Training as Part of the Capacity Building Ladder in Australian Agriculture

Dominie Wright[ab], Ann Grand[c], Bill MacLeod[c] and Lynette K Abbott[a]

[a]*School of Agriculture and Environment, The University of Western Australia, Crawley, Western Australia*
[b]*Department of Agriculture and Food, Western Australia, South Perth, Western Australia.*
[c]*School of Biological Sciences, The University of Western Australia, Crawley, Western Australia*

Corresponding author: Ms Dominie Wright. dominie.wright@research.uwa.edu.au; dominie.wright@agric.wa.gov.au

Abstract: This research evaluates growers' and agronomists' preferences regarding types of training, if training increases knowledge and how they intend to use increased knowledge. If Australian agriculture is to remain competitive, growers and agronomists perceive a need to continually update their skills and knowledge. A mixed methods approach was used to determine: a) what training events growers and agronomists preferred; b) why they preferred that style; and c) if participants' knowledge increased as a result after training. Data were collected from growers and agronomists in the Australian grains industry by questionnaire and interview. The data were analysed using non-parametric tests and inductive thematic coding. Growers preferred field days held on farms because of the relevance of the location and field experiments and the opportunity for informal interactions. Agronomists preferred formal workshops, whereas growers thought workshops were redundant. Participants' knowledge increased after training and was related to the activity attended. Growers and agronomists value field days and workshops for their opportunities for interaction and increasing knowledge. Growers preferred to attend field days. Agronomists valued field days but preferred to attend formal workshops. Participants' knowledge increased and many participants indicated that they would use this new knowledge on the farm or in the workplace.

Key words: Field days, workshops, growers, agronomists, knowledge levels, evaluation

Introduction

The political, social and economic climate has changed how extension (training and education) reaches Australian farmers (Carberry *et al.* 2002; Cristovão *et al.* 2009; Jones and Garforth 1998; Marsh and Pannell 2000). It has evolved from being a government-provided service to one predominantly delivered by agronomists (private consultants) and commercial companies (Keogh and Julian 2014; Marsh and Pannell 2000). These changes correspond to changes in farming in Australia; farming has become more mechanised and specialised (Keogh and Julian 2014) Farmers now need more specialist advice and targeted information (Cristovão *et al.* 2009; Jones and Garforth 1998; Marsh and Pannell 2000). Farms have also grown in size. In Western Australia, farm size has trebled (from 1000 ha to 3,500 ha under crop); increases in other states have been lower, to an average size of 1000 ha (Keogh and Julian 2014).

In the rural community, informal education programs enable change in individuals, communities and industries (Feder *et al.* 2011; Vanclay and Leach 2011). In Australia, since the early 2000s, extension has focussed on capacity-building and community engagement (Coutts and Roberts 2011). This paradigm relies on interactions between five models; a) facilitation and empowerment, b) technological development, c) information access, d) training and e) consultancy. These models can work alone, but are ineffective for capacity-building unless linked (Coutts and Roberts 2011). Vanclay and Leach (2011) argue that extension is only related to the primary industry sector, and yet, as exemplified by the American university land-grant system, extension covers much more. In the USA, extension

not only operates in rural communities but also in cities, and includes nutrition programs, youth programs, community gardens and master gardener programs, using workshops, webinars, seminars, and field trips. The effectiveness of these programs needs to be evaluated.

Any training program must be evaluated to determine its impact and effectiveness. Alvarez *et al.* (2004) define effectiveness as the examination of the variables that increase or decrease the success of the training at different stages of the program. Thus, in assessing the effectiveness of extension activities, for example farmer field schools or the use of farmer teachers, participants' knowledge should be tested before and after the training, and in some cases behavioural change is also monitored. Haccoun and Hamtiaux (1994) suggest a similar simple procedure for measuring training effectiveness; assessing participants' knowledge before and after (the 'internal reference' strategy), based on the assumption that training with relevant content will show more change than training with irrelevant content (Salas and Cannon-Bowers 2001). Glaze and Ahola (2010) monitored the change in knowledge of participants in a training program by asking them to self-evaluate before and after training using a Likert Scale (Likert 1932). However, Schmitt *et al.* (2000) found that the education level of participants influenced their perception of their knowledge before a training course. Those with higher education levels generally ranked themselves lower than those with lower education levels.

A considerable body of literature discusses the successes or failures of extension strategies in developing countries (Amudavi *et al.* 2009; van de Berg and Jiggins 2007; Yang *et al.* 2008) but there is very little research on their use in the grains industry of developed countries. This paper discusses the training preferences of Australian grain growers and agronomists and the evaluation of these activities to determine if growers' and agronomists' knowledge changed and how they plan to use this knowledge.

Materials and Methods

This paper reports on part of a larger project examining the training needs of growers and agronomists in the Australian grains industry in relation to pest and diseases in their crops (Wright 2017).

Research methods

Approval for this work was obtained from the Human Research Ethics Committee of The University of Western Australia (RA/4/1/6607).

Data were collected via questionnaires and interviews from participants attending three field days (Esperance Downs Research Station (EDRS), the Liebe Group Field Day and West Midlands) in Western Australia in September 2014. These locations were selected as they cover a range of cropping systems in low to high rainfall zones. These field days are very popular with growers and agronomists in those regions and more than a hundred people attended each event. Data were also collected from participants in three workshops in Victoria. Other data were collected from participants in the USA at seven field days and two workshops, but they are not presented here.

For this study, a grower was defined as a person who lives and farms land to produce grain crops. An agronomist was defined as a person employed by grain growers to provide technical information and advice for grain crop production (Wright *et al.* 2016). Participants were: growers (62%), agronomists (13%), other occupations (11%), government (8%), sales (4%) and university (2%). Participants had been working from less than one year to more than 31 years.

To examine the types of training attended by participants, two targeted questionnaires were developed, one for growers and the other for agronomists. Both questionnaires comprised six sections: A) how they like to obtain information, B) the types of training that they had attended in the previous 12 months (field days, workshops, grower group meetings, webinars, and seminars), C) pest and diseases in their crops, D) knowledge about diseases in crops, E) knowledge about biosecurity threats and F) demographic information, such as sex, age, occupation, length of time working and what crops they grew (Appendix A).

The questions were designed to be simple and easy to understand and provide reliable and valid measures (Fowler 2009; Dillman *et al.* 2009). The questionnaires were tested before distribution (Wright *et al.* 2016). The questionnaires were distributed (i) online via emails and newsletters, (ii) on paper at regional meetings during March 2014 and (iii) posted to growers and agronomists from the Birchip Cropping Group (Wright *et al.* 2016). A total of 133 growers and 108 agronomists answered this questionnaire.

The one-page questionnaire was administered before and after the events (Appendix B). Participants were asked to self-rate their knowledge using a Likert scale of 1-5; to rate their level of satisfaction with the event (1-5) and how they planned to use their new knowledge (an open answer question). A total of 124 questionnaires were collected from participants at the field days and workshops and 32 participants, selected at random, were interviewed.

The response rate from the two-targeted questionnaires was estimated to be 26% as it was not possible to determine the exact number of requests disseminated online. Questionnaires with incomplete demographic data (n=47), such as no postcode, were not included in the analysis. Due to the low number of returns from Queensland, NSW, Victoria and South Australia the data collected from these states were combined as "Eastern Australia" (EA) which was used in the corresponding cross tabulation and Pearson's Chi-Square analysis (Wright *et al.* 2016).

Analysis

This paper reports only on the identical sections of the two questionnaires, allowing comparisons to be made between growers and agronomists. These were: what type of training they had attended including field days, workshops, grower group meetings, webinars and seminars (questions 7, 11, 20), what barriers prevented them from attending the training events (8, 14), what they liked about the training they had attended (9, 12, 22) and how could it be improved (10, 13, 23). The final section collected demographic information from the participants (41, 43, 44, 47). (See Appendix A.)

The demographic data formed the variables used in the data analysis: *Age* (≤30 years, 31-50 years, ≥ 51 years)*; Education level* (school, vocational education training (VET), University)*; Occupation* (grower, agronomist); *Location* (Western or Eastern Australia) and *Sex* (male, female).

The questionnaire data were split into groups based on whether they came from workshops or field days and which state they were held in. They were analysed using SPSS23 (IBM, 2016) using cross tabulation and Pearson's Chi-Square (X^2) to determine the influence of occupation, age, sex, education and location on the types of training attended by participants, and barriers to attending training. If Pearson's Chi-Square failed the assumption that more than 20% of the cells had a frequency count of less than 5, then the Likelihood ratio statistic test was used in its place. This test is preferred when samples are small and still uses a chi-square distribution (Field 2013). A Wilcoxon Signed Rank test was used to compare participants' knowledge before and after the training. A Kruskal-Wallis test was used to examine the influence of occupations and length of working on knowledge and on the amount of learning participants felt they received. If the result from the Kruskal-Wallis test was significant, a means test was conducted to determine the median levels of each category. This

was followed up with a Mann-Whitney U-test to determine if there were any significant differences between the categories. A Bonferonni adjustment was done on each Mann-Whitney U-test to reduce the type 1 errors. The open responses were themed using an inductive approach informed by previous research and developed incrementally (Fereday and Muir-Cochrane 2006). Frequency counts were used to determine what participants liked about the training they attended, how the training could be improved and what topics they would like training on. The interview transcripts were analysed using NVivo11 (NVivo 2016) and grouped into categories based on the training event that participants attended. Thematic coding was applied using a combination of templates codes based on the questions asked in the interview and an inductive approach (Fereday and Muir-Cochrane 2006). A cross-coding check on six interviews was completed using the coding template; a match of 82% was achieved.

Interview data were categorised with codes as follows: the first two letters refer to the training event; 'G' indicates a grower and 'A' an agronomist; and the number refers to the interview number.

Results

Field day attendance

Many participants described field days as informative (22%), interactive (19%), visual (13%) and providing an opportunity for networking (13%).

> *"Lets you keep up to speed with anything that's happening in the area" WAG3.*
>
> *"50-50 get it in the paper, read it and here you pick up a lot of visual" WAG1.*

The demographics of the participants influenced the attendance at field days. Men participated in four or more field days in 2013 compared to women (X^2 (n= 245), 2, = 9.356, $p \leq 0.05$) (Figure 1A). A greater proportion of participants from Western Australia (WA) attended more than four field days, whilst a greater proportion of Eastern Australia (EA) participants attended between one and three field days (Likelihood ratio X^2 (n= 241), 2, = 9.289, $p \leq 0.05$) (Figure 1B). Participants with a higher education were more likely to attend field days than those without high-level qualifications (Likelihood ratio X^2 (n= 248), 2, = 10.746, $p \leq 0.05$) (Figure 1C). Only 12% of agronomists surveyed did not attend any field days while 56% attended 4 or more field days during the season (Likelihood ratio X^2 (n= 248), 2, = 14.386, $p \leq 0.001$) (Figure 1D). The only demographic variable that did not influence attendance was participants' age ($p > 0.05$).

Participants' major barrier to attending field days was lack of time (16%). Some participants did not find field days useful (7%) and some felt the topics were irrelevant (7%). Location had a significant impact on attendance; participants in EA experienced this more than those in WA.

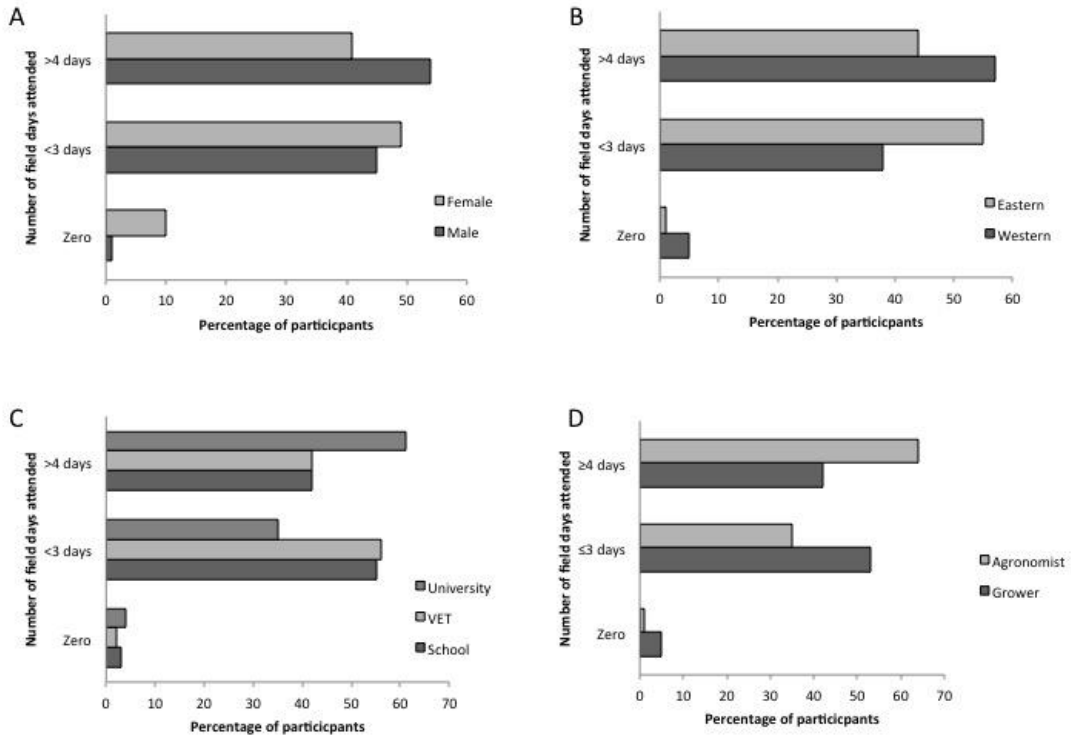


Figure 1. Demographic influences on numbers of field days attended in 2013. A) Sex B) Location (Eastern Australia or Western Australia) C) Education level D) Occupation

Formal workshop attendance

Participants liked workshops that were informative (40%), interactive (12%) and local (12%). The attendance of growers and agronomists at formal workshops varied significantly (Figure 2). A higher proportion of agronomists (54%) attended three or more workshops on agronomy compared to 27% of growers attending this many workshops (X^2 (n= 216), 2, = 19.15, $p \leq 0.001$). Only 4% of agronomists did not attend any workshops on agronomy, compared to 16% of growers. For every other topic at least 37% or more did not attend any workshops, indicating that agronomy workshops were most highly valued.

Participants' age had a significant influence on the number and type of workshops attended (Figure 3). Growers and agronomists who were less than 30 years of age attended workshops more frequently than other participants.

The number of years a participant had been working had a significant influence on attendance at the disease identification (Likelihood ratio X^2 **(**n=188 (6), = 16.308, $p \leq 0.05$), farm management (Likelihood ratio X^2 (n= 196 (6), = 15.967 $p \leq 0.05$) and pest identification workshops (Likelihood ratio: X^2 **(**n= 200 (6), = 18.875, $p \leq 0.05$).

The most frequent reasons given for not attending workshops were: (i) lack of time (60%), (ii) distance from venue (35%) and (iii) perceived irrelevance of topics (31%).

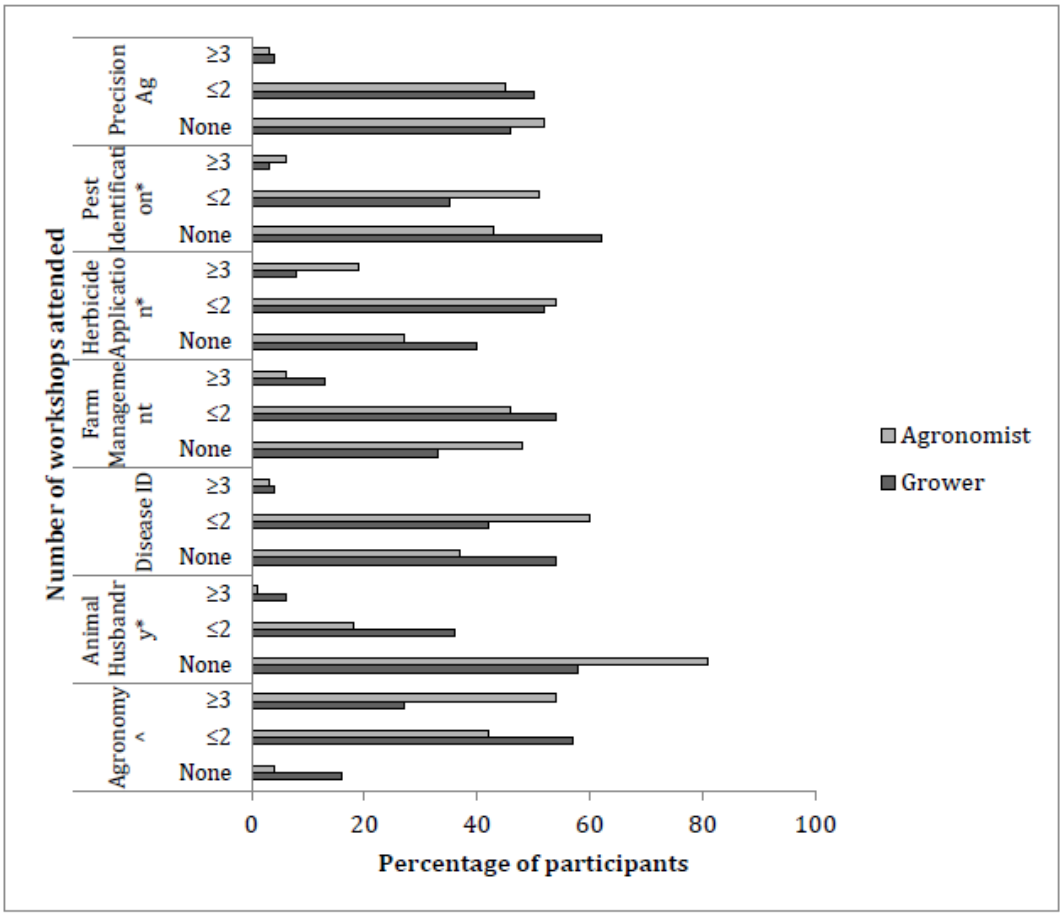


Figure 2: Percentage of growers and agronomists and the number of formal workshops attended between January 2013 and June 2014. Significant differences were seen between growers and agronomists at ^$p \leq 0.001$ or * $p \leq 0.05$

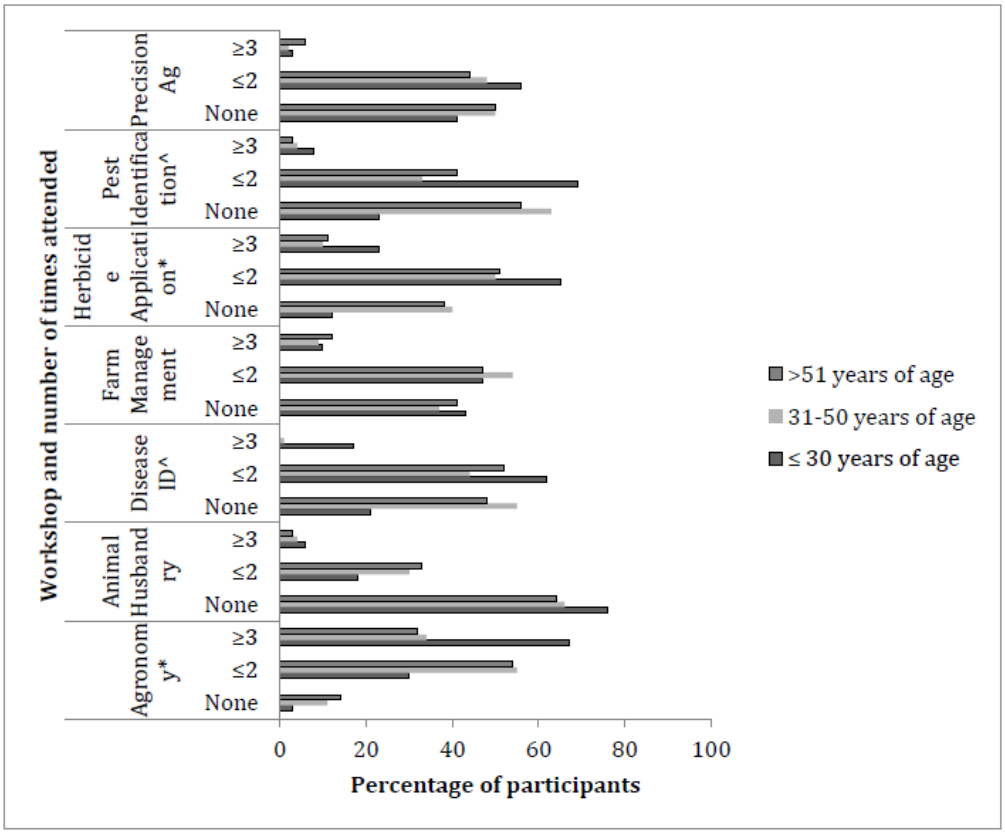


Figure 3. Influence of age on participation of growers and agronomists in workshops between January 2013 and June 2014. There was a significant difference between age groups at $^p \leq 0.001$ or $* p \leq 0.05$

Field days

Field days are training events attended by growers and agronomists. These days are held on farms to provide information and demonstrate results from field experiments associated with growing crops, new varieties released, and new cropping practices. In Australia they are held in conjunction with grower groups and local state departments of agriculture.

Participants came to field days for a variety of reasons, ranging from compulsion (work-related), wanting a better and deeper understanding on a range of subjects, networking with other growers, colleagues and specialists, to gaining knowledge:

> *We're new to the area yeah we wanted to know a bit more about agriculture in the least high rainfall areas. WAG6*

In some cases, people attended to see if there was any new knowledge available and to brush up their skills.

Observation of participants at field days showed a number of similarities:

1. Some participants tended to stand to one side, only interacting amongst themselves or with speakers after the talks. They did not interact with other growers.
2. Where speakers did not have a microphone, or a loud voice, only those who were standing directly in front of the speaker were able to hear what was being said. In these situations, participants towards the back tended to form small groups speaking to each other rather than listening.

3. Speakers were able to catch the attention of the participants by using props, having a loud voice, or being enthusiastic about what they were showing and talking about.

These observations demonstrated most participants preferred informal interaction amongst themselves or with the speakers rather than the formal knowledge transfer that would be used in a workshop.

Hoping to learn

When asked about what they were hoping to learn, participants expressed a range of views, from broadening knowledge to gaining new ideas and techniques:

> *Absolutely, we're doing it all now but just wanted confirmation what we're doing is the right thing that we're doing. WAG5*

This also illustrates that some participants wanted reassurance that the farming practices they were using were correct.

Knowledge

A Wilcoxon Signed Rank Test showed that participants showed a significant increase in knowledge levels after participating in field days (z = -7.64 $p \leq 0$, with a large effect size (0.40). The 25th percentile of participants' knowledge increased from 'some knowledge' (*Md* = 2) to 'moderate knowledge' (*Md* = 3) after the field days. The 50th and 75th percentiles stayed the same, at moderate and considerable respectively (Figure 4).

To determine the influence of demographic variables on knowledge a Kruskal-Wallis test showed that occupation significantly influenced knowledge before and after the field days. (Knowledge before X^2 (n= 116), 5 = 15.80 $p \leq 0.05$); knowledge after X^2 (n= 116), 5 = 14.21 $p \leq 0.05$)).

University participants (mainly students) ranked themselves lowest in knowledge before the field day; their median knowledge was 1.5 (a little knowledge) compared to all other occupations, which had a median knowledge of 2 (some knowledge). However, a Mann-Whitney U test conducted on this showed that the differences between university participants and other occupations were not significant ($p > 0.01$ with the Bonferroni adjustment).

Government participants ranked the lowest for knowledge after the field day; their median score was the same as those who identified as farmers (*Md* = 2, moderate level). Agronomists and Sales participants had a median knowledge of 3 (considerable) while university participants had a knowledge level of 2.5. Agronomists had a significantly higher median score than government participants (Mann-Whitney U –test, U = 27.5, z = -3.04, p = 0.007, Bonferroni adjustment = 0.01). There were no significant differences between government participants and other occupations.

The length of time working had a significant influence on knowledge (Kruskal-Wallis test (X^2 (n= 110), 4 = 11.06 $p \leq 0.05$)). Participants who had worked for 11 to 20 years had a higher mean rank than the other participants, however, the Mann Whitney U test conducted showed that there were no significant differences ($p> 0.012$, Bonferroni adjustment) between this group and other groups.

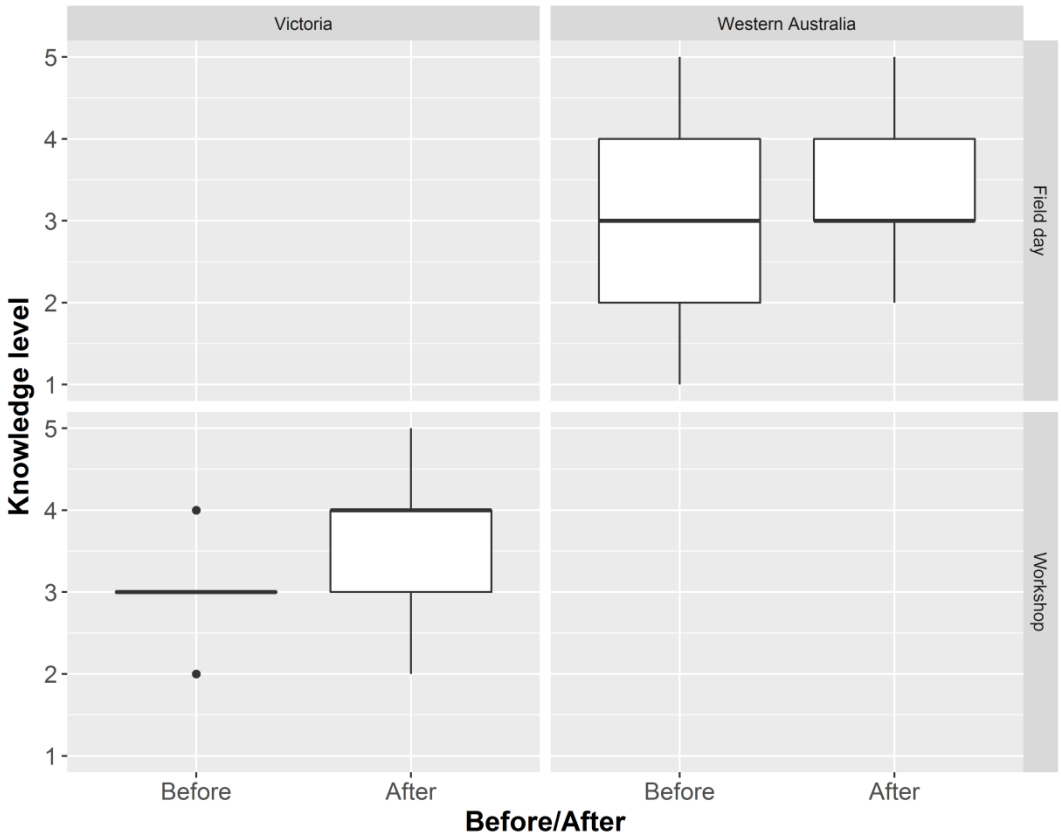


Figure 4. Knowledge levels of participants before and after training events (field days and workshops) held in different locations. Each box corresponds to the 25th and 75th percentile of scores while the bar within the box represents the median (50th percentile score). Whiskers on each box indicate the range of scores (1.5* inter-quartile range). Outliers are denoted by circles.

Workshops

Three workshops in Victoria were attended. Workshop participants were largely agronomists. These workshops were formal training events using lectures and practical exercises to teach agronomists about soil testing, interpreting results from soil testing and understanding fertiliser regulations.

Back Paddock training courses

Participants in the course were either in sales (63%) or were agronomists (37%). Length of time working data was not collected with this group. The majority of participants came to this course because it was compulsory:

> *My branch manager thought it was a good idea for me to come. And then obviously when he explained what it was I thought it was a good idea as well. Just basically to broaden my knowledge on the whole fertiliser soil aspect of the job which I am currently working in.* BPA3

Participants hoped to learn in a variety of ways, from broadening knowledge to achieving accreditation, and learning new ideas and techniques:

> *I hoped to learn about soil science but also to gain the accreditation of being Fert. Care accredited. BPA7*

> *I wanted to come away with a lot more understanding of fertilisers, soil testing, and all that sort of thing which I think I have a good base knowledge now. I need to go*

away and put a little bit more of that into practice, working with James the economist at work. BPA9

A Wilcoxon Signed Rank Test showed a significant increase in participants' knowledge after participating in the workshops, $z = -2.22$ $p \leq 0.05$, with a medium effect size (0.34). The 50th percentile of participants' knowledge increased from a moderate ($Md = 3$) to considerable ($Md = 4$ after the workshops (Figure 7.1). A Kruskal-Wallis test showed that there was no significant difference ($p > 0.05$) between participants' occupations and their knowledge before and after the field day.

Many of the participants said the information or new skill they learnt at these workshops would be used every day at work, or applied on their farm. Some felt that they had become more aware of issues or had a greater understanding of issues faced by their clients.

Hopefully it will make it a bit more useful for the farmer, hopefully he will get more useful information out of me rather than just hand ball it over to somebody else that deals with it. BPA2

The majority of participants at the workshops thought that the level of learning helped to increase their knowledge and that they could use it in improving the crops that they grow, especially how to solve problems such as controlling weeds and pests in crops.

Discussion

This research demonstrates that the growers and agronomists value field days and workshops for the opportunity they offer for interaction with other growers, specialists and agronomists, and the space to gain new knowledge that they can take back to the farm or workplace.

Growers prefer interactive events such as field days to formal workshops. Growers have been characterised as social learners, who prefer informal methods of learning with a 'hands on' approach, and interacting with other growers and researchers (Anil *et al.* 2015; Franz *et al.* 2010; Kilpatrick and Johns 2003; Wenger 2000). Such informal interaction allows them to compare views and values before making a change on their farm (Eckert and Bell 2006; Kilpatrick and Johns 2003).

Field days are also very popular with agronomists, with the majority attending four or more field days a year. In Australia, most field days are held in association with local grower groups. Miller and Cox (2006) showed that growers felt that field days which demonstrated small plot field experiments (e.g. research stations) were not indicative of what might occur on their own farms but if these same experiments were held on a growers' property they were more interested in the results. Field days are an effective route for learning, providing opportunities for growers, agronomists and other people in rural communities to assess new technologies, including crop varieties and farm equipment suitable for use in their area (Amudavi *et al.* 2009; Wortmann *et al.* 2011).

Miller and Cox (2006) argued that field days and workshops were the best methods for transferring information to growers. However, growers thought that workshops were redundant because of their timing, and tended to carefully choose which they attended. Growers prefer workshops where they can interact with other growers (Miller and Cox 2006). This research supports Miller and Cox (2006) findings, showing that growers placed a higher value on agronomy workshops (16% did not attend) than on workshops on pest and disease identification, herbicide application, and other topics (up to 37% of growers did not attend). This may be related to the relationship between agronomists and growers; in the Australian grains industry, agronomists provide advice to growers about specific issues such as pest and diseases in crops and the use of herbicides and in general agronomists are employed in relation to the cropping phase of the farm system. This means growers may feel they have no

need to attend workshops based on these specific topics because the agronomists employed by the grower provide this knowledge.

Kilpatrick (1997; 2000) showed that attending training and planning to attend training is related to participants' education level. Those with a lower level of education generally do not see a need to attend formal training, which may be due to their lack of confidence and lower literacy levels (Kilpatrick 2000). Education level showed no influence on participation in formal workshops. However, those with a university education were more inclined to attend other types of training events, such as webinars. Technology can improve communication among people spread across a large geographical area but it can also hinder communication, as webinars do not support the informal networking opportunities that growers prefer (Anil *et al.* 2015; Wenger 2000).

There was a distinct difference between occupation (grower and agronomist) and attendance; agronomists attended training events more frequently than did growers. They enjoyed the events because they were interactive, informative and, in the case of webinars, allowed participation without travelling.

Knowledge

The Coutts and Roberts's (2011) capacity-building model places high importance on training for increasing the skills and knowledge of people in the agricultural industry. However, there is little research on capacity-building for agronomists, and no evaluations of knowledge gain and how agronomists intend to use new knowledge after training.

Moreover, it is clear that Coutts and Roberts (2011) based their deductions on formal training events with set curricula and specific learning objectives, whereas informal learning events are flexible in their content and objectives (Malcolm *et al.* 2003; Marsick and Watkins 2001; Merriam 2001). Kilpatrick and Johns (2003) argue that growers use a variety of informal learning to educate themselves and increase their capacity and skills.

Australian field days very much fit into the informal learning pattern; this research is the first to examine the knowledge of growers and agronomists both at informal training events (field days) and formal events (workshops). This research shows that the median level of knowledge remained the same at all the field days, while participants in the 25^{th} percentile increased their knowledge. These are the first published data to show a change in knowledge of both growers and agronomists attending informal training events.

At field days in WA, participants' occupations influenced their knowledge; a similar finding to that of Schmitt *et al.* (2000). Participants' education influenced their perception of their knowledge before a training course; those with higher education levels generally ranked themselves lower than those with lower education levels. For example, university students ranked their knowledge lower than that of other participants.

Using new knowledge

This research is the first to consider how participants at training events intended to use their new knowledge. All participants indicated that knowledge gained during training would benefit them in some way, whether on the farm or at work. Agronomists felt that they better understood the problems their clients faced and could offer more solutions, especially in relation to herbicide resistance. Growers planned to use their new knowledge to improve crop production or control weeds. Some just enjoyed having time to think and ponder the issues they face. Further research is needed to determine if participants did subsequently use their new knowledge in the ways they planned.

Conclusion

This research is the first study to evaluate the impact of training events such as field days and workshops on the knowledge of growers and agronomists in the agricultural industry. Training events can be categorised as formal (e.g. workshops) or informal (e.g. field days). Both growers and agronomists regard both informal and formal events as engaging, useful and important for capacity-building. Participants' knowledge increased after attending training and most participants indicate they will be able to use their new knowledge on their farm or in their consultancy.

Preferences for training types and topics vary considerably between growers and agronomists. Growers prefer to attend informal, interactive events such as field days that represent conditions similar to those on their farm. Such informal interaction allows growers to compare values and beliefs before they use the new knowledge. Agronomists do attend field days but are more likely than growers to attend formal workshops that offer them an opportunity to network with colleagues, researchers, specialists and growers. Demographic characteristics such as sex, location, occupation and length of working life also affect participation in training.

In future, it is hoped that greater understanding of the influence of demographic characteristics and preferences for type of event will improve the design and relevance of training events.

Conflicts of Interest:

No potential conflict of interest is reported by the authors.

Acknowledgements

The authors acknowledge the Council of Grain Growers Organisation (COGGO) for funding the project **"**Up-skilling the Western Australian grains industry in disease surveillance for a more productive and biosecure future", and the Grains Research and Development Corporation (GRDC) for funding a Postgraduate Scholarship (GRS 10666) during which this study was undertaken. The authors would also like to thank all of the growers, agronomists that responded to the survey, and to all those that helped with the piloting of the survey. They would also like to acknowledge the help from Marty Firth (UWA), and Rebecca O'Leary (DAFWA) for their help with the statistics and Dr Nichole Hammond for the graphs drawn in R.

References

Alvarez, K., E. Salas and C.M. Garofano. 2004. An integrated model of training evaluation and effectiveness. *Human resource development Review* 3, no 4: 385-416.

Amudavi, D.M., Z.R. Khan, J.M. Wanyama, C.a.O. Midega, J. Pittchar, A. Hassanali and J.A. Pickett. 2009. Evaluation of farmers' field days as a dissemination tool for push-pull technology in western kenya. *Crop Protection* 28, no 3: 225-35.

Anil, B., M. Tonts and K. Sidique, H.M. 2015. Strengthening the performace of farming system groups: Perspectives from a community of practice framework application. *International Journal of Sustainable Development and World Ecology* 22, no 3: 219-30.

Carberry, P.S., Z. Hochman, R.L. Mccown, N.P. Dalgliesh, M.A. Foale, P.L. Poulton, J.N.G. Hargreaves, D.M.G. Hargreaves, S. Cawthray, N. Hillcoat and M.J. Robertson. 2002. The farmscape approach to decision support: Farmers', advisers', researchers' monitoring, simulation, communication and performance evaluation. *Agricultural Systems* 74, no 1: 141-77.

Coutts, J. and K. Roberts. 2011. Theories and approaches of extension: Review of extension in capacity building. In *Shaping change: Natural resource mangement, agriculture and the role of extension*, eds Jennings, J, Packham, R and Woodside, D. Australia: Australasia-Pacific Extension Network (APEN).

Cristovão, A., P. Ferrão, R. Madeira, M.L. Tibério, M.J. Rainho and M.S. Teixeira. 2009. Circles amd communities, sharing practices and learning: Looking at new extension education approaches. *The Journal of Agricultural Education and Extension* 15, no 2: 191-203.

Dillman, D.A., J.D. Smyth and L.M. Christian. 2009. *Internet, mail and mixed-mode surveys: The tailored design method*. Third ed. United States of America: John Wiley and Sons, Inc.

Eckert, E. and A. Bell. 2006. Continuity and change: Themes of mental model development among small-scale farmers. *Journal of Extension* 44, no 1: 1FEA2.

Feder, G., R. Birner and J.R. Anderson. 2011. The private sector's role in agricultural extension systems: Potential and limitations. *Journal of Agribusiness in Developing and Emerging Economies* 1, no 1: 31-54.

Fereday, J. and E. Muir-Cochrane. 2006. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International journal of qualitative methods* 5, no 1: 80-92.

Field, A. 2013. *Discovering statistics using ibm spss statistics*. 4th ed. London: SAGE.

Fowler, F.J. 2009. Ed. Bickman, L and Rog, DJ. *Survey research methods.* Vol. 1 of *Applied social research methods*. Fourth ed. United States of America: SAGE.

Franz, N.K., F. Piercy, J. Donaldson, J. Westbrook and R. Richard. 2010. Farmer, agent, and specialist perspectives on preferences for learning among today's farmers. *Journal of Extension* 48, no 3: 1-10.

Glaze, J.J.B. and J.K. Ahola. 2010. Training sessions provide working knowledge of national animal identification system. *Journal of Extension* 48, no 1: 1-6.

Haccoun, R.R. and T. Hamtiaux. 1994. Optimizing knowledge tests for inferring learning acquisition levels in single group training evaluation designs: The internal referencing strategy. *Personnel Psychology* 47, no 3: 593-604.

Jones, G.E. and C. Garforth. 1998. The history, development and future of agricultural extension. In *Improving agricultural extension. A reference manual*, eds Swanson, BE, Bentz, RP and Sofranko, AJ, 1-16. Rome: FAO.

Keogh, M. and C. Julian. 2014. Optimisng future extension systems in the austrailan grains industry, part 1: Background, literature and demographics of the australian grain production sector., 64. Sydney, Australia: Australian Farm Institute.

Kilpatrick, S. 1997. Effective delivery methodologies for education and training to rural australia. Tasmania: Tasmanian Rural Industry Training Board.

Kilpatrick, S. 2000. Education and training: Impacts on farm management practice. *Journal of Agricultural Education and Extension* 7, no 2: 105-16.

Kilpatrick, S. and S. Johns. 2003. How farmers learn: Different approaches to change. *The Journal of Agricultural Education and Extension* 9, no 4: 151-64.

Malcolm, J., P. Hodkinson and H. Colley. 2003. The interrelationships between informal and formal learning. *Journal of Workplace Learning* 15, no 7/8: 313-18.

Marsh, S.P. and D.J. Pannell. 2000. Agricultural extension policy in australia: The good, the bad and the misguided. *Australian Journal of Agricultural and Resource Economics* 44, no 4: 605-27.

Marsick, V.J. and K.E. Watkins. 2001. Informal and incidental learning. *New Directions for Adult and Continuing Education* 2001, no 89: 25-34.

Merriam, S.B. 2001. Andragogy and self-directed learning: Pillars of adult learning theory. *New Directions for Adult and Continuing Education* 2001, no 89: 3-14.

Miller, R.L. and L. Cox. 2006. Technology transfer preferences of researchers and producers in sustainable agriculture. *Journal of Extension* 44, no 3: 1-6.

Salas, E. and J.A. Cannon-Bowers. 2001. The science of training: A decade of progress. *Annual review of psychology* 52, no 1: 471-99.

Schmitt, M.A., B.R. Durgan and S.M. Iverson. 2000. Impact assessment and participant profiles of extension's education programs for agricultural chemical/seed retailers and crop advisors. *Disease Management* 2, no 2.7: 3.0.

Van De Berg, H. and J. Jiggins. 2007. Investing in farmers - the impacts of farmer field schools in relation to integrated pest management. *World Development* 35, no 4: 663-86.

Vanclay, F. and G. Leach. 2011. Enabling change in rural and regional australia. In *Shaping change: Natural resource management, agriculture and the role of extension*, eds Jennings, J, Packham, R and Woodside, D, 6-11. Australia: Australasia-Pacific Extension Network (APEN).

Wenger, E. 2000. Communities of practice and social learning systems. *Organization* 7, no 2: 225-46.

Wortmann, C.S., K.L. Glewen and S.N. Williams. 2011. Impact of crop management diagnostic clinics on advisors' recommendations and producer practices. *Journal of Extension* 49, no 4.

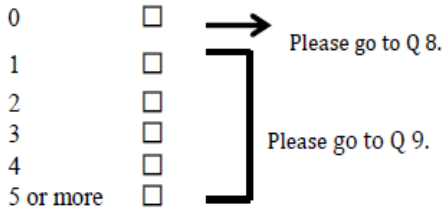
Wright, D. 2017. Are we going against the grain in training; developing an information and training framework for farmers and agronomists in australia. PhD, The University of Western Australia.

Wright, D., B. Macleod, N. Hammond and N. Longnecker. 2016. Can grain growers and agronomists identify common leaf diseases and biosecurity threats in grain crops? An australian example. *Crop Protection* 89: 78-88.

Yang, P., W. Liu, X. Shan, P. Li, J. Zhou, J. Lu and Y. Li. 2008. Effects of training on acquisition of pest management knowledge and skills by small vegetable farmers. *Crop Protection* 27: 1504-10.

Appendix A: General Questionnaire

7. In the last 12 months how many field days have you attended?



8. What prevented you from attending any field days? (Tick all that apply)

- Distance to travel was too far ☐
- I do not find field days useful ☐
- Lack of childcare facilities / help ☐
- No field days were held in my district ☐
- No time available to attend ☐
- Time of day was inconvenient ☐
- Topics were not relevant to my situation or me. ☐
- Other:

_____

9. What did you like about the field days?

a._____

b._____

c._____

10. Do you have any suggestions on how the field day(s) could be improved?

a._____

b._____

c._____

11. In the last 12 months how many times have you attended workshops on the following subjects?

	0	1	2	3 or more
Animal husbandry	☐	☐	☐	☐
Disease identification	☐	☐	☐	☐
Farm business training	☐	☐	☐	☐
Farm management	☐	☐	☐	☐
Herbicide application	☐	☐	☐	☐
Pest Identification	☐	☐	☐	☐
Precision agriculture	☐	☐	☐	☐
Other:	☐	☐	☐	☐

12. What prevents you from attending these workshops?

- Cost of attending was too high ☐
- Distance to travel was too far ☐
- I do not find workshops useful ☐
- Lack of childcare facilities / help ☐
- No time available to attend ☐
- None were held in my district ☐
- Time of day was inconvenient ☐
- Topics were not relevant to my situation or me ☐
- Other:

_____

13. What did you like about these workshops?

a._____

b._____

c._____

14. Do you have any suggestions on how the workshop(s) that you attended could be improved?

a._____

b._____

c._____

20. Have you attended any other seminars / learning events / information events in the last 12 months?

Yes ☐ → Please go to Q 21

No ☐ → Please go to Q 24

21. Please name these events

a._____

b._____

c._____

22. What did you like about these events?

a._____

b._____

44. Please indicate the age group that you fit into based on your last birthday.

<21 ☐
22-27 years old ☐
28-33 years old ☐
34-40 years old ☐
41-47 years old ☐
48-53 years old ☐
54-60 years old ☐
>60 years old ☐

c._____

23. Do you have any suggestions on how the events that you attended could be improved?

a._____

b._____

c._____

41. Gender

Male ☐
Female ☐
Other ☐

43. What is the highest level of education that you have completed?

Completed Year 10 ☐
Completed Year 12 ☐
Trade qualification ☐
Diploma ☐
Bachelor's degree ☐
Post-graduate qualifications ☐

47. What is the postcode of where your farm is located?

_____

Appendix B

Field Day Evaluation

Name of field day: _____

Date: _____

Occupation: Farmer ☐Crop consultant ☐Extension specialist ☐ Chemical rep ☐ Uni/Govt ☐ Other ☐

How many years have you been working? _____

What crops do you work with?

_____

1. Please place a tick in the response that best describes your knowledge of the topics covered at today's field day.

Before today

No Knowledge	Some knowledge	Quite a bit of knowledge	Considerable knowledge	Thorough knowledge
☐	☐	☐	☐	☐

After today

No Knowledge	Some knowledge	Quite a bit of knowledge	Considerable knowledge	Thorough knowledge
☐	☐	☐	☐	☐

2. Did you learn what you were hoping to learn?

No, not at all	A little	Some	Mostly	Yes, Fully
☐	☐	☐	☐	☐

Comments?

3. Are you planning on using the knowledge that you learnt today? If so how? (Feel free to use back if necessary.)