Environment and Pollution; Vol. 5, No. 1; 2016
ISSN 1927-0909 E-ISSN 1927-0917
Published by Canadian Center of Science and Education

Implementation and Evaluation of a Communication Strategy to Control Ragweed Pollen

Céline Plante, M. Sc.[1], Audrey Smargiassi[2,3], Francine Hubert[1] & et Sophie Goudreau D.E.S.S.[1]

[1] Direction de santé publique, Agence de la santé et des services sociaux de Montréal, Canada

[2] Chaire sur la pollution de l'air, les changements climatiques et la santé, Département de santé environnementale et de santé au travail, Université de Montréal, Montréal, Canada

[3] Institut national de santé publique du Québec, Montréal, Canada

Received: May 12, 2015 Accepted: June 13, 2015 Online Published: April 28, 2016

doi:10.5539/ep.v5n1p87 URL: http://dx.doi.org/10.5539/ep.v5n1p87

Abstract

The common ragweed (*Ambrosia artemisiifolia*) is widespread in southwestern areas of Quebec, Canada. It is known to release large quantities of pollen from July through September, triggering allergic reactions such as rhinitis and generating significant costs for public health. The objective of this study was to implement and evaluate a communication intervention aimed at decreasing ragweed pollen. Selected lands with potential ragweed presence were visited twice, before and after the intervention, on three seasons in the East of the Montreal Island, Quebec. At the first visit done in 2010, 2011, and 2012, ragweed plots were located and measured; at the second visit in 2012, the measures were redone. Various numbers of communications were sent to owners of ragweed-infested lands that included explanations of health impacts of ragweed pollen and the importance of mowing. Mixed logistic regressions were used to test the effect of the number of communications on the mow. In the group that received four notices, a statistically significant three-fold increase in the proportion of land owners that had cut ragweed plots (OR = 3.20; 95 %CI: 1.16-8.84) was noted, compared to the group that received only one notice. For owners of vacant lands, the effect was somewhat more pronounced (OR = 3.82; 95%CI: 1.23-11.67). Nonetheless, the change from one to three communications showed no increase of mowing. In conclusion, the results of the present study suggest that communications and reminders of the importance of ragweed cut to landowners could be an effective measure to limit ragweed pollen.

Keywords: Ambrosia**,** Seasonal Allergic Rhinitis, Prevention & Control

1. Introduction

Pollen is a leading cause of seasonal allergic rhinitis and contributes to the aggravation of asthma (Bacsi et al. 2006; Jacques et al. 2008). The prevalence of seasonal allergic rhinitis of the general population in the province of Quebec is 11% (Ministère de la Santé et des Services sociaux du Québec, 2008). In 2005, the costs due to allergic rhinitis related to ragweed were estimated between 157 and 240 million dollars (Tardif 2008). Ragweed (*Ambrosia* spp.) would be responsible to 50 to 90 % of the seasonal allergic rhinitis (Comtois & Gagnon, 1988).

Without controlling for ragweed pollen and the plants, the health impact of ragweed is expected to worsen with climate change through the spread of the geographic distribution and the increase in the duration of the pollination period likely to occur in Canada (Ziska *et al*., 2011).

An awareness of the problem has led to the suggestion of several ragweed control methods where the plant is abundant. Among the methods for controlling the plant, mowing or cutting is of particular interest because of its low cost. An experimental study done in green house by Agriculture and Agri-food Canada (AAFC 2011) suggests that cutting ragweed plants when the plant reaches about 25 cm to a height of about ten cm twice in the season, around mid-July and mid-August, can reduce pollen production by a factor of nine and reduce seed production by a factor five. In turn, pollen reduction could lead to health improvements of allergic persons (Masson et al. 2012).

The objective of this study was to implement and evaluate an intervention aimed at decreasing ragweed pollen. The intervention consisted of personalized information distributed to the owners of ragweed-infested lands, explaining the health risks for residents and requesting that the grass be cut twice during the summer season in the region of the local health center of the East-end of Montreal (the CSSS de la *Pointe-de-l'Île* of Montreal,

Quebec).

2. Methods

2.1 Sampling

Measurements on the field took place during three ragweed seasons (2010, 2011 and 2012) in the East end of the Montreal island, Quebec, specifically in the municipality of *Montréal-Est* and the boroughs of *Anjou*, *Mercier-Hochelaga-Maisonneuve* (North-East part) and *Rivière-des-Prairies-Pointe-aux-Trembles*, all of which cover a combined 75 km^2.

Potential ragweed colonized lands were identified a priori using a risk scale based on land use categories and knowledge of habitat preferences of the species. Most of the lands selected belong to the following land use categories: industrial, commercial, institutional, park and vacant. The selected lands, which cover 9 km^2 were visited twice, before and after the intervention. During the first visit, the lands were inspected entirely to locate ragweed plots, to measure the area infested and the plant sizes as well as their cutting state. At the second visit, the ragweed plots were re-located, and the measures redone. The first visit was done during any of the three years, while the second was done in 2012.

Following the first visit, communications as notices or reminders containing information on the health effects of ragweed pollen, on the importance of mowing at the most effective periods, and a map of the areas infested, were sent by mail and email to almost all landowners with ragweed on their lands (Table 1). These communications suggested mowing in mid-July and mid-August. It should be noted that for a subgroup of the land owners, permission to visit their land(s) was obtained by the mean of a telephone conversation during which the importance of mowing was mentioned. In 2012, the second visit took place at least two weeks after the communication. The numbers of communications varied principally according to the date of occurrence of the first visit in the field (2010, 2011, and 2012) as described in Table 1. Of the 456 lands with ragweed at the first visit, a total of 386 lands were revisited, but ragweed plots were retrieved at this second visit for 347 of those lands which were the ones used to evaluate the intervention. So there were 39 lands (10 %) with ragweed at the first visit for which no measures were recorded during the second visit. All field work was done by Nature Action Québec.

Table 1. Description of the intervention to landowners of lands with ragweed according to the year of the first visit of the land

	1st visit in 2010	1st visit in 2011	1st visit in 2012
Number of land lots	1st visit: 125 2nd visit: 94	1st visit: 109 2nd visit: 106	1st visit: 152 2nd visit: 147
Number of land owners	1st visit : 22 2nd visit: 21	Both visits: 5	1st visit: 107 2nd visit: 102
Notices sent	Spring 2011 (where visit authorized)	Spring 2012 (all)	August 2012 (all)
Reminders sent	July 2011, July 2012, August 2012	July 2012, August 2012	None
Total number of reminders	Either 3 or 0	2	0
Total number of communications†	4 (10 owners,80 lands) 0 (11 owners, 14 lands)	3 (106 owners, 106 lands)	0* (5 owners, 6 lands) 1 (97 owners, 141 lands)

* Due to mail returned, 5 landowners. † For owners of lands with ragweed at the 2nd visit.

The intervention to reduce ragweed via landowner's awareness took the form of various numbers of notices or reminders sent. Intervention's efficiency was defined for each land through two measurements: 1. Mowing observed (yes/no), and 2. Height of grass ≤ 15 cm. This height corresponds to the lowest of the categories in which grass height was registered in the field and is the closest to the cutting height suggested in the AAFC

study (unpublished at the study onset). The land was the unit of analysis. A land was categorized as mowed if at least one ragweed plot (in cases there were more than one) had been cut according to field surveyors.

2.2 Statistical Analyses

Mixed logistic regressions were used to test the effect of the intervention. The 1st level of the model was the land, and the 2nd level, the owners. The two cutting state variables were used as dependant variables, i.e. mowing observed (binary), and height of grass (binary, ≤ 15 cm or > 15 cm). The independent variable (intervention) was the number of notices/reminders (binary; three and four versus one). Cases with no letter (letters returned) were rare and include no variation so cannot be used in the analyses. No owner received two notices. Regressions were run separately for all lands sampled and for the large subset of lands with ragweed made of vacant lands. Results are presented as odds ratios (OR) with their 95% confidence intervals. The regressions were performed on 347 lands (number of lands with ragweed at the two visits).

3. Results

3.1 Summary of Field Data

The presence of ragweed during the first visit was found in 456 of the 866 land lots visited, or 53% of lands targeted (Table 2). The number of ragweed plots identified extended from one to 44 with an average of two per land lot. The ragweed plot area at the first visit ranged from 0.5 m^2 to 26,000 m^2 per lot with a median of 25 m^2. The proportion of lands with the presence of ragweed was similar between years (Chi square test; 95 % level). Table 2 also shows that the presence of ragweed is less common on residential properties than in other land use categories. The overall proportion of lands mowed at the second visit was 67 %. The vacant lots, which are numerous, were mowed in a proportion of 55 %.

Table 2. Description of field data and presence of ragweed, by year of first visit and by type of land use

	Total land lots surveyed (first visit)	Lands with ragweed at first visit	Lands revisited in 2012 for the intervention's evaluation
By year			
2010	257	139 (54%)	94
2011	217	114 (53%)	106
2012	382	203 (52%)	147
Total	866	456 (53%)	347
By land type			
Commercial	55	30 (55%)	21
Industrial	101	61 (60%)	57
Institutionnal	48	32 (67%)	25
Park	31	25 (81%)	24
Residential[1]	81	7 (9%)	3
Vacant	550	301 (55%)	217

3.2 Intervention Effect

Increasing the number of communications to the landowner tended to result in a higher proportion of land mowed. As such, in the group that received four communications, the proportion of land owners having cut ragweed plots was about three time higher (OR = 3.20; 95 %CI: 1.16-8.84) than in the group that received only one notice (Table 3). For owners of vacant lands, the effect was somewhat more pronounced (OR = 3.82; 95%CI: 1.23-11.67). Nonetheless, the change from one to three communications showed no increase of mowing. No tendency was observed between grass height and intervention (Table 3). In fact, the two cutting state variables (mow observed and height ≤15 cm) were correlated (phi=0.6) but not equivalent, as some land lots with grass >15 cm high were considered cut.

We also tested the effect of the authorization to visit the lot from the land owners as it represents a personal

contact with the landowners. A regression analysis (testing the effect of authorization obtained or not obtained) showed no significant effect of the authorisation on the mow (data not shown).

Table 3. Odds Ratios* relating the land cutting state recorded at the second visit in 2012 and intervention, in the East-end of Montreal island, Quebec

	Cutting state of land			
Intervention variable	**Mowing noted**		**Height of herbs ≤15 cm**	
Number of communications	**All type of lands**	**Vacant lots**	**All type of lands**	**Vacant lots**
Three versus one	0.98 (0.43-2.21)	1.16 (0.47-2.85)	0.55 (0.27-1.14)	1.00 (0.60-1.67)
Four versus one	3.20 (1.16-8.84)	3.82 (1.23-11.86)	1.45 (0.65-3.24)	0.96 (0.55-1.68)

***** Odds ratios estimated from logistic regression models for grouped data (lands grouped par landowners). Intervention variables are tested in separate models.

4. Discussion and Conclusion

This study aimed at implementing and evaluating a ragweed control strategy, in Montreal Island, Quebec, Canada, using personalized information distributed to the owners of potentially ragweed-infested lands.

The results suggest that land owners, specifically of vacant lots, may have a tendency to mow more when they receive several notices and reminders that include information on the state of their lands regarding ragweed infestation and health effects of ragweed pollen. However statistical significance was only reached when comparing four communications to one communication and not for three communications compared to one, so caution in the interpretation of the results is necessary.

No trend was observed when grass height was used as the effect measure variable (comparing ≤15 cm and >15 cm), perhaps because height classes used in the field (defined *a priori*) did not sufficiently correspond to the cut observed by the investigators. In fact, there were some lands with grass higher than 15 cm that were considered cut. However, observed mowing may be a better variable to assess the effectiveness of the intervention (communications) than grass height, given that grass height is influenced by the time since the last mow.

There are several possible reasons why land owners do not cut the weeds on their land. Beyond the question of cost, it is possible that a lack of knowledge about the ragweed plant and the impacts of its pollen on the respiratory health of allergy sufferers have an influence on mowing. In the case of land managed by public organizations, there could also be a lack of clarity about the areas of responsibility of the various owners. This could be the case, for example, for the road network and its access roads, where different levels of government share the responsibilities for maintenance.

This study has limitations. First few "control" lands, i.e. owners who received no communication, no recall and no request for permission to visit, were excluded in the analyses. Thus, our estimate of the impact of communications and reminders is limited to a comparison to the number of notices sent. Furthermore, some owners had many lands and the effect of the intervention among them may be different than from other owners.

Finally, it should be added that other strategies, excluding herbicides, can be used in conjunction for an optimal control ragweed pollen, such as hand-pulling and re-vegetation after disturbance with perennial species.

In conclusion, the results of the present study suggest that communications and reminders on the importance of ragweed cut to landowners could be an effective measure to reduce ragweed pollen, especially for owners of vacant lands. Although the results need to be replicated due to the limitations of the study, they suggest that a simple intervention may help reduce ragweed pollen.

5. Acknowledgements

This study has been supported by OURANOS (Consortium sur la climatologie régionale et l'adaptation aux changements climatiques) and the Direction de la santé publique du Centre intégré universitaire de santé et des services sociaux du Centre-Est-de-l'Île-de-Montréal. The authors thank Allen Brand who revised the text.

References

Agriculture and Agri-food Canada. (2011). *The effects of cutting on pollen and seed production in ragweed*. Retrieved from

http://www.agr.gc.ca/eng/science-and-innovation/science-publications-and-resources/technical-factsheets/the-effects-of-cutting-on-pollen-and-seed-production-in-ragweed/?id=1310674754431

Bacsi, A., Choudhury, B. K., Dharajiya, N., Sur, S., & Boldogh, I. (2006). Subpollen particles: carriers of allergenic proteins and oxidases. *Journal of Allergy and Clinical Immunology*, *118*(4), 844-850. http://dx.doi.org/10.1016/j.jaci.2006.07.006

Comtois, P., & Gagnon, L. (1988). Concentration pollinique et fréquence des symptômes de pollinose: une méthode pour déterminer les seuils cliniques. *Revue Française d'Allergologie et d'Immunologie Clinique, 28*(4), 279-286. http://dx.doi.org/10.1016/S0335-7457(88)80046-7

Jacques, L., Goudreau, S., Plante, C., Fournier, M., Thivierge, R. L. (2008). *Prévalence des manifestations allergiques associées à l'herbe à poux chez les enfants de l'île de Montréal. Montréal*: Direction de santé publique - Agence de la santé et des services sociaux de Montréal.

Masson, E., Noisel, N., Benoît, D.-L., Pinsonneault, L., Groulx, J., Hénault, G., & Simard, M.-J. (2012). Assessment of the effectiveness of a mobilization project for the control of ragweed on the quality of life of allergic individuals. *Ambroisie, the first international ragweed review, 27*(10), 33-42.

Ministère de la Santé et des Services sociaux du Québec. (2008). *Enquête québécoise sur la santé de la population. Quelques repères - Le Québec et ses régions*. Quebec Public Health Survey.

Tardif, I. (2008). *Portrait des coûts de santé associés à l'allergie au pollen de l'herbe à poux, Année 2005*. Longueuil: Agence de la santé et des services sociaux de la Montérégie.

Ziska, L. H., Epstein, P. R., & Schlesinger, W. H. (2009). Rising CO_2, Climate Change and Public Health: exploring the links to plant biology. *Environmental Health Perspectives, 117*(2), 155-158. http://dx.doi.org/10.1289/ehp.11501