Cicer milkvetch (*Astragalus cicer L.*)

Description

Cicer milkvetch (Astragalus cicer L.) is a cool season, perennial legume introduced to North America from Europe. In well-managed stands, the plant is long -lived and competitive.

Cicer milkvetch's rooting system consists of a short, branched taproot and a dense mass of thick rhizomes. Roots do not penetrate the soil as deeply as those of alfalfa generally extending less than 1 m vertically. Rhizomatous growth permits new roots to emerge from nodes along the rhizomes but independent plants do not develop from the rhizomes. Cicer milkvetch plants will spread horizontally to 120 cm in diameter under favorable conditions.

Cicer milkvetch stems are hollow, succulent and grow upright early in the season. As plants mature stem growth begins to bend over or trail, leaving the plant decumbent or prostrate. When grown in mixtures with grasses, stem growth tends to be more upright. Crop height is around 70 cm although stems can reach a length of 1.2 m by the flower stage. Cicer milkvetch is multifoliate with a single leaf consisting of 10 to 13 pairs of leaflets attached to a midrib, plus one terminal leaflet. The leaf-to-stem ratio is generally higher than in alfalfa, and the retention of leaves is also better in mature plants.

The inflorescence is a spike of up to 60 pale yellow to white flowers. Seedpods change from a pale yellow to black with maturity. Cicer milkvetch flowers are cross-pollinated by bumblebees, honeybees or leaf cutter bees. Seeds are almost twice the size of alfalfa and covered with a naturally thick coating that protects them from the environment. Consequently, recommended seeding rates for a pure stand should be double those of a comparable seeding of alfalfa.

Legumes require inoculation with rhizobia bacteria to properly fix atmospheric nitrogen. Cicer milkvetch requires a specific strain of inoculant. This inoculant is called *Astragulus – specific Rhizobia* and differs from the inoculants needed by alfalfa, sainfoin and other legumes.

Adaptation

Cicer milkvetch will grow in moderately coarse calcareous soils, silty loams or fine clay loams but not deep sandy soils. Its salinity tolerance is low, preferring soils with an E.C. rating below 5 ds/m. It is not tolerant of acidic soils (pH less than < 6.0), but it is tolerant of moderately alkaline soils (pH less than < 8.1).

Cicer milkvetch is best suited to regions that receive moderate to high amounts of moisture. For optimum forage production, cicer milkvetch should be seeded either under irrigation or in areas that receive a minimum of 400 mm of annual precipitation. Cicer milkvetch is not flood tolerant, but does perform well on sub-irrigated sites where water

tables are within 1 m of the soil surface. Under good moisture conditions, cicer milkvetch is highly competitive in grass legume mixtures.

Establishment

Cicer milkvetch has a reputation for being difficult to establish. Many factors such as seedbed conditions, seedling vigor and competition during the seedling year may limit stand establishment. Soil temperature requirements for good germination and emergence are higher for cicer milkvetch than other legumes, such as sainfoin or alfalfa

Seed Scarification:
Cicer milkvetch seed contains a high percentage of hard seeds. This seed coat acts as a barrier preventing microbial invasion that would otherwise penetrate and damage the seed germ. The coat also reduces the ability of the seed to absorb water, which has the effect of increasing the seed's ability to stay dormant for an extended time. The result is slow and uneven germination rates.

For rapid and uniform germination, cicer milkvetch seed requires scarification. Mechanical, chemical or freeze-thaw processes can be used to scarify the seed coat on cicer milkvetch seed. Seeding should occur within a week or so of scarification because seed viability will start to decline.

Seeding Rates:
Seeding rates for cicer milkvetch should be based on pure live seed (PLS). Suggested seeding densities range from 50 to 90 PLS seeds/meter of row (300 to 400 PLS seeds/m^2 for broadcast seedings). The final bulk-seeding rate will be higher than this amount, reflecting variables such as row spacing, seed quality and the weight of seed amendments such as seed coatings. Table 1 provides an illustration of the PLS seed requirements for several seeding densities and row widths.

Table 1 **PLS Seeding Rate kg/ha**

PLS Seeding Density/m of row	**Row Spacing in cm** 15 cm	20 cm	25 cm	30 cm
25 PLS/m	6.0	5.0	4.0	3.0
50 PLS/m	12.0	9.0	7.0	6.0
75 PLS/m	18.0	14.0	11.0	9.0
100 PLS/m	24.0	18.0	14.0	12.0

- PLS kg/ha: *Canada Seeds Act* standards are used for germination and purity to develop PLS seeding rates. PLS seed rate based on bare seed.

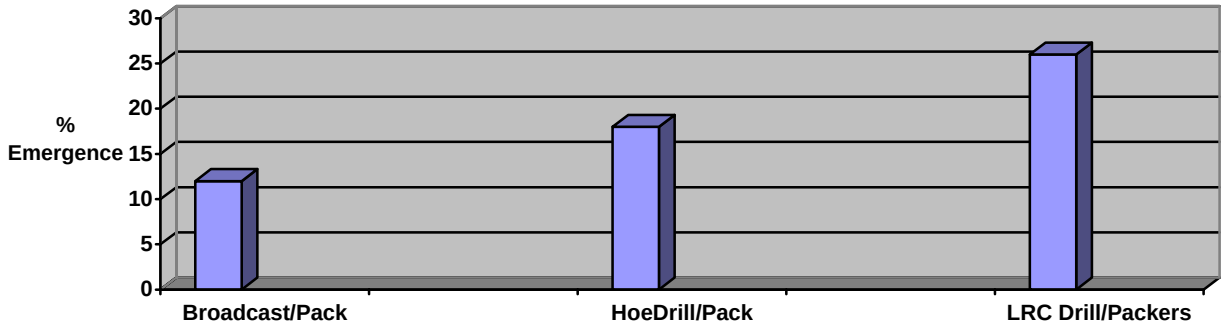
Seeding rates can be developed with the use of the "Forage Seed Mixture Calculator." The calculator provides the option to input a number of variables in developing a seeding rate for pure or mixed stands of cicer milkvetch. The calculator is located on Alberta Agriculture's Ropin the Web Internet site (www.agric.gov.ab.ca). Select "Calculators" and click on "Crops."

Establishment guidelines:
The following management practices should be used when seeding cicer milkvetch:

- Plant improved varieties such as AC Oxley II or Windsor.
- Use seed that has been recently scarified and inoculated.
- Delay seeding until seedbed temperatures are a minimum of 18^0C.
- Seed to a depth of 1.5 to 2.0 cm.
- Use drills with depth bands and in row packers. As shown in **Figure1**, drills provide a higher level of seedling emergence in comparison to broadcast seeding.
- Avoid the use of companion crops, which can vigorously compete with slow-to-establish cicer milkvetch seedlings.
- Mow the new stands to eliminate weeds, and ensure grass species don't overtake the cicer milkvetch seedlings. Delay mowing until the stand reaches a height of 20 cm and leave a stubble height of 10 cm.
- Control annual or perennial weeds before seeding with non-residual and non-selective herbicides
- In irrigation areas, water the seedbed site three to four days prior to seeding

Further information on forage establishment is available through the fact sheet "Perennial Forage Establishment in Alberta," Agdex FS 120/22-3.

Figure 1 : Impact of Seeding System on CMV Seedling Emergence



* Percent emergence based on seedling plant counts 70 days post seeding. Original seeding density equal to 517 PLS/m^2 or 79 PLS/m of row in 15 cm spacings.
* LRC research drill is a specialized forage seeding drill that provides packing in front and behind disc opener
Source: Canadian Journal Plant Science. 86: 49-62 A Review of Research Progress on Cicer milkvetch

Use and Management:

Seasonal Growth:
Compared to alfalfa or sainfoin, spring growth of cicer milkvetch is slow. Forage re-growth in cicer milkvetch depends more on residual leaf area than roots reserves as found

in alfalfa. Consequently, re-growth tends to be more rapid under grazing than under hay management.

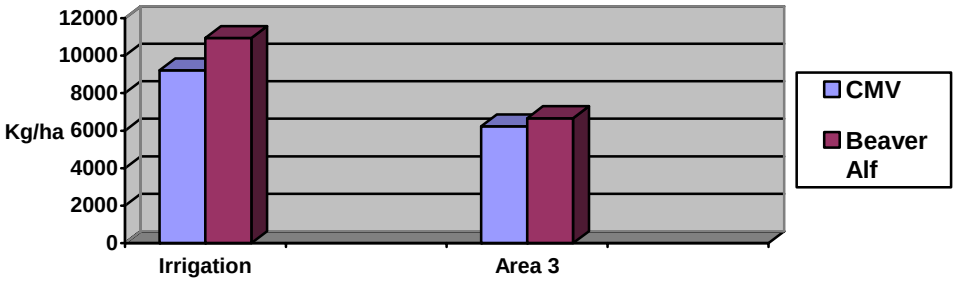
As a non-bloat legume, cicer milkvetch's growth characteristics make it well suited for inclusion in mixtures with cool season grass species for use in pasture or hay production systems. Research suggests that forage productivity in well-established stands of cicer milkvetch is approximately 80 percent of comparable alfalfa stands.

Use as Hay:
The nutrient value of cicer milkvetch hay is generally equal to alfalfa when harvested at a similar stage of maturity. The protein content of cicer milkvetch hay can often exceed alfalfa. This is due in part to a higher leaf -to- stem ratio in cicer milkvetch (40 percent higher than alfalfa) and better leaf retention during cutting and baling. Livestock feeding trails at Agriculture Canada's Lethbridge Research Center have shown that the intake of cicer milkvetch hay is similar to that of alfalfa hay.

Spring growth in cicer milkvetch begins about three weeks later than alfalfa. Under hay management, re-growth is slower than alfalfa. As a shown in Figure 2, forage yields for cicer milkvetch are lower than Beaver alfalfa under irrigated two or three-cut systems but comparable in areas where hay harvests are primarily one harvest per season.

In a pure stand, cicer milkvetch is more difficult to cure for hay than other legumes. Stem and leaf growth continue during flowering, resulting in higher moisture contents at harvest. To reduce the drying time, cicer milkvetch should be cut with hay conditioners. Seeding cicer milkvetch in a mixed stand with a compatible grass such as meadow brome can help drying time.

Figure 2: Average Hay Yields: Cicer Milkvetch vs. Beaver Alfalfa



* Average yield for first 3 years post seeding, CMV yields based on AC Oxley II
* Area 3 represents Black Soil Zone (425 –475 mm annual precipitation)
* Data should only be used as an indicator of potential yield differences

Source: Varieties of Perennial Hay and Pasture Crops for Alberta 2006

Use as Pasture:
In pasture systems cicer milkvetch can be used as either a pure stand or as part of a grass-legume mixture. This non-bloating legume is compatible with grasses such as meadow brome, orchard grass, creeping foxtail or tall fescue. Under good moisture conditions,

cicer milkvetch can remain competitive in mixed stands due to its creeping root system (rhizomes). Re-growth in pastures is generally faster than under hay production.

Cicer milkvetch's best forage growth generally occurs during mid summer. This seasonal growth pattern suits cicer milkvetch for use as a source of summer grazing. Nutrient retention in late season growth may also permit the use of cicer milkvetch as a source of stockpiled forage for fall grazing.

Cicer milkvetch is more dependent than alfalfa on residual leaf material to support new growth. The energy and nutrients available from the ungrazed or unharvested leaves are available to establish new growth from axillary, crown or rhizome buds. A rotational grazing system that provides rest periods of five to six weeks is recommended to help preserve cicer milkvetch in pastures systems.

Sheep, beef and dairy heifers have shown a photosensitization response in grazing trials with pure cicer milkvetch stands in Minnesota. This response may be due to unique environmental conditions or the specific cultivars. Photosensitization has not been reported in grazing or feeding trails in western Canada.

Disease/Insects:
Cicer milkvetch stands have been shown to be susceptible to the fungus (*Rhizoctonia leguminicola*) and to root, crown or stem-rot (*Sclertotina*) diseases. These diseases are found in many perennial forage legumes. Observations suggest that diseased cicer milkvetch plants can recover as a result of new rhizome growth. To minimize disease problems, new seedings for forage or seed production should follow grass or cereal crop rotations.

Insects such as aphids, thrips, seed chalices, sweet clover weevils and grasshoppers have been observed on cicer milkvetch. But their effect on cicer milkvetch does not seem to be too severe.

Weed Management:
Weed growth during the seedling year can jeopardize stand establishment. Problem weeds should be mechanically, chemically or culturally controlled before sowing and during the establishment year. Pre-seeding applications of glyphosate can be used to control annual and winter annual weeds. In crop herbicide options are limited. Check Alberta Agriculture's publication *Crop Protection (606-1).*

Varieties Registered in Canada or Alberta: Windsor, AC Oxley II and Oxley

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