

## Weed spread prevention: simple activities for field operations

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**Summary** In the absence of precautions, field staff and researchers can inadvertently become vectors of weed spread. This paper discusses how spread of weeds can be minimised via an improved knowledge of the weeds ecology and their dispersal, combined with improved knowledge of surveillance techniques and treatment methods. Undertaking simple prevention activities reduces the risk of spreading weeds, with minimal costs to projects.

**Keywords** Clean-down, *Chromolaena odorata*, containment.

### INTRODUCTION

Weeds cost Australian agricultural industries approximately 4 billion dollars annually (Sinden *et al.* 2004). The importance of weed spread prevention has increased significantly over the last few years, as evidenced by the number of national, state and local strategies addressing the issue (Barker 2005a). A key element of the National Weeds Strategy is prevention of further spread. Weed spread prevention has also been incorporated into state legislation and procedures (Barker 2005b). One of the primary goals of the Queensland Weed Spread Prevention Strategy is to incorporate policies and actions to prevent weed spread into the work practices of industries and organisations. Guidelines for the construction of wash-down facilities, check-lists for clean-down procedures and a list of wash-down locations within Queensland are tools to assist with the management of weed spread (NRW 2007). The Far North Queensland Code of Practice – Disaster Management Weed Spread contains strategies to be implemented at the initiation of emergency response operations and includes clean-down facilities at critical containment zone boundaries.

Weed spread management is a critical component of the national cost-shared Siam Weed Eradication and Four Tropical Weeds Eradication Programs, which are currently focused on the wet and dry tropics of the north east coast of Queensland. Eradication could not be attained by these programs if control operations caused the species to spread to new locations. Containment is one of the key indicators of an eradication

programs progress (Panetta 2007). Although containment is difficult to measure directly, this paper outlines practical measures to assist with the containment of infestations once control and monitoring activities commence.

**Ecology of plants** Weeds targeted for management and/or research can include an array of plant forms and dispersal methods. Pest management plans must consider the biology and ecology such as flowering time, of each species. Aerial and extended on-ground survey for *Chromolaena odorata* L. (Asteraceae) is conducted during peak flowering as this is when this species is most detectable. Surveillance and monitoring needs to be scheduled to ensure no plants reach maturity, thereby preventing reproduction and achieving containment. The production of fresh seeds adds to the seed bank, prolongs eradication and increases the risk of spread via natural processes or via staff activities (e.g. seeds adhering to clothing).

**Mechanisms of spread** Efficient dispersal methods are common attributes of invasive species. Efficient dispersal enables rapid population development and spread across a landscape. It is essential that researchers and field-based pest management officers understand all possible dispersal mechanisms so that appropriate weed spread prevention activities can be incorporated into management plans. The seeds of *C. odorata* are readily dispersed by vehicles, machinery, people, wind, water and animals. The seed's pappus facilitates wind-dispersal and, when moist, adheres to people undertaking control activities, especially in the wet tropics. Tiny barbs on the shaft of the pappus enable seeds to get caught in clothing and equipment such as hydration packs. *C. odorata* can also reproduce and spread vegetatively. Its stems break easily and can become lodged in the undercarriage of vehicles, or be carried by floodwater. Care must be taken to prevent any stems from touching the ground following hand removal; otherwise they can take root and re-grow. This can be achieved by tying plant material onto nearby vegetation.

**Dispersal buffers** Following the discovery of a new infestation, the extent of the infestation needs to be delineated by surveys (e.g. aerial, vehicle and foot). Treatment and surveillance activities should commence in the areas of lowest weed density or the outer edge of the infestation area and work towards areas of highest density. This ensures that common pathways are used when staff exit the core of the infestation and these pathways can be regularly monitored.

**Simple weed spread prevention activities** Human-assisted weed spread has been highlighted by Barker (2005a). On-ground weed control staff tend to have a higher level of exposure to the seeds of invasive plants compared with the general public and tend to travel across large areas of land (Moerkerk 2006). This poses a high risk of spreading weeds. To ensure containment is achieved and eradication remains a potential outcome, practices in the following four categories have been adopted by the National Siam Weed Eradication Program and Four Tropical Weeds Eradication Program: (1) Exclude unnecessary movement through an infestation (2) Adopt strict hygiene protocols to minimise contamination of vehicles (3) Rationalise and maintain clean equipment and (4) Ensure field operators maintain high levels of weed hygiene practices.

(1) *Exclusion* Avoiding movement of people within weed infested areas is a highly desirable management technique for minimising weed spread. Weed Spread Prevention Implementing measures to deter entry and identifying who is required to enter an infestation area minimises the number of potential vectors. This can be achieved in several ways. Potential intrusion by animals and people can be minimised by the erection of fencing. Signage that highlights the presence of a weed can be used to reduce entry by contractors, slasher drivers and utility personnel. Grazing animals being taken out of an infested area should be spelled in a holding yard or paddock for a period of five days to allow any seeds to be dislodged from the animal or pass through the digestive tract. Bunding can also be constructed to contain reproductive material within an infestation area, where there is the risk that seeds will be spread by flood-water.

(2) *Vehicle hygiene* Roadsides are being increasingly recognised as habitats suitable for weed establishment and are conduits for dispersal vectors. For this reason, vehicles are the focal point of any weed spread prevention activity. Limiting the number of vehicles that enter an infested area and

utilising the same vehicles each time minimises the number of potential vectors and decreases the time required for clean-down activities. If a vehicle cannot avoid entering an infested area, steps can be taken to minimise contamination. People need to be advised of flowering and seeding cycles, pathways for access and clean-down procedures and locations. This advice should be included in contract agreements and formal pest management plans. The vehicle can be fitted with 'self-cleaning' tyres (alternating lugs) to reduce the volume of soil carried. Temporary shade-cloth slings or fine mesh screens can be fitted across the front of the vehicle extending down to the chassis to block entry of seeds into the radiator and vehicle cavities. This fixture can be easily removed and replaced in the field in circumstances where contamination has occurred. Small cavities under wheel guards, on the chassis and tray can be blocked with silicone to eliminate the harbourage of soil and contaminants. Unnecessary fixtures on vehicles, such as number plate surrounds and tow-balls, should be removed to minimise areas that can trap soil and contaminants. Equipment on utility trays or trailers such as motorised spray units should be mounted on blocks or frames to allow access underneath to conduct clean-downs. Vehicles can be fitted with aluminium trays to minimise harbourage areas. When travelling through infested areas the air-conditioner can be operated on recirculation to minimise the draw of air and the risk of small weed seeds entering the engine bay.

There is evidence that most weed seeds on a vehicle are actually inside the vehicle's cabin (Moerkerk 2006). Lipped rubber mats can contain the movement of contaminants on the floor of the vehicle. Windows should be wound up to avoid entry of seeds into the cab.

Vehicles and equipment should be cleaned down at the perimeter of the infested area at a common, easily monitored and signed location, away from roads and waterways. Clean-down activities can be carried out using portable, motorised spray units or a banister brush in dry conditions. Physical removal, 12 volt air compressors and vacuums can also be used in situations where the water supply is limited. Attention should be paid to areas such as the winch, bull bar, tyres, springs, wheel arches and mud-guards and underneath the chassis. It is recommended that further cleaning at constructed wash-down facilities is conducted between shire boundaries to minimise the spread of weeds at a regional scale.

- (3) *Equipment hygiene* Hand tools, spray-packs, back-packs and hydration packs can have areas of potential weed seed harbourage. The number of these items taken into an infestation should be kept to a minimum. Items such as cameras, PDAs and binoculars can be carried in one pack rather than in belt-mounted pouches. Packs should have a minimal number of pockets and fabric that does not attract seeds, such as 'Velcro' and webbing. All equipment should be thoroughly cleaned prior to leaving a high density area and again at the designated clean-down point on the perimeter of an infestation. Clean-down locations should be signed and monitored to prevent seeding events. Heavy duty plastic bags can be carried for the collection and containment of plant product or contaminated clothing such as overalls.
- (4) *Personnel hygiene* When undertaking survey and treatment operations, people can not be excluded from infestations. When developing a field operational plan, appropriate clothing for weed spread prevention should be considered along with workplace health and safety requirements. Where there is no danger of heat exhaustion, overalls or disposable full body suits can be worn inside the infestation zone and removed and bagged prior to leaving. It is important that clothing material such as open weave fabrics and 'Velcro' fasteners are free of seed. Clothing items with a minimal number of pockets is preferable. Ankle skirts/gaiters can be worn to reduce the amount of seed being trapped by laces and eyelets on footwear. As well as being 'sun smart', hats should be worn to keep seeds out of hair. Long hair should be braided. Facial hair should also be checked for seeds. All items carried on a person are potential carriers of seed and other vegetative material and require thorough checking. A team approach is required when checking clothing, hair and packs. Particular attention needs to be paid to footwear. Treating boots with a chlorine solution, applied via a small spray bottle, should be considered in environmentally sensitive areas to minimise the movement of soil borne pathogens. All personnel should take part in clean-down activities after completing operations in seeded areas and again prior to leaving the infestation at the signed clean-down point. A designated clean-down point should be monitored for weeds on subsequent visits.

## CONCLUSION

Low-cost measures can be implemented to mitigate of the spread of weed propagules. As with other compulsory workplace health and safety practices, weed spread prevention is an activity that must be considered before undertaking treatment, surveillance or research within infested areas. Although these processes have been developed for eradication programs, the simple weed spread prevention activities outlined in this paper can be readily implemented to prevent weed spread when managing any weed infestation

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