# Forage Kochia: To Seed or Not To Seed

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In today's political climate, planting of introduced species on western ranges ignites controversy. Maintenance of big sagebrush/bunchgrass rangelands that have been depleted by past excessive grazing and now are subject to repeated destructive wildfires are major challenges for resource managers. Many native plant communities have been replaced by exotic plant species. The remaining areas continue to shrink in size. For some plant communities the exclusion of domestic animals increases the hazard of wildfires, and exclusion does not produce a spontaneous return of the native perennial species. Resource managers keep asking scientists for plants that will both protect sites against erosion and provide forage. To date there is no universal cure. Such a plant must be able to compete with invasive annuals such as cheatgrass. In 1901, P.B. Kennedy suggested that science attack this problem for Great Basin ranges. Nearly a century later we face the same problems, but the extent and dominance of annual weeds is hundreds of times greater. Today we have a plant potentially capable of suppressing annual weeds on a sustainable basis. The question is however, is society collectively willing to use this species?

This review focuses on `Immigrant' forage kochia (*Kochia prostrata*) as a reclamation candidate for degraded habitats. We also want to encourage resource managers to be aware of the important role this plant can play on arid rangelands.

## Historical Perspective

Forage kochia, also known as prostrate summer cypress and perennial summer cypress, is native to Eurasia. This shrub, which averages 1 to 3 ft. in height, belongs to the Chenopod family (Fig. 1). This family contains many valuable arid rangeland species like the saltbushes, winterfat and black greasewood. Red molley (often called gray or green molley) is a perennial *Kochia* native to the western United States. A second native perennial is *Kochia californica* or red molley. Red molley is a preferred forage of sheep on winter ranges and declined greatly in abundance early in the 20th century. With the fall of the range sheep industry in the Great Basin, these native perennials have increased. These plants are restricted to salt effected soils in desert environments, so they have not been competitive with invasive annual weeds in the big sagebrush zone. Red molley is difficult to grow from seed and apparently it has never been used in revegetation trials.

Forage kochia has long been cultivated as a forage species in Central Asia. It has been called the "Russian Alfalfa". The Russian literature has many contradictory statements concerning the forage value of forage kochia. In the original *Flora of the USSR* it was ranked about equal to cereal rye in forage value (Shishkin 1936). In the same text however, it was rated as valuable browse for domestic stock and wildlife in the Asiatic portions of the USSR. In the deserts of central Asia it was considered a valuable species. Horses and camels were reported to highly prefer forage kochia and Kazaks herdsmen esteemed this perennial as a fattening forage for sheep, goats, and camels (Larin 1956). Forage kochia's greatest asset however is that it's an extremely variable species that grows naturally over a wide range of environments. Presently it has been introduced to even a wider range of environments in eastern Europe and Asia. The Karakul Sheep Experiment Station, Samarkand, Uzbekistan, has assembled a collection of some 1,500 accessions of *Kochia prostrata*.

**Fig. 1.** *Immigrant forage kochia providing nutritional browse in a cheatgrass dominated rangeland.*

Wesley Keller, who was a long time chief of the Forage and Arid Pasture branch of the Agricultural Research Service (ARS), USDA, observed *Kochia prostrata* growing in the gardens of the V.I. Williams Museum at the Timiryazev Academy in Moscow in 1959 (Keller and Bleak 1974). He was advised the species was widely recommended for seeding on sandy soils as a compliment to crested wheatgrass. Seeds were requested from the Russian gardens and they were increased at the USDA Plant Introduction Garden, Pullman, Washington. A total of 18 accessions were imported.

For many years there had been a search for desirable plant materials that could biologically suppress *Halogeton*, and crested wheatgrass was widely planted on sagebrush sites in the Great Basin for this purpose. Crested wheatgrass was not adapted to salt effected soils where halogeton thrived, however, scientists proposed that *Kochia* be used to suppress halogeton.

Several accessions of forage kochia have been admitted to the United States. The first occurred in 1961 with additional material received in 1966, 1969, and 1971 (Davis 1979). The Intermountain Station of the USDA, Forest Service, established test gardens of *Kochia prostrata* at several locations as it became available, and Perry Plummer suggested that forage kochia provided quality winter forage for mule deer (Plummer et al. 1970). Crude protein of forage kochia ranges between 14.7% in August to a low of 8.9% in March (Davis 1979). Antelope bitterbrush, which is noted for its contribution of high quality nutrition on mule deer winter ranges, ranges between 13% in August to 11.28% in May (Doughty 1966). Forage kochia also exhibits adequate crude fiber and carotene levels while tannins are well below the critical level (Davis 1979). In some environments forage kochia also supports green foliage year-round and can tolerate heavy grazing pressure from rabbits, livestock, deer, and other wildlife.

Once established crested wheatgrass can suppress cheatgrass, stabilize sites against further erosion, and provide seasonal forage for livestock. Crested wheatgrass is not preferred by wintering mule deer, but they will rely on it heavily if snow cover limits selection (Urness et al. 1983). The addition of forage kochia to grass seed mixtures provides an excellent means of restoring degraded big game winter ranges. Since the first suggestions that forage kochia was desirable fall and winter forage for mule deer, it has been the subject of substantial research in Utah. Most of this research has been focused on establishment and grazing management techniques.

## A Case History: The Dunphy Hills

The rehabilitation of rangelands that have been altered by disturbances such as fire and excessive grazing is a chore resource managers deal with on a daily basis. Fire is an annual event in the Intermountain West. These fires resulted in large expanses of landscapes characterized by annual weed species and little remaining native vegetation. The Dunphy Hills, located north of Interstate 80 between Battle Mountain and Elko, Nev. were once dominated by big sagebrush and native bunchgrasses (Robertson and Kennedy 1954). The Dunphy Hills form the southwestern extension of the Tuscarora Mountains. The Dunphy Hills range are 5,000 to 6,500 ft. in elevation. They are foothills to the much higher Tuscarora and Independence ranges to the north. Excessive, continuous, and improperly timed grazing in the late 19th and early in the 20th century depleted the perennial grasses and stimulated an increase in big sagebrush. Eventually cheatgrass invaded, and the hills have burned many times in wildfires. The great fire storm of 1964 burned about 300,000 acres in this area. Since that fire the area has experienced repeated wildfires that stimulated further increases in cheatgrass and tumble mustard. Wildfires now burn the area so frequently that woody vegetation has been virtually eliminated.

Dunphy Hills is critical mule deer winter range, and its degradation has caused significant decreases in local mule deer numbers, as well as noticeable declines in native animal and plant diversity. Competition for forage between livestock and wildlife became severe due to limited selective opportunity in these habitats. This continuation of heavy use further degrades these habitats that are too often thought to be so degraded that the situation could not possibly get any worse.

Continued heavy use by wildlife and livestock further degrade these areas, and resource managers are called upon to restore these degraded habitats back to their pristine conditions. Efforts to reseed native plant communities have not been successful. The cheatgrass dominated ranges are closed to the establishment of native perennials unless the competition from the invasive annual is reduced (Robertson and Pearse 1945). J.H. Robertson pioneered the use of crested wheatgrass to biologically suppress cheatgrass. Crested wheatgrass has proven to be a highly productive forage producer on millions of acres in the Intermountain Area. Besides providing valuable forage, many of the large scale seedings reduced the frequency and spread of wildfires, suppressed invasive weeds, and prevented accelerated soil erosion. These large scale conversions of degraded native communities to perennial grasslands were later criticized by the environmentalist and wildlife managers who suggested that wildlife habitat had been sacrificed for livestock forage. This concern, along with a push by native plant societies to reintroduce native species further complicated management programs as range managers approached their task of restoring the area.

In 1989 the Nevada Division of Wildlife, Bureau of Land Management, USDI, and Newmont Gold Company implemented a rehabilitation plan for the Dunphy Hills. They seeded, with assistance from other groups (i.e. sportsman organizations, and the T. S. Ranch), a mixture of `Immigrant´ forage kochia, Wyoming big sagebrush, four-wing saltbush, and a variety of

bunchgrasses (i.e. thickspike wheatgrass, Indian ricegrass, and crested wheatgrass) on degraded rangelands in the Dunphy Hills. Among the various treatments (green stripping, mixture, and forage kochia plots) these seedings totaled about 1,000 acres per year. The first year after the seeding, cheatgrass and mustard still dominated the landscape, but as each year passed forage kochia plants became larger and successfully competed with the cheatgrass and mustard. By the fourth growing season Wyoming big sagebrush, thickspike wheatgrass, and other native bunchgrasses and forbs were becoming more visible. Portions of the area have experienced more wildfires, but forage kochia has resprouted successfully. As a consequence mule deer fawn ratios have increased in recent years.

As one travels across the Intermountain Area, it is readily apparent that many habitats have been lost to exotic weedy annuals. Many resource managers have given up on many of these degraded ranges as fire frequency has increased to such a level that native perrenials can not establish. In some instances public opinion limits the tools available to land managers; a do nothing attitude prevails. The cost of rehabilitating vast areas of degraded rangelands is staggering. Wyoming big sagebrush is currently $46 per pound and prices for other desired native species are prohibitively high (antelope bitterbrush $19, fourwing saltbush $7.50, Indian ricegrass $5.20, and thickspike wheatgrass $3.50). The success of seeding native species is quite variable, but generally poor. Mining companies have spent up to $1,000 per acre in their rehabilitation efforts, and most have experienced marginal success at best. Crested wheatgrass ($3/lb) has an 80% chance of success on acceptable sites and `Immigrant´ forage kochia ($19/lb) a 70% chance of success (USDA, Agricultural Research Service, unpublished data). These seedings are multi-purpose since they provide critical winter forage browse, and cover for mule deer, other wildlife, and seasonal forage for livestock. Changes in fuel characteristics also aid in the suppression of wildfires, and decrease soil erosion.

`Immigrant´ forage kochia can be successfully established from direct seeding with minimal to no tillage (Davis 1979). As a half-shrub it provides mule deer with the highly digestible protein levels lacking in crested wheatgrass. Forage kochia is adapted to very dry sites (5–27 inches annual precipitation) (Stevens et al. 1985), is more easily established, and has more rapid growth rates than antelope bitterbrush. Forage kochia is one of the few perennial species that can compete with cheatgrass, and once established on a cheatgrass dominated site it successfully sustains itself.

The abundant seed production and vigorous seedlings of forage kochia are frightening to some, who insist the plant is an invasive weed that may spread and take over vast acreages to the detriment of native species. As evidence they point to the annual exotic weed *Kochia scoparia*, that has invaded roadsides, barren areas, and row crops throughout the west. In the sagebrush/bunchgrass region of the Great Basin forage kochia does not appear to be invasive. There has been little to no movement outside the area of established stands. Forage kochia is a preferred forage for domestic livestock and wildlife, and *Kochia scoparia* is rarely utilized by large herbivores. *Kochia scoparia* is not a weed typical of sagebrush rangelands in the Great Basin. Areas must be reduced to bare soil before it successfully invades.

In the end, forage kochia offers more positive attributes than risk. If cheatgrass and associated species are not biologically suppressed, eventually there may be no native plant communities in the big sagebrush zone of the Great Basin. Forage kochia provides resource managers with an opportunity to decrease fire frequency by competing with and decreasing cheatgrass density. It increases the nutritive value of the range by providing a year-round quality forage, and perhaps an open window for the return of native plants by decreasing fire frequency. We have observed big sagebrush seedlings in stands of forage kochia that had first suppressed the cheatgrass. The nature of these competitive relationships is unknown, but if applicable to a wide spectrum of big sagebrush sites, it further enhances the appeal of forage kochia. We should be cautiously exploring the vast collections of forage kochia germplasm available in Uzbekistan to fine tune and direct the competitive relationships among cheatgrass, forage kochia, and a variety of our native species.

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