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Survey of *Polymeria longifolia* (Lindley) in the Australian cotton industry

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Summary

The present status and control of polymeria take-all (*Polymeria longifolia* Lindley) in the Australian cotton industry was assessed in a survey involving the 96 cotton consultants and farm agronomists in New South Wales (NSW) and southern and central Queensland (Qld) at the start of the 1996/97 growing season. The survey aimed to draw together much of the anecdotal information that existed about the weed and to use this information to direct future research needs. A response rate of 62.5% was achieved indicating that the survey technique was successful and that there was real concern about the impact of this weed.

The areas of greatest concern for polymeria take-all were the Gwydir, Namoi and Macintyre Valleys and the St. George area. Overall, even though infestations occurred in only 1% of the area surveyed, it was believed to be the fourth worst weed in cotton crops, being difficult to control and causing large yield reductions by removing moisture from the soil. The additional cost of treatment of polymeria take-all ranged from $12 to $100 ha^{-1} y^{-1}. Herbicide application was regarded as the most successful means of control but it resulted in a decrease in the occurrence of the weed in only 37% of cases and all herbicides registered for in-crop use in non-herbicide resistant cotton were ineffective.

Introduction

Polymeria take-all (*Polymeria longifolia* Lindley) is a native Convolvulaceae species and a weed of both irrigated and dryland cropping in Australia (Johnson 2000). In a survey of NSW cotton growers conducted during the 1988/89 growing season, polymeria take-all was found to affect 23% of cotton properties and appeared to be increasing in abundance (Charles 1991). The difficulty in controlling polymeria take-all in existing cotton areas and the rapid development of large infestations in areas of expanding production, for example, Walgett (north western NSW) and St. George/Dirranbandi (south western Qld), has highlighted the need for ecologically based research in an effort to develop more successful management strategies.

While there has been extensive research into the distribution, biology and control of many weeds in Australia, for example, Groves *et al*. (1995) and Panetta *et al*. (1998), there is a notable lack of published data on the 34 genera indicated as cotton weed problems, including polymeria take-all (Charles 1991). The survey reported in this paper aimed to draw together observations made by cotton consultants and agronomists regarding the weed to direct future research. In particular, information was sought on the relative importance of polymeria take-all among other weeds of cotton, where polymeria take-all occurred, the factors believed to favour its growth and what problems it caused, the cost of control and effective management methods.

Materials and methods

The mail survey was undertaken at the start of the 1996/97 cotton growing season. The survey was given advance publicity by way of a poster presentation at the Eighth Australian Cotton Conference (August 1996) where the form was piloted to elucidate any ambiguities or other problems intrinsic in the questions.

Professional consultants and large-farm agronomists (referred to from here on as consultants) were targeted in the survey rather than individual growers for two important reasons. Firstly consultants are responsible for a wide range of agronomic advice to growers including weed identification and control. Secondly, a broader and more comprehensive picture could be obtained which would show less variability than responses from individual growers.

A short presentation about polymeria take-all was delivered at a meeting attended by NSW consultants during September 1996. The one page, double-sided survey was then handed out for

immediate completion to enhance the return rate. Survey forms were then mailed to all consultants who were not present or had failed to complete the form at the meeting. Included with the survey form in the mail out was a covering letter, a coloured information sheet to aid with the identification of polymeria take-all and a pre-paid, self-addressed envelope for return of the survey form. In total, 66 surveys were sent to NSW members and 12 surveys to Qld members during October and November 1996. A follow-up reminder mail out was used four weeks later and included a short accompanying letter, an additional survey form with information sheet and a reply-paid envelope.

Although mail surveys can be a time-effective method of determining the general distribution of a weed (Cuthbertson 1978) they have traditionally suffered from a low return rate. This survey used many techniques to ensure this problem was overcome including the survey form being as short and succinct as possible (Sudman and Bradburn 1983) and printing the form on pink stationery so that it stood out on the consultants' desk (Robinson and Agisim 1950). In addition, the survey was conducted when the weed was growing and obvious in fields (Sindel and Michael 1988), in this case spring, when emergence occurs.

Percentages quoted are percentages of actual respondents for each question unless otherwise stated. Because respondents could give more than one answer for some questions, percentages do not always add to 100%.

Results and discussion

Survey response rate

All 96 cotton consultants in the industry were contacted from which 60 (62.5%) replied. The response rate was comparable with that of other surveys that had utilized techniques to enhance the response rate, for example 65–74% (Dillon and Jarrett 1964, Freebairn 1967, Sindel and Michael 1988, Stoller *et al.* 1993).

General consultant information

The largest percentage of respondents was from the Gwydir and Namoi Valleys (Table 1). The total number of properties covered was highest in the Namoi Valley, the Darling Downs/South Burnett region and the Gwydir Valley (Figure 1).

Consultants who responded to this survey covered between 46 and 100% of each cotton production region (Table 1). The consulted areas in the Gwydir Valley and Tandou areas were overestimated when compared with industry estimates, while specific Lachlan Valley estimates could not be identified (Dowling 1997). Consultants in this survey covered a total of 72% of the cotton production area. This gives considerable confidence in the coverage of the results.

The worst weeds

The importance of polymeria take-all amongst cotton weeds was evaluated by asking consultants to list the five worst weeds they encountered in cotton crops in the 1995/96 (the previous) season. The results indicate that polymeria take-all was the fourth worst weed in Australian cotton crops, a significant increase in importance since the last survey of NSW cotton growing regions in the 1988/89 season (Charles 1991, Table 2).

There are a number of possible reasons for the increased importance of polymeria take-all in this survey, with no single reason likely to be solely responsible. While it is probable that this weed had increased in area and level of infestation during the period between the surveys, promoted in part by the difficulties experienced in controlling the weed with current techniques when compared with other weeds, the limited rate of spread of the species (Johnson 2000) could not account for all of the large increase in perceived importance. The importance of this weed may have been elevated in the minds of respondents because the survey dealt specifically with polymeria take-all. This is likely given that polymeria take-all has not been rated as highly in more recent surveys (Inglis 1999, Taylor and Walker 2002). Nevertheless, polymeria take-all continues to be a sustained and increasing problem for the industry (Johnson 2000, Charles and Johnson 2002).

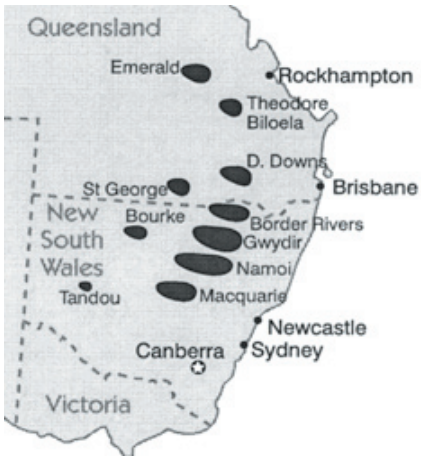

Figure 1. Cotton growing areas in Australia (CRC for Sustainable Cotton Production). The name Macintyre Valley has been used throughout this paper instead of the Border Rivers.

Table 1. General consultant information on the location, number and size of properties.

Cotton growing region	Number and % of respondents (No.)	(%)	Number of properties in survey (No.)	Total area in survey (ha)	Total cotton area[A] (ha)	Proportion of area covered by survey (%)
Namoi Valley	16	27.6	154	39 250	83 000	47
Gwydir Valley	20	34.5	114	95 930	95 500	100
Macintyre Valley	10	17.2	70	47 350	57 000	83
Macquarie Valley	5	8.6	45	24 130	34 000	71
Lachlan Valley	1	1.7	1	1 670	–	–
Tandou	1	1.7	1	10 000	5 400	100
Bourke	2	3.4	5	10 100	12 500	81
Darling Downs/Sth. Burnett	7	12.1	146	33 950	62 500	54
St George	4	6.9	46	15 300	20 000	77
Theodore/Biloela/Moura	0	0	0	0	7 000	0
Emerald	2	3.4	28	5 550	12 000	46
Total	60	100	610	283 330	388 900	72

[A] Cotton Yearbook estimate (Dowling 1997).

The most important weeds encountered in the 1988/89 season were Noogoora burr (*Xanthium occidentale* Bertol.) and nutgrass (*Cyperus* spp.) and these continued to be the major weed problems in the industry in the 1995/96 season. These weeds were mentioned by 63 and 57% of respondents, respectively. Many other species remained at a similar relative level of importance, for example cowvine/peachvine (*Ipomoea lonchophylla* J.M.Black), bladder ketmia (*Hibiscus trionum* L.), thornapple/castor oil (*Datura* spp.) and caltrop/yellow vine (*Tribulus* spp.).

When the problem weed species were examined with respect to region, a total of 21 taxa were rated among the ten worst weeds in the Namoi, Gwydir,

Table 2. The ten worst weeds encountered in cotton crops in the 1995/96 season.

Weed	Common name/s	**Percentage of respondents**[A]	**Score** (out of 5)[B]	**Rank**	**Rank** Charles (1991)
Cyperus spp.	Nutgrass	57	2.11	1	2
Xanthium occidentale	Noogoora burr	63	1.89	2	1
Ipomoea lonchophylla	Cowvine/peachvine	48	1.66	3	5
Polymeria longifolia	Polymeria take-all	29	1.16	4	10
Hibiscus trionum	Bladder ketmia	34	1.00	5	6
Datura spp.	Thornapple/castor oil	34	0.88	6	7
Xanthium spinosum	Bathurst burr	29	0.75	7 (equal)	3
Sesbania cannabina	Sesbania pea	23	0.75	7 (equal)	11
Salvia reflexa	Mintweed	16	0.63	9	13
Tribulus spp.	Caltrop/yellow vine	25	0.61	10	8

[A] This percentage represents the number of times that the weed was mentioned as one of the five worst weeds.
[B] The weeds were ranked from 1 to 5 (1 being the worst). Scores were allocated to each weed, i.e. a score of 5 was given to the worst weed, through to a score of 1 for the fifth worst weed. The score above is the average score across all respondents.

Table 3. The ten worst weeds encountered in cotton crops in the 1995/96 season by geographical cotton growing region.

Weed	Common name	**Weed ranking by region**[A]					
		Namoi	Gwydir	Macintyre	Macquarie	Darling Downs/ Sth. Burnett	St. George
Cyperus spp.	Nutgrass	1	2	3 (equal)	1 (equal)	3	1 (equal)
Xanthium occidentale	Noogoora burr	2	3	2	3 (equal)	7 (equal)	8 (equal)
Polymeria longifolia	Polymeria take-all	3	4	5	–	–	1 (equal)
Datura spp.	Thornapple/Castor oil	4	7 (equal)	9 (equal)	5 (equal)	7 (equal)	–
Hibiscus trionum	Bladder ketmia	5	–	7 (equal)	7	1	–
Ipomoea lonchophylla	Cowvine/Peachvine	6	1	1	–	2	5
Salvia reflexa	Mintweed	7	–	6	1 (equal)	–	6
Xanthium spinosum	Bathurst burr	8	7 (equal)	–	5 (equal)	–	8 (equal)
Echinochloa spp.	Barnyard grass	9	–	–	–	–	–
Tribulus spp.	Caltrop/Yellow vine	10	5	–	–	7 (equal)	–
Sesbania cannabina	Sesbania pea	–	6	3 (equal)	–	5 (equal)	4
Citrullus/Cucumis spp.	Wild melon/Paddy melon	–	7 (equal)	–	–	–	–
Polymeria pusilla	Annual polymeria	–	10	–	–	–	–
Urochloa panicoides	Liverseed grass	–	–	7 (equal)	–	–	–
Anoda cristata	Anoda weed	–	–	9 (equal)	–	5 (equal)	3
Rhynchosia minima	Rhynchosia	–	–	9 (equal)	–	10	8 (equal)
Solanum nigrum	Blackberry nightshade	–	–	–	3 (equal)	–	–
Cynodon dactylon	Couch	–	–	–	8	–	–
Physalis spp.	Wild gooseberry/Ground cherry	–	–	–	9 (equal)	–	–
Haloragis spp.	Raspwort/Haloragis take-all	–	–	–	9 (equal)	–	–
Ipomoea plebeia	Bellvine	–	–	–	–	4	7

[A] The weeds were ranked from 1 to 5 (1 being the worst) in each region. Scores were allocated to each weed, i.e. a score of 5 was given to the worst weed, through to a score of 1 for the fifth worst weed. The average score across all respondents for the region was determined and then the weeds ranked in order of importance.

Macintyre and Macquarie Valleys, the Darling Downs/South Burnett and St. George regions (Table 3). The ten worst weeds overall featured prominently in this list as would be expected (Table 2 *c.f.* Table 3).

The equal seventh rated weed in Table 2, sesbania pea (*Sesbania cannabina* (Retz.) Pers.), did not rate as an important weed in the Namoi Valley and failed to be mentioned by respondents in the Macquarie Valley (Table 3). It was found in the more northern cotton growing regions. Both anoda weed (*Anoda cristata* (L.) Schltdl.) and rhynchosia (*Rhynchosia minima* (L.) DC.) were ranked in the top ten weeds in cotton growing regions in Qld (the Macintyre Valley, the Darling Downs/South Burnett and St. George regions). Bellvine (*Ipomoea plebeia* R.Br.), similar to cowvine, was problematic in the latter two regions. The rating of these three species in Qld, but not in the NSW cotton growing regions, indicated that the weed flora varied on a regional basis.

The problem weed flora of the Macquarie Valley of NSW was distinct from the Namoi, Gwydir and Macintyre Valleys, the other areas in NSW (Table 3). There was a notable absence of polymeria take-all and cowvine, but another take-all weed, haloragis take-all was present, combined with blackberry nightshade (*Solanum nigrum* L.), couch (*Cynodon dactylon* (L.) Pers.) and wild gooseberry/ground cherry (*Physalis* spp.).

Some species were not positively identified down to species level by consultants and have been listed only under their generic names (Tables 2 and 3). The confusion about which species were actually present highlights the need for education of consultants so that positive identification and control can be achieved. A weed identification guide has recently been developed as part of a larger integrated weed management guide, WEEDpak, for the Australian cotton industry for this purpose (Johnson 2002).

Where is polymeria take-all a problem?
Across the whole survey, 45% of respondents indicated polymeria take-all was a problem, whether minor, moderate or major (Table 4). The highest percentages were in the Gwydir (76% of respondents) and Namoi Valleys (53% of respondents) and to a lesser extent in the Macintyre Valley (27%).

Some 29% of respondents indicated that polymeria take-all did not occur on the properties for which they consulted (Table 4). Furthermore, respondents noted that polymeria take-all was not present in the Lachlan Valley, Tandou and Bourke regions. However, anecdotal evidence suggests that Polymeria take-all may be present in the Bourke area. The weed was of little concern in the Macquarie Valley. Only 5–20% of respondents in any region felt that the problem, while present, had been controlled.

Infestation levels of polymeria take-all
Actual infestations of polymeria take-all covered at least 2595 hectares (Table 5). This was approximately 1% of the total cotton production area surveyed during the 1995/96 season. Charles (1991) indicated that 3±2% of the area he surveyed in NSW (the Namoi, Gwydir, Macintyre and Macquarie Valleys) was covered by this weed. That area, which represented 2028 hectares, was comparable with the 2261 hectares in cotton growing regions in the same regions in this survey. The area covered by polymeria take-all has apparently not increased rapidly in the time between the surveys. This is consistent with anecdotal observations and the biology of the weed indicating a slow creep rather than a rapid spread of the species in infested fields (Johnson 2000).

The geographical regions with the largest areas of infestation were the Gwydir Valley (1245 ha) and the Namoi Valley (629 ha). Infestations covered 377 hectares in the Macintyre Valley and 251 hectares in the St. George region while there were small infestations in the Macquarie Valley and Emerald region. The area of infestation in the Darling Downs/South Burnett

Table 5. Actual and potential field areas of infestation for polymeria take-all in each cotton-growing region. Actual areas are estimates of ground area covered by polymeria take-all while potential areas of infestation are the total areas of fields that currently have some level of infestation on them.

Cotton growing region	Actual infestation area (ha)	Potential infestation area (ha)	Total area in survey (ha)
Namoi Valley	629	5 008	39 250
Gwydir Valley	1 245	11 508	95 930
Macintyre Valley	377	2 803	47 350
Macquarie Valley	10	10	24 130
Lachlan Valley	0	0	1 670
Tandou	0	0	10 000
Bourke	0	0	10 100
Darling Downs/Sth. Burnett	80	130	33 950
St George	251	2 840	15 300
Emerald	3	60	5 550
Total	2 595	22 358	283 330

Table 4. The severity of the polymeria take-all problem with respect to cotton growing region. No responses were received from the Biloela/Theodore/Moura region.

		Percentage of respondents by region who indicated a rating									
Polymeria take-all rating	Overall survey	Namoi	Gwydir	Macintyre	Macquarie	Lachlan	Tandou	Bourke	Darling Downs/ Sth Burnett	St. George	Emerald
Does not occur	28.8	17.7	14.2	9.1	80.0	100.0	100.0	100.0	57.1	20.0	33.3
Present, not a problem	20.5	29.4	4.8	45.4	–	–	–	–	42.9	–	33.3
Present, controlled	5.5	–	4.8	18.2	20.0	–	–	–	–	–	–
Minor problem	15.1	23.5	23.8	9.1	–	–	–	–	–	20.0	–
Moderate problem	17.8	11.7	42.9	9.1	–	–	–	–	–	–	33.3
Major problem	12.3	17.7	9.5	9.1	–	–	–	–	–	60.0	–

area may have been artificially elevated because two consultants did not differentiate between infestation areas in this region and the Macintyre Valley. In these cases, the areas were allocated proportionally between the two regions based on the number of properties the respondents identified in each area.

At least 22 350 hectares of cotton fields had infestations covering part of the field area (Table 5). The potential spread of actual infestations to other clean areas within these fields is a concern, particularly with cultivation. The potential infestation area (if the weed spread over the total field area) was largest in the Gwydir Valley with over 11 500 hectares of fields with infestations on them. Potential infestation areas are seven to twelve times greater than current infestation areas in most cotton growing regions.

Polymeria take-all presence in fields

Some 71% of respondents indicated that the presence of polymeria take-all was increasing and only 6% that it was decreasing (Table 6). The highest percentages of respondents indicating an increase were in the Macquarie and Gwydir Valley. Less than 11% of respondents felt that polymeria take-all was decreasing in any region. This increase in incidence has been indicated by Charles (1991) and in a NSW consultant survey in 1993 (D. Clark personal communication). It is likely that the perceived increase in incidence as illustrated here may actually be higher than the actual level of increase noted earlier. This perception has probably arisen, in part at least, because of the sustained difficulties encountered in controlling the weed.

Growth conditions that favour polymeria take-all

Cropping practices and soil types appeared to influence the growth of polymeria take-all (Table 7). Over 90% of respondents indicated that irrigated production favoured polymeria take-all over dryland production (12% of respondents). The similar proportions of irrigated to dryland cotton grown in the 1995/96 season (80% to 20% respectively, Dowling 1997), indicate that responses for this question could merely reflect irrigation practice, but other observations suggest that polymeria take-all is a greater problem in irrigated fields. For example, at least two authors state that polymeria take-all grows in naturally wet areas, often in shallow depressions and floodways (Cunningham *et al.* 1981, Williams 1988). In addition, 17% of survey respondents noted that the growth of polymeria take-all was favoured in irrigation channels and watercourse areas.

Respondents indicated that conventional tillage favoured the growth of polymeria take-all over reduced tillage (54% c.f. 22% of respondents). The proportion of conventional tillage to permanent beds (a form of reduced tillage) during the 1995/96 season was 25% to 75% respectively (Allen and Lonergan 1998).

There is increasing evidence to suggest that some perennial and rhizomatous weeds increase under reduced tillage farming systems both in Australia (Gavin *et al.* 1999) and the USA (Bryson and Keeley 1992, Murray *et al.* 1992). However, in this survey, conventional tillage favoured the growth of polymeria take-all presumably because cultivation was perceived as spreading the weed. Alternatively, there may be a lag period in the build up of this weed after which it will become a major problem in reduced tillage systems.

Over 85% of respondents said that polymeria take-all was found on heavy soil types rather than the lighter soils (Table 7). Since 88% of cotton production is undertaken on these heavier cracking clay soils and only 11% on lighter red brown earths and river alluviums (Inglis 1999), the incidence of polymeria take-all on the cracking clays may simply reflect the soil types used for cotton production. However, polymeria take-all is recognized as a diagnostic species of heavy cracking clay soils and was probably present on much of this country before cotton production occurred (R. Johnson personal communication).

Three factors intrinsic to most Australian cotton production appeared to favour polymeria take-all – irrigation, cultivation and clay soils. Management of the weed may therefore rely on altering some of the current cultural practices.

Why is polymeria take-all a problem?

Polymeria take-all is a problem on cotton farms for many and varied reasons. The difficulty in controlling this weed has been realized for many years (McMillan 1988, Osten 1988) and this was again emphasized by 86% of respondents (Table 8).

Nearly 65% of respondents indicated large yield reductions occurred with polymeria take-all infestations (Table 8). Nearly 76% of respondents believed that polymeria take-all removed moisture from

Table 7. The situations and soil types that favoured the growth of polymeria take-all.

Situation or soil type	% of respondents
Situation:	
Irrigated production	90.2
Dryland production	12.2
Reduced tillage practices	22.0
Conventional tillage practices	53.7
Land recently brought into crop production	17.1
Long term cropped country	43.9
Land that has never been cropped	2.4
Along or in irrigation channels or watercourses	17.1
Along roadsides	7.3
Soil type:	
Light	14.6
Heavy	85.4

Table 6. The change in the presence of polymeria take-all over time.

		Percentage of respondents by region						
Polymeria take-all presence	Overall survey	Namoi	Gwydir	Macintyre	Macquarie	Darling Downs/ Sth Burnett	St. George	Emerald
Decreasing	6	7	6	11	–	–	–	–
Not changing	22	29	6	33	–	67	33	–
Increasing	71	64	89	56	100	33	67	100

the soil and that the original clumps were increasing in size. The latter was undoubtedly a result of difficulties encountered in controlling the weed.

Over 50% of respondents indicated that new clumps appeared in infested fields while nearly 25% of respondents noted that clumps of polymeria take-all appeared in uninfested fields. These results are notable as they suggest that there is less spread from one field to another than within fields, but that such spread can occur.

How does polymeria take-all spread?

Most respondents believed that polymeria take-all spread naturally by an underground root or rhizome (83%) or by a shoot or root segment moved by cultivation (78%) (Table 9). Only 20% of respondents thought that polymeria take-all spread by seed. Since polymeria take-all is not being effectively controlled at present, the areas of infestation are expected to increase in the future.

Management of polymeria take-all

A total of 83% of respondents with infestations of polymeria take-all had attempted control and they estimated that the additional cost for the treatment of polymeria take-all (over and above other weeds) in fields where the weed occurred averaged $36.20 per hectare per year, but ranged anywhere from $12 to $100 per hectare per year. Hence, while the polymeria take-all problem is currently small (but increasing), attempts to control it are expensive.

Of the various methods of managing polymeria take-all, herbicide application resulted in a decrease in the occurrence of the weed in only 37% of cases and no change in the problem in another 58% of cases (Table 10). Some 5% indicated an increase in polymeria take-all after using herbicides. Herbicides that were registered for in-crop use in non-herbicide resistant cotton crops were generally unsuccessful in controlling polymeria take-all infestations, e.g. diuron, fluometuron and prometryn (Table 11). An opportunity may exist to obtain more effective control of polymeria take-all with the introduction of glyphosate tolerant cotton, i.e. Roundup Ready® cotton, because glyphosate, along with 2,4-D amine, fluroxypyr and 2,4-D ester, were the most successful herbicides reported (14-17% of respondents). Conversely, glyphosate, fluroxypyr and 2,4-D amine were also listed by respondents as the most unsuccessful herbicides used (Table 11). For whatever reason, the action of herbicides on polymeria take-all is very variable and is an area requiring further investigation.

Cultivation was not successful in reducing the occurrence of polymeria take-all (Table 10). Hand chipping had little

Table 8. The reasons why polymeria take-all was a problem.

Why polymeria take-all is a problem	% of respondents
Original clumps are increasing in size	75.7
New clumps are appearing in infested fields	51.4
Clumps appearing in uninfested fields	24.3
Plant removes moisture from the soil	75.7
Plant is difficult to control	86.5
Plant results in large yield reductions	64.9
Others specified:	
Some yield reduction	5.4
Plants use nutrients	2.7

Table 9. Respondent's suggestions as to how polymeria take-all spreads.

Means of suspected spread	% of respondents
Underground root or rhizome	82.9
Aboveground shoot or runner	7.3
Root or shoot segment moved by cultivation	78.0
Seed	19.5
Seed in irrigation water	12.2
Not known	12.2

Table 10. The overall effect of control methods on polymeria take-all.

Control method	% of total respondents who used each method	Effect of control method on weed occurrence (Percentage of respondents who used each method)		
		Decrease	No change	Increase
Herbicides	63.3	36.8	57.9	5.3
Cultivation	56.7	14.7	32.4	52.9
Hand chipping	33.3	20.0	80.0	–

Table 11. The most common herbicides used either successfully or unsuccessfully to control polymeria take-all.

Active ingredient of herbicide	% of respondents who stated herbicide used	
	Successfully	Unsuccessfully
2,4–D amine	17	10
2,4–D ester	14	3
Dicamba	–	9
Diuron	2	5
Fluometuron	3	5
Fluometuron/prometryn	–	7
Fluroxypyr	17	12
Glyphosate	15	33
Imazapyr	7	–
MCPA	2	–
Metsulfuron	2	–
Paraquat/diquat	3	2
Pendimethalin	–	2
Prometryn	–	3
Trifluralin	–	3

effect on the incidence of the weed either. For this reason, chipping contractors will not attempt to chip large and dense infestations of polymeria take-all (Johnson *et al*. 2000).

This survey has highlighted the fact that all existing methods of managing polymeria take-all have only limited success. This result concurs with previous research by McMillan (1988) and Charles (1991).

Conclusion

Polymeria take-all is a small but significant problem in many cotton-producing areas of Australia and particularly in the Gwydir, Namoi and Macintyre Valleys and in the St. George area. The weed does not appear to have spread rapidly over the last ten years but it is likely that the slow vegetative encroachment on production areas will continue.

It is a weed that is obviously difficult to control and results in large cotton yield reductions. Further research is needed into effective management strategies.

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