final report

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Industry Evaluation and use of the Buffalo Fly Tunnel Trap

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Contents

1 Abstract

A simple non-chemical method for managing buffalo fly was evaluated on commercial properties throughout coastal and sub-coastal Queensland.

The buffalo fly tunnel trap was generally accepted as an effective fly control option especially in more intensively managed systems and from the sector of industry that is concerned with or opposed to insecticide use. The impediments to wide-scale adoption of this technology include the need to control stock movement (such as at a controlled watering points) and the cost of placing a unit at all such places on a commercial property.

The buffalo fly tunnel trap is a useful control option in an integrated approach to buffalo fly management.

2 Executive summary

The buffalo fly (*Haematobia irritans exigua)* is recognised as a serious ectoparasite of beef cattle in northern Australia costing the Australian beef industry an estimated $20-30 million per year. The impacts of buffalo flies on the beef industry include production losses, increased production costs, animal welfare issues, hide damage and chemical residue risks associated with inappropriate parasiticide use (non-adherence to withholding periods and export slaughter intervals).

There is increased market pressure on producers to use non-insecticidal management strategies for the range of parasites affecting beef cattle. A previous project (TR.062) developed and evaluated the buffalo fly tunnel trap. It is a simple non-insecticidal method for managing buffalo flies. The trap is a closed in “tunnel” (approximately 2400 mm X 1800 mm X 800 mm) with 200 mm wide windows on either side (approximately 700 mm from the ground). Attached to both sides of the tunnel (over each window) is a fly proof cage with a simple baffle system. The trap works on changes in light intensity at the tunnel entrance to remove flies from animal as they pass through the tunnel. The flies tend to follow their host into the tunnel where they are attracted to the light coming through the side windows. Once the flies pass through these windows they tend to work their way to the top of the cages through a baffle where they become trapped. As the flies are unable to return to their host, they die within several hours.

This research and development project, demonstrated that fly populations could be reduced by 60% – 80% using a tunnel trapping system and recommended that the tunnel trap be further evaluated on commercial properties in a range of production environments. It recommended that a strategy be developed to facilitate the adoption of the tunnel trap by beef producers.

The objectives of this project were to evaluate the buffalo fly tunnel trap in a range of commercial beef enterprises, to promote the development of management systems using this trap, to investigate commercialisation prospects and to conduct a general extension and awareness campaign.

Five primary evaluation sites were set up throughout coastal and sub-coastal Queensland in the first year. Each site contained a group of animals using the trap and a control group with no buffalo fly treatment. Fly numbers on animals were monitored throughout the season. The trap was shown to reduce fly numbers by 40%–75%. This figure was slightly lower than the reduction demonstrated in the development work (60%-80%) and could be due in part, to less rigorous evaluation procedures associated with difficulties in developing matched paired sites on commercial properties.

In the second year of the project additional “satellite” sites were established to increase industry exposure to the technology. Fly numbers were only casually monitored on these sites as there were no control groups of animals used.

A range of construction techniques and materials for the tunnel trap was evaluated. Critical factors include general construction principles and screen materials used to cover the fly cages. A range of screen materials was evaluated for fly escape under controlled conditions, and for durability in the field.

The extension and awareness campaign was based on field day activities at the primary and secondary sites, displays at agricultural field days and shows, media coverage (print media, local radio and television coverage) and on published materials. A DPI Note, assembly instructions and plans of the buffalo fly tunnel trap are available through the DPI&F call centre, DPI&F offices and DPI&F Internet site (www.dpi.qld.gov.au).

Beef producers generally accepted the trap as a fly control option. Interest was strongest from producers operating intensively managed systems and from the sector of industry that is concerned with or opposed to insecticide use. The need to control stock movement (such as at controlled watering points) and the cost of placing a unit at all such places on a commercial property were recognised as impediments to wide-scale adoption of this technology.

It is believed that adoption would be highest in enterprises where cattle movement was regulated for management purposes (such as self mustering systems or intensive grazing systems) and in enterprises that actively avoid the use of insecticides (such as for marketing purposes). Adoption on a partial basis within an enterprise was also considered feasible.

The buffalo fly tunnel trap is a useful control option in an integrated approach to buffalo fly management.

3 Main report

3.1 Background

The buffalo fly (*Haematobia irritans exigua)* is recognised as a serious ectoparasite of beef cattle in Northern Australia (summary of producer surveys in Buffalo Fly Technical manual 1995). Buffalo fly cost the Australian beef industry an estimated $20-30 million per year (MLA recommendations for integrated Buffalo fly control). The impacts buffalo fly have on the beef industry include:

- production losses due to fly worry;
- increased production costs (especially parasiticides and increased husbandry);
- animal welfare issues;
- hide damage; and
- chemical residue risks associated with inappropriate parasiticide use (non-adherence to WHP's and ESI's).

There is increasing market pressure on producers to use non-insecticidal management strategies for the range of parasites affecting beef cattle. MLA have recognised this need through funding a previous project "Non-insecticidal control of buffalo flies using behaviour modifying systems" (TR.062). This project demonstrated that fly populations could be reduced by 60%–80% using a tunnel trapping system and recommended that that the tunnel trap be further evaluated on commercial properties in a range of production environments. It also concluded that a strategy be developed to facilitate the adoption of the tunnel trap by beef producers.

3.2 Project objectives

By June 2003:

- Demonstrate that the buffalo fly tunnel trap reduces buffalo fly numbers on cattle by more than 70% over the full fly season.
- Develop specifications for the buffalo fly tunnel trap to allow commercialisation.
- Have at least three commercial companies aware of the buffalo fly tunnel specifications, mode of action and likely market size.
- Have at least 75% of collaborators agree that the buffalo fly tunnel trap is a cost effective way to control buffalo fly.

By June 2004:

- Refine the design and construction of the buffalo fly tunnel and redraft specifications in line with producer requirements.

3.3 Methodology

3.3.1 Buffalo fly tunnel

The buffalo fly tunnel prototype is constructed of relatively cheap materials and is simple in its mode of action. The tunnel is a covered race-like structure (2.4 m x 1.8 m x 0.8 m; LxHxW). On each side of the tunnel is a 20 cm wide window about 0.7 m from the ground which extends for the majority of the tunnel's length. A pair of fly screen covered cages are attached to the exterior of the tunnel over the windows with fly proof seals.

The tunnel trap operation is simple. Cattle pass through the tunnel daily to access water or a supplement. The change in natural light at the entrance of the tunnel causes the buffalo flies to lift off the animal. The flies then follow the animal into the tunnel. Once in the tunnel they are

attracted to the light coming through the windows. Having escaped the tunnel through the window, the flies are caught in the cages. A baffle prevents them from returning to the tunnel.

3.3.2 Evaluation sites

There were five primary evaluation sites throughout coastal and sub-coastal Queensland. These sites were located at:

- Charters Towers
- Mackay
- Calliope
- Lowmead
- Widgee.

Justification for this number of sites and their location includes:

- The need to account for different beef production systems.
- Buffalo fly is most serious in coastal and sub-coastal districts.
- A previous project evaluating dung beetles had established effective producer networks in these areas.

3.3.3 Producer groups

Local producer groups oversaw the management of the evaluation sites and provided input into tunnel trap modifications. The development of the groups was based on client contacts from the Dung Beetle Project or on existing Beefplan groups. DPI&F coordinators facilitated the formation of the groups at the start of the project with potential field sites being nominated by the group. These producer groups formed the core of the extension component of the project.

3.3.4 Extension

In the first year, extension activities focused at the district level. The main activities were field days at the evaluation sites. These days were used to survey producers on the potential of the tunnel and to collate feedback on possible design, construction and implementation modifications.

The second phase of the extension component of the project was to promote the tunnel system to the broader industry.

Evaluation site coordinators from DPI&F had a key role in each aspect of the project, including:

- Facilitating the formation and operation of the producer groups.
- Evaluating the appropriateness of potential sites.
- Monitoring fly numbers (field counts using binoculars).
- Conducting a range of extension activities to facilitate industry adoption of the tunnel trap.

4 Results and Discussion

4.1 Demonstration sites

4.1.1 Far north Queensland

2003 season
The Charters Towers site was completed by the end of March 2003. The co-operator at this site 'Lakeview Station', Balfes Creek, also has an engineering firm and constructed the trap.

Continuing drought conditions resulted in the paddock being severely destocked (from 250 head to 50). A watering point was fenced and the trap installed. There was little trouble in educating cattle to use the trap.

Generally fly numbers were very low and provided no reliable data on the trap's effectiveness. Flies were found in the cages, demonstrating that although fly numbers were very low, the trap was working.

2004 season
For the second year in a row, dry conditions prevailed at the Charter Towers' site for much of the fly season. Dung beetles were active following the sporadic rainfall events and may have kept fly numbers lower than what is usually the case in the district.

The fly counts for the 2004 season are presented below. The fly count data suggested variable results of between 35% and 77% reduction in buffalo fly numbers. On one occasion fly numbers on the trap group were 30% higher than on the control group. Contributing factors for the variable results include:

- Ineffective buffer strips (probably fly movement between the treatment and control groups).
- Stock movements as part of standard husbandry practices on the property.
- Stock not using the trap at times when surface water was available.
- Possible problems in counting technique.
- Damage to cages allowing flies to escape (particularly during the period when fly numbers were 30% higher).

There was significant ant activity at this site. Trapped buffalo flies were removed by ants within 20 minutes of a mob passing through the trap.

The co-operator at this site acknowledged that the trap seemed to work, but has reservations as to the buffalo fly trap providing a cost effective means of buffalo fly control. The main cited drawbacks include the cost, lack of application to areas where cattle have unregulated access to water and the effect of fly reinfestation from adjoining, untreated paddocks.

4.1.2 North Queensland

The Mackay site at Ray and Shirley Watt's property, Kuttabul, was completed by the end of March 2003. The trap was set up on a supplementary feeding station. Fly counts showed a 56–63% reduction in fly numbers (see fly count data below). Fly numbers were moderately high at the start of the evaluation period but fell from early April.

Possible reasons why reductions in fly burdens at this site were lower than the earlier evaluation work include:

- Fly escape when fly population was moderately high (construction fault that was corrected)
- Mixed herd with large size variation in animals
- Apparent lack of light contrast (curtains were attached to the each end of the tunnel)

- Trap too close to the feeding station allowing rapid reinfestation of cattle (the trap was later moved further away from the supplementary feeding point).
- Difficulty in finding paired (evaluation and control) sites for a commercial demonstration.

Once the trap was moved further from the feeding point, efficacy improved to 63% reduction in fly numbers.

2004 season
Curtains installed at either end of the tunnel proved ineffective due to problems associated with wind.

Due to a continuous number of cloudy wet days the trap was generally ineffective. On one occasion (3/2/04) an opportunity presented when fly could be counted prior to cattle moving through and again immediately after passing through the trap. Fly numbers were reduced by 24% (one-off fly reduction count, not included in fly count data presented below).

With the continuous wet weather a deep pad was worn through the trap and may have added to apparent lack of light contrast. The trap was relocated to a stony ridge in a lane way. A single curtain was hung from the roof in the centre of the tunnel. Later two rubber wings were located on either side of the trap, midway along the tunnel. The aim was to disturb the flies on all animals that ranged in size from calves to mature bull.

By late April the showery weather had cleared and warm sunny days predominated. At the final count on 23/4/04 the cattle using the trap had 56% fewer flies than the control group.

4.1.3 Central Queensland

The Rockhampton site was set up by the end of March 2003. The trap was set up on a watering point and there was some difficulty in training the animals to use the trap. This was overcome by using Copra meal as an inducement. Fly numbers on the trap group fell from about 250 to 50 flies per side over three weeks (see fly count data below).

The co-operating owner of the control group of animals felt it necessary to treat his cattle with insecticidal ear tags. This action prevented us from obtaining a percent control for the trap tunnel. The ear tags immediately reduced the fly numbers from 150 to 50 flies per side. Thus, the control of buffalo fly was roughly the same for both the tunnel trap and the tags, even though the trap took longer to achieve the reduction.

Although fly numbers were low, casual inspection during June and July, showed flies being caught in the traps. This may have impacted on fly numbers surviving the winter and may have helped reduce build up of numbers when the season broke in early December.

4.1.4 South east Queensland

In southeast Queensland there were two primary sites; one at Lowmead (north of Bundaberg); the second at Widgee (west of Gympie).

2003 season at Lowmead
The Lowmead site, on the Baffle Creek flood plain, was completed by the end of February 2003. As there was considerable surface water at this site, the trap was set up between two paddocks; one on the creek flat and the other on a ridge above the creek flat. The trap group had the run of the two paddocks and tended to graze the creek flat during daylight hours and move onto the higher country during the evening. Throughout the evaluation period the trap consistently

achieved 51 to 75% reduction in buffalo fly numbers with one exception (9/4/2003 36%; see fly count data below).

The trap at this site was initially demonstrated to producers in December 2002 when the Miriam Vale Rural Science and Landcare group held their annual field day on the co-operators property. This group has been kept informed of the projects progress at five general meetings since the commencement of the project.

2004 season at Lowmead
Initial fly counts during December 2003 indicated that the fly counts for the trap group were lower at the start of the season than for the control group. Due to the co-operator's partnership dissolving, the trial paddocks were unavailable during the first three months of 2004 and no fly counts were conducted. The trap was again used from March 2004 with the co-operator indicating that similar results to 2003 were achieved.

The co-operator was happy with the trap and believes it is a suitable control strategy for buffalo fly in his operation. He has indicated he will build several additional units for other mobs on his property.

2003 season at Widgee
Fly counts at the Gympie site commenced in mid February 2003 with the trap being installed by early March. Fly numbers were lower in the trap group than the control group prior to the trap installation and this difference (in percent) remained relatively constant during the trial. Field inspection of the trap throughout the period of data collection clearly showed that the trap was removing significant numbers of buffalo flies.

This trap was set up in a gateway between a small watering paddock and a dry paddock. Initially the animals were uncomfortable using the trap and tended to pass through rapidly. This had the potential to damage the trap and also may had had a negative impact on the number of flies the trap was removing. Within a few weeks the cattle had become familiar with the trap.

It was also noticed at this site that ants were very active in removing trapped flies. The problem with small flies escaping through the fly screen was also apparent (see modifications below).

A Gympie District Beef Liaison Group field day was held at this site in May 2003 and was attended by 120 beef producers.

2004 season at Widgee
The Widgee demonstration site was not actively monitored during the 2004 season, as it was reported to be working satisfactorily. Instead, the extension effort in the Gympie region was concentrated on providing extension support to graziers interested in either purchasing or building their own, traps, providing design support to commercial fabricators, and working with other SEQ Industry groups to establish satellite demonstration sites.

4.2 Satellite sites

4.2.1 Far north Queensland

A second site was established on a grazing property at Mena Creek near Innisfail. The trap, built by the Charters Towers engineering firm, was constructed of materials deemed to be more appropriate to the humid, high rainfall area. Sheet metal was used for the tunnel sides and roof and the cages were covered with galvanised mesh. The effectiveness of these materials is discussed in the section on trap modifications.

At this site cattle entered and exited via the trap into a yard where they often camped. Fly counts were recorded for this mob and a control group (see page 22 for graph). At first, the trap was ineffective at this site compared with other sites. Using a molasses based supplement to encourage animals to use the trap several times a day rectified the problem. Once cattle were regularly using the trap it appeared to work very effectively.

Some of the possible causes for poor initial efficacy include:
- the yard entrance becoming a quagmire during very wet weather
- prolonged overcast conditions possibly reducing light contrast
- high gloss paint on the tunnel interior possibly also reducing light contrast
- difficulty in counting fly numbers in the control group (possibly leading to underestimation of numbers).

A dairy farmer at Malanda on the Atherton Tablelands built a modified trap using the base plans. The trap was erected at the exit end of an existing spray race. This farmer had some queries as to the apparent poor efficacy of the trap and contacted the North Queensland extension officer. This officer visited the site to investigate and make recommendations.

The tunnel was constructed of flexible polythene sheeting over a metal frame. The cages were not securely attached to the tunnel sides and buckling of the poly sheeting allowed flies to escape through gaps between the cages and the tunnel side. The poly sheeting itself had a high gloss finish, which may have reduced light contrast in the tunnel. The cages were not adequately protected and screens were frequently damage by horns.

The position of the tunnel on the exit end of an existing covered spray race may also have negatively impacted on fly behaviour and reduced the trap's efficacy.

4.2.2 Central Queensland

A trap was installed on a property operated by the Emerald Agricultural College. The trap was set up on a fenced watering point in a breeder mob paddock. Cattle readily used the trap, and there have been no problems with use. As this was not a paired site there was no fly count data recorded. The co-operator was happy with the trap, and although fly numbers have remained low, flies were regularly observed in the cages.

College staff members have indicated they intend to incorporate the trap into their curriculum with students building a trap as part of their Ag engineering studies.

4.2.3 South-east Queensland

Several satellite sites were established in southeast Queensland. None were paired sites so no data was recorded.

The Monto Landcare group built a trap and installed it at the Monto State High School. A field Landcare group meeting and day was held in February 2004. The agricultural and manual arts teacher incorporated the trap into both the Ag Studies subject and the Manual Arts subject. Fly numbers were relatively high in the Monto district during February and March but numbers remained low on the cattle using the trap. The local Landcare group was satisfied with the efficacy of the trap. Flies were obviously being caught.

A trap was installed on a property at Mulgildie in January 2004. At this site flies were observed escaping through the standard size fly screen, supporting observations from several primary sites the year before. The problem was corrected by replacing the standard screen mesh with the finer midge mesh. Due to location issues, cattle didn't use the trap for several weeks between

March and April. At this time fly numbers increased. After cattle were shifted back into the paddock with the trap, fly numbers dropped. As this was not a site with a control group, it is difficult to determine the impact of the trap on fly numbers. The co-operator was satisfied with the efficacy of the trap. Flies were visible in the cages after cattle used the trap to access water.

A third site with two traps was established near Kingaroy in early 2004 in conjunction with the South Burnett BeefPlan Group. The first trap was constructed as a permanent fixture in a laneway system leading to water. The second trap was a portable unit able to be moved with paddock rotations. A field day was held at the site on 20 March 2004, and was attended by about 20 beef producers. The operator was satisfied the trap provided an effective means for reducing fly numbers.

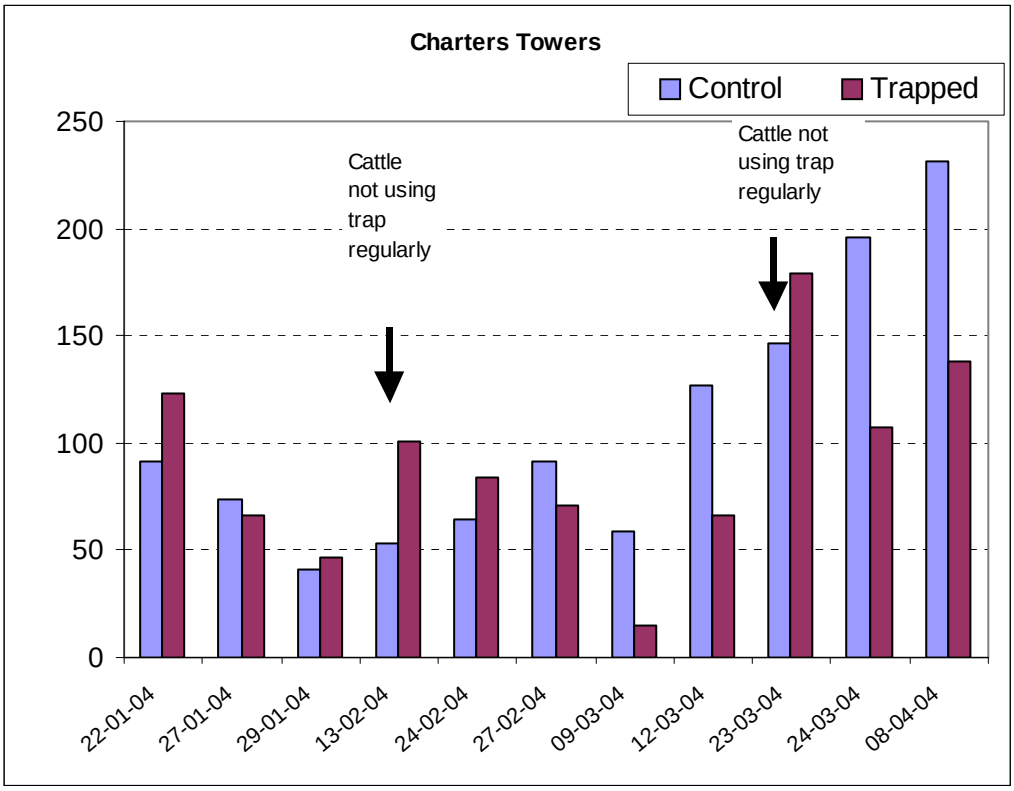
Two additional satellite sites in the Upper Brisbane Valley (Kilcoy and Esk) are currently in the process being established in conjunction with the Brisbane Valley AgForce Group.

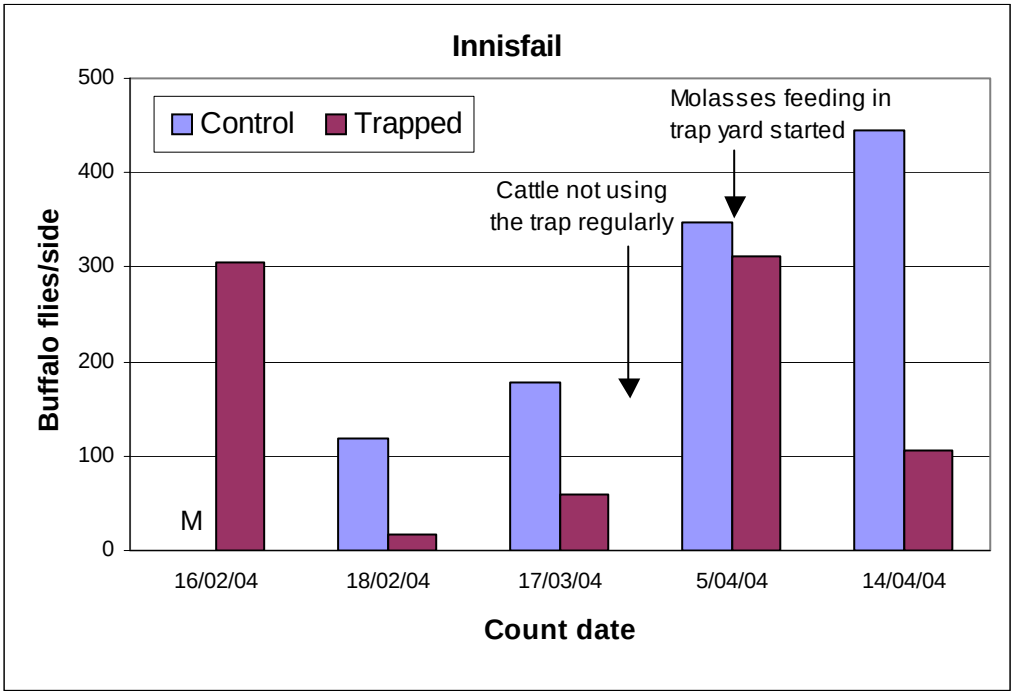
4.3 Fly count data

Buffalo fly tunnel trap – performance evaluation (fly counts) summary

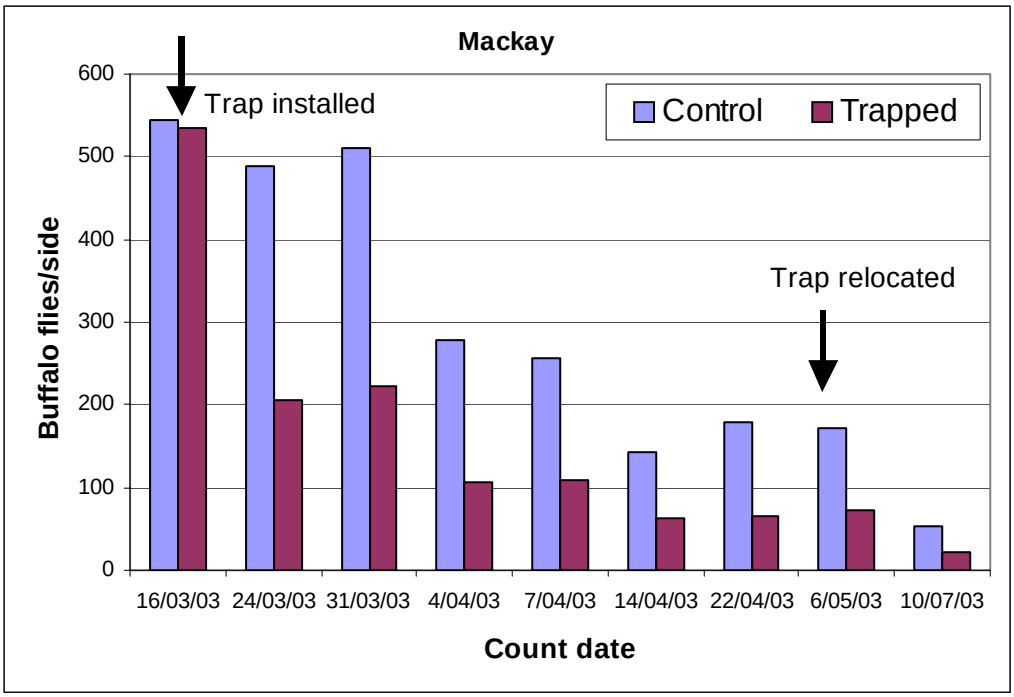
Location	Site	Date	Control (reduction in fly burden) %	Comments
FNQ	Innisfail (Spurwood)	Feb to April 2004	67-85% (n=3); 11% (n=1)	No fly counts on control prior to installation of tunnel; low control (11%) after cattle were not using the trap.
	Charters Towers (Lakeview)	Jan to April 2004	No reduction during late Jan/Feb; 35-77% (n=4); -30% (n=1) Mar/April	Fly counts during January/February equal on both groups except on one occasion (trap group 2x control) when cattle were not regularly using trap; -30% value occurred when there was a hole in fly cage; it looks as trapped group would have higher fly count if trap not present?
NQ	Mackay	Mar to July 2003	56-63% (n=8)	Identical fly counts on both groups prior to tunnel installation; consistent reduction during trial with moderate/high to low fly burdens (seasonal reduction from April onwards).
CQ	Rockhampton (Calliope)	Mar to April 2003	N/A	Ear tags applied to control group at same time as tunnel installed; tags reduced fly population immediately from 150 to 50 flies per side (no fly counts in control group at end of March/April); tunnel reduced burden more slowly, reaching 50 flies per side after 3 weeks.
	Rockhampton (Calliope)	Nov 2003 to May 2004	-173-98% (n=3)	Control group was cell grazing; data variability very high; only 3 comparative counts; -173% when too wet for trap use; performance can't be determined from available data.
SEQ	Bundaberg (Lowmead)	March to April 2003	36-75% (n=6)	Control >50% except one occasion (36%); equal fly burden on control and tunnel groups prior to tunnel installation.
	Gympie	Feb to May 2003	40-60%	Difference in fly burden between control and tunnel group was the same before (n=2) and after (n=7) tunnel installation; observed control cannot be attributed to tunnel.

Far north Queensland

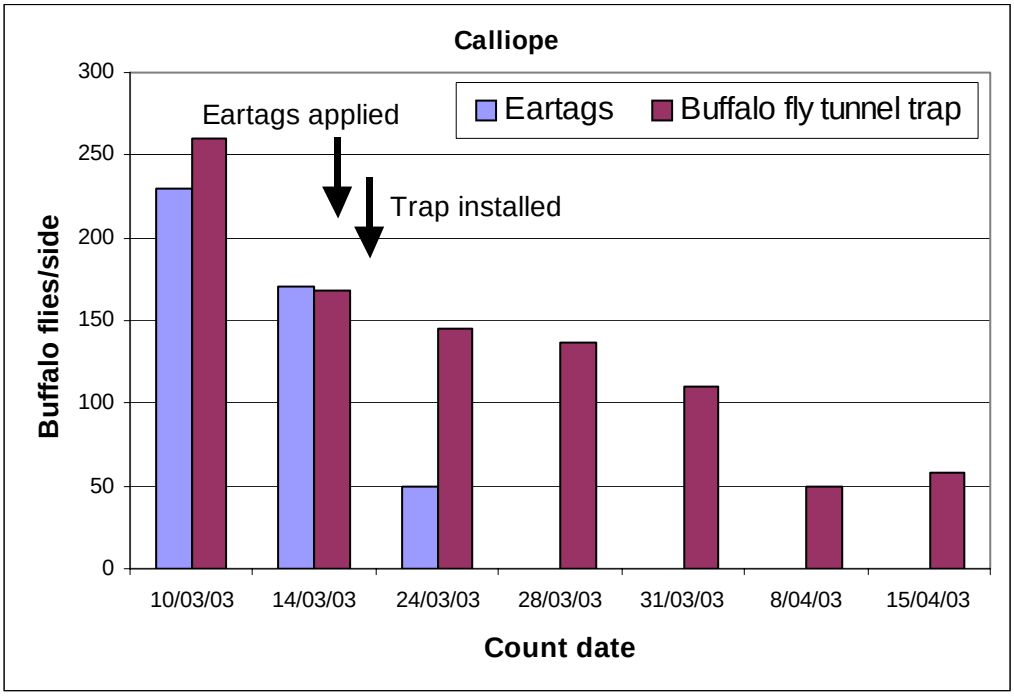




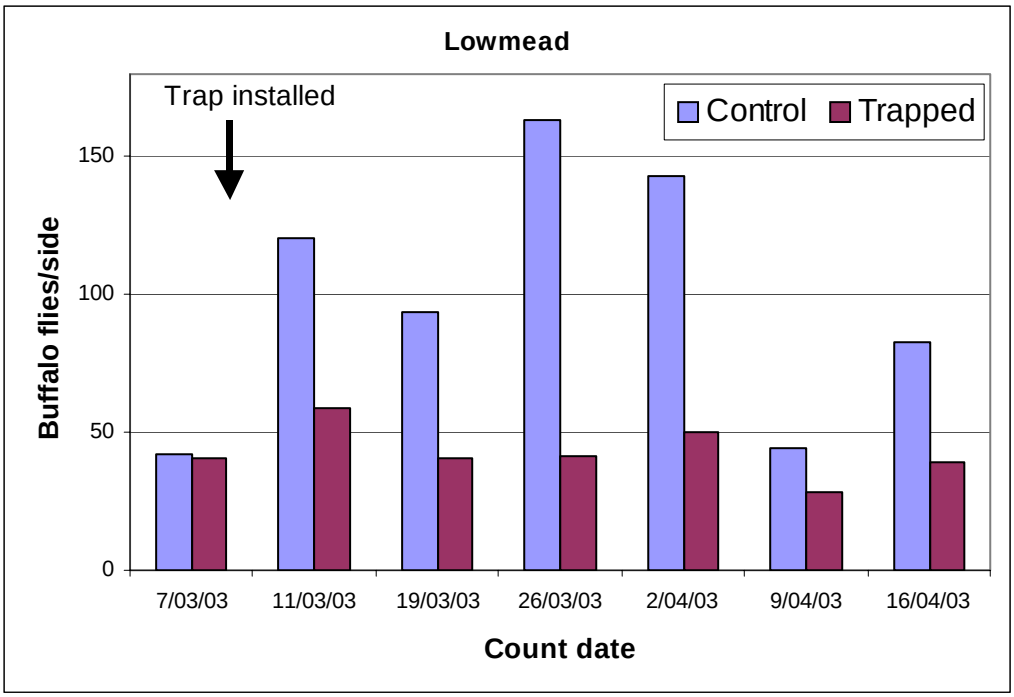
North Queensland

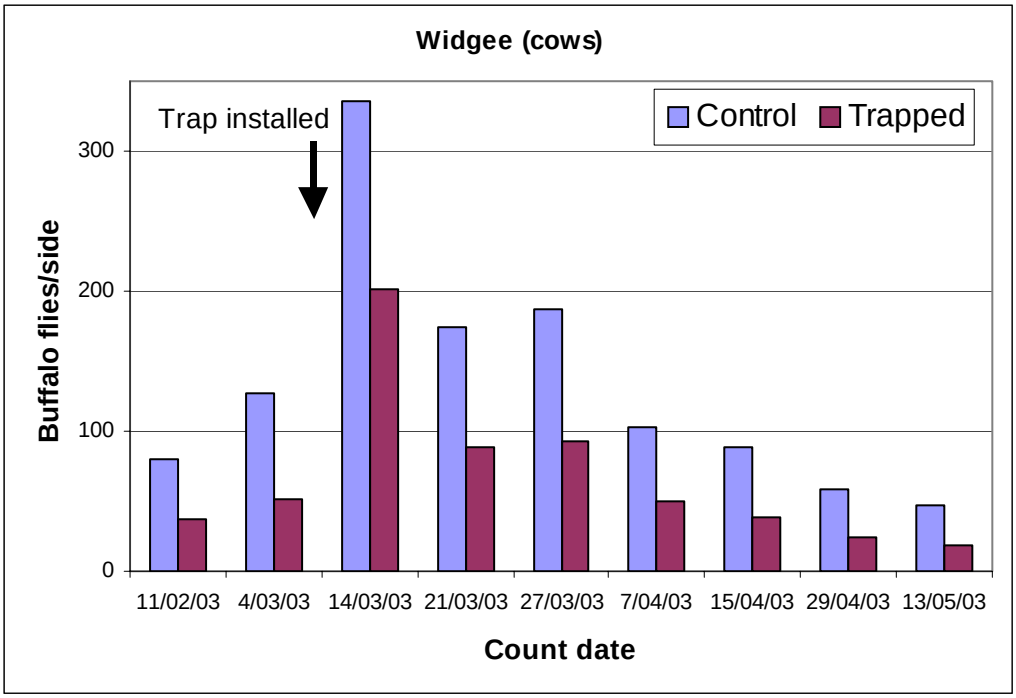


Central Queensland



South-east Queensland





4.4 Trap modifications

4.4.1 Design

4.4.1.1 Tunnel design and dimensions

Several of the engineering firms made minor modifications to the basic design. These modifications were primarily about improving production efficiency and include:

- Longer end braces to improve stability
- Side windows 100 mm lower so that the seam of one full 2400 X 1200 mm ply sheet and one half sheet (2400 x 600 mm) is reinforced by the lower RHS bar of the window.
- A cambered roof (sheet metal construction) to better shed water.
- A permanent fixed trap constructed of round timber and plywood.

4.4.1.2 Cage design and dimensions

The earlier cage size was 650 mm high, 300 mm wide and 2000 mm long. This required a mesh width of 1250 mm to wrap around the whole cage. Standard width of mesh is 1220 mm. Therefore the cage dimensions have been modified to make cage 600 mm high, 300 mm wide and 2000 mm long to fit standard width mesh.

4.4.1.3 Baffle design and dimensions

A rigid baffle (instead of hinged) can be better fixed inside the cage.

4.4.2 Materials

4.4.2.1 Fly screen

In the first season it became apparent at several sites that smaller flies were able to escape through the standard aluminium fly screen. The majority of fly escaping did so at the upper and outer corners of the cage. The size of the adult buffalo fly is determined by the size of the larvae/pupae which is dependent on the available nutrition in the dung. The problem of fly escape was not observed or encountered in the development work, probably because colony flies of uniform size were used and the early evaluation sites were on relatively fertile country at a time when cattle nutrition was good.

The main suggestion to improve retention of small flies is to use a finer weave mesh. The results of an evaluation of alternative materials are discussed below.

Alternative mesh materials

Screen type	Aperture mm^2	Wire diameter mm	% Open	Mesh	Cost (1220 mm wide) $/lineal m	Cost $/tunnel	Approx weight kg/cage
Aluminium fly wire, powder coated	1.78	0.26	70	18 x 14	14	73	0.6
Cyclone MINIweave (PVC coated fibreglass)	0.74	0.26	58	18 x 30	14	73	0.5
Woven wire, galvanised	0.81	0.37	50	20	40	206	4.7
Woven wire, stainless steel (Type 304)	0.81	0.37	50	20	62	320	4.3
Bolting cloth, stainless steel (Type 316)	0.90	0.20	68	22	73	380	~2.5

Other Options			% Open (over top half)		Cost (1220mm wide)	Cost $/tunnel	Approx weight kg/cage
Aluminium fly wire with double layer over top half of cage			45-70			110	0.9
Aluminium fly wire with additional MINIweave layer over top half of cage			31-58			110	0.8
Aluminium fly wire on bottom half, woven galvanised wire on top half of cage			50			140	2.6
Aluminium fly wire on bottom half, woven stainless steel on top half of cage			50			198	2.4
Aluminium fly wire on bottom half, stainless steel bolting cloth on top half of cage			68			227	~1.6

% Open – a range is given when two layers overlap;approx weight is for 1220 mm wide x 2600 mm long; Cost: Aluminium and MINIweave prices ex Bunnings Warehouse; Stainless and galvanised mesh prices ex Metal Mesh Pty Ltd.

Results of controlled study of fly escape through alternative mesh material
Following the observation of buffalo flies escaping through normal fly mesh a controlled study with buffalo flies contained in a cylinder screened with different materials was conducted. The number and percent of flies that were able to escape through the screens were determined. The results are presented in the following tables.

Test 1 – flies counted after 2 days

Mesh	**# Flies in cylinder**	**# Flies escaped**	**% Escaped**
Fibreglass fly wire, powder coated	115	2	1.74
Aluminium fly wire, powder coated	181	5	2.76
Woven wire, galvanised	169	0	0
Bolting cloth, stainless steel	100	0	0

Fly pupal weight = 3.3 mg

Test 2 – flies counted after 4 days

Mesh	**# Flies in cylinder**	**# Flies escaped**	**% Escaped**
Fibreglass fly wire, powder coated	348	0	0
Aluminium fly wire, powder coated	367	1	0.27
Woven wire, galvanised	265	0	0
Bolting cloth, stainless steel	241	0	0

Fly pupal weight = 3.0 mg

Buffalo flies of average size from the DPI&F colony were generally not able to escape through any of these screens Some flies were observed pushing their heads through the fibreglass mesh and many flies managed to push their heads and two legs through the aluminium mesh, but they were not able to put heads through the galvanised and stainless meshes. The escape observed in field trials could be due to smaller size or different behaviour of wild flies.

In the field they fibreglass mesh is not very robust and subject to damage by cattle and birds. The galvanised woven wire was evaluated in the field at the Innisfail site (under humid tropical conditions) and rusted out within several weeks. In these situations the other types of mesh are recommended.

The co-operator at the Lowmead site came up with another solution to minimise fly escape from the cages. Based on a simple set of baffles (made from used 2 L plastic drink bottles) attached to the outer corners of the cages (see appendix).

We recommend that beef producers do not use the standard poly or aluminium mesh on the upper surface of the cages due to fly escape problems. We recommend the miniweave (midge) poly mesh or the stainless steel mesh. The galvanised mesh is not recommended due to rust problems especially in humid and high rainfall areas.

4.4.3 Tunnel materials

Various fabricators and individual landholders have trialled a range of tunnel materials. Generally, the tunnel frames are constructed of RHS steel (20 mm or 25 mm). Cladding material options include:

- sheet metal
- form ply (12–16 mm)
- marine ply (16–20 mm)
- polythene sheeting (6 mm)
- used belt line rubber.

The more durable materials such as sheet metal, marine ply and poly sheeting, tend to increase the cost of units, but increase field life and decrease repair and maintenance costs. Where heavier cladding material is used the tunnel frame can be constructed of lighter (and cheaper) materials.

Where flexible materials such as poly sheeting and beltline rubber are used, care must be taken to ensure cages are adequately fixed with and gaps between the cage and sheeting eliminated.

The design of the trap is such that a range of these materials can be used. Generally, the heavier and more durable the materials, the higher the cost of the unit. Where traps are manufactured on farm, operators can use materials on hand. The critical success factors for construction include the need to have cages without gaps, a tight seal where the cages attach to the tunnel side and no gaps along the top edge of the tunnel where the sides meet the roof.

4.5 Pre-fabricated cages

The Gympie traps were constructed by an aluminium screen manufacturer. These cages are constructed out of commercial fly screen materials (mesh, framing, rubber beading etc. such as used in screen door manufacture) and results in easier cage maintenance and replacement of damaged screen panels.

The cages have a clear perspex panel fixed at both ends to reduce construction costs and improve light penetration. This also improves the rigidity of the cages and gives a firmer seal against the side of the tunnel.

The finer ‘midge mesh’ is used on the top and outer panel to prevent fly escape. Standard fly mesh is used on the bottom panel and on the internal baffle, to maximise light penetration.

The baffles in these units are rigid and fixed in place prior to the cages being attached to the tunnel. The cages have removable side panels (such as for commercial window screens) that facilitate cage cleaning and maintenance. In the field evaluations, ants tended to remove dead flies thereby eliminating the need to manually clean the cages.

These pre-fabricated cages are a useful option for producers. During the construction process of the standard trap, the construction of the cages is the most time consuming and difficult component of the option. The pre-fabricated cages provide a cost effective alternative for beef producers. These cages are professionally finished and can be easily attached to a home manufactured tunnel.

4.6 Other modifications

Several co-operators have included slight modifications such as:

- lugs welded to tunnel frame for attaching portable yard panels
- removable axels and tow hitches
- sling eyes attached to tunnel top
- convex tunnel roof to effectively shed rainfall.

These modifications have no impact on the trap's efficacy, but improve its applicability to different property situations.

4.7 Commercial companies constructing traps

Local engineering firms at each of the primary demonstration sites were approached to build traps. These firms followed the basic design and incorporated various modifications in materials and construction techniques. A list of these companies is attached as Appendix 1 Section 8.1. Some of the modifications are discussed above under trap modifications.

4.8 Buffalo fly management in production systems

4.8.1 Extension materials

4.8.1.1 DPI Note

A DPI note was prepared in early 2003. It describes the principles behind the operation of the trap, lists common/suggested building materials, highlights how the trap can be incorporated into existing cattle management systems and it contains links to the construction plans. A copy of the DPI Note is attached as Appendix 2 Section 8.2.1.

The DPI Note is currently being re-written. To better incorporate findings from the project, there will be a series of three DPI&F Notes. The first will provide an overview of how the trap operates and a summary of trial results. The second will detail construction principles, discuss options and alternatives and list manufactures. The third DPI&F Note will describe how the trap can be incorporated into cattle management systems and its application in integrated buffalo fly control.

4.8.1.2 Plans

The plans for trap construction were developed early in 2003 and have been available as an addendum to the DPI Note. Minor amendments will be made to the plans to accompany the revised DPI&F Notes. A copy of the plans is attached as Appendix 2 Section 8.2.2.

4.8.1.3 Visual displays

A set of posters was prepared for incorporation into static displays for agricultural field days and stakeholder forums and meetings. These are attached as Appendix 2 Section 8.4.

4.8.1.4 Distribution

The DPI Note and plans have been the primary extension materials for the project. The DPI Note has been available through the DPI&F Call Centre, on the DPI&F Internet site (www.dpi.qld.gov.au) and at regional DPI&F centres. A summary of the number of hits on the

DPI&F buffalo fly tunnel trap web page and the number of downloaded plans since November 2003 is attached in Appendix 2 Section 8.3.

The buffalo fly tunnel trap web pages are popular and constitute a significant proportion of the amount of material being down loaded from the DPI&F web site.

4.8.2 Extension activities

4.8.2.1 Site field days

Field days were held at each of the primary evaluation sites and most of the satellite sites during 2003–2004. These field days were attended by producers from the local area. An example flier promoting a field day is attached in Appendix 2 Section 8.2.3.

4.8.2.2 Agricultural field days/shows

Some of the field days and shows where the trap was presented to the general public included:

- NQ field days (Townsville) 2004
- AgGrow (Emerald) 2003
- Agrotrend (Bundaberg) 2004
- Brian Pastures research station 50th anniversary open day
- Brisbane Exhibition 2004
- Hughenden Show (31/5/2003)
- Swans Lagoon Field day for NQBRC (16/6/2003)
- Binkar (Pentland) Field day (9/9/2003)
- Aramac Field day (10/9/2003)
- Jericho Field day (11/9/2003)
- Swans Lagoon Field day for Beef Plan leaders (15/10/2003)
- NQ Beef Research Committee meeting (Wambiana) 7/2/2003)
- Upper Cape Landcare group (Pentland) - trap displayed (15/7/2003)
- Dalrymple Landcare group (Belyando) - trap displayed (22/8/2003)
- Three Rivers Landcare group (Greenvale) - trap displayed (24/8/2003)
- Hughenden Agforce meeting - trap displayed (4/9/2003)
- 2004 Queensland Landcare Conference, Gympie.

4.8.2.3 Beef 2003

Beef 2003 was the premier Australian beef cattle event during the period of the project. The trap was on display in the Queensland Government pavilion and was one of the popular attractions. During the course of the three-day event some 750 DPI notes and plans were distributed to interested producers. During this time media coverage culminated in an ABC TV Stateline report.

4.8.2.4 Media releases and newsletter articles

FNQ site was visited by the NQ Register rural newspaper on the 1st of May 2003 and discussed the trap with the station owner, and an article was published.

NQ site featured in an article in the Queensland Country Life (5/6/03 – page 33).

CQ site featured in an ABC TV Stateline report in early May. A field day was also held at this site in June with about 20 interested landholders attending. A field day was also held in conjunction with Agforce at the Emerald Agricultural College trap site.

Courier Mail, 16/8/2004 (Graeme Elphinstone).

Australian Organic Journal, Winter 2003, Issue 54, p 23.

5 Success in achieving objectives

5.1 2003 Objectives

5.1.1 Objective 1 Demonstrate that the buffalo fly tunnel trap reduces buffalo fly numbers on cattle by more than 70% over the full fly season.

The fly count data from the field evaluation sites suggest that a 75% reduction is about the maximum that producers can expect. In most sites the reduction varied between 40% and 75%. These levels were slightly lower (60 – 80% reduction) than obtained in the original evaluation work. As these later evaluation sites were on commercial properties, there were some limitations to the matching of paired sites. Nevertheless, the efficacy of the traps approached that of the earlier work. Teething problems with commercially produced tunnel traps also reduced the extent of fly control.

In most situations fly number were significantly reduced to below 50 flies a side. Previous investigations have nominated the level at which fly burdens represent an economic loss at somewhere between 50 and 100 flies a side. Field observations indicated animals using the trap suffered far less fly worry than animals in the control groups.

5.1.2 Objective 2 Develop specifications for the buffalo fly tunnel trap to allow commercialisation.

A set of plans and a DPI Note explaining the manufacture of the trap were developed. A range of construction materials was evaluated. Both private operators and commercial companies used slight variations in materials and construction techniques according to local availability and cost of materials, existing manufacture processes and personal preference. Provided the basic principles of the trap design were adhered to, there appeared to be little functional difference between traps. Some differences in cost and durability were noted.

5.1.3 Objective 3 Have at least three commercial companies aware of the buffalo fly tunnel specifications, mode of action and likely market size.

Five commercial fabrication companies (listed in the appendix) have built traps, both for the purposes of the project and for general sale to beef producers. These companies have customised the buffalo fly traps to suit their manufacturing processes and material supplies. This customisation is primary related to type of materials but also includes minor construction variations. The critical construction areas of general tunnel size, effective attachment of cages and the elimination of gaps at the interface of the tunnel sides and the roof and the tunnel sides and the cages, have been adhered to. The buffalo fly tunnel traps are now being supplied on an ongoing basis by these manufacturers.

5.1.4 Objective 4 Have at least 75% of collaborators agree that the buffalo fly tunnel trap is a cost effective way to control buffalo fly

With the exception of one primary site collaborator (out of a total of 5 primary site collaborators and 6 secondary site collaborators; 91%), our collaborators agreed that the buffalo fly tunnel trap provides an alternative to chemical control of buffalo fly. While there was genuine concern regarding the cost of the fly trap on extensive properties with uncontrolled watering points, most of our collaborators indicated that they would expand the use of these units on their properties.

5.2 2004 Objectives

5.2.1 Objective 1 Refine the design and construction of the buffalo fly tunnel and redraft specifications in line with producer requirements.

A range of fly screen materials was evaluated for fly escape problems, reduced light transmission and durability. This information will be included in revised versions of the DPI Note. The experiences of collaborators will also be included in such revised versions.

We recommend that beef producers do not use the standard fibreglass or aluminium fly wire on the upper surface of the cages due to fly escape problems. We recommend the miniweave (midge) coated fibreglass or the stainless steel bolting cloth. The galvanised woven wire is not recommended due to rust problems especially in humid and high rainfall areas.

6 Impact on Meat and Livestock industry

The problems associated with buffalo fly and traditional methods of managing them fall into three broad areas:

- production losses and animal welfare issues associated with fly worry
- cost of insecticide treatments and risks of insecticide resistant strains of buffalo fly
- potential meat quality issues associated with non-adherence to withholding period (WHP) and export slaughter interval (ESI).

In situations where the buffalo fly tunnel trap can be incorporated into existing management systems, it provides an additional tool for integrated fly control. As such it can address each of the three issue areas listed above.

For production systems that actively avoid the use of chemical inputs (e.g. Organic Production and Environmental Management Systems), the buffalo fly trap constitutes an effective fly control measure.

7 Conclusions and recommendations

The buffalo fly tunnel trap was generally accepted as a useful tool for buffalo fly control. There was strong interest from the grazing community, especially in more intensively managed systems and from the sector of the industry which is concerned with or opposed to insecticide use.

The impediments to wide-scale adoption of this technology include the need to control stock movement (such as at a controlled watering points) and the cost of placing a unit at all such places on a commercial property.

It is believed that adoption will be highest in those enterprises where cattle movement is regulated for management purposes (such as self mustering systems or intensive grazing systems) and for enterprises that actively avoid the use of chemical (such as for marketing purposes).

Adoption on a partial basis within an enterprise is also considered feasible. An example of this is a breeding and finishing operation where the producer is reluctant to muster and treat sale cattle simply for fly control and is concerned with parasiticide withholding periods.

The buffalo fly tunnel trap is a useful control option in an integrated approach to buffalo fly management.

8 Appendices

8.1 Appendix 1. Commercial companies

Towers Engineering
48 Deane Street
Charters Towers Qld 4820

Connors Welding Works
Gracemere Qld 4702

Hans Welding Works
17 Enterprise Street
Bundaberg Qld 4671

Brian Heck Aluminium & Glass
Southside Industrial Park
Gympie Qld 4570

Kilcoy Welding Works
4 Mary Street
Kilcoy Qld 4515

8.2 Appendix 2. Extension Materials

8.2.1 DPI Note

Queensland Government
Department of Primary Industries

DPI Notes

Buffalo fly tunnel trap – construction plans

Officers of the Queensland Beef Industry Institute

Front and side views of Buffalo fly tunnel trap

Buffalo fly cause a chronic loss of production in beef herds in coastal and sub-coastal northern Australia. The majority of the production loss is because of reduced grazing time due to fly worry. Buffalo fly costs the Australian beef industry at least $20 - 30M each year (up to $30 per head) in lost production and treatment costs.

There is increased marketing pressure on producers to implement non-insecticidal management strategies for the range of parasites affecting beef cattle. A recent project jointly funded by DPI and MLA has demonstrated that fly populations could be reduced by 60% to 80% using a simple tunnel trapping system.

The trap is a short tunnel through which cattle have to pass regularly. This may be a controlled watering point or feed station for beef cattle, or perhaps a laneway or yards leading up to the milking shed for dairy cattle.

The flies leave the cattle in response to the change in light intensity at the tunnel entrance, and are subsequently caught in cages attached to the sides of the tunnel. The trap is simple to build and since there are no obstructions in the tunnel, training of cattle is relatively easy.

Trap construction details

- Overall size is 2400mm x 1800mm x 800 mm (LxHxW inside measurements).
- It is a demountable steel frame constructed of 25mm RHS.
- The tunnel sides are covered with 12mm plywood panels; the roof is covered with 7mm plywood.
- The sides are set on a base/footing and the roof has 20mm RHS or 15mm pipe pegs that slide into the top of the side frames (ensure there is no gap for light to enter the top of the tunnel).
- The plywood and frame are painted matt black (to reduce light in the tunnel).
- A window (1900mm x 200mm) is cut into each of the side panels (700-900mm from ground).

- Fly trap cages are attached to the side panels, to completely cover the windows. This attachment needs to be fly proof.

Cage general construction

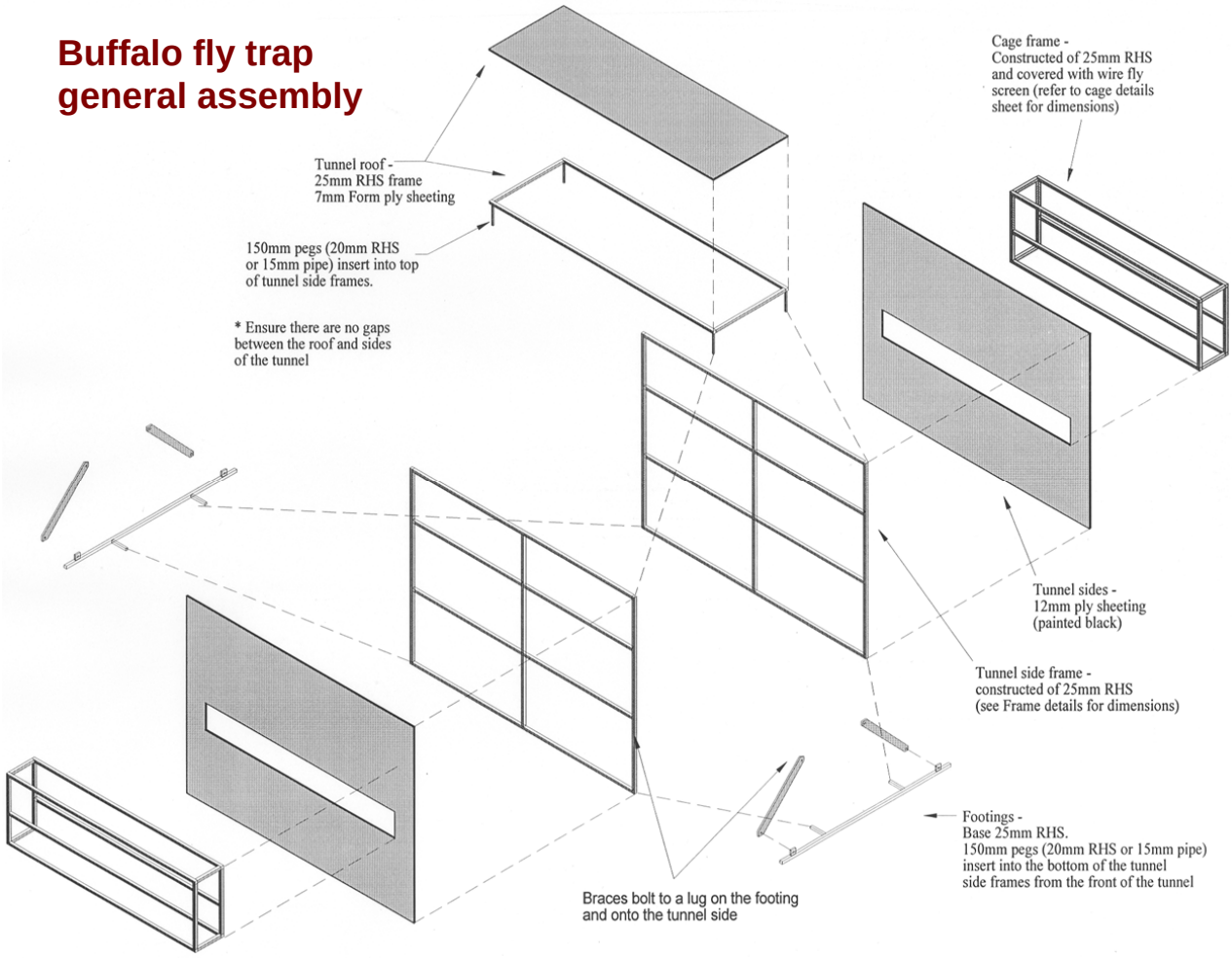
- The cages can be constructed of 25mm aluminium or steel RHS.
- The frame is 2000mm x 650mm x 300mm (LxHxW outside measurements) and is covered with wire fly screen (except the panel facing the tunnel).
- The cage should be tightly sealed except for the opening that fits over the tunnel side windows.
- Door sealing strips or silicon sealant should be used between the tunnel side panels and the cage to eliminate any gaps.
- The cage is attached to the tunnel with bolts or screws through the horizontal RHS frame bars.
- A funnel shaped baffle (with a 20 - 40 mm gap at the top) is used to trap the flies in the upper section of the cage.

The baffle

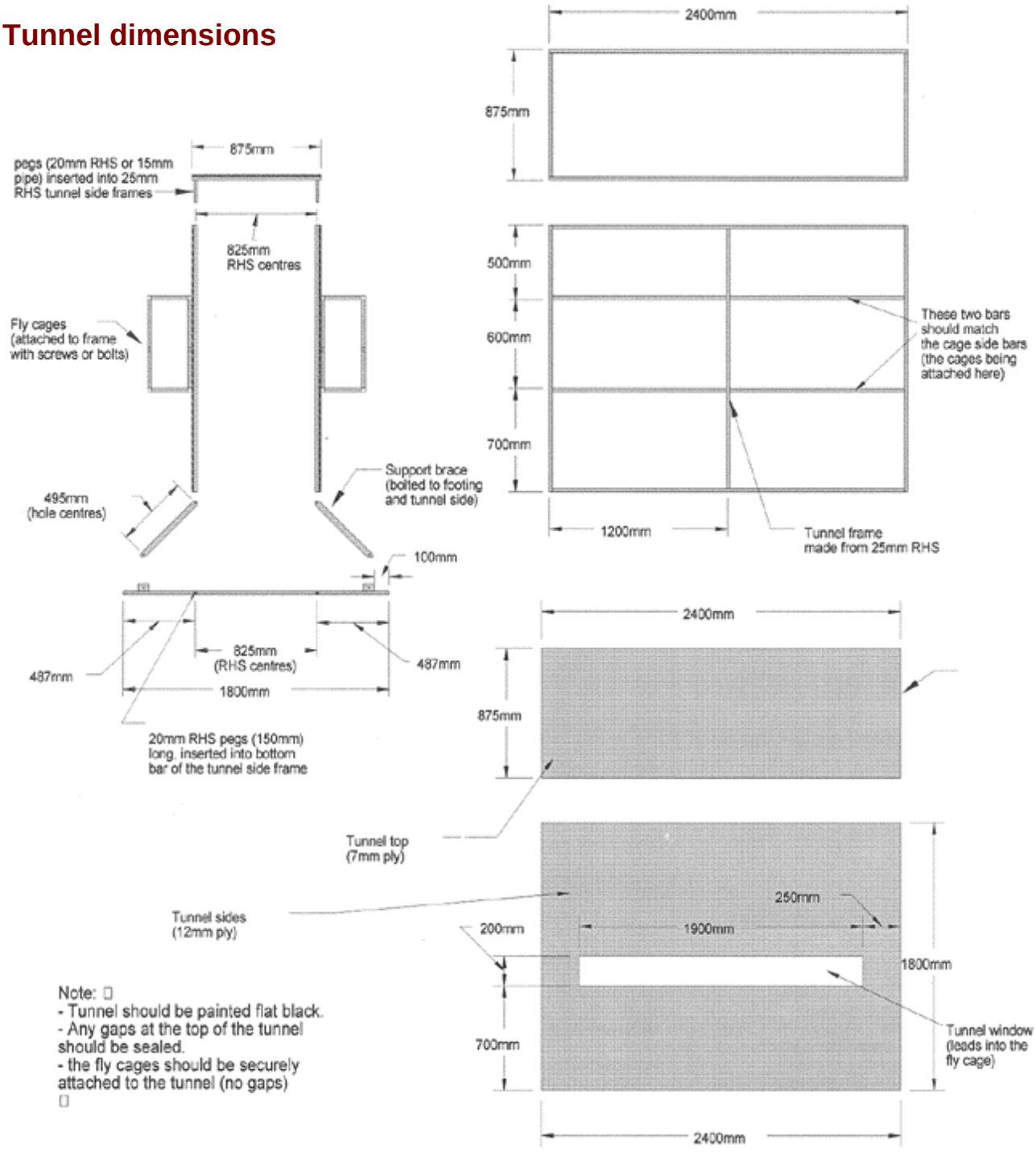
- Baffles can be made out of flat steel and fly screen or fly screen framing (as indicated in the plans).
- Hinges can be used to join the two sides of the baffle. The hinges will allow the baffle to be folded during installation.
- It is important to get a fly proof seal between the baffle and the cage sides.
- The baffle will rest on the cage centre bars. To prevent the baffle pushing against and damaging the screen, the flat steel used to attach the screen to the cage frame, should be lifted 5mm above the cage frame centre bar so as to form a lip. It may be necessary to fix a bracket to hold the baffle in place.

Using the tunnel trap

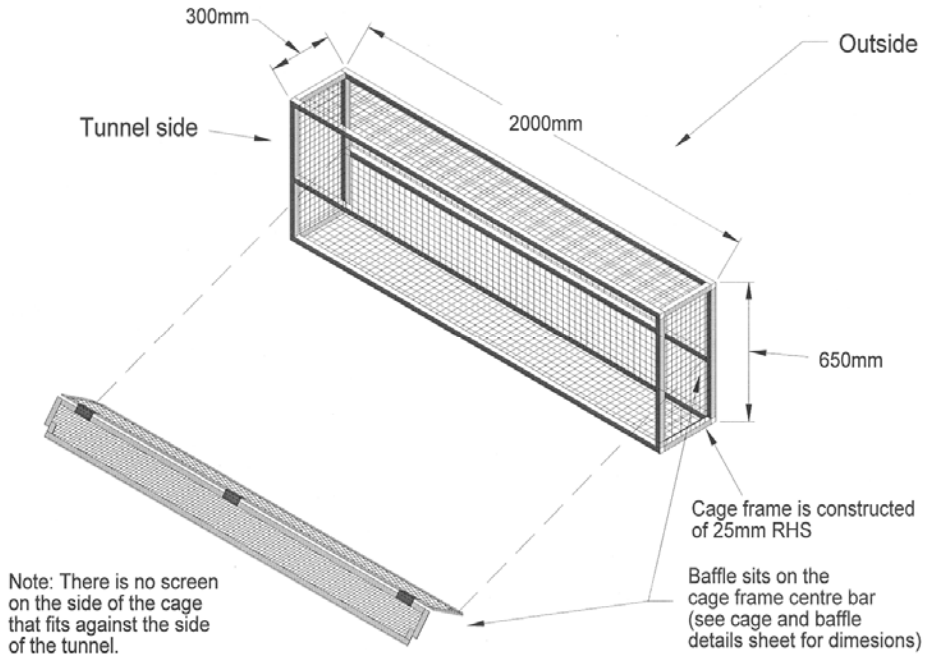
To effectively reduce fly numbers, all animals in a mob need to pass through the tunnel at least once daily. The best way to achieve this is to have controlled access to water. This could include fencing off troughs or dams. The tunnel can be set up as a permanent structure or as a temporary one. It is best set up in a gateway on a well-drained site. If used as a permanent fixture, it may pay to pour a concrete pad to prevent the development of deep pads.
Where it is impractical to control access to water, an alternative is to use a feed supplement as an attractant and to control access to the feeding station. The tunnel trapping system can be easily adapted to self-mustering (trapping) systems.
Cattle may need to be trained to use the tunnel trap. The tunnel should be assembled in stages to allow the animals to become familiar with using it.


Buffalo fly trap
general assembly
Cage frame -
Constructed of 25mm RHS
and covered with wire fly
screen (refer to cage details
sheet for dimensions)
Tunnel roof -
25mm RHS frame
7mm Form ply sheeting
150mm pegs (20mm RHS
or 15mm pipe) insert into top
of tunnel side frames.
* Ensure there are no gaps
between the roof and sides
of the tunnel
Tunnel sides -
12mm ply sheeting
(painted black)
Tunnel side frame -
constructed of 25mm RHS
(see Frame details for dimensions)
Footings -
Base 25mm RHS.
150mm pegs (20mm RHS or 15mm pipe)
insert into the bottom of the tunnel
side frames from the front of the tunnel
Braces bolt to a lug on the footing
and onto the tunnel side

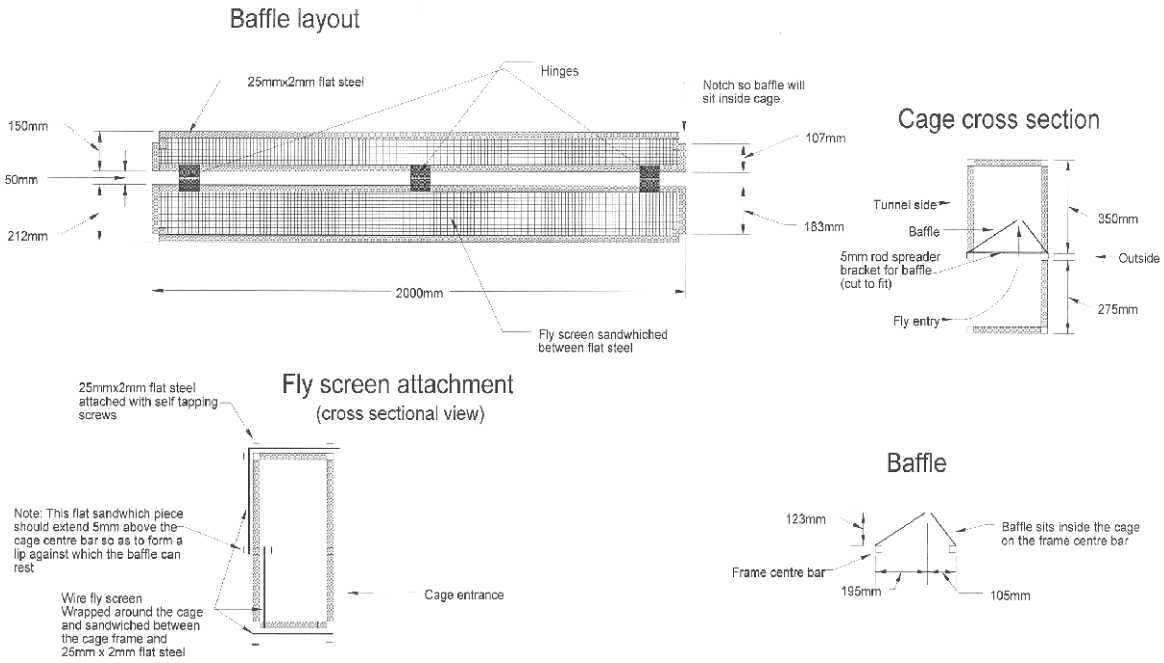
Tunnel dimensions



Cage frame dimension, baffle construction and layout



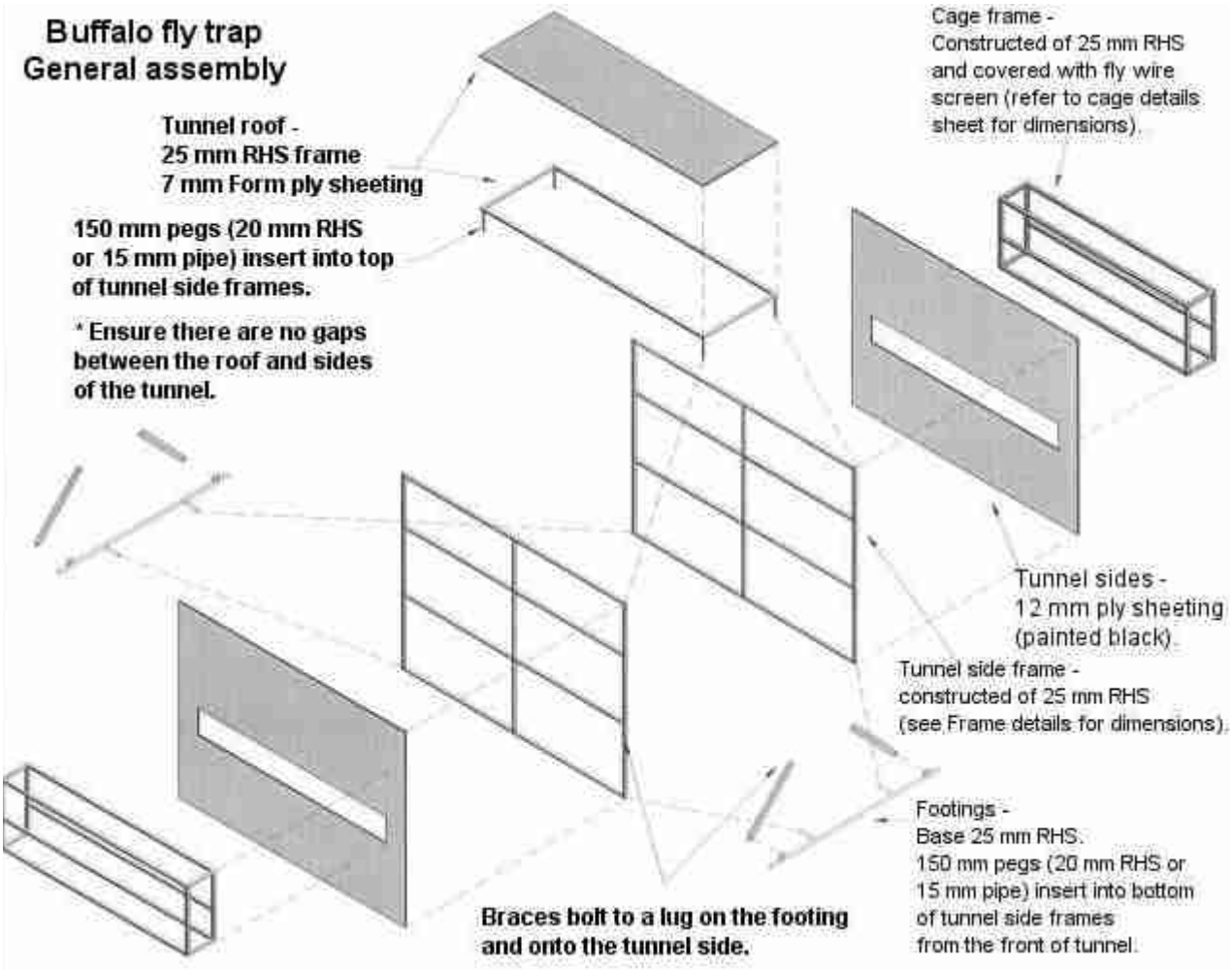
Cage and baffle details



Further information

DPI Call Centre: phone 13 25 23 (Queensland residents) between 8 am and 6 pm weekdays; non-Queensland residents phone 07 3404 6999; email callweb@dpi.qld.gov.au
DPI's web site: www.dpi.qld.gov.au ■

8.2.2 Trap Plans

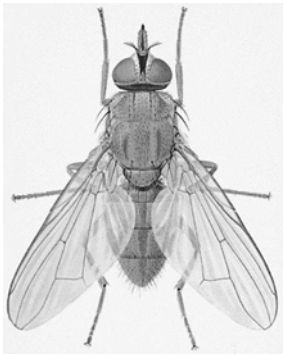


8.2.3 Field Day Flier

South Burnett BeefPlan Group

invites beef producers and dairyfarmers to a

Buffalo Fly Tunnel Trap Demonstration Field Day



Saturday 20 March 2004 - 1pm to 3pm

at Graeme & Cheryl Goldsworthy property

Goldsworthy Road off Booie Road off Barkers Creek Road, east of Kingaroy

Directions to property

- from Kingaroy, take the Barkers Creek Road for 16 km and turn right into Booie Road (then follow the field day signs) **or**
- from the Goomeri/Nanango Road, take the Barkers Creek Road for 7 km and turn left into Booie Road (then follow the field day signs)

Program

- inspect the Tunnel Trap demonstration set up in a laneway
- catches 60 to 70 % of buffalo flies from cattle using it twice /day
- reduces the use of parasiticide sprays for controlling buffalo flies and thereby reduces the risks of damage to your dung beetle populations
- the Trap costs about $1300 to purchase ready-made
- copies of plans will be available for producers to make their own Trap at a cost of about $750 (materials only)

For further information contact:

Graeme Goldsworthy (4163 5142)
Jim Cross (4162 4890 or email jjcross@bigpond.com)
Graeme Elphinstone, DPI Gympie (5480 4403 or email graeme.elphinstone@dpi.qld.gov.au)

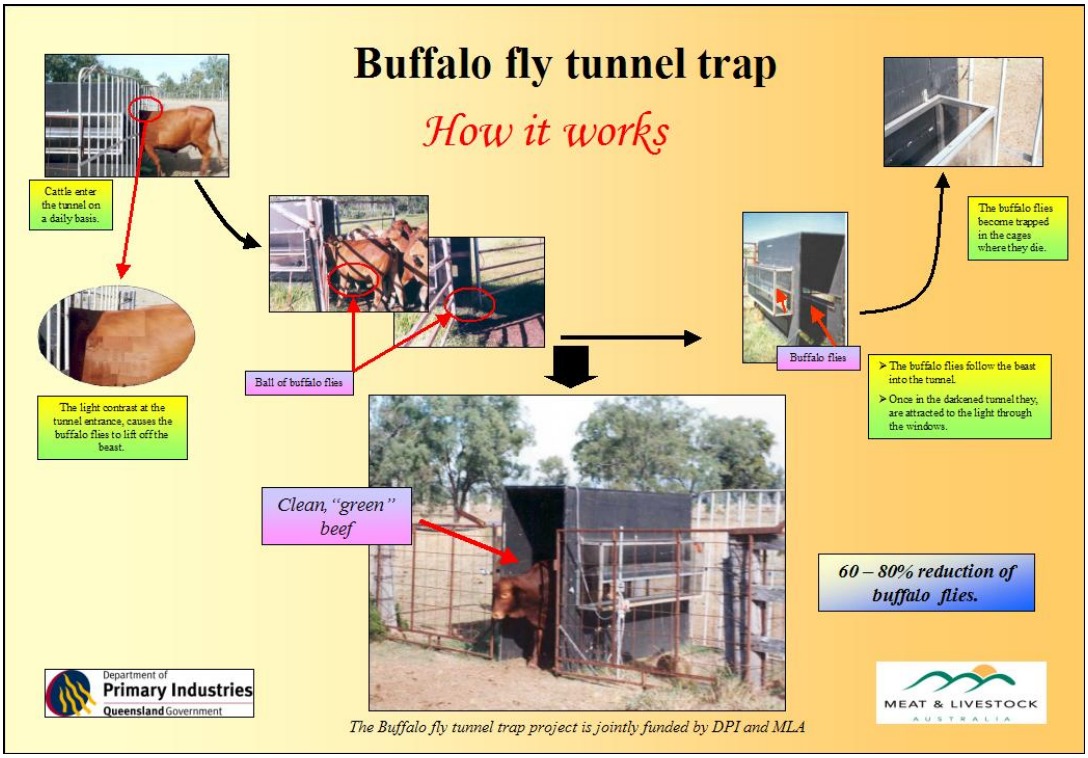
This Buffalo Fly Tunnel Trap demonstration is a joint project between DPI's Agency for Food & Fibre Sciences and Meat & Livestock Australia.

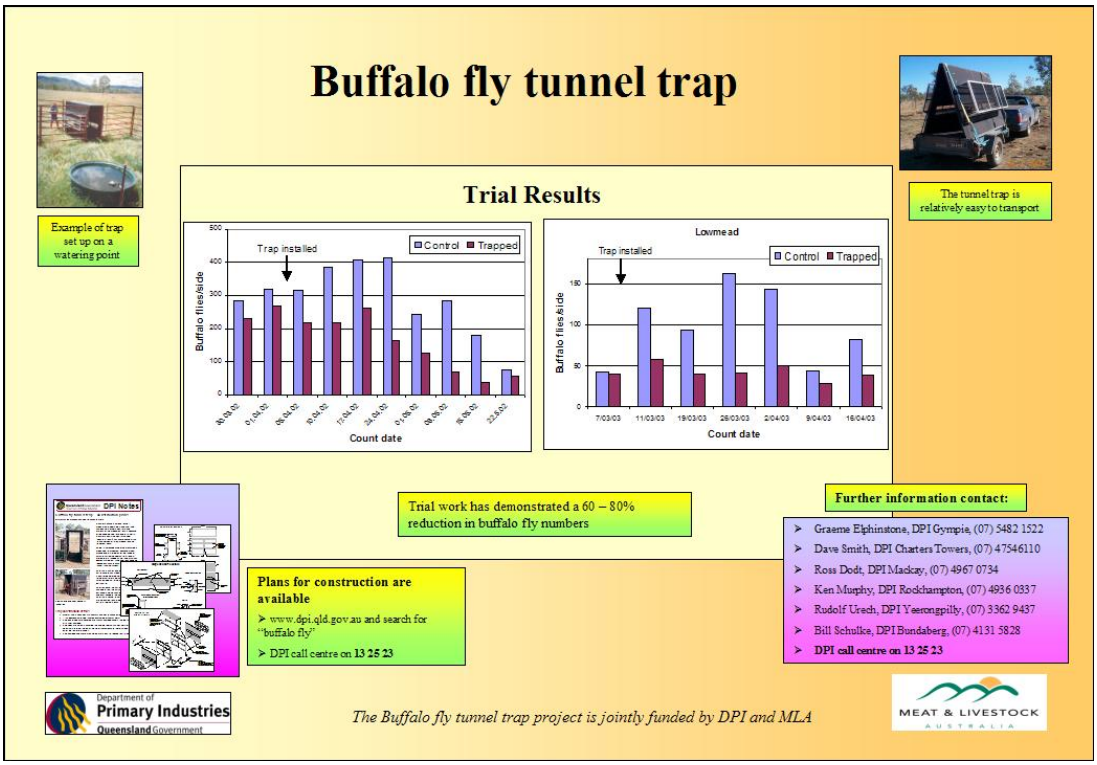
An example of the extension materials used to promote field days.

8.3 Web Statistics

Visits – Buffalo fly Trap HTML page	**Number**	**Rankings in 230 pages**	**Time spent**
May	137	27	5.24
April	123	21	5.45
March	115	32	5.14
February	98	29	4.54
January	97	31	4.59
December 03	95	19	5.07
November 03	123	22	5.20
Top Downloaded Pages - General Assembly PDF	**Ranking / total**	**Percentage of total downloads**	**Total downloads**
May	1 / 14	23.04	560
April	1 / 16	20	990
March	1 / 16	17.81	848
February	2 / 14	17.82	707
January	1 / 12	29.01	717
December 03	1 / 18	22.56	758
November 03	2 / 12	18.07	974
Top Downloaded Pages - Tunnel Dimensions PDF	**Ranking / total**	**Percentage of total downloads**	**Total downloads**
May	4 / 14	11.43	560
April	5 / 16	8.89	990
March	3 / 16	13.56	848
February	3 / 14	13.86	707
January	3 / 12	14.78	717
December 03	3 / 18	12.14	758
November 03	4 / 12	12.73	974
Top Downloaded Pages - Cage Frame Dimensions PDF	**Ranking / total**	**Percentage of total downloads**	**Total downloads**
May	3 / 14	11.61	560
April	6 / 16	6.87	990
March	5 / 16	9.91	848
February	6 / 14	9.05	707
January	4 / 12	9.76	717
December 03	5 / 18	10.42	758
November 03	3 / 12	14.78	974
Top Downloaded Pages - Cage and Baffle Dimensions PDF	**Ranking / total**	**Percentage of total downloads**	**Total downloads**
May	5 / 14	10.18	560
April	8 / 16	6.46	990
March	7 / 16	9.43	848
February	5 / 14	9.19	707
January	5 / 12	9.34	717
December 03	6 / 18	10.42	758
November 03	6 / 12	9.03	974

8.4 Display posters





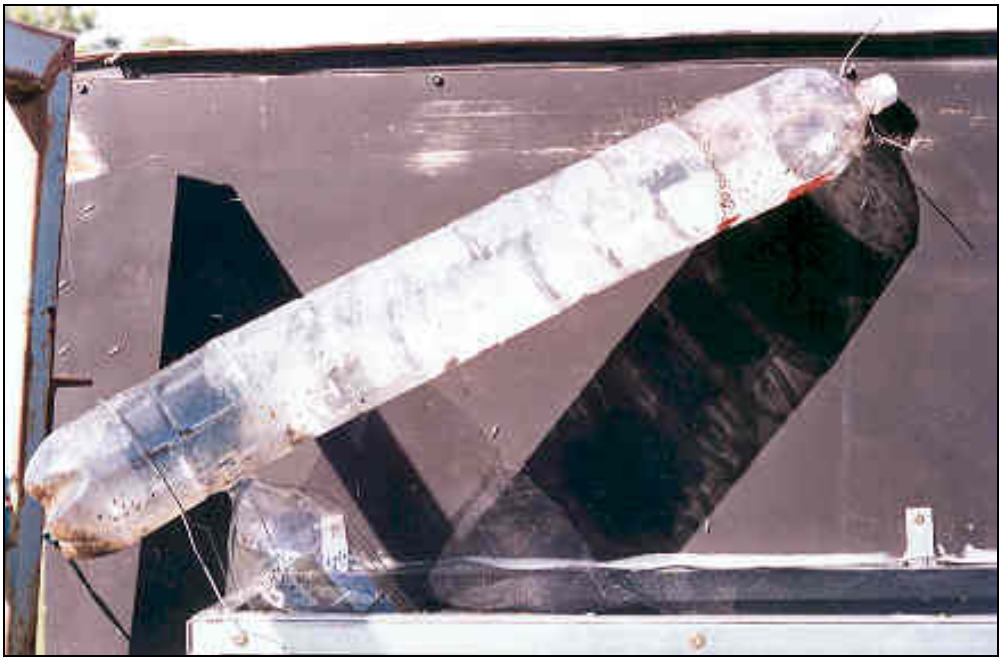
Selected photographs from evaluation sites

Beef 2003

Charters Towers Trap on site

8.5 Extension officer Ken Murphy (left) with interested producers at the Calliope field day

Extension officer Ken Murphy (left) with interested producers at the Calliope field day.



A novel baffle system made of 2 litre soft drink bottles and attached to the upper outside corners of the cages.

8.6 Field day at the Kingaroy satellite site; mobile unit on left and fixed unit on right

Field day at the Kingaroy satellite site; mobile unit on left and fixed unit on right.

Field day at Kingaroy site; producers discussing the fixed unit.