1994

COTTON RESEARCH & DEVELOPMENT CORPORATION

FINAL REPORT

OVERSEAS TRAVEL

ATTENDANCE AT SIXTH INTERNATIONAL VERTICILLIUM SYMPOSIUM, DEAD SEA, ISRAEL.

DAN 90C

June, 1994

STEPHEN J. ALLEN

NSW AGRICULTURE

Cotton *Research & Development Corporation*
FINAL REPORT

OVERSEAS TRAVEL

NAME	:	**Stephen J ALLEN**
ORGANISATION	:	**NSW Agriculture**
POSITION	:	**Senior Plant Pathologist** **Agricultural Research Station** **Narrabri, NSW, 2390**
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TRAVEL DATES	:	**14-29th June, 1994**

OBJECTIVES OF VISIT:

(i) To attend and present a paper and a poster at the Sixth International Verticillium Symposium, Dead Sea Israel.

(ii) To have discussions with Israeli reseachers at the Volcani Institute on Alternaria leaf spot of cotton.

ITINERARY

14-15 June	**Narrabri Sydney Singapore Cairo Tel Aviv**
19-23 June	**Sixth International Verticillium Symposium**
24 June	**The Volcani Institute**
26 June	**Northern Negev Cotton Production**
27-29 June	**Tel Aviv Bangkok Sydney Narrabri**

NB - In order to obtain the cheapest airfare available it was necessary to stay in Israel a minimum of 10 days. In order to get the connections for the cheapest airfare it was necessary to stay in Israel for 12 days. Consequently it was necessary to take two days recreation leave during the visit. In order to reduce costs there were no stop-overs during transit between Narrabri and Tel Aviv. ie. 3 days 11 hours were spent in transit!

HIGHLIGHTS

*** presentation of a paper entitled "The effects of various cultural practices on the epidemiology of Verticillium wilt of cotton in New South Wales" to the Sixth International Verticillium Symposium**

*** presentation of a poster entitled "Cotton Research & Development Corporation funded research into verticillium wilt of cotton in Australia".**

*** discussions with Dr Dani Schtienberg at the Volcani Institute on Alternaria leaf spot of cotton and inspection of cotton production in the Northern Negev with cotton extension specialist Mr. Igal Flash.**

FINANCIAL SUMMARY

All expenses were met from funds approved and allocated by the Cotton Research & Development Corporation. Registration fees ($282) and Travel insurance ($100) were paid in advance from other CRDC project funds. No other funds were available and Departmental approval for travel was given on the condition that there would be "No cost to the state other than the Officer's salary".

ITEM	Budget estimate	Actual expenditure
Air fares (economy class)	$2622	$2622.10
Local travel (bus and Taxi)	-	$ 72.74
Sustenance	$1762	$1900.00
Symposium Registration	$ 282	$ 282.00*
Misc.(Insur., Med., Depart. tax, etc)	$ 250	$ 100.00*
TOTAL	$4766	$4976.84

*Registration fees and Travel insurance were paid in advance (in May) from other CRDC project funds.

ITEMS OF SIGNIFICANCE

1.Dr. M. Rataj from Poland has agreed to act as co-ordinator for all Verticillium strain identification based on vegetative compatibility groups. She will be establishing a collection of all those tester strains being used and establishing a protocol to standardise strain identification across the world.

2. Dr. M. Nagtzaam from Holland volunteered to co-ordinate an evaluation of soil assay methods. Currently many methods are in use and each group has a favorite 'best' method. Soil samples will be collected from each group and subdivided to send to all other groups. Each group will then assay all soils with their 'best' method and the results will be co-ordinated to determine a 'universal best method'.

3. A review paper on "Recent progress in understanding relationships between Verticillium Species and sub-specific groups" by Dr. R. C. Rowe of Wooster, Ohio and a discussion session on methods led by Prof. J. Katan of Israel were excellent. One whole session was devoted to biological control.

4. Mr Igal Flash, a cotton extension specialist, is investigating the factors responsible for the development of cavitoma or microbial damage in Israeli cotton and methods for reducing the impact of the condition. Future co-ordination of our efforts in Australia with those in Israel is envisaged.

5. The Symposium also moved to establish a 'International Verticillium Newsletter.'

6. The next (Seventh) International Verticillium Symposium will be held in Greece in 1997. It will be important for those working on Verticillium wilt of cotton in Australia to be represented at that conference.

NB. COPIES OF ABSTRACTS AND PAPERS PRESENTED AT THE SYMPOSIUM HAVE BEEN MADE AVAILABLE TO ALL MEMBERS OF THE CRDC SPONSORED ('Covert') COMMITTEE CO-ORDINATING RESEARCH ON VERTICILLIUM WILT IN AUSTRALIA

THE SIXTH INTERNATIONAL VERTICILLIUM SYMPOSIUM:

The International Verticillium Symposiums are held every four years and bring together a significant number of leading researchers who are working on diseases caused by *Verticilium dahliae* and *Verticillium albo-atrum* . Symposiums have been previously held in the U.K., U.S.A., Italy, Canada and Russia.

The Sixth International Symposium was held at the Dead Sea in Israel. A total of 69 scientists from 15 countries participated in sessions on epidemiology, strain identification, host resistance, cultural, chemical and biological control and laboratory techniques. I presented a paper entitled "The effects of various cultural practices on the epidemiology of verticillium wilt of cotton in New South Wales" and a poster entitled "Cotton Research & Development funded research into verticillium wilt of cotton in Australia". Numerous valuable contacts were made with other researchers - especially those from the USA, Greece, Spain and Israel who are currently working on Verticillium wilt of cotton.

The programme for the Symposium and a list of participants as well as Abstracts of the paper and poster presented are included as appendices to this report. A full copy of all abstracts of all papers and posters presented at the Symposium is available and copies have been given to relevant researchers at the University of Sydney, Queensland Dept. of Primary Industries at Toowoomba and CSIRO Plant Industry at Canberra.

VISIT TO THE VOLCANI INSTITUTE - DR DANI SCHTIENBERG:

Dr Schtienberg is President of the Israeli Phytopathological Society and has worked on the epidemiology and control of Alternaria leaf spot of cotton for many years. The Volcani Institute is Israel's premiere agricultural research facility and is situated in the outskirts of Tel Aviv at Bet Dagan.

The cotton growing season in Israel is completely dry with no rainfall and all crops are irrigated. Cotton production areas are situated between the Mediterranean Sea on the West and a range of mountains in the East. Consequently the area experiences high humidity and very heavy dews every night and into the morning for much of the season. These conditions favour Alternaria leaf spot caused by *Alternaria macrospora* on Pima cotton and *Alternaria alternata* on upland cotton.

Dr Schtienberg's work has demonstrated that effective economic chemical control of Alternaria leaf spot on Pima cotton requires the initiation of a spray programme at flowering - based on periodic assessments of disease incidence. The current 'recommended action threshold' for spraying is "when an average of one lesion per 10-metre row of plants is detected on true leaves." The application of fungicides results in yield increases of up to 30% when compared to the yield of unsprayed plots. There is no

economic or yield advantage associated with fungicide applications prior to flowering - regardless of the level of disease.

COTTON PRODUCTION IN THE NORTHERN NEGEV AND CAVITOMA

Mr Igal Flash, a cotton extension specialist, had previously written to Australia with questions about our work on cavitoma. I was able to meet up with Mr Flash for discussions on our work. This provided an opportunity to look at cotton production in the northern Negev - in behind the Gaza strip.

(i) The 1994 season featured some large areas of coloured cotton for the first time.

(ii) There are three levels of pest control ie.:-

- organic cotton - no pesticide inputs
- environmentally friendly cotton - much reduced pesticide inputs
- cotton with full pesticide protection

(iii) There are four categories of water ie.:-

- Galilee water - for domestic use - too expensive for irrigation
- Salty water from bores - no more than two consecutive crops - slow growth
- A few on-farm storages with water stored from winter rain
- Recycled water from major cities - cleaned, dumped into aquifer and pumped out 20km away and the sold at US$0.14cents/ cubic metre

(iv) Sophisticated drip irrigation control systems. Several fields on several farms controlled from a central computer via radio links etc.

(v) Locally developed cultivars are proving to be better than introduced US cultivars

The heavy dews, which occur every night, favour the development of leaf spots and microbial growth on exposed seed cotton. Consequently 'gray' cotton and cavitoma are major problems. The problem is exacerbated by delayed harvests while waiting for contract harvestors or later maturing bolls.

APPENDICES

1. List of Symposium Participants (in Hebrew? format!!)

2. Symposium Programme

3. Abstract of Paper Presented

4. Abstract of Poster Presented

TEMPORARY LIST OF PARTICIPANTS

061-67931186	061-67991500	AUSTRALIA	2390	HYALL VALE	AUSTRALIAN COTTON	ALLEN S.
80242926	80243090	ITALY	70126	VIA G. AMENDOLA	UNI. OF BARI	AMANDINI M.
		ISAREL			HEBREW UNIVERSITY	BAO J.
0732849067	0732843833	UK	HE196BJ	MALLING	HORTI. RES.	BARBARA D.
0031 1745 13730	0031 1745 32300	THE NETHERLA	2678 ZG DE		RIJK ZWAAN	DAZELHANS A.
057202721	057293333	SPAIN	14080	CORDOVA		DEJARNO A.
		ISRAEL			ARO	BEN-YEPHET Y.
03457218569	03457218528	SPAIN	14080	CORDOVA	COL. AGR. CORDOVA	BLANCO-LOPES H.
0732849067	0732843833	UK	HE196BJ	EAST MALLING	HORTI. RES.	CARDER J.
80242926	80242922	ITALY	70126	VIA G. AMENDOLA	UNI. OF BARI	CICCARESE F.
80242926	80242923	ITALY	70126	VIA G. AMENDOLA	UNI. OF BARI	CIRULLI M.
0225-826779	0225-826826	UK	BA27AY	BATH	UNI. OF BATH	COOPER R.
208-3974311	208-3974181	USA			UNI. OF IDAHO	DAVIS J.
0091-278-21134	2078-20002/6/7	INDIA	364002	BHAVNAGAR UNI.	BHAVNAGAR	DUBE H.
0734-352421	0734-875123	UK	RGB2AT	EARLY GATE READING	UNI. OF READING	ELDON S.
3712463608	3712466210	UZBEKISTAN	700095	TASHKENT	INS. OF MICROBIO.	FEIZIEV R.
301-5045960	301-5045080	USA	20705	BELTSVILLE	USDA-ARS	FRAVEL D.
		ISAREL	BET DAGAN	P.O. BOX 6	A.R.O	GAMLIEL A.
5198372075	5190244120	CANADA	N1G2H1		UNI. OF GUELPH	GOLD J.
		ISRAEL			DOR	GONEN Y.
		ISRAEL			ARO	GRINSHTEIN A.
0732-849067	0732-843833	UK	HE196BJ	WEST MALLING	HORT. RES. INT.	HARRIS D.
071-3334500	071-3334297	U.K	NW7AH	CHPDEN HILL LONDON	KING'S COLLEGE	HEALE J.
		ISRAEL			DOR	HEIMAN O.
		HOLLAND				HIEMSTRA J.
403-3823156	403-3274561	CANADA			AGRICULTURE CANADA	HUANG H.
34-57218569	34-57218527	SPAIN	14080	CORDOVA	INST. OF SUST	JIMENEZ-DIAZ R.
	0044-71-3334537	UK	LONDON W8 7	CAMPDEN HILL ROAD	KING'S COLLEGE	KARAPAPA V.
		ISRAEL	REHOVOT	FAC. OF AGRI.	HEBREW UNI.	KATAN J.
		ISRAEL			ARO	KATAN T.
		ISRAEL			BROH	KLEIN L.
		ISRAEL			BROH	KOHEN S.
011-81155494020	011-81155485111	JAPAN		HOKKAIDO	OBIHIRO UNI.	KOIKE H.
408-7583018	408-7584637	USA	93901	SALINAS	UNI. OF CALIF	KOIVE S.
		ISRAEL			HEBREW UNIVERSITY	KOROLYOV N.
0320030479	0320091642	HOLLAND	8200AK	LELYSTAD	TBC	LAMERS J.
519-6454085	519-6633099	CANADA	N5V4T3	ONTARIO	AGRICULTURE CANADA	LAZAROVITS G.
		ISRAEL			ARO	LIVESCU L.
0905-763180	0905-763355	UK	WR52LQ	WORCESTER	ADAS	LOCKE T.
					PARAMOUNT	MACILVAINE J.
057293429	057293333	SPAIN	14080	CORDOVA		MELERO-VARA J.
0716316198	0715806622	UK	HO1E7HX	HALLET ST.	BRIKBEKK COL.	MELO I.
405-7447373	405-7449957	USA	74078	OSU CAMPUS	USDA-ARS	MELOUK H.
031-1837084575	031-1837023040	HOLLAND			WAGENINGEN AGR.	MOL L.
		ISAREL			NIR-OZ	MOSES G.
972-7-926337	972-7-960442	ISRAEL	85280 NEGEV	GILAT EXP. ST.	A.R.O	NACHMIAS A.
1473662234	1473631221	JAPAN	271	MATDUSO	CHIBA UNI.	NAGAO H.
031-837083412	031-837084662	HOLLAND		WAGENINGEN	ALMDDOUW UNI.	NAGTZAAM M.
		ISRAEL			ARO	ORENSHTEIN J.
010077506	010077829	GREECE	14561	KIFISSIA ATHENS	BENAKI PHYTO.	PAPLOMATAS E.
814-8637043	814-8637625	USA	16802	PENN ST. UNI.	PENNSL. ST. UNI.	PENNYMAKER B.
03457218563	03457218577	USA	14080	CORDOVA	UNI. OF CALIF.	PERES-ARTES E.
		ISRAEL			ARO	PINKAS Y.
902-5666821	902-5666839	CANADA			AGRI.	PLATT H.
	266735	RUSSIA	398037	LIPETSK		PORTENKO G.
5037373573	503-7375309	USA	97331	CORVALIS OR	OREGON ST. UNI.	POWELSON M.
	230511	POLAND	POZNAN 5047		POZNANI INST. OF PLANT GENETIC	RATAJ M.
001 805 399 173	001 805 399 445	USA	BAKERSFIELD	33141 E. LERDO,	F.C.PARAMOUNT	RAVID N.
	0044 225 826026	UK	BATH BA2 7A	BATH	UNIVERSITY OF BATH	RESENDE M.
001 418 648 242	001 418 657 798	CANADA	,SAINTE-FOY	R.S. 2560 BLVD. HO	AGRICULTURE CANADA	RICHARD C.
0713334500	0713334537	UK	W87T2	KENSINGTON	KING'S COLLEGE	ROBERTS O.
608-2632626	608-2621395	USA	53706	MADISON WI	UNI. OF WIS.	ROUSE D.
216-2633841	216-2633840	USA	WOOSTER OHI	OHIO ARDC	OHIO ST. UNI.	ROWE R.
081-10410	081-10420	POLAND	21-002	LUBLINA	INST. OF SOIL	SOLARSKA E.
031-837083412	031-837083411	HOLLAND	6700EE	P.O 8025 WAGENINGE	LANDBOUW UNI.	TERMORSHUIZEN A.
3013460085	3013468528	GREECE	11855	ATHENS	AGRI. UNI. ATHENS	TJAMOS E.
972-7-926337	972-7-960910	ISRAEL	NEGEV 85280	GILAT EXP. ST.	A.R.O	TSROR L.
31837024988	31837095310	NETHERLAND	6700AA	WAGENINGEN	FORES. & NATURE RES.	VAN DAM B.
08161714536	08161713683	GERMANY	85350	WEIHENSTEPAN	PHYTO. HINCHEN	ZINKERNAGEL V.

SIXTH INTERNATIONAL VERTICILLIUM SYMPOSIUM

Dead Sea, Israel, June 19-23 1994

SCHEDULE

Sunday, June 19

12:00-19:00	- Registration	
20:00	- Get Together	

Monday, June 20

08:30-09:00	Opening Ceremony:	A. Nachmias - Organizer D. Steinberg - Israeli Phytopathoiogical Society M. Cirulli
09:00-12:00	Morning Session: Chairperson:	The Pathogen (part I) R. Rowe
09:00-09:30	Rowe, R.	Opening review.
09:30-09:50	Rouse, D.	Verticillium species specific molecular probes and their application for biological assay and phyllogenetic studies.
09:50-10:10	Barbara, D.	Molecular studies and relationship between isolates of V.dahliae and V.albo- atrum.
10:10-11:00		Announcements and coffee break
11:00-11:20	Roberts, D.	Genome analysis of isolates of V.albo- atrum, V.dahliae and V.lecani.
11:20-11:40	Koike, M.	RAPD analysis of V.dahliae in five different pathogenicity groups in Japan.
11:40-12:00	Harris, D.	Characteristics of English isolates of V. dahliae.
12:00-13:30		Lunch
13:30-16:00	Afternoon Session: Chairperson:	The Pathogen (part II) D.C. Harris
13:30-13:50	Koike, S.	Verticillium wilt of cauliflower: a new disease in California.
13:50-14:10	Nagao, H.	Vegetative compatibility groups in Japanese isolates of V.dahliae using nitrate-nonutilizing mutants.

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14:10-14:30	Paplomatas, E.	Use of DNA hybridization and vegetative compatibility groups for the detection and differentiation of V. species.
14:30-15:00		**Announcements and coffee break**
15:00-15:20	Portenko, L.	Study of vegetative compatibility in V.dahliae.
15:20-15:40	Dube, H.	Cell wall degrading enzymes and toxins of V.dahliae (cotton isolate) from India.
15:40-16:00	Hiemstra, J.	Recovery of Verticillium-infected ash trees.
16:00-17:00	**Poster Session**	
	Eldon, S.	A comparative study of resistance mechanism to Verticillium and Fusarium wilt in cotton.
	Solarska, E.	Effect of rye intercropping-enhanced flourescent pseudomonads on the control of V. wilt in hops.
	Harris, D.	The threat posed to wilt susceptible crops in the U.K. by linsed cultivars.
	Melo, I.	Antagonistic properties of wild-types and mutants of Talaromyces flavus against V.dahlae.
		Use of isolated cells to detect phytotoxic activity of V.dahliae culture extracts on Solanum melongena.
	Barbara, D.	Arbidopsis thaliana as an experimental host of haploid isolates of V.dahliae.
		Vegetative compatibility and pathogenicity groupings within V.albo-atrum.

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	Melero-Vara, J.	Influence of crop rotation on population of defoliating and nondifoliating pathotypes of V.dahliae in field soils.
	Gold, J.	Verticilllium collonization in selected resistant, tolerant and susceptible alfalfa plants as determined by PSR-base assay.
	Harris, D.	Field assessment of wilt resistance in hop.
	Ten, L.	Lectine role in V. wilt of cotton.
	Allen, S.	Cotton research and development corporation funded research into V. wilt of cotton in Australia.
	Tsror(Lahkim),L.	V. wilt comparison of the tolerance phenomenon in potato to Ve Gene resistance in tomato.
	Maharshak, G.	Formaldehide as a soil disinfectant for control of V.dahliae in crop rotation.
		Methyl Bromide as a soil disinfectant for control of V.dahliae in crop rotation.
	Shadmanov, R.	Mechanism, caused a tolerance of plants to wilt.
	Richard, C.	Physiological, pathological and molecular characterization of V.albo-atrum strains isolated from potato and alfalfa.
	Jimenez-Diaz, R.	Use of random amplified polymorphic DNA (RAPD) to characterize cotton defoliating and nondefoliating isolates of V.dahliae.
17:00-18:30		**Dinner**
18:30-20:30	**Evening Workshop:**	**The role of molecular biology techniques in Verticillium research.**
	Moderator:	**J. Heale**

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Tuesday, June 21

08:30-11:40	**Morning Session: Chairperson:**	**Epidemiology G. Lazarovits**
08:30-08:50	Huang, H.	Survival of V.albo-atrum in alfalfa seeds.
08:50-09:10	Allen, S.	The effects of various cultural practices on the epidemiology of Verticillium wilt of cotton in New South Wales.
09:10-09:30	Lazarovits, G.	The production of microsclerotia of V.dahliae for use in studies of survival.
09:30-09:50	Mol, L.	The influence of plant roots on the germination behaviour of microsclerotia of V.dahliae in the soil.
09:50-10:20		**Announcements and coffee break**
10:20-10:40	Termorshuizen, A.	The search for the recovery in detection methods of microsclerotia of V.dahliae.
10:40-11:00	Nachmias, A.	Enhancement of Verticillium infection in potato under stress conditions.
11:00-11:20	Lamers, J.	V.dahliae incidence of potatoes grown after a monoculture of onions, forage maize, flax, kidney beans, peas or field beans.
11:20-11:40	Lazarovits, G.	Concluding remarks.
11:40-13:00		**Lunch**
13:00-16:00	**Afternoon Session: Chairperson:**	**Resistance E. Tjamos**
13:00-13:20	Lazarovits, G.	The role of melanin in the survival of microsclerotia in V.dahliae.
13:20-13:40	Cooper, R.	Studies on the resistance of cocoa to vascular wilt caused by V.dahliae Kleb.

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13:40-14:00	Resende, M.	The role of tannins and multiple phytoalexin response in the resistance of cocoa to V.dahliae Kleb.
14:00-14:40		**Announcements and coffee break**
14:40-15:00	Pennypacker, B.	Regulation of resistance to V.albo-atrum in Alfalfa.
15:00-15:20	Gold, J.	A possible source of resistance to V.dahliae Race 2 in tomato.
15:20-15:40	Ciccarese, F.	Progress in search for Verticillium wilt-resistant artichoke.
15:40-16:00	Tjamos, E.	Concluding remarks.
16:20		**Leaving to Massada**
19:00		**Barbecue on Massada ramp**
21:00		**"Light and Sound" performance**
22:15		**Coffee in Beduin atmosphere**

Wednesday, June 22

07:00	Field trip to the South Negev:	Gilat Experiment Station
13:00		Ramon Crater
14:00		Lunch
17:00		Ovdat Ancient Agriculture.

Thursday, June 23

08:00-14:00	**Morning Session:**	Control
	Chairperson:	D. Fravel
08:00-08:20	Rowe, R.	Variability in virulence among pathotypes of V.dahliae and possible implications of IPM programs for potato early dying.
08:20-08:40	Powelson, M.	Prospects for managing irrigation water to suppress potato early dying.
08:40-09:00	Davis, J.	Soil suppressivness of V.dahliae infection on potato cropping practices.
09:00-09:20	Melouk, H.	Inhibitory effects of volatile compounds from rapeseed meal to V.dahliae.

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09:20-09:50		**Announcements and coffee break**
09:50-10:10	Fravel, D.	Augmentation of performance of Talaromyces flavus by combination with sublethal metham sodium or heat.
10:10-10:30	Tjamos, E.	Distribution of establishment of Talaromyces flavus, a biocontrol against V.dahliae in soil and roots of solanaceous crops.
10:30-10:50	Nagtzaam, M.	Talaromyces flavus as potential biocontrol agent for controlling V.dahliae in potatoes.
10:50-11:10	Gamliel, A.	Control of V. wilt with Methyl Bromide at reduced dosage using virtually impermeable films.
11:10-11:30	Fravel, D.	Concluding remarks.
11:30-13:00		**Lunch**
13:00-14:30	**Afternoon Session:**	**Concluding Session**
	Chairperson:	**J. Katan**

THE EFFECTS OF VARIOUS CULTURAL PRACTICES ON THE EPIDEMIOLOGY OF VERTICILLIUM WILT OF COTTON IN NEW SOUTH WALES

S. J. ALLEN

Australian Cotton Research Institute, Narrabri, New South Wales, AUSTRALIA 2390

Irrigated cotton production was introduced to Australia in the early 1960's and Verticillium wilt (*Verticillium dahliae* Kleb.) was soon recognised as an important disease. A comparison of isolates of the pathogen from cotton in Australia with isolates from the U.S.A. has shown that the Australian isolates are similar to, thongh less virulent than, the mild, non-defoliating isolates of *V. dahliae* from the U.S.A. Recently the Australian isolates were described as belonging to the VCG 4 group which cause mild to moderate symptoms, even in susceptible cotton cultivars. Despite the presence of only mild isolates of the pathogen, significant yield reductions occur.

Commercial cotton crops in all of the major cotton growing areas of New South Wales have been surveyed annually since the 1984/85 season. The purpose of these surveys is to monitor the distribution, incidence and severity of cotton diseases.

The mean incidence of foliar symptoms of verticillium wilt of cotton increased from 4.1% in the 1984/85 season up to 16.5% in the 1989/90 season. During the same period the mean incidence of the disease in the Namoi valley increased from 4.7% to 30.1%. This increase coincided with the increased adoption of minimum or reduced tillage practices and permanent bed systems which have resulted in greater retention of crop residues from season to season. In addition, crop residues are spread from field to field in irrigation water. The incidence of Verticillium wilt increases quickly when newly developed fields are watered with water which has run off a field where the disease is well established. The pathogen is easily isolated from crop residues in this re-circulated water. Repeated cotton cultivation in the same field year after year and the use of susceptible cultivars has also contributed to the increase in mean disease incidence.

The mean incidence of Verticillium wilt has decreased since reaching the peak in the 1989/90 season. A major factor in this decrease was the commercial release of the cultivar 'Sicala V1' which has significant resistance to *V. dahliae*. New cultivars with higher levels of resistance are soon to be released. A second factor which may have contributed to the decreasing incidence of the disease has been the widespread adoption of raking and burning crop residues. The results of several replicated field experiments comparing raking and burning with stubble-mulching have failed to demonstrate a direct reduction in the incidence of Verticillium wilt in the following season. However, the long term effects of raking and burning crop residues at the end of the season have not been determined.

The results of annual disease surveys for individual fields demonstrate the importance of tillage systems, crop residue management and cultivar in the epidemiology of Verticillium wilt of cotton in New South Wales.

COTTON RESEARCH & DEVELOPMENT CORPORATION FUNDED RESEARCH INTO VERTICILLIUM WILT OF COTTON IN AUSTRALIA

S. J. ALLEN

Australian Cotton Research Institute, Narrabri, New South Wales, AUSTRALIA 2390

The Australian Cotton Research and Development Corporation (CRDC) is funded jointly by cotton growers and the Commonwealth Government. Growers contribute $1.75 per bale as a research levy and these funds are then matched by the Government and used to assist a wide range of research projects. The CRDC has annual funding of about $6 million and accounts for more than 40% of all cotton research in Australia.

Verticillium wilt (*Verticillium dahliae* Kleb.) is now considered to be the most important disease of cotton in Australia. The CRDC is currently funding seven research projects which either directly or indirectly include aspects of verticillium wilt. These projects are as follows :-

(i) Breeding improved cotton varieties - Dr N. J. Thomson, Dr G. A. Constable and Mr P. E. Reid - Commonwealth Scientific and Industrial Research Organisation, Division of Plant Industry, Australian Cotton Research Institute, Narrabri.

(ii) Diseases of cotton - Dr S. J. Allen - NSW Agriculture, Australian Cotton Research Institute, Narrabri.

(iii) Survey of cotton diseases in Queensland - Dr J. K. Kochman - Queensland Department of Primary Industries, Toowoomba.

(iv) Biological control of verticillium wilt and seedling diseases of cotton - Dr S. J. Allen and Dr V. S. Putcha - NSW Agriculture, Australian Cotton Research Institute, Narrabri.

(v) Verticillium wilt of cotton: Identification of fungal pathogens and isolation of potential plant resistance genes - Dr B. Lyon - University of Sydney.

(vi) Genetic manipulation of natnral plant defenses for the biocontrol of verticillium wilt disease of cotton - Dr E. Dennis and Dr D. Llewellyn - Commonwealth Scientific and Indnstrial Research Organisation, Division of Plant Industry, Canberra.

(vii) Induced resistance to cotton diseases as part of integrated pest and disease management - Prof. B. J. Deverall - University of Sydney.

In addition to these a project entitled "Using glucose oxidase to control verticillium wilt of cotton." is being funded by Cotton Seed Distributors Ltd which is a grower-controlled company prodncing planting seed for the Australian cotton industry.

Information on the relevant objectives of each of these projects and the addresses of the research staff involved will be presented.