Appendix 2: Survey questionnaire

1. What is your main role in citrus production?

a. Grove owner

b. Ranch manager

c. Pest Control Adviser (PCA)

d. Pest Control Operator (PCO)

e. Other

2. How many acres of citrus do you grow or manage?

a. <5 acres

b. 5-25

c. 26-100

d. 101-500

e. >500

3. What age group are you in?

a. <35 years

b. 35-50

c. 51-65

d. >65 years

4. Where are your groves located? (click all that apply)

a. Fresno

b. Imperial

c. Kern

d. Madera

e. Riverside

f. San Bernardino

g. San Diego

h. Santa Barbara

i. Tulare

j. Ventura

5. How do you grow citrus?

a. Conventionally

b. Organically

c. Both

6. What percentage of your income comes from citrus?

a. 0-25%

b. 26-50%

c. 51-75%

d. 76-100%

7. How likely do you think it is that an HLB-positive tree will be detected in your grove in the next year?

a. Very unlikely

b. Unlikely

c. Maybe

d. Likely

e. Very likely

8. How likely is it that you will stay informed about HLB and actively communicate with your grower liaison?

a. Very unlikely

b. Unlikely

c. Maybe

d. Likely

e. Very likely

f. I don't know who my liaison is

9. How likely is it that you will be actively communicating with your neighbors (growers and homeowners)?

a. Very unlikely

b. Unlikely

c. Maybe

d. Likely

e. Very likely

11. How likely do you think it is that coordinated insecticide treatments for ACP will slow down HLB spread more than uncoordinated treatments?

a. Very unlikely

b. Unlikely

c. Maybe

d. Likely

e. Very likely

12.What do you think is the main barrier to area-wide management of ACP in your area? (read the whole list before you choose)

a. Preference to spray in one's own timing

b. Access to sprayers

c. Cost

d. Getting everyone to participate

e. Disruption of IPM

13. How likely do you think it is that your neighbors will apply insecticides for ACP within recommended treatment windows?

a. Very unlikely

b. Unlikely

c. Maybe

d. Likely

e. Very likely

Text A2.2: Data analysis

All statistical analyses were done in the R programming environment version 4.0.3 (R Foundation for Statistical Computing 2020) with a Windows 10 Pro version 1909, 64-bit operating system (Microsoft, Redmond, WA, U. S. A.). Data manipulation and descriptive statistics were conducted using the R package "dplyr" (Wickham et al. 2021) and base R. Plots were generated with the R package "ggplot2" (Wickham 2016).

Analysis of survey data

Correlations between ordered categorical variables from the survey were tested using Spearman's rank correlation test.

Analysis of participation in AWM

Four of the independent variables in the regression model (group size, size of the resource system, size of citrus groves, heterogeneity in grove size) were based on information recorded in the database of citrus operations in California maintained by the Citrus Research Board (CRB), hereafter referred to as the *citrus layer*. We obtained access to the June 2020 version of the citrus layer (Rick Dunn, personal communication) and the outlines of each AWM unit in the state of California (Rick Dunn and Robert Johnson, pers. com.). The software ArcGIS Pro (ESRI, Redlands, CA, U. S. A.) was used to overlay the citrus layer and the institutional layer in order to calculate the group size, size of the resource system, size of citrus groves and heterogeneity in grove size in each AWM unit using the "Dissolve" tool. Correlations between numeric independent variables in the regression model were tested using Pearson's correlation test.

- Group size: It was calculated as the number of different PURs within each AWM unit on the CRB citrus layer, which was compared with the number of PURs routinely collected by the grower liaisons and found to be highly correlated (ρ=0.72, P=2E-15).
- Size of the resource system: It was calculated by aggregating all of the citrus properties in each PMA/PCD and calculating the sum of the grove acres. The calculated total citrus acreage under each management unit was highly correlated with data provided by the grower liaisons (ρ=0.97, P<2.2E-16) and with the citrus acreage recorded in the California Statewide Crop Mapping database (ρ=0.98, P<2.2E-16) (Department of Water Resources 2020).
- Size of citrus groves: It was calculated with the "Dissolve" tool from the software ArcGIS Pro by aggregating all of the citrus properties in each PMA/PCD and calculating the mean of the grove acres.
- Heterogeneity in grove size: It was calculated with the "Dissolve" tool from the software ArcGIS Pro by aggregating all of the citrus properties in each PMA/PCD and calculating the standard deviation of the grove acres.

Some preliminary statistical analyses were conducted to guide the hypotheses tested with the zoib regression model.

- Institutional approach (PMA/PCD): there was significantly higher participation in AWM in PCDs than PMAs in every season ($P \leq 0.043$ on t-tests), except the Fall of 2016 ($P=0.99$).
- Group size: there was a significant negative correlation between the number of pesticide use permits and participation in AWM ($\rho=-0.28$, $P<2.2E-16$).
- Size of citrus groves: there was a significant positive correlation between the average size of citrus groves and participation in AWM ($\rho=0.27$, $P \leq 2.2E-16$).

Zero-and-one-inflated beta regression models were constructed using the R package "zoib" (Liu and Kong 2015). A zoib model assumes that the dependent variable *y* (the percentage of citrus acreage in each PMA/PCD treated within the recommended window) follows a piecewise distribution such that

$$f(y_i) = \begin{cases} p_i & \text{if } y_i = 0 \\ (1-p_i)q_i & \text{if } y_i = 1 \\ (1-p_i)(1-q_i)\text{Beta}(\alpha_{i1}, \alpha_{i2}) & \text{if } y_i \in (0,1) \end{cases}$$

where p_i represents the probability $\Pr(y_i=0)$, q_i represents the conditional probability $\Pr(y_i=1|y_i\neq0)$, and α_{1i} and α_{2i} represent the shape parameters of the beta distribution for $y_i \in (0,1)$. These distributions are combined to derive the unconditional estimate of the response $E(y_i)$:

$$E(y_i) = (1-p_i)(q_i + (1-q_i)\mu_i^{(0,1)}$$

The zoib regression model estimates the logit [*i.e.*, the log(odds)] of the expected value of the beta distribution, the logit of *P*(0) and *P*(1) and the log of the dispersion of the beta distribution as linear functions of fixed and/or random effects. The coefficients of the effects on the mean of the beta regression can be interpreted as the expected change in the logit of participation with a one unit change in the corresponding variable. The coefficients of the effects on P(0) and P(1) are interpreted as the change in the logit of either having Participation=0 or Participation=1 with a one unit change in the corresponding variable. The coefficients of the effects on the dispersion of the beta distribution indicate the change in the log of the dispersion with a one-unit change in the corresponding variable (van Woerden et al. 2019). Based on a Bayesian framework, the coefficients are estimated through a Markov Chain Monte Carlo (MCMC) approach (Liu and Kong 2015). Two independent MCMC chains were run per model, each with 5000 iterations, including 200 iterations for burn-in, and thinned by a factor of 2. We assumed a Normal prior distribution N(0, 0.001) for each regression coefficient.

MCMC convergence was visually checked with trace plots and autocorrelation plots. The potential scale reduction factor (psrf) was calculated for each model parameter and the threshold psrf≤1.1 was used to determine that convergence had been reached (Gelman et al. 2021). In cases where psrf>1.1, we repeated the MCMC process with three chains, 10000 iterations per chain, 1000 for burn-in and thinned by a factor of 50. Posterior inferences for each parameter are reported as the mean and 95% credible interval (CI). Model selection was based on the deviance information criterion (DIC) (Liu and Kong 2015). Starting with the most complex model including the seven independent variables mentioned in the previous section, we examined the results and iteratively removed variables for which the CI of the posterior estimates was bounded by a negative and a positive value, and therefore comprised zero. Among competing models that fulfilled the previous condition, we chose the one with the lowest DIC (Table A4.1, Table A4.2).

Finally, the participation levels predicted by the zoib regression model were calculated using the pred.zoib function in the R package "zoib" (Liu and Kong 2015). Predictions were based on a new dataset where the independent variable under evaluation was allowed to vary within the range observed in the original dataset and the rest of the independent variables were fixed at their mean value, except in the case of interaction terms, where both variables were allowed to vary within the observed range.

All the R code used in this study will be posted in a repository at the following URL after publication: https://github.com/nmcr01?tab=repositories.

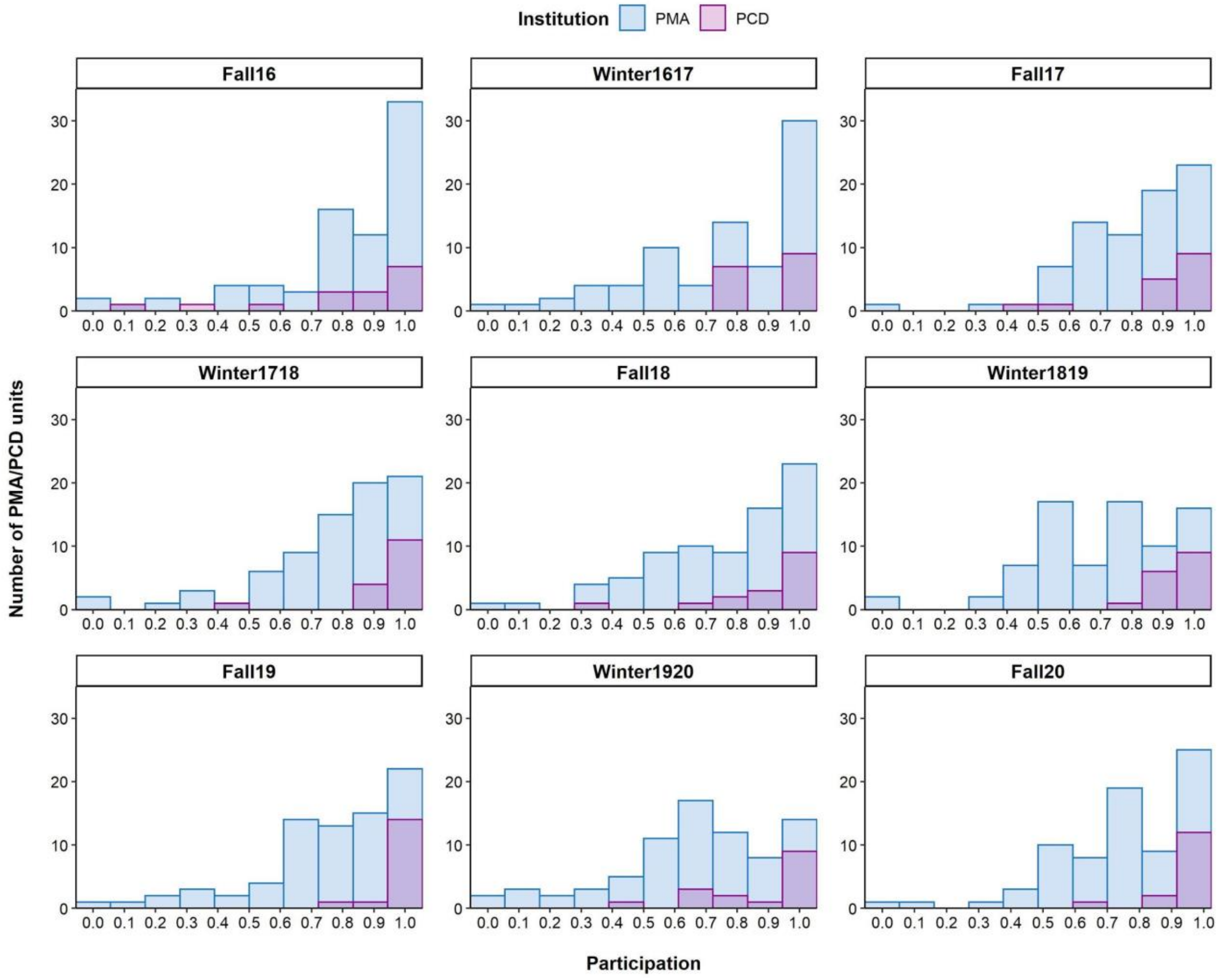

Fig. A2.1: Histogram of participation levels in area-wide management in Psyllid Management Areas (blue) and Pest Control Districts (purple) over nine seasons.

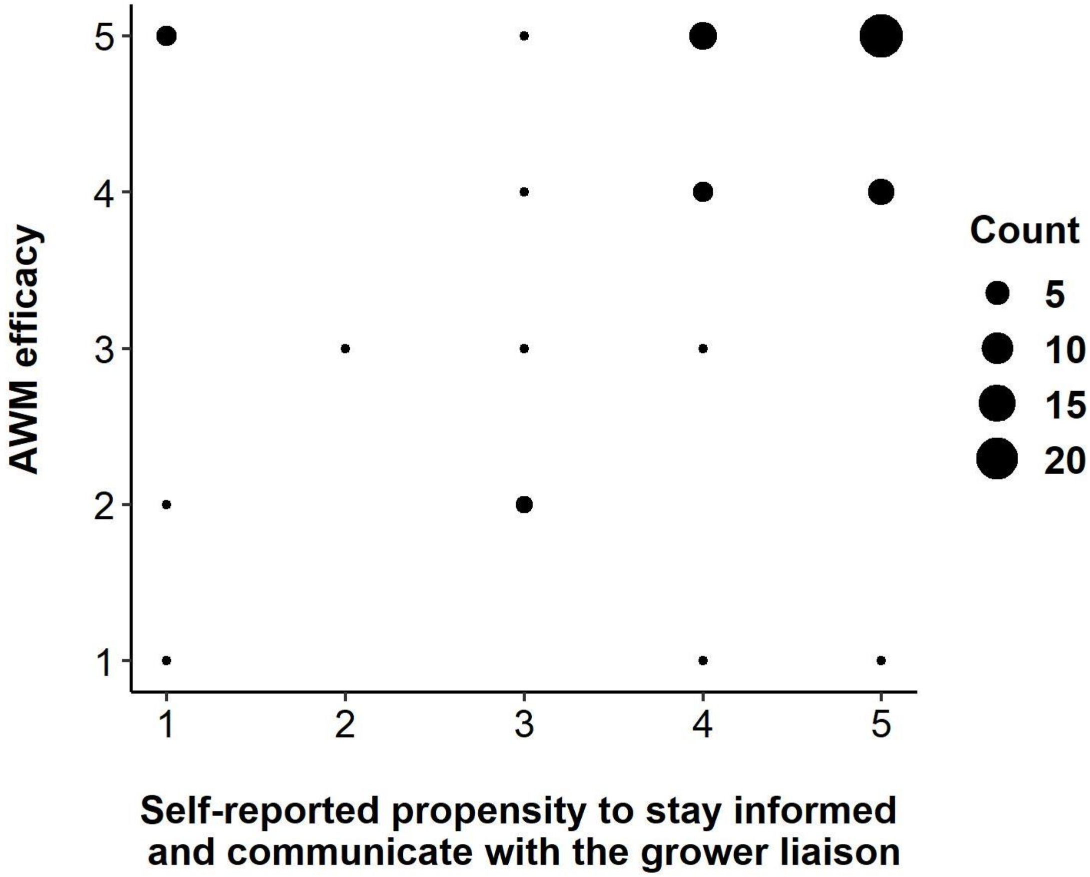

Fig. A2.2: Relationship between the self-reported propensity to stay informed and communicate with the grower liaison and the belief that coordinated insecticide treatments for ACP will slow down HLB spread more than uncoordinated treatments (AWM efficacy). Responses to the survey questions were transformed to numeric so that *very unlikely* = 1, *unlikely* = 2, *maybe* = 3, *likely* = 4, *very likely* = 5. The size of the points represents the number of participants who chose that combination of responses.

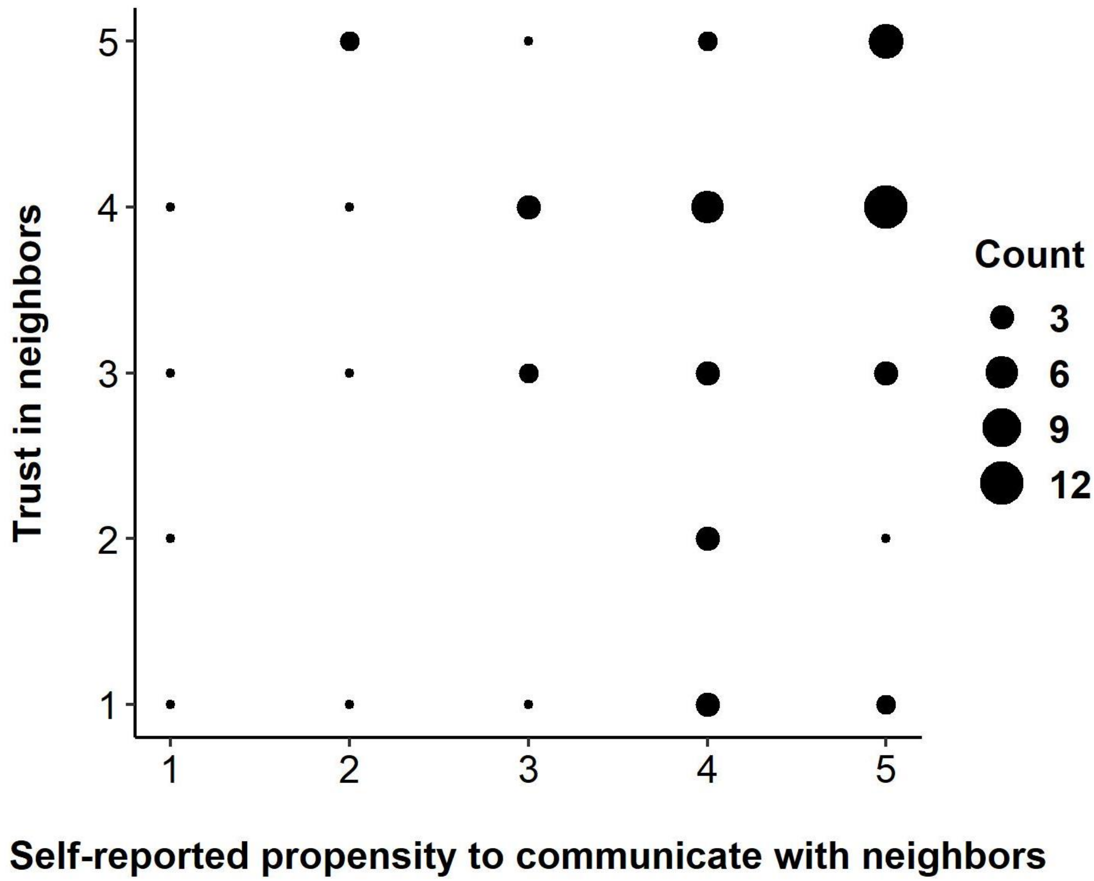

Fig. A2.3: Relationship between the self-reported propensity to communicate with neighbors and the belief that neighbors will apply insecticides for ACP within the recommended treatment window (trust in neighbors). Responses to the survey questions were transformed to numeric so that *very unlikely* = 1, *unlikely* = 2, *maybe* = 3, *likely* = 4, *very likely* = 5. The size of the points represents the number of participants who chose that combination of responses.

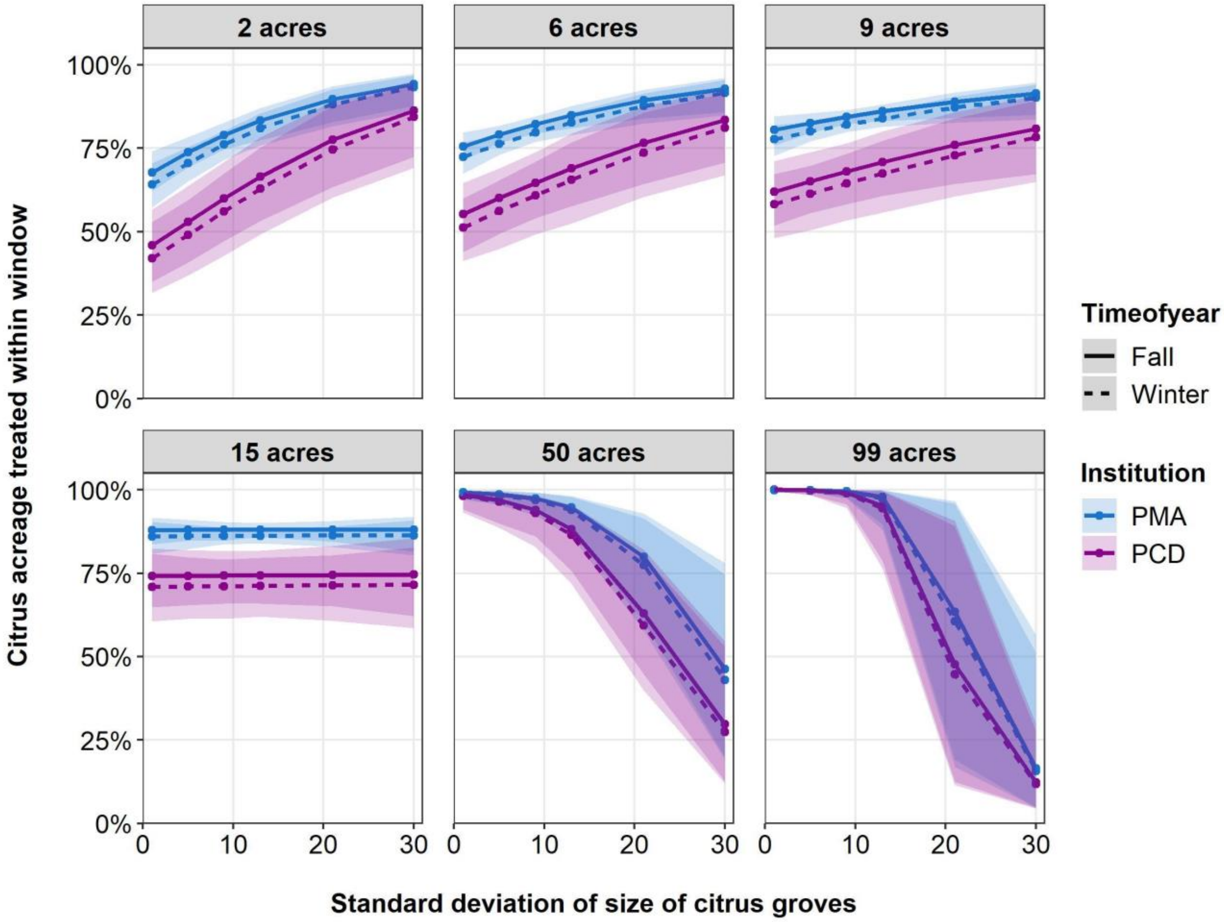

Fig. A2.4: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 1 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

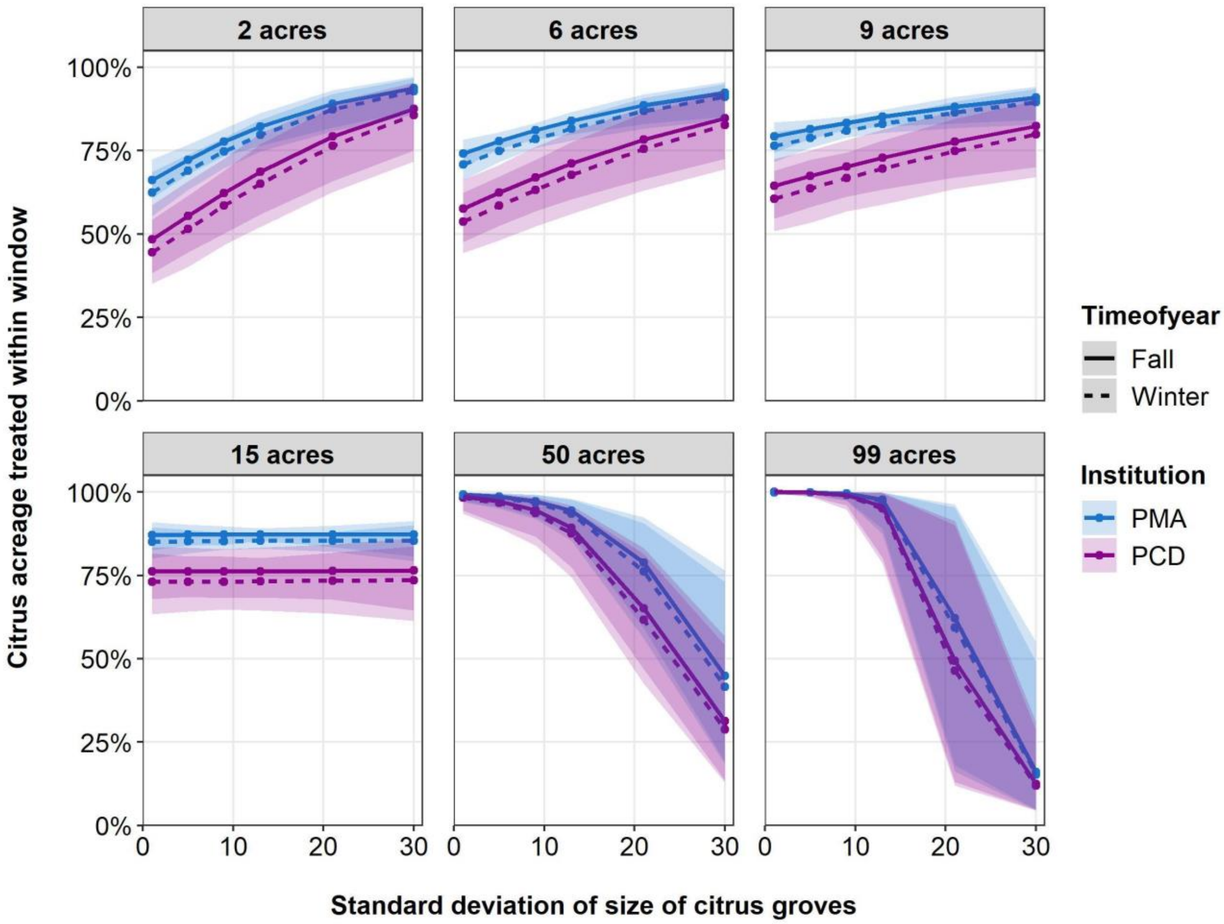

Fig. A2.5: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 2 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

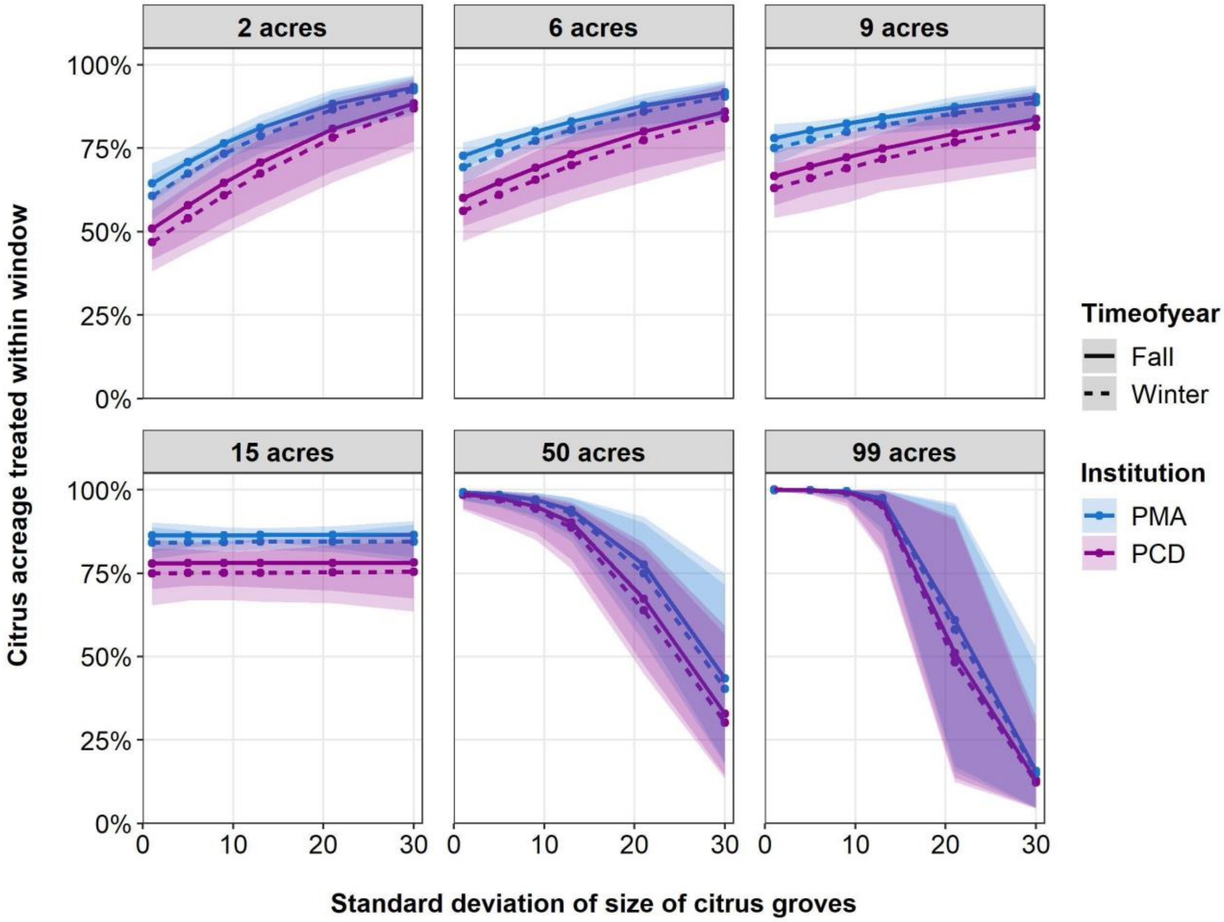

Fig. A2.6: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 3 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

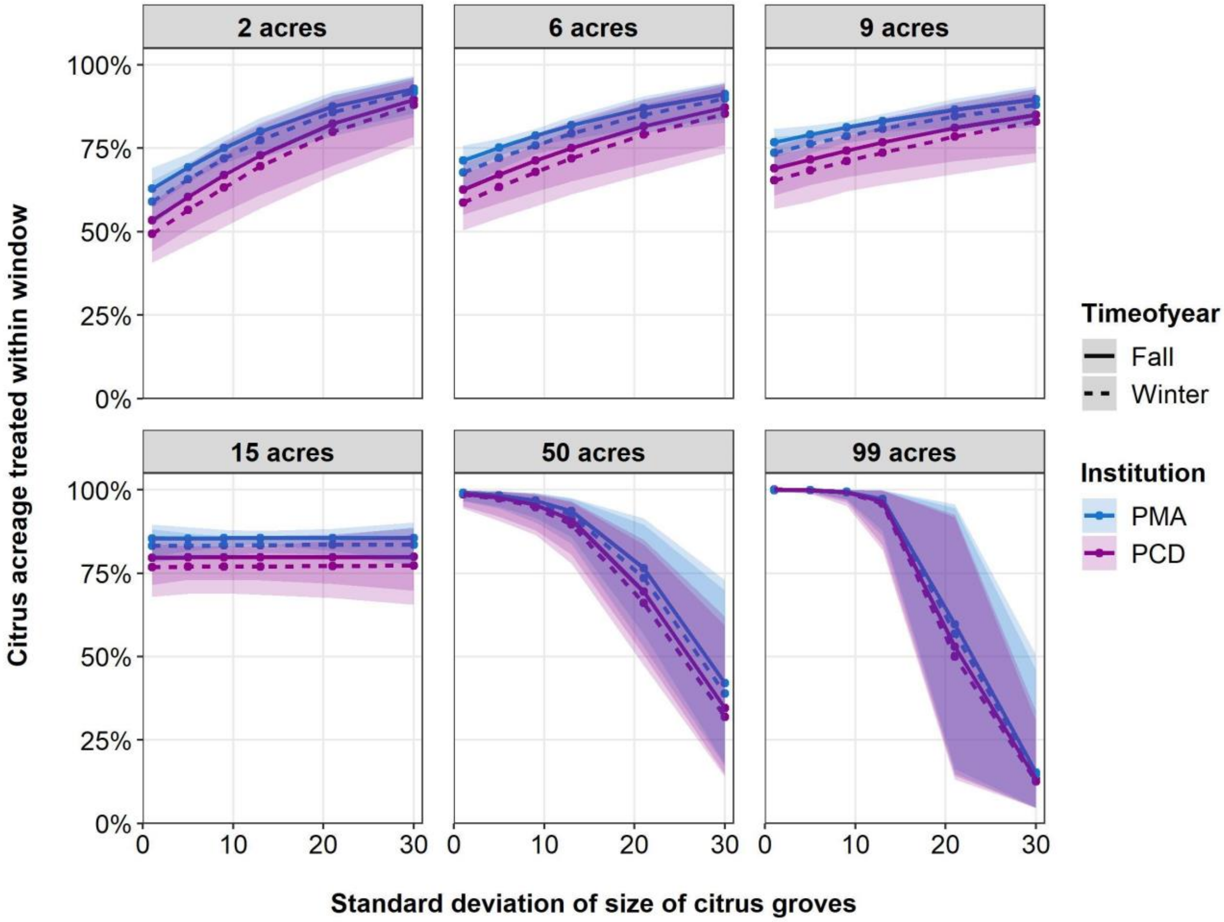

Fig. A2.7: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 4 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

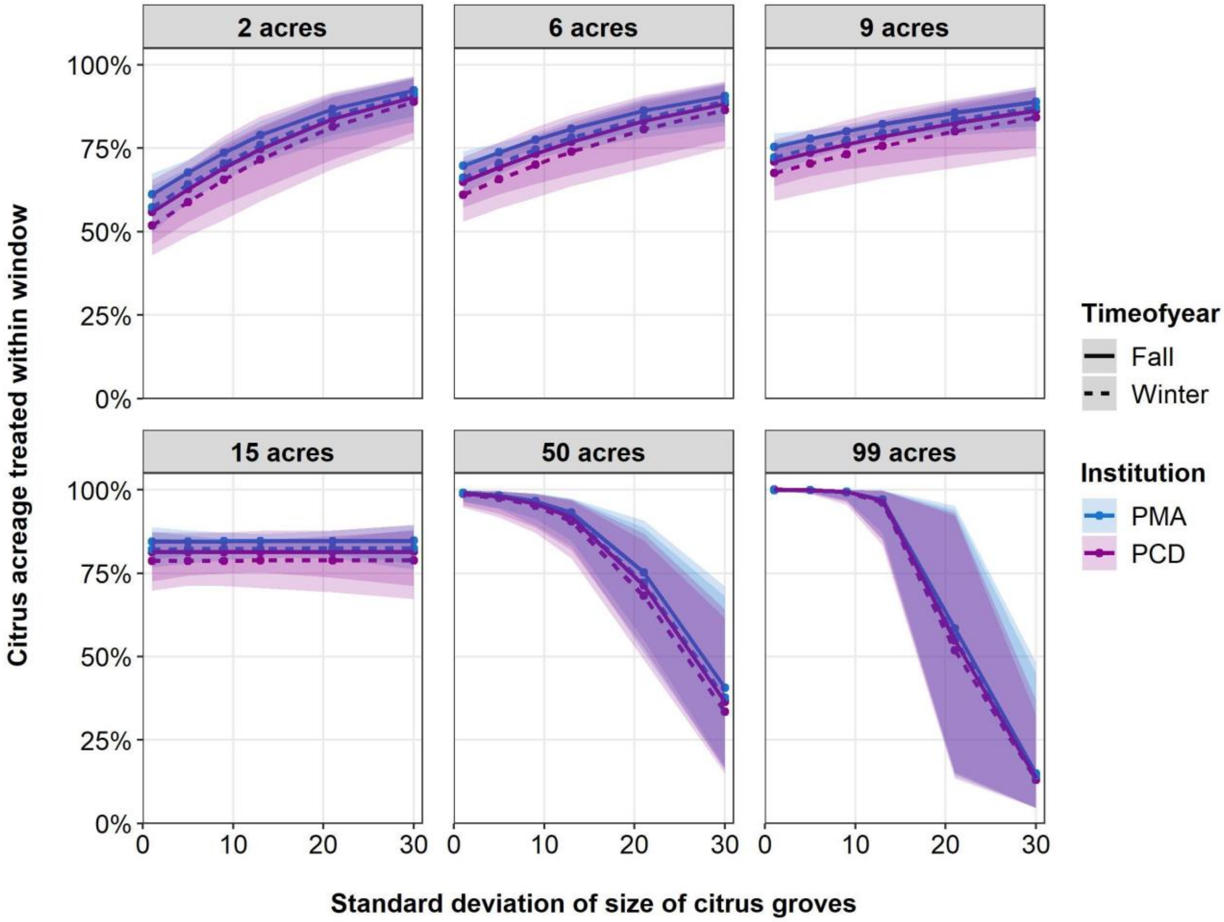

Fig. A2.8: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 5 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

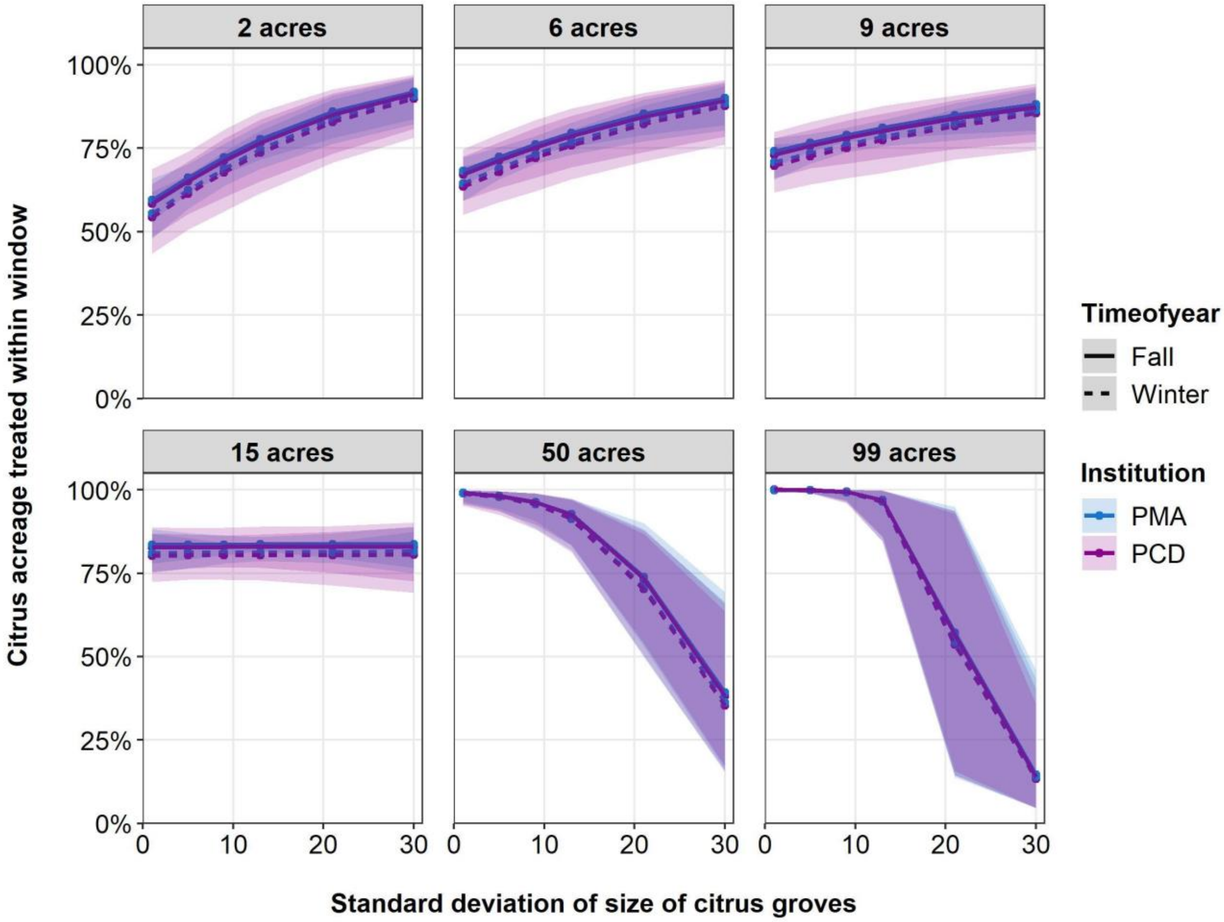

Fig. A2.9: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 6 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

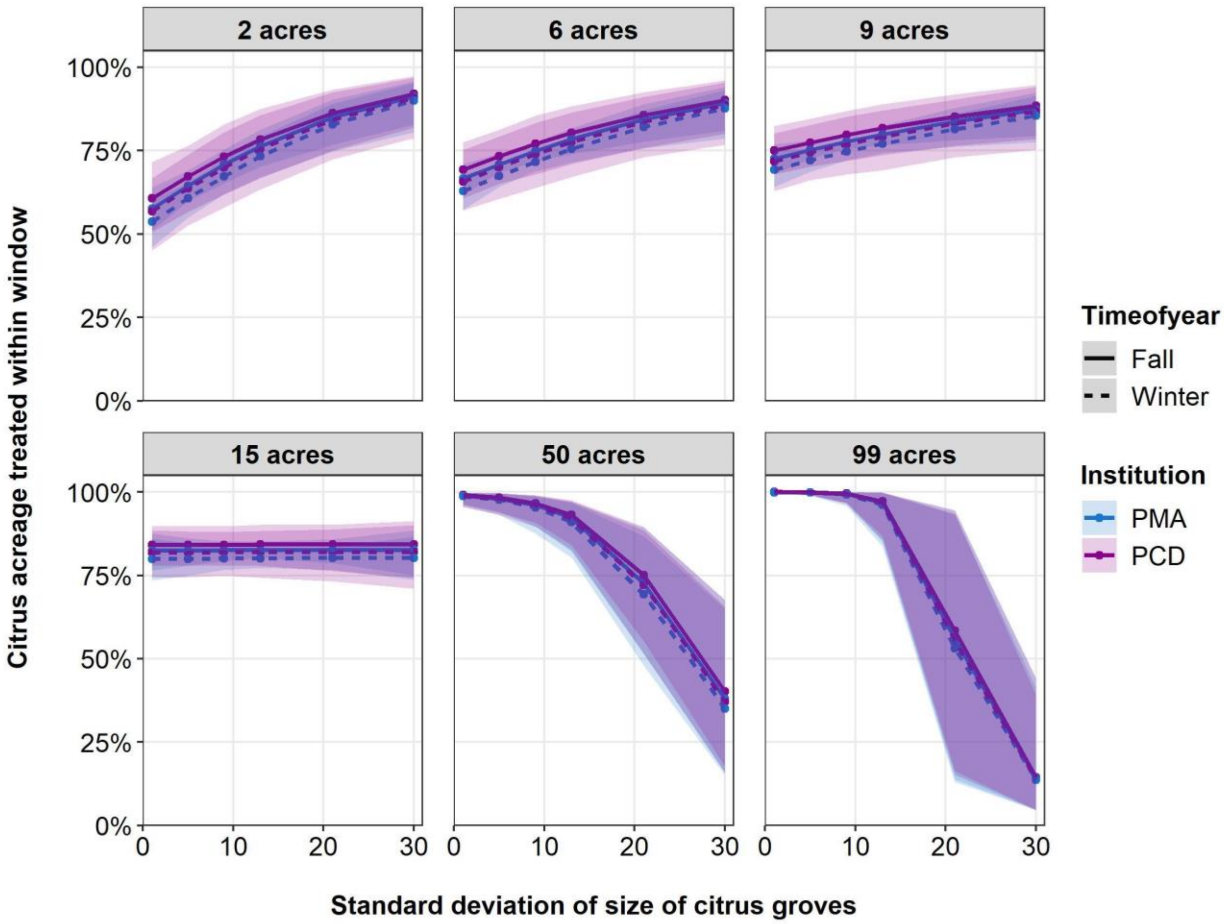

Fig. A2.10: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 7 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

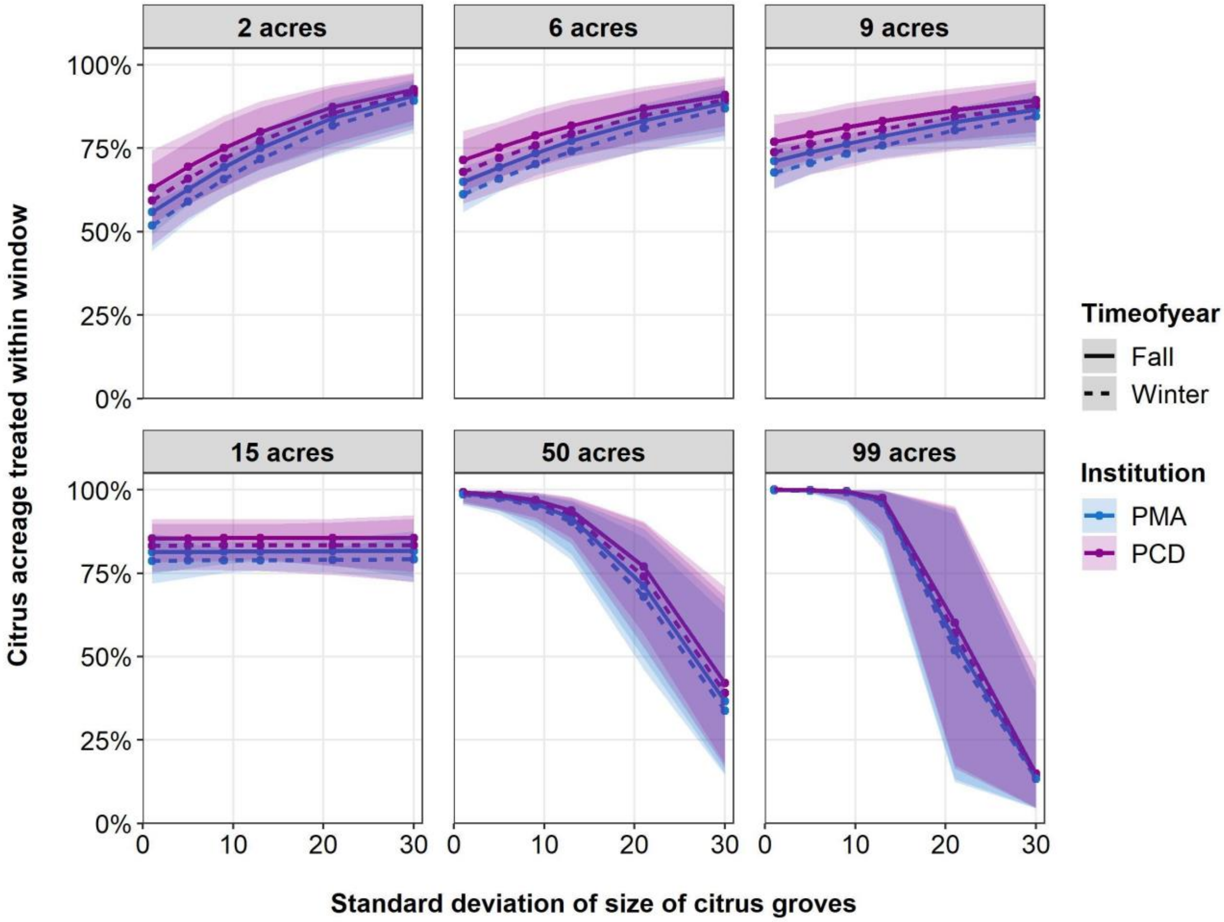

Fig. A2.11: Participation levels in AWM predicted by the zoib model depending on the average size of the citrus groves and their heterogeneity. The mean of the predicted values for season number 8 is shown in blue (PMAs) or in purple (PCDs). Predicted values for the fall treatments are linked by solid lines and predicted values for the winter treatments are linked by dashed lines. The panels show different average sizes of the citrus groves in a management unit.

Table A2.1: Institutions coordinating area-wide management of ACP in Southern California.

County	Institution	History	Citrus acreage	Assessment rate (2018)	Coordinated treatments	Number of management units	Using PMAs?	Participation in AWM	Challenges	Other activities
Imperial	Imperial County Citrus Pest Control District	Formed in 1972 for California red scale (*Aonidiella aurantii*) control[1]. Expanded in 2013 to the whole county for ACP and HLB control[2]	7,200	$15 / acre	Fall (Aug-Oct, Winter (Dec-Jan), Spring (Feb-Apr)	7 (6 after 2020)	No, PCD growing zones	High	ACP from across the Mexican border	Outreach, trap monitoring, coordination with Mexican authorities
Riverside	Citrus Pest Control District No. 2 (Coachella	Formed in 1946 for California red scale	8,000	$150 / acre	Fall (Sep-Oct), Winter (Dec-Jan)	4	No, four zones	High, reimbursing for treatments	Reinfestation from residential areas	Tree removal, biocontrol

	Valley)	control[3]								
	Citrus Pest Control District No. 3 (Hemet)	Formed in 2017 for ACP and HLB control	2,134	$100/acre	Fall (Sep), Winter (Dec-Jan)	2	No, two zones	Very high, three growers. Reimbursing for treatments	Reinfestation from residential areas	Funding some activities in residential areas
	Rest of the county	No entity directing the sprays	1,500	None	Fall, Winter			Low, not tracked	Absentee owners, small growers	UC Riverside promoting participation
San Bernardino	San Bernardino ACP/HLB Task Force	Formed in 2014[4]	3,000	None	Fall (Oct-Nov), Winter (Nov-Dec), Spring (May-Jul)	19	Yes	Variable	Small growers, scarcity of PCOs, urban interface, water supply, bad actors	Grower liaison in contact with homeowners, reporting abandoned trees
San Diego	San Diego County Citrus Pest Control District	Formed in 2017 for ACP and HLB control[5]	4,500	$180 / acre	Fall (Aug-Sep), Winter (Jan), Spring (May-Jun)	3	No, three areas (Borrego Springs, San Pasqual, Pauma/Pala)	Variable when it was voluntary. Now higher because of assessment reimbursements	Problems with organic treatments, small growers	County authorities monitor abandoned trees and try to remove them

							Valley)			
Santa Barbara	Advisory committee	Formed in 2015 for ACP and HLB control[6]	4,425	None	Fall (Sep), Winter (Jan)	12 (11 after 2019)	No, treating by cities	High	Weather, small properties	
Ventura	Ventura ACP/HLB Task Force	Formed in 2010 for ACP and HLB control[7]	25,000	None	Fall (Jul-Sep + Sep-Nov), Winter (Jan-Mar), Spring (Apr-Jun)	50	Yes	High	Spraying equipment shortage, continuous harvest, weather, movement of fruit	Outreach campaign in residential areas, reporting system for abandoned trees

[1] (Margo Sanchez, pers. comm.), [2] (Mark McBroom, pers. comm.), [3](Baker 1988), [4](Bob Atkins, pers. comm.), [5](Cressida Silvers, pers. comm.),[6](SDCCPCD 2021), [7](John Krist, pers. comm.)

Table A2.2: Socio-economic characteristics of the survey respondents who indicated that they had citrus groves in Southern California (n =98).

Survey item	Responses
Role in citrus production	
Grove Owner	38
Ranch Manager	17
PCA	18
PCO	2
Other	18
NA	5
Farm size	
< 5 acres	23
5 – 25 acres	18
26 – 100 acres	11
101 – 500 acres	13
> 500 acres	28
NA	5
Age	
<35 years	12
35 - 50 years	14
51 – 65 years	37
> 65 years	35
Management system	
Conventional	59
Organic	13
Both	23
NA	3

Income from citrus	
< 25%	40
26 - 50%	13
51 - 75%	16
76 - 100%	23
NA	6

Note: Pest Control Adviser (PCA), Pest Control Operator (PCO), no answer (NA)

Table A2.3: Posterior mean and 95% credible interval for the parameters in the zoib regression models evaluated that were more complex than the selected model (SD28).

		SD22 mean	SD22 2.5%	SD22 97.5%	SD23 mean	SD23 2.5%	SD23 97.5%	SD24 mean	SD24 2.5%	SD24 97.5%	SD19 mean	SD19 2.5%	SD19 97.5%	SD28 mean	SD28 2.5%	SD28 97.5%
logit (mean)	Institutional approach[†]	-1.08	-1.67	-0.52	-1.08	-1.61	-0.53	-1.06	-1.63	-0.50	-0.68	-1.21	-0.13	-1.09	-1.65	-0.57
	Group size	-0.01	-0.02	0.00	-0.01	-0.02	0.00	-0.01	-0.02	0.00	-0.01	-0.02	-0.01	-0.01	-0.02	0.00
	Size of resource system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Grove size	0.10	0.06	0.14	0.10	0.07	0.14	0.10	0.06	0.15	0.08	0.04	0.12	0.10	0.06	0.14
	Heterogeneity	0.08	0.05	0.12	0.09	0.05	0.12	0.09	0.05	0.12	0.12	0.08	0.15	0.08	0.05	0.12
	Season[‡]	-0.18	-0.32	-0.04	-0.17	-0.30	-0.04	-0.17	-0.29	-0.03	-0.16	-0.29	-0.03	-0.17	-0.30	-0.05
	Age	-0.07	-0.10	-0.04	-0.07	-0.10	-0.05	-0.07	-0.10	-0.05	-0.07	-0.10	-0.05	-0.07	-0.10	-0.05

	Institution† x Age	0.17	0.10	0.25	0.17	0.09	0.25	0.17	0.09	0.25	0.18	0.09	0.26	0.17	0.10	0.25
	Grove size x Heterogeneity	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00
	Intercept	0.43	0.06	0.78	0.40	0.07	0.73	0.42	0.07	0.77	0.46	0.12	0.81	0.43	0.11	0.79
log(dispersion)	Institutional approach†	-0.81	-1.32	-0.30	-0.81	-1.32	-0.33	-0.80	-1.30	-0.31				-0.81	-1.30	-0.38
	Group size	0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.03	0.04	0.03	0.02	0.04
	Size of resource system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				0.00	0.00	0.00
	Grove size	0.06	0.02	0.11	0.06	0.02	0.11	0.06	0.01	0.10				0.06	0.02	0.10
	Heterogeneity	-0.05	-0.09	-0.01	-0.05	-0.09	-0.02	-0.05	-0.09	-0.01				-0.05	-0.08	-0.02
	Season‡	-0.07	-0.27	0.13												
	Age	0.00	-0.03	0.04												
	Intercept	0.90	0.56	1.27	0.88	0.60	1.15	0.89	0.60	1.17	1.07	0.91	1.23	0.88	0.62	1.13

logit(P(1))	Institutional approach[†]	-92.64	-221.71	-6.68	-34.93	-85.72	-3.62	-46.39	-119.37	-3.70				-67.45	-188.90	-4.66
	Group size	-0.69	-1.21	-0.29	-0.61	-1.01	-0.31	-0.59	-1.07	-0.28	-0.49	-0.87	-0.22	-0.58	-0.93	-0.30
	Size of resource system	0.00	0.00	0.00												
	Grove size	-0.02	-0.15	0.10												
	Heterogeneity	0.04	-0.12	0.19							-0.01	-0.13	0.10			
	Season[‡]	0.51	-0.86	1.85												
	Age	-0.13	-0.40	0.13												
	Intercept	-1.06	-3.25	0.93	-1.37	-2.35	-0.43	-1.41	-2.45	-0.37	-2.13	-3.42	-0.96	-1.43	-2.38	-0.51
logit(P(0))	Institutional approach[†]	-0.22	-0.91	0.49												
	Group size	-0.31	-0.39	-0.24	-0.30	-0.37	-0.24	-0.32	-0.39	-0.26	-0.28	-0.34	-0.23	-0.32	-0.38	-0.27

Size of resource system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Grove size	0.08	0.04	0.13	0.08	0.04	0.13	0.05	0.02	0.08	0.07	0.05	0.10			
Heterogeneity	-0.05	-0.11	0.00	-0.05	-0.10	0.00							0.03	0.00	0.06
Season‡	-0.36	-0.82	0.08												
Age	-0.08	-0.17	0.00												
Intercept	0.50	-0.27	1.30	-0.13	-0.74	0.46	-0.20	-0.77	0.36	-0.34	-0.91	0.22	0.54	0.10	1.04
DIC	1679813			1679811			1679814			1679852			1679849		
Multivariate psrf	1.39			1.05			1.20			1.01			1.10		

Note: deviance information criterion (DIC), potential scale reduction factor (prsf)

† Institutional approach was modeled as a factor, considering PMA as the baseline

‡ Season of treatment was modeled as a factor, considering Fall as the baseline

Table A2.4: Posterior mean and 95% credible interval for the parameters in the zoib regression models evaluated that were less complex than the selected model (SD28).

		SD27 mean	SD27 2.5%	SD27 97.5%	SD29 mean	SD29 2.5%	SD29 97.5%	SD30 mean	SD30 2.5%	SD30 97.5%	SD31 mean	SD31 2.5%	SD31 97.5%	SD13 mean	SD13 2.5%	SD13 97.5%	SD21 mean	SD21 2.5%	SD21 97.5%	SD0 mean	SD0 2.5%	SD0 97.5%
logit (mean)	Institutional approach†	-1.08	-1.64	-0.51	-1.34	-1.89	-0.83	-0.24	-0.68	0.20	-0.54	-0.97	-0.13	-0.67	-1.17	-0.13	-0.58	-1.13	-0.03			
	Group size	-0.01	-0.02	0.00	-0.02	-0.02	-0.01	-0.01	-0.02	0.00	-0.02	-0.02	-0.01	-0.01	-0.02	-0.01	-0.02	-0.03	-0.01			
	Size of resource system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	Grove size	0.10	0.07	0.14	0.03	0.00	0.06	0.10	0.06	0.14	0.03	0.00	0.05	0.08	0.04	0.12	0.09	0.05	0.12			
	Heterogeneity	0.08	0.04	0.12	0.02	-0.01	0.05	0.08	0.05	0.12	0.02	-0.01	0.05	0.12	0.08	0.15	0.13	0.09	0.16			
	Season‡	-0.17	-0.29	-0.04	-0.15	-0.28	-0.02	-0.17	-0.30	-0.04	-0.15	-0.28	-0.03	-0.16	-0.29	-0.03	-0.16	-0.30	-0.02			

	Age	-0.07	-0.10	-0.05	-0.07	-0.10	-0.05	-0.06	-0.08	-0.03	-0.06	-0.08	-0.03	-0.07	-0.10	-0.05	-0.07	-0.10	-0.04			
	Institution† x Age	0.17	0.09	0.25	0.16	0.08	0.24							0.18	0.09	0.26	0.17	0.08	0.26			
	Grove size x Heterogeneity	-0.01	-0.01	0.00				-0.01	-0.01	0.00				-0.01	-0.01	0.00	-0.01	-0.01	0.00			
	Intercept	0.41	0.07	0.76	1.05	0.79	1.30	0.34	-0.01	0.69	0.96	0.71	1.23	0.47	0.12	0.81	0.51	0.17	0.86	1.06	0.98	1.15
log (dispersion)	Institutional approach†	-0.82	-1.32	-0.33	-0.88	-1.38	-0.40	-0.89	-1.38	-0.41	-0.95	-1.44	-0.44									
	Group size	0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.03	0.04						
	Size of resource system	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
	Grove size	0.06	0.02	0.11	0.06	0.02	0.10	0.07	0.03	0.11	0.07	0.03	0.11									

	Heterogeneity	-0.05	-0.09	-0.02	-0.06	-0.10	-0.02	-0.06	-0.09	-0.02	-0.06	-0.10	-0.03									
	Season‡																					
	Age																					
	Intercept	0.88	0.60	1.16	0.87	0.60	1.16	0.87	0.59	1.14	0.87	0.59	1.14	1.07	0.91	1.23	1.53	1.42	1.63	1.24	1.14	1.34
logit (P(1))	Institutional approach†																					
	Group size	-0.47	-0.83	-0.23	-0.48	-0.89	-0.23	-0.47	-0.84	-0.22	-0.51	-0.91	-0.24	-0.49	-0.85	-0.22						
	Size of resource system																					
	Grove size																					
	Heterogeneity																					
	Season‡																					
	Age																					

	Intercept	-2.22	-3.12	-1.36	-2.17	-3.10	-1.31	-2.21	-3.12	-1.35	-2.14	-3.06	-1.27	-2.17	-3.10	-1.30	-4.37	-5.00	-3.79	-4.37	-5.03	-3.79
logit (P(0))	Institutional approach†																					
	Group size	-0.32	-0.38	-0.27	-0.32	-0.38	-0.26	-0.32	-0.38	-0.26	-0.32	-0.38	-0.26	-0.31	-0.37	-0.26						
	Size of resource system																					
	Grove size																					
	Heterogeneity	0.03	0.00	0.07	0.03	0.00	0.07	0.03	0.00	0.07	0.03	0.00	0.07									
	Season‡																					
	Age																					
	Intercept	0.53	0.06	1.01	0.53	0.05	1.00	0.53	0.05	1.02	0.53	0.05	1.03	0.89	0.55	1.25	-1.43	-1.61	-1.25	-1.43	-1.60	-1.26
	DIC	1679860			1679885			1679877			1679900			1679883			1680225			1680402		

Multivariate psrf	1.0 4	1.0 2	1.0 5	1.0 5	1.0 2	1.0 5	1

Note: deviance information criterion (DIC), potential scale reduction factor (prsf)

† Institutional approach was modeled as a factor, considering PMA as the baseline

‡ Season of treatment was modeled as a factor, considering Fall as the baseline

Table A2.5: Posterior mean and 95% credible interval for the parameters in the selected zoib regression model (SD28) with the size of the resource system, and the model without this independent variable (SD32).

		SD28 mean	SD28 2.5%	SD28 97.5%	SD32 mean	SD32 2.5%	SD32 97.5%
logit(mean)	Institutional approach†	-1.09	-1.65	-0.57	-0.65	-1.17	-0.13
	Group size	-0.01	-0.02	0.00	-0.01	-0.01	0.00
	Size of resource system	0.00	0.00	0.00			
	Grove size	0.10	0.06	0.14	0.13	0.09	0.16
	Heterogeneity	0.08	0.05	0.12	0.10	0.07	0.13
	Season‡	-0.17	-0.30	-0.05	-0.17	-0.31	-0.04
	Age	-0.07	-0.10	-0.05	-0.07	-0.10	-0.05
	Institution† x Age	0.17	0.10	0.25	0.17	0.09	0.26
	Grove size x Heterogeneity	-0.01	-0.01	0.00	-0.01	-0.01	-0.01
	Intercept	0.43	0.11	0.79	0.26	-0.06	0.58
log(dispersion)	Institutional approach†	-0.81	-1.30	-0.38	-0.42	-0.82	0.01
	Group size	0.03	0.02	0.04	0.04	0.03	0.05
	Size of resource system	0.00	0.00	0.00			
	Grove size	0.06	0.02	0.10	0.07	0.03	0.11
	Heterogeneity	-0.05	-0.08	-0.02	-0.05	-0.08	-0.02
	Season‡						

	Age						
	Intercept	0.88	0.62	1.13	0.88	0.62	1.15
logit(P(1))	Institutional approach†	-67.45	-188.90	-4.66	-53.65	-126.63	-3.99
	Group size	-0.58	-0.93	-0.30	-0.58	-0.94	-0.30
	Size of resource system						
	Grove size						
	Heterogeneity						
	Season‡						
	Age						
	Intercept	-1.43	-2.38	-0.51	-1.42	-2.39	-0.47
logit(P(0))	Institutional approach†						
	Group size	-0.32	-0.38	-0.27	-0.32	-0.37	-0.27
	Size of resource system						
	Grove size						
	Heterogeneity	0.03	0.00	0.06	0.03	0.00	0.07
	Season‡						
	Age						
	Intercept	0.54	0.10	1.04	0.54	0.06	1.04
	DIC	1679849			1679861		
	Multivariate psrf	1.10			1.33		

Note: deviance information criterion (DIC), potential scale reduction factor (prsf)

† Institutional approach was modeled as a factor, considering PMA as the baseline

‡ Season of treatment was modeled as a factor, considering Fall as the baseline

LITERATURE CITED

Baker, B. P. 1988. Pest Control in the Public Interest: Crop Protection in California. *UCLA Journal of Environmental Law and Policy* 8(1):31–71.

Department of Water Resources. 2020, January 7. 2016 Statewide Crop Mapping GIS Shapefiles. California Natural Resources Agency.

Gelman, A., J. Carlin, H. Stern, D. Dunson, A. Vehtari, and D. Rubin. 2021. *Bayesian Data Analysis*. Third Edition. CRC Press/ Chapman and Hall, Boca Raton, FL.

Liu, F., and Y. Kong. 2015. zoib: An R Package for Bayesian Inference forBeta Regression and Zero/One Inflated Beta Regression. *The R Journal* 7(2):34–51.

R Foundation for Statistical Computing. 2020. *R: A language and environment for statistical computing*. Vienna, Austria.

SDCCPCD. 2021. About Us. https://sdccpcd.specialdistrict.org/about-us.

Wickham, H. 2016. *ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag, New York, NY.

Wickham, H., R. François, L. Henry, and K. Müller. 2021. *dplyr: A Grammar of Data Manipulation*.

van Woerden, I., D. Hruschka, and M. Bruening. 2019. Food insecurity negatively impacts academic performance. *Journal of Public Affairs* 19(3):e1864.