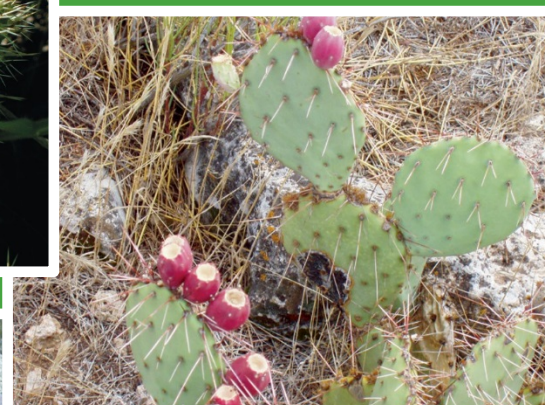


Field Guide for Managing Prickly Pear in the Southwest



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Prickly pear (*Opuntia* species)

Cactus family (Cactaceae)

Although none of the potentially weedy *Opuntia* species are included on noxious weed lists of States associated with the U.S. Forest Service's Southwestern Region, jointed prickly pear (*O. aurantiaca*) is on the Federal noxious weed list. This field guide serves as the Forest Service's recommendations for management of prickly pear in woodlands and rangelands associated with its Southwestern Region. The Southwestern Region covers Arizona and New Mexico, which together have 11 national forests. The Region also administers 4 national grasslands in northeastern New Mexico, western Oklahoma, and the Texas panhandle.

Description

Prickly pear (synonyms: nopal, tuna prickly-pear, Indian fig, jointed cactus, tiger pear) is a common name often given to the numerous species in the *Opuntia* genus and is sometimes given to cacti from other genera as well. Certain species are native to the Southwest, while others have been introduced from Central America and the West Indies.

Prickly pear's appearance (including growth form, flower color, pad shape, number of spines, and other characteristics) is sensitive to environmental change, thus contributing to the description of numerous varieties and nearly 60 different species. Regardless of native or nonnative status, these cacti share a common mode of spread whereby clones from detached pads are able to root and form new colonies. Cross-species reproduction is also common, and hybridization between species can make identification difficult at times.

Growth Characteristics

- Perennial, cool-season cactus; may be shrubby and grow to 12 feet tall, forming clumps up to 4 feet wide; certain species are tree forming and may grow to be 100 feet tall.
- Shallow, wide-spreading fibrous roots.
- Broad, flat green to grey-green, waxy succulent stem segments (also called joints or pads) oval to

rounded in shape; Plains prickly pear (*O. polyacantha*) pad may grow to 6 inches long; Texas prickly pear (*O. lindheimerii*) pads are 8–12 inches long and Engelmann prickly pear (*O. phaeacantha* var. *discata*) pads grow 8–16 inches long; pads are typically less than 1 inch thick in all species.

- Leaves are reduced to spines up to 2.5 inches long; although variable, typically 7–10 spines emerge from each areole; areoles are white to yellowish-brown circular bud zones, 1.5 inches apart and may completely cover the pads. Each areole may also contain tiny, fine barbed spines called glochids that easily adhere to humans or animals causing skin irritation.
- Solitary, showy yellow, pink, or red flowers, approx. 1–2 inches across occur along the apex or edge of pads. Blooms late spring to early summer.
- Fruit are dehiscent (i.e., natural bursting open of a fruit at maturity to release seed), barrel to pear-shaped fleshy berries to 1.5 inches long, usually below the bloom; glochids may be present or not. Fruit color ranges from yellow-green to magenta or purple in late summer.
- Reproduces vegetatively via cloning and seed; seeds are orbicular, flattened, approximately 1/8" long.

Ecology

Impacts/Threats

Grazing areas have reduced accessibility and forage availability where prickly pear forms into large colonies and dense populations. In severe drought conditions, livestock and wildlife often develop scouring and bloat when forced to eat the pads and fruit. Sharp protective spines and glochids cause discomfort to the animal's eyes, skin, and mouth areas. Some wildlife such as quail, javelina, small rodents, and birds take advantage of prickly pear, especially for cover. However, excessive presence of prickly pear degrades wildlife habitat, reduces flora and fauna species diversity, and decreases land value.

Site/Distribution

Prickly pear prefers dry, well-drained, gravelly to sandy soils. Ideal growth conditions occur in areas with high sunlight and warm temperatures, such as those found on south-facing slopes and rocky outcrops.

Spread

Vegetative reproduction from detached pads is the most common method by which prickly pear is spread. Hard rains, high winds, or passing animals may cause stem segments (pads) to break off, whereby each segment can root and propagate a new plant. Prickly pear seed and pads are spread over long distances when (1) washed away in waterways or during floods; (2) carried on surfaces and undercarriages of road vehicles and road maintenance equipment; or (3) attached to animal fur. The fruit is readily consumed, and seed is moved in the droppings of large animals, which can then be dispersed widely by beetles, ants, and other insects. New plants may be started during any month of the year.

Invasive Features

Prickly pear is superbly adapted to arid and semiarid landscapes. It has the ability to fix carbon dioxide at night and close its pores (or stomata) during the day. Waxy coating on stems allows it to tolerate a wide range of temperatures and to thrive in water limited environments. The wide-spreading, fibrous root system of prickly pear allows access to surface water, and its succulent stems store large quantities of water. During drought years, prickly pear usually spreads more readily than grasses, especially under hot, dry conditions.

Management

Prickly pear can be both a nuisance and a valued plant. Persistence and a long-term commitment is a must for prickly pear control. Unmanaged, smaller populations may quickly expand and become more difficult to eradicate if early control measures are not taken. The following actions should be considered when planning an overall management approach:

- Healthy plant communities should be maintained to limit prickly pear infestations.

- Check hay and straw for presence of plant fragments or seed before using them in areas without prickly pear; certified weed-free hay or pellets should be fed to horses in the back country.
- Detect, map, and eradicate new populations of prickly pear as early as possible. Keep annual records of reported infestations.
- Implement monitoring and a follow-up treatment plan for missed plants and seedlings.

Table 1 summarizes some management options for controlling prickly pear under various situations. Further details on these management options are explained below. Choice of method(s) taken for prickly pear control depends on numerous factors including the current land use and site condition; accessibility, terrain, microclimate; extent and density of infestations; and non-target flora and fauna present, etc. Other considerations include treatment effectiveness, cost, and the number of years needed to achieve control. More than one control method may be needed for each site.

Physical Control

Since prickly pear reproduces both vegetatively and via seed, care must be taken with cacti debris when physical methods are employed. **Any cacti pads remaining in contact with soil will likely root and grow into new plants.** Therefore, methods that completely remove or severely desiccate and dry out the stems (pads) are especially effective.

Manual Methods

Grubbing or digging up prickly pear is an effective management option for small, isolated populations. Cut the main root of prickly pear about 2 to 4 inches below the soil surface with a grubbing hoe or shovel. If a hydraulic or hand grubber is used, do so during hot, dry conditions for maximum stress to the plant; pile plant debris and burn or bag and completely remove from the site.

Prickly pear spines can cause injury, and the fine glochids will irritate the skin. Therefore, protective clothing (long pants, long-sleeved shirts, and leather gloves) should be worn when working in cacti areas. Manual methods may

Table 1. Management options*

Site	Physical Control	Cultural Control	Biological Control	Chemical Control
Roadsides, fence lines, or non-crop areas	Remove aboveground growth by scraping pads close to the ground. Combine with follow-up individual plant treatment for seedlings and re-growth.	Use seed, mulch, and fill materials certified to be weed-free. Clean machinery following activity in infested areas. Train road crews to identify and report infestations.	None available.	For individual plant treatment, use backpack sprayers or ATV-mounted spraying equipment. Wash under vehicle after application to prevent spread.
Rangelands, pasture, or riparian corridors	Completely shred pads with high-powered mulching equipment or use two-way raiiling; preferably during hot, dry weather. Use hand or hydraulic grubbers; remove and burn debris. Prescribe burn every 2–4 years.	Use seed and forage hay certified to be weed-free. Avoid driving directly through infestations. Reseed with desirable plants that will compete.	Same as above.	For extensive and dense infestations, use ground or aerial broadcast spraying. For fence line and sparse infestations, use backpack sprayers or ATV-mounted sprayers to treat individual plants on pads or stems.
Wilderness, other natural areas, and/or small infestations	Remove aboveground growth or grub and burn.	Use seed and forage hay certified to be weed-free. After passing through infested areas, inspect and remove any vegetative material or seeds from animals, clothing, and vehicles.	Same as above.	Use backpack or hand-held sprayers to spot treat plants.

* Choice of a particular management option must be in compliance with existing regulations for the land resource.

be followed up with herbicide treatments for missed plants and re-growth to increase control effectiveness.

Mechanical Methods

Mechanical methods such as disking, chaining, roller chopping, root plowing, or two-way raiiling will destroy prickly pear top growth. However, the vegetative parts are spread out and new plants will often take root, which can eventually increase cactus density. In some situations, mulching/grinding may be used to destroy top growth completely. Effectiveness of mechanical methods is usually enhanced when used in combination with other control methods such as follow-up herbicide control (see “Integrated Control Methods” at the end of this section for more information).

If using machinery to manage prickly pear, the equipment should be cleaned after use to prevent movement of pad (stem) fragments into adjacent areas.

Mulching/grinding –High powered mulching/grinding equipment can be used to reduce top growth to near ground level. All material should be finely shredded during hot, dry conditions to allow pads to dry out and desiccate. Follow-up monitoring and herbicide treatment will likely be necessary to address regrowth or missed plants.

Two-way raiiling – A length of anchor chain is modified to include a section of railroad rail, either with swivels or without. The chain is pulled between two tractors spaced 50–75 feet apart that go first in one direction, then a second pass is made in the opposite direction. A J-shaped swath pattern where one tractor lags behind the other has been found to be more effective than a U-shaped pattern. While two-way raiiling is limited by slope and uneven terrain, it can be effective in addressing taller, dense stands that are extremely difficult to access for spraying purposes. Debris should be gathered or raked with tractor equipment (i.e., front-end loader and stacker) and piled for later burning.

Table 2. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example ¹	Broadcast Treatment (rate per acre)	Spot Treatment (spray solution) ²	Time of Application	Remarks
Picloram ³	Tordon 22K	2–4 pints	1–2% + 0.25% NIS ⁴ and a blue dye	Pad or stem spray method can be applied year round but best during growing season; do not apply in extreme cold; preferably with moderately moist soil.	Follow herbicide label directions. Prickly pear dies at a slow rate following application; may take 2–3 years. To avoid damage to desirable trees and other plants, do not spray dense prickly pear growing beneath or near these plants. Cost of treatment increases rapidly as density and size of prickly pear and other cacti increases.
Picloram ³ + fluroxypyr	Surmount	4 pints	Same as above.	Same as above.	Same as above.

¹ Trade names for products are provided for example purposes only, and other products with the same active ingredient(s) may be available. Individual product labels should be examined for specific mixing information and appropriate use with prickly pear.

² Spray solution is the herbicide/water ratio in a spray mix that may be used for spot treatment with backpack or hand-held sprayers. The amount of product applied during an annual growing season must not exceed the maximum application rate per acre as specified by the product label – refer to the product label for the site type and application.

³ Picloram is a restricted-use pesticide. A certified applicator’s license is required for purchase and use.

⁴ NIS is an abbreviation for nonionic surfactant, an additive commonly recommended by herbicide labels for post-emergent foliar herbicide application.

Follow-up individual plant treatment is usually necessary with this method to address re-growth.

Prescribed Fire

Certain species of prickly pear are more susceptible to fire than others. For burning to be effective, there must be sufficient fine fuel available to support an intense hot fire that engulfs the cacti and ruptures plant cells. If heat from the fire is not long lasting and hot enough to completely destroy the pads, then only modest top killing usually occurs. New pads will quickly grow from surviving tissue, and the plant will return to its original size within 3–5 years. Prescribed burns repeated every 3–4 years will increase control effectiveness, but this approach is often impractical in the Southwest. In general, summer fires are more effective than winter fires provided that the fuel source is dry. However, prescribed fire may be more useful when combined with

herbicide application (see “Combined Control Methods” at the end of this section for more information).

Cultural Control

Prevention, early detection, and plant removal are critical for managing prickly pear. Land managers should determine appropriate control goals for the land use and educate the local public as to how they can help meet those goals. Vehicles, humans, and livestock should be discouraged from traveling through infested areas; and a program to check and remove vegetative fragments and seeds from vehicles and livestock should be implemented to help stop dispersal. Seed and materials used for mulch, forage, or fill should be certified to be weed-free. If possible, weed screens should be used on irrigation water intakes in infested areas to prevent fragment and seed transportation in irrigation canals.

Biological Control

Grazing

Prickly pear is occasionally grazed by livestock and wildlife, especially to obtain moisture during times of drought. When cattle consume prickly pear onsite or when the cacti is harvested to provide an emergency forage source, it is important to have supplements available to counteract the effect of overconsumption. Use of cottonseed meal or other protein source will decrease the likelihood for pear ball formation in the rumen. Feeding hay or other dry matter helps to counteract slow digestion and lessens the effects of scours by reducing the rate of passage after eating prickly pear. Some livestock will come to prefer prickly pear; however, this preference could lead to poor body condition, mouth sores, and ulcerations.

Classical Biological Control

The USDA has not approved any classical biocontrol agent (insects, pathogens, etc.) for use in the United States. Although Australia uses a parasitic moth (*Cactoblastis cactorum*) with some success to manage prickly pear, Mexico widely grows prickly pear as an edible crop and as a harvested livestock feed. Therefore, release of a biocontrol agent in the Southwest is highly unlikely.

Chemical Control

Herbicides recommended in table 2 will control prickly pear when properly applied, but do not expect quick results. After spraying, it may take 6–8 months before visible effects show and another year or two before mortality occurs. Picloram is the key ingredient in the products listed for cactus control. Surmount[®] and Tordon[®] 22K, the primary herbicides available for cactus control, are restricted-use products that require an applicator license for purchase and use. Licensing information is available through a State's department of agriculture.

Each herbicide product has different requirements and restrictions according to the label. Read and understand the label prior to any application. Consult the registrant if you have questions or need further detail.

Herbicide Application

Picloram can impact nearby desirable trees, shrubs, and crops; therefore, precautionary measures should be taken if non-target plants (including woody species) need to be protected. Also, picloram can impact water quality. It should not be used on more than 25 percent of a watershed, and care should be taken especially within 100 feet of known sinkholes or fractures where herbicide could reach belowground aquifers.

Ground application – This control method works best on thin or isolated stands of prickly pear and other cacti, such as those found along fence lines or other areas where cacti are unwanted. As described under the Brush Busters program of the Texas AgriLife Research and Extension Service (TARES), ground application can be applied throughout the year. To control prickly pear, TARES recommends the herbicide Surmount[®]. The herbicide combines fluroxypyr with picloram, which is the single active ingredient in Tordon[®] 22K. Prickly pear is notoriously slow to die, but pads turn yellow and melt down quicker with Surmount[®] (about a year) as compared to Tordon[®] 22K (about 2 to 3 years). These herbicides are taken up through the pads and stems and through the roots after rains have moved the herbicide into the soil. A lack of rain over an extended period of time after spraying may reduce cactus plant kill.

Hand-held sprayers, backpack sprayers, cattle sprayers, or sprayers mounted on 4-wheel all-terrain vehicles (ATVs) may all be used effectively according to TARES. Hand-held sprayers may be used for small patches. Backpack sprayers are more efficiently used in dense stands of cacti or cacti intermixed with brush. ATV sprayers are better used on relatively large acreages or where the cacti are spread out over large areas. The sprayer should have a nozzle that can deliver a coarse spray (large droplet-size). TARES suggests that fan-type nozzles may work better for large prickly pear plants, but an adjustable cone nozzle (such as the Conejet[®] 5500-X6 or 5500-X8 produced by the Spraying Systems Co.) is more efficient for small plants. Any equipment used to spray herbicide should be calibrated.

Approximately 76 to 100 percent root kill of prickly pear and other cacti can be achieved by spraying Surmount®. To prepare the spray mix, add herbicide at a 1 percent concentration to water. To ensure a thorough coating of the waxy pads or stems, add either a nonionic surfactant or liquid dishwashing detergent to the spray mix. It is helpful to add a spray marking dye, such as Hi-Lite® blue dye, to mark plants that have been sprayed and to indicate whether and adequate amount of spray is being sprayed on the green pads or stems. Apply the spray until the pads or stems are almost wet, but not to the point of runoff. Results will be faster and more consistent if both sides of prickly pear pads are sprayed.

Aerial spraying – A helicopter is ideal for targeted spraying of localized or hard-to-reach patches of cacti, whereas a fixed wing aircraft is more efficient for open rangeland. If equipped with the correct spray system, either type of aircraft can be used to deliver an effective spray mixture to prickly pear. Aircraft equipped with a satellite guidance system and GIS (geographic information system) are essential when spraying in wildland situations. This alleviates the need for on-the-ground flaggers and provides detailed maps showing areas sprayed. Surmount® applied at 4 pints per acre provides about 75 percent control of prickly pear cover. It can be used safely on rangeland grasses so forage production is not sacrificed. Always read and follow label direction for handling and mixing.

Integrated Control Methods

Prescribed burning may be combined with herbicide treatment to control prickly pear if a fine, dry fuel is available. However, herbicide spraying alone is suitable in areas where burning is impractical. A **prescribed burn-herbicide** treatment is particularly useful for controlling cacti in large, open areas where herbicide applications can be made with rotary or fixed wing aircraft. Enough fuel must be present to insure a hot, long-lasting fire that burns most pads and stems to the ground surface or, at a minimum, greatly reduces the waxy surface on pads. Burning in early summer is better provided the grass fuel source is dry and uniformly distributed across the area

planned for prescribed fire. Follow-up spraying should be scheduled in autumn to catch young succulent prickly pear regrowth that has not yet built up a waxy surface on its pads. However, spraying should be delayed until the next spring or fall if prickly pear regrowth is poor during the first season after burning.

Herbicide spraying can be used as a single control method or in combination with other top-removal methods. Effectiveness of mechanical methods is usually enhanced when used in combination with herbicide treatment. If spraying in combination with a mechanical method, it is best to bruise or puncture stems before applying herbicide. Anticipate the need to monitor and use follow-up herbicide applications for several years to attain long-term control.

Management Strategies

Because each treatment situation is unique, any strategy adopted for managing prickly pear should involve careful planning. Land use goals should be evaluated to determine where cacti presence is acceptable and in what quantity. Small, isolated infestations on otherwise healthy sites should be given high priority for treatment. Perimeters of larger infestations should be treated first and then worked toward the center.

Regardless of the management approach followed, it must be recognized that prickly pear cannot be effectively controlled within a single year or by treating only one time. Acceptable levels of control will likely require 2 to 3 years of repeated control methods with follow-up treatments extending over an additional 2 to 3 years. Since it is ordinarily useless to treat an area only once without retreatment, sufficient resources must be allocated for the area where control is attempted. After initial treatment, it is important that resources are also available to respray or retreat the treated area as necessary. Treated areas should be monitored periodically and measures taken to control missed plants and newly emerged seedlings. It is also important to monitor the return of desirable native plant species.

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Suggested Web Sites

For information on invasive species:

<http://www.invasivespeciesinfo.gov/>

<http://www.invasive.org/weedus/index.html>

For information about calibrating spray equipment: NMSU

Cooperative Extension Service Guide A-613 Sprayer

Calibration. Available at <http://aces.nmsu.edu/pubs/>

[_a/A-613.pdf](http://aces.nmsu.edu/pubs/_a/A-613.pdf)

Herbicide labels online: <http://www.cdms.net/>

**For more information or
other field guides, contact:**

USDA Forest Service
Southwestern Region
Forest Health
333 Broadway Blvd., SE
Albuquerque, NM 87102

**Or visit the Southwestern Region's
website for invasive species:**

<http://www.fs.usda.gov/goto/r3/invasivespecies>



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