Messina (Melilotus siculus) Management Package

Ross Ballard
Primary Industries and Regions SA (PIRSA)
Messina management package

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Illustration of messina plant structure drawn and provided by Megan Hele design.

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1. What is messina?

Messina is an upright, aerial seeded, annual pasture legume adapted to moderately saline, winter-waterlogged soils.

2. Why consider growing messina?

Messina has been developed following extensive evaluation in salt and waterlogged affected pasture lands. It produces more biomass than the two best current pasture legume options for saline land; early season balansa clover (Trifolium michelianum) and burr medic (Medicago polymorpha).

Messina is an outstanding seed producer. It develops a large seed bank and re-establishes higher seedling densities compared to other salt-land legume options.

It is suitable for grazing in combination with other pasture species and will provide the opportunity to increase stocking rate, compared to areas where no legume is present. Economic studies have shown that complementing current salt-land based pastures with an adapted legume can increase the returns from pasture by up to $60/ha.

Messina supplies fixed nitrogen (N) to N-deficient soils, provided it is inoculated with the specially developed salt tolerant rhizobia. These inputs of fixed N will increase the production of grasses and herbs in the salt-land pasture.

It has higher levels of combined tolerance to salinity and waterlogging than all other pasture legumes.

Messina will improve the value and aesthetics of salt-land, providing better pasture coverage and improved livestock health.

3. Description of the plant

3.1. Origin and appearance

Messina (Melilotus siculus) is native to the Mediterranean basin, but has become naturalised in some areas of West Australia. The cultivar Neptune was collected from the wild in Israel.

Messina is an aerial-seeding annual legume that can grow up to 0.8 m tall. Leaves are trifoliate, with the central leaflet attached to a longer petiole than the adjacent two leaflets, similar to the annual medics which are close relatives. The leaflets of the commercial cultivar Neptune have a distinct orange-red colored mid-rib when young which fades as the plant matures in spring.
3.2. Flowers and seed

Messina produces clusters of bright yellow flowers. It flowers around the same time as Frontier balansa clover, commencing in mid-September when sown in May/June. Each flower matures to form a pod containing a single large seed (about 3 mm long). The seed pods are free of spines. Pods are held on the plant at maturity if not grazed and can be harvested with a grain harvester (see section 7.4).

The seed produced by messina is initially hardseeded (>80%), with very little seed softening occurring until mid-March. This delay means that messina is likely to suffer negligible seedling losses from false breaks to the season. Seeds soften (are able to germinate) between mid-May and mid-June, deferring germination until late autumn-early winter, after rainfall has flushed salts from the soil surface.

About 30% of seed produced in the previous year remains hard and contributes to the seed bank that provides the seed source for germination in future years.

3.3. Nodules and nitrogen fixation

Rhizobia that nodulate messina are generally absent in salt-land areas and therefore messina must be inoculated. A specific salt tolerant rhizobia has been selected for messina and must be used to ensure adequate nodulation of regenerating messina pastures (further details are provided in section 6.2).
4. Adaptation

4.1. Climatic requirements

Messina is best adapted to areas with Mediterranean-type climates, characterised by mild wet winters and hot dry springs, similar to the regions where subterranean clover and annual medics are grown.

In terms of rainfall, it is recommended that Neptune messina be sown in areas with >400 mm annual average rainfall (AAR) based on its good performance in evaluation trials at sites with AAR between 450 and 525 mm. Neptune messina has performed well in this rainfall zone. In regions with less than 400 mm rainfall, messina may be less reliable.

4.2. Soil texture and pH

Messina has grown well on a range of soil textures. The soil types in evaluation trials have ranged from sands to sandy clay loams. However, messina has also grown well on soils with a high clay content at Bunbury and Yealering in West Australia. It is, therefore, likely that messina can be grown on a range of soil types, provided they meet the pH, waterlogging and salinity criteria described below.

Neptune requires soil pH(CaCl2) ≥ 5.5 or pH(water) ≥ 6.0, which is important as messina nodulation is sensitive to soil acidity. Where soil pH falls below this threshold, liming of soil will be required.

4.3. Waterlogging and salinity tolerance

Messina is best adapted to saline soils that experience winter waterlogging.

Neptune messina is adapted to winter waterlogged areas where summer-early autumn topsoil (0–10 cm) salinity levels are 8–30 dS/m ECe (moderate-high salinity).

It has a particular role where summer-early autumn surface (0-10 cm) ECe levels exceed 8 dS/m, beyond which balansa clover performs poorly. Messina has performed well on severely saline soils, with summer-early autumn surface ECe levels up to 32 dS/m. Seedling germination tests have also shown that messina will tolerate NaCl concentrations up to 32 dS/m. At higher ECe levels, its performance will decline.

Messina roots have two special anatomical features that enable it to cope with waterlogging:

Firstly, its roots contain aerenchyma, which are air channels that allow exchange of gases between the shoot and the root. In this way, oxygen can be supplied to roots in waterlogged soils.

Secondly, hypocotyls and roots are covered in a white, spongy layer, known as phellem, which enables hypocotyl-to-root oxygen transport in messina. The phellem increases rapidly under stagnant conditions and contributes to the waterlogging tolerance of messina.

The specialised root adaptations for waterlogged soils allow this plant also to be considered with balansa clover on winter waterlogged soils that are inundated, but have low salinity.

4.4. Farming system

Messina is best suited to permanent pasture situations, which are the most common landform use in salt-land areas. Further investigation is needed to determine the extent to which messina and its rhizobia are able to persist and regenerate after a crop.

Once established, messina is able to tolerate several weeks of winter waterlogging.
5. Paddock selection

Messina is best adapted and provides advantages over other pasture legumes in paddocks that experience winter waterlogging and where summer ECe levels range between 8 and 30 dS/m.

Soil tests taken in summer are recommended to understand maximum site salt levels and soil pH.

Messina is not recommended where summer ECe exceeds 30 or where soil pH (measured in calcium chloride) is less than 5.5, below which liming will be required. Soil tests taken in winter, after rain has flushed salt from the soil surface, underestimate the salt levels that messina will be exposed to at establishment.

Salt levels in a paddock will vary from year to year, dependent on seasonal rainfall. It is therefore important to measure salt level in the establishment year, rather than rely on old soil tests.

A portable EC meter can be used to confirm that salt levels are acceptable prior to planting messina and help to understand variation across the paddock. Information on how to calculate ECe is provided in Table 1.

While the limits of messina adaptation beyond these levels is yet to be fully explored, its establishment and production are likely to be restricted. Messina has limits; it will not grow in salt scalds.

As a general guide, where paddocks support the growth of grasses such as puccinella (Puccinellia ciliata) and sea barleygrass (Hareum marinum), salinity levels should be at a level that messina can tolerate.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record salinity meter reading (milliSiemens/meter)</td>
<td>Convert to dS/m (divide by 100)</td>
<td>1255 Multiply by soil texture factor</td>
<td>dS/m saturation extract (ECe)</td>
</tr>
<tr>
<td>176</td>
<td>1.76</td>
<td></td>
<td>Sands = 17 30 (upper limit for messina)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Loams = 10 18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Light Clays = 8 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clay = 7 12</td>
</tr>
</tbody>
</table>


Plan 12 months ahead. No herbicides are registered for messina, so weed control prior to planting messina is the best strategy. Undertake weed control such as spray topping the previous spring or choose a paddock where weeds levels are low.

Avoid paddocks treated in the previous year with Group B or SU herbicides. Messina is very sensitive to this herbicide Group and where herbicide residues persist, messina establishment will be affected (refer section 7.2).
6. Inoculation and sowing

6.1. Seed

Seednet, a business unit of Landmark Operations Ltd, has been awarded the license to market and produce seed of Neptune messina. Certified seed can be purchased from Landmark under the Dyna-Grow brand.

Neptune is presently the only cultivar of messina available. Neptune was selected and is jointly owned by the South Australian Research and Development Institute and the WA Department of Primary Industries and Regional Development.

Seed harvested on farm will require scarification before sowing for maximum germination. The messina seed coat is impermeable and requires greater scarification than subterranean clover and annual medics. On farm harvested seed should be tested for germination percentage and sowing rates adjusted to ensure recommended sowing rates are achieved.

6.2. Inoculation

Inoculation with the 'special' rhizobia inoculant for messina (strain SRDI-554) is critical to ensure adequate nodulation. Rhizobia strain SRDI554 has been selected to ensure adequate nodulation of regenerating messina pastures.

A slurry of the peat inoculant should be applied to the seed as close as possible before sowing and the seed pelleted with fine lime (e.g. Omyacarb Grade 5 micro fine lime). Do NOT use builders hydrated lime or slaked lime, they will kill the rhizobia.

Other rhizobial inoculants, including the Group AM medic inoculant and AL lucerne inoculant, are NOT suitable for use with messina.

Greenhouse, laboratory and field studies were used to select a more salt tolerant rhizobia strain for use on messina. Strain SRDI-554 persists in the saline soils where messina is grown and has high N-fixation capacity. It is essential that new sowings of messina are inoculated with the new rhizobia strain to ensure the successful nodulation of regenerating messina pastures.

The messina symbiosis is sensitive to acidity. Even with the new inoculant strain, the percentage of plants that form nodules will likely decrease below pH 5.5Ca. Even this pH level may carry some risk, but this can be reduced with the application of fine-lime to the seed before sowing.

Lime pelleting should not be used to push the pH boundary for messina below pH 5.5. This is because the benefits of lime pelleting are transient and limited to the establishment year. Hence, nodulation of the regenerating messina pasture would likely be poor where soil pH is less than 5.5Ca.

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Nodulation and growth of regenerating messina seedlings will be poor (indicated by arrows) if rhizobia strain SRDI-554 is not used to inoculate messina.

The nodulation of messina is reduced below pH 5.5 (left to right, top row) but can be improved with the application of fine lime to the seed (bottom row).
6.3. Seed treatments

No fungicides are registered for use on messina. The information that follows is provided in the event that registration status for the use of Apron changes.

In research trials, the fungicide Apron XL 350 (metalaxyl) improved the percentage of messina seedlings that established in wet soils. Indications are that the application of Apron may improve the emergence of messina seedlings by 30%.

While satisfactory establishment of messina has been achieved in many research trials without the application of Apron, the results indicate that some level of seedling loss was likely. These losses are very easily overlooked in the field.

Maintaining a sowing rate of 10 kg messina seed/ha, similar to what was used in field trials, will provide a buffer against seedling losses.

A further consideration in the potential application of Apron is that it was shown to significantly reduce the nodulation of seedlings in a very acidic soil, in the absence of lime pelleting. This finding is almost certainly the result of Apron reducing the number of rhizobia on seed, which is a critical limitation to nodulation under acidic conditions. This effect can be reduced if the seed is lime pelleted and sown within 24 hours of inoculation.

The addition of fine lime (Omyacarb Grade 5) improves nodulation and messina establishment on acid soils (refer section 6.2).

6.4. Time of sowing

Seeds should be sown into moist soil in the autumn or early winter, when the probability of continued rainfall is high.

On highly saline soils, it is important to delay sowing until early rains have flushed salts from the soil surface to allow reliable germination. Portable EC meters are relatively affordable and can be used to determine when salt levels fall below 30 dS/m. However, sowing should not be delayed for too long in these soils, as they are likely to become waterlogged in winter. While established plants will perform well in waterlogged soils, plant establishment will be adversely affected if seedlings become submerged.

Spring sowing is not an option because it does not provide enough time for messina to flower and set seed.

6.5. Paddock and seed bed preparation

A seed-bed should be prepared similar to what is done for other small seeded pasture legumes. Weeds should be controlled before sowing to reduce competition.

Seed should be sown into a moist seed-bed, with the aim of achieving good seed soil contact.

6.6. Sowing rate and depth

A sowing rate of 10 kg/ha is recommended to ensure a seedling density sufficient for good growth and seed set. Sowing rate should be at least 5 kg/ha, even where sown with companion species.

Sowing depth should be 5-20 mm deep, similar to subterranean clover which has a similar seed size. Pasture seeds are small and easily sown too deep, but on the other hand if placed on the soil surface may dry out before the seedlings root has gained a foot-hold in the soil. Accurate seed placement is important to achieve good seed to soil contact. The appearance of about 5% of sown seed at the soil surface, provides some indication that it has not been sown too deep.

6.7. Companion species

Messina is recommended for use in mixed pastures (Table 2). Mixed pastures will provide livestock with a balanced diet, avoid issues around palatability observed in pure messina stands and ensure that variable salt-land environments are adequately colonised by different plants where messina is less suited.

Where messina is sown into new paddocks or where other pasture species have been removed, it is best sown with companion species such as puccinellia, balansa clover and burr medic. These legumes and grasses can also be sown as understory species with saltbushes. When sown with companion species, messina should still be sown at 5 kg/ha.
6.8. Fertiliser and lime

Soil tests are a useful tool to assess soil nutrient status. Apply adequate rates of fertiliser to ensure phosphorus, potassium and other trace elements do not limit production.

Lime should be applied to the paddock and preferably incorporated the year prior to sowing, where soil pH is less than 5.5Ca.

Table 2
Different tolerances to salinity and waterlogging means different pasture species will colonise different environmental niches in a salt-land pasture.

<table>
<thead>
<tr>
<th>Legume</th>
<th>Salinity tolerance</th>
<th>Waterlogging tolerance</th>
<th>*Sowing rates (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Messina cv. Neptune</td>
<td>High</td>
<td>High</td>
<td>5 - 10 (alone) 5 (mixes)</td>
</tr>
<tr>
<td>Balansa clover cv. Frontier has performed well in research trials</td>
<td>Moderate</td>
<td>High</td>
<td>2 – 5 (alone) 1 – 2 (mixes)</td>
</tr>
<tr>
<td>Burr medic cvv. Scimitar and Cavalier have performed well in research trials</td>
<td>Moderate</td>
<td>Low</td>
<td>4 - 10 (alone) 2 - 4 (mixes)</td>
</tr>
<tr>
<td>Puccinellia</td>
<td>High</td>
<td>High</td>
<td>3 – 8 (alone) 1 - 3 (mixes)</td>
</tr>
</tbody>
</table>

7. Messina management and use

7.1. Growth

In research plots, messina has produced up to 9 t/ha of dry matter and has regularly produced 3t/ha across a range of salt-land environments.

Where sites are limited by both waterlogging and salinity, messina has produced considerably more biomass than the other legumes used in salt-land pastures. Across three sites Neptune messina produced 2.5 times more biomass than Frontier balansa clover, 4.2 times more than Scimitar burr medic and 57 times more than Jota white melilot (Figure 1).

As with many annual legumes, production in the establishment year can be low, but generally increases in subsequent years. Production of second and third year messina pastures has been outstanding at some sites.

7.2. Weed management

The paddock should be weed free prior to sowing.

There has been limited herbicide testing and, as it is a new species to agriculture, no chemicals are registered for use on messina. Herbicides should only be used where they are registered for general ‘legume seed crop establishment’ or use on ‘grass and legume pastures’.

Weed control in the year before sowing and shortly before sowing is the best option. Research trials have identified a range of herbicides that are safe to use on messina and some that are not.

Neither the seed industry nor growers appear to be limited by the range of herbicides that could be registered and used to establish and favour the growth of messina.
Pre-sowing products

Knockdown herbicides such as Glyphosate and Paraquat can be used before sowing to control a range of grass and broadleaf weeds. Trifluralin (Group D) has been shown to cause some damage at high rate. It has safely been used at a lower rate (1.4 L/ha Treflan or 670 g active ingredient (a.i.) per hectare). It should only be used with strict adherence to application rate timing and method of application.

Post-emergent products

The broadleaf herbicides Flumetsulam (Broadstrike, Group B) and Terbutryn (Igran, Group C) have been used safely at rates of 25 g/ha Broadstrike (20 g.a.i./ha) and 550 ml/ha Igran (385 g.a.i./ha) respectively. Other broadleaf herbicides such as Imazethapyr (Spinnaker at 100 ml/ha or 70 g.a.i./ha; Group B,) and Simazine (550 ml/ha or 500 g.a.i./ha; Group C) caused some damage and were less effective at controlling capeweed, although their performance may be improved under grazing where sheep are used to selectively graze treated weeds. Propyzamide (Kerb 1.5 L/ha or 750 g.a.i./ha, group D) has been safely used on messina.

Group A grass selective herbicides Haloxyfop-R (Verdict at 100 ml/ha or 50 g.a.i./ha), Clethodim (Select xtra at 170 ml/ha or 60 g.a.i./ha) and Butroxydim (Factor at 180 g/ha or 45 g.a.i./ha) have been used safely on messina.

Figure 1
Mean biomass production of Neptune messina, Frontier balansa clover, Scimitar burr medic and Jota white melilot (as a percent of Neptune) over three years at the three saline sites (Darkan and Tambellup, WA and Keith, SA).
Low rates of MCPA and 2,4-DB have caused significant damage to messina and are not suitable for use.

**Herbicide residues in soil:**

Severe sensitivity of messina to be the SU herbicide chlorsulfuron (Glean) highlights that growers are best to avoid fields sprayed with SU herbicides where possible, or if they have been used strictly observe plant back times (Figure 2)

7.3. Grazing and nutritive value

**When to graze**

In the establishment year, the aim is to maximise seed set and set up a seed bank for future years. To this end, in the first year messina should only be lightly grazed.

Grazing should be deferred until seedlings are well established and anchored to the soil. Grazing should be reduced around flowering to maximise seed set.

Messina has markedly longer hypocotyls and its first leaves sit higher off the soil surface than other pasture legumes. This suggests seedlings of messina may be more prone to grazing damage than other legumes, particularly by sheep.

For this reason only light grazing of seedlings in the establishment year is recommended. Ensuring that messina is not grazed to less than 7 cm height will help limit damage to the growing points and help with recovery after grazing.

Regenerating paddocks of messina can tolerate moderate grazing pressure and recover to set seed. Several older trials have been grazed in common with surrounding paddocks and Messina has persisted strongly after seven seasons.

**Figure 2**

Plant growth score (0 = cotyledons only, 5 = two trifoliate leaves) of messina and barrel medic cultivars Caliph (SU intolerant) and Sultan-SU (SU tolerant) after 4 weeks exposure to six rates of Glean designed to simulate soil residue levels.
Light grazing near the end of summer will help to knock seed from the messina stems onto ground and help reduce plant residues which can restrict messina germination.

Animal performance

Neptune messina has similar digestibility and protein levels to balansa and subterranean clovers. It does not contain compounds known to pose a threat to livestock health and produces sheep meat that is acceptable to consumers. However, when grown as a pure sward it is less palatable to sheep than sub-clover, and therefore is likely to be better utilised by livestock as a component of a mixed pasture.

Messina contains no known anti-nutritional or toxic factors. In general, messina is distinctive from other Melilotus species in having very low levels (similar to balansa clover) of coumarins (Stevenson 1969; Nair et al. 2010), which are compounds that can cause livestock health issues and are typically associated with a strong aromatic smell. The isoflavones; genistein, formononetin and biochanin A, were all measured at levels of <0.01% of DM and similarly should not cause any livestock health issues.

An ‘unpalatability factor’ in messina may limit its intake, particularly when grown in pure swards. Messina intake was observed to decline prior to flowering and seed set, with sheep grazing the messina only maintaining liveweight, compared to sheep grazing sub-clover that gained weight (Table 3). The grazing trial was on land not affected by salinity, to allow the comparison with sub-clover. Under more realistic conditions, where messina is grown in a mixed pasture and compared to an unimproved salt-land pasture of unproductive and N-deficient grasses, livestock carrying capacity and production should be improved. In this scenario, the messina will also contribute fixed N to the system, leading to higher overall biomass production of grasses and other pasture components.

7.4. Seed production and harvesting

Neptune messina is an outstanding seed producer, with yields up to 1,200 kg/ha recorded in trial plots. It is an aerial seeder. Mature pods are retained on the plant and do not shatter. Seeds are easily threshed from pods to give a clean sample.
These attributes enable seed to be readily harvested with a conventional grain harvester, although scarification of the seed will still be needed.

The relative unpalatability of messina in the plant reproductive stage has agronomic advantages, as it allows seed set needed for pasture regeneration in subsequent years and may reduce the subsequent grazing and depletion of pods. Regenerating pastures of messina may be able to be grazed harder through flowering and seed set than medic pastures.

8. Pests and diseases

Messina should be monitored for redlegged earth mites (Halotydeus destructor), particularly around emergence, and controlled as required.

Heavy infestations of bluegreen aphid (Acyrthosiphon kondoi) and spotted alfalfa aphid (Therioaphis trifolii) have occasionally been observed in the field. If large aphid numbers are observed in messina pastures, an aphicide should be used to prevent herbage and seed losses. Messina is susceptible to damage from native bud-worm (Heliothis punctigera) and seed production may be reduced if they are not controlled.

To date, no foliar fungal diseases have been observed in field plots. However, powdery mildew has been observed in messina breeders seed increase rows that were irrigated overhead and in greenhouse experiments. Neptune messina has some susceptibility to powdery mildew. Grazing to reduce the canopy density may help reduce progression of the disease.

Table 3
Liveweight (kg) of lambs grazing Neptune messina and Monti subterranean clover on non-saline paddocks; at the commencement of the trial, and at days 22, 42 and 52 of the grazing period.

<table>
<thead>
<tr>
<th>Time</th>
<th>Messina</th>
<th>Sub-clover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>32.7</td>
<td>33.3</td>
</tr>
<tr>
<td>Day 22</td>
<td>36.7</td>
<td>40.9</td>
</tr>
<tr>
<td>Day 42</td>
<td>36.9</td>
<td>45.6</td>
</tr>
<tr>
<td>Day 52</td>
<td>35.4</td>
<td>47.0</td>
</tr>
</tbody>
</table>

9. Plan for success with messina

The aim in the first year is to maximise seed set.

Paddock selection

Messina is best adapted to saline soils that experience winter waterlogging. Summer-early autumn topsoil (0–10 cm) salinity levels should not exceed 30 dS/m ECe (moderate-high salinity).

Soil pH (measured in CaCl2) should be >5.5.

Paddock preparation

Prepare a weed free seed bed

Seed and inoculant

Check seed germination. Inoculate the seed with the special rhizobia (SRDI 554). Apply inoculant as close as possible to sowing and apply fine lime to the seed.

Get the timing right

Sow into a moist seed bed, ideally after rains have flushed salts from the soil surface, but before paddocks are waterlogged.

Sowing

Sow enough seed. 10 kg/ha alone or 5 kg/ha in mixtures. Sow shallow. No deeper than 20 mm. Do not broadcast seed onto the seed surface.

Pests

Monitor for redlegged earth mites (Halotydeus destructor), particularly around emergence, and control as required. Monitor for aphids and native budworm and control if needed.

Nutrition

Soil test and provide adequate nutrition, particularly phosphorous.

Weeds

Manage competition from broad leaf weeds.

Grazing

Delay grazing until plants are well anchored to the soil in the establishment year. Reduce grazing pressure around flowering to maximise seed set.
10. Commonly asked questions

Where is messina best grown?
Messina grows well in winter waterlogged soils in regions receiving >400 mm annual rainfall. Where summer salinity levels are between 8 and 30 dS/m EC it will perform better than other legumes. It will not grow in salt scalds. Soil pHCa should be greater than 5.5.

Where can I get seed and inoculant?
Seed and inoculant is available to farmers from Landmark.

Does it need to be inoculated?
Yes, seed must be inoculated with the special rhizobia (SRDI 554) and inoculated with fine lime

What cultivar should I use?
Neptune messina is the only cultivar available

What sowing rate should I use?
10 kg/ha if sown as a monoculture, or 5 kg/ha in a mixture.

When is the best time to sow messina?
Late autumn/early winter, after salts have been flushed from the soil surface, but before paddocks become waterlogged.

How long will it last?
In trials, it has persisted for seven years.

What insect pests should I look out for?
Redlegged earth mites, aphids and native budworm.

What herbicides are safe to use?
No herbicides are registered specifically for use on messina.

In research trials, Broadstrike and Igran have been used safely. Grass selective herbicides Verdict, Select and Factor have been used safely. MCPA has caused significant damage to messina and is not suitable for use. Messina is very susceptible to the SU herbicide chlorsulfuron (Glean).

How do livestock perform on it?
Messina is safe for grazing. However, it is less palatable to sheep than sub clover, when grown as a pure sward. It is recommended that messina is sown and grazed as a mixed pasture.

Where can I get more information on salt-land pastures?
