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Can general surveillance detect high priority pests in the Western Australian Grains Industry?

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ABSTRACT

Initial detection of plant pests (includes diseases) is often made by the growers and consultants that work directly with crops; this form of detection is referred to as general surveillance. General surveillance activities have an important role in plant biosecurity for the early detection of pests and for demonstrating area freedom. In the Western Australian grains industry, reports of suspect high priority pests to the state Department of Agriculture and Food is the main form of general surveillance. There is little information on the level of knowledge of high priority pests in the grains industry in Western Australia and the ability of members to detect high priority pests if they were present. This study details a survey of members of the grains industry to determine their knowledge of the signs of high priority grains pests and the likelihood that they would detect a high priority pest if it were present in grain or crops. Knowledge of the signs of the high priority grain diseases, Karnal bunt and Barley stripe rust, were found to be higher than those of the high priority insect pests, Khapra beetle and Russian wheat aphid. A wide range of responses was collected from respondents' self-rated likelihood of detecting each of these pests and diseases in crop or harvested grain. However, respondents were more confident in their ability to detect the two plant diseases than the two insect pests. The results of this study suggest that further training in recognition of the signs and symptoms of high priority grains pests is required to increase the ability of members of the grains industry to confidently detect and differentiate high priority pests from common pests in the course of routine activities.

1. Introduction

Surveillance is defined by the International Plant Protection Convention (IPPC) as 'an official process which collects and records data on pest occurrence or absence by survey, monitoring or other procedures' (FAO, 2013, International Standards for Phytosanitary Measures (ISPM) No. 5). In terms of general plant health, surveillance could be loosely defined as any activity involving the close observation of plants or their surrounds, which generates information on the presence or absence of a pest. Thus, it also includes the collection of data on pest occurrence or absence through other sources such as published literature, data from diagnostic laboratories and reports from experts, growers and agricultural consultants that have knowledge of the pest in the geographical area of interest (FAO, 2011, International Standards for Phytosanitary Measures (ISPM) No. 6). The terms specific survey and general surveillance are commonly used in the area of plant health, based on whether information is collected through active, targeted pest or host surveys (specific surveys) or through other activities that are not specifically undertaken for the pest(s) of interest such as results of routine diagnostic samples and reports to government departments. This type of surveillance is known as general surveillance (FAO, 2011, International Standards for Phytosanitary Measures (ISPM) No. 6; Hellström, 2008; Kean et al., 2008).

General surveillance activities are an important part of early detection and demonstrating area freedom. Early detection of plant pests allows a rapid response to an incursion and improves the likelihood of successful eradiation or pest management. General

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surveillance uses data that has been generated for other purposes and often includes reports of suspect cases to the authorities (Hadorn and Stärk, 2008; McMaugh, 2005). Much of the data available from general surveillance in the Western Australia (WA) grains industry is collected through reports of endemic and unusual plant pests that have been detected by growers and consultants. Samples are sent to diagnostic services and reports made to the Department of Agriculture and Food, Western Australia (DAFWA) by growers, agricultural consultants and researchers.

Reporting systems and samples submitted to diagnostic laboratories rely on an individual detecting a suspect pest in a crop or grain and being able to differentiate it from common pests and diseases. The ability to detect a suspect disease has been shown to be an important factor in the ability of general surveillance systems to detect animal diseases (Hadorn et al., 2008, 2009; Hadorn and Stark, 2008; Martin, 2008). Common factors that influence the sensitivity of many animal health general (passive) surveillance systems are the “disease awareness” of farmers and veterinarians and the probability that clinical signs of the disease are detectable.

In the broader literature there are few studies relating the probability of detecting exotic pests via general surveillance. Many studies of surveillance systems in animal health utilise broad semi-quantitative categories to represent disease awareness (Hadorn et al., 2008, 2009; Hadorn and Stark, 2008) or use values elicited from expert opinion to parameterise probability distributions (Martin, 2008). One study assessing community members’ ability to detect fictional exotic plant pests has been conducted in Australia, however this study simulated an active surveillance program providing training in recognising the fictional pests to the participants prior to the surveillance exercise (Mangano et al., 2011). There have been no studies to date focussing on surveillance for high priority pests (HPPs) in the Australian grains industry.

With a view to modelling the contribution of general surveillance to establishing area freedom, we investigate detection of four HPPs by the WA grains industry. A questionnaire was directed to members of the WA grains industry to 1) elicit the reporting structure for grains pests in WA, 2) identify factors that influence reporting behaviour in the grains industry, and 3) elicit data that can be used in the quantitative evaluation of general surveillance programs relating to the likelihood that suspect HPPs will be detected and reported by members of the grains industry in Western Australia.

This paper reports on the results of the questionnaire that relate to the detection of high priority plant pests (HPPs) and the knowledge of signs of four HPPs held by members of the WA grains industry.

2. Methods

The study encompassed members of the grains industry in WA including members of the general public who handle cereal grain as part of their main source of income through involvement in growing grain crops, providing advice to growers of grain crops, handling of grain or conducting research or testing of grain crops. A cross-sectional survey was performed during the 2008 growing season (May–December) using both random and opportunistic sampling.

2.1. Questionnaire

The questionnaire was sent by mail to 300 randomly selected growers generated from DAFWA's Client Resources and Information Database. Complete sampling frames for the other groups involved in the grains industry do not exist; therefore opportunistic sampling was used to collect responses from these groups. Agricultural consultant groups, grower groups and researchers in Western Australia dealing with grain crops were identified from listings on the Australian Association of Agricultural Consultants (WA) Inc. website (http://www.aaacwa.com.au/) and through a Google search. Larger agricultural consultant groups (12) and grower groups (2) were contacted through their state representatives with a request to circulate the questionnaire to their members. The leaders of research groups at DAFWA (Biosecurity, Cereal breeding, Entomology and Plant pathology groups), CSIRO Entomology and Plant Industries, University of Western Australia, and Curtin and Murdoch Universities were also requested to circulate the questionnaire to staff in their groups. Thirty-seven agricultural consultants that operate as small businesses or individuals were contacted through individual emails. Agricultural consultants, grower groups and researchers were asked to complete the questionnaire online. For both the online survey and the mail-out survey a reminder was sent at approximately five weeks (35 days) after the initial contact.

When formulating the questionnaire care was taken to ensure that a clear outline of the purpose of the survey was presented and that the questions were clear and unambiguous to reduce unintentional biasing of responses. Questions were posed in a variety of forms including Likert-scales, multiple-choice questions, and a probability scale (Appendix 1). The order of the factors in questions 3, 7 and 8 were randomised in the online questionnaire. Four different randomisations were used for the mail-out questionnaire to reduce any bias that may have been introduced by the ordering of choices.

Responses to Question 5 were coded based on the problem as described into the following categories; stored grain insect, mouldy/discoloured grain, weed seed, other foreign object, screenings (small, shrivelled seed), sprouting grain, in-crop disease issue, in-crop insect issue, and seed-borne disease.

Questions 9 through 12 were designed to assess the respondents’ familiarity with the symptoms and signs of the four HPPs of grain crops. The four HPPs considered in the survey were *Tilletia indica* Mitra 1931 (Karnal bunt), *Puccinia striiformis* f.sp. *hordei* Eriksson 1894 (Barley stripe rust), *Diuraphis noxia* Kurdjumov, 1913 (Russian wheat aphid) and *Trogoderma granarium* Everts, 1899 (Khapra beetle). These questions were scored as multiple true/false questions with eight possible symptoms/characteristics for each HPP, of which three to four were symptoms/characteristics known to be associated with the HPP (Table 1). Each correctly marked symptom/characteristic, associated symptoms/characteristics checked and non-associated symptoms/characteristics not checked, was scored equally for a possible total score of one where all answers were correct. The order of the possible choices in questions 9 to 12 which related to detection of HPPs were randomised in the online questionnaire. Four different randomisations were used for the mail-out questionnaire to reduce any bias that may have been introduced by the ordering of symptoms/characteristics.

2.2. Data management and analysis

The online questionnaire was designed and administered using SurveyMonkey, web-based survey software available at www.SurveyMonkey.com (Finley, 2008). Statistical analysis of the survey responses was conducted in the statistical software environment R (version 2.11.0) using the reshape, plyr and stats packages for data analysis and the ggplot2 package for generating plots of the results (R Development Core Team, 2008; Wickham, 2007, 2009a, b). Homogeneity tests (Fisher exact) were used to assess between-group differences in responses based on demographic