

The first weed management textbook in the United States (part 2)

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Intriguing World of Weeds

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Abstract

This article overviews the earliest weed management book published in the United States. The most problematic weeds of that era are named, along with suggestions for their control.

Introduction

This article is a continuation of a discussion of 19th-century weed science textbooks published in the United States. In the first of this series of articles, the first two textbooks with an emphasis on weed identification and biology/ecology published in the United States were reviewed (Byrd et al., [in press](#)). This second article focuses on the first weed science textbook that provides more detailed information on management of specific weeds.

Physician William Darlington's (1847) *Agricultural Botany* contained a few suggested weed management strategies, such as encouraging agriculturalists to prevent weed seed production, increase cultivated crop seeding rates to minimize areas for weed invasion, and remove weeds from cultivated or pastured areas. There weren't a lot of other options in the middle of the 19th century. The text *American Weeds*, revised by Thurber (Darlington and Thurber 1859), contained several pages focused on weed management suggestions pertinent at the time, albeit limited compared to current technology. A protégé of Dr. Darlington, also a physician, Ezra Michener (1872), wrote a more detailed management guide for weeds that plagued the agricultural community of that era.

Darlington requested the assistance of Ezra Michener in preparing his first botanical work, *Florula Cestricea* (Darlington 1826). Michener apparently had special interest in collecting and identifying lichens and other nonflowering plants (Harshberger 1899). Despite his interest in botany, Michener, like Darlington, ultimately became a physician. Michener's medical education and experience started when he was hired as an assistant to the apothecarist at the Philadelphia Dispensary while studying at the University of Pennsylvania (Michener 1893). He received his diploma in 1818 after an oral examination by five physicians (Michener 1893). In his autobiography, Dr. Michener (1893) describes himself as both a country doctor and a farm manager.

The Weed Exterminator

Dr. Michener's interest in botany was not forgotten, however. At the age of 78, Michener (1872) published *A Manual of Weeds; or, The Weed Exterminator*. In the preface to this book, Michener stated that his intent was not to compete with Darlington's (1847) *Agricultural Botany* but to create an inexpensive "Handbook of Weeds" practical for every young, intelligent farmer or gardener. He encouraged those who wanted more botanical knowledge to acquire and study *The Botanical Text-Book* (Gray 1842) and *How Plants Grow* (Gray 1858). However, given the limited weed management tools and technology available at the time, there was some duplication in the texts of both Darlington and Thurber (1859) and Michener (1872).

In *The Weed Exterminator*, Dr. Michener (1872) wrote 13 pages of general weed science concepts. He also stated that "every plant, out of place is a weed"—not worded exactly as Darlington and Thurber (1859) stated in their three-page weed science discussion, but there are only so many ways this can be stated. He then stated that because of the diversity of plants that could be weeds in any given environment, every plant should be studied to determine the best method of attack for control. He gave the example that tillage effectively controlled some plants, such as annual weeds, but that "Rhizomatous, Bulbiferous, or Tuberiferous" weed populations only increased following tillage, unless, after tillage, remaining vegetative fragments were removed from the field (Michener 1872). In essence, Michener attempted to explain to agriculturalists of the era that the practical and logical strategy for weed control should be based on the plant life cycle combined with an understanding of its reproduction mechanism(s). To achieve that end, he categorized four lists that totaled 100 plants he considered the most

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Table 1. Annual weeds with scientific and common names from *A Manual of Weeds* (Michener 1872) and current scientific and common names.

Michener (1872)		USDA-NRCS (2023) ^a	
Scientific name	Common name	Scientific name	Common name
<i>Papaver dubium</i> Linn.	field poppy	<i>Papaver dubium</i> L.	blindeyes
<i>Argemone Mexicana</i> Linn.	prickly poppy	<i>Argemone mexicana</i> L.	Mexican pricklypoppy
<i>Camelina sativa</i> Crantz.	wild flax, false flax	<i>Camelina sativa</i> (L.) Crantz	false flax
<i>Capsella bursa pastoris</i> Moench.	shepherd's purse	<i>Capsella bursa-pastoris</i> (L.) Medik.	shepherd's purse
<i>Lychnis githago</i> Lam.	cockle, rose campion	<i>Agrostemma githago</i> L. (WFO 2023a)	common corn cockle
<i>Portulacca oleracea</i> Linn.	common or garden purslane	<i>Portulaca oleracea</i> L.	little hogweed
<i>Abutilon avicennæ</i> Gaertn.	indian mallow, velvet-leaf	<i>Abutilon theophrasti</i> Medik.	velvetleaf
<i>Sida spinosa</i> Linn.	spinose sida	<i>Sida spinosa</i> L.	prickly fanpetals
<i>Sicyos angulata</i> Linn. ^b	wild cucumber, single-seed cucumber	<i>Sicyos angulatus</i> L.	oneseed bur cucumber
<i>Ambrosia trifida</i> Linn.	tall rag-weed	<i>Ambrosia trifida</i> L.	great ragweed
<i>Ambrosia artemisiifolia</i> Linn.	rag-weed, bitter-weed	<i>Ambrosia artemisiifolia</i> L.	annual ragweed
<i>Xanthium strumarium</i> Linn.	clot-bur, cockle-bur	<i>Xanthium strumarium</i> L.	rough cocklebur
<i>Xanthium spinosum</i> Linn.	thorny clot-bur	<i>Xanthium spinosum</i> L.	spiny cocklebur
<i>Bidens frondosum</i> Linn. ^c	bur-marigold	<i>Bidens frondosa</i> L.	devil's beggarticks
<i>Bidens bi-pinnatum</i> Linn. ^d	Spanish needles	<i>Bidens bipinnata</i> L.	Spanish needles
<i>Maruta cotula</i> D.C.	dog's fennel, stinking chamomile	<i>Anthemis cotula</i> L.	stinking chamomile
<i>Erechtites hieracifolia</i> Raf.	fire-weed	<i>Erechtites hieracifolia</i> (L.) Raf. ex DC.	American burnweed
<i>Sonchus oleraceus</i> Linn.	common sow thistle	<i>Sonchus oleraceus</i> L.	common sowthistle
<i>Lithospermum arvense</i> Linn.	stone-seed, pigeon-weed, gromwell	<i>Buglossoides arvensis</i> (L.) I.M. Johnst.	corn gromwell
<i>Datura stramonium</i> Linn.	James-town weed, thorn apple	<i>Datura stramonium</i> L.	jimsonweed
<i>Solanum nigrum</i> Linn.	common night-shade	<i>Solanum nigrum</i> L.	black nightshade
<i>Chenopodium album</i> Linn.	Lambs'-quarters	<i>Chenopodium album</i> L.	lambsquarters
<i>Amaranthus hybridus</i> Linn.	pig-weed	<i>Amaranthus hybridus</i> L.	slim amaranth
<i>Amaranthus spinosus</i> Linn.	thorny amaranthus	<i>Amaranthus spinosus</i> L.	spiny amaranth
<i>Polygonum arifolium</i> Linn.	halbert-leaved tear-thumb	<i>Polygonum arifolium</i> L.	halberdleaf tearthumb
<i>Euphorbia hypericifolia</i> Linn.	field euphorbia	<i>Chamaesyce hypericifolia</i> (L.) Millsp.	graceful sandmat
<i>Cenchrus tribuloides</i> Linn.	bur-grass, hedge-hog grass	<i>Cenchrus tribuloides</i> L.	sanddune sandbur

^aUnless other reference given.

^b*Sicyos angulata* written in Michener's tabular list of plants but written *S. angulatus* in plant descriptions.

^c*Bidens frondosum* written in Michener's tabular list of plants but written *B. frondosa* in plant descriptions.

^d*Bidens bi-pinnatum* written in Michener's tabular list of plants but written *B. pinnata* in plant descriptions.

common and troublesome weeds. The weeds from Michener's tables, with scientific and common names he provided and current scientific and common names, are presented in Tables 1 to 4. Those lists included 27 annuals (Table 1), 23 biannuals (biennials) (Table 2), 28 per-annuals (nonspreading herbaceous or woody perennials) (Table 3), and 22 bi-per-annuals (rhizome-, bulb-, or tuber-producing perennials, i.e., creeping perennials) (Table 4).

General Weed Science Principles

Michener (1872) offered eight general weed management suggestions. First, he wrote, never allow weeds to produce and sow seeds. For his second point, he used his medical experience as he paralleled infestations of some weeds to leprous spots and stated that tillage should be avoided to eliminate spreading vegetative fragments into areas of the field not infested. Third, Dr. Michener suggested to prioritize removing all perennial weed roots from infested fields, followed by frequent scouting to remove any new shoots. Fourth, he wrote that leaves are the primary source of plant "digestion, assimilation and respiration" and the most accessible and vulnerable part of the plant to remove. Fifth, he recommended eliminating leaves as soon as they form to starve weed roots. Michener suggested that a key to weed control is preventing leaf production. He included information from and quoted from a letter written by Caleb Bemet (1843) of Three-hills Farm in New York that was published in the October 15 *Farmers' Cabinet*, and *American Herd-book* about Canada thistle [*Cirsium arvense* (L.) Scop.] control; Bernet stated that leaves are as essential to plants as lungs are to animals and that leaves and roots are mutually

dependent. He stated that Canada thistle had been eradicated (and could be by other agriculturalists) by continuously removing all leaves and stalks during June, July, and September for one or two seasons. As a sixth recommendation, Michener (1872) suggested hand removal; hoeing in gardens; or plowing, cultivating, and harrowing fields as the best methods to prevent weed leaf formation. He also suggested that suffocation (i.e., mulch with straw or bagasse) or the addition of poisons (spent tan) may also be used. His sixth suggestion also included the recommendation of a practice of "high farming," which was described as production practices that encourage luxuriant crop growth to "suffocate" weeds. The seventh of Michener's recommendations was "other subordinate means" noted in his book. The eighth and final recommendation was a reminder that weed seed buried in the soil seedbank would be exposed by tillage and would germinate after the farmer thought weeds had been eradicated, so one should continue to scout for and remove new weeds that emerge.

Agricultural Boards of Health Proposed

In the final pages of general weed management concepts, Michener (1872) stated that noxious weeds infesting farmland was not just a local problem nor a problem limited to agricultural interests but a national problem. He wrote that many acres of highly productive farmland had become useless because some landowners failed to prioritize weed control. His philosophy was that noxious weeds were a national problem that would not be solved without laws enforced to mandate control. Again, drawing on his training and experience as a physician, he made the analogy that municipalities

Table 2. Biannual weeds with scientific and common names from *A Manual of Weeds* (Michener 1872) and current scientific and common names.

Michener (1872)		USDA-NRCS (2023) ^a	
Scientific name	Common name	Scientific name	Common name
<i>Oenothera biennis</i> Linn.	evening primrose	<i>Oenothera biennis</i> L.	common evening primrose
<i>Daucus carota</i> Linn.	Garden carrot, wild carrot	<i>Daucus carota</i> L.	Queen Anne's lace
<i>Heracleum lanatum</i> Mx.	cow-parsnip	<i>Heracleum maximum</i> W. Bartram	common cowparsnip
<i>Archemora rigida</i> D.C.	cow's-bane	<i>Oxypolis rigidior</i> (L.) Raf. (WFO 2023c)	stiff cowbane
<i>Archangelica atropurpurea</i> Hoffm.	purple archangelica	<i>Angelica atropurpurea</i> L. (WFO 2023b)	purplestem angelica
<i>Æthusa cynapium</i> Linn.	fools parsley	<i>Aethusa cynapium</i> L.	fool's parsley
<i>Cicuta maculata</i> Linn.	water hemlock	<i>Cicuta maculata</i> L.	spotted water hemlock
<i>Conium maculatum</i> Linn.	poison hemlock	<i>Conium maculatum</i> L.	poison hemlock
<i>Dipsacus sylvestris</i> Mill.	wild teasel	<i>Dipsacus fullonum</i> L.	Fuller's teasel
<i>Dipsacus fullorum</i> Mill. ^b	Fuller's teasel	<i>Dipsacus fullonum</i> L.	Fuller's teasel
<i>Cirsium lanceolatum</i> Scop.	common thistle	<i>Cirsium vulgare</i> (Savi) Ten.	bull thistle
<i>Cirsium discolor</i> Spreng.	two-colored thistle	<i>Cirsium discolor</i> (Muhl. ex Willd.) Spreng.	field thistle
<i>Cirsium altissimum</i> Spreng.	tall thistle	<i>Cirsium altissimum</i> (L.) Hill	tall thistle
<i>Cirsium muticum</i> Mx.	pointless thistle	<i>Cirsium muticum</i> Michx.	swamp thistle
<i>Cirsium pumilum</i> Spreng.	dwarf thistle	<i>Cirsium pumilum</i> Spreng.	pasture thistle
<i>Cirsium horridulum</i> Mx.	yellow thistle	<i>Cirsium horridulum</i> Michx.	yellow thistle
<i>Onopordum acanthium</i> Linn.	cotton thistle	<i>Onopordum acanthium</i> L.	Scotch cottonthistle
<i>Plantago major</i> Linn.	common plantain	<i>Plantago major</i> L.	common plantain
<i>Verbascum thapsus</i> Linn.	common mullein	<i>Verbascum thapsus</i> L.	common mullein
<i>Verbascum blattaria</i> Linn.	moth mullein	<i>Verbascum blattaria</i> L.	moth mullein
<i>Echium vulgare</i> Linn.	viper's bugloss, blue devils	<i>Echium vulgare</i> L.	common viper's bugloss
<i>Bromus secalinus</i> Linn.	cheat-grass, chess	<i>Bromus secalinus</i> L.	rye brome
<i>Lolium temulentum</i> Linn.	darnel, bearded darnel	<i>Lolium temulentum</i> L.	Darnel ryegrass

^aUnless other reference given.^bPossible typographical error spelling or poor electronic scan of *Dipsacus fullonum* in Michener's text.**Table 3.** Per-annual weeds with scientific and common names from *A Manual of Weeds* (Michener 1872) and current scientific and common names.

Michener (1872)		USDA-NRCS (2023) ^a	
Scientific name	Common name	Scientific name	Common name
<i>Memespermum canadense</i> Linn.	moon-seed	<i>Menispermum canadense</i> L.	common moonseed
<i>Hypericum perforatum</i> Linn.	St. John's wort	<i>Hypericum perforatum</i> L.	common St. Johnswort
<i>Malva rotundifolia</i> Linn.	running mallow	<i>Malva neglecta</i> Wallr. or <i>M. pusilla</i> Sm.	common mallow or low mallow
<i>Rhus glabra</i> Linn.	common sumac	<i>Rhus glabra</i> L.	smooth sumac
<i>Rhus venenata</i> D.C.	swamp sumach, poison sumach	<i>Toxicodendron vernix</i> (L.) Kuntze (WFO 2023h)	poison sumac
<i>Rhus toxicodendron</i> Linn.	poison vine, poison ivy	<i>Toxicodendron pubescens</i> Mill.	Atlantic poison oak
<i>Rubus villosus</i> Ait.	common blackberry	<i>Rubus flagellaris</i> Willd.	northern dewberry
<i>Rubus canadensis</i> Linn.	running brier, dewberry	<i>Rubus canadensis</i> L.	smooth blackberry
<i>Rosa carolina</i> Linn.	swamp rose	<i>Rosa carolina</i> L.	Carolina rose
<i>Vernonia noveboracensis</i> Wild.	iron weed	<i>Vernonia noveboracensis</i> (L.) Michx.	New York ironweed
<i>Eupatorium perfoliatum</i> Linn.	thorough stem, bone-set	<i>Eupatorium perfoliatum</i> L.	common boneset
<i>Eupatorium purpureum</i> Linn.	purple eupatorium	<i>Eutrochium purpureum</i> (L.) E.E. Lamont	sweet-scented joe pye weed
<i>Aster ericoides</i> Linn.	heath aster, field aster	<i>Symphotrichum ericoides</i> (L.) G.L. Nesom var. <i>ericoides</i>	white heath aster
<i>Solidago nemoralis</i> Ait.	field solidago, golden rod	<i>Solidago nemoralis</i> Aiton	gray goldenrod
<i>Leucanthemum vulgare</i> Lam.	ox-eye daisy, white-weed	<i>Leucanthemum vulgare</i> Lam.	oxeye daisy
<i>Lappa major</i> Gaertn	common burdock	<i>Arctium lappa</i> L.	greater burdock
<i>Taraxacum dens leonis</i> Desf.	dandelion	<i>Taraxacum officinale</i> F.H. Wigg. (WFO 2023g)	common dandelion
<i>Verbena hastata</i> Linn.	blue vervain	<i>Verbena hastata</i> L.	swamp vervain
<i>Verbena urticifolia</i> Linn.	common vervain	<i>Verbena urticifolia</i> L.	white vervain
<i>Leonurus cardiaca</i> Linn.	mother-wort	<i>Leonurus cardiaca</i> L.	common motherwort
<i>Leonurus marrubiastrum</i> Linn.		<i>Chaiturus marrubiastrum</i> (L.) Rchb.	lion's tail
<i>Cynoglossum morissonii</i> D.C. ^b	beggars' lice	<i>Hackelia virginiana</i> (L.) I.M. Johnst. (WFO 2023d)	beggarslice
<i>Solanum dulcamara</i> Linn.	bitter-sweet	<i>Solanum dulcamara</i> L.	climbing nightshade
<i>Asclepias incarnata</i> Linn.	swamp milk-weed	<i>Asclepias incarnata</i> L.	swamp milkweed
<i>Phytolacca decandra</i> Linn.	common poke	<i>Phytolacca americana</i> L. var. <i>americana</i>	American pokeweed
<i>Rumex crispus</i> Linn.	sour dock, curled dock	<i>Rumex crispus</i> L.	curly dock
<i>Rumex obtusifolius</i> Linn.	bitter dock	<i>Rumex obtusifolius</i> L.	bitter dock
<i>Symplocarpus foetidus</i> Salisb.	swamp cabbage, skunk cabbage	<i>Symplocarpus foetidus</i> (L.) Salisb. ex W.P.C. Barton	skunk cabbage

^aUnless other reference given.^b*Cynoglossum morissonii* written in Michener's tabular list of plants but written *C. morisoni* in plant descriptions.

Table 4. Bi-per-annual weeds with scientific and common names from *A Manual of Weeds* (Michener 1872) and current scientific and common names.

Michener (1872)		USDA-NRCS (2023) ^a	
Scientific name	Common name	Scientific name	Common name
<i>Rhizomatous</i>			
<i>Saponaria officinalis</i> Linn.	soap-wort	<i>Saponaria officinalis</i> L.	bouncingbet
<i>Ægopodium podagraria</i> Linn.	goats-foot, ground-ash	<i>Aegopodium podagraria</i> L.	bishop's goutweed
<i>Sambucus canadensis</i> Linn.	common elder	<i>Sambucus nigra</i> L. ssp. <i>canadensis</i> (L.) R. Bolli	American black elderberry
<i>Achillea millefolium</i> Linn.	yarrow, milfoil	<i>Achillea millefolium</i> L.	common yarrow
<i>Cirsium arvense</i> Scop.	Canada thistle, field thistle	<i>Cirsium arvense</i> (L.) Scop.	Canada thistle
<i>Linaria vulgaris</i> Mill.	toad flax, ranstead weed	<i>Linaria vulgaris</i> Mill.	butter and eggs
<i>Teucrium canadense</i> Linn.	wood-sage, germander	<i>Teucrium canadense</i> L.	Canada germander
<i>Calystegia sepium</i>	hedge bind-weed	<i>Calystegia sepium</i> (L.) R. Br.	hedge false bindweed
<i>Calystegia pubescens</i>	California rose, Mexican rose	<i>Calystegia hederacea</i> Wall.	Japanese false bindweed
<i>Convolvulus arvensis</i> Linn.	field bind-weed	<i>Convolvulus arvensis</i> L.	field bindweed
<i>Solanum carolinense</i> Linn.	horse nettle	<i>Solanum carolinense</i> L.	Carolina horsenettle
<i>Apocynum androsaemifolium</i> Linn.	dog's-bane	<i>Apocynum androsaemifolium</i> L.	spreading dogbane
<i>Apocynum cannabinum</i> Linn.	Indian hemp	<i>Apocynum cannabinum</i> L.	Indianhemp
<i>Asclepias phytolaccoides</i> Parsh.	poke-leaved asclepias	<i>Asclepias exaltata</i> L.	poke milkweed
<i>Cynodon dactylon</i> Pers.	Bermuda grass, dog-tooth grass	<i>Cynodon dactylon</i> (L.) Pers.	bermudagrass
<i>Triticum repens</i> Linn.	couch grass, squitch grass	<i>Elymus repens</i> (L.) Gould	quackgrass
<i>Bulbiferous</i>			
<i>Ranunculus bulbosus</i> Linn.	butter-cups, crow-foot	<i>Ranunculus bulbosus</i> L.	St. Anthony's turnip
<i>Ornithogalum umbellatum</i> Linn.	ten-o'clock	<i>Ornithogalum umbellatum</i> L.	star of Bethlehem
<i>Allium vineale</i> Linn.	field garlic	<i>Allium vineale</i> L.	wild garlic
<i>Cyperus strigosus</i> Linn.	bristly galingale	<i>Cyperus strigosus</i> L.	strawcolored flatsedge
<i>Tuberiferous</i>			
<i>Cyperus repens</i> Elliott.	nut grass	<i>Cyperus esculentus</i> L. (WFO 2023f)	yellow nutsedge
<i>Cyperus hydra</i> Mix.	coco grass	<i>Cyperus rotundus</i> L. (WFO 2023e)	purple nutsedge

^aUnless other reference given.

had the authority to impose quarantine laws against invasion of human or animal diseases, could rigidly enforce hygiene regulations, and could even forcibly remove occupants from their premises if the threat of highly infectious disease existed. He proposed that similar authority should exist to govern the “health” of plant agriculture in farm districts. Michener recommended that “Agricultural Boards of Health” be established in districts to inspect, oversee, and regulate clean crop seed and grain sales with additional responsibility to inspect farms for noxious weeds. These boards of health would have the authority and resources to temporarily remove landowners who failed to control problematic weeds on their property. He suggested that property management be assigned to agricultural health board “agents” to remove the noxious weeds from the neglected land. Agents would be compensated either by revenue generated from the sale of the cleaned crop or from a general fund managed by the board and were essential to protecting the district's resources.

Weeds and Specific Management Suggestions

Weeds described in the pages following Dr. Michener's (1872) general weed management suggestions were written in the Linnean arrangement of plants similar to that of *Agricultural Botany* (Darlington 1847), *American Weeds and Useful Plants* (Darlington and Thurber 1859), and Gray's (1842) *Botanical Text-Book*. Like these earlier texts, Michener (1872) provided scientific names, life cycles, botanical descriptions, habitats, common names, sources or origins of introduced plants when known, flower and/or fruiting periods, and general observations of the 100 weeds he viewed as most important for American agriculturalists. Michener's text differs from Darlington and Thurber's (1859) *American Weeds* as no images were provided to assist with weed identification. Two additional differences exist between Michener's (1872) text and the earlier texts by Darlington (1847) and Darlington and Thurber

(1859). First, Michener's (1872) text is focused solely on the plants he considered weeds, whereas Darlington (1847) and Darlington and Thurber (1859) described both weeds and plants considered useful for other purposes. The second and perhaps more important difference is that despite limited control options in the late 19th century, Michener (1872) attempted to relate management suggestions to control most of the weeds described in *The Weed Exterminator*.

Weeds known or thought to be toxic to humans or livestock are documented in Michener's (1872) as well as Darlington's (1847) and Darlington and Thurber's (1859) texts. Michener (1872) indicated toxicity for weeds, such as common moonseed (*Menispermum canadense* L.), poison sumac [*Toxicodendron vernix* (L.) Kuntze, synonym of *Rhus venenata* DC.; WFO 2023h], Atlantic poison oak (*Toxicodendron pubescens* Mill., synonym of *Rhus toxicodendron* L.; USDA-NRCS 2023), spotted water hemlock (*Cicuta maculata* L.), poison hemlock (*Conium maculatum* L.), black nightshade (*Solanum nigrum* L.), climbing nightshade (*Solanum dulcamara* L.), Darnel ryegrass (*Lolium temulentum* L.), and common St. Johnswort (*Hypericum perforatum* L.), thought to cause scabs and cutaneous ulcers on white-skinned feet and the noses of cattle and horses. Michener (1872) stated that his experiences and observations of populations of common St. Johnswort in the years following 1842 differed from those Darlington (1847) shared in *Agricultural Botany*. These two authors' observations paralleled in the fact that although populations of common St. Johnswort had been abundant for many years, it did not emerge in 1842. Darlington speculated that it did not emerge anywhere in the entire state of Pennsylvania in 1842, with only sparse populations in 1843. However, common St. Johnswort was again abundant by the time his text was published in 1847. By comparison, Michener (1872: 8) reported that populations of common St. Johnswort were sparse as long as 3 decades after 1842, relating that housewives had not found



Figure 1. Illustration showing the use of an implement to uproot shrubs from *Systema Agriculturae* (Worlidge 1687).

sufficient quantities to “keep up a supply of ‘Red Oil’ to treat corns and burned fingers.”

Michener (1872) did not provide specific management suggestions for every weed he described in his book. For several species of weeds, Michener recommended careful monitoring for volunteers or escaped plants of plants intentionally cultivated, such as common evening primrose (*Oenothera biennis* L.), Mexican pricklypoppy (*Argemone mexicana* L.), and several others. He recommended hoeing, hand removal, scythe, cultivation, and so on to prevent seed production from weeds like lambsquarters (*Chenopodium album* L.), slim amaranth (*Amaranthus hybridus* L.), velvetleaf (*Abutilon theophrasti* Medik.), and Fuller’s teasel (*Dipsacus fullonum* L.). Hand removal was specifically recommended for blindeyes (*Papaver dubium* L.), little hogweed (*Portulaca oleracea* L.), devil’s beggarticks (*Bidens frondosa* L.), common mullein (*Verbascum thapsus* L.), and moth mullein (*Verbascum blattaria* L.) to prevent seed production and seed rain from these plants. Michener mentioned several farm and garden implements useful for management in his recommendations for various weeds, including the grubbing hoe, fork-spade, horse-hoe, cultivator, plow, harrow, “dock-spit,” and mower. Michener provided neither a description of nor use instructions for the “dock-spit” in his textbook. The authors believe this to be a smaller variation of an implement John Worlidge (1687) credited Gabriel Platt for inventing to uproot shrubs and similar weedy vegetation which he described and illustrated in *Systema Agriculturae* (Figure 1). A variation of this tool specifically associated with uprooting dock was later described by Pitt (1806), but he called it a docking iron (Figure 2). Loudon (1871)

also briefly described the device in *An Encyclopedia of Agriculture* (Figure 3).

Michener (1872) also stated that it was good practice to have a “brush-heap” on which weed biomass could be piled to periodically burn, that is, to practice field sanitation. But he related his own failed experience burning Scotch cottonthistle (*Onopordum acanthium* L.) biomass (“I thought I had burned every seed it produced”; Michener 1872: 59): one or more volunteer plants emerged every year for 12 yr. His experience with Scotch cottonthistle also helped him realize the potential negative effect of introducing plants of “doubtful character” to the farm, garden, or landscape. Michener’s failure to eradicate Scotch cottonthistle was not the only reason he was convinced that burning would not eliminate all perennial weeds. He also related John Bartram’s observation with butter and eggs (*Linaria vulgaris* Mill.) in his text. Although Michener did not state the source, he quoted portions of a letter dated June 16, 1758, in which John Bartram wrote Philip Miller a list of the most troublesome plants of Pennsylvania pastures and fields (Darlington 1849). In that letter, Bartram stated that butter and eggs, “the most hurtful plant” in northern pastures, could not be eradicated from pastures by “spade, plough nor hoe” nor by “burning log piles that burned the earth” 0.15 m (“half a foot deep”) (66), after which populations reemerged densely enough to prevent grass growth. However, Michener (1872) then went on to relate his success eradicating butter and eggs by smothering a population 10 m² (“2 rods square”) with piles of weed stubble 1.5 m (“5 feet”) deep over the infested area, to which he added 50 bushels

observations; I shall therefore only slightly touch upon the several particulars: upon fallows some observations are made above; respecting fold-yard manure, it should always undergo a fermentation before laying on the land, sufficient to prevent the future vegetation of any seeds that may be contained therein; but it should also be kept as free as possible from the seeds of weeds, and perhaps it is best laid on grass land, applying only lime, or other manures certain of being clean, to fallows; or if dung not certainly clean from seeds be laid on fallows, it should be laid on early enough to give time to the seeds to vegetate and spend themselves before sowing for the crop. Every one knows the necessity of clean seed to producing a clean crop, but sometimes neglect to apply such knowledge, and indeed clean seed is not always to be procured. Short tillages are universally approved in theory, but sometimes the idea of present advantage tempts a deviation in practice. Weeding of crops is generally imperfectly performed, and likely to continue so in many places, from the difficulty of procuring hands enough for work only temporary; thistles are generally only cut off, but they should always be drawn up by tongs, and other weeds by hand: the hoe has yet been only of general use in turnips, nor is it likely to extend farther, unless the drill husbandry should be more established, nor even in its present application can hands enough be always procured at reasonable rates. In the laying down of land to grass, the importance of clean seed is well understood, yet the seeds of docks are often sown with clover, and those of other pernicious plants with ray-grass: in the weeding of grass land, docks and thistles are often mown, or only cut off, but they should always be rooted up; for which purpose **docking irons** are formed upon a construction proper enough; they are, I suppose, every where understood, consisting of a forked or clefted spike of iron, jagged within the cleft, and fixed to the end of a wooden lever; this being forced down by the hand or foot, so as to inclose the root of a dock, or large thistle, will easily bring it up, particularly after rain; but mowing them off, being done with more expedition, is often practised, and they are sometimes left undisturbed, and suffered to scatter their seeds without any effort being made to prevent it.

Upon breaking up a turf, it is understood here, that unless a wheat fallow or a turnip crop compose a part of the tillage, the land will be injured and rendered fouler, and more addicted to produce weeds; this notion is, I believe, a just one, though often deviated from in practice for the sake of present profit, and under the idea of cleaning the land again next tillage; it is, however, well ascertained, that

Figure 2. Description of the docking iron from “On the Subject of Weeding” (Pitt 1806: 256).

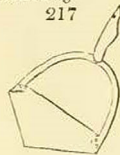
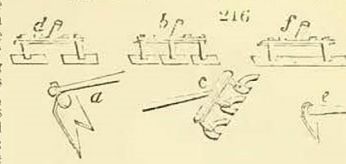
magnesium lime, then let cattle trample the area in autumn of the next year. He also related that a small infestation of butter and eggs had been eradicated from his garden after only 5 yr of attentive cultivation, which entailed removal of every piece of the plant and thread of root as short as 2.5 cm (1 in.).

Another recommendation Michener (1872) suggested as a management practice for weeds such as sheperd’s purse [*Capsella bursa-pastoris* (L.) Medik.], common dandelion (*Taraxacum officinale* F.H. Wigg.), and wild garlic (*Allium vineale* L.) was use of production practices he termed “high farming.” High farming was explained as part of his management suggestions for wild garlic, which included the addition of lime, plaster, and “the farrago of modern fertilizers” (100) to agricultural lands to crowd out or smother noxious weeds, a relatively new agricultural practice. *Webster’s New Dictionary of the English Language* defines *farrago* as a “confused collection.” Tilden (1867) explained “high farming” as maximizing production inputs to maximize productivity of small farms, rather than increasing farm size with lower production inputs, using farm practices in the Netherlands as the example.

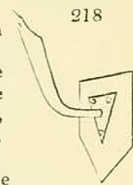
Michener (1872) also stated in the management recommendation for wild garlic as well as for star of Bethlehem (*Ornithogalum umbellatum* L.), another bulbous weed, that in addition to high farming, fields overrun with these two weeds had been cleaned by planting oats two consecutive seasons.

Observations and management suggestions for annual ragweed (*Ambrosia artemisiifolia* L.), which Michener (1872) described as “The Weed” most abundant in American farmland, were that tillage appeared to encourage emergence of annual ragweed, whereas competitive grass crops, such as grains, reduced the populations by smothering. He was uncertain if the soil seedbank contained abundant quantities of seed for population emergence or if annual seed production resulted in these dense populations. He related the weed management strategy shared with him by a deceased housekeeper, whom he held in high regard, who related that she prevented the production of seed by any weed in her garden 7 yr and as a result had minimal weed pressure. He speculated that this method could work to reduce annual ragweed presence.

has been recommended as adapted to thin either at a greater or less distance, according to the depth it is thrust into the soil. Lord Somerville recommends the forked tool (fig. 215. a.) or heavy hoe, used in the vineyards on the Continent; but it is an implement more oppressive to the cultivator than a spade, as it requires him to stoop very low. Duckett, jun. recommends a treble hoe (b) for thinning; another of a different description (c) for making drills by drawing; one for making them by striking in a line, in order to form a trench for dung and potatoes (f); one for forming a drill in the common way (e); and, lastly, one for hoeing both sides of a drill at once (d). It is said that by this last tool two acres of barley may be hoed in a day, and that it makes good work among oats or wheat; but such hoeing, even on the slightest soils, can be little more than a mere scraping of the surface; and though the weeds may be cut, yet this is only one object of hoeing.

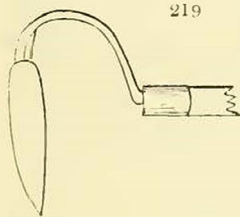


2460. The Dutch hoe is more frequently used in gardening than in agriculture; but, as it may sometimes be found preferable to the spade or dew-hoe, in cutting the weeds at the roots of young hedges and trees, where it is not desirable to stir the soil more than an inch deep, we shall introduce a figure of the most improved form (fig. 217.)



2461. The thrust hoe (fig. 218.) is an improvement on the Dutch hoe. (Gard. Mag. vol. i. p. 343.)

2462. The Spanish hoe (fig. 219.) may be usefully employed on some occasions in stirring the soil among potatoes, where roots and weeds are abundant. To render stooping unnecessary, it should have a long handle. (Gard. Mag. vol. ii. p. 65.)

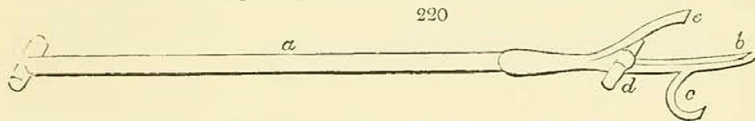


2463. The hoe-fork may be used as the Spanish hoe, and is most valuable where the roots of couch-grass abound. (Gard. Mag. vol. ii.)

2464. The scraper may be described as a broad hoe, of treble the usual size and strength, used in cleaning roads or court-yards, and sometimes in cleaning grassy surfaces. One with the ends of the blade turned inwards an inch or two is found more effective in scraping the mud or dust from roads.

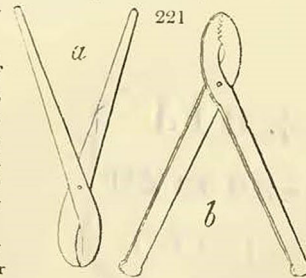
2465. Of weeding-tools used in agriculture there are three or four kinds; one with a long handle and fulcrum to the blade, for digging docks and other tap-rooted plants from pastures; a common spud or spadlet for cutting smaller weeds in hedges or standing corn; a thistle-spud for cutting and rooting out thistles in pastures; besides short-handled weeders of different kinds, to be used in hand-weeding young and delicate broad-cast crops, as onions, &c. in stiff soils.

2466. Baker's thistle extirpator (fig. 220.) is an effective implement where that weed



abounds. It consists of a handle about four feet six inches long (a), claws between which the thistle is received (b), a fulcrum over which the purchase is obtained for extracting the root (c), and an iron rod or bar upon which the foot is placed to thrust the claws into the ground (d). In case the root of the thistle breaks while the operator is endeavouring to extract it, there is a curved blade, which has a sharp end like a chisel (e), which is thrust into the ground, in order to cut off the underground stem, some inches below the surface, and thus prevent or retard the re-appearance of the weed.

2467. Weeding-pincers, or thistle-drawers (fig. 221. a, b) are sometimes used for pulling thistles out of hedges and from among standing corn: the handles are about two feet six inches long, and the blades are faced with plate iron made rough by cross channels or indentations. There is a variety of this implement called the Havre pincers b, which is used in France both for pulling thistles and other weeds, and for taking tench and eels from the ponds. (Thouin.)



2468. The besoms used in farming are commonly small faggots with handles, formed of birch spray, for the stables and cattle-houses, and of broom, heath, straw, &c. for the barns.

2469. The straw-rope-twister, or twisting-crook (fig. 222.) is used for twisting straw ropes, and consists of a stick or rod from two to three feet long, and from one inch to

Figure 3. Description of a tool to uproot dock from "Of the Implements of Manual Labour Used in Agriculture" (Loudon 1871: 371).

Another strategy Michener (1872) used to encourage agriculturalists to control weeds was psychological. In fact, by today's standards, some may call it bullying. He used terms or phrases, such as "sluggard occupant," "negligent," "a reproach," "indolent,"

"slovenly," "would-be farmer," "poorer cultivator," "lazy man," to imply that the presence of certain weeds was an indication of poor management. Webster's New Dictionary of the English Language defines slovenly as untidy or lazily or carelessly done. This is likely

the rationale for Michener's (1872) suggestion that farms be inspected for noxious weeds and crop management confiscated by agents of the agricultural boards of health until noxious weeds were removed. His attitude toward spiny cocklebur (*Xanthium spinosum* L.), which he encountered at Port Deposit, Maryland, on the Susquehanna River, was that every citizen should defend the country's best interest against such pests. Furthermore, he stated, "it behooves every good citizen, to extirpate it, wherever it may appear" (42). He went on to share his disbelief that spiny cocklebur had become such a nuisance in the streets of an unnamed city that an ordinance was enacted by city officials in which the plant was denounced as Canada thistle (Michener 1872).

Michener (1872) wrote almost two pages regarding management of oxeye daisy (*Leucanthemum vulgare* Lam.), which he indicated was widely dispersed. He stated that hand removal, digging, plowing, and mowing were effective methods of control. However, he warned that this weed matured seed while still in bloom and therefore must be removed and deposited onto a burn pile before flowering. He also related the experience of his neighbor, who, with two small boys, removed every oxeye daisy from the field, roadside, and every place that could not be plowed and subdued the problem in "a very few years (8 or 10)" (49).

In a lengthy explanation of the mischievous formation of rhizomes by Canada thistle, Michener (1872) labeled the weed one of the most vile of American agriculture. He advised agriculturalists never to allow any thistle to produce seed and to plow, harrow, or fork-spade to thoroughly pulverize soil every few days throughout the season and the next if needed and to hand pick all to remove all roots exposed on the soil surface. Michener even went on to recommend a herbicide treatment of a small handful of a mixture of 3 parts salt (NaCl) to 1 part "copperas" (FeSO₄) to Canada thistle "parent" stalks after cutting the stalk below the soil surface with a chisel-shaped tool. He hoped this mixture would be translocated to shoots sprouting from the rhizome, "the juices of the parent carrying the poison to its attached and still dependent offspring" (57).

Michener (1872) quoted almost an entire page on the observations Curtis (1777–1798) shared in *Flora Londinensis* about the invasiveness and crop competition of field bindweed (*Convolvulus arvensis* L.). He described field bindweed as having "indomitable vitality," then stated that the only method of bindweed eradication was "suffocation"—either smothering the weed with weeds or rubbish or "incessantly stirring" soil, taking care not to spread the rhizomes further in the process.

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The Prognosticks of Dearth, Scarcity, Plenty, Sickness, Heat, Cold, Frost, Snow, Winds, Rain, Hail, Thunder, etc. and Dictionarium Rusticum: or The Interpretation of Rustick Terms. The Whole Work being a Great Use and Advantage to All that Delight in that Most Noble Practise. London. 140 p