Taxon: Celosia argentea L. **Family:** Amaranthaceae

Common Name(s): plumed cockscomb
silver cock's comb

Synonym(s): Celosia argentea var. cristata (L.)
Celosia cristata L.

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 5 Mar 2021

WRA Score: 20.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Annual Herb, Crop Weed, Edible, Dense Stands, Seeds Prolifically

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	n=0, y = 1*multiplier (see Appendix 2)	y
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
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	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
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		
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)	y=1, n=-1	y
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	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
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**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	[Not domesticated, but different cultivars may have different competitive abilities] "Celosia argentea is by far the most popular and most widely cultivated species. There are three major types of Celosia argentea cultivated as vegetable in Nigeria and Benin: green broad leaved cultivars called 'Soko green'; broad-leaved cultivars with anthocyanin pigmentation of the leaf blades and parts of the stem called 'Soko pupa'; and cultivars with deep green narrow leaves with a hard texture and early flowering. ' Soko pupa' imparts the anthocyanin-red colour into the soup, making it less popular than 'Soko green'. Improved cultivars of 'Soko green' with broad pale green leaves are more vigorous. Ornamental types of Celosia argentea with fasciated inflorescences have been described as Celosia cristata L. and were later considered as a variety or form of Celosia argentea. They are tetraploid (2n = 36), rarely 12x (2n = 108), whereas wild plants are usually octoploid (2n = 72) and rarely tetraploid (in India). " … "Limited breeding work has been done on celosia. In Nigeria selections have been made in local and improved cultivars based on leaf size and shape, and on flowering period. Lines have been selected for low red or purple colouration in the leaves. Completely green cultivars were selected in Benin and Nigeria and are now generally used. Improved cultivars are more efficient in terms of leaf production and leaf area per plant than the unselected local cultivars."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. (2021). Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. (2021). 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**

Qsn #	Question	Answer
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"The wide diversity of Celosia argentea in tropical Africa points to an origin in this region. Celosia argentea is a widespread weed throughout tropical Africa, from Senegal east to Somalia and south to northern South Africa and the Indian Ocean islands, and a traditional vegetable in West and Central Africa. It is one of the leading leaf vegetables in south-western Nigeria, where it is known as 'soko yòkòtò' in the Yoruba language, meaning 'make husbands fat and happy'. It is extremely important as well in southern Benin, also popular in Togo, Ghana and Cameroon, and recorded as a vegetable from several other West and Central African countries. Outside Africa, it occurs in tropical and subtropical Asia and America. The ornamental forms of Celosia argentea with fasciated inflorescences (cock's comb) probably originate from India. These are widely grown as an ornamental in the tropics and subtropics, and in summer in temperate regions."

202	Quality of climate match data	High
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	

203	Broad climate suitability (environmental versatility)	y
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	[Elevation range >1000 m] "Celosia grows well in the lowland humid forest zone at day temperatures of 30–35°C and night temperatures of 23–28°C and at an altitude up to 1700 m. Growth is greatly retarded by temperatures below 20°C, consequently it does not grow well in the savanna region of West Africa during the harmattan period."

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 3 Mar 2021]	"Naturalized (widely natzd. tropical weed) Other (exact native range obscure, perhaps India)"
	Starr, F. & Starr, K. (2021). Maui Early Detection Botanists, pers. comm. 02 March 2021	"Numerous plants growing along Iao Stream."
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"The wide diversity of Celosia argentea in tropical Africa points to an origin in this region. Celosia argentea is a widespread weed throughout tropical Africa, from Senegal east to Somalia and south to northern South Africa and the Indian Ocean islands, and a traditional vegetable in West and Central Africa."
	Oppenheimer, H. L. (2003). New plant records from Maui and Hawai'i Counties. Bishop Museum Occasional Papers. 73: 3-30	[Hawaii Island] "A small population, consisting of dozens of randomly scattered individuals in all size classes, was recently found growing along an intermittent stream in Hilo, Hawai'i. It was noted that it did not appear to be under cultivation in adjacent areas."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia comprises about 50 species and occurs in all tropical and subtropical regions. Celosia argentea is by far the most popular and most widely cultivated species."

301	**Naturalized beyond native range**	**y**
	Source(s)	**Notes**
	Flora of North America. (2021). Celosia argentea. http://www.efloras.org. [Accessed 4 Mar 2021]	"Flowering summer. Waste places, weedy areas; 0-1400 m; introduced; Ala., Fla., Ind., Ky., La., Md., N.J., N.C., Pa., S.C., Tenn., Tex., Utah, W.Va.; West Indies; South America; native to Asia (India). Celosia argentea is locally escaped from cultivation, and perhaps originally native to India."
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2003. Flora of China. Vol. 5 (Ulmaceae through Basellaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Hillsides, field margins, a common weed. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan, Zhejiang [Bhutan, Cambodia, Japan, Korea, India, Laos, Malaysia, Myanmar, Nepal, Philippines, Russia, Sikkim, Thailand, Vietnam; tropical Africa]."
	USDA, Agricultural Research Service, National Plant Germplasm System. (2021). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. https://npgsweb.ars-grin.gov/. [Accessed 3 Mar 2021]	"Naturalized (widely natzd. tropical weed)"

Qsn #	Question	Answer
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"The wide diversity of Celosia argentea in tropical Africa points to an origin in this region. Celosia argentea is a widespread weed throughout tropical Africa, from Senegal east to Somalia and south to northern South Africa and the Indian Ocean islands, and a traditional vegetable in West and Central Africa"
	Oppenheimer, H. L. (2003). New plant records from Maui and Hawai'i Counties. Bishop Museum Occasional Papers. 73: 3-30	[Hawaii Island] "Hillebrand (1888: 370) treated this ornamental as a garden escape; however, Wagner et al. (1990: 179) saw no evidence that it had become naturalized. Staples et al. (2000: 15) listed it as potentially invasive via the adhesive fruit. A small population, consisting of dozens of randomly scattered individuals in all size classes, was recently found growing along an intermittent stream in Hilo, Hawai'i. It was noted that it did not appear to be under cultivation in adjacent areas. Celosia argentea, cockscomb, is an erect, glabrous, sparingly branched annual 1–2 m tall; leaves are simple, alternate, margins entire, somewhat fleshy, dull purple beneath, approximately 5–15 cm long × 1–2 cm wide. The inflorescence is pink to purple, axillary and spike-like, sometimes crested, and composed of numerous, tiny flowers; fruits are papery, gray, each with a single, small, black seed. Celosia is a genus of about 60 species from tropical Africa and America; many are weedy, with some ornamentals, mostly hybrids (Whistler, 2000: 117). Material examined: HAWAI'I: South Hilo Dist, Waiākea Stream, 18 m, 2 Aug 2001, Oppenheimer H80105."
	Starr, F. & Starr, K. (2021). Maui Early Detection Botanists, pers. comm. 02 March 2021	[Maui] "Celosia argentea (cockscomb) - Numerous plants growing along Iao Stream."

302	Garden/amenity/disturbance weed	y
	Source(s)	**Notes**
	Henty, E. E., Pritchard, G. H. 1975. Weeds of New Guinea and their control. 2nd edition. Department of Forests, Division of Botany, Botany Bull. No. 7. Lae, Papua New Guinea	"a plant of roadsides, particularly where disturbance has been recent, and on building sites, earthworks, quarries, river-beds; also a weed in annual crops and sometimes in heavily-grazed pasture"
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2003. Flora of China. Vol. 5 (Ulmaceae through Basellaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Hillsides, field margins, a common weed."
	Womersley, J.S (ed.) (1978). Handbooks of the Flora of Papua New Guinea, vol. 1. Melbourne University Press, Melbourne	"often occurring as a weed in dry open places such as roadsides and waste lands, as well as stream beds, from sea level to 1200 (-1800) m altitude"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Bananas, Cereals, Cotton, Orchards & Plantations"
	WRA Specialist. (2021). Personal Communication	A weed of disturbed sites and crops

303	Agricultural/forestry/horticultural weed	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Inamdar, A., & Kamble, A. B. (2009). Allelopathic Effects of the Plant Celosia argentea L. on Seed Germination and Seedling Growth of Vigna mungo L. Journal of Nature Environment & Pollution Technology, 8(1), 57-61	"Celosia argentea is a predominant weed of leguminous crop fields and has been reported to reduce the yield of pearl millet, maize and pulse legumes. It was, thus, thought that the reduction in yields of these crops was not due to only competition but also because of allelopathic inhibition of growth and development of these crop plants."
	Ravindra, G. M., Sridhara, S., Girijesh, G. K., & Nanjappa, H. V. (2008). Weed biology and growth analysis of Celosia argentea L., a weed associated with groundnut and finger millet crops in southern India. Communications in Biometry and Crop Science, 3(2), 80-87	"Celosia argentea L. is an herbaceous annual weed found in many crops such as Groundnut (Arachis hypogaea L., Finger Millet (Eleusine coracana L. Gaertn) and Maize (Zea mays L.). It is erect plant and grows to a height of 1.0 to 1.6 m under favorable condition. It has numerous lateral roots below the soil surface. These enable it to efficiently absorb nutrients from the soil. Lately it has become a troublesome weed to control in field crops as it emerges several times during a cropping cycle and escapes weed control measures."
	Zhenghao Xu & Meihua Deng. (2017). Identification and Control of Common Weeds: Volume 2. Zhejiang University Press, Hangzhou and Springer Nature, Singapore	"Harmfulness A common upland weed." … "Management Weeding at early stage can reduce the seed amount of Celosia argentea in upland fields. Cleaning up the weeds at field margins can lessen the intrusion of the weed from outside. Rotating of paddy and upland cultivation can change the weed community in upland fields and reduce the occurrence of the weed. Chemical control can choose bromoxynil and bentazon."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Bananas, Cereals, Cotton, Orchards & Plantations"

304	Environmental weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Bananas, Cereals, Cotton, Orchards & Plantations"

305	Congeneric weed	y
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia trigyna often becomes weedy in other crops. It can be controlled fairly easily both mechanically and with herbicides."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[Celosia trigyna] "Weed of: Cereals, Cotton, Orchards & Plantations, Pastures, Vegetables"

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	[No evidence] "Erect annual herb up to 2 m tall; stem ridged, glabrous, branches up to 25 per plant, ascending. Leaves alternate, simple, without stipules; petiole indistinctly demarcated; blade ovate to lanceolate-oblong or narrowly linear, up to15(–20) cm × 7(–9) cm, tapering at base, acute to obtuse and shortly mucronate at apex, entire, glabrous, pinnately veined. Inflorescence a dense, many-flowered spike, at first conical but becoming cylindrical, up to 20 cm long, bracteate, silvery to pink, in ornamental forms completely or partly sterile and in many colours. Flowers small, bisexual, regular, 5-merous; tepals free, narrowly elliptical-oblong, 6–10 mm long; stamens fused at base; ovary superior, 1-celled, style filiform, up to 7 mm long, stigmas 2–3, very short. Fruit an ovoid to globose capsule 3–4 mm long, circumscissile, few-seeded. Seeds lenticular, 1–1.5 mm long, black and shining, shallowly reticulate."

Qsn #	Question	Answer
402	**Allelopathic**	**y**
	Source(s)	**Notes**
	Ashraf, N., & Sen, D. N. (1978). Allelopathic potential of Celosia argentea in arid land crop fields. Oecologia Plantarum, 13(4), 331-337	"Abstract : The effects of aqueous extracts of leaf, stem and root of 2 forms of Celosia argentea on the germination and seedling growth of Pennisetum typhoideum [= P. americanum] (bulrush millet) and Sesamum indicum (sesame) were examined. Growth inhibiting substances were found in C. argentea which differed in their chemistry between the 2 forms. The level of growth inhibition by different parts of the plant was in the order leaf > stem > root. In the field, maximum inhibition of bulrush millet occurred when C. argentea was controlled by burning and the millet was sown immediately afterwards. Total inhibition (non-germination) of sesame occurred when C. argentea plants were buried in the soil. "
	Inamdar, A., & Kamble, A. B. (2009). Allelopathic Effects of the Plant Celosia argentea L. on Seed Germination and Seedling Growth of Vigna mungo L. Journal of Nature Environment & Pollution Technology, 8(1), 57-61	"Celosia argentea is a predominant weed of leguminous crop fields and has been reported to reduce the yield of pearl millet, maize and pulse legumes. It was, thus, thought that the reduction in yields of these crops was not due to only competition but also because of allelopathic inhibition of growth and development of these crop plants." … "The extracts of leaf, inflorescence and root of Celosia argentea caused adverse effects on the seedling growth of Vigna mungo"
	Saritha, P., & Sreeramulu, A. (2013). Allelopathic effects of Celosia argentea L. leaf extracts on crop plant seed germination. International Journal of Life sciences Biotechnology and Pharma Research, 2(1): 1-9	"Cocks comb (Celosia argentea L.) is one of the most famous allelopathic plants. The present study was conducted to investigate the allelopathic effects of different concentrations of Celosia argentea L weed on seed germination and seedling growth of surrounding crop plants Sorghum bicolor, Phaseolous aureus, Arachis hypogaea, Dolichos lab lab and Vigna unguiculata. The average growths of plumule and radicle was measured and compared. 1%, 2%, 3% and 5% aqueous extracts of leaf inhibited seed germination and seedling growth of crop plant seeds. The percentage seed germination and seedling growth of crop plant seeds decreased with concentration of leaf extracts used. The reduction of germination percentage may be due to the presence of allelochemicals of Celosia argentea L. which is reported to contain hyaluronic acid, celosianin, betanin and isocelosianin. Among the five crop plant seeds, C. argentea leaf extract showed more inhibitory effect on growth of seedlings of groundnut (8.96%)."

403	Parasitic	n
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Erect annual herb up to 2 m tall; stem ridged, glabrous, branches up to 25 per plant, ascending." [Amaranthaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Plants for a Future. (2021). Celosia argentea cristata. https://pfaf.org. [Accessed 5 Mar 2021]	"Known Hazards None known"

Qsn #	Question	Answer
	Singh, J. P., Mathur, B. K., Rathore, V. S., & Beniwal, R. K. (2012). Weeds as a Source of Fodder in Hot Arid Zone-A Review. Pp. 124-144 in N.V. Patil et al. (eds.). Feeding and Management of Livestock During Drought and Scarcity. Scientific Publishers, Jodhpur	"The annual species like Celosia argentea occurs throughout India in crop fields, grasslands/pastures and grazed by goats, sheep and also by cattle before seed setting during monsoon and post monsoon season."

405	Toxic to animals	n
	Source(s)	**Notes**
	Plants for a Future. (2021). Celosia argentea cristata. https://pfaf.org. [Accessed 5 Mar 2021]	"Known Hazards None known"
	Singh, J. P., Mathur, B. K., Rathore, V. S., & Beniwal, R. K. (2012). Weeds as a Source of Fodder in Hot Arid Zone-A Review. Pp. 124-144 in N.V. Patil et al. (eds.). Feeding and Management of Livestock During Drought and Scarcity. Scientific Publishers, Jodhpur	[No evidence] "The annual species like Celosia argentea occurs throughout India in crop fields, grasslands/pastures and grazed by goats, sheep and also by cattle before seed setting during monsoon and post monsoon season."

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia is susceptible to several leaf fungi, which can be severe when air humidity is high and during rainy weather and result in poor leaf quality. Cercospora celosiae causes red-rimmed grey spots on the leaves. White rust (Albugo bliti) forms white pustules on the underside of the leaves. Other diseases affecting the leaf quality are Alternaria leaf spot (Alternaria spp.) and charcoal rot (Macrophomina phaseolina, Curvularia spp.), which cause dark spots on the leaves. Wet rot or stem rot caused by Choanephora cucurbitarum, the main disease of amaranth during the wet season, is sometimes serious in densely planted celosia. Rhizoctonia solani and Pythium aphanidermatum cause damping-off of seedlings. Celosia is highly susceptible to root-knot nematodes (Meloidogyne spp.) causing galls on roots, unthrifty growth, small and chocolate-coloured leaves as well as reductions in yield of up to 40%. It is therefore recommended that celosia not be grown continuously and that it not be followed by other crops susceptible to root-knot nematodes such as okra, gboma eggplant, Jew's mallow, lettuce or tomato. Variation in degree of susceptibility to root-knot nematodes exists among cultivars, but no resistant cultivars have been reported. However, the application of much organic manure reduces the nematode population, as well as annual flooding. Caterpillars of Hymenia recurvalis and Psara bipunctalis feed on the leaves. The use of appropriate pesticides can control them. Spraying should start at detection of the caterpillars and should be applied once a week for three weeks. Grasshoppers and aphids cause minor damage in celosia."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Plants for a Future. (2021). Celosia argentea cristata. https://pfaf.org. [Accessed 5 Mar 2021]	"Known Hazards None known"

Qsn #	Question	Answer
	Quattrocchi, U. (2012). CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"leaves used as vegetables, a weed, Celosia cristata L. usually regarded as a cultivated form of Celosia argentea" [No evidence. Numerous medicinal uses]
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	[No evidence] "Celosia is primarily used as a leafy vegetable. The leaves and tender stems are cooked into soups, sauces or stews with various ingredients including other vegetables such as onions, hot pepper and tomato, and with meat or fish and palm oil. Celosia leaves are tender and break down easily when cooked only briefly. The soup is consumed with the staple food of maize, rice, cassava or yam. The young inflorescences are also eaten as a potherb."

408	Creates a fire hazard in natural ecosystems	
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia grows well in the lowland humid forest zone at day temperatures of 30–35°C and night temperatures of 23–28°C and at an altitude up to 1700 m. Growth is greatly retarded by temperatures below 20°C, consequently it does not grow well in the savanna region of West Africa during the harmattan period. Celosia performs well under partial shade, especially in dry conditions." [No evidence, although ability to grow in dry conditions, combined with formation of dense stands, could contribute to fuel load and fire risk]

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia performs well under partial shade, especially in dry conditions."
	Setyawati, T., Narulita, S., Bahri, I.P., & Raharjo, G. T. (2015). A Guide Book to Invasive Alien Plant Species in Indonesia. Research, Development, and Innovation Agency, Ministry of Environment and Forestry, Republic of Indonesia	"It cannot grow in the shade."
	Zhenghao Xu & Meihua Deng. (2017). Identification and Control of Common Weeds: Volume 2. Zhejiang University Press, Hangzhou and Springer Nature, Singapore	"It prefers full to partial sun conditions and can endure poor-nutrition soil surroundings."

Qsn #	Question	Answer
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"A well-drained sandy loam soil allows optimum growth, but celosia also grows well on marshy soils. In Nigeria and Benin it is frequently produced during the dry season in so-called 'fadama' cropping systems, i.e. on hydromorphic soils of river banks and seasonally flooded areas."
	Plants for a Future. (2021). Celosia argentea cristata. https://pfaf.org. [Accessed 5 Mar 2021]	"For best leaf production, the plant requires a fertile, moisture-retentive but well-drained soil in a sunny sheltered position[200 , 300], though it is tolerant of a range of soil types[300]. Prefers a pH in the range 6 - 6.5, tolerating 5.5 - 7.5[418]."

411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Erect annual herb up to 2 m tall; stem ridged, glabrous, branches up to 25 per plant, ascending."

412	**Forms dense thickets**	**y**
	Source(s)	**Notes**
	Zhenghao Xu & Meihua Deng. (2017). Identification and Control of Common Weeds: Volume 2. Zhejiang University Press, Hangzhou and Springer Nature, Singapore	"Ecology The species fits for from moist to drought situations, and it forms dense clumps or predominant or monocultures both in moist or drought habitats."
	Aluri, J. S. R., & Chappidi, P. R. (2018). Reproductive ecology of Allmania nodiflora, Celosia argentea var. margaritacea, and Digera muricata (Amaranthaceae). Botanica Serbica, 42(2): 185-198	"It forms dense stands as an emergent weed in open wet and dry soils, and in irrigated cultivated lands such as maize fields."

501	**Aquatic**	**n**
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	[Terrestrial] "Celosia grows well in the lowland humid forest zone at day temperatures of 30–35°C and night temperatures of 23–28°C and at an altitude up to 1700 m."

502	**Grass**	**n**
	Source(s)	**Notes**
	WFO (2021): Celosia argentea L. Published on the Internet; http://www.worldfloraonline.org/taxon/wfo-0000593019. [Accessed 4 Mar 2021]	Amaranthaceae

503	**Nitrogen fixing woody plant**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	WFO (2021): Celosia argentea L. Published on the Internet; http://www.worldfloraonline.org/taxon/wfo-0000593019. [Accessed 4 Mar 2021]	Amaranthaceae

504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**
	Source(s)	**Notes**
	Zhenghao Xu & Meihua Deng. (2017). Identification and Control of Common Weeds: Volume 2. Zhejiang University Press, Hangzhou and Springer Nature, Singapore	[Celosia argentea] "Root: Main root strong, with many fibrous roots."

601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	[No evidence] "The wide diversity of Celosia argentea in tropical Africa points to an origin in this region. Celosia argentea is a widespread weed throughout tropical Africa, from Senegal east to Somalia and south to northern South Africa and the Indian Ocean islands, and a traditional vegetable in West and Central Africa. It is one of the leading leaf vegetables in south-western Nigeria, where it is known as 'soko yòkòtò' in the Yoruba language, meaning 'make husbands fat and happy'. It is extremely important as well in southern Benin, also popular in Togo, Ghana and Cameroon, and recorded as a vegetable from several other West and Central African countries. Outside Africa, it occurs in tropical and subtropical Asia and America. The ornamental forms of Celosia argentea with fasciated inflorescences (cock's comb) probably originate from India. These are widely grown as an ornamental in the tropics and subtropics, and in summer in temperate regions."

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia is grown on raised beds, ridges or flat beds. It is propagated by seed, either direct sown or transplanted. The 1000-seed weight is 1.0–1.1 g. For direct sowing, used for harvesting by uprooting whole young plants, a seed rate of 6–9 g per 10 m2 is used for sowing in rows or broadcasting. Seed is sometimes mixed with dry fine sand to obtain an even seed distribution. Direct sowing is prone to excessive use of seed, excessively high plant densities, difficult management, poor vegetative growth and low yield. With transplanting, less seed is required. Seed is then first sown in nursery beds and after 2–3 weeks the seedlings are transplanted. For harvesting by pruning the seedlings are widely spaced (15 cm × 15 cm on the beds), for once over harvest by uprooting a spacing of 10 cm × 10 cm is adequate. Compared to direct sowing, transplanting gives more uniform and vigorous plants."

Qsn #	Question	Answer
	Ravindra, G. M., Sridhara, S., Girijesh, G. K., & Nanjappa, H. V. (2008). Weed biology and growth analysis of Celosia argentea L., a weed associated with groundnut and finger millet crops in southern India. Communications in Biometry and Crop Science, 3(2), 80-87	"It produces 2,000 to 3,000 seed plant-1 which add to the soil seed bank."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Grant, W. (1954). A Cytological Study of Celosia argentea, C. argentea var. Cristata, and Their Hybrids. Botanical Gazette, 115(4), 323-336	"Cockscomb (Celosia argentea var. cristata), C. argentea, an almost sterile hybrid between them, and eight F 2 plants raised from seed from the hybrid have been studied cytologically. The hybrid possessed a chromosome number (2n = 54) intermediate between those of the parents (2n = 36 and 72 for cockscomb and C. argentea, respectively)." [Unknown. Celosia cristata is a synonym of Celosia argentea L. var. cristata (L.) Kuntze]

604	Self-compatible or apomictic	
	Source(s)	**Notes**
	Aluri, J. S. R., & Chappidi, P. R. (2018). Reproductive ecology of Allmania nodiflora, Celosia argentea var. margaritacea, and Digera muricata (Amaranthaceae). Botanica Serbica, 42(2): 185-198	[Theoretically possible, but unlikely] "Celosia argentea var. margaritacea is functionally gynodioecious." … "In C. argentea var. margaritacea also, the flowers facilitate autonomous selfing, but it is precluded by strong protandry." … "In C. argentea var. margaritacea also, such a situation exists to facilitate autogamy in bisexual plants, but it does not occur since the stigma commences its receptivity in the evening of the day of anthesis; however, it may occur if the pollen deposited on an un-receptive stigma is viable, allowing pollination during the receptive phase of the stigma. There is no possibility for autogamy or any form of selfing in pistillate plants due to non-production of pollen in their anthers."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Pollination is by wind and insects, especially bees and flies, which visit the flowers regularly."

606	Reproduction by vegetative fragmentation	n
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia is grown on raised beds, ridges or flat beds. It is propagated by seed, either direct sown or transplanted."
	Aluri, J. S. R., & Chappidi, P. R. (2018). Reproductive ecology of Allmania nodiflora, Celosia argentea var. margaritacea, and Digera muricata (Amaranthaceae). Botanica Serbica, 42(2): 185-198	"Seeds are dispersed by wind during dry spells in the rainy season. Therefore, seed dispersal is anemochorous. The plant reproduces exclusively by seed."

Qsn #	Question	Answer
607	**Minimum generative time (years)**	**1**
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2003. Flora of China. Vol. 5 (Ulmaceae through Basellaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Herbs annual, 30100 cm tall."
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"The seedling emerges 5–7 days after sowing. Early vegetative growth is slow but flowering may occur already 6–7 weeks after sowing."

701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y**
	Source(s)	**Notes**
	Staples, G.W., Herbst, D.R & Imada, C.T. 2000. Survey of invasive or potentially invasive cultivated plants in Hawai'i. Bishop Museum Occasional Papers 65: 1-35	"Table 2. Annotated checklist of invasive or potentially invasive cultivated plants in Hawai'i with dispersal syndrome" [Celosia argentea; Disperal Syndrome - M = mechanical; Comments = fruit adhesive]

702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	"Celosia comprises about 50 species and occurs in all tropical and subtropical regions. Celosia argentea is by far the most popular and most widely cultivated species."

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	[Presence as a crop weed suggests seed contamination can or will be a recurring problem] "Weed of: Bananas, Cereals, Cotton, Orchards & Plantations"
	Wilson, C. E., Castro, K. L., Thurston, G. B., & Sissons, A. (2016). Pathway risk analysis of weed seeds in imported grain: A Canadian perspective. NeoBiota, 30: 49–74	[Reported as a seed contaminant in imported grain] "Table 5. Contaminants that represent potential new weed species introductions to Canada, reported in imported grain crops examined in a Canadian sampling program 2007–2015. #Reports indicates the number of samples a species was reported in of a possible 947, and #Crops indicates the number of crops it was reported in, of a possible 10." [Celosia argentea - #Reports = 2; # Crops = 2]

Qsn #	Question	Answer
704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**
	Aluri, J. S. R., & Chappidi, P. R. (2018). Reproductive ecology of Allmania nodiflora, Celosia argentea var. margaritacea, and Digera muricata (Amaranthaceae). Botanica Serbica, 42(2): 185-198	"Fruits dehisce by means of a circumscissile lid to disperse the seeds; in this dehiscence mode, the membranous fruit pericarp breaks horizontally, after which the seed slips out and falls to the ground. Fruit dehiscence and seed dispersal occur acropetally in the spikes from September to March. Seeds are dispersed by wind during dry spells in the rainy season. Therefore, seed dispersal is anemochorous."

705	**Propagules water dispersed**	**y**
	Source(s)	**Notes**
	Oppenheimer, H. L. (2003). New plant records from Maui and Hawai‘i Counties. Bishop Museum Occasional Papers. 73: 3-30	"A small population, consisting of dozens of randomly scattered individuals in all size classes, was recently found growing along an intermittent stream in Hilo, Hawai‘i. It was noted that it did not appear to be under cultivation in adjacent areas."
	Starr, F. & Starr, K. (2021). Maui Early Detection Botanists, pers. comm. 02 March 2021	"Celosia argentea (cockscomb) - Numerous plants growing along Iao Stream."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Dispersed by: Humans, Water, Escapee"
	WRA Specialist. (2021). Personal Communication	Distribution along streams and riparian areas suggests movement by water

706	**Propagules bird dispersed**	**n**
	Source(s)	**Notes**
	Aluri, J. S. R., & Chappidi, P. R. (2018). Reproductive ecology of Allmania nodiflora, Celosia argentea var. margaritacea, and Digera muricata (Amaranthaceae). Botanica Serbica, 42(2): 185-198	"Fruits dehisce by means of a circumscissile lid to disperse the seeds; in this dehiscence mode, the membranous fruit pericarp breaks horizontally, after which the seed slips out and falls to the ground. Fruit dehiscence and seed dispersal occur acropetally in the spikes from September to March. Seeds are dispersed by wind during dry spells in the rainy season. Therefore, seed dispersal is anemochorous. The plant reproduces exclusively by seed."

707	**Propagules dispersed by other animals (externally)**	**y**
	Source(s)	**Notes**
	Staples, G.W., Herbst, D.R & Imada, C.T. 2000. Survey of invasive or potentially invasive cultivated plants in Hawai‘i. Bishop Museum Occasional Papers 65: 1-35	"Table 2. Annotated checklist of invasive or potentially invasive cultivated plants in Hawai'i with dispersal syndrome" [Celosia argentea; Disperal Syndrome - M = mechanical; Comments = fruit adhesive]

708	**Propagules survive passage through the gut**	**n**
	Source(s)	**Notes**

Qsn #	Question	Answer
	Aluri, J. S. R., & Chappidi, P. R. (2018). Reproductive ecology of Allmania nodiflora, Celosia argentea var. margaritacea, and Digera muricata (Amaranthaceae). Botanica Serbica, 42(2): 185-198	"Seeds are dispersed by wind during dry spells in the rainy season. Therefore, seed dispersal is anemochorous."
	Staples, G.W., Herbst, D.R & Imada, C.T. 2000. Survey of invasive or potentially invasive cultivated plants in Hawai'i. Bishop Museum Occasional Papers 65: 1-35	"Table 2. Annotated checklist of invasive or potentially invasive cultivated plants in Hawai'i with dispersal syndrome" [Celosia argentea; Disperal Syndrome - M = mechanical; Comments = fruit adhesive]

801	Prolific seed production (>1000/m2)	y
	Source(s)	**Notes**
	Ravindra, G. M., Sridhara, S., Girijesh, G. K., & Nanjappa, H. V. (2008). Weed biology and growth analysis of Celosia argentea L., a weed associated with groundnut and finger millet crops in southern India. Communications in Biometry and Crop Science, 3(2), 80-87	"It produces 2,000 to 3,000 seed plant-1 which add to the soil seed bank."
	Setyawati, T., Narulita, S., Bahri, I.P., & Raharjo, G. T. (2015). A Guide Book to Invasive Alien Plant Species in Indonesia. Research, Development, and Innovation Agency, Ministry of Environment and Forestry, Republic of Indonesia	"The seeds are extremely small, up to 43,000 seeds per ounce."

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	**Notes**
	Royal Botanic Gardens Kew. (2021) Seed Information Database (SID). Version 7.1. http://data.kew.org/sid/ . [Accessed 5 Mar 2021]	"Storage Behaviour: Orthodox"
	Grubben, G.J.H. & Denton, O.A. (ed.). 2004. Plant Resources of Tropical Africa. Volume 2. Vegetables. PROTA, Wageningen, Netherlands	[Possibly persists for >1 year, but longevity of seed bank not specified] "Seeds are mature in 10–20 weeks from sowing and shatter when the inflorescence is dry. They remain dormant on the soil surface until the start of the next rainy season."

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Zhenghao Xu & Meihua Deng. (2017). Identification and Control of Common Weeds: Volume 2. Zhejiang University Press, Hangzhou and Springer Nature, Singapore	"Chemical control can choose bromoxynil and bentazon."
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 5 Mar 2021]	"Suggested method of management and control. Dig out small infestations. Slash in winter and/or spray with 1% glyphosate + penetrant in spring to autumn. Follow up treatment until regrowth ceases. Follow-up seedling control. Use unplanned fire events to effectively control any regrowth."

Qsn #	Question	Answer
	Ahmed, S., & Chauhan, B. S. (2014). Performance of different herbicides in dry-seeded rice in Bangladesh. The Scientific World Journal, http://dx.doi.org/10.1155/2014/729418. [Accessed]	[Certain herbicides are effective] "Oxadiargyl was superior to other herbicides in reducing weed density and biomass of several individual weed species, including E. colona, Ageratum conyzoides, Amaranthus spinosus, Cleome rutidosperma, and Celosia argentea. The next best treatment was pendimethalin, which suppressed all weeds that were suppressed by oxadiargyl, except C. argentea and P. niruri."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**
	Western Australian Herbarium (1998–2021). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 5 Mar 2021]	[Information here suggests plants will regrow unless treated with herbicide] "Fire response. Resprouts." … "Suggested method of management and control. Dig out small infestations. Slash in winter and/or spray with 1% glyphosate + penetrant in spring to autumn. Follow up treatment until regrowth ceases. Follow-up seedling control. Use unplanned fire events to effectively control any regrowth."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. (2021). Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Broad climate suitability
• Grows, and able to spread, in regions with tropical climates
• Naturalized on Hawaii and Maui (Hawaiian Islands) and widely naturalized elsewhere
• A disturbance and crop weed
• Other Celosia species are invasive
• Allelopathic
• Tolerates many soil types
• Forms dense monocultures
• Prolific seed production
• Reaches maturity quickly (<1 year)
• Dispersed externally, but wind, water and as a seed contaminant, and intentionally cultivated
• May form a persistent seed bank (longevity undetermined)
• Resprouts after fires, and possibly after cutting

Low Risk Traits
• Despite weediness, valued as a food crop or ornamental
• Unarmed (no spines, thorns, or burrs)
• Palatable to animals and people
• Relatively shade-intolerant
• Not reported to spread vegetatively
• Herbicides may provide effective control