

Caucasian clover

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Introduction

Caucasian clover (*Trifolium ambiguum*) is a very persistent perennial legume originating from temperate areas in southern Russia, Romania, eastern Turkey, Iran and Iraq. In these areas it is generally found in a wide variety of environments, from valley floors through to mountainous landscapes with altitudes greater than 3000 m. Rainfall, temperature and soil conditions vary greatly across this range of habitats.

As Caucasian clover developed in areas with very different climatic and soil conditions, distinctly different forms of the plant evolved. The difference between the forms is a result of variation in the number of chromosomes the plant contains, referred to as 'ploidy'. Caucasian clover exists as hexaploid (6 sets of chromosomes), tetraploid (4 sets of chromosomes) and diploid (2 sets of chromosomes). Usually, plants with higher ploidy will have larger leaves, although there can be large variations within and between ploidy groups.

Caucasian clover was first introduced to Australia in 1931. The original material was from southern Russia and was evaluated at Canberra. Further introductions were made from Russia, Turkey, USA, Iran, England and New Zealand.

Early field testing proved disappointing, mainly due to a lack of suitable rhizobia for initiation of nodulation, which impacted severely on herbage and seed production. Additionally, at this stage the different ploidy groups had not been recognised, and this resulted in experimental lines being tested in inappropriate environments.

Once the issue of ploidy and suitable rhizobia had been resolved, renewed interest in Caucasian

clover resulted in extensive evaluation of the species in the Snowy Mountain and Monaro regions of NSW. This research found that at higher altitudes diploid and tetraploid types were most persistent, while at lower altitudes tetraploid and hexaploid types were generally most productive and persistent.

Caucasian clover has been found to be a useful and very persistent pasture plant in higher elevation areas of south-eastern Australia, and has also been used for erosion control and stabilisation of roadside cuttings in alpine and sub-alpine regions.

Adaptation

Caucasian clover is suited to temperate tableland areas receiving a minimum of 450 mm average annual rainfall. It performs best at altitudes above 700 m with some summer rainfall. It is very tolerant of cold conditions and drought.

Caucasian clover grows best on well-drained soils with pH (CaCl₂) of 4.5 or greater, but will also tolerate intermittent waterlogging. It will tolerate low fertility conditions, but responds well to fertiliser.

Once established, Caucasian clover is very tolerant of heavy continuous grazing and has persisted for over 20 years in elevated tableland regions.



Figure 1. Caucasian clover



Description

A distinguishing feature of Caucasian clover is its strong underground root system, consisting of a dense network of rhizomes and taproot. The dense root system enables Caucasian clover to survive drought and extreme cold. Caucasian clover spreads predominately via rhizomes, but may also increase in density by recruitment from seed.

Leaf characteristics can vary significantly depending on a number of factors, including ploidy and grazing intensity. Leaflet size generally increases with ploidy, with diploid varieties having the smallest leaflets and hexaploid varieties the largest; however, this characteristic can be variable. Leaflets are hairless, up to one-third longer than they are wide, and have a pointed tip. Depending on variety, leaflets may or may not show markings.

In heavily grazed situations Caucasian clover remains prostrate, but may grow to 50 cm high in less intensively grazed environments. Leaflets are generally smaller in intensively grazed swards.

Flowers are round to oval in shape, with a diameter of approximately 2 cm. Flowers become larger and more cylindrical with age, and change to a pinkish-white colour. Flowers are composed of approximately 170 florets, each containing 1–2 seeds, which are cream to brown in colour and oval in shape. Seed size varies with ploidy, with approximately 660,000, 580,000 and 335,000 seeds/kg for diploid, tetraploid and hexaploid varieties respectively.

Varieties

Hexaploid varieties

These are the main varieties of Caucasian clover that have been used in agricultural situations in Australia.

Endura was developed in New Zealand and released in 1998. It was selected from populations of the cultivar Monaro, for increased seedling vigour and seed production.

Monaro was developed in Australia from material collected in the former Soviet Union. It was selected for drought tolerance, more rapid establishment, resistance to clover stunt virus, better nodulation and uniformity of flower and seed production. This variety was released in the mid 1980s. Seed is no longer readily available.

Prairie was developed in Australia from germplasm collected in the former Soviet Union. It was selected for increased vigour and winter hardiness. This variety also had very high tolerance of waterlogging. It was released in the late 1970s.

Tetraploid varieties

Kuratas is a new variety of Caucasian clover, developed by Eric Hall and Andrea Hurst of the Tasmania Institute of Agricultural Research (TIAR), from material introduced to Australia via the USA. This variety has been selected for increased seedling vigour, increased winter activity and higher seed production. Field experiments conducted in NSW support this claim (Table 1) – Kuratas established more rapidly than Endura and was consequently more productive in the first 2 years.

Treeline was developed from original Soviet Union material introduced to Australia in 1931, and released in the early 1970s. It was best suited to higher sub-alpine regions, where it has been used for erosion control and stabilisation of road cuttings. Seed production from this variety was low due to an irregular flowering pattern, and seed is no longer available.

Table 1. Establishment counts (plants/m²) and cumulative herbage production over two years for two Caucasian clover varieties at Berridale NSW.

	Plants/m ²	Herbage production (kg DM/ha)
Kuratas	135	3055
Endura	21	374

Diploid varieties

Summit was developed from original Soviet Union material introduced to Australia in 1931, and released in the early 1970s. This variety performed better at higher alpine elevations than Treeline, and showed good tolerance of waterlogging. It was also successfully used in land stabilisation situations. Seed is no longer available.

Forest was also developed from material imported from the former Soviet Union, and was released in the late 1970s. It was developed for sub-alpine areas, where it proved to be more productive than Summit. It was used in revegetation programs. Seed is no longer available.

Alpine was selected from populations of Summit, for more uniform flowering and improved seed production. It was released in the early 1980s. Seed is no longer available.

Establishment and management

Sowing

Caucasian clover can be sown into a conventional seed bed, or direct drilled to a depth of no more than 10 mm. It should be sown in late summer or early autumn to allow for sufficient seedling development prior to winter. Alternatively, it can be sown in early spring.

Caucasian clover should be sown at 3–6 kg/ha, in a mix with perennial grasses such as cocksfoot, tall fescue or phalaris. Strongly competitive grasses such as ryegrass and perennial bromes should be avoided, as they may out-compete Caucasian clover in the establishment phase. To reduce competition between Caucasian clover and other species in the pasture mix, some producers have sown Caucasian clover in drill rows separate to the remaining components of the pasture mix.

Inoculum

Caucasian clover requires a specific strain of rhizobia (cc283b) for nodulation.

Fertiliser

Adequate phosphorus (P) is required to promote vigorous growth of pasture legumes. At least 10 kg P/ha should be used when sowing Caucasian clover. Added sulphur (S) and molybdenum (Mo) may be required in some areas. Once established, Caucasian clover is more tolerant of low fertility conditions than many other clover species; however, production and persistence will be enhanced by regular fertiliser application. Consult your local agronomist for further information.

Grazing

Care should be taken to minimise grazing in the year of establishment. Once established, Caucasian clover can tolerate persistent close grazing.

Hard seed

Hard seed levels of Caucasian clover vary between cultivars, but in general Caucasian clover is classified as having moderately high levels of hard seed. Accordingly, seed should be scarified prior to sowing. Kuratas[®] has 40% hard seed.

Pests and diseases

Caucasian clover is resistant to attack by cockchafers, a pasture grub that is common in tableland areas. Caucasian clover is susceptible to attack by red-legged earth mite, particularly at the seedling stage.

Caucasian clover can be affected by powdery mildew, but this generally only occurs in ungrazed swards.

Seed production

Seed production has been a consistent problem in Caucasian clover, with common yields of 250 kg/ha or less. This has made seed very expensive and difficult to obtain. However, Kuratas[®] has been found to produce seed much earlier than previously available cultivars, with yields of up to 1000 kg/ha (Figure 2).

Seed is harvested with a conventional header.



Figure 2. Eric Hall (TAIR) pictured in a seed production block of Kuratas[®] Caucasian clover (Photo courtesy Eric Hall, TAIR).

Herbage production and quality

Herbage production

Caucasian clover grows primarily during spring, summer and autumn, becoming less productive over winter with the onset of frosts. It may also senesce over summer if rainfall is low.

Once established, Caucasian clover is capable of producing moderate quantities of herbage (Table 1). The main advantage of Caucasian clover is its ability to persist and produce in areas where frequent drought, extreme cold and/or heavy grazing prevent other perennial legumes, such as white clover, from persisting.

Herbage quality

Caucasian clover is capable of producing herbage of very high quality (Table 2). It contains no known anti-nutritional factors.

Table 2. Herbage quality of Caucasian clover

Digestibility (%)	80.9
Crude protein (%)	19.7
Metabolisable energy (MJ/kg DM)	11.9

Digestibility data provided by Eric Hall (TIAR)

Acknowledgements

Eric Hall and Andrea Hurst, Tasmanian Institute of Agricultural Research (TIAR).

The authors wish to acknowledge the assistance of Craig Rodham and Gabrielle Dyce (formerly Technical Officer NSW DPI) for the management and maintenance of field trials associated with information contained in this Primefact.

Warnings

Pasture improvement may be associated with an increase in the incidence of certain livestock health disorders. Livestock and production losses from some disorders are possible. Management may need to be modified to minimise risk. Consult your veterinarian or adviser when planning pasture improvement.

Legislation covering conservation of native vegetation may regulate some pasture improvement practices where existing pasture contains native species. Inquire through your office of the Department of Natural Resources for further information.

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ISSN 1832-6668

Replaces Agnote DPI-390

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Job number 7809