

American Foulbrood Disease *Paenibacillus larvae* in New South Wales apiaries

Survey Results 2006

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The information contained in this publication is based on knowledge and understanding at the time of writing (January 2006). However, because of advances in knowledge, users are reminded of the need to ensure that information on which they rely is up to date and to check the currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent advisor.

TRIM reference:

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INTRODUCTION

The New South Wales Department of Primary Industries (NSW DPI) conducted a mail survey of beekeepers registered with NSW DPI in May 2006. The purpose being to establish current benchmark information on industry practices and to obtain an estimated dollar value for the damage and control costs from American Foulbrood Disease (AFB) to the NSW beekeeping industry.

SURVEY METHOD

Beekeepers owning 50 or more hives, registered under the Apiaries Act 1985 with NSW DPI were mailed a questionnaire requesting information on past and current histories of AFB in their apiaries. Beekeepers were not required to identify themselves however the option was left open for them to do so. A number of interstate based beekeepers operating in NSW were included. A stamped, self-addressed return envelope was included with each questionnaire to encourage return of the forms. Forms were mailed in June 2006 with a request for their return by July 2006.

Survey forms are shown in Appendix 1.

SURVEY RETURNS

655 persons were surveyed, 324 persons responded (49.5%). This is a good response from a mail survey showing a high interest by NSW beekeepers.

Number of beekeepers contacted and number responding, according to the number of hives owned. The rate of response was largely independent of the number of hives owned by beekeepers.

Number of hives owned by beekeeper	Number of beekeepers registered and sent survey questionnaire	Number of beekeepers returning questionnaire (%)
50-199	300	142 (47.3)
200-499	200	92 (46.0)
500-699	68	37 (54.4)
700-999	44	29 (65.9)
1000-1499	31	14 (45.2)
More than 1500	12	10 (83.3)
Total	655	324 (49.5)

Many beekeepers did not provide information in answer to some questions. Many responses were in the form of a comment or an approximate number and were not included in the survey results. Only information relating to AFB occurrence in apiaries in NSW was included.

SUMMARY

The essential issues derived from the survey are as follows:

- 56% of beekeepers responding to the survey have a current or past history of AFB in their apiaries. 298 beekeepers out of 655 surveyed responded to this question.
- The number of AFB outbreaks recorded each year. Results showed that higher numbers of outbreaks occurred in some years but a cycle of high and low years was not able to be identified.
- AFB was diagnosed in their own apiaries by 47% of owner beekeepers, 27% at a NSW DPI diagnostic laboratory, and 26% by NSW DPI apiary staff, and commercial and amateur beekeepers other than the apiary owner.
- Districts of NSW with the highest incidence of AFB:
 - (i) based on the number of beekeepers with an AFB history are the North Coast, Mid North Coast and the Riverina. High incidence was reported from the North West Slopes and Plains, South West Slopes, Central Tablelands and the Northern Tablelands.
 - (ii) based on the highest number of apiaries infected with AFB are the Northern Tablelands, North Coast and Mid North Coast.
- A major increase in the number of outbreaks of AFB in apiaries occurred between 1971 and 2006. An almost fivefold increase occurred for the period 1981-90 compared with 1971-80, an almost fourfold increase between 1991-2000, and 1981-90 and a similar number of outbreaks occurred for the 5 years 2001-6 as for the 10 year period 1991-2000.
- The number of months for a beekeeper to eradicate an AFB outbreak from their apiaries. Average time was 17 months, range 1 to 72 months.
- Estimated average increased costs to eradicate an AFB outbreak, per beekeeper, is \$13000. Costs between beekeepers varied considerably, one beekeeper reported increased costs of \$84000.
- Estimated average increase in labour per beekeeper, per year, to manage an AFB outbreak is 125 hours, range 3-660 hours. The total number of hours to eradicate an outbreak varied between beekeepers with one beekeeper reporting a total increased time of 830 hours.
- Increased labour costs were identified as a major cost in AFB surveillance and eradication. Loss of use of apiary sites, loss of production and negative health effects on beekeepers were identified. Costs were measured by beekeepers in terms of actual cash costs and non-cash costs.
- 38% of beekeepers with a history of AFB did not report the outbreak to NSW DPI.
- Principal reason for not reporting AFB to NSW DPI was the beekeeper did not intend to claim compensation or irradiation costs (47%), followed by beekeepers did not know reporting was required (20%).
- Identified risks for AFB spreading from an outside source to a beekeeper's apiaries are the beekeeper's bees robbing from another beekeeper's apiary, from neglected or abandoned hives and bee equipment, or from feral colonies or weak/dead-out hives.
- Identified risks for spreading AFB within their own apiaries are the exchange of equipment/hive materials/frames from infected to clean hives, and the failure to inspect brood frames on a regular basis.

- Responsible persons/groups for managing AFB in NSW. The beekeepers owning an infected apiary (75%) were considered responsible for managing disease control in their own apiary. The beekeeping industry (67%) and NSW DPI (63%) were seen as having a high responsibility for controlling AFB outside managed apiaries. A high degree of support for beekeepers managing infected apiaries from the beekeeping industry (33%) and NSW DPI (37%) was recorded.

Beekeepers have little control in preventing an outbreak of AFB occurring in their apiaries due to the way AFB is spread between colonies. The effects of an outbreak on a beekeeping business and on the beekeeper vary considerably from minor to significant for different beekeepers. A beekeeper's business is affected economically in terms of increased costs to manage and eradicate the outbreak and the beekeeper's health may be affected due to stresses associated with managing the outbreak.

Overall, the results suggest that AFB is widespread within NSW and increasing in incidence. Beekeepers would benefit from having an AFB management plan permanently in place to monitor for, and to identify and eradicate AFB from their apiaries quickly and at minimum cost.

RESULTS

QUESTION 1: IN WHAT YEAR DID YOU COMMENCE KEEPING BEES?

Table 1: The number of beekeepers who responded for all districts and for all hive numbers managed.

Year commenced	Number of beekeepers	%
1941-50	14	4.7
1951-60	40	13.6
1961-70	46	15.6
1971-80	67	22.7
1981-90	55	18.6
1991-2000	58	19.7
2001-6	15	5.1
Total	295	

Comment: The majority of beekeepers (75%) have 16 or more years beekeeping experience with only 5% having less than 6 years experience in owning/managing hives.

QUESTION 2: HAVE YOUR HIVES BEEN DIAGNOSED WITH AFB AT ANY TIME?

Table 2a: The number of beekeepers who responded who have had AFB “Yes”, or have not had AFB diagnosed in their apiaries “No” for all beekeepers who responded in all districts according to the number of hives managed. 298 beekeepers responded to this question.

Number of hives managed	Number of beekeepers			
	Yes		No	
	Number	%	Number	%
50-199	54	43.5	70	56.5
200-499	60	64.5	33	35.5
500-699	21	65.6	11	34.4
700-999	20	71.4	8	28.6
1000-1499	9	75.0	3	25.0
More than 1500	4	44.4	5	55.6
Total number of beekeepers	168	56.4	130	43.6

Comment: A majority of beekeepers (56%) indicated a current or previous history of AFB. The number of beekeepers indicating a history of AFB, 168 beekeepers, represents 26% of the total number of beekeepers surveyed (ie. 655), this is a high percentage and is of concern. This is of more concern if the percentage of beekeepers who have had apiaries diagnosed with AFB, and did not respond to this survey, is at least this high.

Table 2b: The number of beekeepers who have had AFB “Yes”, or have not had AFB diagnosed in their apiaries “No” for beekeepers who operate in one district according to the number of hives managed. 161 beekeepers operate apiaries in one district only.

Number of hives managed	Number of beekeepers			
	Yes		No	
	Number	%	Number	%
50-199	51	50.5	50	49.5
200-499	21	56.8	16	43.2
500-699	4	36.4	7	63.6
700-999	2	40.0	3	60.0
1000-1499	4	80.0	1	20.0
More than 1500	2	100.0	0	0.0
Total number of beekeepers	84	53.4	77	46.6

Comment: 137 of the 298 who responded operate apiaries in more than one district and it was not possible to determine the number of beekeepers with an AFB history for each district using information supplied by all beekeepers.

Table 2c: The number of beekeepers with AFB diagnosed in their apiaries and who operate in one district, according to the number of hives managed and by district. 84 beekeepers provided information.

District	Number of beekeepers for number of hives owned						Total	%
	50-199	200-499	500-699	700-999	1000-1499	More than 1500		
Sydney Basin	3	0	0	0	0	0	3	3.6
Central T'lands	6	1	0	0	0	0	7	8.3
Hunter Valley	2	0	0	0	0	0	2	2.4
Manning G/Lakes	1	1	0	0	0	0	2	2.4
Mid Nth Coast	10	2	0	0	0	0	12	14.3
North Coast	10	6	0	0	0	0	16	19.0
N'thern T'lands	4	1	1	1	0	0	7	8.3
NW Slopes/ Plains	2	3	2	0	1	1	9	10.7
Western Plains	0	1	0	0	0	0	1	1.2
SW Slopes	7	1	0	0	0	0	8	9.5
Riverina	2	4	1	1	3	1	12	14.3
S'thern T'lands	1	0	0	0	0	0	1	1.2
Illawarra	0	0	0	0	0	0	0	0.0
South Coast	3	0	0	0	0	0	3	3.6
Monaro	0	0	0	0	0	0	0	0.0
Other	0	1	0	0	0	0	1	1.2
Total	51	21	4	2	4	2	84	

Comment: Table 2c shows that the highest numbers of beekeepers with AFB diagnosed in their apiaries (*ie.* almost 50%) operate in the North Coast District, the Mid North Coast and the Riverina. High incidence of AFB was also reported for the North West Slopes and Plains, the Northern Tablelands and the Central Tablelands.

QUESTION 3: IN WHAT YEAR WAS AFB FIRST DIAGNOSED IN YOUR APIARIES?

Table 3a: The number of beekeepers responding, the earliest year and the latest year AFB reported, according to number of hives managed, for all districts.

Number of hives managed	Number of beekeepers	Year AFB diagnosed	
		Earliest	Latest
50-199	63	1955	2006
200-499	55	1971	2006
500-699	22	1965	2004
700-999	20	1983	2005
1000-1499	7	1975	2005
More than 1500	4	1994	2001
Total	171		

Table 3b: The number of AFB outbreaks diagnosed for each year information was supplied, 171 beekeepers provided information for all numbers of hives managed and for all districts.

Year	Number of times represented	Year	Number of times represented
1955	1	1988	3
1965	1	1989	7
1971	1	1990	16
1972	1	1991	3
1973	1	1992	5
1974	-	1993	2
1975	3	1994	7
1976	2	1995	5
1977	1	1996	10
1978	1	1997	5
1979	1	1998	12
1980	-	1999	6
1981	-	2000	9
1982	3	2001	10
1983	5	2002	9
1984	-	2003	7
1885	7	2004	9
1986	5	2005	8
1987	-	2006	5

Comment: The information suggests a higher incidence of AFB in some years. A cycle of AFB outbreaks was not able to be identified based on the number of years between outbreaks or when high represented years were associated with drought conditions previous to, during or following those years.

Table 3c: The years AFB first diagnosed in apiaries for beekeepers operating in one district according to the number of hives managed and the number of beekeepers responding.

District	Years AFB diagnosed for Number of hives managed (No. beekeepers)						Total
	50-199	200-499	500-699	700-999	1000-1499	> 1500	
Sydney Basin	1996, 2001, 2002 (3)	-	-	-	-	-	3
Central T ^l ands	1985, 1989, 1990, 1990, 2001 (5)	1997 (1)	-	-	-	-	6
Hunter Valley	1990, 1998 (2)	-	-	-	-	-	2
Manning G/Lakes	1985 (1)	2000 (1)	-	-	-	-	2
Mid Nth Coast	1986, 1991, 1992, 1996, 1999, 2001, 2003, 2005, 2005 (9)	1998, 2005 (2)	-	-	-	-	11
North Coast	1985, 1989, 1991, 1992, 1994, 1995, 1996, 1999, 2003, 2006, 2006 (11)	1975, 1990, 1990, 1994, 2002, 2003 (6)	1996 (1)	-	-	-	18
N ^o rthern T ^l ands	1955, 1993, 1996, 2001 (4)	2000 (1)	1989 (1)	2005 (1)	-	-	7
NW Slopes/Plains	1998, 2000 (2)	1986, 1999, 2000 (3)	1989 (1)	-	2002 (1)	1994 (1)	8
Western Plains	-	1990 (1)	-	-	-	-	1
SW Slopes	1973, 1975, 1978, 1982, 1982, 1995, 1997 (7)	2006 (1)	-	-	-	-	8
Riverina	2005 (1)	1971, 1985, 1999, 2005 (4)	2004 (1)	2004 (1)	1975, 1989 (2)	1994 (1)	10
S ^o thern T ^l ands	2003 (1)	-	-	-	-	-	1
Illawarra	-	-	-	-	-	-	0
South Coast	1992, 1996, 2004 (3)	-	-	-	-	-	3
Monaro	-	-	-	-	-	-	0
Other	-	1996 (1)	-	-	-	-	1
Total	49	21	4	2	3	2	81

Comment: The higher number of AFB diagnosed amongst beekeepers owning 50-500 hives reflects their higher representation in the number of beekeepers supplying information to this survey. Districts with the highest number of beekeeper responses were North Coast, Mid North Coast and Riverina.

QUESTION 4: HOW WAS THE AFB DIAGNOSED?

Table 4a: Number of beekeeper responses for all numbers of hives managed for all districts.

	Diagnosis source	Number of beekeeper responses (%)
1	Beekeeper/owner	132 (47)
2	NSW DPI diagnostic laboratory	74 (27)
3	NSW DPI apiary officer	47 (17)
4	NSW DPI regulatory officer	15 (5)
5	A commercial beekeeper	9 (3)
6	An amateur beekeeper	3 (1)
	Total	280

Comment: In the majority of cases AFB was diagnosed by the beekeeper (47%) suggesting a high level of knowledge of AFB symptoms and skill in identification of the disease in the apiary by beekeepers. The importance of the DPI laboratory diagnostic service is also shown with 27% of outbreaks identified. The remaining 26% was identified, presumably under apiary conditions, by persons other than the beekeeper owning the bees and included DPI apiary staff and commercial and amateur beekeepers, also suggesting a high level of knowledge and skill in identifying AFB under field conditions by this group of people.

Table 4b: Diagnosis of AFB. Number of beekeeper responses according to number of hives managed for all districts.

AFB diagnosed by -	Number of hives managed						Total
	50-199	200-499	500-699	700-999	1000-1499	>1500	
NSW DPI diagnostic laboratory	28	23	9	9	4	1	74
NSW DPI regulatory officer	5	7	1	2	0	0	15
NSW DPI apiary officer	30	9	5	1	1	1	47
Commercial beekeeper	6	3	0	0	0	0	9
Amateur beekeeper	3	0	0	0	0	0	3
Beekeeper/owner	42	45	17	19	6	3	132

Comment: These figures indicate the high reliance upon self-identification by the beekeeper across the full range of number of hives owned.

QUESTION 5: PROVIDE A HISTORY OF AFB IN YOUR APIARIES.

Table 5a: The number of affected apiaries and hives, the number of hives destroyed and the number of hives/hive materials irradiated are shown for 167 beekeepers who provided one or more responses to various sections of this question.

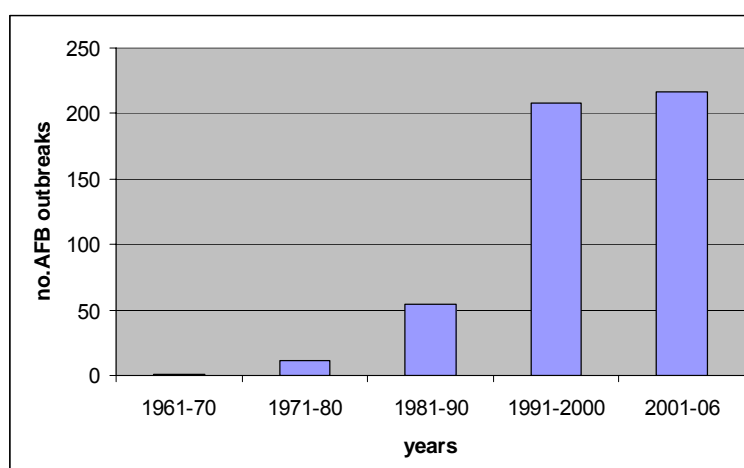
District	Number Apiaries Affected			Number AFB Hives in Affected Apiaries			Number Hives Destroyed			Number Hives/ Hive Materials Irradiated		
	Total	n*	Mean	Total	n*	Mean	Total	n*	Mean	Total	n*	Mean
Sydney Basin	12	10	1.2	98	9	10.9	284	10	28.4	182	9	20.2
Cent T ^l and	55	36	1.5	396	32	12.4	1113	39	28.5	608	38	16.0
Hunter Valley	81	9	9.0	123	6	20.5	172	10	17.2	131	8	16.4
Manning G/Lakes	22	6	3.7	81	6	13.5	408	7	58.3	69	6	11.5
Mid Nth Coast	279	17	16.4	398	17	23.4	856	18	47.6	640	15	42.7
Nth Coast	280	30	9.3	582	27	21.6	818	29	28.2	831	23	36.1
N ^o rthern T ^l ands	416	27	15.4	934	26	35.9	1151	27	42.6	4676	25	187.0
NW Slopes/ Plains	47	22	2.1	630	19	33.2	909	20	45.5	1025	19	53.9
West ^o n Plains	10	9	1.1	149	9	16.6	144	9	16.0	91	6	15.2
SW Slopes	20	13	1.5	169	10	16.9	377	16	23.6	346	12	28.8
Riverina	17	12	1.4	63	4	15.8	136	12	11.3	77	10	7.7
S ^o thern T ^l ands	22	10	2.2	164	9	18.2	1563	10	156.3	357	10	35.7
Illawarra	0	0	0	0	0	0	0	0	0	0	0	0
South Coast	48	25	1.9	232	21	11.1	625	24	26.0	299	18	16.6
Monaro	2	2	1.0	0	0	0	4	2	2.0	4	2	2
Other	22	12	6.5	131	12	19.2	237	16	23.3	304	13	23.4
Total	1333	240	5.6	4150	207	20.0	8797	249	35.3	9640	214	45.0

n* = Number of responses.

Comment: For each beekeeper experiencing an AFB outbreak, the mean number of apiaries affected (5.6), number of hives in affected apiaries (20), number of hives destroyed (35.3) and number of hives/hive materials irradiated (45) are shown. For the four categories of data shown, the districts with the highest numbers represented are the Northern Tablelands, the North Coast, and the Mid North Coast.

Table 5b: The number of AFB outbreaks present in apiaries in each district during the years shown. 231 beekeepers provided information.

District	Years				
	1961-70	1971-80	1981-90	1991-2000	2001-06
Sydney Basin	1		1	4	6
Cent T'lands			12	30	22
Hunter Valley			3	22	13
Manning G/Lakes			10	23	4
Mid Nth Coast			2	12	12
Nth Coast			5	26	30
N'thern T'lands			4	15	25
NW Slopes/ Plains		2	5	21	22
West'n Plains			4	2	5
SW Slopes		4	1	11	9
Riverina			3	5	10
S'thern T'lands				4	7
Illawarra				1	1
South Coast		5	3	4	23
Monaro					3
Other			1	28	25
Total	1	11	54	208	217



Comment: The information supplied shows a major increase in the number of outbreaks identified between 1971 and 2006. There was an almost fivefold increase between 1971-80 and 1981-90, an almost fourfold increase between 1981-90 and 1991-2000, and a similar number of outbreaks between the ten years 1991-2000 and the 5.5 years 2001-6.

QUESTION 6: HOW MANY MONTHS DID IT TAKE TO ERADICATE EACH AFB OUTBREAK FROM YOUR APIARIES?

Table 6: The average and range of months to eradicate each AFB outbreak, according to district, for the number of responses shown.

District	Number of responses	Number of months to eradicate AFB Average (range)
Sydney Basin	7	8 (1-24)
Cent T ['] lands	22	24 (3-48)
Hunter Valley	5	11 (3-14)
Manning G/Lakes	6	33 (12-72)
Mid Nth Coast	10	18 (1-60)
Nth Coast	16	17 (2-48)
N ['] thern T ['] lands	19	28 (1-60)
NW Slopes/Plains	15	25 (1-60)
West ['] n Plains	4	10 (1-24)
SW Slopes	13	17 (1-36)
Riverina	6	11 (3-12)
S ['] thern T ['] lands	3	12 (1-24)
Illawarra	-	-
South Coast	12	12 (6-18)
Monaro	-	-
Other	4	17 (4-48)
Total 142		Average (range) 17 (1-72)

Comment:

(i) The amount of time required to eradicate an AFB outbreak from a beekeeper`s business varies considerably, between 1 and 72 months, with an average time of 17 months. Many factors would contribute to the amount of time taken, including - the number of hives managed, number of staff, knowledge and ability of the beekeeper to control AFB, honey flow and breeding conditions, and sources of recontamination. All of these factors would be expected to vary for each of the beekeepers responding to this question.

(ii) The results indicate the potential range of increased costs of eradication beekeepers are subjected to depending on the number of months required to eradicate an outbreak.

QUESTION7: ESTIMATE THE INCREASED COSTS OF PRODUCTION FOR YOUR BUSINESS TO MANAGE EACH AFB OUTBREAK.

Table 7a: Number of hives destroyed between 1972-2005 for the number of beekeepers responding.

Year	Number of hives destroyed	Number of responses	Year	Number of hives destroyed	Number of responses
1972	6	1	1989	528	7
1973	0	1	1990	118	16
1974	-	-	1991	41	3
1975	165	3	1992	11	5
1976	23	2	1993	451	2
1977	49	1	1994	592	7
1978	0	1	1995	198	5
1979	0	1	1996	650	10
1980	-	-	1997	380	5
1981	-	-	1998	1167	12
1982	11	3	1999	293	6
1983	102	5	2000	533	9
1984	-	-	2001	290	8
1985	1100	7	2002	259	14
1986	60	5	2003	196	11
1987	-	-	2004	1377	13
1988	0	3	2005	1227	27

Comment: The variation in the number of hives destroyed each year between 1972 and 2005 suggests high and low years for AFB presence (see graph, below). Although there were years with peaks of high numbers of hives destroyed with AFB eg. 1985, 1998, 2004 and 2005, no cycle of high incidence was able to be determined from this data based on the number of years between peaks or the relationship of drought years either preceding, during or following the peak years.

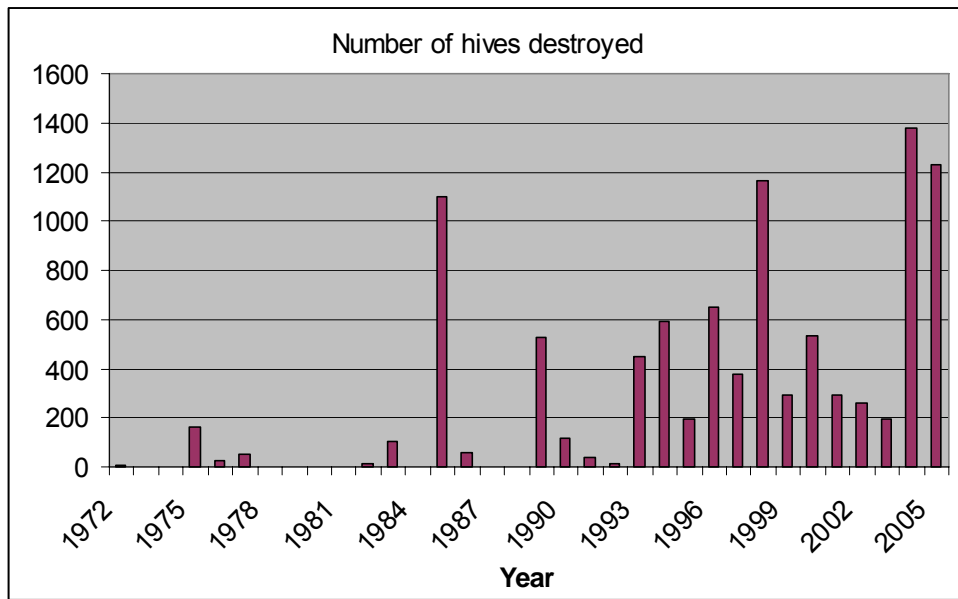


Table 7b: Estimated increased costs to their business to eradicate AFB for the years 2001-2005 for the number of beekeepers shown providing information.

Year	Hives destroyed		Irradiation costs of hives and materials	Reduced honey prices. Lost income	Transport increased costs	Other increased costs	Total
	No.	Value \$					
2001							
Total	290	14080	29340	20850	15550	125	79945
Av. (range)	36 (1-150)	2011 (200-5000)	4890 (200-26000)	6950 (150-17100)	2221 (50-14000)	125	
n*	8	7	6	3	7	1	
2002							
Total	259	19300	6270	6370	1560	200	33700
Av. (range)	19 (3-50)	1608 (200-5000)	1045 (125-3600)	1593 (180-5270)	260 (60-500)	200	
n*	14	12	6	4	6	1	
2003							
Total	196	12140	22829	12736	4700	9320	61725
Av. (range)	18 (3-84)	1349 (100-5040)	3805 (90-20000)	2547 (150-10886)	588 (50-3000)	1864 (180-5400)	
n*	11	9	6	5	8	5	
2004							
Total	1377	128000	6122	11678	1590	1150	148540
Av. (range)	106 (1-1000)	9846 (40-100000)	875 (150-2960)	3893 (1750-6760)	265 (50-300)	383 (50-900)	
n*	13	13	7	3	6	3	
2005							
Total	1227	102690	19651	72036	20235	150	214762
Av. (range)	45 (2-350)	3950 (20-40000)	1638 (150-4760)	6549 (60-20000)	1190 (10-6000)	150	
n*	27	26	12	11	17	1	

n* = Number of beekeepers providing information.

Comment: Changes in the component costs of eradicating AFB may reflect changing eradication and treatment practices, but there is little doubt that the annual costs to the industry for dealing with AFB are increasing.

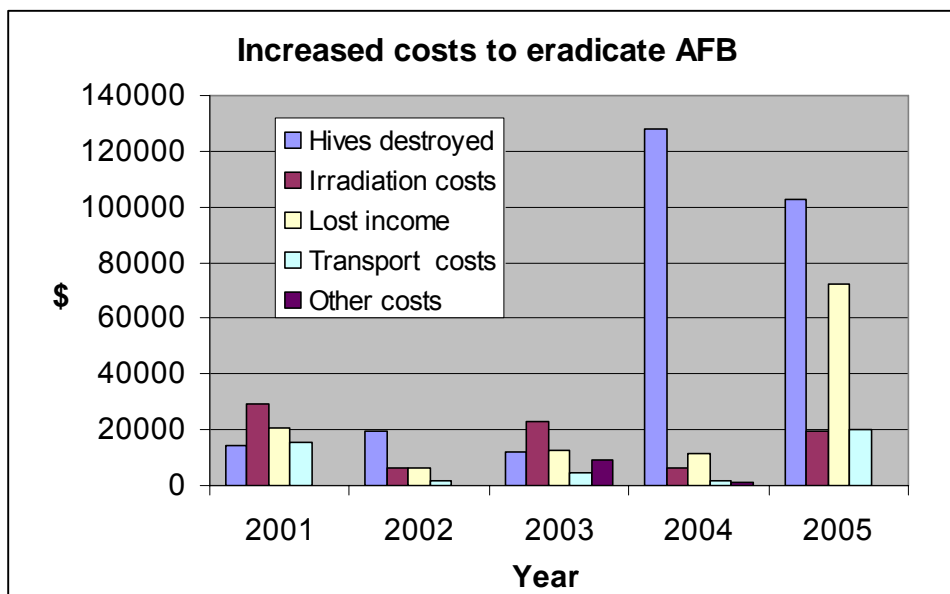


Table 7c: Average increased cost per beekeeper to manage an AFB outbreak based on data provided for 2001-5 (Table 7b).

Years 2001-5	Hives destroyed Number	Hives destroyed Value \$	Irradiation costs of hives and materials \$	Reduced honey prices. Lost income \$	Transport Increased costs \$	Other costs \$
Total	3349	276210	84212	123670	43635	10945
n*	73	67	37	26	44	11
Average	46	4123	2276	4757	992	995

n* = Number of beekeepers providing information.

Comment: The estimated average increase in costs per beekeeper to eradicate an outbreak of AFB from their apiaries has been determined from the sum of the average dollar values for each category recorded in Table 7c. The estimated average increased cost is \$13 000 per beekeeper per outbreak.

Table 7d: Number of increased hours of labour per year to manage an AFB outbreak according to number of hives managed for all districts.

Hours/year	Number of hives managed						
	50-199	200-499	500-699	700-999	1000-1499	> 1500	
Average	83	110	332	108	94	178	125
Range	3-400	6-350	4-660	12-350	70-100	50-360	3-660
n*	24	44	9	13	5	3	98

n* = Number of responses.

> = More than.

Comment: The number of hours of increased labour per year to manage an AFB outbreak varied for beekeepers within and between each hive size group managed. The large variation between beekeepers within each hive size group would be dependent on the number of hives infected and management practices in place to reduce spread of AFB within and between apiaries. From Table 7d the average number of increased hours to manage AFB per beekeeper per year is 125 hours, range 3-660 hours.

Table 7e: Five examples are shown of individual beekeeper`s responses to Question 7 demonstrating the range of increased management costs an AFB outbreak has on different beekeeper`s enterprises.

Beekeeper No.	1	2	3	4	5
Beekeeper status*	700-999	200-499	1000-1499	500-699	50-199
Year(s) of outbreak	2001-5 (5 years)	2001-5 (5 years)	2002 (1 year)	2002 and 2005 (2 years)	2000-6 (7 years)
No. hives destroyed	152	100	23	12	5
Replacement cost of hives \$	-	15000	-	-	-
Value of hives \$	9120	-	3400	1550	-
Irradiation costs \$	3195	-	26000 (all supers and other materials)	220	150
Reduced honey production (loss) \$	-	30000 (10000kg at \$3/kg)	40500	-	300
Lower price received for honey (loss) \$	21750	-	-	1080	-
Transport cost increase \$	2050	500	14000	180	300
Other costs \$	-	5000**	400	-	50
Labour increase Hours	830	160	Not provided	16	8
Total costs -					
\$	36 115	50 500	84 300	3 030	800
Labour (hours)	830	160	-	16	8

* number of hives managed (range)

** details not provided

Comment: Where beekeepers were able to supply relatively detailed information on costs (*ie.* Table 7e) a wide range of management procedures and costs are demonstrated resulting in a wide range of total increased costs for each beekeeper. There does not appear to be a standard approach adopted by beekeepers for eradicating an AFB outbreak from their own apiaries.

QUESTION 8: PROVIDE EXTRA INFORMATION/COMMENT ON THE COSTS OF AFB TO YOUR BUSINESS.

Table 8: Beekeepers who were not able to provide detailed information for Question 7 provided a written comment on their experiences.

Extra Costs

- The cost of taking major action to eliminate AFB from your enterprise can cost 50% of your income (production). Most beekeepers do not want such a reduction in income and hence the continuation of AFB problems.
- Labour costs are a key issue in disease control.
 - I estimate I spend 25% of my time checking for disease.
 - Increased brood inspections estimated to cost my business \$7200 extra per year.
 - The biggest costs are labour costs especially if the apiaries are being reinfected.
 - It is very difficult to put a cost on the number of hours cleaning up an outbreak.
- Loss of use of apiary sites
 - There are 5 apiary sites I no longer use due to AFB present in the area
 - I estimate loss of use of apiary sites is costing me about \$15000/year
 - An added expense is finding new apiary sites to replace those not able to be used
- AFB not a problem
 - AFB is nothing to worry about, I have minimal costs
 - AFB is not a large problem, I use irradiation as a management tool
 - AFB has no effect on my business, I am constantly looking for AFB

Loss of Production

- My estimated yearly loss of production since 1997 is 30 drums/year (\$22500 @\$2.50/kg for honey)
- I calculate that lost production while rebuilding/replacing hives is 100kg honey/hive
- Due to AFB I missed out on the best honey prices
- It is very difficult to put a figure on lost production

NSW DPI

- There is too much paperwork in claiming compensation
- My best site now cannot be used because DPI failed to inform me of a serious outbreak over several months
- As well as my own costs in cleaning up AFB there were costs to the DPI

AFB Areas

- AFB appears endemic in this area (Riverina District)
- We are reluctant to use sites in the northern rivers area due to AFB infection
- I have not had a major outbreak since 1991 (North Coast District) but continue to find 1 or 2 infected hives on a regular basis
- We do not use sites in the Richmond River area due to the amount of AFB there
- I have never seen AFB as bad as it has been in the last couple of years (Northern Tablelands District)
- Many beekeepers have eradicated AFB from their apiaries and it can be eradicated from the state
- AFB is systemic in old outfits. It is an ongoing disease and impossible to eradicate

AFB and Beekeeper Health

- The main cost of AFB is via the depression it generates destroying the beekeeper's enthusiasm
- There is a high cost of stress on the beekeeper
- There is a lot of stress and anxiety dealing with AFB which affects the beekeeper's ability to work

QUESTION 9: AFB IS A NOTIFIABLE DISEASE UNDER THE NSW APIARIES ACT 1985. FROM TIME TO TIME BEEKEEPERS DO NOT NOTIFY THE NSW DPI FOR A VARIETY OF REASONS.

Table 9a: Number of beekeepers who have had AFB in their apiaries and did not notify NSW DPI.

	Number of responses (%)
I have had AFB in my apiaries and DID notify the NSW DPI	95 (62)
I have had AFB in my apiaries and DID NOT notify the NSW DPI	59 (38)

Table 9b: Reasons provided by beekeepers for not notifying NSW DPI of the presence of AFB in their apiaries.

	Number of responses (%)
Was not intending to claim compensation/irradiation costs	35 (47)
Did not know reporting of AFB was required	15 (20)
Did not want to involve DPI in my business	7 (9)
Did know reporting AFB was required but did not want to do so	6 (8)
Intended to report AFB but failed to do so	4 (5)
Did not want DPI to have record of AFB in my apiaries	4 (5)
Did not know who to contact	3 (4)
Total	74

Comment: (i) The high number (38%) of beekeepers not reporting AFB is of concern as it significantly affects records compiled by the NSW DPI from AFB notifications resulting in a reduced perception of the importance of AFB by the NSW DPI and by the NSW beekeeping industry. During 2005-6 NSW DPI received reports of 45 beekeepers with AFB in their apiaries. A corrected number based on 38% not reporting AFB would increase this figure to 73 beekeepers (Table 9a).

(ii) Beekeepers are required to notify the NSW DPI of the presence of AFB in their apiaries whether they intend to claim or not claim compensation or irradiation costs (Table 9b).

(iii) A high number of beekeepers stated they did not know reporting of AFB was required (Table 9b).

QUESTION 10: WHAT DO YOU CONSIDER TO BE THE HIGHEST RISKS IN SPREADING AFB?

- a. From an outside source to your apiary.
- b. Within your apiary.

Table 10a: Identified risk with AFB spread from an outside source to the beekeeper`s apiary.

Identified Risk	Number of responses (%)
Another beekeeper`s apiary close by (robbing)	33 (18.5)
Abandoned or neglected hives and beekeeping equipment (robbing)	23 (12.9)
Feral colonies (robbing)	20 (11.2)
Robbing (source not specified)	20 (11.2)
Dead-out hives (robbing)	16 (9.0)
Lack of knowledge (of disease recognition/control) by beekeeper - owner of infected hives/materials	12 (6.7)
From apiaries of non-commercial and non-registered beekeepers	10 (5.6)
Failure of owner of infected hives to inspect hives on a regular basis	6 (3.4)
Sudden cut-off of nectar/drought conditions (robbing)	5 (2.8)
Buying infected hives/equipment	5 (2.8)
Small Hive Beetle (not specified whether from SHB transmitting AFB , or SHB weakening hives which are robbed out)	5 (2.8)
Beekeepers knowingly operating AFB infected apiaries	5 (2.8)
Misuse of antibiotics	4 (2.2)
Weak hives (robbing)	3 (1.7)
Malicious spreading of AFB by beekeepers	3 (1.7)
Other persons inspecting your hives	2 (1.1)
Other risks -	
Beekeeper hygiene (hands, clothes, hive tools)	1 (0.6)
Feeding infected honey to hives	1 (0.6)
Purchased queen bees	1 (0.6)
Operating in known AFB endemic areas	1 (0.6)
Central extracting plants	1 (0.6)
Beekeeper confusing AFB with other diseases	1 (0.6)

Table 10b: Identified risk spreading AFB within the beekeeper`s own apiary.

Identified Risk	Number of responses (%)
Exchange of equipment/hive materials within the apiary	37 (30.8)
Failure to inspect brood frames on a regular basis	14 (11.7)
Robbing (source not specified)	13 (10.8)
Exchange of frames between hives	13 (10.8)
Weak hives in apiary (robbing)	9 (7.5)
Dead-out hives in apiary (robbing)	7 (5.8)
Beekeeper hygiene (hand, clothes, hive tools)	6 (5.0)
Hives positioned too close in apiary (drifting)	6 (5.0)
Migrating hives (drifting)	3 (2.5)
Lack of knowledge on disease identification and control by beekeeper	3 (2.5)
Misuse of antibiotics	3 (2.5)
Small Hive Beetle (transmission method not specified)	2 (1.7)
Other persons inspecting your bees	2 (1.7)
Other -	
Purchased queen bees	1 (0.8)
Using infected nucleus colonies	1 (0.8)

QUESTION 11: WHAT PERSON(S), INDUSTRY GROUP(S) OR GOVERNMENT DEPARTMENT(S) DO YOU CONSIDER HAVE RESPONSIBILITIES FOR MANAGING AFB IN NSW?

Table 11: Persons/groups/Government Departments that beekeepers consider have a responsibility for controlling AFB in NSW.

Responsible Person/Group	Within your apiaries Number of responses (%)	Outside your apiaries Number of responses (%)
The beekeeper owning the infected apiaries	139 (75)	47 (25)
The beekeeping industry	28 (33)	56 (67)
A Government Department eg NSW DPI	53 (37)	92 (63)

Comment: The beekeeper owning an infected apiary (75%) was clearly considered responsible for managing disease control in their apiary. The beekeeping industry (67%) and the DPI (63%) were both seen as having a high responsibility for controlling AFB outside managed apiaries with a high degree of support expected from the industry (33%) and DPI (37%) for assisting beekeepers with AFB management in their own apiaries.

QUESTION 12: OTHER COMMENTS.

Table 12: Many comments were received which have been summarised according to a common theme.

Inspections

- AFB infected hives and materials should be checked to ensure they have been destroyed/irradiated
- DPI should follow up on trace-back and trace-forward as beekeepers are not able to do this
- DPI should appoint experienced beekeepers in certain areas to act as inspectors as required
- The industry wants honey testing reintroduced. A large number of beekeepers have found out they had AFB through honey tests
- The honey culture test appeared to be a very effective tool for identifying apiaries with AFB
- Part of the cost of registration should include free testing of honey, within limits
- More full-time DPI apiary inspectors are needed
- DPI regulatory officers have been a great help in assisting me to clean up an AFB outbreak
- The health certificate system to cross borders does not work and needs to be overhauled or scrapped, preferably overhauled
- A concerted effort is required to control AFB rather than the current situation (of dealing with individual outbreaks)
- The old style bee inspectors have gone and hence more AFB

Owner Responsibility

- The individual beekeeper must be responsible for eradicating AFB from his own apiaries. Money spent officially is largely returning no benefits
- The owner has a major responsibility in the identification of AFB but support should be provided by industry/DPI
- I would like to see beekeepers accept responsibility for controlling AFB themselves instead of relying on DPI to control it for them. I would like to see the NZ system adopted
- Beekeepers have to be honest with themselves and their fellow beekeepers and not hide any problems. It is in their own and the industries interests to keep AFB under control
- We were able to clean up an outbreak of AFB in our apiaries successfully and regularly have honey samples examined in the laboratory which is a great service
- We are able to eradicate AFB from our apiaries but have been unable to have one year without an infection since 1994. AFB awareness and management are standard practice and part of beekeeping today in our apiaries
- The beekeeper is ultimately responsible for management of AFB, the DPI are responsible for implementing the Apiaries Act. Beekeepers need to operate within the requirements of the Act.

DPI Responsibility

- AFB control must be kept within the DPI as they are independent and have the authority for inspection and destruction of diseased materials. Some beekeepers will not do anything and keep diseased materials stored
- Some beekeepers need help by DPI to control and manage AFB. Some beekeepers do not care about AFB and the problem they cause other beekeepers and need DPI to control them
- DPI have an important role in ordering the destruction of neglected hives
- Without the Apiaries Act the beekeeping industry would be in the dark ages
- DPI has failed to follow up on outbreaks (trace-back and trace-forward). This is creating a lack of confidence with beekeepers. Beekeepers are now cleaning up their own outbreaks at their own expense and not notifying DPI. There needs to be drastic changes to DPI response to this disease to address sources of this disease
- DPI should provide advice on AFB management and follow up on reported cases
- DPI should notify beekeepers before their apiaries are inspected
- There is a need for at least 2 full-time apiary inspectors funded by DPI and the beekeeping industry

Management to Control Disease

- A major effort is required to select breeder queens that produce progeny with the cleaning gene
- Continue to educate beekeepers to examine their brood chambers
- Feedback from honey packers to beekeepers after laboratory testing is required
- It is hard to compete with overseas beekeepers when they treat with antibiotics and we burn or irradiate hives. We work 600 hives/man and they work 1500 hives/man

RECOMMENDATIONS DEVELOPED FROM THE SURVEY RESULTS

1. All beekeeping enterprises should consider developing permanently operating strategies in their day-to-day management programs that will allow them to –

(a) identify the presence of AFB in their apiaries quickly

(b) contain an outbreak to a small, manageable portion of their apiaries

(c) eradicate the outbreak according to a pre-arranged program in a short period of time at a minimum cost.

Comment: Information suggests that AFB incidence is increasing in apiaries in NSW (Table 5b). The large range of increased costs by beekeepers to eradicate AFB (Table 7d) suggests that AFB control plans, in general, are not in place and each outbreak is being managed as the situation demands. A number of beekeepers have introduced AFB awareness and management as standard practices in their operations (Table 12).

2. A methodology for eradication of an AFB outbreak from a beekeeper's business in a short period of time, eg. less than 12 months, requires development.

Comment: The amount of time to eradicate an outbreak is excessive, average 17 months, range 1 to 72 months (Table 6). The extended time increases the eradication costs of the beekeeper with the outbreak and increases the risk of spreading AFB to apiaries of other beekeepers and to feral colonies.

3. Introduction of laboratory testing of honey samples to be reconsidered.

Comment: Beekeepers commented on the benefits of honey testing in assisting with early diagnosis of AFB in their apiaries (Table 12).

4. The effects of increased economic costs and stress on personal health to individual beekeepers when managing AFB infected apiaries requires identification and attention.

Comment: Table 8 reported on increased economic costs and on increased stress/depression reducing the ability to work by some beekeepers when attempting to eradicate AFB from their apiaries.

5. Beekeeper and Departmental personnel education in aspects of AFB identification, control and Apiary Act requirements should continue.

Comment: A high reliance on field identification of AFB by beekeepers and Department officers was shown (Table 4a). A lack of understanding of requirements of the Apiaries Act and Regulations was demonstrated (Tables 9a and 9b).

6. A key factor when planning AFB control programs for a district is the number of infected apiaries in the district rather than the number of beekeepers owning infected apiaries.

Comment: Each apiary containing one or more infected hives represents a source of infection for the beekeeper owning the apiary, nearby apiaries owned by other beekeepers and feral colonies. High numbers of beekeepers owning infected apiaries (Tables 2c and 3c) did not correlate with high numbers of infected apiaries in the same district (Table 5a).

7. Development of a program to identify and reclaim for beekeeping use areas of NSW currently not used by beekeepers due to endemic AFB in those areas.

Comment: Beekeeper comments (Table 8) identified problems and costs associated with areas identified as endemic AFB areas.

8. Determine the amount of used beehive materials and equipment being stored by beekeepers where the beekeeper/owner does not know the AFB history of those materials. The problem needs identification and attention if required.

Comment: The problem of stored used beehive materials and equipment with an unknown AFB history was raised in the survey, Table 12. Stored used materials are a continuous, unknown and major potential source of residual infection to the apiaries of the beekeeper owning those materials, apiaries of other beekeepers placed within flight range and nearby feral colonies.

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APPENDIX 1: SURVEY FORMS MAILED TO BEEKEEPERS

NSW Department of Primary Industries, Calala, NSW, 2340

Form 1 – Beekeeper Information.

No. _____

Date _____

1. Number of hives managed during 2005-6. Tick the appropriate box.

50-199
200-499
500-699
700-999
1000-1499
More than 1500

2. Tick the Districts where you have apiary sites. Name other areas in NSW where you have apiary sites by providing the name of the nearest major town. Use the District number to identify apiary site areas when answering questions in Forms 2 and 3.

District Number	Tick	District Number	Tick
1	Sydney Basin	11	Riverina
2	Central Tablelands	12	South`n Tablelands
3	Hunter Valley	13	Illawarra
4	Manning Gr/Lakes	14	South Coast
5	Mid North Coast	15	Monaro
6	North Coast	16	
7	North`n Tablelands	17	
8	NW Slopes/Plains	18	
9	Western Plains	19	
10	SW Slopes	20	

3. How many times, on average, would you move your apiaries each year? _____

4. Your name and address are NOT required but you may provide them if you wish. All information provided is confidential.

Name _____ Address _____

Form 3: American Foulbrood Survey No. _____

1. In what year did you commence to keep bees? _____

2. Have your hives been diagnosed with AFB at any time? (circle) YES / NO

If your response to Question 2 is NO, stop here and RETURN the form in the envelope provided. If the response is YES, continue with the following questions.

3. In what year was AFB first diagnosed in your apiaries? _____

4. How was the AFB diagnosed? Tick the appropriate box or supply information.

1	NSW DPI Diagnostic Laboratory
2	NSW DPI Regulatory Officer
3	NSW DPI Apiary Officer
4	A commercial beekeeper
5	An amateur beekeeper
6	Yourself (owner beekeeper)
7	Other (describe)

5. Provide a history of AFB in your apiaries. Use District Numbers from Form 1.

District Number	Year(s) AFB present	No. of apiaries affected	No. of hives in affected apiaries	No. of hives destroyed with AFB	No. of hives /materials irradiated

6. How long has it taken you, on average, to eradicate AFB from your apiaries? Complete the appropriate box.

Months
Years
And/or – no. of rounds of inspections

7. Estimate the INCREASED costs of production for your business to manage each AFB outbreak. Provide answers in each box.

Year of outbreak	Estimate INCREASED costs to your business					
	Hives destroyed – Number and value (\$)	Costs of hives/ materials irradiated (\$)	Reduced honey prices (\$)	Extra transport costs (\$)	Extra labour costs (Hours)	Other costs (\$)

List other costs: _____

8. Provide extra information/comment of the costs of AFB to your business eg. loss of use of apiary sites due to presence of AFB in area.

9. AFB is a notifiable disease under the NSW Apiaries Act 1985. From time to time beekeepers do not notify the NSW DPI for a variety of reasons.

Circle A or B:

A I have had AFB in my apiaries and DID notify NSW DPI

B I have had AFB in my apiaries and DID NOT notify NSW DPI

If B, you have had AFB in your apiaries and DID NOT notify NSW DPI, what were your reasons for NOT reporting AFB? (Tick the appropriate box(es) or write your response.)

	Tick
1	Did not know reporting AFB was required
2	Intended to report AFB but failed to do so
3	Did know reporting AFB was required but did not want to do so
4	Did not know who to contact
5	Was not intending to claim compensation/irradiation costs
6	Did not want NSW DPI to have a record of AFB in my apiaries
7	Did not want to involve NSW DPI officers in my business

Other _____

10. What do you consider to be the highest risks in spreading AFB?

A. From an outside source to your apiary

B. Within your apiary

11. What person(s), Industry Group(s) or Government Department(s) do you consider have responsibilities for managing AFB in NSW? (Tick appropriate.)

	Within your apiaries	Outside your apiaries
The beekeeper owning the infected apiaries		
The Beekeeping Industry		
A Govt. Dept. eg NSW DPI		

Other (identify) _____

12. Other comments
