

SprayDay mobile app for infrequent pesticide users



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Pesticides are an important tool in modern agricultural practice, but it is recognised that their use can have significant negative ecological impacts and pose risks for human health if not removed from drinking water sources. Whilst there are technological solutions available to remove the majority of pesticides from drinking water, these approaches are expensive and may not always be effective. Consequently, the use of professional pesticide products is strictly controlled, with usage limited to holders of, or those supervised by holders of, appropriate certification.

One challenge that is becoming increasingly apparent is that the infrequent use of pesticide products by many users means that adherence to best practice can be problematic. In addition, the best source of information is not always clear, or easily accessible. This problem is further exacerbated by the fact that pesticide usage is a practical process meaning that notes taken in training sessions are unlikely to be to hand when questions arise in the farmyard or the field. Modern tools such as mobile telephones and the internet provide a theoretical solution to this problem, but connectivity in rural areas, is often poor and many individual users still prefer a more traditional method for gaining information.

One of the aims of the FAIRWAY project (<https://fairway-project.eu/>) was the development of a phone app that would provide guidance to users on the application, disposal and environmental risks associated with the use of different pesticides for weed and pest control.

The work was undertaken in a number of stages:

1. Market Research:

Market research was carried out in two steps. A review of the currently available online resources showed that there were a small number of resources available that specialised in providing information on specific factors relating to pesticide usage, but none sought to act as a centralised hub for all issues. Further, provision tended to target more frequent users and those who have recently purchased new equipment.



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The second step was a series of structured interviews with 83 farmers who used professional pesticide products. The purpose of these interviews was to determine the specific mix of features that would increase the appeal of the app to potential users.

2. App Design and Development:

Building on the outcomes of the market research, the app development team, which consisted of scientists and software developers, determined that the most appropriate target audience for this app would be:

- Users who apply pesticides infrequently (1-2 times a year).
- Users who would like assistance with calibration and dilution calculations
- Users who want access to easy-to-use, straightforward decision support tools

The development team then used a number of MoSCoW meetings (**M**ust have, **S**hould have, **C**ould have, **W**on't have) meetings to determine the content of the app. These are:

- A local weather forecast and an assessment of the suitability of conditions for planned pesticide application.
- Sprayer details, to include calibration and dilution of pesticide guides
- The ability to photograph and archive any aspect of pesticide usage that users wish to document
- A brief exploration of the regulations on the disposal of pesticide-contaminated items (e.g. containers, PPE, foil caps) as well as links to more in-depth sources of information (websites and organisations).

A series of wire-frame visualisations were then developed and presented to stakeholders representing agricultural interests, civil servants, academics and professional training bodies from across the island of Ireland, Great Britain and Europe in order to gain their feedback on content and presentation.

Following a final MoSCoW meeting, the app was developed to operate under the Android mobile phone software platform, which holds approximately 72% of mobile phone operating system market share. The working prototype was developed following industry standard software development lifecycle processes in line with internal best practices and procedures and using the Xamarin Open-source mobile app platform for .NET. An object-oriented approach to coding was taken where the different elements of the system were designed, coded and tested individually and then brought together to form the completed system. System testing was carried out using Android OS emulation software before the first round of user-acceptance testing. The App was named "Sprayday".

3. User review and testing:

The app was presented to 64 stakeholders from across the island of Ireland, the United Kingdom and Europe. Individuals represented a range of interest groups, ranging from civil servants to agricultural advisory service employees and from water utility employees to farmers. Several participants who had participated in the initial market research survey were included in this group. Overall feedback received was positive with more than 94% of respondents stating that they believed that the app was suitable for the target user groups. A number of respondents made it clear that they would prefer to see a more richly featured app that would provide users with the ability to generate the documentation associated with pesticide application, as well as storeroom records, as they felt this would improve the appeal of the app to the community. However, other respondents took exactly the opposite view, indicating that they felt that a simple app would be more appealing to the target audience.

Restrictions in 2020/21 due to Covid-19 meant that it was not possible to carry out a field trial of the app and there is a clear need for this work to be undertaken. In addition, future works should include the following components.

- Explore alternative weather data suppliers other than the UK Meteorological Office (e.g. Met Eireann, Meteo Weather). This would enable the user to select their preferred data provider and would broaden the appeal to non-UK users.
- The complexity of handling weather data at this scale meant that it was not possible, within the current project timescale, to develop the protocols necessary to assess the suitability of the weather for spraying on the day that the user consults the app. This is a clear limitation of the app that needs to be addressed in the next phase of development.
- The app currently provides a basic suite of services to all users. The utility of the app may be increased by the addition of login facilities where more advanced functionality can be accessed. This could include record management and interfacing with existing commercially available farm management software.
- At present the app is written solely within the Android environment. Further work, within the Xamarin Open-source mobile app platform, would allow expansion onto the Apple platform. The possibility and benefits of expanding onto the Linux and Windows mobile operating systems could also be considered.

In conclusion the SprayDay app is a Decision Support Tool designed to target low-frequency users of professional pesticide products and assist with their adoption of best practice. There is a particular focus on providing information on the planning and execution of pesticide application. The app has been developed to approximately TL6 (Technology demonstrated in relevant environment) or TL7 (System prototype demonstration in operational environment) and has primarily targeted the Northern Irish/UK market but could be adapted for the international market as part of a programme of further developments focused on developing the app to TL9 (Actual system proven in operational environment). Reviews suggest that the app has successfully been designed to appeal to infrequent users (1 – 2 applications per annum) of professional pesticide products from both agricultural backgrounds and other business sectors, such as groundskeepers managing amenity spaces.

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