Department of Agriculture and Food
GOVERNMENT OF WESTERN AUSTRALIA

Factsheet

Updates at Department of Agriculture and Food

Roly poly

Roly poly, also known as prickly saltwort or tumbleweed (*Salsola australis* R.Br.), is a native species found throughout Australia with the exception of Tasmania (Image 1). The dead plants can break off at ground level, forming the iconic 'tumbleweeds' seen in movies. Roly poly, along with a range of other species in the Salsola genus, is a prominent weed of agricultural systems internationally. Like most summer weed species, roly poly utilises soil moisture and nutrients that would otherwise be available to the following crop. The time taken to clear uncontrolled plants may delay seeding. Livestock will graze the young plants. However, they will not eat the mature plants, and are injured by the prickly leaves. This species has tentatively been linked to oxalate poisoning, but most tests indicate that oxalate levels are insufficient to poison sheep. Levels of oxalates and nitrates in roly poly may increase in the presence of nitrogen fertiliser or legume species. The dead, mobile tumbleweeds can become a significant fire hazard, particularly when too many plants pile up against fences or buildings. Note that as a native species, this species is not a problem in areas of native vegetation, and plays a valuable role in revegetation of disturbed sites.

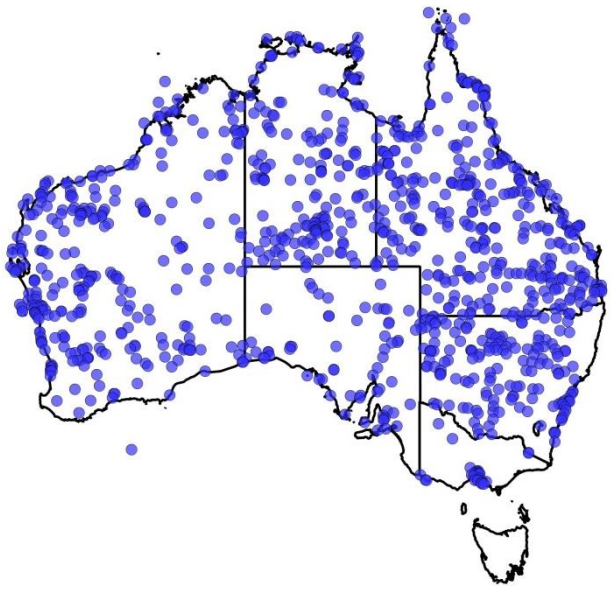

Image 1 - Distribution of roly poly in Australia. Map sourced from Australia's Virtual Herbarium (http://avh.ala.org.au) on 20 March 2017.

Identification and attributes

Roly poly seedlings have two cotyledons, approximately 10 mm long and round in section. The juvenile growth stage of the plant has round, succulent leaves that range in length from less than 5 mm to over 50 mm long. Plants may remain in the juvenile growth stage for several weeks or months, or progress to the adult growth stage in less than a month. Adult vegetative growth is characterised by leaves that are short (usually less than 10 mm), flat and taper to a spine (of 1-5 mm long). The mature plants are highly branched from the main stem, and grow in a round or hemispherical shape (although plants are occasionally prostrate, particularly in a saline environment). Mature plants are approximately 0.6 m high (maximum diameter of 2 m). Flowering/reproduction is indeterminate, commencing immediately upon entering the adult vegetative stage or up to six months later. Adult vegetative growth continues during the reproductive stage. Some plants produce juvenile growth from axillary buds near the stem base during the adult vegetative growth or reproductive phase. These juvenile branches then progress to adult vegetative growth and reproduction. Single seeds form at the base of leaves. Each seed is contained in a fruit with five wings, although wingless fruit are also found on each plant. Plants can survive for over 12 months. However, life span is not related to size or seed production.

Seed shed before, during and after plant senescence (death). Following senescence, the plant may break free from the root system to form the iconic ‘tumbleweed’, and the wind-dispersed plants frequently travel over 1 km (while shedding more seed) before becoming entangled in fence lines, vegetation or large piles of other dead roly poly plants. The abscission layer that develops at the base of the stem and allows the senesced plant to break free of its root system appears to form during the transition from juvenile to adult vegetative growth. A plant that dies during the juvenile vegetative growth stage degrades without being released from the root system.

Roly poly is a native species. There are many variants that are morphologically distinct (i.e. plants that look a bit different to roly poly) but are not classified as separate species/sub-species. The most common form of roly poly found in agricultural regions is displayed in Image 2, but many other forms of this species have been recorded, including variants that are perennial rather than annual.

Image 2 – A young roly poly in the juvenile vegetative growth stage, with long, soft, succulent leaves (top left), a mature roly poly with short, prickly leaves and fruit (top right), a close up of roly poly branches with fruit starting to shed (bottom left) and dead roly poly (bottom right). Photos courtesy of Dave Nicholson, Abul Hashem and Catherine Borger, Department of Agriculture and Food Western Australia.

This species is commonly confused with black roly poly (*Sclerolaena muricata*), which has spiny burrs and is generally hairier. It may also be confused with kochia (*Kochia scoparia*) and tumbleweed (*Amaranthus albus*).

Biology

When they emerge

Roly poly seeds have variable dormancy. There are short term after-ripening requirements as the seed finishes maturing, and then seedlings germinate following exposure to sufficient moisture. Seeds will germinate over a wide temperature range, although 11-20^{o}C is the optimal temperature. No germination occurs over 40^{o}C and germination is reduced at 5^{o}C. Burial is not necessary for germination, but increases the likelihood that a seedling will successfully establish.

As seeds have little dormancy and can germinate over a broad temperature range, emergence can occur throughout the year. Peak establishment is variable between populations. Roly poly seed collected from three locations in Western Australian had peak establishment in summer (Lake Grace population), winter (Morawa population)

or emergence of small cohorts throughout the year (Merredin population). All of these populations had the same temperature range for optimal germination. Clearly these populations have evolved differences in dormancy/after-ripening requirements in response to different environmental conditions or agronomic management regimes in the different regions.

Where they grow

Roly poly is most abundant in disturbed habitats, and prefers alkaline or saline soils. However, it can tolerate a very wide range of soil types and climates. If habitats remain undisturbed for over three years (i.e. a long term pasture) the roly poly population quickly declines.

Seed production

Roly poly seed production in Lake Grace and Morawa WA ranged from less than 100 to approximately 20 000 seeds per plant, and was directly related to dry plant biomass. Between different populations, seed viability can range from less than 10% to over 90%.

The seedbank

In the event of rainfall during seed production (direct water contact with the seeds), some seeds will sprout prior to shedding. Seeds shed when the mature plant is still actively growing, and then more rapidly after the senesced plant breaks off to form a tumbleweed and starts moving (not all plants break free to form a tumbleweed). A mature, senesced plant also contains younger seeds that will not initially shed (even in a thresher). These retained seeds have similar viability to the shed seeds, but have greater dormancy (imposed by lack of maturity). The retained seeds shed over time due to natural aging and weathering, regardless of whether the senesced tumbleweed is mobile or stationary. However, viability of the retained seed dropped to less than 2%, two months after the plant reached senescence (a decline of 79%). Seed with low viability will have little impact on the population growth rate, but these seeds maintain a capacity for dispersal if the mature tumbleweed continues to move. The dead tumbleweed plants have been recorded moving anywhere from 1 m to over 1 km at Morawa WA. Over 10% of the Morawa population of plants traversed the (1 m high) fence to move into neighbouring fields. In a dense stand of roly-poly, about half of the plants become entangled with other roly-poly plants before they can travel far.

An average of 19% of seed from field plants and 68% of seed from plants grown in controlled conditions germinated in the year following seed production. However, It is not known if the ungerminated seeds were dormant or had degraded and lost viability. The very thin seed coat indicates that the seed is unlikely to last long in the soil seed bank.

Tactics for integrated weed management

Roly poly is a problematic weed of cropping and pasture areas in southern Australia, but it can be effectively managed with an integrated weed management (IWM) plan.

Both cultural and chemical options are required (Table 1). As the seed viability is usually 1-2 years, the IWM plan should focus on killing all weeds, preventing seed-set and preventing introduction of seeds from external sources (i.e. contaminated grain or machinery) for at least a year.

Herbicide resistance

Roly poly herbicide resistance has not been recorded in Australia, but it is a common problem in the USA and Canada. Mature roly poly plants can travel outside their field of origin, and disperse seeds over a wide area. So if resistance is suspected, it is important to crush or burn the mature plants before they have a chance to roll away.

Knockdown herbicide options

A knockdown of paraquat (e.g. Nuquat®) or paraquat+diquat (e.g. Spray.Seed®) may be more effective than glyphosate. However, mature plants may re-sprout after paraquat or paraquat+diquat application with sufficient rainfall. High rates are required to kill the mature plants growing over summer, but young plants in the juvenile vegetative stage are relatively easy to kill.

Crop

There are no herbicides registered for control in crop. However, roly poly plants are generally shorter than crop, and highly susceptible to crop competition. Therefore, narrow row spacing or high seeding rates can reduce roly poly growth in crop.

Pasture

The only registered herbicide product for pasture is 2,4-D (e.g. Surpass® 475). Heavy grazing will remove young plants, but plants may re-sprout. A Lake Grace WA population in a volunteer, grazed pasture did not have significantly reduced seed production compared to un-grazed pasture (28 000 seeds m^{-2} compared to 40 000 seeds m^{-2}). Rolling or crushing can be used to remove mature plants. Roly poly prefers disturbed soil and is unlikely to remain in a long term pasture (more than 3 years).

Non-agricultural areas

Products registered for non-agricultural areas include 2,4-D (e.g. Surpass® 475), imazapyr (e.g. Arsenal®) or imazapyr+glyphosate (e.g. Arsenal® Xpress) and paraquat (e.g. Nuquat®) or paraquat+diquat (e.g. Spray.Seed®).

Residue burning

The small seeds have a thin seed coat and papery wings, making them very easy to destroy through burning, if sufficient residue is available. Note that the dead tumbleweeds may be a fire hazard if they roll around while burning.

Table 1 Tactics to consider when developing an integrated plan to manage roly poly.

Tactic name	Most likely % control (range)	Comments on use

Knockdown (non-selective) herbicides for fallow and pre-sowing control	80 (30–99)	If possible delay spraying until full emergence and youngest plants have two leaves.
Improving crop competition	-	Optimum sowing rates essential. Row spacing >250mm will reduce crop competitiveness. Early sowing where possible, especially for populations that emerge in May.
Grazing — actively managing weeds in pastures	25 (20–80)	Graze infested areas heavily and continuously during winter and spring.
Burning residue	80 (60–80)	Sufficient crop residues are needed. If the tumbleweeds can move, it may be necessary to crush/roll them prior to burning to ensure adequate fire safety.

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Other useful links

Summer fallow weed management.
https://grdc.com.au/Resources/Publications/2014/05/Summer-fallow-weed-management

GRDC project UA00156

Important disclaimer