"Jota" annual sweet clover (*Melilotus albus* Medik.): a new salt tolerant legume for the high rainfall zone of southern Australia.

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Abstract

Jota is the first cultivar of annual *Melilotus albus* commercially released in Australia by the National Annual Pasture Legume Improvement Program (NAPLIP). It is intended for neutral to alkaline soils where it can be used as a companion legume for tall wheat grass. The target area has saline soils receiving more than 500 mm of annual rainfall and a soil pH of 6 or higher.

In southern Victoria, Jota can produce more than 10 t/ha of dry matter in soils with an electrical conductivity of up to 5 dS/m (1:5 soil:water suspension). As around 70% of its growth occurs between November and March the plant fills the summer-autumn feed gap and dries the soil profile. Sheep grazing Jota, at a rate of 25 dse/ha between October and early April, gained 6-7 kg/head compared to a tall wheat grass pasture where they maintained weight stocked at 10 dse/ha. Total clean wool production per hectare was 240% higher under "Jota".

Jota regenerates well in the second and third seasons after planting but subsequently declines. The vigorous growth in the first two seasons appears to improve conditions for other plants.

Jota is a low coumarin selection from a south American population. There is no health risk to animals when the plant is grazed as standing forage. Sensory tests in sheep meat on a pure diet of Jota have shown no "tainting". Under optimum conditions for dicoumarol production (the derivative of coumarin which can cause animal health problems), Jota only produced 10 ppm, well below the 20-30 ppm safe threshold.

Key Words

Salt tolerance, salinity, sweet clover, production, persistence

Introduction

In Victoria, between 8 and 18% of the state's agricultural land is predicted to fall into the category of high salinity risk (Anon. 2001). The area of winter-waterlogged, moderately saline land is four times greater than that severely affected by salt. It is necessary to identify and develop legumes that will grow well and persist on saline land as currently available cultivars often perform poorly and cannot form productive mixtures with salt tolerant grasses.

Melilotus albus (Medik.), an annual or biennial legume native to Europe and Asia, is grown in saline areas in Argentina, Spain, Canada and Russia (Evans and Kearney 2003). Reports indicate good performance of dairy cows in Argentina using mixtures of *Melilotus* spp with chicory and sorghum (Pozzo *et al.*1986). Other attributes of the species include excellent suitability for the production of honey, drought tolerance, and the ability to lower water tables and to improve soil conditions so that new crops, which previously could not be grown on certain soils, can be established (Rios et al. 1993). Tall wheat grass (TWG, *Thinopyrum ponticum* (Podp. Z.W. Liu & R.R.C. Wang)) and *Puccinellia* spp can grow well in saline areas (Rogers and Bailey 1963) but lack a suitable companion legume in Australia as Persian and balansa clovers fail at higher levels of salinity (Evans and Snowball 1993). *Melilotus* spp grow well in association with grasses in China and Russia (Cui *et al*. 1993; Zilenskii *et al* 1994), over a range of climatic zones. It would be reasonable to assume that the species may associate well with grasses adapted to Australian climatic and edaphic conditions.

Results with *Melilotus albus* in Australia

Early work by Valder (1896) at Wagga Wagga found the crop worthy of further research as it tolerated the dry weather well and the stock 'appeared to be fond of it'. McKeown (1896) at Richmond River found the crop vigorous and capable of resisting dry seasons. Very little Australian information is found after Breakwell (1923) stated that the plant performed well in several areas of NSW.

More recently, *Melilotus albus* was shown to have salt tolerance in hydroponic solutions of NaCl at concentration up to 180 mM in the glasshouse. This tolerance was associated with ion exclusion from the shoots (Rogers and Evans 1996). Early field work in SW Victoria showed *Melilotus* spp performing well in saline soil as well as neutral to alkaline non-saline soil (Evans and Cameron 1998). Monocultures of *Melilotus* spp produced three times more than strawberry clover (*Trifolium fragiferum* L.) on a soil with a pH of around 7 and an electrical conductivity ranging between 1.5 and 3.1 dS/m. At another site where the conductivity reached 5.1 dS/m and the pH was above 8, total seasonal DM of pure *Melilotus* reached 9.1 t DM/ha. Mixtures of *Melilotus*/TWG yielded 10.8 t DM/ha. Second year regeneration of *Melilotus* at both sites reached more than 4000 plants/m^2 (Evans and Kearney 2003).

Under a range of cutting regimes, ranging from a single cut to six cuts between October and March, more than 13 t DM/ha for the season were achieved with 1 or 2 cuts on H11743 (the population from which Jota was derived). This study determined that if maximum seed yields are to be achieved, cutting or grazing should stop in December and resume in March (Evans *et al*. 2004).

Jota has a high nutritive value (75-80% DM digestibility and >25% crude protein when in the vegetative phase). Sheep grazing *Melilotus* at a stocking rate of 25 dse/ha gained 7 kg between October and March compared to sheep stocked at 10 dse/ha on a 'control' pasture of TWG and barley grass which only maintained weight (Thompson *et al*. 2001). As 70% of *Melilotus* production occurred between October and March, the plant has the potential to fill the summer-autumn feed gap. Total clean wool production per hectare was more than double that of the control treatment between early December and late March, reflecting the increased stocking rate.

No ill effects on animal health were detected in a feeding trial with sheep designed to determine if there were effects on animal health or tainting of meat in animals consuming Jota, compared with animals consuming a diet of ryegrass and subterranean clover. Sensory testing using a consumer taste panel following the methodology of Thompson *et al*. (2005) showed there were no differences in taste between animals consuming Jota or ryegrass/subterranean clover.

Results in South Australia showed that no dicoumarol was present in Jota samples spoiled in the field and that if these samples were spoiled under ideal conditions in the laboratory only 10 mg/kg of dicoumarol could be produced. As the safe limit of dicoumarol for animals at this stage is 30 mg/kg, Jota is currently considered safe (Dean Revell, pers. comm.).

Melilotus is naturalised in Victoria and can be found sporadically in most regions of the state (Jeanes 1996). In addition to this, the plant has not escaped the perimeter of experimental areas established in Victoria during 1995-1998. Studies on the seed softening in the parent population of Jota have shown that 200 days after maturity, only 10 percent of the original seed remains hard in the ground (Evans *et al*. 2004). We conclude from this evidence that the chances of Jota becoming a weed in Victoria are very low.

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