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PLANT MATERIALS TECH NOTE

Description, Propagation and Use of Rocky Mountain Juniper, *Juniperus scopulorum*

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Introduction: This bulletin transfers information on the identification, culture, and use of **Rocky Mountain juniper,** *Juniperus scopulorum* Sarg. for Montana and Wyoming. This valuable native species provides numerous conservation benefits. Specific information is also provided for Bridger-Select Rocky Mountain juniper.



FIGURE 1

I. DESCRIPTION

***Habit*:** Small-to-medium, coniferous, evergreen shrub or tree; species normally narrow, pyramidal but highly variable (Bridger–Select broadly pyramidal); spreading branches that extend to the ground; usually multi-stemmed. (FIGURE 1)

***Size*:** Variable; under clean cultivation and dryland conditions east of the Continental Divide, expect a 20-year height and width of approximately 12 and 9 feet, respectively, for adapted ecotypes (20-y height and width of 15+ and 13.5+ ft., respectively, for Bridger-Select); mature height estimated at 15 to 20 feet.

***Growth Rate*:** Slow, less than 6 to 12 inches/year (9 to 11 in./yr. for Bridger–Select) under clean cultivation and dryland conditions east of the Continental Divide; anticipate greater rates of growth for all Rocky Mountain juniper in higher precipitation zones and when supplemental moisture is provided.

***Hardiness*:** USDA Hardiness Zones 3 to 7. (SEE ALSO **Adaptation**)



FIGURE 2

***Leaves*:** Mature leaves scale-like (FIGURE 2), young plants with a high percentage of needle-like foliage; shape between an egg and a diamond; tip of leaf with sides that are straight to curved and taper to a point; margins without teeth; tops varying in color from dark green or bluish green, with a whitish covering or light green; back of leaves dark or light bluish green, with a whitish covering, or light green with inconspicuous glands, winter color similarly variable ranging from dull green to bluish purple to nearly reddish brown, dark purple to brown winter color often mistakenly diagnosed as symptomatic of stress.

***Bark*:** Reddish-brown, slightly rough, persistent, scaly bark in the sapling and pole stages, becoming increasingly stringy and fibrous with age—usually with multiple stems.

***Flowers*:** Male and female cones (strobili) on separate plants, small and borne on the ends of short branchlets from mid-April to mid-June; female cones are greenish-yellow becoming more conspicuous in late summer and opening the following spring before pollination (FIGURE 3); pollination primarily by wind; male cones brown. (FIGURE 4)

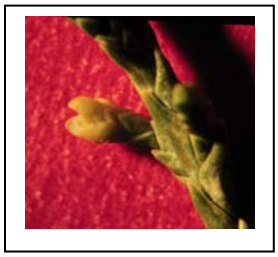


FIGURE 3



FIGURE 4



FIGURE 5



FIGURE 6

Fruit: Berry-like, purplish-blue-black in color at maturity, with a whitish surface covering (FIGURE 5), 0.2 to 0.3 inches diameter; ripening 2 years after pollination, from mid-September to mid-December, and can remain on the tree until March or April of the following year—for detailed collection and processing information, reference PM Tech Note No. MT-34: *Improved Processing of Rocky Mountain Juniper*—contains one, sometimes two, and rarely three seed; production typically begins at 10 years of age under favorable conditions.

***Seed*:** Reddish brown, angular, and lightly to prominently grooved. (FIGURE 6) A high proportion of unfilled seed is common, but varies widely from tree to tree and season to season. It averages 27,100 seeds per pound, but ranges from 17,800 to 42,100 seeds per pound. One, two, or even three seeds can be found in each fruit. Variation in the number and arrangement of embryos also occurs. A single seed may contain a single embryo or it may contain two embryos in individual chambers separated by a common woody wall. In some cases, two seed, each with an embryo, are lightly fused but can be separated with force to produce two distinct seed. Wildland Rocky Mountain juniper rates as a fair seed producer in Montana—Bridger-Select rates fair to good under cultivation. Heavy crops occur every 2 to 5 years, but some seed is produced almost each year. Wildland seed viability is fair, with an average germination capacity of 22 percent and maximum values seldom exceeding 35 percent. In a cultivated orchard, Bridger-Select Rocky Mountain juniper averages 40 to 50 percent viability, ranging from 8 to 91 percent. **When procuring commercial seed, purchase it on a Pure Live Seed (PLS) basis with a current germination test to assure viability. Bulk seed of unknown viability, purity and/or origin is often a poor value.** Store seed at 10 to 12 percent moisture content in a sealed container at 20 to 40°F. A 30 percent germination level after 3.5 years in storage has been measured for this species.

***Roots*:** Rocky Mountain juniper has a shallow but extensive lateral root system, but develops a deeper system in bottom lands and deeper soils.

Adaptation: Nonspecific and variable edaphic requirements allow it to grow on numerous soil types such as soils derived from basalt, limestone, and shale including poorly developed, stony, shallow, and erodible soils with low moisture-holding capacity. Infrequently found on calcareous or adobic soils, high in clay and slightly alkaline (pH 8.0). Performs best on fertile, well-drained sites at a pH of 6.5 to 7.0. Favors average minimum temperatures above -10 to -5°F, but is classified as USDA Zone 3b hardy (average minimum temperatures of -30 to -35°F) and does well in Montana and Wyoming on Zone 4 sites (-20 to -30°F). Over much of its range, grows in areas with an annual precipitation of 15 to 18 inches; can tolerate as little as 11 to 12 inches and as much as 26 inches.

Suitable for Conservation Tree and Shrub Suitability Groups 1, 2, 3, 4, 5, 6, 7, 9, and all Plant Adaptation Zones in Montana. (SEE FOTG, Section II—Windbreak Interpretations, revised CTSG)

Bridger-Select Rocky Mountain juniper will perform well in most of central, south-central, and southeastern Montana, north-central and northeastern Wyoming, far western Nebraska, far western South Dakota, and southwestern North Dakota. This selection will perform well in most of Montana at elevations below 5,500 feet. It will probably perform well in eastern Idaho, most of north-central and eastern Wyoming, western Nebraska, and western South Dakota. **Rocky Mountain juniper is <u>not</u> recommended for central, southern, and eastern Great Plains planting sites because of its susceptibility to foliar diseases in warm, humid environments.** (SEE BELOW)

Pests and Potential Problems: Numerous damaging agents including spider mites (*Oligonychus ununguis* and *Eurytetranychus admes*), juniper berry mites (*Trisetacus quadrisetus*), and red false spider mites (*Pentamerismus erythreus*), the latter is a potentially serious problem in shelterbelt and landscape plantings. Several true insects, butterflies and moths, flies, midges, and jumping plant lice are also pests. In nursery settings, a nematode (*Pratylenchus penetrans*) can injure seedlings by causing root lesions. Juniper seed chalcid (*Eurytoma juniperina*) attacks the seed of Rocky Mountain juniper and can cause high seed mortality. Its life cycle is currently being studied at the BPMC. (SEE **Fruit and Seed Collection** FOR DETAILS)

Rocky Mountain juniper is host to several disease organisms including Cercospora blight caused by *Pseudocercospora juniperi* (formerly *Cercospora sequoiae* var*. juniperi*) that can cause mortality in native stands and devastation in shelterbelts. The foliage near the base of infected branches becomes bronzed then necrotic, leaving the inner crown of the plant devoid of foliage. Phomopsis blight (*Phomopsis juniperova*) can also be serious, causing reduced vigor and mortality in nursery stock and recently transplanted seedlings. Infected branches turn light green then rapidly change to a red-brown color before becoming ashen gray. Kabatina tip blight of junipers (*Kabatina juniperi*) primarily reduces the growth and aesthetic value of Rocky Mountain juniper in the Great Plains and is currently not serious enough to warrant control in farmstead or windbreak plantings. This disease is characterized by a yellow-brown discoloration of branch tips beginning in early spring. Gymnosporangium or “cedar-apple” rusts infect both juniper and rosaceous species, these diseases need two hosts to complete their life cycle and are typically more damaging to their rosaceous hosts than to juniper. The orange, gelatinous, finger-like growths that form on the branches of junipers are common symptoms of one type of cedar-apple rust (FIGURE 7). Damage to juniper is generally not severe but can become serious at high elevations characterized by increased moisture and concentrations of rosaceous species. Heavy infection reduces the yield, quality, vigor, and aesthetics of its rosaceous host, especially apples. Isolation of apple orchards, up to 2 miles or more, from juniper plantings is recommended. Preventative and curative fungicides can be applied to both hosts for control. Juniper can suffer serious mechanical damage from animal rubbing and reduced vigor from livestock and wildlife browsing when range conditions are poor or overstocked. Use seedling protectors and electric fence for damage prevention.



FIGURE 7

I. PROPAGATION

Fruit Collection and Storage: Collecting mature fruit at the optimal time reduces the chances of picking immature (first-year) seed and, therefore, ultimately improves seed quality. Mature fruit is dark blue to nearly black in color with a white waxy coating; whereas, immature fruit is green or light blue and covered with bloom. It is helpful to rub off the waxy coating from fruit samples while picking to assure ripeness and determine the true color of the berries. Maturation requires two years, and both first-year and second-year fruit are often found growing simultaneously on the same plant. With a 2-year maturation, ripe fruit will be found on older growth, as opposed to the current season’s growth. Use a cut test to determine percent fill prior to collecting fruit. Open grown, stunted and stressed wildland trees are often prolific seed producers. Rocky Mountain juniper rates as a good to prolific seed producer over most of its natural range, except in parts of Idaho and Montana where it is only fair. Heavy crops usually occur every 2- to 5-years, but some fruit is produced almost annually.

Avoid collecting from trees with a high percentage of fruit having evidence of insect damage. One potentially serious seed pest is the inconspicuous juniper seed chalcid *Eurytoma juniperina*. (FIGURE 8) It leaves small (0.04 in.) exit holes at the base of second-year seed and fruit. Little information is available on the biology or control of this insect. It is assumed that the adult female, a 0.08– to 0.11–inch wasp, oviposits in first-year developing seed. The eggs or larvae probably then overwinter in first-year seed and emerge as adults the following spring and summer. Second-year seed has, therefore, already been damaged by early spring of the second year. Emergence begins in early June in Bridger, Montana. It is not known if multiple generations occur each year. The exit holes are already present at the base of mature fruit at collection time. In some cases, nearly 100 percent of the seed from an individual tree may be lost. No established control protocols are currently available, but might include the timely application of contact or ingestion insecticides. An initial application 5 days before emergence, followed by one or more additional applications at 10-d intervals has been suggested. If control proves inadequate, a systemic insecticide in early- to mid-spring may be applied, although translocation of systemic chemicals to seed tissues is limited. Contact your local university extension specialist or county extension agent for chemical recommendations. Treatment this year is needed to provide protection for next years' crop.



FIGURE 8

Fruit collection is a manual labor operation. Aprons with a large front pocket and either sacks or buckets secured with a strap around the collectors' neck work well. Wear snug fitting, disposable gloves to prevent sap from getting on your hands. Mature fruit is readily stripped from branches with a rolling and light pulling motion of the fingers, with little or no resultant damage to foliage. Ease of collection appears to be both timing (ripeness) and temperature dependent. By reducing the amount of immature fruit that is collected, cleaning time and product quality are significantly improved. Optimum fruit collection at Bridger, Montana, normally occurs from late October through December, but varies year to year. Some fruit will persist until the following spring or early summer. Monitor fruit condition and persistence often to minimize losses to birds and animals. Expect to collect 4 to 9 pounds of fruit for every 1-pound of clean seed. In the Bridger orchard heavily fruited, 20-year old trees measuring 8-feet tall and wide can produce 25 pounds of fruit and 4.2 pounds of bulk seed. Fruit is best processed as soon as possible after collection, but can be stored for several months under proper environmental conditions. Rocky Mountain juniper fruit stores well in paper sacks in a cooler maintained at 34°F with high humidity (80 to 90 percent). Surface dry the fruit prior to storage to prevent molding. Avoid conditions promote heat build-up and molding such as overly full containers or stacked sacks that reduce air circulation among the fruit.

Fruit Processing and Seed Storage: Rocky Mountain juniper fruit is usually processed in a macerator to remove the skin and pulp from the seed. This species has a tough skin and resinous pulp that make cleaning difficult. (SEE PM Tech Note No. 34) Rocky Mountain juniper stores well in sealed containers at 10 to 12 percent moisture content maintained at 20 to 40°F.

Germination: Germination is usually delayed due to embryo dormancy and, possibly, seed coat impermeability. Low and slow germination is not uncommon. Comparing results among growers is difficult because germination is reported in various manners.

One recommendation is warm moist stratification (68 to 86°F) for 45 to 90 d followed by an unspecified period of cold moist chilling (34 to 37°F). At Bridger, we consistently have germination that is 40 to 50 percent of the TZ viability with a similar treatment. We sow fresh seed (<1 year) in a peat-lite mix directly into containers and then warm moist stratify for 120 d at 75 to 80°F days and 60 to 65°F nights, keeping the seeds moist the entire time. Containers are then moved to a cooler for 150 d at 34 to 37°F. When space is limited, we warm moist stratify and cold moist chill the seeds in sand in cloth sacks or hardware cloth (screen) in the greenhouse or cooler.

Other nurseries report success with various cold:warm:cold sequences. Generally, imbibed seeds are sown in moist sand and chilled at 34 to 38°F in a cooler from January or mid-March until early July (150 to 200 d). Then seeds are either sown directly into seedbeds or buried outdoors in wooden screen boxes or

burlap sacks. Seedbeds are covered with aspen fiber mulch, whereas, buried seeds are covered with 1 to 2 in of topsoil. Seeds are irrigated regularly until the ground freezes, usually mid-November. Seeds in beds receive their cold moist chilling naturally through the winter. However, buried seeds are uncovered and maintained in a cooler at 25 to 28°F. The seeds are periodically inspected for early germination until they are sown either in seedbeds (April) or containers (January through March). Optimal germination occurs at 50 to 60°F and is delayed above 60°F. One nursery reports that 80 percent of seed lots handled this way in recent years had a germination of approximately 50 percent of the TZ viability.

Other juniper seeds have been treated with sulfuric acid for 35 to 120 min plus cold moist chilling for 120 d at 40°F, and this may apply to Rocky Mountain juniper. In recent trials with a single seed lot and multiple treatments, we achieved the highest germination (72 percent of the TZ viability) with a 45-min sulfuric acid soak prior to a 116-d warm moist stratification then 150-d cold moist chilling.

Periodic inspection for signs of active germination is needed. High viability seed may be sown directly, given adequate field or greenhouse space. Geographically separated seed sources respond differently to treatment. The use of fresh seed reduces the warm stratification requirements and the interaction between seed source and warm stratification.

Nursery Establishment: Nursery propagation primarily by seed. Spring planting can be substituted for the acid treatment and warm stratification, whereas fall planting can substitute for the prechilling period. In nurseries, seedlings are best established on mulched beds under partial shade. Under proper cultivation, seedlings can reach 6 inches in 3 years. Container production, potting, and root balling can increase survival over bareroot planting, especially during dry years. In nurseries, undercutting of third-year seedlings stimulates strong lateral root development. With age, it becomes increasingly difficult to transplant balled and burlapped, and is best moved before 10 years of age.

Bareroot and Container Handling, Storage, Planting, and Maintenance: Bareroot and container nursery stock can be handled, stored, planted and maintained as other coniferous species. Use accepted horticultural and forestry techniques as described in PM Tech Note No. MT-31, *Restoration of Woody Plants within Native Range Communities*.

Field Establishment: Under natural conditions, Rocky Mountain juniper prefers to germinate on moist sites under partial shade and is unable to establish itself from seed on exposed, drier sites. Moist sites are, however, conducive to frost-heaving, which can take a heavy toll on seedlings. As a result of the lengthy dormancy period and undependable germination, the use of bareroot or container stock for field plantings is recommended. (SEE PM Tech Note No. MT-31) Use standard establishment techniques such as removal of sod-forming grasses, weed control, mechanical cultivation, and watering at planting time to increase success. Field establishment by seed is usually poor except under nursery conditions and is, therefore, not recommended. Rocky Mountain juniper is relatively shade-tolerant during the seedling and sapling stages, but becomes increasingly intolerant with age requiring top light for height growth and crown development and is considered a very shade-intolerant species. Locate on the south or outside rows of windbreak and shelterbelt plantings. Protection of recently planted seedlings from sun and wind during periods of hot, dry weather is advised.

I. USES

Provides year round effect as a medium-size evergreen component in multi-row **windbreaks** and **shelterbelts** or in twin-row, high density **living snow fences**. Useful in visual **screenings** in farmstead/landscape applications. Provides nesting, loafing, shelter, and food for **wildlife**. Other uses include species diversity, site stabilization, erosion reduction, reduced soil surface temperatures, wildlife habitat in **mineland reclamation.** Provides species diversity and wildlife habitat in **range restoration**.

Useful in various **landscape** applications such as reduced irrigation management (xeriscape), low energy input, and naturalistic designs. Numerous **ornamental** cultivars are available for specimens, ground covers, foundation plantings, and other landscape applications (Bridger-Select for screenings, naturalistic uses, windbreaks, and shelterbelts). Provides **carbon sequestration** via photosynthesis and plant tissue production.

Cultivars, Improved Materials, and Availability: Use Bridger-Select Rocky Mountain juniper for conservation applications in Montana and Wyoming. It was selected for rate of height growth, uniformity of shape, vigor, and crown density, and demonstrates a high survival rate. It has excellent seedling survival, winter hardiness, and few pest problems. Request Foundation seed through the NRCS Plant Materials Specialist or the Montana State University Foundation Seed Stocks Program. Bareroot and container stock may be available through the Montana Conservation Seedling Nursery in Missoula, Montana, other State Forest Nurseries, and commercial nurseries. Numerous ornamental selections of Rocky Mountain juniper are available through the landscape industry.

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