4. Agrichemicals and agrichemical containers

4.1 Introduction

The use of agrichemicals is widespread and long-standing, and is regarded by most as integral to high productivity and product quality. Herbicides, sanitisers, bactericides, fungicides, insecticides, defoliants, nematocides, rodenticides, and fumigants and their containers are common sights on modern day farms.

Agrichemicals can become unwanted or unusable, due to changes in farm practices, regulations, or replacement by newer products. Not only is the chemical unwanted but the container also, whether empty or not.

4.2 Information sought

The aim of this section was to profile agrichemical usage and redundant container generation on farms. Farmers were asked if they used agrichemicals on the farm, if they had any unwanted agrichemicals or containers, and how they dispose of these. Other information gathered in this section was the average agrichemical container size, and if rinsing of containers was practiced and to what degree e.g. triple rinsing.

4.3 Results

All farmers stated that they had empty agrichemical containers on their farm. 14% stated they had unwanted chemicals on their farm. The type and volume of these unwanted chemicals was beyond the scope of the survey. All farmers surveyed knew the Taranaki Regional Council and district councils had carried out unwanted agrichemical collections in the past and this was seen by the farming community as a very useful exercise. Approximately 10% stated they had used the service within the previous 10 years.

With regard to stocking of agrichemicals on farms 82% stated they only held 1 years supply, 9% held approximately 2 years supply, and 9% held approximately 3 years supply.

Table 11 shows the disposal methods employed for agrichemical containers. It should be noted that a farmer may use more than one disposal method.

Table 11 Disposal methods for agrichemical containers generated on farms as surveyed (n=90)

	Reused	Landfill	Burn	Skip/wheelie bin	Bury	Stockpile
Disposal route*	24%	5%	56%	19%	13%	8%

Key: * denotes that farmers may use more than one disposal method

It was considered important to document the amount of reuse of containers on farms. However, all containers reused on farm eventually require disposal by a method identified in Table 11. The majority of farmers rinsed their agrichemical containers twice (see Table 12) with only 8% stating that they did not rinse their containers at all, which may indicate a high awareness of rinsing as a good practice.

Table 12 Profile of agrichemical container rinsing on farms (n=85)

	Single	Double	Triple	Did not rinse
Rinsing practised	20%	45%	27%	8%

As shown in Table 13, 81% stated that they disposed of the rinse to the spray tank – using the chemical for the purposes it was intended for, while 11% disposed of rinse to drains which entered the farm effluent pond.

Table 13 Disposal of rinse from agrichemical containers (n=85)

	Spray tank	Ponds/drai n	Track
Rinse disposed of to	81%	11%	8%

Photo 1 Typical agrichemical containers on farms in Taranaki

4.3.1 Agrichemicals used on farms

Some of the herbicides on farms recorded during the survey included Grazon (Gorse, Broom), Preside (Giant Buttercup, Chickweed, Spurrey, Mayweed), Tordon 2G (Ragwort, Thistle, Gorse, Hemlock), Tordon Gold (Ragwort, Thistle, Fennel), Tordon Brushkiller (Gorse, Blackberry), and Roundup/Glyphosate (all purpose weedkiller) as shown in Photo 1.

Agrichemical used on the farm included Eprinex, Genesis, and Cydecton. Treatment of these parasites can also be by injection to the animal's blood system. This type of treatment results in very small quantities of unwanted container wastes.

There are some fungicides used on farms but their quantity and use is very low, resulting in a low quantity of packaging waste. This reflects predominantly pastural rather than horticultural activity in the region.

4.4 Discussion

Burning of agrichemical containers was the most common disposal method (56%) employed by farmers while 19% stated that they disposed of their containers by skip or wheelie bin, and 13% by burying. It was encouraging to note that 24% of farmers attempted some reuse of containers, using them for such things as tool boxes on four wheel bikes, fly traps, rattle cans, used oil containers. However, eventually these containers would require disposal after their reuse has expired, and would be disposed of by burning, skip/wheelie bin, burying, or landfill.

When Table 11 is compared to Table 4 with regard to burying and burning disposal methods it shows that plastic agrichemical containers are burned in preference to burying – burying being the most used disposal option on farms at 48%. This is probably due to the bulky/space consuming nature of the container which is perceived as a nuisance and also due to the fact that the containers are very easy to burn, and have a high calorific value.

It is very difficult to estimate the number of empty agrichemical containers on farms in the region at present. It is probably reasonable to estimate that a farmer would generate three agrichemical containers per year with the majority sized 5 or 20 litres. This equates to approximately 9,000 agrichemical containers (3,000 farms generating 3 empty agrichemical containers) generated on farms in the region each year.

At present (January 2005) there is a proposal for a national collection of agrichemical containers. The scheme, if implemented, would place a levy on agrichemical containers, which would finance a collection and processing system. Essentially, the scheme would require farmers to present cleaned containers at a designated drop-off point in their locality, which would be recycled to produce other plastic products. If the collection scheme is established then this should adequately address waste disposal issues relating to agrichemical containers, providing a significant participation rate is achieved.

While a nationwide on-going collection scheme is likely to be most cost effective an alternative would be occasional collections. An investigation of the cost-benefits of an occasional stand-alone region wide collection is required. It should be noted that such a collection could only proceed if there is an end disposal route for the collected material i.e. plastics recycling company.

Of the 85 farmers that responded to the question of rinsing agrichemical containers 92% did practice rinsing while 8% did not. Triple rinsing, as recommended by the Ministry for the Environment, was only carried out by 27% of those surveyed. Double rinsing was the most poplar at 45%, and 20% of those surveyed stated they rinsed only once. Therefore, 73% of those surveyed did not reach the recommended triple rinse. Most of those surveyed stated that they only rinse until the liquid looked clear, which was typically after two rinses. It may be that part of the triple rinsing message should emphasis that the last rinse will look clear but contain some chemical. It is worth noting that trial agrichemical container collection carried out in 2003 in the Waikato and Hawkes Bay regions, [Sustainable Management of Waste Agrichemicals and Waste On-Farm Plastic, Project 4183 – MfE], recycled 92% of containers with the remaining 8% of those collected contaminated by agrichemical or other residues.

Finally, 81% poured their rinse into the spray tank and thus used the chemical for its intended purpose. However, 11% poured rinse into the farm pond/farm pond inlet drain, and 8% poured onto the ground both of which are practices carrying some degree of environmental risk and effectively wasting product.

There is scope for education on rinsing of containers and disposal of residues. There is also a need to develop off-farm disposal/recycling routes for this plastic.

4.5 Future disposal options

The proposed nationwide agrichemical container collection system, if implemented, would be a significant improvement to the disposal options currently available for this material. Such a system would provide an appropriate disposal option for the estimated 9,000 agrichemical containers generated in the region each year.

Reasonable assistance to establish the proposed container collection scheme (see 4.4) in Taranaki could be provided by parties interested in agrichemical container disposal in the region. Reasonable assistance could include advice on suitable drop-off points, making transfer stations available as drop-off points, promotion by advocacy.

If the proposed national collection scheme does not proceed then a once off, stand-alone collection, based on the proviso that there is an end disposal route for the collected containers i.e. plastics recycling company, may be worth investigating.

The Ministry for the Environment could review it's message on rinsing of agrichemical containers to emphasise that the final third rinse will still contain a small amount of residue and therefore, justifies the third rinse. The message could be supported with some chemical analysis results of first, second, and third rinses of a typical agrichemical.

5. Plastics wrap, pit covers and bags

5.1 Introduction

Taranaki is the second largest dairying region in New Zealand and as a result generates a large quantity of farm plastic because of its association with hay and silage production. Plastic is a significant and problematic waste for farmers to deal with and the aim of this section was to gain an understanding of the types of farm plastics generated on the farm excluding chemical containers, and how this material is disposed. Silage bale wrap, silage pit cover, and feed bags were considered in this section.

5.2 Information sought

Each farmer was asked if they generated pit cover, bale wrap, and plastic bags through the use of feed and urea bags, and how this plastic was disposed. The average surface area of a silage pit was estimated, using information provided by farmers. Silage bale equivalent size and quantity of bales made per farm was recorded. Farmers was asked how the bales were tied, by either twine or net, and which of the two they found easier to handle when removed from the bale. The number of farmers making individually wrapped silage bales and the number wrapping bales by the tube method was noted.

5.3 Results

The results of questions in this section of the survey are presented in Table 14, Table 15, and Table 16. Of the 90 farmers surveyed 79 (88%) made silage by pit or bale or a combination of both.

Table 14 Silage produced on farms as surveyed (n=79)

	Pit silage	Bale silage	10 equivalent size	12 equivalent size	14 equivalent size
Silage production format	38 [48]	69 [87]	-	-	-
Bale silage size type (n=69)	-	-	72	26	2

Key: numbers in [ ] are percent

Of the 38 farmers that stated they made pit silage 20 (52%) reused their pit cover for a second year. Usually two layers are applied, the new cover plus the cover from the previous year which protects the new cover. Patching of pit covers was also employed. 30 farmers gave their silage pit dimensions and from this the average pit size was determined as 225 m^2 which is equal to 15 metres by 15 metres.

Table 15 Bale format on farms as surveyed (n=69)

	Individually wrapped	Tube wrapped
Bale format produced	59 [86]	10 [14]

Key: numbers in [ ] are percent

The most common disposal method for silage wrap and cover plastic, and feed and fertiliser bags was by burning, 71%, (see Photo 2).

Table 16 Disposal method for silage and bag plastic

Disposal method	Silage plastic
Burn	56 [71]
Bury	11 [14]
Landfill/skip	13 [16]

Key: numbers in [ ] are percent

The average number of silage bales produced on the farms surveyed was 215 and ranged from 25 to 1000. The most common method for tying silage bales was by net (62%), which is usually determined by the contractor. Farmers did not have a preference for one type over the other.

59 farmers stated that they had unwanted fertiliser and/or animal feed bags on their farm. While some of these bags are reused for rubbish collection on the farm, given to neighbours, and used for local good causes, the majority are burned.

Photo 2 Waste silage bale plastic wrap piled for burning

5.4 Baled and pit silage

From conversations with farmers the cost of producing a 12 equivalent silage bale is approximately $22. This is high compared to less than $10 for the same amount produced by silage pit. The reason for choosing one method over the other or for combining the methods used on the farm could be due to farmer preference, absence of silage pit and/or feed out wagon, tradition, finance, silage quality, grass available, and land quality.

Better quality silage is attained using baled silage. Difficulties achieving a good airtight seal in a pit and water ingress means the percentage of poor quality silage produced is higher for pit method than bale method. Overall, bale silage produces better quantity and quality return for each tonne produced. The advantages of using the pit method are significantly less cost per tonne to produce compared to baled silage, and less plastic to dispose during the season.

Other matters worth considering between the two methods are the capital and annual costs, handling requirements, land area taken up by each method, and fencing requirements.

5.5 Discussion

Of the 79 farmers that stated they made silage 69 (87%) made baled silage while 38 (48%) made pit silage. The average number of silage bales on farms surveyed was 215 with some farmers using both methods. While it is difficult to determine the quantity of plastic produced on farms, an estimated 76% of farmers make baled silage and produce and average 215 bales per year at an average of 1kg plastic/bale. This suggests that of the approximate 3,000 dairy and beef farms in the region 2,280 make baled silage, producing approximately 490 tonnes of spent bale wrap per year in the region.

A very rough estimate of the surface area of pits on farms surveyed was 224 m^2. The cover plastic used is predominantly 0.125 kg/m^2 of 125 micron LDPE. Derived from the survey, approximately 1,260 (42%) of the approximate 3,000 dairy and beef farms in the region make pit silage. Therefore, approximately 35 tonnes of waste pit cover plastic is produced each year in the region.

This equals, approximately, 525 tonnes of waste plastic wrap and cover to be disposed of in the region each year of which approximately 380 tonnes (71%) is burned. The conditions under which this plastic is burned such as other materials burned with it, initial burn temperature and maximum temperatures reached, condition of plastic when burned (wet, dry, loose, bundled, and contaminant content) were not investigated since this was beyond the scope of the survey.

Equivalent size 10 bales were the most common type produced (72%) on farms, with 26% making size 12 and 2% making size 14. Nearly all bales produced on farms were individually wrapped (86%), while 14% were tube wrapped. Since each end of an individual bale does not have to be wrapped when in tube format there is less plastic to be disposed and ultimately this is comparatively better for the environment.

Of those surveyed, 71% burned their plastic wrap. This is permitted in the Regional Air Quality Plan for Taranaki, however, the Taranaki Regional Council encourages farmers to take a more environmentally friendly approach and bury or landfill their wrap. Most farmers that use a skip dispose of their wrap by this method, this is especially true of those with individually wrapped bales which can be tied in to small bundles and placed in a skip over several lifts.

The most common method for tying silage bales was by net and farmers did not have a preference for one type over the other, with regarding to handling this waste.

Most of the farm wrap plastic is produced on farms in the autumn and spring seasons, with hay being fed out in winter. Any collection system of this plastic would need to make allowances for this seasonal factor and plan accordingly.

WrapRecovery scheme
This proposed scheme is a product stewardship program for the systematic recovery of feed conservation products (wrap, net wrap, twine and pit covers) in New Zealand. This scheme would operate in conjunction with the proposed agrichemical container collection scheme (see section 4.4). Income for the recovery scheme would be raised by way of a levy from responsible brand owners of feed conservation products who join the WrapRecovery scheme.

Essentially, the scheme would require farmers to present plastic silage wrap and covers, in a certain manner and to a certain quality, at a designated drop-off point in their locality. This plastic would then be recycled. If the collection scheme is established, and providing a significant participation rate is achieved, then this should adequately address waste disposal issues relating to plastic silage wrap and covers.

5.6 Future disposal options

The proposed nationwide farm plastics collection system, if implemented, would be a significant improvement to the disposal options currently available for this material. Such a system would provide an appropriate disposal option for the estimated 525 tonnes of bale wrap and pit cover generated in the region each year.

Reasonable assistance to establish the WrapRecovery scheme (see section 5.5) in Taranaki could be provided by parties interested in agrichemical container disposal in the region. Reasonable assistance could include advice on suitable drop-off points, making transfer stations available as drop-off points, and promotion by education and advocacy.

If the proposed collection scheme does not proceed then a once off, stand-alone collection, based on the proviso that there is an end disposal route for the collected containers i.e. plastics recycling company, may be worth investigating.

6. Waste oil and containers

6.1 Introduction

Used oil is the single largest non-watery liquid waste stream in New Zealand. An estimated 30 million litres are generated each year. Approximately 60 million litres of lubricating oil are sold each year. About 50% is leaked, burned or otherwise lost during use (MfE website).

During use, oil becomes contaminated with a range of substances that are hazardous to human health and the environment, including heavy metals and polyaromatic hydrocarbons, some of which are potential carcinogens. Good management is required to ensure environmentally sound disposal.

The purpose of this section was to determine the sources of oil on farms, number of vehicles per farm, vehicle servicing practices, and how oil and oil containers are disposed. It should be noted that there was no data available relating to the number of farm vehicles in the region, for this report.

6.2 Information sought

Farmers responded to questions concerning who serviced their vehicles, where they were serviced (farm or garage), was waste oil stored on the farm, what volume of oil was generated on the farm each year, how were oil containers and oil filters disposed, and how oil was disposed. Later in the survey it became evident that oil driven vacuum pumps in milk sheds could be a considerable user of oil, depending on the make and age, and two questions were added to the questionnaire with regard to these types of pumps.

6.3 Results

Over 95% of farmers owned a minimum of one tractor and a two or four wheel bike. This means that there are at least 6,000 farm vehicles requiring oil changes each year in the region. Allowing for a family car or a second tractor, or other additional farm vehicle, a more realistic number would be 9,000 farm related vehicles in the region.

The principal oil types resulting from servicing were engine and hydraulic. Older model tractors typically have only one oil filter but modern tractors can have many more depending on the sophistication of the unit.

Servicing of farm machinery can take place either on the farm by a mobile service unit, or by the farmer, or at a garage. The frequency of servicing is directly related to the amount of hours the vehicle is operated (tractor, ATV, baler) or the number of kilometres clocked up in a month or season.

There was a good response to this section of the survey. Farmers were definite about who serviced their machinery and where waste oil and containers were disposed. Servicing of vehicles owned by sharemilkers was less certain but overall seemed consistent with that of the farm owner. It should be noted that several disposal methods may have been carried on at any one time by a farmer.

Table 17 Farm vehicle servicing practices as surveyed (n=90)

	Garage	Mobile service on farm	Farmer
Service carried out by	57 [63]	71 [79]	35 [39]

Key: numbers in [ ] are percent

The predominant method of servicing a vehicle was to use a mobile service unit (79%), while 63% serviced a vehicle at a garage. Only 39% of farmers serviced some or all of their machinery (see Table 17).

Empty containers resulting from engine oil changes and top-up oil were disposed by various methods as shown in Table 18. Burning was the most common disposal method, 50%, while 27% of farmers found reuse for some or all of these containers. 17% stated that they dispose of these containers to a skip or wheelie bin. 37 farmers (45% when n=82) disposed of oil filters on their farm, which is typically three or four oil filters per year.

Table 18 Empty oil containers disposed on farm (n=82)

	Bury	Burn	Reuse	Stockpile	Dump on farm	Skip/wheelie bin
Empty oil container disposal	12 [15]	41 [50]	22 [27]	11 [13]	3 [4]	14 [17]

Key: numbers in [ ] are percent

The volume of waste engine oil generated on farms each year was predominantly 11 to 30 litres. Typically this waste is reused to lubricate machinery and sprayed or painted on machinery to prevent rust. It should be noted that a farmer may employ more than one method for oil disposal.

Table 19 Volume of waste engine oil generated on farms per year and disposal method (n=82)

	<10 ltr.	11-30 ltr.	31-100 ltr.	>101 ltr.	General lubrication and rust prevention	Poured on track
Waste oil generated	17 [20]	44 [54]	16 [20]	5 [6]	-	-
Disposal method	-	-	-	-	77 [94]	9 [11]

Key: numbers in [ ] are percent

The predominant source of waste engine oil on farms is from tractor servicing which was noted at 88% of farms surveyed. The remaining 12% either had their tractor serviced off farm or several farmers stated they did not own a tractor as it was not necessary to the operation of the farm. Most cars and utes were serviced at the local garage and nearly all waste engine oil from these vehicles remained at the garage.

Table 20 Estimate of possible number of farms in the region possessing waste oil and estimated possible quantities generated annually

	<10 ltr.	11-30 ltr.	31-100 ltr.	>101 ltr.
Waste oil generated	17 [20]	44 [54]	16 [20]	5 [6]
Number of farms in the region possessing waste oil *	546	1474	546	164
Estimated possible volume of waste oil on farms in each range, annually	Max. 5.5 m^3	16.2-44.2 m^3	16.9-54.6 m^3	Min. 16.4 m^3

Key: numbers in [ ] are percent

* based on 91% (82 farms out of 90 had waste oil) of the 3,000 farms in the region, which equates to 2730 farms in the region generating and storing waste engine oil.

Estimated quantities of waste oil on farms in the region, Table 20, show that there is a minimum of 49.5 m^3 (49,500 litres) and a maximum of approximately 104.3 m^3 (104,300 litres). These estimated volumes are consistent with the estimate of 30 million litres of waste oil generated each year in New Zealand.

Table 21 Sources of waste engine oil on a farm (n=82)

	Tractor	ATV	Ute	Car	Truck, motor bike, digger etc.
Vehicles generating waste oil on farms	72 [88]	31 [38]	12 [15]	9 [11]	29 [35]

Key: numbers in [ ] are percent

Another source of waste oil on farms is older model single cycle (non-return) vacuum pumps that use a considerable volume of hydraulic oil (when compared to the volume of waste engine oil produced by a car or ute). When this was established as a significant waste oil source a question was added to the survey questionnaire for the remaining 33 participants to answer.

Table 22 Estimate of possible number of farms in the region with waste vacuum pump oil and estimated possible quantities in the region

	41-60 ltr.	61-80 ltr.	>80 ltr.
Waste vacuum pump oil generated	7 [39]	8 [44]	3 [17]
No. of farms with waste vacuum pump oil *	610	726	280
Estimated possible volume of waste vacuum pump oil on farms in each range	25 – 36.6 m^3	44.2 - 58 m^3	>22.4 m^3

Key: numbers in [ ] are percent

Table 22 shows that of the 33 farmers asked 18 (55%) had single cycle (non-return) vacuum pumps, 11 had return type vacuum pumps and 4 did not know what type they had.

It was difficult to determine the number of farmers, using single cycle vacuum pumps that captured the exhaust oil. Discussion with these farmers indicated that over 50% of those did not capture the exhausted rotary oil (see Photo 3) but allowed it to spill and soak to ground. Keeping in mind the small sample number of farmers questioned on this waste (33, which is approximately 1.1% of farms in the region) then it is estimated that there is a minimum of 69 m^3 (69,000 litres) and approximate maximum 117 m^3 (117,000 litres) of waste rotary oil generated in the region each year. If 50% of farmers using single cycle (non-return) vacuum pumps do not collect their waste rotary oil then there is possibly 34.5 m^3 to 58.5 m^3 (34,500 to 58,500 litres) waste rotary oil being discharged directly to ground in the vicinity of milk sheds.

Photo 3 Agrichemical containers reused as diesel containers (left), and vacuum pump oil (right)

Photo 4 Milk shed vacuum pump

6.4 Discussion

The majority of vehicle servicing on farms is carried out by mobile service units with 79% of those surveyed stating that they used this type of service. Farmers stated that the service unit usually took away the oil unless requested otherwise. Farmers typically would ask for some oil to be left on the farm for machinery lubrication purposes and to paint or spray on machinery as a rust prevention measure.

63% stated that they had machinery, mainly car, ATV and ute, serviced at a garage and only one farmer stated they took waste oil back from the garage. There were a reasonable number of farmers (39%) servicing machinery on the farm but it seemed from discussions that this is declining. It was noted that farmers were more likely to service a tractor or ATV only after the warranty expired. This decline of servicing of farm vehicles on farms may indicate that the amount of waste oil on farms is declining also. If a farmer services a vehicle on the farm the waste from the process becomes a disposal problem for the farmer. However, if a mobile service unit is used the unit will take away the waste oil, and in most cases the oil filters. Therefore, the farmer has greater control over how much oil remains on the farm.

50% of farmers stated that they burn some or all of their empty oil containers and 15% bury these containers. 27% stated that they find a reuse for some or all of these containers which is in keeping with the upper end of the waste hierarchy of reduce, *reuse*, recycle, recover, and dispose. However, when containers have come to the end of their useful life it is likely that they will be burned or to a lesser extent buried. It is worth noting that only 17% of farmers stated that they dispose of these containers by skip or wheelie bin. This is consistent with the amount of farmers using skips (16%).

From this survey it was estimated that there are approximately 1,650 farms using single cycle (non-return) vacuum pumps. It seems that of these approximately 50% (825) are allowing the expelled rotary oil to soak to ground at the point of discharge. If 50% of farmers using single cycle (non-return) vacuum pumps do not collect their waste oil then there is possibly 34.5 m^3 to 58.5 m^3 (34,500 to 58,500 litres) of waste rotary oil per year is being discharged directly to ground in the vicinity of milk sheds. If 83% (see Table 22) of these farmers are discharging between 40 and 80 litres of waste rotary oil per year to ground then this volume will have an environmental effect in the immediate surrounding soil and possibly reach ground water, depending on the circumstances.

Waste oil disposal options for farmers servicing their own machinery on farm vary from location to location within the region. Only three transfer stations and several garages in the region officially accept waste oil. Service stations used to accept waste oil but this is rapidly declining due to collection issues.

6.5 Future disposal options

Increased waste engine oil disposal facilities at transfer stations and garages in the region would be beneficial to increase waste engine oil capture and recycling, and consequently might increase oil recycling rates in the rural community, particularly given the decline of service stations taking waste engine oil.

Farmers using single cycle (non-return) vacuum pumps could collect their exhausted waste rotary oil and prevent it from being discharge to ground. Farming organisations and the MfE could promote this action and emphasis the environmental and farm value benefits of such.

Farmers could ensure that mobile service units take all waste oil and oil filters away when a service is complete.

The MfE could consider targeting the farming community if it wants to ensure greater recovery of waste oil in New Zealand. There may be merit in investigating the impact of exhausted rotary oil on soil and ground water in the vicinity of milk sheds, and the possible production of best practice guidelines with regard to waste oil handling and disposal on farms. There is also opportunity to educate and promote better disposal methods with regard to oil containers.