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The provision of pest and disease information using Information Communication Tools (ICT); an Australian example

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ABSTRACT

The Australian grains industry relies on growers and agronomists to report endemic pest and disease issues in their crops to their local agriculture department and to also report anything that appears unusual. Previous work conducted by Wright et al., (2016), demonstrated that 70% of growers and 80% of agronomists could identify endemic diseases in crops. However, skills in identifying high priority pests and diseases that can cause major threats were very low. To improve the surveillance and reporting skills of growers and agronomists the use of information communication tools (ICT) was explored. These tools included; webinars, YouTube videos, podcasts and a mobile app.

A survey was conducted with growers and agronomists within the Australian grains industry to determine if they use smartphones or tablets, the Internet and mobile apps. Currently there is a digital divide in Australia as individuals in major cities have better access to Internet services than those in rural regions. In our survey, agronomists accessed the Internet more frequently than growers, and those participants with a university education accessed the Internet more frequently. There was no demographic influence on the usage of apps by participants.

A suite of apps was developed by the Department of Agriculture and Food, Western Australia called MyPestGuide (MPG) suite. In this suite there are a number of different tools, one of them being MPG Reporter. This app was promoted to encourage growers, agronomists and the general public to report anything unusual in their crops, gardens, parks or local bushland. This app was also used during a recent outbreak of Russian Wheat Aphid (*Diuraphis noxia* (Mordvilko)) (RWA) in South Australia in June 2016. Western Australia asked all growers, agronomists and departmental staff to send in reports of presence and absence of the aphid in crops during their seasonal work via the app. Approximately 500 reports were made, supporting the absence of this pest in Western Australian crops.

Ten webinars were held during the 2015 growing season and 2016 growing season on topical pest and disease issues in Western Australian grain crops. These webinars were converted to YouTube videos that proved to be very successful with agronomists, as they provided a source of readily available information that was up-to-date. The use of podcasts was trialled during the 2016 growing season for those participants in regional areas that have poor Internet access. Information on RWA was provided to growers and agronomists for the first time using webinars and YouTube videos. The YouTube video was the most frequently watched video out of all the videos produced.

Our research has shown, that growers and agronomists are very receptive to the use of ICT as a method to provide immediate and up-to-date information in relation to pest and diseases in crops.

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1. Introduction

1.1. Biosecurity and pest and disease identification

The impact of pests and diseases on the grains industry in

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Australia is estimated to be $77 (AUD) per hectare annually. These losses represent 19.5% of the average annual value of the crop production over the last decade (Murray and Brennan, 2009a, b; 2012). Improving the knowledge and skills of growers and agronomists could be important for reducing these losses. However, it is not always easy for growers and agronomists to access training courses due to time commitments, degree of interest and the availability of information and training in a format that is perceived to be useful (Wright, 2017). An alternative to attending a training event is needed that will enable the skills and capacity of growers and agronomists to be increased.

The Australian grains industry relies upon growers and agronomists being aware of pests and diseases in their crops and notifying their local State Agricultural department when they suspect there has been an incursion of a high priority pest (HPP). This is to facilitate the effective management of endemic diseases and pests and to prevent the incursion and establishment of biosecurity threats (Hammond et al., 2016a, b; Wright et al., 2016a). Based on the requirement for accurate identification, a training needs analysis (TNA) was conducted by Wright et al. (2016a) on the ability of growers and agronomists in the Australian grains industry to recognise endemic leaf diseases in their crops. The TNA showed that benchmarks of 70 and 80% for growers and agronomists respectively were met for the identification of endemic leaf diseases in their crops. However, the ability of growers and agronomists to recognise the top four high priority pest threats to the grains industry was well below expectations (Hammond et al., 2016a; Wright et al., 2016a).

Russian Wheat Aphid (*Diuraphis noxia* (Mordvilko)) was one of the top four high priority pests in the Australian Grains Industry (Plant Health Australia, 2016). This pest was detected and identified in Australian for the first time in June 2016 in in the mid-north region of South Australia (PIRSA, 2016). This detection meant that the other States in Australia undertook surveillance of wheat and barley crops and other potential grass hosts to determine the spread of the pest. This new incursion provided the opportunity to test if information communication technology tools (ICT) could be used for providing information in relation to the surveillance and reporting of pests and diseases in crops.

1.2. Information Communication Technology tools

Web 2.0 technologies enable online sharing, collaboration and networking to occur throughout the world in both developing and developed countries (Aker, 2011; James, 2009; Rhoades and Aue, 2010). Information communication technology (ICT) tools have enabled and created changes in the way information is transferred to people in developing and developed countries (Aker, 2011; Formiga et al., 2014; James, 2009; Rhoades and Aue, 2010; Wright et al., 2016b). Tools considered in our research paper included the use of webinars, mobile apps, YouTube videos and podcasts. Webinars and YouTube videos allow extension to reach more individuals and provide education over large geographic areas (Johnson and Schumacher, 2016). Webinars are an excellent communication tool as they allow two-way communication and therefore interaction to occur between participants and the presenter (Formiga et al., 2014; James, 2009). The interaction occurs between participants either verbally or by typing questions, and the use of webcams allows participants to see each other. YouTube videos however, do not provide the two-way communication between the presenter and the audience.

Formiga et al. (2014) evaluated the use of webinars in an eOrganic program for the USA and found that they reached a very large audience of farmers, extension educators, agricultural professional, researchers and some students. In the USA many farmers now have access to high speed Internet, and are more likely to access webinars. The use of email newsletters were the best way to inform participants within the industry about webinars whilst social media only generated one percent of their webinar participants (Formiga et al., 2014). In this study, Formiga et al. (2014) found that growers were not interested in research-based webinars; they preferred webinars that provided practical recommendations based on research. When participants were surveyed after the webinars; it was demonstrated that knowledge had increased and some participants had changed their working practices in response to the information in the webinar (Formiga et al., 2014; James, 2009; Johnson and Schumacher, 2016).

Access to ICT has increased with the increase of mobile phone ownership in the last decade regardless of whether they are smart phones or not (Aker, 2011; Walter, 2011). In developing countries such as in sub-Saharan Africa, Asia and Latin America, more than 60% of the population had access to mobile phones (Aker, 2011), and in rural regions of developed countries mobile phone ownership is approximately 90%. In the USA, Walter (2011) showed that 94% of farmers had a mobile phone and 70% of them used it to access the Internet. However, in the USA, Australia and Europe the digital divide still exists between urban and rural areas (Salemink et al., 2017; Willis and Tranter, 2006); access to the Internet is not equal for all. Access to the Internet is generally available through telephone lines, however, cable Internet, fibre optics and mobile broadband are widely available except in rural areas (Salemink et al., 2017). In Australia, although mobile phone coverage is expanding in rural regions, according to the Telstra coverage map (https://www.telstra.com.au/coverage-networks/our-coverage, accessed on the 23rd October 2016) most of the Western Australian wheatbelt only has 3G connectivity and some areas require a 3G external antenna for reception on their mobile devices. Eastern Australia appears to have more 4G device coverage in rural areas however, the majority is still relies on 3G connectivity. Thomas et al. (2016) found that there was a difference among states in Australia in the percentage of households that have access to the Internet; those that live in cities have are more likely to have access compared to those that live in regional Australia. Indeed, 88% of households in major cities have access, 82% of those living in inner regional and 79% of those in outer regional areas Australia, have access respectively (Thomas et al., 2016). Over 50% of people in the regional areas of Australia rate their internet coverage as very poor, and this affects their ability to connect to ICT initiatives, and is therefore reducing their production efficiency (Vidot, 2016).

Mobile apps can be grouped into three categories: a) information delivery; b) collaborative research; and c) decision support tool (Drill, 2012). Information delivery means that the user can access information when they want to (Drill, 2012). The Department of Agriculture and Food, Western Australia (DAFWA) developed the MyPestGuide suite of apps (MPG), as a set of tools that enables two-way collaboration between participants and DAFWA researchers. The apps function on both Apple and android devices and the suite has a selection of information delivery tools (MPG Guides) that contain information on major pests and diseases in crops. There are three MPG guides: a) Crops which contains 202 pests of grain crops; b) Grapes which contains 138 pests and diseases associate with table and wine grapes and c) Diseases which contains common diseases along with high priority pests on grain crops. Another component of MPG is the reporting function (MPG Reporter); photos can be taken and uploaded to a database in DAFWA where it is then reviewed by the relevant entomologist and/or pathologist and an email is sent back to the participant with the identification of the pest and/or disease found in their crop and the information is mapped. When using MPG reporter the participant does not need to be in mobile data range when they make a report. The report

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