**Nicola Gemmell has recently completed her BSc Honours in Horticulture. As part of her final year, she investigated the use of environmental management on the golf course. Here she explains her results...**

# Manager's special?

## Environmental Management

There are over 500 golf courses in Scotland covering around 25000 hectares in total land area. As the game continues to grow in popularity, we must make the best use of the natural processes that have formed the courses and help maintain them. Almost every part of the golf course is potentially valuable to wildlife, but especially areas outwith normal playing zones that can amount to nearly 45% of the total area. Most courses have a wide range of natural features providing possible wildlife habitats. These habitats, such as grassland, woodland, hedges, individual trees and water features also draw in all sorts of insects, birds and animals making the golf course a potential wildlife haven.

## Aims

As part of my Honours year at the University of Strathclyde/Scottish Agricultural College, Auchincruive, I chose for my dissertation to investigate the use of amenity pesticides on golf courses and their probable impacts on that environment. There is evidence that the use of amenity turf chemicals on the golf courses could be limiting their environmental quality and conservation potential. By using alternative methods to amenity pesticide use and through a reduction in their use, the environment of the golf course is enhanced. Another aim of this study was therefore to find out what measures have been taken to control the use of amenity pesticides as well as the underlying reasons.

## Objectives

1. To assess the factors that are working for and against wildlife conservation on the golf course.
2. To determine to what extent environmental management plans are used in golf course management.
3. To review the role of amenity pesticides and fertilisers in golf course management and the factors that influence their use.
4. To determine the current threats posed by the use of amenity pesticides and fertilisers on the golf course and the implications for the surrounding environment.

The main focus of the investigation was to evaluate the use of fertilisers and pesticides on golf courses in Scotland. To gain relevant information, a questionnaire was produced for course managers. Two hundred and fifteen of these questionnaires were sent out to golf courses throughout Scotland, some small and some larger, more prestigious ones. Questions were designed to determine changes in amenity pesticides and fertiliser use and to determine what alternative methods are being employed.

A second questionnaire was sent out to 30 companies that supply and/or manufacture amenity pesticides and fertilisers. This questionnaire was used to determine whether the agrochemical companies have changed and are changing their product range to deal with the changes occurring in golf course management. Forms of advertising were also assessed to determine how the greenkeepers are kept informed about new products. In a competitive market, it is important to keep the greenkeeper updated with new products and improved methods of course management. The questionnaires were used to provide information about golf course maintenance and how this might be adapted to provide a better environmental management. They were used as the primary source of data collection, to gain information from golf courses throughout Scotland.

Results from Questionnaire sent to Course Managers:

Sixty-five responses were received from the 215 golf courses targetted in Scotland on which the analysis is based.

## Land use

The majority (64.6%) of the courses have been built on agricultural land.

See Figure 1: Previous Land Use

## Changes in amenity pesticide use:

The use of amenity pesticides has decreased over the last 10 years (Table 1).

The frequency of application of amenity pesticide products has also decreased or stayed the same.

See Table 1: Perceived Changes in Amenity Pesticide and Fertiliser Use in last 10 years by Greenkeepers/Course Managers

There has been a slight increase in the number of products used; this is because a wider range of products exists on the market and only a selection of products are used. For fertiliser products, it is the perception of the course managers, that the use of fertilisers has increased overall, but there is an increase in the use of organic and slow release products.

Most of the amenity pesticides are applied to the greens, with fertilisers mainly applied to the greens and tees. The greens are the main areas where fertiliser is used and where amenity pesticides are used to cure disease problems. Some fertilisers and amenity pesticides are also used on tees and fairways.

It was shown that a relatively wide selection of amenity pesticides are used; most frequent was Glyphosate, with 2,4-D & Dicamba used only half as often. Glyphosate is used as a total herbicide to remove all weeds from paths, hard surfaces and clearing vegetation prior to reseeding. 2,4-D & Dicamba is used to control annual and perennial dicotyledons in turf.

For fungicides, Iprodine and Fenarimol are popular for the treatment of Fusarium, Red Thread and Dollar Spot disease problems. Gamma HCH is used to control earthworms and leatherjackets in turf.

## Environmental Management

Only a third (33%) of the golf courses are actively using environmental management plans.

Independent Agronomists are used by just over half of the courses most being visited every year (57%), some (36%) are visited more than once a year and a smaller number (7%) are visited every two to three years.

The most commonly used method of distributing information is through suppliers (28%), and other useful methods include; other greenkeepers (i.e. word of mouth) (19%), independent agronomists (18%), and trade press (18%), (Figure 2). Information about new products is provided by the agrochemical suppliers through personal visits. Other sources of information are important such as the trade press and others, e.g. BIGGA.

See Figure 2: Information about New Products

## Integrated Pest Management (IPM)

Two-thirds of those respondents were aware of the concept of IPM but only one-third actually use these methods (Table 2). In general, of those who currently use IPM, most of the greenkeepers were using IPM as a method for improving the environment on the golf course and as a way to reduce costs of pesticide applications.

See Table 2: IPM Awareness and use

## Water use

In an age when there is less available water and more frequent drought periods (less so in Scotland), there will be implications for the golf courses. It is impractical to irrigate all areas of the course, so irrigation of only specific parts of the course, mainly the greens is undertaken. The size of the greens will have an influence on the wear and compaction of the green as well as their water requirement. The majority of courses (72%) use irrigation on the greens throughout the summer.

Pop-Up sprinklers (22 courses) are used to irrigate specific areas and are fixed, usually around the edge of the greens. Hand watering is used (5 courses) but is more labour intensive although there is less problem with overwatering. Bowsers (5 courses) are used when there is no local water supply and less frequently used - when absolutely necessary.

## Rough

The percentage of rough varies between courses and a wide frequency distribution is shown in Table 3. As there are different heights of rough, it was difficult to determine accurately the mowing regimes and the length of the grass. On the majority of courses, the rough is cut more than 3 times per

year (54%) and usually clippings are not removed (71%).

See Table 3: Frequency Distribution of Percentage Rough Ground

### Other areas

There are several features which exist on the course outwith the playing areas. Mainly there are woodland areas (45%) and water features (67%) which exist on the golf course. Other features include heather, gorse, hedgerows and wildflower meadows, represented in Figure 3.

See Figure 3: Other Features on Golf Courses

Results from Questionnaires sent to Agrochemical Companies:

Questionnaires were sent to 30 agrochemical companies that supply and/or manufacture amenity pesticide products; 15 responses were received.

Most manufacturers or suppliers responded that there has been an increase in the number of amenity pesticides used and that frequency of application of all amenity pesticides has increased in the last 10 years (Table 4). This is contradictory to the views of greenkeepers who thought that amenity pesticide use was perceived to have decreased. The number of amenity pesticide products sold increased but not in all the companies. For fertilisers, it is a different story as the use has increased but there is a greater number of slow release and organic fertilisers used instead of the inorganic or compound form.

See Table 4: Changes in the Selling of Amenity Pesticides and Fertiliser

### Advertising Methods

Many forms of advertising are used and are listed below (Table 5). By rating the different forms of advertising on their success rate, it was shown that this depends on the company; 47% of the companies rated suppliers as the most successful methods of spreading information. Other greenkeepers were rated highly for spreading information (33%) while the other forms of advertising were not rated as highly, mostly with an average success rate. These forms of advertising are still used as they are still a viable means of advertising. There are a high percentage of no comments in this section as several companies did not rate the advertising methods.

See Table 5: Methods of Advertising

Representation at the major trade shows is important to the marketing of company products and many products are sold (Table 6). The most successful way to sell products is though company representatives and personal visits to the golf courses. Mail shots of literature are also a good method for trading and advertising in trade press, like Greenkeeper International and The Groundsman, are also successful, shown in Table 6.

Table 7: Changes in company to deal with Environmental Management

Changes need to be made within the company to adapt to the changes in golf course management (Table 7).

### Conclusions and Future Prospects

The work carried out in this research project is an introduction to the development of environmental management on golf courses in Scotland. Work has been carried out in environmental management in the US and elsewhere in Europe. However, little work has been done in Scotland. To ensure that environmental management continues more research needs to be carried out in Scotland and in particular to investigate the effect that amenity pesticides have on the environment and to develop new methods to overcome the use of chemicals.

If I was able to extend this project I would have liked to:

- Send out a larger number of questionnaires to all the golf courses in Scotland to get a fairer representation of the course managers' work in Scotland.
- Arrange meetings with agrochemical company representatives directly to interview them on specific areas of their product development and application. This would have gained a better response than the questionnaire. Several of the questions were poorly answered perhaps because they were unclear to some respondents.
- Meet with Agronomists to determine their role in golf course management.

### Views of the Golf Club Members

A number of questions concerning environmental management were included in a questionnaire distributed to Golf Club members. However there was a poor response from this questionnaire. This was very disappointing as I feel that the members' viewpoint is important since it is their golf course which is being managed for better or worse.

Various methods have been used to inform the members, as shown in Figure 4. The most successful methods were found at Kilmacolm Golf Club, Renfrewshire. Members were taken on guided tours and rambles across the course to point out some of the areas which they are trying promote, e.g. heather plantings, and pointing out wildflowers. Other forms of communication used included; distribution of newsletters, talks, posters and notices in the clubhouse.

See Figure 4: Methods of Informing Members

Members are not willing to sacrifice their playing conditions to increase the natural habitats on the golf course. There are plenty of areas outwith the greens and fairways which do not need to be intensively maintained. More than one-third of the members are willing to allow the rough and other areas to change as these are less intensively used areas of the course.

### Summary

This study was designed to evaluate the environmental effects of golf course development and management in Scotland. Golf courses cover a large area of our country and as such can provide important habitats for the survival of wildlife as well as providing an increasingly popular pastime. Most golf courses contain a high percentage of ground that can remain undisturbed by the application of amenity pesticides and fertilisers and with careful management and stewardship can provide ideal circumstances for the retention of the natural environment for plants, animals, birds and insects.

With the development of Environmental Management ideas it appeared appropriate to evaluate their effect on our golf courses. The results

Table 1

| For Herbicides Products: | Increase | Same | Decrease | No answer |
|---|---|---|---|---|
| Frequency | 6 | 28 | 31 | 0 |
| Area | 9 | 28 | 24 | 4 |
| Number | 8 | 27 | 22 | 8 |
| **For Fungicide Products:** | | | | |
| Frequency | 16 | 19 | 29 | 1 |
| Area | 8 | 38 | 11 | 8 |
| Number | 15 | 24 | 18 | 8 |
| **For Insecticide Products:** | | | | |
| Frequency | 8 | 32 | 26 | 2 |
| Area | 9 | 30 | 19 | 7 |
| Number | 6 | 26 | 22 | 11 |
| **For Fertiliser Products:** | | | | |
| Inorganic | 17 | 3 | 27 | 18 |
| Compound | 26 | 4 | 26 | 9 |
| N only | 20 | 4 | 23 | 18 |
| P/K only | 17 | 3 | 20 | 25 |
| Organic | 40 | 2 | 9 | 14 |
| Slow Release | 29 | 3 | 10 | 23 |
| **Others:** | | | | |
| Conditioners | 5 | - | - | - |
| Liquid Fe | 4 | - | - | - |

Table 2

| | IPM aware (%) | | Use IPM (%) |
|---|---|---|---|
| Yes | 60 | Yes | 29 |
| No | 40 | No | 71 |

Table 3

| % Rough | No. Courses |
|---|---|
| 0-10 | 5 |
| 11-20 | 11 |
| 21-30 | 13 |
| 31-40 | 9 |
| 41-50 | 8 |
| 51-60 | 9 |
| 61+ | 4 |

Table 5

| Advertising | Companies (%) |
|---|---|
| Other GKs | 66.7 |
| Contractors | 46.7 |
| Suppliers | 73.3 |
| Manufacturers | 73.3 |
| Ind Agronomist | 53.3 |
| Trade Press | 66.7 |
| Others | 20 |

Table 4

| For Herbicide Products: | Increase (%) | Same (%) | Decrease (%) | No Comment (%) |
|---|---|---|---|---|
| Frequency of Application | 40 | 13.3 | 13.3 | 66.7 |
| Number of Herbicide Products Sold | 33.3 | 0 | 20 | 46.7 |
| **For Fungicide Products:** | | | | |
| Frequency of Application | 33.3 | 20 | 13.3 | 33.4 |
| Number of Herbicide Products Sold | 20 | 13.3 | 20 | 46.7 |
| **For Insecticide Products:** | | | | |
| Frequency of Application | 33.3 | 6.67 | 13.3 | 46.7 |
| Number of Herbicide Products Sold | 20 | 0 | 20 | 60 |
| **For Fertiliser Products:** | | | | |
| Inorganic | 26.7 | 13.3 | 6.67 | 46.67 |
| Compound (N, P, K) | 20 | 20 | 13.3 | 46.7 |
| Nitrogen only | 33.3 | 6.67 | 6.67 | 53.35 |
| K/P only | 20 | 6.67 | 20 | 53.3 |
| Organic | 53.3 | 0 | 6.67 | 40 |
| Slow Release | 53.3 | 6.67 | 0 | 40 |
| Other – Control Release | 6.67 | 0 | 0 | 93.3 |
| Liquids | 6.67 | 0 | 0 | 93.3 |

Table 6

| Form of Trading | Rating: 1 | 2 | 3 | 4 | 5 | Other |
|---|---|---|---|---|---|---|
| Trade Shows | 0 | 26.7 | 40 | 20 | 0 | 13.3 |
| Trade Press | 6.67 | 13.3 | 26.6 | 33.3 | 6.67 | 13.5 |
| Company Representatives | 66.7 | 6.67 | 0 | 6.67 | 6.67 | 13.3 |
| Company Literature | 0 | 33.3 | 26.6 | 26.6 | 0 | 13.5 |
| Other (Seminars) | 6.67 | 0 | 0 | 0 | 0 | 93.33 |

Table 7

| Changes made | Yes (%) | No (%) | No Comment (%) |
|---|---|---|---|
| Environmentally Friendly Products | 80 | 3.3 | 16.7 |
| Increase in Specific Target Pest & Disease Products | 53.3 | 13.3 | 33.3 |
| Reduction in Broad Spectrum Products | 46.7 | 20 | 33.3 |
| Decrease Persistence of Chemical after Application | 46.7 | 13.3 | 40 |
| Other - Product Stewardship Campaigns | 6.67 | 0 | 93.3 |

Figure 1: Previous Land Use

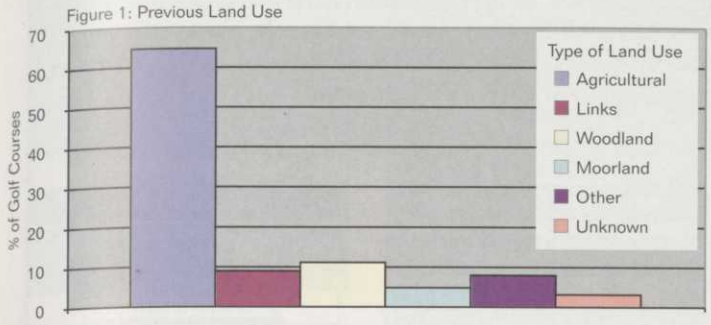



Figure 2: Where do you get your information from?

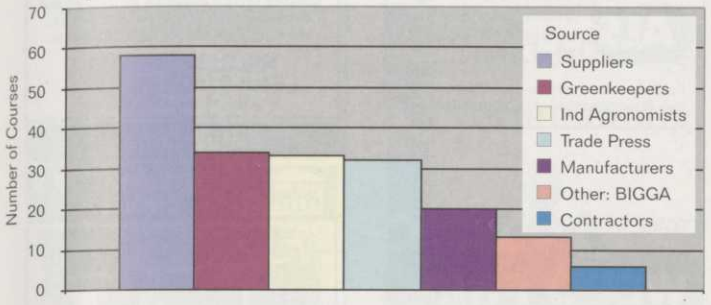



Figure 3: Features outwith Playing Areas of the Golf Course?

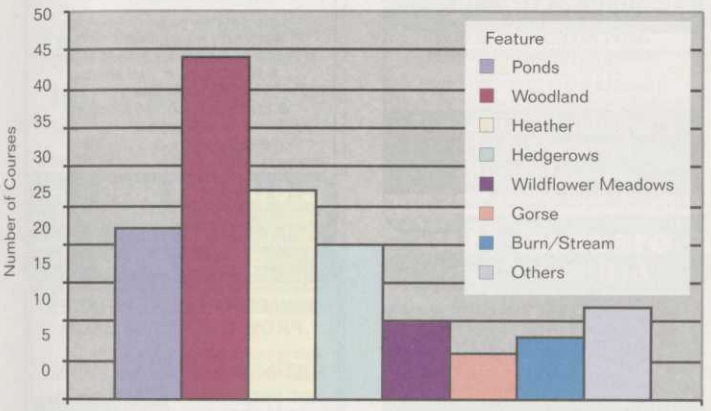
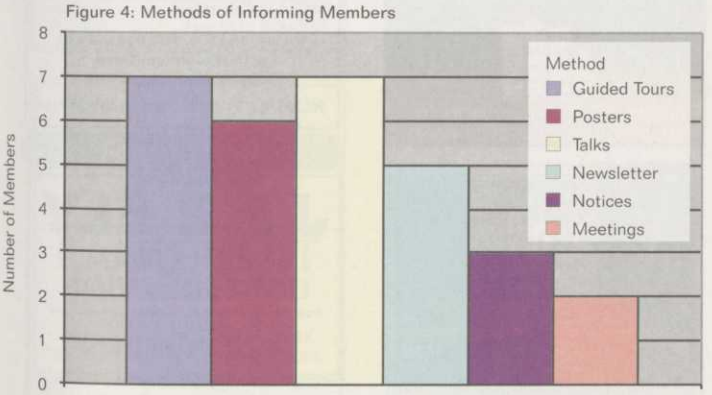



Figure 4: Methods of Informing Members




were carefully analysed and the major conclusions to be made from the answers included; pesticide use had decreased in the last ten years, the use of organic fertilisers has increased and there is a limited awareness of IPM techniques.

Furthermore, a number of initiatives are being developed both nationally and internationally to encourage environmental management. Now agrochemical companies are working more closely with greenkeeping staff to produce and market more environmentally friendly products.

Nicola Gemmell is currently gaining experience of greenkeeping at Elmwood Golf Course, Fife. She would be interested in discussing this project and is contactable on 01505 613350 (answerphone) or via email - nicgemmell@hotmail.com

Manager's special?