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Field Guide for Managing African Rue in the Southwest

Forest Service

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Cover Photos

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African rue (*Peganum harmala*)

Caltrop family (Zygophyllaceae)

African rue is listed as a noxious weed in both Arizona and New Mexico. This field guide serves as the U.S. Forest Service's recommendations for management of African rue in forests, woodlands, and rangelands associated with the Service's Southwestern Region. The Southwestern Region covers Arizona and New Mexico, which together have 11 national forests. The Region also includes four national grasslands located in northeastern New Mexico, western Oklahoma, and the Texas panhandle.

Description

African rue (synonyms: wild rue, rue weed, Syrian rue, Harmal, isband, ozallaik, ruin weed, steppenraute) is a bright green, succulent herb with a woody base with a deep growing and robust perennial root system that is a major obstacle to plant control. This invasive weed is very drought tolerant and exhibits "drought evader" growth characteristics. In southern New Mexico, plants die back to their roots during winter and initiate new annual growth in mid-to-late March. After spring growth and flowering, plants may become senescent (old-looking) and die back to the base as soils dry in summer. With cooler temperatures and additional moisture later in the season, African rue usually undergoes a second vegetative growth phase until freeze occurs in early November.

Growth Characteristics

- Perennial bushy herb that grows 1 to1.5 feet tall and 3-4 feet in diameter.
- Has a hardy woody taproot that reaches 25 feet or more downwards into the soil profile. Creeping, lateral roots are produced about 12-15 inches below the surface that can extend up to 20 feet away from the parent plant.
- Leaves are alternate, smooth and divided deeply into narrow lobes. Leaves have a very disagreeable odor when crushed.
- Single flowers are borne along the stem and in the forks of leaves. Flowers have five white petals and produce a green, orange, or brown-colored cylindrical seed pod (2-4 celled) with 45-60 seeds.
- Reproduces by seed, but new shoots and plants are also produced from adventitious buds along lateral roots. Seed is secured in a leathery, fruit capsule; each plant may produce as many as 1,000 fruits.

Ecology

Impacts/Threats

African rue is extremely drought tolerant and undergoes robust and rapid vegetative growth when soil moisture is available. This weed is extremely toxic to cattle, sheep, horses, and humans; it contains at least four poisonous alkaloids. The seeds and fruit are the most toxic, followed by young leaves and mature leaves. Animals typically avoid eating African rue because of its bad taste and smell. Most parts of the plant contain allelopathic chemicals that reduce the growth of surrounding native plants.

Location

Common in disturbed and barren areas such as roadsides, parking lots, oil pads, corrals, stockyards, open fields, abandoned crop fields, river banks, ditches and arid/semi-arid desert areas, especially in moist soils. It can grow in many soil types, including alkaline soils and those with high salinity. Found throughout most western states, including New Mexico, Texas, Arizona, California, Montana, Nevada, Oregon, and Washington. In New Mexico, it is found primarily in southern counties with isolated populations in central and northwestern counties. It is common in eastern Arizona and western Texas.

Spread

Seeds and root fragments are readily transported by running water. Seeds can be carried in mud that sticks to vehicles, railcars, and earth-moving equipment; thus, new plants easily spread along transportation corridors. Seed may also adhere to the feet, fur, or feathers of animals. Seed longevity is unknown but is probably persistent.

Invasive Features

African rue favors disturbed areas such as those impacted by earth-moving equipment, excessive grazing, or vehicle use. Disturbed areas with moist soil are especially susceptible, such as roadsides, river or stream banks, riparian corridors, waterways, and drainage or irrigation ditches.

Management

Because of African rue's elaborate root system, efforts to eliminate the plant by means other than herbicidal control are very difficult. Grazing is not an option due to toxicity. There are no known biological controls at this time. The plant quickly grows back after mowing or burning, and deep cultivation only divides and spreads the roots. Since African rue is able to regenerate from root fragments, grubbing or cultivation may actually increase the population size.

Consider the following strategies to contain and reduce African rue populations:

- Maintain healthy plant communities to prevent or limit infestations of African rue.
- Detect and eradicate new populations of African rue as early as possible, especially along roadways, waterways, and ditches.
- Use foliar active or soil active herbicides at recommended rates for effective control of African rue populations. Application methods include broadcast or individual plant treatment (IPT).

Choice of control method(s) for African rue depends on the land use and current site conditions (accessibility, terrain, soil and air temperature, weather, density and degree of infestation, other flora and fauna present, etc.). Other considerations include treatment effectiveness, cost, and the time needed to achieve control. Table 1 below summarizes some approaches for common situations involving African rue. Combining control methods may increase effectiveness. In addition, more than one control method may be needed for each site.

Physical Control

Given African rue's complex root system, it is extremely difficult to control the plant using only mechanical techniques. The more practical and economical way to obtain effective long-term control is to use herbicide treatments alone or in combination with a physical method.

Manual Methods

Hand pulling, digging, or hoeing for control of mature plants is virtually impossible due to the depth of the root system. Continued hand removal of seedlings and young plants year after year may eventually control individual plants, but this approach is tedious and usually impractical.

Mechanical Methods

Controlling African rue by plowing or grubbing individual plants is ineffective because the roots are too deep to dig out and any root parts left in the ground will likely resprout. In many instances, cultivation may actually lead to an increase in population size. In certain agronomic situations, repeated deep cultivation combined with reseeding perennial plants has been found to be somewhat successful; but this is an expensive option. Mowing or blading also causes the plant to resprout and spread.

Prescribed Fire

Fire is not an effective control method as plants grow back rapidly after burning.

Cultural Control

Early detection and plant removal, especially of seedlings and young plants, are critical for preventing African rue establishment and spread. Land managers, road crews, and the local public should be educated on identification so they can report suspected populations. Vehicles, humans, and livestock should be discouraged from traveling through infested areas; and a program to check and remove seeds from vehicles and livestock after going through infested areas

Table 1. Management options*

Site	Physical Methods	Cultural Methods	Biological Methods	Chemical Methods
Roadsides	Few options available. Combine suppression methods (e.g., repeat deep cultivation or mowing) with reseeding desired native perennial plants.	Use certified seed. Limit disturbances along roadsides. Implement requirements for vehicle operations and for reporting infestations along roads.	None known at this time.	Use truck or tractor spraying equipment. Wash underneath to prevent spread.
Ditches and waterways	Few options available. Hand extraction or hoeing can be used to target seedlings.	Limit disturbances along waterways and ditches. Increase public awareness and reporting of plant presence along ditches and roadways.	Same as above.	Use herbicide with approved aquatic labeling for use near or in water.
Rangeland	Few options available.	When moving livestock or vehicles through infested areas, inspect mud on animals, clothing, and vehicles and remove any seeds before entering uninfested areas.	Same as above.	Use ground broadcast spraying with ATV or tractor; however, backpack spraying may be more practical in areas difficult to access. Consider individual plant treatment in areas with less dense infestation or near desirable vegetation.
Wilderness and other natural areas	Few options available. Hand removal repeated year after year may be required for effective control.	Post signs warning visitors to remove seeds.	Same as above.	Same as above.

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

should be implemented to help stop the spread. Hay, straw mulch, planting seeds, and other related products should be certified to be weed free before use in areas undergoing treatment.

Biological Control

Grazing

Grazing is not a viable option for removing African rue. Because of its bad taste and smell, the plant is usually avoided by livestock unless other forages are unavailable. However, African rue has occasionally been found in baled hay. Poisoning effects on livestock include loss of appetite, trembling, and loss of coordination. Severe poisoning can result in hemorrhaging in the heart and liver.

Classical Biological Control

There are no known biological control agents for African rue at this time.

Chemical Control

Numerous herbicides have been investigated for African rue control in field trials conducted by New Mexico State University, Texas A&M, and other universities. These tests have concluded that only chemicals that are translocated deep into the plant's root system are effective in killing the weed. Unfortunately, the few herbicides that provide effective long-term control are nonselective (e.g., imazapyr,

tebuthiuron, and hexazione) and may cause unacceptable injury to nearby desirable species, especially grasses. Certain selective, systemic herbicides (e.g., metsulfuron) provide seasonal top growth suppression; however, most plants recover and regrow within a year of treatment.

General Considerations for Control

Based on research and practical experience, the following guidelines have been prepared for control of African rue with herbicides:

- **Plant condition and growth stage** at the time of application are critical for control success. Treating African rue that is healthy and robust in late summer (September-October) is optimal when using a foliar spray. Plants in the early vegetative and bloom stage in spring (April) can also be successfully controlled provided soil moisture is adequate. Do not spray African rue that has been stressed from drought, disease, insects, or other causes that might have resulted in die back, yellowing, or other plant damage.
- **Weather conditions** at the time of spraying are important to successful herbicide activity. Coverage is best with low wind speeds (3 to 8 m.p.h.) and cool temperatures (between 50 °F and 85 °F). Air temperatures above 85 °F increase the spray solution volatility and, thus, reduce herbicide available to be absorbed by the plant. Do not spray a foliar active herbicide if a rainstorm is expected within 6 hours of application.
- **The plant community** associated with the African rue population should be closely evaluated before treating an area. Use of a nonselective herbicide should not be made in areas where grass preservation is desired. Individual plant spraying will minimize grass damage relative to broadcast spraying, but some damage should still be expected.
- **Time needed to gain control** is slow, requiring a year or more to kill a plant when either foliar sprayed or treated with a soil active herbicide.

Herbicide Application Options

Broadcast foliar spray treatment – The ideal time to foliar spray African rue varies from year to year because of specific weather conditions. Expect average to above average winter moisture to produce a prolific burst of new vegetation growth in spring, which is needed before spraying to maximize chemical uptake and movement (translocation) through all portions of the plant. In droughty years, African rue will have poor foliage and flower growth; therefore, spraying is not recommended. Similarly, healthy foliage that results from above average summer rainfall can be sprayed late in the season. At the time of spraying, soil temperature at a 6-inch depth should be between 55 °F and 70 °F. In years with average to above average winter precipitation, the desired growth stage and soil temperature range occurs roughly from April 1 to May 15, plus or minus 15 days. In late season, the desired growth stage is usually from September 1 to October 1.

Using imazapyr alone or in combination with other herbicides has consistently provided the best African rue control. Imazapyr is very active on the root system and is the most common commercial product used for African rue control. Imazapyr (Arsenal™) is labeled for control of undesirable vegetation growing on pasture/rangeland, noncropland sites, rights-of-way, industrial areas, fence rows, nonirrigation ditchbanks, establishment and maintenance of wildlife openings, and for bare ground weed control. When broadcast spraying larger infestations, use a 0.75 lb a.i. per acre rate, which is equivalent to 3 pints of product per acre. When spot treating smaller populations or isolated plants, use an IPT approach as described below. A surfactant should be added to the herbicide mixture at rates specified on the herbicide label. Imazapyr is a nonselective herbicide so damage to grasses and other associated plants should be anticipated.

A new herbicide product called Viewpoint™ (active ingredients: aminocyclopyrachlor + imazapyr + metsulfuron) provides good to excellent control of African rue when applied at a rate of 13 to 18 ounces of product per acre. Viewpoint is formulated as a dispersible granule

Table 2. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example[1]	Product Example Rate per Acre (broadcast)	Backpack Sprayer Treatment Using Product Example[2]	Time of Application	Remarks
Imazapyr	Arsenal, Habitat, others	3 pints per acre	3%	Spray healthy regrowth foliage in good condition in late summer or early fall.	Imazapyr is a nonselective herbicide; anticipate damage to associated plants from overspray or root transfer. When performing IPT with a backpack sprayer, adjust nozzle to wet foliage thoroughly.
Aminocyclopyrachlor + metsulfuron + imazapyr	Viewpoint	13–18 ounces per acre	NA	Same as above.	This herbicide combination provides nonselective control and should be used in noncrop areas.
Metsulfuron	Escort, Ally	3.2 –6.4 ounces per acre	NA	Same as above.	Metsulfuron is selective and provides seasonal foliage suppression but low rue plant mortality.
Tebuthiuron	Spike 20p	10–15 pounds of pellets	NA	Anytime; optimal time is just before a rain event.	Apply only on sandy or coarse soils; will likely damage associated vegetation.
Hexazinone	Velpar	NA	Mix 50:50 with water in a backpack sprayer. Apply 4 ml per plant (equivalent to 2 ml undiluted Velpar).	Anytime.	To apply as an IPT, squirt 4 ml of mixture on the soil surface next to each treated plant. Not recommended as a broadcast because it is nonselective and will damage or kill associated vegetation.

[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 information and appropriate use with African rue.

[2] Herbicide/water ratio - As an example, a gallon of spray water with a 3 percent mixture is made by adding a sufficient volume of water to 4 ounces of liquid herbicide until a volume of 1 gallon is reached (4 oz ÷ 128 oz/gal = 0.03 or 3 percent).

that is mixed in water and applied as a liquid spray. This herbicide is labeled specifically for noncrop situations only, such as spraying rights-of-way, oil pads, parking lots, etc. It provides broad-spectrum control of brush and weeds species. Care should be exercised when using this product in the vicinity of crops or other desirable plants because this herbicide combination may injure or kill them. Read the herbicide label carefully for use directions.

Broadcast soil active treatment – African rue growing on rangeland with sandy to loamy soils may be controlled with a broadcast rate of tebuthiuron (Spike 20P®) applied at 2 to 3 lb a.i. per acre. Unlike the liquid foliar active herbicides, tebuthiuron is a dry pellet formulation that is applied to the soil surface. These pellets remain intact until they are dissolved by rainfall and the chemical is moved into the soil where it is taken up by roots. Tebuthiuron is applied by aerial or ground methods and provides fair to good African

rue control. However, damage to associated vegetation should always be anticipated at the relatively high rate of application required.

Individual plant treatment (IPT) – For practical reasons, IPT is ordinarily used only in small areas where African rue is growing sparsely and the population is easy to treat. IPT is an effective way to control the plant, but the method is often time consuming and costly, especially if the African rue population is dense. Two products, hexazinone (Velpar®) and imazapyr, are preferred IPT herbicide choices, but they are applied in different ways as described below:

- Hexazinone can be applied as a liquid directly to the soil surface next to the canopy of individually treated plants. For IPT, hexazinone should be diluted as a 50:50 mix with water in a backpack sprayer. A quick squirt of the handle with the nozzle turned to a straight stream generally administers about 4 ml of solution (or 2 ml of active product), which is the desired rate of application. Before spraying, check the handle pressure and practice with water in the sprayer to calibrate this delivery rate. Adding a blue dye to the spray mixture helps to identify treated plants. Hexazinone moves into the soil profile with rain and is taken up by roots. Thus, application prior to anticipated rainfall is preferred, but the product usually works at any time of year.
- Imazapyr diluted as a 3 percent mixture with water is another effective IPT. Most herbicide activity is through the foliage so use a backpack sprayer with its nozzle adjusted to completely wet the top growth of individual plants. Add blue dye to the spray mixture to help view spray coverage and to identify treated plants.

Control Strategies

Early detection and control of new African rue populations, especially near waterways and ditches, is important to slow the spread of this noxious weed. Once established, African rue is difficult to eradicate without also impacting associated desirable plants. Each treatment situation is unique and requires site-specific management decisions.

In most cases, effective control of African rue requires herbicide spraying. Even with herbicide use, it may take years to reduce the presence of this plant, which can regenerate from deep-growing root parts as well as seed. In areas with a dense widespread population, consider a broadcast herbicide application that eliminates as much of the weed population as possible. Always anticipate the need for monitoring and additional control measures such as spot spraying with a backpack sprayer. Depending on the intended land use and available budget, consider reseeding desired plant communities, as healthy plant populations are a deterrent to the spread of African rue.

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The Plant Database. 2010. U.S. Department of Agriculture NRCS National Plant Database. Baton Rouge, LA (http://plants.usda.gov/java/profile?symbol=PEHA)

Suggested Web Sites

Dirty Dozen Invaders of the Southwest. 2002. NMSU, UA, USU, and the U.S. Department of Agriculture cooperating.

www.invasiveweeds.com/dirty/african_rue/welcome.html

For information on invasive species:

http://www.cdfa.ca.gov/phpps/ipc/weedinfo/peganum.htm

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 at http://aces.nmsu.edu/pubs/_a/A-613.pdf

Oregon Department of Agriculture ODA Plant Division Noxious Weed Control

http://www.oregon.gov/ODA/PLANT/WEEDS/profile_africanrue.shtml

For more information or other field guides, contact:

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Or visit:

http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies