



## Personal safety issues related to the use of pesticides in agricultural production in the Al-Batinah region of Northern Oman



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### HIGHLIGHTS

- Pesticide-related safety standards are frequently poor on many farms in Northern Oman.
- Pesticides are frequently stored within the living accommodation of farm workers.
- Safety standards generally increase with the education status of farm workers.
- A local farmers' association (FA) has the effect of raising safety standards on member's farms.
- FA farm workers are more likely to conform to the behaviour shown by owners of FA farms.

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### ABSTRACT

The level of uptake and use of personal protective equipment (PPE) by farm workers in Oman is low; the conditions under which pesticides are stored are frequently below acceptable international standards. Research was undertaken to explore the drivers working against safe storage of agrochemicals and effective personal protection usage by pesticide application personnel. Results from a survey of over 200 respondents, representing workers in, and owners of, farms either within or outside a local farmer's association (FA), suggest that FA membership raises standards of behaviour both in terms of safe pesticide storage and use of PPE. Age of respondents had no apparent effect on the likelihood of PPE (gloves and masks) use. PPE use was, however, highest among respondents with more advanced educational backgrounds. Positive responses for glove and mask use, when applying pesticides, were higher for owners and workers in FA farms compared to non-FA farms. Lowest reported use of PPE was among workers in non-FA farms. Analysis of responses appears to indicate that behaviour patterns of workers in FA farms mirror that of the farm owners. This was not the case in non-FA farms. The results suggest that conformity to social norms, in this case acceptable work-environment behaviour, is a powerful driver behind raised usage levels of PPE in farms in Oman.

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### 1. Introduction

Previous research in Oman has suggested that membership of a local farmers' association can bring about an apparent increase in the level of adoption of safe-practice procedures related to pesticide use at the farm level (Al Zadjali et al., 2013, 2014). This appears to affect the choice of pesticide products with fewer prohibited pesticides encountered in farms that belong to a local association (Al Zadjali et al., 2014). For example, in farms within the local association 1.3% of products encountered were prohibited under local legislation compared to 4.9% in farms not in the local association (Al Zadjali et al., 2014). Similarly farms outside of the association were more likely to be using older pesticide

types, especially organo-phosphates and pyrethroids, whilst farms within the association were more likely to be using neonicotinoid (not currently restricted in Oman) and strobil-containing products (Al Zadjali et al., 2014). Membership of an association also appears to raise the level of awareness with regard to methods used for the safe disposal of pesticide waste (Al Zadjali et al., 2013). These papers by Al Zadjali et al. (2013, 2014) appear to be the first, not just from Oman, but also elsewhere, to report an effect of farmers' association membership on the safe use of pesticides at the farm level. However, even if membership of a local association decreases the use of prohibited pesticides and improves the procedures adopted for the safe disposal of pesticide waste, changes in other aspects of pesticide use remain to be determined – in particular the use of personal protective equipment (PPE) and the safe storage of pesticide products before and after use. These are important issues given the increasing political emphasis

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being placed on encouraging the establishment of more local associations across the country and given that local legislation places the onus of PPE purchase on the farm owner. Previous work (Al Zadjali et al., 2013, 2014; Al Zadjali, 2014) has described the economic and social benefits that accrue to members of the local association.

In a multi-year survey covering more than 8500 smallholder farmers in 26 countries, Matthews (2008) found that the highest proportion of those applying pesticides but declining to use some elements of PPE was in Asian countries, with Bangladesh being the highest. The reasons for low uptake of PPE adoption in countries such as Bangladesh are unclear but could have important ramifications for Oman where nationals from this country make up the overwhelming majority of farm workers (Al Zadjali et al., 2013). The likely reasons for low use of PPE have been classified into four main strands by Feola and Binder (2010). First, socio-demographic factors such as age, education and gender and/or socio-economic factors such as income and education status (Salameh et al., 2004; Mekonnen and Agonafir, 2002) may be disincentives to PPE use. Second, the significant cost may limit farmers' access to equipment, especially for smaller scale farmers (Yassin et al., 2002; Matthews, 2008). Feola and Binder's (2010) third strand suggests the importance of contingent and/or external factors such as pesticide label information accessibility (Gomes et al., 1999; Waichman et al., 2007) and discomfort felt by those working in the field (Cole et al., 2002); this may be important in Oman where temperatures during the growing season can reach 40 °C. The fourth strand identified by Feola and Binder (2010) include personal values and cultural orientation influencing risk perception (Palis et al., 2006). Feola and Binder (2010) raise a further category of factors influencing PPE use – social norms including peer pressure. Citing influences such as symbolic sanction (including mockery) it has been suggested that these factors might, through social conformity, work against the use of protective equipment (Feola and Binder, 2010).

In the current study the presence of a recently constituted local farmers' association in the northern part of Oman (Al Zadjali et al., 2013) provides the opportunity to examine a further factor related to social norms, namely employer pressure or expected behaviour norms applied to workers. The extent to which workers in farms conform to behaviour patterns prescribed by farm owners could provide insights into further mechanisms by which PPE use could be increased. In effect, is there evidence to suggest that membership of a farmers association, and the various factors that may be associated with that, such as exposure to information, training and 'peer' pressure, results in enhanced use of PPE among farm workers employed by farm owners? Whilst at first glance this covers similar drivers to those noted by Feola and Binder (2010) it raises the important issue of targeting. If farm owners become convinced of the need for PPE then can they not override the constraints to PPE adoption that one may see among farm workers? To date this potentially important contribution has not been explored in the literature.

## 2. Materials and methods

A detailed description of the study area has been given by Al Zadjali et al. (2013, 2014). The study was based within the Al-Batinah region since it represents the most important agricultural region of Oman and has similarities in terms of crop production methods to much of the region (Al Zadjali, 2014). From 171 farms randomly selected from those listed in the agricultural census database in Al-Batinah North and South governorates, face to face interviews were carried out between January and November 2012 (but excluding the May–September summer months when agricultural activities are minimal). A structured questionnaire was implemented with 213 farm worker and farm owner respondents. Respondents were divided into those from farms belonging to the recently constituted FA and those from non-FA farms. Within each group the respondents were divided into workers and owners in roughly equal proportion. 'Owners' here are defined as

those who actually own the farm and derive the benefits from selling produce. They may not necessarily be resident on the farm, but they are the ones who may become members of a farmers association. 'Workers' are in essence the labourers who work and, in most cases, live on the farm. The worker respondents were represented by the 'foreman' or most senior labourer present (Al Zadjali et al., 2013, 2014). The workers cannot become members of a farmers association, only the owners. Thus there were four categories of respondent in total:

- (a) FA – farm owner;
- (b) FA – farm worker;
- (c) Non-FA – farm owner; and
- (d) Non-FA – farm worker.

The emphasis of the survey was to determine the level of adherence to safety procedures related to pesticide storage, pesticide application and the use of personal protective equipment. Exploring differences in attitude among the owners of the farm – those with the responsibility to supply guidelines for safe pesticide use and provision of personal protective equipment, and those employed as essentially migrant workers – those with the responsibility for pesticide application procedures and ultimately for deciding whether or not to implement safety procedures including the use of protective equipment, was a key objective of the survey. General questions about farm size and labourer's nationality were included. Farms were grouped into sizes classes as very small (<2.5 ha), small (2.6–5.0 ha), small–medium (5.1–10.0 ha), medium (10.1–15.0 ha), medium–large (15.1–30.0 ha) and large (>30.0 ha). Information on respondents' age and education status were also included so as to explore differences between the FA and non-FA categories and how this might explain any differences in knowledge and practice. The questionnaire was semi-structured in nature.

For question on pesticide storage, responsibility for pesticide application and types of clothing worn during application, respondents were given prepared lists of key words (see Table 1) and asked to indicate their response. Two additional Likert scale questions were included to determine the supply/use of specific pieces of personal protective equipment, namely facemasks and gloves. No attempt was made to distinguish types of gloves or masks at this stage. Data were analysed for significant differences in response to Likert scale questions using the Kruskal–Wallis test for mean rank separation with  $P < 0.05$  taken to indicate a significant difference among mean ranks. Where significant differences in respondent group mean rank were indicated ( $P < 0.05$ ), individual mean rank values were separated by calculating the z-value for the threshold of significance using the method of Gwet (2011) implemented for Microsoft Excel 2010.

**Table 1**

Storage of pesticides, responsibility for pesticide application procedures and use of personal protective clothing reported by farm workers and farm owners in Al-Batinah region of northern Oman.

Figures are the percentage of respondents who reported a particular practice (no response figures are excluded).

	Workers <sup>a</sup>		Owners <sup>a</sup>	
	FA	Non-FA	FA	Non-FA
<i>Where are pesticides stored prior to use?</i>				
Worker accommodation	0.0	60.8	0.0	23.2
Separate place	96.2	39.2	100.0	69.6
<i>Who has responsibility for the application of pesticides?</i>				
Identified key workers	63.5	31.4	81.5	33.9
Any available worker	36.5	66.7	16.7	57.1
<i>What clothing does the pesticide applicator wear when spraying pesticides?</i>				
Normal clothes	88.5	80.4	74.1	80.4
Overalls	23.1	13.7	25.9	3.6
Hat	19.2	2.0	27.8	1.8
Boots	40.4	3.9	33.3	10.7
Glasses/goggles	3.8	15.7	24.1	16.1

<sup>a</sup> Data excludes those who gave no response.

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