



Forage Kochia Establishment: Effects of Planting Time and Grass Mixtures

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Forage kochia (*Bassia prostrata*) is a highly nutritious, semi-evergreen, perennial semi-shrub native to central Eurasia that can be used for forage or reclamation of degraded areas in the western United States (and other areas). Establishment of forage kochia is extremely important.

We tested planting times and mixtures with various grass species. Our observations demonstrate early spring (April) planting provided higher densities of forage kochia than late winter planting (March) irrespective of monoculture and grass mixture.

We highly recommend selecting planting sites and dates based on weather patterns in a particular location within the state.

Forage kochia was introduced into the United States in the 1960s for rehabilitation and forage production in arid and semi-arid rangelands. It is highly adapted to the Intermountain West and Great Basin regions and has high salt and alkali tolerance, good drought and fire tolerance, and has been used for fire breaks or green stripping in many regions of western rangelands (Figure 1).

Forage kochia is also highly competitive against annual exotic weeds such as halogeton, cheatgrass, and Russian thistle and other exotic invasive weeds, and is very efficient at extracting soil moisture.



Figure 1. This forage kochia green strip stopped wild-fire in Idaho (adapted from Harrison et al., 2002).

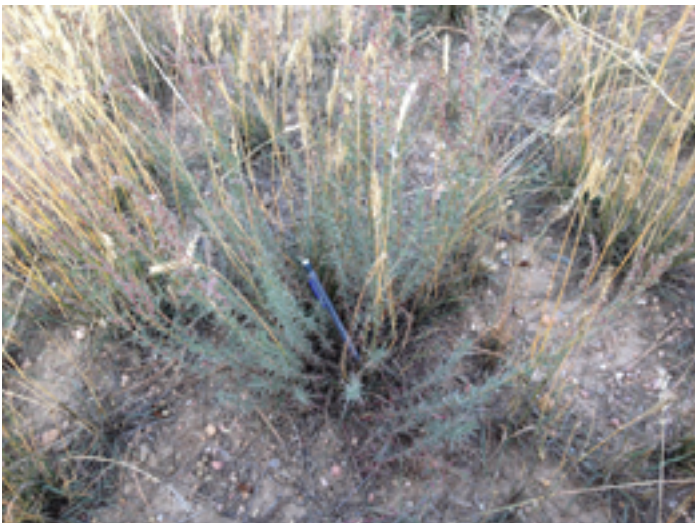


Figure 2. Forage kochia in a grass-mixture in west Laramie. Forage kochia can improve range productivity and be used as valuable forage crop for livestock and wildlife.

Forage kochia is a valuable forage crop for livestock and wildlife (Figure 2). It has high nutritive values during the fall and winter months (7-14 percent crude protein, CP), lower oxalate levels, and good palatability.

Establishing stands is one of the biggest challenges. Many factors affect establishment, such as seed quality, seeding techniques, and planting dates.

Forage kochia should be planted with freshly harvested seeds in late fall or winter on soil or snow at shallow depths. A favorable planting date in one location is not necessarily suitable for another due to different environmental conditions. This raises the question, "What is the right planting time for successful establishment of forage kochia in Wyoming?"

Optimum planting time for successful stand establishment

Seeding only one plant species may not guarantee success. Using forage kochia in a mixture with cool-season perennial grasses is one possible way to increase success. Field studies conducted in 2014-2015 at the James C. Hageman Sustainable Agriculture Research and Extension Center (SAREC) near Lingle helped determine factors for successful establishment.

Forage kochia was planted with different perennial grass seeding mixtures at different planting dates

(March, winter dormant; April, early spring; and May, late spring-early summer) in highly degraded and heavily cheatgrass-infested soils.

Forage kochia ('Immigrant') and six perennial cool-season grass species (four natives and two non-natives) were the test species. Native species were 'Critana' thickspike wheatgrass, 'Rosana' western wheatgrass, 'Anatone' bluebunch wheatgrass, and 'Magnar' basin wildrye. Non-native perennial grasses were 'Hycrest' crested wheatgrass and 'Texoma MaxQ II' tall fescue.

Species in each seeding mixture were in equal proportion based on their seeding rate on a pure live seed (PLS) basis. The purity percentage and germination percentage were multiplied and then divided by 100 to calculate PLS. The seeding was either on top of snow or drilled (Figure 3). The seeding rate for forage kochia was 6 pounds PLS per acre and 20 pounds PLS per acre for grasses.

The overall density of forage kochia was higher in the April planting than March regardless of monoculture or mixture with grasses (Table 1). This clearly indicates the April planting (early spring planting) may be suitable for higher emergence than the March planting (late winter dormant planting).

Plants failed to emerge when planted in late spring-early summer (May) of 2014. This might be due to lack of soil moisture during germination.

Table 1. Density (plant per square meter) of forage kochia in 2014 and 2015 for different seed mixtures within each planting dates at SAREC, Lingle. Lower case letters indicate significant differences among different seed mixtures within each planting date and capital letters indicate difference within a seed mixture between different planting dates. FK, forage kochia; Na, four native grasses (basin wildrye, bluebunch wheatgrass, thickspike wheatgrass, and western wheatgrass); CWG, crested wheatgrass; TF, tall fescue; NN, nonnative grasses (CWG+TF). One square meter is equal to 10.76 square feet.

Figure 3. Planting forage kochia and grass seeds. Broadcast-seeding on the top of snow in March, 2014 (top), and drill seeding in May, 2014 (bottom), at SAREC, Lingle. Forage kochia can be broadcast aerially on top of snow or drilled as clean-tilled or on existing species.

However, forage kochia seeds emerged soon after the early April planting from precipitation that month. Studies in Idaho, a similar environment to Wyoming, suggest spring seeding would be successful if enough precipitation occurs for germination. This indicates time of planting and moisture play major roles in establishment. Similar results were also obtained for establishment of grasses in this study.

Seeding success was calculated as the percentage of planted seeds that developed into live seedlings. Results suggest the April planting had higher seeding success than late winter (March) planting for forage kochia and grasses (Table 2). In case of seeding mixtures, forage kochia monoculture had higher density than seed mixtures with grasses.

In 2015, one year after planting, overall density of forage kochia and grasses was reduced to about one-third of 2014 levels (Tables 1 and 2). This might be due to heavy competition from large and dense weed stands throughout the growing season. Small seedlings of forage kochia and grasses could be susceptible to dense weed cover during early establishment. However, remaining plant densities (Table 2) are considered satisfactory, and, once established, they can outcompete annual weeds, enhancing stand establishment (Figure 4) and productivity, especially in the winter (Figure 5). Some previous studies in neighboring states have also shown forage kochia can be established in dense annual weed cover as they outcompete weeds over time.

Table 2. Seeding success (%) of forage kochia and grass as influenced by planting dates at SAREC, Lingle. Different lowercase letters indicate significant differences among the planting dates. May planting was not successful (see text for details).

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Figure 4. Immigrant forage kochia plant (with flowers) in dense weed stand during the first growing season of 2014 at SAREC, Lingle.

Figure 5. Immigrant forage kochia during winter at west Laramie (January, 2015). Forage kochia can provide high quality feed to grazing animal during winter when availability of other forages are limited.