Identifying Adaptation Options and Constraints: The role of agronomist knowledge in catchment management strategy

Water Resources Management

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Online Resource 3. Results from Stage 3 online survey

This document presents results from the 43 Likert items included in the Stage 3 survey for online consultation with pesticide agronomists (Tables 1–7), and the results from three acquiescence bias tests and two internal consistency tests performed to validate responses to the online consultation with pesticide agronomists (Table 8), as described in Section 2.4

Tables 1–7 each include a count distribution of responses against the Likert response scale (‘Strongly disagree’ (SD), ‘Disagree’ (D), ‘Neither agree nor disagree’ (N), ‘Agree’ (A), ‘Strongly agree’ (SA)), a p-value from chi-squared ‘goodness of fit’ tests, and a conclusion at significance level (α) = 0.05 regarding whether to accept or reject H_n (i.e. that there is no consensus in response to the Likert item).

Table 1. Likert items for propyzamide and carbetamide

Item #	Likert Item	Distribution (count) (n=94)					p-value	Conclusion (Accept Null Hypothesis Hn or alternative hypothesis Ha)
		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
1a	If propyzamide is not available, carbetamide can be used to manage resistant blackgrass in the OSR stage of a combinable rotation	13	26	14	34	7	0.823	Accept Hn: No consensus
1b	There are no pesticide alternatives to propyzamide and carbetamide for resistant blackgrass management in the OSR stage of a combinable rotation	2	5	8	27	51	0.000	Accept Ha: Agree
1c	If propyzamide and carbetamide were banned OSR would continue to be grown in areas where resistant blackgrass is a problem	22	40	12	15	3	0.000	Accept Ha: Disagree
1d	Without propyzamide and carbetamide, no autumn break crops can be grown where resistant blackgrass is a problem	0	19	11	40	22	0.000	Accept Ha: Agree
1e	Without propyzamide and carbetamide, a change to the rotation would be needed where resistant blackgrass is a problem	0	1	4	42	43	0.000	Accept Ha: Agree.
1f	The loss of propyzamide and carbetamide will lead to increased use of spring crops to manage resistant blackgrass in the rotation	2	5	15	48	22	0.000	Accept Ha: Agree

Table 2. Likert items for metaldehyde

Item #	Likert Item	Distribution (count) (n=94)					p-value	Conclusion (Accept Null Hypothesis Hn or alternative hypothesis Ha)
		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
2a	If you couldn't use metaldehyde, methiocarb could be used for slug management	1	5	6	65	15	0.000	Accept Ha: Agree.
2b	If you couldn't use metaldehyde, ferric phosphate could be used for slug management	1	5	11	61	14	0.000	Accept Ha: Agree.
2c	There are no pesticide alternatives to metaldehyde	23	54	6	6	1	0.000	Accept Ha: Disagree.
2d	Cultural control is not a substitute for metaldehyde slug control	0	14	18	41	15	0.000	Accept Ha: Agree.
2e	In the absence of metaldehyde, pesticide substitutes of equal efficacy are available	0	18	13	48	11	0.000	Accept Ha: Agree.
2f	The loss of metaldehyde would lead to a change to the rotation where OSR and Wheat are grown on heavy soils	5	36	28	20	3	0.024	Accept Ha: Disagree.

Table 3. Likert items for mesosulfuron-methyl (Atlantis)

Item #	Likert Item	Distribution (count) (n=94)					p-value	Conclusion (Accept Null Hypothesis Hn or alternative hypothesis Ha)
		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
3a	There are no pesticide alternatives to Atlantis for blackgrass management at the post-emergence stage in wheat	4	39	9	29	12	0.827	Accept Hn: No consensus
3b	Where the efficacy of Atlantis is reduced, there will be an increase in the use of residual chemistry at pre-emergence timing in wheat	0	4	6	40	43	0.000	Accept Ha: Agree.
3c	Cultural control can replace the loss of Atlantis	16	49	14	12	2	0.000	Accept Ha: Disagree.
3d	In high pressure resistant blackgrass areas, a reduction in the efficacy of Atlantis will reduce wheat yields	1	1	9	46	36	0.000	Accept Ha: Agree.
3e	In high pressure resistant blackgrass areas, a reduction in the efficacy of Atlantis will prompt a change to the rotation	1	15	16	49	12	0.000	Accept Ha: Agree.

Table 4. Likert items for clopyralid

Item #	Likert Item	Distribution (count) (n=94)					p-value	Conclusion (Accept Null Hypothesis Hn or alternative hypothesis Ha)
		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
4a	Clopyralid is the only available pesticide for thistle management in OSR	0	14	12	53	14	0.000	Accept Ha: Agree.
4b	There are available pesticide alternatives to replace clopyralid for thistle management	8	48	20	18	0	0.000	Accept Ha: Disagree.
4c	Cultural control interventions can substitute for clopyralid control of thistles in OSR	17	55	16	4	2	0.000	Accept Ha: Disagree.
4d	In the absence of clopyralid, thistles will reduce OSR yields	0	11	24	49	10	0.000	Accept Ha: Agree.
4e	In the absence of clopyralid, thistles can be managed without a change to the rotation	6	44	25	18	1	0.000	Accept Ha: Disagree.

Table 5. Likert items for pendimethalin

Item #	Likert Item	Distribution (count) (n=94)					p-value	Conclusion (Accept Null Hypothesis Hn or alternative hypothesis Ha)
		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
5a	The loss of pendimethalin will lead to increased stacking of other pre-emergence residual herbicides to manage grassweeds in cereal crops	0	1	9	45	39	0.000	Accept Ha: Agree.
5b	If pendimethalin were the only active substance lost, it would be possible to maintain cereal yields using alternative herbicides	5	13	18	52	6	0.000	Accept Ha: Agree.
5c	Pendimethalin is one of many modes of action used as part of a resistance management strategy for Blackgrass	0	1	4	52	37	0.000	Accept Ha: Agree.
5d	The loss of pendimethalin would trigger a change to the combinable rotation	9	33	34	15	3	0.002	Accept Ha: Disagree.

Table 6. Likert items for chlortoluron

Item #	Likert Item	Distribution (count) (n=94)					p-value	Conclusion (Accept Null Hypothesis Hn or alternative hypothesis Ha)
		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
6a	The loss of chlortoluron will lead to increased use of other herbicides at the pre-emergence stage for blackgrass control in the combinable rotation	3	7	10	60	13	0.000	Accept Ha: Agree.
6b	If chlortoluron were the only active substance lost, it would be possible to maintain cereal yields using alternative herbicides	3	5	17	60	8	0.000	Accept Ha: Agree.
6c	Chlortoluron is one of many modes of action used as part of a resistance management strategy for Blackgrass	1	1	12	56	23	0.000	Accept Ha: Agree.

Table 7. Likert items for general trends

Item #	Likert Item	Distribution (count) (n=94)					p-value	Conclusion (Accept Null Hypothesis Hn or alternative hypothesis Ha)
		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
GS1a	No new herbicides for blackgrass will be available in the next 5 years	2	7	10	40	34	0.000	Accept Ha: Agree.
GS1b	When one active substance is lost (for whatever reason) other active substance(s) will be used to manage the weed, pest or disease issue	1	9	9	56	18	0.000	Accept Ha: Agree.
GS1c	In the absence of effective pesticide control, weed and pest pressures will increase over time	0	1	2	39	50	0.000	Accept Ha: Agree.
GS1d	The agronomic impact of losing an active substance depends upon what active substances remain available	0	1	1	52	38	0.000	Accept Ha: Agree.
GS1e	Cultural control is a complement to, not a direct substitute for pesticides	0	0	2	38	52	0.000	Accept Ha: Agree.
GS1f	Effective resistance management requires as many different modes of action as possible	0	0	1	22	69	0.000	Accept Ha: Agree.
GS1g	When an active substance is lost, alternative active substances will be tried in preference to non pesticide interventions	0	7	14	52	18	0.000	Accept Ha: Agree.
GS2a	Where alternative pesticides cannot prevent severe gross margin losses, spring cropping will increase	1	5	13	64	9	0.000	Accept Ha: Agree.
GS2b	A change to the rotation is the intervention of last resort	3	17	8	49	15	0.000	Accept Ha: Agree.
GS2c	In general, direct substitutes do not exist for any active substance	1	15	14	51	10	0.000	Accept Ha: Agree.

GS2d	If the withdrawal of an active substance is announced 5 years in advance, alternative active substances will be available by the time of withdrawal	24	38	19	10	2	0.000	Accept Ha: Disagree.
GS2e	The adoption of wide OSR rows and inter row spraying will reduce current dependency on propyzamide and carbetamide	9	25	36	21	2	0.145	Accept Hn: No consensus
GS2f	If approved for use, RoundUp Ready OSR would reduce current dependency on propyzamide and carbetamide	4	2	14	47	26	0.000	Accept Ha: Agree.
GS2g	If the future of one active substance is uncertain, alternative active substances will come to the market	17	47	17	11	0	0.000	Accept Ha: Disagree.

Table 8. Spearman's rank correlation coefficient (ρ) tests for acquiesence bias and internal consistency using Spearman's rank correlation test

Test	Test pair	ρ	Conclusion
Acquiescence bias	4a + 4b	0.548	Accept H_n**
Acquiescence bias	1c + 1e	0.333	Accept H_n**
Acquiescence bias	2e + 2c	0.589	Accept H_n**
Internal consistency	3d + 3e	0.245	Accept H_n *
Internal consistency	GS12d + GS2g	0.63	Accept H_n **

* Accept at significance level (α) = 0.05, ** Accept at α = 0.05 and α = 0.01