivel at the soil line. The foliage wilts and the plant dies. African types are most susceptible. Remove and destroy infected plants."
	Missouri Botanical Garden. 2017. Tagetes patula. http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=a611. [Accessed 27 Jul 2017]	"Problems - Susceptible to powdery mildew, Botrytis, leaf spot and rots. Watch for spider mites and thrips."

407	Causes allergies or is otherwise toxic to humans	
	Source(s)	**Notes**
	Pollen Library. 2017. French Marigold (Tagetes patula). http://www.pollenlibrary.com/Specie/Tagetes+patula/. [Accessed 28 Jul 2017]	"Allergenicity: French Marigold (Tagetes patula) is a mild allergen"
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Potential to cause dermatitis in susceptible individuals] "Flowers and leaves are edible (Kunkel 1984 ; Facciola 1990). Flowers are used in refreshing drinks and the leaves are used for flavouring food. The dried fl owers are used as an adulterant of saffron (Crocus sativus) and used for colouring foods yellow. The essential oil is used as a food flavouring, though it is inferior to the oil obtained from T. minuta (Bown 1995)." ... "Topically applied alpha-terthienyl evoked biphasic phototoxic dermatitis and the appearance of 'sunburn' cells in human epidermis (Towers et al. 1979). None of 11 polyacetylenes had the same effect although they mimicked alpha-terthienyl in their phototoxic effects on Candida albicans and certain pathogenic microorganisms. Bilsland and Strong (1990) reported a case of allergic contact dermatitis from the essential oil of French Marigold (Tagetes patula) in an aromatherapist."

Qsn #	Question	Answer
408	**Creates a fire hazard in natural ecosystems**	**n**
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[May be a minor component of fuel load in fire prone regions. No evidence that it increases fire risk] "In its native range, it is found from near sea level up to altitude of 1,350 m. It is frost tender and is quite adaptable to poor soils, heat, humidity and especially drought but not adaptable to shade or water-logged sites. It thrives best in full sun, on well-drained sandy or loamy soils."
	Lorenson, L. & Callahan, K. 2010. Firewise Pants for Western Nevada County. Fire Safe Council of Nevada County, Grass Valley, CA	No evidence. Tagetes patula included in a list of firewise plants.

409	**Is a shade tolerant plant at some stage of its life cycle**	**n**
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It is frost tender and is quite adaptable to poor soils, heat, humidity and especially drought but not adaptable to shade or water-logged sites. It thrives best in full sun, on well-drained sandy or loamy soils."
	Missouri Botanical Garden. 2017. Tagetes patula. http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=a611. [Accessed 27 Jul 2017]	"Sun: Full sun" ... "Annual. Easily grown in average, evenly moist, well-drained soils in full sun."

410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**
	Missouri Botanical Garden. 2017. Tagetes patula. http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=a611. [Accessed 27 Jul 2017]	"Easily grown in average, evenly moist, well-drained soils in full sun."
	Plants for a Future. 2017. Tagetes patula. http://pfaf.org/user/Plant.aspx?LatinName=Tagetes+patula. [Accessed 27 Jul 2017]	"Grows well in heavy clay soils and in sandy soils[188]."
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"It is frost tender and is quite adaptable to poor soils, heat, humidity and especially drought but not adaptable to shade or water-logged sites."
	Wasatch Shadows Nursery & Gift. 2017. Durango Orange Marigold - Tagetes patula 'Durango Orange'. http://plants.wasatchshadows.com/12190004/Plant/13149/Durango_Orange_Marigold. [Accessed 27 Jul 2017]	"It is not particular as to soil type or pH, and is able to handle environmental salt."

411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root." [Asteraceae]

412	**Forms dense thickets**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[No evidence found] "In its native range, it is found from near sea level up to altitude of 1,350 m. It is frost tender and is quite adaptable to poor soils, heat, humidity and especially drought but not adaptable to shade or water-logged sites. It thrives best in full sun, on well-drained sandy or loamy soils."

501	Aquatic	n
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Terrestrial herb] "In its native range, it is found from near sea level up to altitude of 1,350 m." ... "A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root."

502	Grass	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 26 Jul 2017]	Family: Asteraceae (alt.Compositae) Subfamily: Asteroideae Tribe: Tageteae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root." [Asteraceae]

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 27 Jul 2017]	"Native: Northern America Northern Mexico: Mexico - Durango, - Zacatecas Southern Mexico: Mexico - Aguascalientes, - Guanajuato, - Hidalgo, - Jalisco, - Mexico, - Michoacan, - Queretaro" [No evidence. Also widely naturalized & cultivated]

602	Produces viable seed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Missouri Botanical Garden. 2017. Tagetes patula. http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=a611. [Accessed 27 Jul 2017]	"For earlier bloom, start seed indoors 6-8 weeks before last frost date or purchase plants in cell/six packs from local nurseries. Set plants out after last frost date."
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"Fruit 6–11 mm black achene, with scaly pappus."
	Plants for a Future. 2017. Tagetes patula. http://pfaf.org/user/Plant.aspx?LatinName=Tagetes+patula. [Accessed 27 Jul 2017]	"Propagation - Seed - sow March in a greenhouse. Only just cover the seed. Germination usually takes place within 2 weeks. When they are large enough to handle, prick the seedlings out into individual pots and plant them out after the last expected frosts."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Towner, J. (1961). Cytogenetic Studies on the Origin of Tagetes patula. I. Meiosis and Morphology of Diploid and Allotetraploid T. erecta x T. tenuifolia. American Journal of Botany, 48(9), 743-751	[Artificial hybrids possible, but difficult to produce] "In many respects, the tetraploid species Tagetes patula L. is morphologically intermediate between the diploids Tagetes erecta L. and Tagetes tenuifolia Cav. (- T. signata Bartl.). As reported in this study and by Towner (1956, 1958), crosses among these 3 species are difficult to produce, and the hybrids are almost completely sterile. These facts suggest that T. erecta and T. tenuijolia, or other diploid species closely related to them, might have been involved in the origin of T. patula through amphiploidy"

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Towner, J. (1961). Cytogenetic Studies on the Origin of Tagetes patula. I. Meiosis and Morphology of Diploid and Allotetraploid T. erecta x T. tenuifolia. American Journal of Botany, 48(9), 743-751	"Tagetes patula, T. erecta, and the artificial allotetraploid, T. erecta-tenuifolia, were fully self-compatible"

Qsn #	Question	Answer
605	**Requires specialist pollinators**	**n**
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"Capitulum solitary and terminal, 1.5–3 cm across, on 30–15 cm long peduncle. Single flower heads have widely spreading ray florets, but double-flowered head has mounding ray florets in the shape of globular, flabellate button flower heads. Ray florets 5–9 (25+), female, ligulate, flabellate to oval-quadrate, yellow, orange to red or variegated blends of red-brown, yellow/red-brown (Plates 1 , 2 , 3 , 4 and 5). Disc florets numerous, tubular, bisexual."
	Comba, L., Corbet, S. A., Barron, A., Bird, A., Collinge, S., Miyazaki, N., & Powell, M. (1999). Garden flowers: insect visits and the floral reward of horticulturally-modified variants. Annals of Botany, 83(1), 73-86	"In its native areas Tagetes patula is probably visited by insects with long and medium-length tongues. With florets of both cultivars 8±5±9 mm long, medium- and long-tongued foragers can reach the nectar at the base of the corolla more readily than honeybees with their shorter tongues. We did not measure how far a bee can insert its head into the corolla tube, but Apis mellifera was an infrequent forager on both single and double Tagetes cultivars."
	Plants for a Future. 2017. Tagetes patula. http://pfaf.org/user/Plant.aspx?LatinName=Tagetes+patula. [Accessed 27 Jul 2017]	"The flowers are hermaphrodite (have both male and female organs) and are pollinated by Insects."

606	Reproduction by vegetative fragmentation	n
	Source(s)	**Notes**
	Plants for a Future. 2017. Tagetes patula. http://pfaf.org/user/Plant.aspx?LatinName=Tagetes+patula. [Accessed 28 Jul 2017]	"Propagation" Seed - sow March in a greenhouse. Only just cover the seed. Germination usually takes place within 2 weeks. When they are large enough to handle, prick the seedlings out into individual pots and plant them out after the last expected frosts." [No evidence]
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[No evidence. Annual] "A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root."

607	Minimum generative time (years)	1
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	[Annual] "A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root."

Qsn #	Question	Answer
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	
	Source(s)	**Notes**
	Parker, J.L. & Parsons, B. 2016. New Plant Records from the Big Island for 2015. Bishop Museum Occasional Papers 118: 17–22	"sprouting out of roadside corridor, many fruits and seeds."
	Salvesen, A. B. (2006). Escape of Introduced Ornamentals in Asteraceae": with main focus on Tagetes patula L. in Western Ethiopia. MSc Thesis.University of Oslo, Oslo, Norway	[Possibly Yes] "The cypselas of T. patula have no distinct adaptations for being dispersed by either wind or animals, but they are obviously spread by cattle faeces (endozoochory, cf. Stiles 1992)." ... "However, Tagetes patula is probably mainly eaten by accident by domestic animals, apparently trying to avoid it, in search for something else. In addition the cypselas carry a pappus of short hairs that give some possibility for ectozoochory, including dispersal by road construction machines and people's clothes."
702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"T. patula is a popular ornamental plant especially in temperate and subtemperate areas around the world."
703	**Propagules likely to disperse as a produce contaminant**	**y**
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Crop, Herbal, Ornamental Dispersed by: Humans, Escapee"
704	**Propagules adapted to wind dispersal**	
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"Fruit 6–11 mm black achene, with scaly pappus."
	Salvesen, A. B. (2006). Escape of Introduced Ornamentals in Asteraceae": with main focus on Tagetes patula L. in Western Ethiopia. MSc Thesis.University of Oslo, Oslo, Norway	"The cypselas of T. patula have no distinct adaptations for being dispersed by either wind or animals, but they are obviously spread by cattle faeces (endozoochory, cf. Stiles 1992)."
705	**Propagules water dispersed**	**n**
	Source(s)	**Notes**
	Salvesen, A. B. (2006). Escape of Introduced Ornamentals in Asteraceae": with main focus on Tagetes patula L. in Western Ethiopia. MSc Thesis.University of Oslo, Oslo, Norway	"The cypselas of T. patula have no distinct adaptations for being dispersed by either wind or animals, but they are obviously spread by cattle faeces (endozoochory, cf. Stiles 1992)." [Water unlikely to be an important means of dispersal]
706	**Propagules bird dispersed**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Salvesen, A. B. (2006). Escape of Introduced Ornamentals in Asteraceae": with main focus on Tagetes patula L. in Western Ethiopia. MSc Thesis.University of Oslo, Oslo, Norway	"The cypselas of T. patula have no distinct adaptations for being dispersed by either wind or animals, but they are obviously spread by cattle faeces (endozoochory, cf. Stiles 1992)."

707	Propagules dispersed by other animals (externally)	
	Source(s)	**Notes**
	Salvesen, A. B., Awas, T., & Nordal, I. (2010). Escape and Naturalization of Tagetes patula in Western Ethiopia. SINET: Ethiopian Journal of Science, 33(2), 89-100	[Possibly Yes] "Tagetes patula is probably mainly eaten by accident by domestic animals, apparently trying to avoid it, in search for something else. In addition the cypselas carry a pappus of short hairs that give some possibility for ectozoochory, including dispersal by road construction machines and people's clothes."

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Salvesen, A. B. (2006). Escape of Introduced Ornamentals in Asteraceae": with main focus on Tagetes patula L. in Western Ethiopia. MSc Thesis.University of Oslo, Oslo, Norway	"The cypselas of T. patula have no distinct adaptations for being dispersed by either wind or animals, but they are obviously spread by cattle faeces (endozoochory, cf. Stiles 1992)." ... "However, Tagetes patula is probably mainly eaten by accident by domestic animals, apparently trying to avoid it, in search for something else. In addition the cypselas carry a pappus of short hairs that give some possibility for ectozoochory, including dispersal by road construction machines and people's clothes."

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Parker, J.L. & Parsons, B. 2016. New Plant Records from the Big Island for 2015. Bishop Museum Occasional Papers 118: 17–22	"sprouting out of roadside corridor, many fruits and seeds. 1.5 ft tall with seeds germinating on mother plant."
	Salvesen, A. B., Awas, T., & Nordal, I. (2010). Escape and Naturalization of Tagetes patula in Western Ethiopia. SINET: Ethiopian Journal of Science, 33(2), 89-100	"The density of viable seeds recovered from soil samples collected at the study sites indicates that both T. patula and B. prestinaria accumulate seed reserves in the soil." ... "Table 2. Capitula and average propagules production in T. patula (n=100) and B. prestinaria (n=20), mean ± S.D." [Average no. of propagule/plot (4 m2) = ca. 225]

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Rao, C. C., Dadlani, N. K., & Dadlani, M. (2003). Maintenance and enhancement of germination and vigour in Marigold (Tagetes spp.) seed. Seed Science and Technology, 31(3), 745-751	"Marigold is one of the important annual flowers grown for commercial purposes in India. Non availability of high quality seeds of marigold is one of the major constraints to its cultivation. The present investigations reveal that there is a rapid decline in vigour and viability of marigold seed under ambient conditions of storage from April to October in North Indian plains. Drying seeds to about 8% moisture content and storing in sealed moisture resistant packages resulted in maintenance of satisfactory levels of germination (above 50%) for 6 to 10 months at ambient temperatures, while placing silica gel with seeds in paper packets was effective up to 4 months. When stored at 15 ± 2°C germination could be maintained for 8-10 Months in moisture resistant containers and for 6-8 months in paper packets with silica gel, respectively. Germination (%) after 4 days of accelerated ageing (100%, 40°C) was a good indicator of seed vigour and its field emergence potential."
	Royal Botanic Gardens Kew. (2017) Seed Information Database (SID). Version 7.1. Available from: http://data.kew.org/sid/. [Accessed 28 Jul 2017]	"Storage Behaviour: Orthodox Storage Conditions: No loss in viability following 16 years storage at 35-40% r.h. and 4°C (Bass, 1980); seeds not damaged from exposure to liquid nitrogen (Stanwood & Bass, 1981)"

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	CABI, 2017. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Probably Yes. Related taxon effectively controlled] "In screening trials in Brazil, Lorenzi (1986) showed T. minuta to be susceptible to acifluorfen, ametryne, bentazon, bifenox, bromacil, cyanazine, dicamba, diphenamid, diquat, diuron, 2,4-D, glyphosate, imazaquin, linuron, metribuzin, molinate, oxadiazon, oxyfluorfen, paraquat and simazine. Current Australian registrations for the control of T. minuta include 2,4-D, MCPA, norflurazon, prometryn, pendimethalin, atrazine, 2,4-D + picloram, linuron, and bromacil + diuron (Hamilton, 1997). The effect of these herbicides can be reduced if the herbicide leaches below the germination zone, e.g. in sandy soil."

Qsn #	Question	Answer
804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	
	Source(s)	**Notes**
	Lim, T.K. 2014. Edible Medicinal And Non-Medicinal Plants. Volume 7, Flowers. Springer, Dordrecht	"A small, bushy, erect, branched, glabrous, herbaceous annual, 25–100 cm high with a tap root." [Annual. Possibly not, but might be able to resprout from taproot]
	Salvesen, A. B. (2006). Escape of Introduced Ornamentals in Asteraceae": with main focus on Tagetes patula L. in Western Ethiopia. MSc Thesis.University of Oslo, Oslo, Norway	[Seeds may germinate after some fire, unless temperature is excessive] "Results from the fire simulation experiment revealed that 78% of T. patula seeds germinated from the control, while germination was lower for propagules treated with different dry heat treatments (except the highest temperature impact, i.e., 120°C/5 minutes in which there was no germination at all). The statistical analysis also revealed that only the higher temperature treatment has significant impact on the seeds of T. patula. This suggests that the propagules, to a certain degree will withstand heat, unless the heat becomes excessive."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability
• Thrives in tropical climates
• Naturalized on Hawaii Island. Widely naturalized elsewhere
• Potential disturbance and crop weed
• Other Tagetes species are invasive weeds
• Allelopathic
• Toxic to dog
• May cause dermatitis to susceptible people
• Tolerates many soil types
• Reproduces by seeds
• Self-compatible
• Reaches maturity in <1 year
• Seeds dispersed by animals (internally & externally), intentionally & accidentally by people

Low Risk Traits
• Unarmed (no spines, thorns, or burrs)
• Provides fodder for livestock (palatable despite reports of toxicity)
• Ornamental
• Requires full sun
• Not reported to spread vegetatively
• Herbicides may provide effective control