best practice management guide

7

BEST PRACTICE MANAGEMENT GUIDE FOR ENVIRONMENTAL WEEDS

ISSN 1442-7192

St John's wort, *Hypericum perforatum*

Aculus hyperici mite, a biocontrol agent.
Photo: CSIRO.

Infestation of St. John's wort.
Photo: CSIRO.

St John's wort flowers.
Photo: K. Blood.

Taxonomy and status

Botanical name: *Hypericum perforatum* L. - Family Clusiaceae (previously Guttiferae or Hypericaceae).

Standard common name: St John's wort.

Relationship to other species in Australia: There are two indigenous native species of *Hypericum* which may co-occur with St John's wort and with which it could be confused. Both indigenous species may be distinguished by the absence of black gland dots on the petals and leaves, the presence of 4 longitudinal ridges on the stem (young stems of St John's wort are 2-ridged) and by the stamens not being fused into bundles. *Hypericum gramineum*, small St John's wort, is an indigenous species usually smaller (10-430 cm high) than St John's wort which can be distinguished by its petals being less than 8 mm long (more than 8 mm long in St John's wort), its leaves having recurved margins and the absence of oil glands. *Hypericum japonicum*, matted St John's wort, is a prostrate or procumbent plant rarely more than 8 cm high with leaves less than 10 mm long.

Of the *Hypericum* species introduced to Australia, *H. triquetrifolium*, tangled hypericum or wavyleaf St John's wort, from the Mediterranean region, is a prohibited weed in Victoria and WA. Leaves of this species are not conspicuously dotted with translucent oil glands and have undulating margins that are not recurved. Several other introduced species of *Hypericum* also occur in Australia.

Legislation: The status of St John's wort varies considerably between and within states. It is declared noxious in parts of NSW, Victoria, Tasmania and WA. It is not declared in ACT, NT, Qld or SA. Keep up to date with the latest legislation through local and State/Territory government weed agencies or on the web at www.weeds.org.au

Description

Habit/lifeform: St John's wort is a perennial herb with two growth stages - in autumn and winter as a flat low rosette, diameter 10-60 cm, with spindly non-flowering stems and a dense mat of leaves, and in spring and summer as an erect twiggy form which produces one or more woody flowering or non-flowering stems, 30-120 cm high.

Description: Mature plants have a central woody crown. In late autumn, winter and early spring, horizontal, pale green or reddish stems with bright green, elongate leaves grow from the crown to form a rosette. One to many upright flowering stems are produced from this crown in spring. Clusters of bright yellow flowers (1-2 cm in diameter, with 5 petals and black glands on the margins) develop in summer *(Figure 1)*. Flowers have narrow sepals much smaller than the petals and numerous stamens fused at the base into three bundles. Flowering is followed by the formation of reddish-brown seed capsules that contain small cylindrical black seeds, approximately 1 mm long. Seeds fall from the capsules in autumn, when the erect stems die.

Figure 1. St John's wort flowers.
Photo: K. Blood.

The leaves are ovate to oblong or linear in shape, 5 to 25 mm long and 1.5 to 5 mm wide, with margins usually curved towards the underside. They are dotted with clear oil glands that give a perforated appearance when held to the light.

A large infestation of St John's wort appears light green in October and November as stems elongate, yellow in December and January when in full flower, and reddish-brown in late autumn and winter *(Figure 2)* because of the mature fruits and old stems.

Figure 2. Mature fruits and old stems of St John's wort in winter. *Photo: K. Blood.*

Origin and distribution

Origin: St John's wort is native to Europe, Asia and North Africa where it occurs in a number of different forms.

Introduction: St John's wort was first introduced from Europe for ornamental and medicinal purposes in the 19th century. Many weedy infestations of a narrow-leaf form in eastern Australia can be traced to a garden planting near Bright, Victoria, in about 1880. The presence of a broader-leaf variety of St John's wort in central NSW suggests a separate introduction to that area around 1890. Infestations in SA appear to have originated from plants cultivated in the Adelaide Botanical Gardens in 1859.

Distribution: St John's wort is an important weed in both natural and agricultural ecosystems and infests an estimated 400 000 ha, of which more than 80% carries natural vegetation, particularly open woodlands. St John's wort is currently present in southern Qld, NSW, ACT, Vic, Tas, SA and south-west WA *(Figure 3)*. The major areas of infestation occur in NSW, the ACT and Victoria. St John's wort exists as a number of different varieties or forms in these regions.

Ecosystems invaded: St John's wort is found in grasslands, open *Eucalyptus* and *Callitris* woodlands, and along river banks, as well as in cleared pasture lands and forest plantation areas *(Figure 4)*. It is common on less intensively managed lands such as travelling stock reserves, commons, water catchment reserves, roadsides *(Figure 5)*, power line easements and railway verges.

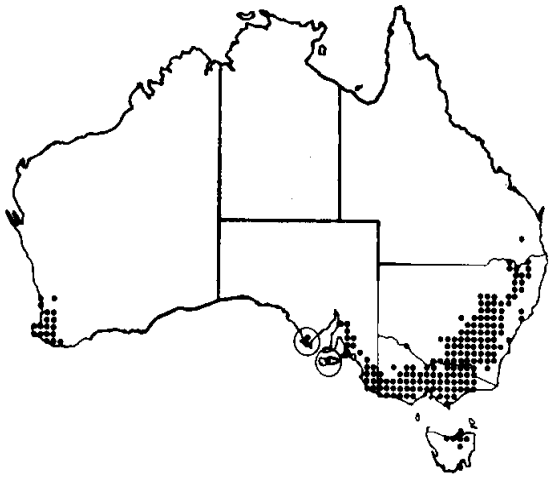

Figure 3. Distribution of St John's wort (Parsons and Cuthbertson 1992).

Figure 4. St John's wort can hinder pine plantation establishment. *Photo: F. Mahr.*

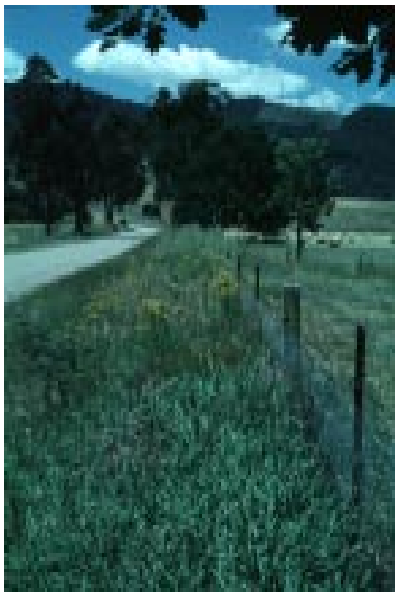

Figure 5. Roadside infestation of St John's wort. *Photo: F. Mahr.*

Impacts

Species and ecosystems at risk: St John's wort is considered a threat to indigenous plants on private property, in national parks, state forests and other reserves. Understoreys of open *Eucalyptus* and *Callitris* woodlands in natural ecosystems are particularly at risk.

Economic impact: St John's wort is a major weed of pastures because of its toxicity to stock and its ability to compete with desirable pasture species. However, 80% of current infestations occur in areas of indigenous vegetation, particularly open *Eucalyptus* woodlands. St John's wort is a common weed of water catchment and conservation areas and therefore poses a threat to natural ecosystems. The economic impacts have not been calculated.

Dispersal and establishment

Reproductive techniques: St John's wort reproduces from seed or by suckering. It mainly sets seed without pollination, but can also outcross. New crowns may be produced by shoots from the lateral roots in spring and autumn. The origin of a mature crown can be determined by digging up the roots. If the main tap root is vertical the plant originates from a seedling, but if there is a right-angled bend just below the crown it originates from a sucker.

Vectors and dispersal mechanisms: The sticky fruits can adhere to the coats or hair of indigenous and pest animals, as well as domestic stock. This is the major method of long-distance dispersal. Machinery movement and shipment of contaminated fodder or seed may also lead to new infestations. Seed is not transported far by wind (less than 10 m per year). An individual plant may spread concentrically (at a rate of 30 cm per year) by shooting ("suckering") from lateral roots which is the main method by which infestations are maintained locally.

Persistence: A single plant can produce up to 30 000 seeds annually. Fresh seeds are dormant for 4-6 months before they can germinate, but may remain viable in the soil for as long as 12 years. Seedlings grow slowly, and are susceptible to drought and plant competition. In an average year, very few seedlings survive to maturity. Favourable years in which there is massive establishment can occur periodically. Once established, lateral spread of individual plants occurs primarily through suckering. The risk of spread into a new region is greatest in a 'wet year' following a drought. Such conditions favour the survival of newly germinated seedlings, probably because of reduced competition.

Tolerances: Frost may burn the new tips of rosette leaves but the plants will recover. Crowns can tolerate summer drought, though extended drought periods may cause plant death.

Properties

Health risks and other undesirable traits: St John's wort contains the alkaloid hypericin, which causes photosensitisation in mammals which ingest it, resulting in blisters on weakly pigmented parts of exposed skin. Sensitivity varies between animal species and between breeds of domestic stock. Cattle are highly sensitive to hypericin poisoning. Mature goats have tolerance. Black-faced meat sheep are more tolerant than white-faced wool sheep and some bloodlines of merinos are more sensitive than others to hypericin poisoning. Native animals are not known to be affected. All of the adverse clinical reactions of sheep that have consumed St John's wort appear to depend upon the activation of hypericin in their bodies by bright sunlight. Recently shorn sheep grazing during fine weather are thus at higher risk.

The level of hypericin is higher in the narrow-leaf than the broad-leaf form, and changes throughout the year. Hypericin levels start to rise rapidly in spring when the new shoots reach a height of 5-10 cm and are greatest in early summer when plants are in full flower. Hypericin content of narrow-leaf forms is approximately twice that of broad-leaf forms in late winter and early summer.

Cultural uses: St John's wort was introduced for its use as a herbal medicine. Currently, there is renewed interest in it as a natural remedy for depression and a large market exists in Europe and North America. This has led to wild-harvesting of St John's wort in Australia.

Biology and ecology

Biology: The most common form of St John's wort in Australia is the narrow-leaf form (leaf length is 3 or more times leaf width). Other broader-leafed forms of the weed (with a leaf length about twice leaf width) are present in some localities, however. These broad-leaf forms tend to be shorter and bushier in appearance and flower earlier.

Plant form also depends on habitat. Deep soil favours the development of larger, multi-stemmed plants with vertical roots and long-lived crowns. In shallow or stony soils, plants are smaller with fewer stems; lateral roots proliferate and suckering becomes more common.

Fire generally favours St John's wort as the crowns can reshoot after being burnt, depending on the intensity and timing of the fire. The hotter the fire the greater the death of crowns. A low intensity fire may stimulate suckering from surviving lateral roots and thereby increase weed density. Fire in autumn may favour St John's wort as it recovers and becomes dominant when it is too cold for other species to germinate. A fire in spring may favour other species that can germinate and compete with St John's wort under warmer conditions.

Growth calendar: Prostrate non-flowering stems grow from the crown in autumn forming a circular rosette, which dies off in late spring, erect stems (both flowering and non-flowering) grow from the crown in early spring, and flowers form on these stems from late spring through summer, after which seed capsules ripen in late summer and autumn. The seeds fall from the capsules in autumn and the erect stems die. This cycle may be repeated for several years before the crowns die.

Management

Prevention: It is important to keep uninfested areas clear of St John's wort. Identify and address existing or potential sources of this plant before it invades further.

Once an infestation is established, preventing spread should be a priority. This may include the quarantining of an area to stop movement of seeds. Stock routes should be kept clear of St John's wort as spread occurs through attachment of seed capsules to animals. Care should be taken to avoid the transport of seed in machinery and vehicles *(Figure 6)*, ie. don't drive through infestations with mature reddish-brown seed capsules. Care also should be taken when cutting fodder, as shipment of contaminated fodder is a prime cause of major new infestations.

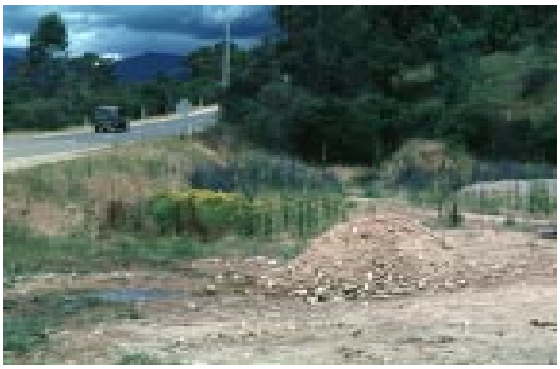

Figure 6. St John's wort can be spread on machinery and in road making material. *Photo: K. Blood.*

Integrated management: Weeds need to be treated as a symptom of larger land and water management issues. When treating St John's wort in a natural ecosystem, it is essential to consider its management in light of other priorities. When using these guidelines, it's essential to realise limitations and modify management recommendations in light of experience and local knowledge. Each situation should be considered individually.

Larger infestations require planning to efficiently reduce the population to an acceptable level determined by the management objectives for the area and the resources available to tackle the problem. There are a number of different treatment techniques that can be used but it is often better to combine a number of techniques for the best results.

Isolated plants or small infestations: Ensure that you have correctly identified the plant before removal. Physical removal is the best option where isolated plants are found on roadsides or in forest openings. They should be removed manually, preferably before they have seeded as they can become the source of much larger infestations. As much of the rootstock as possible should be removed to prevent resprouting and treated sites should be revisited regularly to ensure that there is no further germination or suckering.

Larger infestations: Small to large infestations can be treated with herbicide applied by spot-spraying or other suitable methods. As infestations become larger, a strategically staged approach for removal is advisable to ensure that treated areas are not reinfested.

Treatment techniques:

Herbicide information: **When using herbicides always read the label and follow instructions carefully. Consult a specialist for advice on registered herbicides in your State or Territory. Herbicide information is available at the National Registration Authority web site at** www.affa.gov.au/nra/pubcris.html

Many different herbicides are used to control St John's wort along roadsides or tracks in natural ecosystems, either by spot-spraying or used broader-scale, at various recommended dose rates and with varying results. Consideration should always be given to the impact of the herbicide on other vegetation, eg. glyphosate will kill grasses and picloram can kill legumes and other broad-leaf plants. Fluoroxypyr will not kill grasses or legumes if applied in early summer. Herbicides should be applied when the plants are actively growing and soil moisture is plentiful. If conditions are dry it is unwise to spray. The best time to apply herbicides is when the plant is starting to flower (October to December depending on locality).

Other methods: More research is needed before fire can be used with confidence as a management strategy (see above). Slashing is not effective as it may induce suckering in certain situations.

A number of private companies have been formed in the past few years to wild-harvest St John's wort for the extraction of hypericin (see above). Harvesting is done during peak flowering to maximise hypericin content and, whilst unlikely to reduce density, could reduce seed production and the potential for spread. The companies have different strategies, ranging from carrying out the harvest themselves (the landholder does not receive any remuneration) to selling harvesting equipment to the landholder (who then harvests the material and sells it to the company).

Afforestation may be possible in some areas of low natural heritage value or of infested pasture land. St John's wort does not grow well under closed-canopy pine forests due to shading. Where feasible, infested areas can be planted to pines (although these may also become invasive locally). However, seed may remain viable for the period of a forest rotation and plants may reappear after timber harvesting.

Grazing: On hilly, steep, low value land, the cost of herbicide treatment may exceed the value of the land, so suppression of St John's wort with sheep is the best option. Goats are tolerant of hypericin but may not be acceptable to graziers as a replacement for merino sheep. Sheep will eat green growth of St John's wort at any time of the year, although the more tolerant black-faced sheep are not suitable for poor hill pastures. Research is under way to design a system which will enable infested areas to be grazed when the risk of poisoning to merino sheep is low and the impact of the grazing on the weed is high. This requires a detailed understanding of the variations in hypericin content of the different leaf forms and growth stages of St John's wort and the hypericin tolerance variations in sheep.

Experimental results to date indicate that heavy grazing of broad-leafed types of St John's wort, from late autumn to early spring, by merino wethers with at least 4 months wool growth, is safe, and will suppress wort. Safe grazing of narrow-leafed types is only possible from early July to mid September. These periods may vary slightly from year to year, depending on the stage of development of the plants and their hypericin content. Fine or superfine wool sheep have better protection. Sheep should always be moved off wort infested pastures when new season St John's wort shoot growth reaches 5 cm in height. If such grazing is heavy, and is repeated annually, it should suppress the weed.

Biological control: Effective long-term control in extensive infestations in areas with indigenous vegetation has been achieved with insects, with the most effective being *Chrysolina* beetles. Adults lay orange eggs on the rosettes in autumn and the pinkish-grey larvae feed on rosettes through winter. The adults are iridescent black with bronze, dark blue, green or purple and feed on the elongating stems in spring *(Figure 7)*. Total defoliation of both winter rosettes and flowering stems in late spring can occur *(Figure 8)*, although the weed may recover if there is sufficient summer rain and if beetle populations are low. *Chrysolina* beetles can be collected readily in spring and distributed to areas where they are absent. Close monitoring of beetle numbers and transfer of populations will maximise their effectiveness in areas where other forms of control are not an option. *Chrysolina* beetles are not effective in areas shaded by trees.

The St John's wort mite *Aculus hyperici (Figure 9)* is too small to be seen with the naked eye but its presence can be recognised by stunted leaves and stems. The mite reduces the biomass of St John's wort infestations and the density of plants or restricts the increase in plant density. It too can be redistributed easily, by cutting infested plants that show symptoms in autumn or spring and placing them on to healthy plants in a new area.

The gall midge forms circular galls on leaves in which its red larvae develop. The pale green St John's wort aphid sucks the sap and may cause damage but is not considered an effective control. The St John's wort root-borer can be effective, but is difficult to distribute and establish, and is known only from two locations in Australia.

Figure 7. Chrysolina beetles (*Chrysolina quadrigemina*) are an effective biocontrol agent for St John's wort. *Photo: CSIRO.*

Figure 8. Chrysolina beetles (*Chrysolina quadrigemina*) are able to defoliate St John's wort, note defoliated brown plants on right and unaffected green plants on left. *Photo: F. Mahr.*

Where large infestations occur in natural vegetation, biological control remains the only realistic option. Efforts should be made to monitor agent activity and introduce or redistribute agents as needed. Single plants or localised patches should be physically removed (before they first seed if possible) and subjected to follow-up inspections to ensure eradication. The use of fire is problematic until more research is carried out. In conservation areas where fire may be used as a tool for other purposes, it may be possible to spray St John's wort selectively if it recovers from the fire earlier than other vegetation. If biocontrol agents are present, unburnt refugia can be kept aside for them. There is some evidence that insect numbers increase more rapidly and have greater impact on the nutrient-rich plant growth of St John's wort that follows a fire.

Figure 9. The St John's wort mite (*Aculus hyperici*) is a biocontrol agent too small to be seen by the naked eye. It is pictured here using an electron scanning microscope. *Photo: CSIRO.*

Follow-up: For any treatment technique, it needs to be remembered that seed of St John's wort can remain viable for many years in the soil and there will probably be large seed reserves present. Successful management strategies need to incorporate a way of "wort-proofing" the habitat following treatment, eg. by planting competitive indigenous species in natural ecosystems.

Community awareness: Consider a range of activities as part of national Weedbuster Week in October each year to increase local community awareness of the problem. See the web site at www.weedbusterweek.info.au for more information.

Replacement plants: No studies have been carried out yet to evaluate the most competitive replacement plants for natural ecosystems, but in the first instance these should be selected from indigenous herbaceous understorey plants present in the infested ecosystem. It is best to seek the advice of local flora and revegetation experts about suitable indigenous plants of local provenance for revegetation.

WeedWatch: Legislation prohibits the sale of this plant in a number of areas. If the plant is being sold in such areas then the garden centre or nursery and local weed management authority should be informed. Let garden centre staff know how weedy it is and the damage it is doing locally. Encourage them to provide safer alternatives.

Where plants are found in the bush they should be reported to those managing the area so that infestations can be treated where feasible. If you are uncertain about identification, send a specimen to the State or Territory Herbarium with details on where and when it was found and the contact details of the person who sent the specimen (see the *White Pages* or the *Weed Navigator* for address details of herbaria).

Further reading

Bourke, C. and Southwell, I. (1999) Control of *Hypericum perforatum* L. (St John's wort) by a grazing management system that uses merino sheep. 12th Australian Weeds Conference, Hobart, September 1999, pp 4-7.

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Jupp, P.W., Briese, D.T. and Groves, R.H. (1996) St John's wort, *Hypericum perforatum* L.: Integrated control and management. Proceedings of a workshop sponsored by the Co-operative Research Centre for Weed Management Systems, 13-14 Nov 1996, Canberra. *Plant Protection Quarterly* **12**, 51-108.

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Parsons, W.T. and Cuthbertson, E.G. (1992) *Noxious Weeds of Australia*. Inkata Press, Melbourne.

There are a number of management guides on different weeds being published by the Weeds CRC (see contact details below). Other CRC weed publications include the *Weed Navigator* (lists many weed publications, information resources and contacts in Australia and New Zealand), workshop proceedings, field and management guides, brochures and posters.

Further contacts: Many people interested in environmental weeds communicate regularly through the *Enviroweeds* email discussion group established in Australia. If you would like to join this group free of charge, send this email message <subscribe> to the following email address: enviroweeds@majordomo.nre.vic.gov.au

Acknowledgments: Thanks are due to Russell Knutson and Chris Bourke for comments on drafts of this guide. Editing by Richard Groves and Kate Blood. Design and layout by Kirsty Villis and Kelly Scott.

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Publication date: September 2000. Printed on recycled paper.

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