



## Factors determining pesticide use practices by farmers in the Sultanate of Oman



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### HIGHLIGHTS

- Data for pesticide use on farms in Northern Oman are presented.
- Use of prohibited and restricted active ingredients is less on farms that belong to a local Farmers' Association.
- The belief that pesticide use is always beneficial declines with age and education status of respondents.
- Pesticides on farms in the association are more likely to be branded products from international manufacturing companies.

### ARTICLE INFO

#### Article history:

Received 4 August 2013

Received in revised form 9 December 2013

Accepted 9 December 2013

Available online 1 February 2014

#### Keywords:

Pesticide use

Farmers' Association

Oman

Risk aversion

### ABSTRACT

In a study of pesticide use on farms in Oman, over 200 respondents were surveyed from amongst owners of and workers on farms that belonged to a Farmers' Association (FA) and those that did not belong to the FA. A questionnaire was used to gauge attitudes to pesticide use whilst inventories of active ingredients were taken for all farms. The age profiles of the respondents were broadly similar, as was the distribution of nationalities amongst the workers. Workers and owners of FA farms were better educated than respondents from non-member farms. A majority of non-FA farm workers reported that they always used pesticides, fewer FA member farm workers and non-FA farm owners reported this behaviour with FA owners showing the lowest proportion of respondents who always used pesticides. Responses amongst farm owners to questions about frequency of pesticide use suggested that this was unaffected by age or education status, but for farm workers younger or less well educated respondents were more likely to respond by indicating that pesticides were always used. When asked to rate pesticides on a scale of 1 (bad) to 10 (good), high responses were most frequent amongst non-FA farm workers followed by FA member farm workers and non-FA farm owners. On average FA farm owners had the lowest average response, and responses by all groups were unaffected by age or education status. Prohibited pesticide use was higher on non-FA farms (4.9% of all pesticides) than on FA farms (1.3%). Pesticide products observed on FA member farms generally contained newer classes of active ingredients and were most frequently from major manufacturing companies in Europe, North America and Japan. Older, off-patent active ingredient-containing products were frequently observed on non-FA farms, often from so-called 'me-too' producing companies in Asia, the Middle East and North Africa.

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### 1. Introduction

The growth in the use of pesticide use over the past 50 years has been an integral part of the technological revolution in agriculture that has helped deliver major increases in productivity across much of the globe. The mechanisation revolution of the 1930s and 1940s has been augmented since 1945 by a chemical revolution in terms of pesticides, but this has come with an environmental cost. Problems associated with pesticide use in developing countries are mostly associated with misuse and can be attributed to a number of causes (Atreya et al., 2011),

including lack of education and training in pesticide use, pesticide subsidies, lack or inadequate information on hazards, difficulty in conducting needed research due to fiscal constraints, problems of communication from state extension organisations, unwillingness of farmers to accept the risks of crop loss, the effect of the tropical climates and inadequate regulation and enforcement (Brader, 1982; Schaefer, 1990). In many developing countries the development and enforcement of pesticide policy and regulations does not have priority, and as a result there can be an absence of a clear over-arching strategy for pesticide management (Panuwet et al., 2012). Issues of connection between agricultural researchers, practitioners and policy makers continues to be an issue despite repeated calls over many years for more evidence-based policy (Pretty et al., 2010). But even if appropriate policy and

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regulations have been developed it is necessary to highlight that they alone cannot accomplish this objective unless they are both enforceable and enforced (Schaefer, 1996). However, most developing countries lack policies and sufficient numbers of trained inspectors to monitor and enforce regulations. Whilst there have been notable examples of success with enforcement of stringent policies in some developing countries (Okello and Swinton, 2010) these are relatively few and far between. It would appear that the effective transfer of information to farmers and establishing the means of providing them with advice on the proper use of pesticides are keys to reducing many of the pesticide-related problems in developing countries (Ecobichon, 2001). Rhetorical and practical commitment to pesticide use in developing countries is frequently well established especially to broad-spectrum compounds such as organophosphates and carbamates that are noted for their acute toxicity. These products remain attractive to farmers in part because they are no longer under patent protection and are thus considerably cheaper than many newer products. Indeed many pesticides that have been prohibited in developed countries are still produced and sold in developing countries, either by domestic companies or by multinationals acting through subsidiaries or joint ventures (Mansour, 2004; Schreinemachers and Tipraqsa, 2012). In many developing countries there is an obvious lack of adequate institutional structures and their ability to govern the production and sale of pesticides is limited, and some have even pointed to an interaction between 'bureaucratic quality' (assessed with a suite of indicators) and the influence of the pesticide industry (Marcoux and Urpelainen, 2011); poorer bureaucratic quality tends to provide opportunities for greater influence from the pesticide industry. This is a field that requires further research, especially in developing countries, as there are still many gaps in our knowledge. This paper presents the results of a research project designed to explore the use of pesticides by farmers in Oman, a part of the world where there is a dearth of knowledge regarding the use of this technology.

Anecdotal evidence and import statistics suggest that the use of pesticides has increased dramatically in Oman during the last decades, as shown by the number of Royal Decrees relating to industrial chemicals and pesticides. Royal Decree 46/1995 is concerned with industrial chemicals and pesticides whilst Royal Decree 64/2006 is concerned with pesticide management. Ministerial Decision 194/2007 (from the Ministry of Agriculture and Fisheries Wealth, arising from Royal Decree 64/2006) published, for the first time in Oman, a list of prohibited and restricted pesticides. Ministerial Decision 25/2009 (from the Ministry of Environment and Climate Affairs, and arising from Royal Decree 46/1995) republished the list of prohibited and restricted pesticides as part of a much larger list of pesticides and industrial chemicals including ozone depleting substances. Most recently Ministerial Decision 41/2012 (from the Ministry of Agriculture and Fisheries Wealth, arising from Royal Decree 64/2006) republished, unchanged, the list of prohibited and restricted pesticides from MD 194/2007 and provided regulations covering the sale, handling and use of pesticides. Under these pieces of legislation, 131 pesticides were prohibited from use in Oman and a further 30 were given restricted status, meaning that they can only be used at specified concentrations and formulations. Indeed the shift in policy witnessed in Oman has highlighted tensions between on the one hand a desire to maximise agricultural production (for export and home consumption) as an economic desire and a growing desire to protect the environment. Although the 2007 pesticide regulation specifically prohibited certain pesticides perceived as the most environmentally damaging, the impact of the implementation of this policy has not been determined. As shown by Farah (1993) approximately 25% of developing countries lack any kind of legislation to control the distribution and use of pesticide, and 80% lack the resources to implement and enforce the legislation that does exist. A further concern, exemplified by recent research in Turkey (Durmusoglu et al., 2008) is the extent of the penetration into local markets of so-called "me too" products – pesticides containing off-patent active ingredients manufactured in many Asian, Middle Eastern and North African countries. In the case of

Abamectin (an insecticide, acaricide and nematocide) containing products, Durmusoglu et al. (2008) showed that the active ingredient content of many "me too" products was either chemically inferior or lower than stated on the container. Pesticide applications using sub-optimal or sub-standard amounts of active ingredient can have serious implications in terms of sub-optimal or sub-standard levels of pest or disease control.

The establishment, in 2006, of a local Farmers' Association in Oman provides a contextual backdrop to analyse how membership of a collective organisation might be able to ameliorate behaviour towards pesticide use. The Al-Batinah Farmers' Association in Oman was the first grouping of farmers to be officially sanctioned in the country. Members of the Association pay a minimal annual fee based on farm land area; they hold regular meetings to share experiences but do not conduct farmer field schools or similar direct-action collective practical training sessions. Membership of the Association is open to any farmer and the benefits derived by individuals include cost reduction through collective purchasing of equipment and consumables, increased produce marketing efficiency and knowledge sharing. Al Zadjali et al. (2013) have indicated that the Association appears to be acting as a conduit for knowledge diffusion alongside, or even in preference to the existing state extension service.

Given the importance of pesticides to both agricultural production and environmental damage, let alone societal factors such as their impact on human health, this paper analyses their use in Oman and the factors that have the greatest impact in moderating pesticide use attitudes in Oman especially those covered by the 2007 legislation. Specific objectives are to:

1. Evaluate the extent of pesticide use in general and of prohibited pesticides in particular,
2. Examine the extent, if any, of differences in attitude to pesticide use between farm owners and workers on Omani farms,
3. Explore the effect of age and education status on attitudes to pesticide use within groups of farm owners and farm workers,
4. Analyse the effectiveness of membership of a local Farmers' Association (FA) in influencing attitudes to pesticide use.

Objectives 1 and 2 were designed to set the scene by addressing major gaps in knowledge of pesticide use in Oman. In the case of objective 3 it was hypothesised that younger and more educated owners and workers would be more likely to be aware of the issues with pesticides and adopt better practices for handling and using them. Similarly in the case of objective 4 it was assumed that members of FAs would have a better awareness and handling/use of pesticides than non-members.

## 2. Materials and methods

### 2.1. The Sultanate of Oman

The Sultanate of Oman is located in the southeast of the Arabian Peninsula. The total land area is 309,500 km<sup>2</sup> and supports a total population of 2.7 million, 50% of whom live in Muscat or the northern Al-Batinah Governorate. Al-Batinah is the main agricultural region in the country with 44.3% of total production, with output rising at about 0.5% per year. Over 80% of the agricultural area is occupied by farms with areas of less than 2 ha and a wide range of crops are cultivated, most importantly dates (*Phoenix dactylifera* L.), lime (*Citrus aurantifolia* (Christm. & Panzer) Swingle), mango (*Mangifera indica* L.), Rhodes grass (*Chloris gayana* Kunth) and alfalfa (*Medicago sativa* L.), vegetables and other seasonal crops. Current production in Oman covers just one-third of Oman's food needs, making the country heavily dependent on imports. Agriculture and fisheries employ about 226,500 people, with close to 75% (169,600) of them being Omani (Al Zadjali, 2009). The number of agricultural labour wage earners is 72,155 of whom 15,213 (21.1%) are Omani whilst the majority 56,942 (78.9%) are expatriate labourers mainly from India, Bangladesh and Pakistan (Al Zadjali, 2009). Al Zadjali (2009) has suggested that the low-skilled labour

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