



FRONTIER^P - an early maturing balansa clover for the wheatbelt

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Frontier^P is a new early-maturing cultivar of balansa clover (*Trifolium michelianum*) that offers exciting potential for low and medium rainfall (325 - 450 mm annual average) zones of Western Australia. Although it is productive on many soil types, it provides offers farmers a new and important pasture legume option for waterlogged, mildly saline soils. Frontier^P provides valuable grazing for livestock, can be conserved as forage, and improves crop yields through nitrogen fixation.



Figure 1. *Typical leaf markers and flower of Frontier^P balansa clover.*

Origin

The development of Frontier was initiated and led by the South Australian Research and Development Institute (SARDI). Frontier^P is a cultivar comprised of a mixture of 20 individual lines. Each line was developed through a process of single plant selection from within the cultivar Paradana, followed by an extensive national field evaluation program. The best 20 lines under test were selected and recombined in equal quantities to form the cultivar. Frontier^P is being commercialised by SGB Australia and is protected by Plant Breeder's Rights.

Description and area of use

Frontier^P is an aerial seeding, self-regenerating, annual pasture legume. Its appearance is quite variable, displaying a range of leaf markers. Frontier^P is a prolific seeder and produces very small (seed size <1 mg), yellow-brown seeds (although seeds can be multi-coloured). It produces a high level of hard seeds at maturity and these gradually become germinable through the process of seed softening over the summer/autumn period. The extent of seed softening is dependent on management (see section on Field performance).

Frontier^P resembles the later maturing balansa clover varieties, Paradana and Bolta. The most obvious difference between the varieties is their flowering times - Frontier^P flowers two to three weeks earlier than Paradana and one month earlier than Bolta. In Western Australia, Frontier^P flowers about 80 to 85 days after sowing, which is generally towards the end of August.

The early maturity of Frontier^P should allow adequate seed production for persistence in regions with as low as 325 mm annual average rainfall. It should be used in those soils situated low in the landscape, and it may persist in lower rainfall regions if these soils remain wet for extended periods in spring. Frontier^P can be mixed with Paradana in regions with greater than 400 mm annual rainfall.

Field performance

Frontier^P has performed well on a variety of soil types with pH ranging from 4.7 to 8.0 (CaCl₂). It tolerates waterlogging and moderate salinity - although its performance in saline environments is still being evaluated. Observation suggests it will tolerate salinity levels typical of soils associated with dense barley grass. Best production will be achieved on sandy loams to clays with moderate to high soil fertility, particularly in relation to phosphorus, sulphur and potassium. Fertiliser recommendations based on standard soil tests should be adequate. Frontier^P has performed poorly on deep, acidic sands and should not be grown on these soils.

In a trial at Cunderdin (375 mm annual rainfall) conducted over three years, Frontier^P was more productive than Paradana balansa and Prolific Persian clover (Table 1). The early maturity of Frontier^P ensured that seed production was more reliable and this was reflected in better seedling regeneration. Frontier^P has the capacity to regenerate after cropping but its early season productivity will be much greater in permanent pasture.

Table 1. The superior seed yield and regenerative capacity of Frontier balansa clover at Cunderdin (annual rainfall 375 mm), Western Australia. Trial sown 1998.

Species/Cultivar	Dry matter (t/ha) June-Sept 1998	Seed yield (kg/ha) 1998	Seedling regeneration (plants/m ²)		
			Pasture Yr 2 June 1999	Pasture Yr 3 July 2000	After crop July 2000
Frontier balansa clover	2.69	426	7,818	12,682	674
Paradana balansa clover	2.54	272	3,425	12,193	323

Prolific Persian clover	2.72	174	1,295	1,451	135
Cyprus barrel medic	3.26	511	1,937	1,658	387



Figure 2. Commercial stand of Frontier^P balansa clover in full flower.

Standard management practice to encourage maximum regeneration of balansa clover pasture involves hard summer grazing. This practice is designed to remove dry plant residues that otherwise insulate the seed and prevent exposure to the high soil temperatures which that bring about seed softening. However, if Frontier pastures are to be cropped, we suggest that dry residues should be retained kept as long as possible to make sure hard seed levels remain high. Grazing should be delayed until late autumn and only enough residue removed to allow the passage of seeding machinery.

Frontier is susceptible to red-legged earth mite and lucerne flea attack, particularly at the seedling stage. Both pests should be controlled soon after sowing to ensure good plant establishment. If possible, control red-legged earth mite in the previous spring with the Timerite® package. Glasshouse studies have shown Frontier to be susceptible to pasture aphids, although no significant damage has yet been observed in the field.

Frontier^P provides an excellent source for crops. As a general rule, every one tonne dry matter produced means 25 kilograms per hectare of nitrogen produced.

Establishment

It is important to prepare a fine, clod free seedbed to maximise seedling emergence. Many balansa clover pastures are successfully established by dropping the seed onto the soil surface after cultivation. Seed can be covered with light harrows or a rubber tyred roller. If seed is drilled in, take care not to sow too deep (maximum depth one centimetre).

Sow Frontier at four to five kilograms per hectare as soon as possible after the break of the season, in order to use the relatively high soil temperatures. Early sowing should not be at the expense of good weed control. Frontier^P can be sown in mixtures (using one to two kilograms per hectare) with other pasture legumes such as subterranean clover and annual medics.

Seed can be purchased which that is already inoculated as part of a seed coating process. If seed requires inoculation, use Group C and lime pellet. Pay special attention to pests at seedling emergence and control with systemic insecticides as required. Bare earth insecticides applied at sowing can give several weeks residual control.

Care should be taken if sowing Frontier on areas where residual broad-leaf herbicides have been

used in recent times recently.

Grazing

Newly sown Frontier pastures can be lightly grazed during the establishment year although stock should be removed at the start of flowering to maximise seed set. Pastures should not be crash grazed near flowering or cut for hay during the first year if they are wanted to regenerate. Pastures can be hard grazed when the seed has matured in the head. Up to 40 per cent of Frontier seed eaten by sheep passes through the animal in the faeces, and can be spread with the movement of stock.

Regeneration in the second and following years will be considerably improved when most of the residual dry matter is grazed over summer. Frontier pastures perform best when grazed soon after the autumn break of season, minimising the competition from grasses and broad-leafed weeds. Hard grazing during the first six weeks of growth gives Frontier a competitive advantage. Frontier^P may be rotationally grazed but take care not to allow weeds to overrun the pasture. Frontier^P can be stocked at a moderate rate from flowering until seed maturity. Crash grazing or cutting during this time will severely reduce seed set.

Herbicides

There are few herbicides specifically registered for use in balansa clover. Table 2 shows a selection of experimental results from recent herbicide tolerance trials conducted in Western Australia. The use of many of these herbicides not registered with the National Registration Authority for Agricultural and Veterinary Chemicals and farmers should seek specialist advice.

Table 2. Effect of some common herbicides on herbage production of Frontier balansa clover. Data based on visual assessments in early spring (Note: early and late spring ratings recorded in 1999).

Herbicide (Rate/ha)	Herbage in spring (expressed as a percentage of unsprayed treatment)		
	1998 medium soil	1999 medium soil	2000 heavy soil 22
<i>Pre-sowing</i>			
Treflan®		63 - 78 (1.5 L)	81 (2 L)
<i>Post plant pre-emergence</i>			
Spinnaker®	82 (150 ml)		66 (300 ml)
diuron	46 (500 ml)		73 (750 ml)
metolachlor 500 ml			89
<i>Post emergence (6-8 leaf)</i>			

Broadstrike® 25 g + oil	74 (no oil)	84 - 94	74
Gramoxone® 500 ml	26	51 - 67	38
Tigrex®	89 (300 ml)	74 - 91 (400 ml)	78 (400 ml)
bromoxynil 1.5 L		45 - 55	29
Spinnaker®	79 (250 ml)	73 - 84 (250 ml)	60 (300 ml)
Jaguar® 500 ml	75	54 - 58	50
MCPA (amine) 1 L		48 - 50	55
Verdict® 100 ml + oil			93

Pre-emergent application of metolachlor is registered for the control of toadrush in Paradana balansa clover. Observations with this herbicide have indicated some temporary leaf deformation in Frontier. Reasonable recovery of plant growth after application of Gramoxone® has been observed in some situations. Seasonal conditions can have a major impact on herbage and seed production following any herbicide treatment.

NOTE: *The sale, supply, possession and use of many agricultural chemicals is regulated by law. The terms of the [Important Disclaimer](#) are reiterated.*

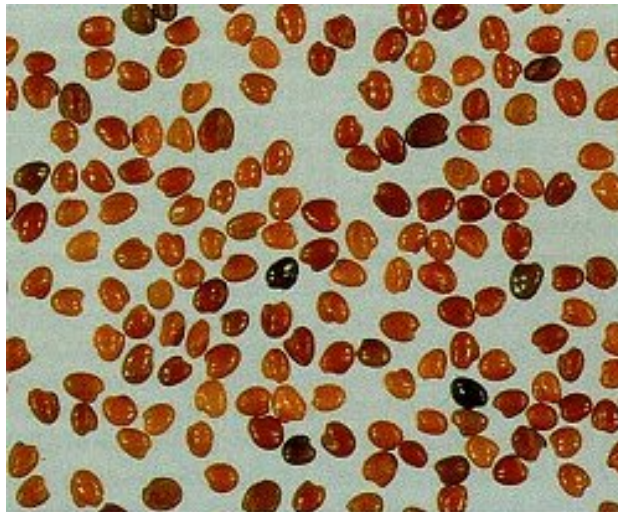


Figure 3. *Frontier^P seeds are small. Magnified ten times.*

Harvesting

Frontier seed can be harvested with a conventional cereal harvester provided the stand reaches an adequate height. Crop lifters may be an advantage in thick, lodged pastures. Timing of harvesting is important and stands should not be left too long after maturity as seed is shed from the head. Dessiccant herbicides (such as diquat) may be necessary in some situations if plants or weeds are still green. Swathing can also improve harvest efficiency, but appropriate timing is important. It is unlikely that large quantities of seed can be harvested with a clover harvester because of difficulties

in separating the seed from sand.

Farmers harvesting their own Frontier seed must ensure that it is scarified before sowing to increase its germination percentage. The use of unscarified seed usually results in a very poor establishment owing to its high hard seed content.

Production and marketing

Under the Plant Breeder's Rights Act (1994) there is no restriction on producing seed of Frontier for personal use but propagation of seed for sale can only be carried out by agreement with the licensee, SGB Australia. Breaches of the act can be subject to prosecution. Frontier can be purchased from local seed distributors.

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Further information

For more information, contact Clinton Revell (AGWEST, Northam) on (08) 9690 2000 or Brad Nutt (AGWEST, South Perth) on (08) 9368 3333 or SGB Australia on (08) 9325 9119.

Further Reading

- Farmnote No. 61/90 *Balansa clover*.(Agdex 137/10)
- Farmnote No. 26/99 *Establishing Balansa and Persian clovers on waterlogged, mildly saline soils*.(Agdex 138/38)
- Farmnote No. 76/96 *Harvesting balansa clover for seed*. (Agdex 137/15).
- Farmnote No. 6/87 *Techniques for inoculation and lime pelleting*. (Agdex 100/20).
- SGB Factsheet *Frontier^P balansa clover - providing crop and pasture management options*.
- Bulletin 4309 *Seed Certification Rules*.(Agdex 100/43).
- Farmnote No. 77/86 *Potassium deficiency in pasture legumes*. (Agdex 137/632).

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