Melons

Camel melon
Citrullus lanatus

Prickly paddy melon
Cucumis myriocarpus

Seeding	High, up one hundred per fruit and thosands per plant .
Seed bank life span	Short to medium (two to four years) (anecdotal).
Herbicide Resistance/Tolerance	Some tolerance to herbicides.
Spread	Can be spread by cattle, sheep and birds, machinery and carried in water.

Photo: T. McNee

Camel melon (top) and prickly paddy melon (bottom).

Melons are a summer weed of fallows or pastures that have winter dominant species. Melons germinate in spring or early summer after rainfall. They have the ability to germinate over an extended period particularly if soil disturbance occurs. Growth is rapid in warm temperatures and a deep taproot ensures that plants can tolerate moisture stress that would be fatal to many other species. Melons rarely die without setting seed. Seeds are thought to remain dormant for several years.

Management

Seedling melons are best sprayed before vining. Isolated melon patches can also be chipped out to prevent the spread. Mature fruit should be removed from the paddock. It is important to identify the melon type as some herbicides do not control both types.

Fallows

Some herbicides, especially glyphosate, are only effective on seedlings. Prickly paddy melon is inconsistently controlled by glyphosate even at the seedling stage, although camel melon is susceptible. Large camel melon vines appear to be quite tolerant to glyphosate. Garlon®/ Invader® is used for control of both species. 2,4-D is also used with grazing for reasonable control of small to medium melons.

Multiple applications of herbicide may be required to control repeated germinations of melons. An effective management technique is to spray just after the winter crop harvest rains to catch small seedlings followed by a later fallow spray.

Photo: A. Johnson

Mature prickly paddy melon fruit.

Wideline cultivation is effective on small melon plants before vining. Use a disc plough after plant vining but before fruit formation. Cultivation can encourage subsequent germination of melons and other summer growing weeds. Delaying the first cultivation on fallows and using herbicide means less dusty conditions for spraying and better spray results.

Pasture

Perennial or summer active pastures such as lucerne provide good competition and reduce melon growth.

Melons are potentially toxic. Stock deaths have been reported from eating large amounts of the fruit.

Photo: K. Roberts

Camel melon vine.

Paterson's curse

Echium plantagineum

Seeding	5000 seeds per plant.
Seed bank life span	More than five years in the soil.
Herbicide Resistance/Tolerance	Medium risk of resistance. Resistance has been identified to Group B in Western Australia.
Spread	By seed, in hay or grain, on the coats of animals, in run-off water. Some seeds are still viable after passing through a sheep's digestive tract.

Paterson's curse persists through prolific seeding, with most seed germinating six months after maturity. Most seeds germinate after summer or autumn rain, often earlier than other winter annuals. However, seeds may germinate at any time of year when there is moisture and warm temperatures. Paterson's curse is tolerant to dry conditions after germination. Most plants survive winter as rosettes, produce flowering stems (bolt) in early spring and set seed in late spring. Plants that germinate in summer can set seed by autumn.

Management

Control of seed set will reduce Paterson's curse. Herbicides are most effective on small rosettes (≤10cm) before the plants bolt.

Pastures

Control Paterson's curse in pastures with a combination of selective herbicides in autumn and competitive pastures. Non selective herbicides leave bare ground on which Paterson's curse thrives. Pastures should consist of perennial grasses and clovers or lucerne that use the soil moisture needed by the germinating weed seeds in autumn. Paterson's curse does not thrive in perennial pastures like lucerne.

Photo: J. Edwards

Paterson's curse in flower.

➢ **For spray grazing see page 55.**

Ground cover needs to be maintained to prevent weeds from reinfesting bare patches. Adult, non pregnant, non-lactating merinos or goats are most tolerant to the liver-toxic alkaloids in Paterson's curse. The effect of the toxins are cumulative so do not repeatedly graze. Do not graze horses where Paterson's curse is abundant as a high intake can be fatal. The alkaloid concentration of flowering Paterson's curse is half that of the rosette.

Photo: A. Johnson

Paterson's curse in pasture.

If sheep graze Paterson's curse with mature seed, quarantine the sheep for three days before moving them to a clean paddock.

For isolated plants, chipping or spot spraying prevents the spread to larger areas. When chipping, ensure the growing point and the top 20 to 40 mm of the tap root are removed to prevent regrowth. Burn or destroy flowering plants as the seed may mature even if the plant is dead.

Fallows

Cultivation will usually kill Paterson's curse seedlings that have emerged after late summer or early autumn rain but will encourage other seeds to germinate. If seed is deeply buried (over 7 cm), it is unable to germinate.

Burning can destroy many seeds and stimulate others to germinate. An autumn burn followed by cultivation before sowing the crop reduces the seedbank.

Cropping

Paterson's curse can be controlled pre-sowing usually by non selective pre-emergent herbicides. Residual and selective broadleaf in crop herbicides can be used. Late sowing can benefit where the weed is a problem as less Paterson's curse germinates during the cooler months.

Photo: A. Johnson

Paterson's curse rosette.

Biological control

➢ **See also page 73 for case study on biocontrol of Paterson's curse.**

Biological control is a long term control option that can be used as part of an IWM plan especially for non arable land or reserves. Refuges (non-control areas) must be provided for biocontrol agents to feed on when other controls are being implemented.

Quena

Solanum esuriale

Seeding	Usually 60 berries per plant each containing 20–100 seeds.
Seed bank life span	Unknown.
Herbicide Resistance/Tolerance	None.
Spread	By seed carried by birds, machinery, water, less so from root segments.

Quena is a native species often confused with silverleaf nightshade. Quena is usually short, less robust and has smaller leaves and fewer spines but can be variable in appearance. Quena relies more on seed and less on root fragments for reproduction than silverleaf nightshade. Quena is mostly an annual and sometimes biannual. Small plants will only form a few berries.

Management

Quena and silverleaf nightshade can be found in mixed populations. Quena is generally only a problem when high populations occur. Competitive pastures are the key to managing this weed.

Quena is a little less invasive and is generally easier to control than silverleaf nightshade.

Follow the guidelines for managing silverleaf nightshade on page 32–33.

Photo: S. Johnson

Quena plant with flower.

Saffron Thistle

Carthamus lanatus

Seeding	Thousands of seeds per square metre.
Seed bank life span	3–10 years.
Herbicide Resistance/Tolerance	None known.
Spread	Wind (short distances), water, on the coats of animals, by birds, and in feed grain and crop seed.

While some thistle problems are a sign of low soil phosphorous levels, saffron thistle can grow in all soil types. Saffron thistle seed germinates in spring or autumn after rain. Seed near the soil surface germinates in two to three years, however buried seeds remain viable for up to 10 years.

Management

Control of saffron thistles must involve the reduction of seed set by herbicides and/or cultivation along with competition from crops or pastures to prevent re-establishment. Salvage spraying with paraquat when the thistle is bolting just before flowering will desiccate the developing bud and prevents flowering and seed set.

Saffron thistle problems can flare if management lapses.

Pastures

Competitive pastures will reduce saffron thistle populations. Avoid overgrazing as saffron thistle readily establishes on bare ground. Annual pastures will also generally out compete saffron thistle. Where legumes are present, topdressing with superphosphate can almost eliminate saffron thistle. Without legumes, topdressing is likely to encourage it.

Saffron thistles can be grazed in the early stages. Only goats and horses will remove the thistle heads. Spines cause injury to stock, and make them susceptible to scabby mouth and pink eye.

Chipping or selective spot spraying may be relied on to clean up isolated infestations.

Photo: J.J. Dellow

Saffron thistle in flower.

Photo: A. Johnson

Saffron thistle rosette.

Saffron thistles are best sprayed in either autumn or spring before bolting. Saffron thistles are weakest or most susceptible to control when at early seedling stage to rosette stage (≤15cm diameter).

Germination of saffron thistle is often staggered giving a staggered maturity of plants. Spray topping can substantially reduce seed set but only when there is a uniform maturity.

Slashing is usually only effective in preventing the seeding of saffron thistles and if done when the plants are just starting to flower (10%). Saffron thistle may occasionally reflower after slashing if there is enough moisture and a repeat treatment may be required.

Dense mature infestations can form a physical barrier to stock and prevent grazing over the summer and autumn period. Access lanes to watering points or gateways need to be slashed. Some farmers slash all the saffron thistle which also allows the sheep to eat the seed (anecdotally of high energy).

Cropping

Infestations of saffron thistle in grain crops can cause yield reductions of up to 70%.

A shallow cultivation or knockdown herbicides applied at or immediately prior to sowing the crop will destroy most seedlings.

There are a variety of post-emergent herbicides that provide effective control of rosettes in crop.

Silverleaf nightshade (SLN)

Solanum elaeagnifolium

Seeding	Up to 60 berries per plant each containing 20–100 seeds.
Seed bank life span	Seeds at least 5–10 years in the soil.* Root segments can remain viable for up to 15 months.
Herbicide Resistance/Tolerance	Naturally tolerant of herbicides when mature.
Spread	Seed is spread by birds, stock and in water. All parts of the root are capable of forming shoot buds which can be spread by machinery and stock.

* Up to 80% of fresh seed can germinate immediately under favourable conditions. Research has found that 81% of remaining seed was unviable after three years.

Silverleaf nightshade (SLN) is not native like quena. SLN has been described as an underground tree with the visible plants as the branches.

SLN can regenerate from pieces of root fragment as small as 1 cm. SLN is very drought tolerant as the roots can grow down to three metres. Root fragments form shoot buds that develop into new plants. Seedlings are not very vigorous and are only found occasionally.

Management

SLN is not easily controlled by herbicides. Timing of control is very important to ensure the roots are killed as well as the plant. Monitor known areas and re-treat if necessary. Spot spray small isolated colonies. Do not spray when plants are stressed.

Quarantine

If SLN is only present in some areas, it is vital to quarantine those areas. Preventing the spread of SLN will save years of problems. Quarantine stock before moving them onto a clean paddock if they have been grazing on SLN to allow seed to pass through the digestive system. Clean machinery of plant fragments when moving from infested to clean areas.

Photo: A. Rice

Silverleaf nightshade has an extensive root system which allows it to move across property boundaries.

Photo: J.J. Dellow

Silverleaf nightshade.

Fallow

Spraying is most successful when plants are fresh, at early flowering. At this time, there is usually a net movement of nutrients into the root system and herbicides are more likely to be carried from the leaves into the roots. If the plant is stressed or dormant the herbicides will have little or no effect.

2,4-D destroys above ground growth and immature berries but does not affect the perennial roots which can reshoot. Spraying with glyphosate during berry development when there is fresh growth on the plant will kill some roots. However areas will still require control over several years to achieve eradication.

During the summer months spot spraying with 2,4-D will kill the immature berries.

Cultivation can never be deep enough to reach the bulk of the roots, and is more likely to drag root pieces to clean areas. All parts of the root are capable of forming shoot buds. Under dry conditions, deep ripping may disturb the root system sufficiently to reduce, but not kill, an infestation.

Pastures

Competitive pastures can be a key element in controlling SLN. Lucerne can suppress SLN as it is deep rooted and can dry out the soil profile limiting SLN growth and regeneration. Perennial grasses and 2,4-D can also suppress SLN colonies. When grazing pastures where SLN is present, maintain plant competition to discourage SLN growth.

Livestock (mostly sheep) should not be allowed to graze fruiting plants as about 10% of seed that passes through the digestive tract remains viable. This seed can take up to two weeks to pass through the gut. Spot spray SLN plants in pasture with 2,4-D to kill off the berries before grazing.

Slashing is not an option for managing SLN as it recovers readily, even under dry conditions. SLN can also form berries close to the ground which will escape the slasher.

Cropping

SLN in summer crops can reduce yield by 50%. In winter crops, the yield losses are less obvious as the SLN only competes in late spring. One barley trial (in 1975) found that nine stems/m^2 in summer still reduced barley yield by 12%. SLN seedlings need to be controlled immediately after harvest. SLN is cold sensitive but seedlings growing in stubble are sheltered and can quickly get away.

Rotation of crops is important in the control of SLN. Triazine tolerant canola and sorghum allows the use of atrazine which can suppress SLN. The use of fluroxypyr in summer crops will also provide some control.

Photo: A. Rice

Controlled (left) and uncontrolled (right) SLN.

Case study 2.3 Managing silverleaf nightshade by Annie Johnson and Karen Roberts

Name	Andrew Rice – Farmer and Agricultural Consultant.
Farm	"Hillview" and "Allambie" (1543 ha).
Location	Cookamidgera near Parkes.
Soil type	Sandy loams to sandy clay loam.
Enterprise	Cropping (wheat, barley, triticale, oats, canola and lupins), sheep and cattle. Normal rotation varies according to soil type, weed population and rainfall.

Silverleaf nightshade has been a concern in the Cookamidgera area and on the Rice family property for a long time. They even refer to one paddock as the 'nightshade paddock', which is a constant reminder of the problem.

However the fact that the 'nightshade paddock' does not have nightshade growing in it anymore shows that it is possible to control.

Control on the majority of the Rice's property involves spot spraying new incursions. However on a newly purchased part of the property (111 ha) "the silverleaf nightshade was so thick that you could hardly put your foot down without stepping on it". Getting control of SLN in this block has required some intensive management over the past four years and it is expected that this will have to continue for many years to come. Silverleaf nightshade is a problem due to its tolerance to many herbicides and its ability to regenerate from masses of roots (rhizomes) that often survive in the soil even after the plant is eaten off or damaged by herbicides.

The SLN is mostly managed through a cropping/pasture rotation that usually follows a canola/wheat/wheat/barley (undersown with pasture) sequence which varies depending on rainfall and soil type. The pasture is usually a mix of lucerne (2 kg), phalaris (1 kg) and short season sub clovers (4 kg). The lucerne is an important part of the pasture as it competes vigorously with the SLN during late spring and early summer when the SLN is germinating or regenerating. During the cropping phase, summer fallow spraying is concentrated on patches of SLN to prevent it from setting seed or building up rhizome reserves.

Timing of control

Experience has found that spraying is most successful when plants are fresh at early flowering; plants are aromatic at this stage (previous research by Barney Milne, NSW Agriculture carried out nearby found the same result). Spraying is usually unsuccessful later on as the plants are larger and stressed in the warmer weather. Plants growing in crop tend to get away faster due to the insulated environment of the crop canopy which is warmer than in open pasture. By harvest time the plants are rapidly growing. So Andrew is always prepared to boom/spot spray shortly after harvest.

Photo: A. Rice

Andrew Rice and 3 daughters (from oldest to youngest: Meg, Emma and Kate).

Glyphosate is preferred by Andrew over amine products for spraying. He has found that glyphosate applied under the right conditions kills the plants where as amines give a more variable result knocking the berries and leaves off the plant with the plant later regrowing. The relative prices of the chemical is also an important factor.

Spot spraying

Spot spraying with glyphosate is usually carried out on isolated infestations. Andrew says that working in a grid across the paddock uses the minimum amount of time, fuel and chemical. The biggest input is time. To get a good kill, the coverage of the plant is more important than the dose. High rates are used in the knapsack but it is really important to cover all the leaves and branches.

When SLN is spot sprayed they usually do not see stems regenerate in those spots again. Spraying in following years is generally required for new patches.

Boom spraying

Boom spraying with glyphosate tends to give less consistent results than spot spraying but is more cost effective for larger populations of SLN. Andrew has found the boom spray usually gives a variable result. As a rough 'rule of thumb'; one third of the stems die immediately, one third get sick and eventually die but one third usually survive long enough to return nutrients back into the rhizomes and come again the following year.

Follow up control

Follow up control is usually attempted on plants that survive the first spray. This is usually carried out with glyphosate as part of normal fallow weed control in cropping paddocks. The follow up needs to be done before the SLN plants can put reserves into the rhizomes. It is often difficult to find the right conditions in summer for spraying due to dust and heat. The main aim of the follow up spray is to try and prevent seed set on the remaining parts of the plant. The results from the second application are most often disappointing in terms of plant death (but are no less important) so the first application is the most important in their management.

Grazing management

Stock are not useful for the control of SLN as they eat and spread the seed which remains viable in the gut. The stock are considered to be the main reason for the spread of SLN. Sheep will chew SLN to the ground so Andrew tries to spot spray all the SLN out before letting the stock in. Since total control is impossible, farm hygiene is important. If stock have been in a SLN paddock they are quarantined before moving them to a clean paddock. This is difficult to manage but not impossible as the average paddock size is between 20 to 25 ha which gives them flexibility in grazing management. They therefore have more opportunities to carry out spot spraying and strategic grazing.

New infestations

New infestations usually come from where stock have transported seed. Rhizomes can also move a distance underground from infested areas such as on the roadside.

Problem areas

A winter crop/summer fallow phase was introduced on the new block as part of the strategy to reduce the population density of SLN. The key to this strategy was the use of triazine (Group C) type products with triazine tolerant (TT) canola. They have found that in areas where triazine was applied but no crop sown there was still good suppression of SLN so they are confident that the herbicide is mainly responsible for the suppression of the SLN. The atrazine has been applied in split applications, prior to sowing and another post-sowing pre-emergent herbicide is used to control any wild radish which is also a problem in the Cookamidgera area.

The TT canola was grown in the first year (2002) followed by a wheat crop (2003) then roatation back into TT canola again (2004) followed by wheat (2005) and barley (2006). Sulfonylurea (Group B) herbicides (Glean® or Logran®) are used under the cereal crops to control wild radish, any volunteer TT canola plants and other broadleaf weeds. Andrew also has the option for a late season 2,4-D application for late wild radish germinations or escapes in the cereal crop.

The suppression of the SLN by residual herbicides has prevented further recruitment from seed. However the SLN has some limited regeneration from rhizomes which are then controlled with glyphosate with both boom and spot spraying, depending on the density.

The SLN is the most dense in prior stock camps and old cultivation lines. An important part of managing these dense infestations is the use of summer herbicide fallows, careful grazing of stubbles to prevent seed movement and reduced tillage to prevent any further spread of the SLN.

Future

It is unknown exactly how many years of winter crop/summer fallow will be required to reduce the SLN down to acceptable densities but another four to five years of crop are planned. Given the results so far, despite the difficult seasons, Andrew feels confident that they are on track to achieve this. This is an unusually long cropping period for the property but they do not wish to sow pasture just yet and risk the return of SLN to other areas of the property through sheep grazing the seeds. The area is too large (111 ha) to graze then quarantine the stock. When the SLN is at an acceptable level, it is planned to sow a dense lucerne pasture to provide year round competition for the SLN. It is proposed that Starane® (fluroxypyr) herbicide will be used to prevent seed set of SLN in summer during the pasture phase.

It is not expected that Andrew will be able to eradicate the SLN totally however a little spot spraying each year and vigilance for new incurrsions will keep the SLN under control with no increase in population.

SLN is still expanding in the Parkes area, therefore farm hygiene and council roadside weed control is very important.

Photo: A. Rice

SLN emerging through stubble.

Skeleton weed

Chondrilla juncea

Seeding	Thousands per plant.
Seed bank life span	Less than 1% of seeds survive to the following year.
Herbicide Resistance/Tolerance	Naturally tolerant of many herbicides.
Spread	Seeds can be airborne and spread in hay, grain and machinery. Skeleton weed can also spread by regeneration from root fragments.

Skeleton weed is a perennial weed with an extensive root system. It can germinate all year but autumn germinations are more likely to survive than summer germinations.

Skeleton weed exists as a rosette from autumn to early spring. Although the rosettes may appear small, the taproot can penetrate several metres in suitable soils and the plant may be well established. Skeleton weed produces viable seeds even in the driest summer.

Management

The pasture phase is pivotal in controlling skeleton weed. Control in the cropping phase requires careful choice of in crop herbicides and high rates of knockdown herbicides in fallow. Seedlings less than 12 weeks old may be destroyed by cultivation or herbicide applications.

Control of skeleton weed over a large area is needed to prevent reinfestion by windbourne seeds.

Pastures

Seedlings are sensitive to competition from pasture species that form a dense sward. Competitive subterranean clover and lucerne pastures suppress skeleton weed to suitable levels for crop production. Lucerne is deep rooted and competes with adult plants by drying out the soil profile, reducing the ability of skeleton weed to regenerate from roots and limiting the establishment of seedlings.

Skeleton weed is only mildly palatable to stock. Stock will eat skeleton weed only if few other plants are available.

Cropping

Skeleton weed is a serious weed in crop; it reduces yield and can impede harvesting. There are some pre-emergent, knockdown and residual herbicides available for some rotation crops.

Skeleton weed can be controlled in crop with 2,4-D, Lontrel® or MCPA (Group I) herbicides to destroy rosettes and prevent or delay the formation of shoot growth. The crop can then be harvested without interference from wiry stems, but such spraying usually does not increase crop yield because most of the competitive damage is done in the fallow before the crop is sown.

Photo: J.J. Dellow

Skeleton weed flower.

Fallow

Skeleton weed has the capacity to regenerate from seed and root fragments. Research showed that mature skeleton weed could be cut off one metre under the ground and still regenerate from the root stock.

Cultivation of skeleton weed plants over 12 weeks old will more likely spread the problem rather than control it. Control skeleton weed at the seedling stage when it is most vulnerable. The 2,4-D herbicides kill rosettes and the top few centimetres of root but do not give total control. Glyphosate can move into the root systems and prevent regeneration.

Wild Radish

Raphanus raphanistrum

Seeding	Up to 17 000 seeds square metre.
Seed bank life span	Seven years (up to 20 years anecdotally) .*
Herbicide Resistance/Tolerance	High resistance risk. Resistance has developed to Groups B, C, F and I in some situations.
Spread	In crop and pasture seed, fodder, fertiliser and on machinery. The seed is encased in a capsule of a similar size to a grain of wheat making grading difficult.

* The wild radish seed bank has a half life of two years. Seed dormancy is higher for buried seed. Research has shown only 20–40% of seed remains viable after 12 months. Another trial found that 64% emerged the first year after seed set only 16–0.5%/year emerged in later years. Research has also found that the early germinating wild radish plants produce the seeds with the greatest dormancy.

Management

Wild radish usually germinates in winter but it has the ability to germinate at any time of the year. This germination pattern makes it difficult to control by any single method. Wild radish also has a high herbicide resistance potential. Crop, pasture and herbicide rotation is vital for preventing resistance.

The length of the seed bank life makes it important to control wild radish for many years. If control practices are relaxed when numbers are low, wild radish can quickly re-establish in high numbers.

Cropping

Wild radish is very competitive in crops (Table 2.7). Continous cropping favours wild radish. Cereals have the most control options available in crop. Wild radish is difficult to control in conventional canola and pulses. If only isolated plants are present they can be easily spotted above the canopy and controlled prior to seed set.

If larger populations are present cultivate prior to sowing and use residual herbicides. A knockdown herbicide is effective against early seedlings before sowing.

Wild radish infested paddock.

Photo: J.J. Dellow

Wild radish flower.

There are a range of herbicides that can be used as pre-emergent, early or late post-emergent options. Use a follow up control to prevent escapes setting seed.

Fallow

Wild radish is favoured by conventional cultivation. Stubble retention systems leave seed on the surface where the loss of viability is fastest. However an autumn cultivation can be used to deplete the seed bank.

A long fallow can be used to reduce the seed bank and to allow different herbicide modes of action or cultivation to be used.

Pasture

A competitive pasture phase is effective in suppressing wild radish. If the seed bank is high at the start of a pasture phase the seed bank may still be significant after six years.

There are a range of herbicide controls for different pasture types, especially for seedling pastures. Mature plants may also be controlled by spot spraying.

Table 2.7 Yield reductions from wild radish in crops.

Wild radish in wheat at Trundle 1981		Wild radish in canola at Cowra 1996	
Egret Wheat	Yield t/ha	Karoo Canola	Yield t/ha
Nil treatment	0.54	Nil treatment	0.34
Treated	1.71	Treated	2.47

Source: Milne, 1981, 1996.

*Case study 2.4 Brassicas in the NSW cropping belt. By Jim Dellow, Warren King, Surrey Jacobs and David Kemp**

Brassicaceae weeds deplete soil nutrients (particularly nitrogen) and soil moisture, impacting production of pastures and following crops.

In spring 2004, a survey of the cropping zone of New South Wales found 12 species of Brassicaceae weeds (mustard family) (Table 2.8).

The survey found that brassica weeds are generally well managed in the cropping and fallow phase. Brassica weeds were far more common in the pastures, particularly in the western areas which indicate that brassica management in pastures could be improved.

Table 2.8 Most common occurring Brassicaceae weeds in the NSW cropping belt.

Common name	Botanical name	Site frequency %
Turnip weed	*Rapistrum rugosum*	18.0
Shepherd's purse	*Capsella bursa-pastoris*	3.0
Indian hedge mustard	*Sisymbrium orientale*	2.8
Pepper cress	*Lepidium africanum*	1.7
Hedge mustard	*Sisymbrium officinale*	0.8
London rocket	*Sisymbrium irio*	0.8
Pepper cress	*Lepidium bonariense*	0.7
Wild radish	*Raphanus raphanistrum*	0.3
Smooth mustard	*Sisymbrium erysimoides*	0.3
Canola	*Brassica x napus*	0.2
Charlock	*Sinapis arvensis*	0.2
Wild turnip	*Brassica tournefortii*	0.1

Turnip weed dominates the landscape of large areas of the northern cropping belt every spring. The survey results suggest a link between turnip weed and soil texture. Turnip weed is mostly limited to heavy clay soils and is particularly abundant in the north west.

Cropping

The crops surveyed included wheat, barley, oats, canola, lupins and faba beans. The three most common species found in crops were; turnip weed, Indian hedge mustard and wild radish.

Turnip weed and most other Brassicaceae species (including volunteer canola) are easy to control in winter cereal crops. The two Brassicaceae weeds that are the greatest threat to winter crops are wild radish and charlock. These two weeds have not reached their full potential range and have proven difficult, competitive and expensive weeds to control.

Wild radish is a major weed in the southern wheat belt and to a lesser extent in the central zone. The survey also identified some isolated stands of both wild radish and charlock in the north west.

Resistance to four herbicide groups has been detected in Western Australia where wild radish resistance is now widespread.

Pastures

Brassica weeds compete with the more desirable pasture species reducing the pastures potential. Where turnip weed occurred in pasture paddocks it averaged 33% of the total dry matter production. On one pasture site in the north west it produced 76% of the total dry matter production (8 t/ha).

Of the 1520 sites surveyed, brassica weeds were present in 26% of the sites (Table 2.9). The dominant Brassicaceae weeds in the pastures were turnip weed, shepherd's purse and Indian hedge mustard. Shepherd's purse was mostly found in pasture lucerne paddocks.

Table 2.9 Frequency of plant types in the pastures.

Type	Site frequency %
Brassicaceae weeds (total)	26
Annual grasses	39
Perennial grasses	16
Legumes – annual	29
Broadleaf weeds – annual	35

Photo: J.J. Dellow

Turnip weed.

* Jim Dellow and Warren King, (NSW DPI, Orange) Surrey Jacobs, (National Herbarium, Sydney) and David Kemp (Charles Sturt University, Orange).

Wild Oats

Avena fatua and ***Avena ludoviciana***

Seeding	Up to 20 000 seeds per square metre.
Seed bank life span	One to three years.*
Herbicide Resistance/Tolerance	High resistance potential. Resistance has developed to Group A and B in some situations.
Spread	Spread in hay and feed grain, crop and pasture seed and on machinery. Also spread on the coats of stock.

* Seeds have a seedbank half life of six months or less. Dormancy is thought to be related to temperature and soil type. Sandier soils and cooler temperatures can have a higher rate of emergence and greater seed bank decline than heavy soils. Anecdotal evidence suggests that buried wild oats can remain viable for up to 10 years. Seed mostly grows where it is falls, resulting in discrete populations.

Wild oats has an extended germination period. The timing can fluctuate each season depending on temperature and moisture. Up to 40% of new seed germinates at the start of the growing season and 10–30% germinates later in the season. This depends on depth of seed burial.

The protracted emergence habit of wild oats and its ability to mature rapidly and shed seed early make it difficult to totally prevent seed set in winter crops.

Management

Management should aim to conserve crop yield and to minimise wild oat seed production. Controlling wild oats with herbicides alone intensifies the selection pressure for herbicide resistance; an IWM plan is needed.

Cropping

Continuous cropping favour wild oats. It has been known to reduce grain yields by up to 80%. Yield losses are highest when there is a low wheat density and a high weed population. Ensure that crops are competitive and use multiple tools to reduce wild oat populations.

Photo: A. Johnson

Wild oats in head.

Photo: K. Roberts

Flowering wild oats.

Knockdown herbicides prior to planting give the crop an early advantage. Early control is important as wild oats are most competitive in the early stages of the crop. There are a range of post-emergent in crop herbicides that can be used (Table 2.10).

Sowing paddocks with the worst infestations last may be of some benefit but has less of an impact than for other weeds like annual ryegrass.

Selective spray topping has no benefits for preserving yield but gives a level of control over seed set. Spray topping should be done when plants begin elongating but prior to head emergence. It is most effective when populations do not exceed 50 plants/m^2.

Cutting crops for hay or silage or green manuring crops is ideal for preventing seed production especially if resistance is confirmed. This must occur prior to seed shedding.

In most years seed capture at harvest is ineffective as seed is shed prior to harvest.

Rotation to summer crops such as grain sorghum allows the use of atrazine to be used in rotation and a reduction in wild oat populations.

Table 2.10 Herbicide groups that can be used for controlling wild oats (always read the label).

Control measures	Modes of action available	Example products
Knockdown herbicide	Group M Group L	glyphosate paraquat, paraquat and diquat (e.g. Spray.Seed®)
Residuals	Group B Group C Group D Group E	imazapic+imazapyr (OnDuty®) imazethapyr (Spinnaker®) simazine, atrazine, diuron trifluralin tri-allate (Avadex XTRA®)
In crop herbicides	Group A Group K	various for use in cereals and in broadleaf crops Mataven L®
Pastures	Group K Group L	propyzamide (Kerb®) in lucerne paraquat (Gramoxone®) in lucerne

Farm hygiene

Use clean crop and pasture seed. Clean down harvest machinery. If feasible, work the paddocks from the cleanest to dirtiest. Avoid contaminating clean areas when feeding grain or hay.

Where wild oats is widespread farm hygiene may not seem important. Where herbicide resistance is a risk preventing the spread from one paddock to the next is critical (Case study 7.1 page 78).

Fallow

A long fallow is ideal for depleting wild oat seeds from the seed bank and also to rotate herbicides used to control wild oats.

Cultivation increases wild oat germination. Cultivation followed by a knockdown herbicide is used to deplete the seed bank.

Burning stubble can destroy seed on the soil surface. A hot burn is required for maximum kill. Burning can stimulate emergence by breaking the dormancy of seeds.

Pasture

The pasture phase is an ideal opportunity to reduce the wild oat seed bank and delay herbicide resistance. The timing of grazing pastures is critical if the aim is to prevent the seed set of wild oats.

Farmer experience has shown that sheep will eat wild oat seed directly off the plant (especially when the seed is at the soft dough stage).

Spray topping, winter cleaning and producing hay or silage are all tools for managing wild oats in pastures.

Pasture and fallow rotations can be crititcal for reducing wild oats populations in the cropping phase.

Photo: S. Johnson

Wild oats in wheat.

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For information on weeds identification see the following book available from the NS W DPI.

Broadleaf weed seedlings of temperate crops and patures.

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Photo: K. Roberts

Saffron thistle.