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Chapter

24

Seed Collection, Cleaning, and Storage

Seed Collection

Acquisition of quality seed in the quantity needed is essential for successful restoration and revegetation programs. Seed is grown and harvested as a crop, or collected from native stands. In the past, when native species were seeded, it was either collect the seed yourself, or go without. Now, there are dealers who supply seed of many native species on a regular basis. Some seed companies will contract for collection of specific species.

There are many grass and forb species that are cultivated for seed. Some of the more common species are: bluebunch wheatgrass, crested and desert wheatgrass, pubescent wheatgrass, intermediate wheatgrass, Russian wildrye, smooth brome, orchardgrass, Indian ricegrass, alfalfa, arrowleaf balsamroot, small burnet, Palmer penstemon, Rocky Mountain penstemon, Lewis flax, cicer milkvetch, crownvetch, Utah sweetvetch, and sainfoin. Seed of a few shrubs, including mountain and Wyoming big sagebrush, fourwing saltbush, and antelope bitterbrush are sometimes produced in orchards. Seed of many shrubs and forbs, and a few grass species are available only from native stands (table 1).



Table 1—Selected seed characteristics, seed collection, and seed cleaning requirements for important Intermountain grasses, forbs, and shrubs.

Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Grasses												
Barley, bulbous	90	60	3	40,770	7/1-8/15	1-2-5	6-1-3	Spikelet	Floret	2	N	N
Bentgrass, red	90	90	2	4,851,200	7/15-9/15	1-2-4	6-2-9	Floret	Floret	2	U	U
Bluegrass, big	90	70	3	843,000	7/1-8/15	1-4-5	6-2-4	Floret	Floret	4	U	U
Bluegrass, Canada	90	80	3	1,998,240	8/1-9/30	1-4-5	6-2-4	Floret	Floret	2	Y,0,1	Y,1-2,0
Bluegrass, Sandberg	95	85	2	925,000	6/15-7/30	1-4-5	6-2-4	Floret	Floret	2	Y,0,1	Y,1-2,0
Brome, meadow	90	85	1	118,745	7/15-8/30	1-2-4-5	6-2-4	Floret	Floret less awn	2	Y,0,1	Y,1-2,0
Brome, mountain	95	90	1	60,475	8/1-9/15	1-2-4-5	6-2-4	Floret	Floret less awn	4	Y,0,1	Y,0,1
Brome, smooth	95	90	1	135,600	7/20-9/30	1-4-5	6-2-4	Floret	Floret	4	Y,0,1	Y,1-2,0
Brome, subalpine	90	80	2	120,640	8/1-9/15	1-2-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,0,1
Dropseed, sand	90	80	3	5,600,000	9/1-10/30	1-4-5	6-2-4	Grain	Grain	3	Y,0,1	Y,4,0
Fescue, desert	95	85	2	162,000	7/20-9/30	1-4-5	6-2-4	Floret	Floret	2	U	U
Fescue, hard sheep	95	85	2	633,520	7/10-8/30	1-4-5	6-2-4	Floret	Floret less awn	2	Y,0,1	Y,2-4,0
Fescue, Idaho	95	85	2	497,370	7/1-8/30	1-4-5	6-2-4	Floret	Floret less awn	2	Y,0,1	Y,2-4,0
Fescue, sheep	95	85	2	680,000	7/10-8/30	1-4-5	6-2-4	Floret	Floret less awn	2	Y,0,1	Y,2-4,0
Foxtail, meadow	90	80	2	440,390	7/1-8/15	1-4	6-2-4	Spikelet	Spikelet less awns	3	Y,0,1	Y,2-4,0
Foxtail, reed	90	80	2	156,415	7/1-8/15	1-4	6-2-4	Spikelet	Spikelet less awns	3	Y,0,1	Y,0,1
Junegrass, prairie	90	80	2	4,123,635	7/10-8/30	1-4	6-2-4	Floret	Floret	2	Y,0,1	U
Needlegrass, green	90	50	3	162,450	7/15-9/30	1-4	6-2-4	Floret	Floret less awn	4	Y,0,1	Y,1-2,0
Needlegrass, Letterman	90	50	3	206,180	8/1-10/15	1-4	6-2-4	Floret	Floret less awn	4	Y,0,1	Y,1-2,0
Needlegrass, needle-and-thread	90	50	3	94,895	8/1-9/30	1-4	6-2-4	Floret	Floret less awn	4	Y,0,1	Y,1-2,0
(con.)												

(con.)

Table 1 (Con.)

Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Grasses												
Oatgrass, tall	90	80	3	189,000	8/15-9/30	1-5	6-2-4	Floret	Floret less awn	2	Y,0,1	Y,0,1
Oniongrass	90	75	3		7/1-8/30	1-4-5	6-2-4	Floret	Floret	2	U	U
Orchardgrass	90	85	3	477,200	7/20-9/15	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,1-2,0
Reedgrass, chee	90	70	4	574,120	7/15-8/30	1-5	6-2-4	Floret	Grain	5	U	U
Ricegrass, Indian	95	65	4	161,920	6/30-7/15	1-2-5	6-2-4	Floret	Floret less hairy lemma	5	Y,0,1	Y,0,1-2
Sacaton, alkali	90	80	3	1,750,000	8/15-10/1	1-4-5	6-2-4	Grain	Grain	3	N	N
Squirreltail, bottlebrush	90	85	2	191,555	7/15-8/15	1-2-4-5	6-2-4	Spikelet	Floret less awn	4	N	N
Sunflower, annual	90	70	2	60,000	7/15-8/30	1-2-4-5	6-2-4-5	Achene	Achene	1	U	U
Timothy	90	90	2	1,246,000	7/15-8/30	1-5	6-2-4	Spikelet	Grain or spikelet	2	Y,0,1	Y,1-2,0
Timothy, alpine	90	85	2		7/15-8/30	1-5	6-2-4	Spikelet	Grain or spikelet	2	Y,0,1	Y,0,1
Wheatgrass, bearded bluebunch	90	85	2	142,640	7/15-9/15	1-2-4-5	6-2-4	Floret	Floret less awn	4	Y,0,1	Y,0,1
Wheatgrass, beardless bluebunch	95	85	2	125,680	7/15-9/15	1-4-5	6-2-4	Floret	Floret	4	Y,0,1	Y,0,1
Wheatgrass, western	95	80	3	115,000	8/15-11/30	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,0,1
Wheatgrass, fairway	95	85	1	319,660	7/15-10/15	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,1-2,0
Wheatgrass, crested	95	85	1	192,785	8/1-10/15	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,1-2,0
Wheatgrass, intermediate	95	90	1	88,110	8/1-10/30	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,1-2,0
Wheatgrass, pubescent	95	85	1	87,000	8/15-10/15	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,1-2,0
Wheatgrass, Siberian	95	85	1	212,855	9/1-12/10	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,0,1
Wheatgrass, slender	95	85	2	133,360	8/15-10/15	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,0,1
Wheatgrass, streambank	90	85	1	137,830	8/15-10/30	1-4-5	6-2-4	Floret	Floret	2	Y,0,1	Y,1-2,0 (con.)

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Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Grasses												
Wheatgrass, tall	95	90	2	76,805	8/1-10/30	1-4-5	6-2-4	Floret	Floret	2	Y,0,1	Y,1-2,0
Wheatgrass, thickspike	95	85	1	137,000	7/25-9/30	1-4-5	6-2-4	Floret	Floret	3	Y,0,1	Y,0,1
Wildrye, Great Basin	95	85	1	130,760	8/4-9/20	1-2-5	6-2-4	Floret	Floret	4	Y,0,1	Y,1-2,0
Wildrye, mammoth	95	85	1	47,130	7/15-8/30	1-2-5	6-2-4	Floret	Floret	4	Y,0,1	Y,1-2,0
Wildrye, Russian	95	85	1	168,240	7/15-8/30	1-4-5	6-2-4	Floret	Floret	4	Y,0,1	Y,1,0
Forbs												
Alfalfa	95	85	1	213,760	9/1-10/30	1-5	6-5	Legume	Seed	5	N	N
Aster, blueleaf	40	70	3	540,000	10/1-10/30	1-2-6	6-2-4	Achene	Achene less pappus	2	Y,0,1	Y,2-4,0
Aster, Englemann	40	70	3	200,000	9/15-10/30	1-2-6	6-2-4	Achene	Achene less pappus	2	Y,0,1	Y,2-4,0
Aster, Pacific	40	70	3	2,668,235	9/15-10/30	1-2-6	6-2-4	Achene	Achene less pappus	2	Y,0,1	Y,2-4,0
Balsamroot, arrowleaf ^g	95	40	3	55,245	5/15-7/25	1-2-4	6-2-4	Achene	Achene	2	Y,0,1-3	Y,0,2-3
Balsamroot, cutleaf ^g	95	40	3	32,220	6/20-7/30	1-2-4	6-2-4	Achene	Achene	2	Y,0,1-3	Y,0,2-3
Burnet, small	95	90	1	55,115	8/1-9/30	1-5	6-4	Achene	Achene	5	Y,0,1	N
Butterweed, groundsel	50	70	3	3,489,230	7/20-10/15	1-2	6-2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Clover, Alsike	95	80	2	680,400	7/20-8/25	1-6	6-2-4	Legume	Seed	4	Y,0,1	N
Clover, strawberry	95	80	2	288,000	7/20-9/30	1-6	6-2-4	Legume	Seed	4	Y,0,0	N
Cowparsnip	85	25	2	44,850	8/15-9/30	1-2	6-0-4	Schizocarp	Schizocarp	1	Y,0,1	Y,0,1-3
Crownvetch	95	75	2	138,160	8/15-9/30	1-5	6-2-4-5	Legume	Seed	4	Y,0,1	Y,0,1-3
Flax, Lewis	95	85	2	278,280	7/1-9/10	1-2-4-5	6-2-4-5	Seed	Seed	3	Y,0,1-2	Y,2-4,0
Geranium, Richardson	95	60	3	65,500	8/15-9/30	1	6-4	Capsule	Seed	3	Y,0,1	Y,0,2
Geranium, sticky	95	60	3	52,550	8/15-9/30	1	6-4	Capsule	Seed	3	Y,0,1	Y,0,2
Globemallow, scarlet	90	20	4	500,000	7/5-8/5	1-2-4	6-2-4-5	Schizocarp	Seed	5	Y,0,1	Y,0,1-3
Globemallow, gooseberry/leaf	90	20	4	500,660	7/10-7/30	1-2-4	6-2-4-5	Schizocarp	Seed	5	Y,0,1	Y,0,1-3 (con.)

Table 1 (Con.)

Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Forbs												
Goldeneye, Nevada	50	40	3	1,000,000	8/1-9/15	1-4	6-2-4	Achene	Achene	2	Y,0,1	U
Goldeneye, showy	50	40	3	1,054,885	8/20-9/20	1-4	6-2-4	Achene	Achene	2	Y,0,1	Y,0,1
Goldenrod, Canada	50	70	3	770,000	10/1-12/15	1-2	6-2-4	Achene	Achene less pappus	1	Y,0,1	Y,0,1
Helianthella, oneflower	60	75	2	52,560	8/15-9/20	1-5	6-4	Achene	Achene	2	Y,0,1	Y,2-4,0
Kochia, Belvedere	85	85	1	745,890	9/1-11/5	1-2	6-2-4	Bracked utricle	Bracked utricle	1	Y,0,1	N
Ligusticum, Porter	90	40	3	69,275	7/25-8/20	1-2	6-4	Schizocarp	Schizocarp	2	Y,0,1	Y,0,1-3
Lomatium, nineleaf	75	70	3	42,225	7/1-8/15	1-2	6-4	Schizocarp	Schizocarp	2	Y,0,1	Y,0,1
Lomatium, Nuttall	75	70	3		7/1-8/15	1-2	6-4	Schizocarp	Schizocarp	2	Y,0,1	Y,0,1
Lupine, mountain	95	90	1	12,530	7/25-8/30	1-4	6-4	Legume	Seed	5	Y,0,1	Y,0,1
Lupine, silky	95	90	1	12,915	7/15-8/10	1-4	6-4	Legume	Seed	5	Y,0,1	Y,2-4,0
Lupine, silvery	95	90	1		7/25-9/15	1-4	6-4	Legume	Seed	5	Y,0,1	Y,2-4,0
Milkvetch, Canada ^h	95	85	2		8/10-11/15	1-5	6-2-4	Legume	Seed	5	Y,0,1-3	Y,0,1
Milkvetch, cicer ^h	95	85	2	113,715	8/10-4/1	1-5	6-2-4-5	Legume	Seed	5	Y,0,1-3	Y,0,1
Penstemon, Eaton	95	70	3	351,085	7/1-8/30	1-2	6-2-4-5	Capsule	Seed	3	Y,0,1	N
Penstemon, low	95	70	3		9/1-11/15	1-2	6-2-4-5	Capsule	Seed	3	Y,0,1	Y,2-4,0
Penstemon, Palmer	95	80	3	609,675	10/1-1/15	1-2	6-2-4-5	Capsule	Seed	3	Y,0,1-3	N
Penstemon, thickleaf	95	70	3	336,000	8/1-8/30	1-2	6-2-4-5	Capsule	Seed	3	Y,0,1-3	N
Penstemon, Wasatch	95	70	3	234,785	8/1-9/10	1-2	6-2-4-5	Capsule	Seed	3	Y,0,1-3	Y,2-4,0
Sage, Louisiana	10	80	1	2,504,400	10/5-12/15	1-2-4-5	6-2-4	Achene	Achene	2	Y,0,1	Y,2-4,0
Sainfoin	95	90	1	26,305	8/1-9/30	1-2-5	6-2-4	Loment	Loment	4	Y,0,1	N
Salsify, vegetable-oyster	85	65	2	306,695	7/1-7/25	2-5	6-2-4	Achene	Achene less pappus	2	Y,0,1	Y,2-4,0
(con.)												

(con.)

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	Purity ^a	Germination ^a										
Forbs												
Sweetanise	95	60	3	29,845	8/10-9/10	1-2-5	6-4	Schizocarp	Schizocarp	2	Y,0,1	Y,0,1
Sweetclover, yellow	95	85	1	258,560	9/1-10/30	1-2-5	6-4	Legume	Seed	5	N	N
Sweetvetch, Utah ^h	90	60	3	33,585	7/5-8/10	1-2-4-5	6-2-4	Loment	Seed	2	Y,0,1	Y,2-4,0
Yarrow, western	50	80	1	4,123,635	8/10-11/30	1-2-5	6-2-4	Achene	Achene	2	Y,0,1	Y,2,0
Shrubs												
Apache plume	80	75	3	546,500	7/15-9/30	2-6	2-4	Achene	Achene less style	1	N	N
Ash, single leaf	90	40	3	20,350	7/15-9/10	1-2	2-4	Samara	Samara	1	Y,0,1-3	Y,0,1-2
Barberry, creeping	95	85	3	71,120	8/5-9/10	1	3-6-4	Berry	Seed	5	Y,0,1-3	Y,0,3
Barberry, Fremont	95	85	3	41,770	7/15-8/20	1	3-6-4	Achene	Seed	5	Y,0,1	U
Bitterbrush, antelope	95	90	1	15,370	6/15-7/20	2	4-2-4-5	Achene	Seed	5	Y,0,1-2	Y,0,2-3
Bitterbrush, desert	95	90	1	20,370	6/25-8/15	2	4-2-4-5	Achene	Seed	5	Y,0,1-2	Y,0,2-3
Blackbrush	95	70	3	27,015	7/1-8/30	1-2	6-2-4	Achene	Achene	4	Y,0,1	Y,0,1
Buckwheat, wild California flattop	95	75	3	907,200	7/28-8/30	1-2	6-2-4	Achene	Achene	2	N	N
Buckthorn, cascara	95	40	3	12,300	7/15-9/15	1-2	3-6-4	Drupe	Stone	3	Y,0,1-3	Y,0,1-3
Buffaloberry, roundleaf	98	75	2	6,855	7/5-7/30	1-2	3-6-4	Drupe	Stone	3	Y,0,1-2	Y,0,1-3
Buffaloberry, russet	98	75	2	59,215	7/15-8/30	1-2	3-6-4	Drupe	Stone	4	Y,0,1-2	Y,0,1-3
Buffaloberry, silver	98	80	2	10,980	8/1-9/30	1-2	3-6-4	Drupe	Stone	4	Y,0,1-2	Y,0,1-3
Ceanothus, deerbrush ^j	98	85	3	70,000	6/10-8/15	1-2	6-4	Capsule	Seed	5	Y,0,6	Y,0,1-3
Ceanothus, Martin ^j	98	75	3	82,900	7/10-8/15	1	6-4	Capsule	Seed	5	Y,0,6	Y,0,1-3
Ceanothus, redstem ^j	98	85	3	131,860	7/10-8/15	1-2	6-4	Capsule	Seed	5	Y,0,6	Y,0,1-3
(con.)												

(con.)

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	Purity ^a	Germination ^a										
Shrubs												
Ceanothus, snowbrush ^j	98	85	3	124,275	8/1-8/30	1-2	6-4	Capsule	Seed	5	Y,0,6	Y,0,1-3
Ceanothus, prostrate ^j	98	85	3	41,000	7/1-8/20	1-2	6-4	Capsule	Seed	5	Y,0,6	Y,0,1-3
Ceanothus, wedgeleaf ^j	98	85	3	49,000	7/1-8/20	1-2	6-4	Capsule	Seed	5	Y,0,6	Y,0,1-6
Cherry, Bessey	98	70	3	2,965	8/1-9/15	1-2	3-6-7-4	Drupe	Stone	2	Y,0,1-3	Y,0,1-6
Cherry, bitter	98	70	3	7,020	7/1-9/30	1-2	3-6-7-4	Drupe	Stone	2	Y,0,1-3	Y,1-6
Chokecherry	98	80	3	4,150	7/25-9/15	1-2	3-6-4	Drupe	Stone	2	Y,0,1-3	Y,0,1-6
Cinquefoil, bush	70	70	3		7/10-9/30	1	2-4	Achene	Achene	2	Y,0,1	Y,0,1
Coloneaster, Peking ⁱ	98	80	2	32,210	5/5-11/15	1-2	3-6-7-4	Pome	Seed	5	Y,0,1-3	Y,0,1-3
Cliffrose, Stansbury	95	85	4	64,615	7/5-8/10	2	2-4-5	Achene	Achene less style	5	Y,0,1	Y,0,1-3
Currant, golden	95	65	3	356,180	7/20-8/10	1-2	3-6-7-4-5	Berry	Seed	5	Y,0,1-6	Y,0,1-2
Currant, sticky	95	65	3	298,000	8/15-9/30	1-2	3-6-7-4-5	Berry	Seed	5	Y,0,1-6	Y,0,1-4
Currant, wax	95	70	3	251,000	7/15-8/30	1-2	2-6-7-4-5	Berry	Seed	5	Y,0,1-6	Y,0,1-4
Cypress, Arizona	95	75	3	40,000	10/1-2/5	1	6-7-4	Cone	Seed	2	Y,0,1	Y,0,1
Dogwood, Redosier	95	85	2	17,260	8/20-9/10	1-2	3-6-7-4	Drupe	Stone	2	Y,0,1-3	Y,0,1-3
Elaeagnus, autumn	98	90	2	27,600	8/20-12/15	1-2	3-6-7-4	Drupe	Stone	5	Y,0,1-3	Y,0,1-3
Elderberry, blue	95	50	4	216,770	8/15-9/25	1-2	3-6-7-4-5	Berry	Stone	5	Y,0,1-3	Y,0,1-6
Elderberry, red	95	50	4	286,000	8/15-9/30	1-2	2-6-7-4-5	Berry	Seed	5	Y,0,1-3	Y,0,1-6
Ephedra, green	95	85	2	24,955	7/15-9/1	2	6-2-4	Seed	Seed	5	Y,0,1-3	Y,2-4,0
Ephedra, Nevada	95	85	2	19,875	7/10-7/25	2	6-2-4	Seed	Seed	5	Y,0,1-3	Y,2-4,0
Ephedra, Torrey	90	85	2		7/1-8/1	2	6-2-4	Seed	Seed	5	U	U
Eriogonum, cushion	80	80	1	170,000	8/15-11/30	1-2	6-4	Achene in perianth	Achene	2	U	U
(con.)												

(con.)

Table 1 (Con.)

Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Shrubs												
Eriogonum, Wyeth	95	75	3	141,310	7/25-8/20	1-2	6-2-4	Achene in perianth	Achene	2	U	U
Forestiera, New Mexican	95	85	2	32,400	7/1-10/15	1-2	3-6-4	Drupe	Stone	4	Y,0,1	Y,0,1
Goldenweed	15	90	2	1,630,000	10/1-11/30	1-2	2-4	Achene	Achene less pappus	1	N	N
Greasewood, Bailey	85	40	2		9/15-11/15	2	1-4	Bracted utricle	Bracted utricle less bract wings	1	Y,0,1	Y,2-4,0
Greasewood, black	85	40	2	253,400	9/15-11/15	2	1-4	Bracted utricle	Bracted utricle less wings	1	Y,0,1	Y,2-4,0
Hawthorn, river ¹	95	70	4	15,050	8/15-10/15	1-2	3-6-7-4	Pome	Seed	5	Y,0,1-3	Y,0,1-3
Honeylocust, common ¹	98	80	4	2,800	9/1-2/15	1	7-4	Legume	Seed	5	Y,0,1-3	Y,0,1-3
Honeysuckle, Tatarian	90	85	4	16,525	7/15-8/10	1-2	2-6-7-4	Berry	Seed	5	Y,0,1-3	Y,0,1-3
Honeysuckle, Utah	90	85	4		7/15-8/10	1-2	2-6-7-4	Berry	Seed	5	Y,0,1-3	Y,0,1-3
Hopsage, spineless	75	80	1	189,950	9/10-12/15	1	2-4	Bracted utricle	Bracted utricle	1	Y,0,1	Y,0,1
Hopsage, spiny	90	80	1	166,765	7/1-9/10	1-2	2-4	Bracted utricle	Bracted utricle	1	Y,0,1	Y,0,1
Horsebrush, cottonthorn	10-15	70	3		10/1-11/30	1-2	2-4	Achene	Achene less pappus	1	U	U
Horsebrush, gray	10-15	70	3		10/1-11/30	1-2	2-4	Achene	Achene less pappus	U	U	U
Horsebrush, littleleaf	10-15	70	3		10/1-11/30	1-2	2-4	Achene	Achene less pappus	U	U	U
Horsebrush, Nuttall	10-15	70	3		10/1-11/30	1-2	2-4	Achene	Achene less pappus	U	U	U
Indian apple	95	50	3	23,000	7/5-8/20	1-2	3-6-7-4	Pome	Seed	3	Y,0,1-3	Y,0,1-2
Juniper, common mountain	98	60	4	36,500	7/1-12/30	1-2	2-6-4	Berry-like cones	Berry-like cones	5	Y,0,1-3	Y,0,1-6
Juniper, Rocky Mountain	98	60	4	22,660	9/1-12/30	1-2	2-6-4	Berry-like cones	Berry-like cones	5	Y,0,1-3	Y,0,1-6
(con.)												

(con.)

Table 1 (Con.)

Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Shrubs												
Juniper, Utah	98	60	4	8,110	9/1-12/30	1-2	2-6-4	Berry-like cones	Berry-like cones	5	Y,0,1-3	Y,0,1-6
Kochia, forage ^k	90	90	4	520,000	9/25-12/15	1-2-5	2-4	Bracted utricle	Bracted utricle	1	Y,0,3	N
Lilac, common	90	70	2	86,000	8/20-10/10	1	6-7-4	Capsule	Seed	1	Y,0,1	Variable
Locust, black ⁱ	98	85	1	23,875	9/1-11/30	1-2	2-4	Legume	Seed	4	Y,0,1-2	Y,0,1-6
Mahogany, birchleaf mountain	90	80	2	55,000	7/1-9/15	2	2-4-5	Achene	Achene less style	2	Y,0,3	Y,0,1-3
Mahogany, curleaf mountain	90	80	2	51,865	7/10-9/1	2	2-4-5	Achene	Achene less style	5	Y,0,3	Y,0,1-3
Mahogany, littleleaf mountain	90	80	2	50,910	7/10-7/25	2	2-4-5	Achene	Achene less style	4	Y,0,3	Y,0,1-3
Mahogany, true mountain	90	80	3	59,030	7/5-9/1	2	2-4-5	Achene	Achene less style	2	Y,0,3	Y,0,1-3
Manzanita, bearberry ^j	95	70	4	42,400	6/1-8/30	1	3-6-7-4	Berry	Berry	5	Y,0,3-6	Y,0,0-6
Maple, Rocky Mountain ^l	90	85	2	13,430	8/1-9/30	1-2	2-4	Samara	Samara	1	Y,0,2	N
Mockorange, Lewis	95	65	4	5,500,000	9/1-10/15	1-2	2-4	Capsule	Seed	4	Y,0,1-2	Y,0,1-3
Mountain-ash, American	90	70	3	138,125	7/15-9/30	1-2	3-6-4	Pome	Seed	3	Y,0,1-3	Y,0,1-3
Mountain lover	90	60	4		7/1-8/30	1-2	2-4	Capsule	Seed	5	Y,0,1-3	Y,0,1-6
Ninebark, mallow	98	40	3	756,000	8/10-9/30	1-2	2-4	Capsule	Seed	3	Y,0,1-2	Y,0,1-3
Oak, Gambel	95	80	3	200	8/10-9/30	1-2	4	Acorn	Acorn	1	Y,0,1	N
Peachbrush, Anderson	98	70	3		7/1-9/15	1	3-6-7-4	Drupe	Drupe	2	Y,0,1-3	Y,0,1-6
Peachbrush, desert	90	70	3	4,500	6/30-7/20	1-2	4	Drupe	Drupe	2	Y,0,1-3	Y,0,1-6
Penstemon, bush	85	80	2	1,260,000	7/1-9/15	1-2	2-4	Capsule	Seed	4	U	U

(con.)

Table 1 (Con.)

Species	Acceptable percent germination ^a		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^f
	Purity ^a	Germination ^a										
Shrubs												
Plum, American	98	70	3	810	9/5-10/5	1-2	3-6-7-4	Drupe	Stone	2	Y,0,1-3	Y,0,1-6
Rabbitbrush, alkali	10-15	75	2		10/15-12/30	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, dwarf	10-15	75	2		10/1-12/15	1-2-4-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, Greene's	10-15	75	3		10/1-12/15	1-2-4-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, low	10-15	75	2		10/1-12/15	1-2-4-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, low mountain	10-15	75	2	782,070	10/15-12/30	1-2-4-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, low narrowleaf	10-15	75	2		10/15-12/15	1-2-4-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, low stickyleaf	10-15	75	2		10/15-12/15	1-2-4-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, Parry	10-15	75	2		10/1-11/30	1-2-4-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, Parry, Nevada	10-15	75	2		10/1-11/30	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, rubber, Green	10-15	75	2		10/15-12/30	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, rubber, leafless	10-15	75	2	432,000	10/15-12/30	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, rubber, leiospermus	10-15	75	2		10/15-12/30	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, rubber, mountain	10-15	75	2	426,000	10/5-12/15	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, rubber, mountain white stem	10-15	75	2	693,220	10/15-12/30	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, rubber, threadleaf	10-15	75	2	756,000	10/5-11/30	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, rubber, tubinatus	10-15	75	2		10/5-12/15	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rabbitbrush, spreading	10-15	75	2		10/5-12/15	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0

(con.)

Table 1 (Con.)

Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Shrubs												
Rabbitbrush, vasey	10-15	75	2		10/5-12/15	1-2-6	2-4	Achene	Achene less pappus	1	Y,0,1	Y,2,0
Rockspirea	95	80	3	5,340,000	8/1-8/30	1	2-4	Achene	Seed		U	U
Rose, Woods	95	70	4	45,300	9/1-8/30	1-2	3-6-7-4	Berry-like hip	Achene	5	Y,0,1-3	Y,0,4-8
Russian-olive	98	90	2	2,870	8/25-1/15	1-2	3-6-7-4	Drupe	Stone	5	Y,0,1	Y,2,0
Sage, purple	95	70	3	349,500	5/15-7/15	1-2	2-4	Nutlet	Nutlet	1	Y,0,1	Y,2,0
Sagebrush, basin big	8-12	80	1	2,575,940	11/1-1/15	1-2-3	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, mountain big	8-12	80	1	1,924,000	10/1-11/30	1-2-3-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, big	8-12	80	1	2,466,000	10/15-12/30	1-2-3-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, Bigelow	8-12	80	1	2,520,000	9/25-11/15	1-2	2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, black	8-12	80	1	907,200	10/15-11/30	1-2-3-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, bud	8	50	2	1,680,000	5/15-6/20	1-2	2-4	Achene	Achene	1	Y,0,1	Y,2,0
Sagebrush, fringed	8-12	80	1	4,536,000	9/15-11/30	1-2-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, longleaf	8-12	70	1	1,080,000	10/1-11/30	1-2	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, low	8-12	80	1	972,000	10/1-12/5	1-2-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, pygmy	8	70	1	472,500	10/1-12/10	1-2-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, sand	8-12	70	1		9/15-12/10	1-2-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, silver	8-12	80	1	846,000	8/15-11/30	1-2-3-4	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, stiff	8	70	1	498,480	10/1-11/30	1-2	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, tall threetip	8-12	75	1	2,212,700	10/15-12/15	1-2	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
Sagebrush, timberline	8-12	70	1		10/1-11/30	1-2	1 or 2-4	Achene	Achene	2	Y,0,1	Y,2,0
(con.)												

(con.)

Table 1 (Con.)

Species	Acceptable percent germination ^a		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^f
	Purity ^a	Germination ^a										
Shrubs												
Saltbush, big	90	70	1	889,410	10/15-3/15	1-2-6	1-4	Bracted utricle	Bracted utricle	2	Y,0,1	N
Saltbush, Bonneville	95	40	2	84,000	10/1-12/30	1-2-6	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	Y,0,1
Saltbush, broadscale	90	40	2	207,630	10/20-2/15	1-2	1-4	Bracted utricle	Bracted utricle	4	U	U
Saltbush, Castle Valley	95	45	2	81,660	10/15-12/30	1-2-6	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	Y,2-4,0
Saltbush, cattle	90	40	1	490,000	10/15-2/15	1-2-6	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	N
Saltbush, desert holly	90	40	2	216,825	9/1-12/15	1-2	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	N
Saltbush, falcate	90	40	1	197,215	9/1-12/30	1-2-6	1-4	Bracted utricle	Bracted utricle	4	Y,0,1-3	Y,0,1
Saltbush, fourwing	95	50	2	55,365	10/20-3/1	1-2-6	1-4	Bracted utricle	Bracted utricle less bract wings	5	Y,0,6	Y,0,1-3
Saltbush, Gardner	90	45	2	111,450	9/10-3/1	1-2-6	1-4	Bracted utricle	Bracted utricle	5	Y,0,3	Y,0,1
Saltbush, Garrett	95	45	2	66,175	7/25-11/1	1-2	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	Y,0,1
Saltbush, mat	95	45	2	66,835	10/1-12/15	1-2	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	Y,0,1
Saltbush, Navajo	90	45	2	44,040	10/1-12/15	1-2	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	U
Saltbush, shadscale	95	35	4	64,920	10/15-3/1	1-2-6	1-4	Bracted utricle	Bracted utricle	5	Y,0,10	Y,0,1-6
Saltbush, trident	90	50	2	168,000	9/10-12/30	1-2	1-4	Bracted utricle	Bracted utricle	4	Y,0,1	U
Serviceberry, Saskatoon	95	85	2	45,395	7/10-9/15	1-2	3-6-7-4	Pome	Seed	5	Y,0,3-6	Y,0,2-6
Serviceberry, Utah	95	85	2	25,800	8/25-4/1	1-2	3-6-7-4	Pome	Seed	4	Y,0,3-6	Y,0,2-6
Snowberry, common	95	80	3	76,000	8/1-9/30	1-2	3-6-7-4	Berry	Seed	3	Y,0,1-3	Y,0,1-4
Snowberry, longflower	95	80	3	68,000	8/10-9/30	1-2	3-6-7-4	Berry	Seed	3	Y,0,1-3	Y,0,1-4
Snowberry, mountain	95	80	3	54,065	8/10-9/15	1-2	3-6-7-4	Berry	Seed	3	Y,0,1-3	Y,0,1-4

(con.)

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Species	Acceptable percent		Germination rating ^b	Seed per lb at 100 percent purity	Seed maturity month/day	Seed collection method ^c	Seed cleaning equipment ^d	Reproductive structure harvested	Reproductive structure seeded	Storage time ^e	After-ripening ^f	Stratification ^g
	Purity ^a	Germination ^a										
Shrubs												
Spiraea, Douglas	80	80	2	1,000,000	7/15-9/30	1-2	4	Follicle	Seed	2	N	N
Sumac, Rocky Mountain smooth	90	40	4	62,430	9/5-3/30	1-2	3-6-7-4	Drupe	Stone	5	Y,0,1-3	Y,0,1-6
Sumac, skunkbush ^h	95	40	4	18,895	6/20-10/10	1-2	3-6-7-4	Drupe	Stone	5	Y,0,1-3	Y,0,1-6
Virginsbower, western	50	70	3	315,000	10/5-12/30	1-6	1-2-4	Achene	Achene, styles removed	1	Y,0,1	Y,0,2-4
Winterfat	50	85	1	112,270	9/25-11/25	1-2-5-7	2-4	Bracted utricle	Bracted utricle	1	Y,0,1-2	N
Wormwood, oldman	8-12	70				1-2	2-4	Achene	Achene	2	U	U
Whortleberry, big	80	80	3	1,500,000	7/10-9/30	1-2	3-6-7-4	Berry	Seed	3	U	U

^aCommonly accepted purity and germination percentage of marketed seed. Purity x total germination = pure live seed (PLS).

^b1 = Excellent, easy to germinate; 2 = Good germinator; 3 = Medium germinator; 4 = Hard to germinate.

^c1 = Hand strip into container; 2 = Beat into container; 3 = Clip into container; 4 = Reel-type harvester; 5 = Combine; 6 = Vacuum harvester.

^d1 = Hammermill; 2 = Barley debearder; 3 = Dybvig with water; 4 = Air-screen separator; 5 = Gravity table; 6 = Dry; 7 = Grinder-macerator.

^eYears seed can be stored dry without significant Dybvig loss in viability: 1 = 0 to 3 years; 2 = 4 to 6 years; 3 = 7 to 10 years; 4 = 11 to 15 years; 5 = 16 or more years.

^fY = Afterripening or stratification is required. Duration: First number = weeks; second number = months.

N = No afterripening or stratification required. U = Afterripening and stratification characteristics unknown.

^gTreat seed with pesticide prior to storage.

^hInoculate seed prior to seeding.

ⁱTreat seed with sulfuric acid to germinate in laboratory.

^jTreat seed with hot water bath to germinate in laboratory.

^kStore seed at ≤7 percent moisture in sealed container.

^lStore seed at <15 percent moisture.

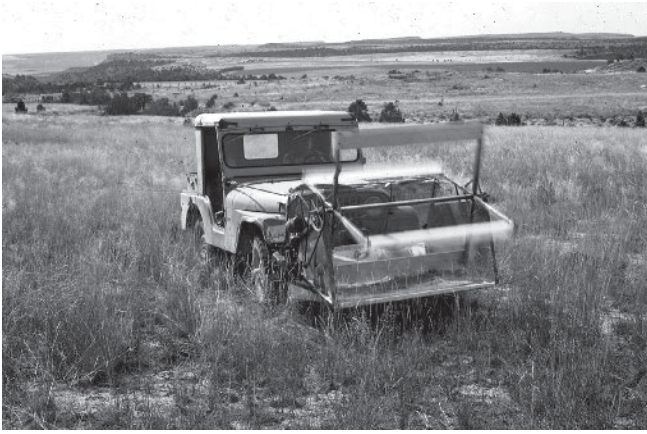


Figure 1—Collecting seed from a wildland stand of Salina wildrye with a reel-type, vehicle-mounted harvester.

Seed of some native grasses and forbs can be mechanically collected (fig. 1) if stands are pure and the topography is flat; if not, beating or stripping seed by hand into shoulder hoppers (fig. 2), tubs, boxes, trash cans, or other appropriate receptacles is the most widely used harvesting procedure. Fleshy fruits are beaten or hand picked (fig. 3). A resourceful seed collector can innovate new and easier ways to harvest seed of most species.

Seeds of most shrubs are obtained by hand harvesting from wildland stands. Seeds can be stripped or flailed directly into canvas hoppers (fig. 1) of various designs, or into tubs, baskets, boxes, or trash cans. These seed-collecting containers may be attached to the harvester by shoulder straps, or placed directly under the bushes and the seed stripped or beaten into them. Seed of species like curleaf mountain mahogany, true mountain mahogany, Apache plume, and cliffrose with plumed seeds are harvested by shaking or by dislodging the seed onto canvas, heavy cloth, or plastic that is spread under the plant. When collecting seed from extra large shrubs or small trees, ladders or platforms may be necessary to pick or dislodge the fruits from the crowns.

Seed of species such as curleaf mountain mahogany, true mountain mahogany, and cliffrose can be picked up directly off the ground, using an ordinary sweep rake to pile the seed and then fork it into sacks or boxes. Care must be taken to ensure that rocks and large limbs are not picked up because they will damage cleaning machines. Dealers will not purchase collected seed containing sticks, rocks, or other foreign objects. Ground collected seed must be picked up soon after the fruits drop or the seed will be lost to field mice, chipmunks, birds, and other small animals (Plummer and Jorgensen 1978).



Figure 2—Hand collecting seed into a shoulder-mounted seed hopper.



Figure 3—Collecting fruits of blue elderberry.

A number of techniques have been developed for collecting cones—cutting trees down, climbing trees, shooting cones off the trees, and raiding rodent caches. A cache may contain just a few cones or many bushels of cones. Favorite spots for caches are small ground depressions, cavities in and around logs, stumps, roots, rocks, moist seeps, and along banks of small creeks and seeps (Schopmeyer 1974b).

With the increasing demand for many species, more interest is being shown in harvesting native seed, especially shrub and forb species, with machines. Mechanical harvesters, such as combines and strippers, can be effective in harvesting seed from native stands of low-growing forbs, shrubs, and grasses (fig. 1). The land, however, must be level, and the species being harvested must be in a relatively pure stand. Some species that have been harvested successfully using some type of combine or stripper are winterfat, black sagebrush, low rabbitbrush, lupine, penstemon, globemallow, balsamroot, showy goldeneye, mountain brome, and salina wildrye.

Several vacuum-type seed harvesters have been developed by the USDA Forest Service, San Dimas Equipment Development Center (Jorgensen 1979). A large truck-mounted seed harvester was developed (Plummer and others 1970a,b) and has been useful for collecting seed of fourwing saltbush, shadscale saltbush, cliffrose, the mountain mahoganies, and a number of forbs and grasses. Custom made backpack vacuum seed harvesters have also been developed. When using vacuum seed harvesters, a machine is needed that does not route the fruits through the impeller, as it usually damages the seed.

Federal and State agencies require seed collecting permits to harvest seed from their lands. Requirements for collecting seed from private land vary with owner. Permits or permission should always be obtained before harvesting seed.

Seed Cleaning

Cleaning seed is necessary to facilitate seeding and to meet acceptable purity levels (table 1). Manufacturers of seed cleaning machinery, researchers, and seed industry personnel have done an outstanding job in developing seed processing equipment and techniques. With a little ingenuity by the processor, equipment and techniques for cleaning seed of most species is now available. The processor must learn the proper operation of each machine and the best cleaning methods for each species. Experience is the best teacher. To clean seed, more than one step is usually required. Table 1 outlines the seed cleaning sequence and lists the equipment required for cleaning seed of grasses, forbs, and shrubs.

When cleaning seed of dry or fleshy fruited species, care must be taken to keep the seed dry to prevent severe damage to the embryo during the cleaning process. Fleshy fruit should not be allowed to “heat up”

or ferment; this can reduce viability and may kill the seed. Cleaning consists of removing unwanted appendages, floral parts, seedcoats, fleshy material, and debris. Following is a description of the most commonly used equipment items and the function of each in cleaning and processing seed.

Hammermill

Hammermills (fig. 4) are used to extract seed from floral parts and to remove appendages. Hammermills come in many sizes, consisting of a hooded inlet or hopper, a central chamber with a rotating shaft that has rows of protruding “hammers,” an interchangeable outlet screen, and a bagger. A number of outlet screens with various hole sizes and shapes to accommodate various seed sizes are available. The holes must be large enough to let the seed pass through without damage, but small enough to remove appendages. Rotation speed of the central shaft should be variable. Processors must use their best judgement and ingenuity to set the speed of the hammermill and choose the proper screen size to meet the requirements of the species being cleaned. Excessive rotation speed may not allow the seed adequate time to pass through the screen holes with the result that seed will be damaged. Too slow a rotation speed may not allow for the appendages to be completely broken off. Some species that can be successfully processed through a hammermill include the saltbushes, sagebrushes, hop-sage, penstemons, greasewood, vetches, and Lewis flax.

Debearder

A debearder (fig. 5) consists of a horizontal beater assembly that rotates inside a steel drum. The beater



Figure 4—Hammermill used to remove seed appendages.

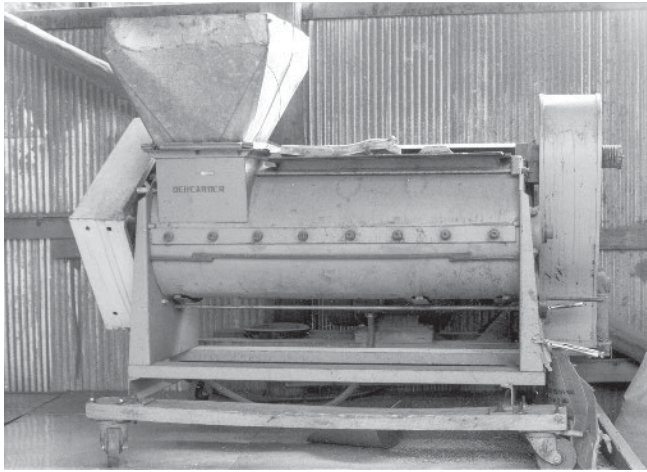


Figure 5—Debearder used to clean seed of a large number of grass, forb, and shrub species.

assembly consists of a shaft with projecting arms that are pitched to move the seed through the drum. Stationary posts protrude inward from the drum and restrain the seed from rotating with the beaters, causing vigorous rubbing action between seeds, pods, heads, and multiple seeds against the arms, posts, and each other. The time seed remains in the unit is varied by regulating a weighted discharge gate. Care should be taken to ensure that seeds do not remain in the debearder until they overheat. This machine can be used to remove awns, tails, styles (fig. 6), and husks to separate seed from flower heads and capsules, break up stems (fig. 7), and to polish seed. Considerably less seed is damaged in the debearder than in the hammermill. The debearder is versatile and can be successfully used to clean seed of many species.

Dybvig Separator

The Dybvig (fig. 8) is a large macerator that consists of a spinning, flanged plate at the bottom of a seed hopper. The rotation speed of the flanged plate can be changed to meet the requirements of each species. A Dybvig is used to clean both fleshy and dry fruits.

The first step in cleaning fleshy fruits is to run the fruit through a Dybvig. The fleshy fruit is thrown against the plate and side of the hopper, which removes the flesh from the seed. A stream of water is required when cleaning fleshy fruits. There are several other types of macerators, but none that outperforms the Dybvig in removing seed from fleshy fruit. When working with small lots of fruit, a home blender has been successfully used. To reduce damage, the steel blades in the blender should be replaced with heavy rubber blades or covered with rubber tubing (Plummer and Jorgensen 1978). Seed appendages can

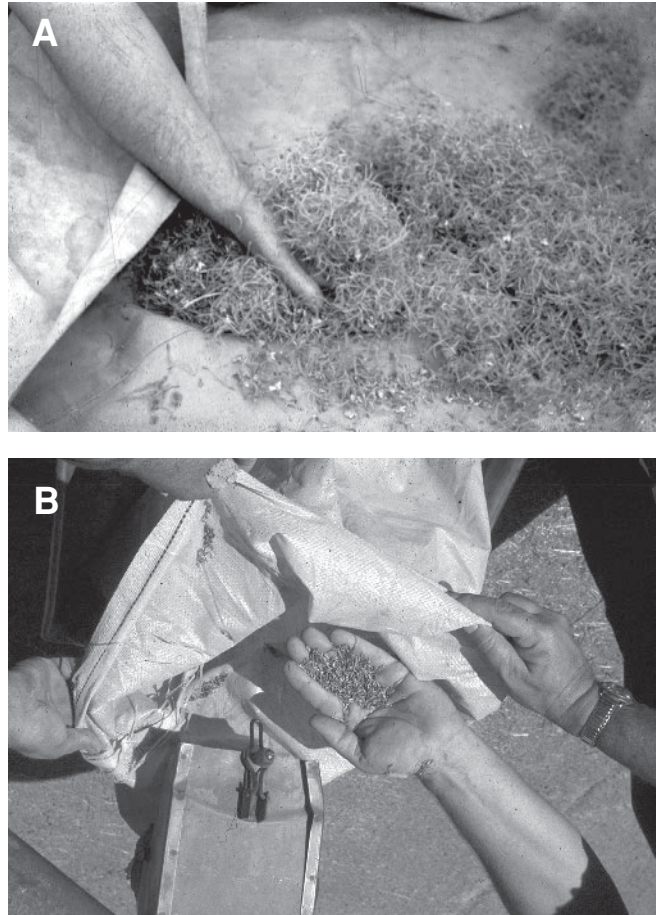


Figure 6—(A) Freshly collected cliffrose seed with styles. (B) Cleaned cliffrose seed that has been run through a debearder to remove styles, and an air-screen separator to remove debris from the seed.



Figure 7—Unprocessed winterfat seed (left) and seed processed through a debearder (right).



Figure 8—Dybvig seed cleaner used to remove seed from fleshy fruits.

be removed from dry fruits with a Dybvig separator. Dry seed is put in the Dybvig and treated until the appendages are removed.

Air-Screen Separator

The air-screen separator combines air, gravity, and screens with various hole sizes to clean and separate seed from impurities. Cleaners vary in size from two-screen (fig. 9) models to large eight-screen types. Regardless of the number of screens, the seed cleaning

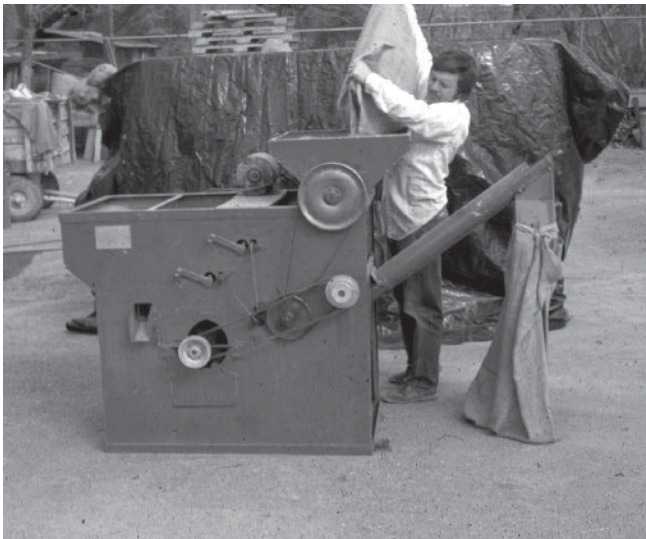


Figure 9—Air-screen separator used to remove floral parts, leaves, chaff, and debris from seed.

principle is the same. The top screen removes the large material and impurities, letting the seed and smaller trash pass through. The second and subsequent screens retain and separate the seed from impurities (fig. 6). The seed then passes through a stream of air that blows out empty and light seed and other trash. The heavy seed is then dropped or augered into a collection container.

Gravity Separators

A gravity table is used to separate light, medium, and heavy seed and impurities from each other. A gravity table consists of a table with a cloth or wire screen that can be tilted in two directions at various pitches and a flow of air that comes up through the table top. As the table moves back and forth and air moves up through and between the seed, the seed and material are separated by weight and deposited in appropriate containers. This machine has great utility for separating and removing sticks and other debris of the same size as, but of different weight than the seed being cleaned. Seed of the same species and seed lot can be separated into various size-weight classes. Depending on the size of the machine, 200 to 500 lb (91 to 227 kg) of seed per hour can be separated and brought to the desired purity. Seed of many species can be cleaned to 98 percent or greater purity with a gravity table.

Grinder-Macerator

The grinder-macerator consists of a rotating shaft with fingers that beat and rub the seed collection. After fleshy fruit is run through the Dybvig water process, all material is dried. It is then run through a macerator to separate dried skin and pulp from the seed. Seed is then separated out with an air-screen separator and gravity table. Dry seed in capsules can be removed from the capsules with a macerator.

Seed Storage

A seed inventory is essential to any successful seeding project. Quality seed must be available when needed. Many species do not produce a high yield of viable seed every year. Therefore, seed must be harvested and stored during years of good seed production to offset years when poor or no seed crops are produced. Storage of commercially produced seed is also required.

Seed must be stored properly to ensure retention of maximum viability. The seeds must be well dried before they are stored in a warehouse or granary, and then they must be kept dry (Justice and Bass 1978). In arid climates such as Nevada and Utah, no special seed storage facilities or techniques are required for most species, other than making sure the seed is dry when put in storage. Seed of some species are best stored at

a specific moisture content. In order to maintain viability of forage kochia seed, moisture content must be lowered to and maintained below 7 percent (Jorgensen and Davis 1984). In more moist or humid climates, some means of artificial drying is necessary before and during storage (Schopmeyer 1974b). With proper storage conditions, seed viability can be retained for many years (Stevens and Jorgensen 1994).

Regardless of the storage method, certain steps should be taken to properly store seed: (1) the seed should remain dry; (2) temperature and humidity should be kept low, preferably with little fluctuation; (3) seed should be kept in rodent-free storage areas; and (4) good housekeeping practices pay dividends (Schopmeyer 1974b).