PROJECT 1

THE CONTROL OF *PHYTOPHTHORA* IN NATIVE PLANT COMMUNITIES

PART B

APPLICATION OF PHOSPHONATE ON THREATENED FLORA POPULATIONS IN THE ALBANY DISTRICT

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1 INTRODUCTION

In 1993 a program was implemented in CALM's Albany District for the application of phosphonate to populations of threatened flora, critically affected by *Phytophthora*. Based on research described in Part A and/or in previous annual reports to Environment Australia (1994-1996) appropriate concentrations of phosphonate were selected for foliar sprays and different methods of fungicide application were examined.

2 OBJECTIVES

The major objectives of this work were:

- To determine whether application of phosphonate could reduce or prevent the observed decline in health of populations of rare or endangered species associated particularly with infection by *Phytophthora* in the Albany District.

- To test different types of delivery equipment and report on their efficiency for application of phosphonate to native flora in the field.

- To develop a strategy and define protocols for the use of phosphonate within the District and Department

- To ensure good communications and interaction between Research (SID) and District personnel.

3 METHODS

Field applications of phosphonate on threatened flora were initiated in June 1993 using a back-mounted Hardi RY2 20l capacity spray unit operated by a hand pump. In subsequent trials, commencing in January, 1994, phosphonate was applied with a Stihl Mist Blower powered by a two stroke engine. The aqueous spray used in these trials contained phosphonate at a conc. of 0.2% and a surfactant (Synertrol) at 1% total volume. Higher concentrations of phosphonate (0.5% - 2.0%) were applied in some other trials utilising the Stihl Mist Blower. Control plants were unsprayed. Sprays were applied to the run off stage. A third manually operated spray unit, the Microfit Herbie was also tested in the field.

In trials undertaken in 1996, an aircraft was used to spray field populations of threatened or rare flora with phosphonate. Aerial spraying was effected using a Micronair ultra low volume boom spray to deliver 30l ha^{-1} (per pass) of an aqueous solution of phosphonate at a concentration of 40%. This was equivalent to application of the active ingredient (phosphite ion) at a rate of 24 kg ha^{-1} per pass. Treatments included applications of phosphite at zero (control), 24 and 48 kg ha^{-1}. Plants subjected to aerial spraying comprised populations of previously sprayed (manually), threatened flora which still appeared to be deteriorating. These trials included several populations of *Banksia brownii* and an *Andersonia* sp. The results of most trials initiated in 1996 are not yet available.

4 RESULTS

Information on modes of phosphonate application and mortalities in stands of threatened plants is provided below in tabular form, together with brief details of spray locations, presence or not of *Phytophthora* infection and specific identities of rare or endangered species considered in this work. Unless otherwise indicated, the number of living plants in a stand was assessed on the date of phosphonate application and on stated dates thereafter. Results

are expressed as percentage decline in population numbers occurring between consecutive observations.

4.1 HARDI RY2 SPRAY UNIT USED TO APPLY 0.2% PHOSPHONATE TO RUN OFF STAGE.

4.1.1 *Andersonia* sp. (GJK 8992). Boulder Hill.

Phytophthora - infected site.

Date	Operation	No. of live plants		Decline (%)	
		Sprayed	Unsprayed		Sprayed
	Unsprayed				
June 1993	Spray/Assess	69	52	-	-
Feb. 1994	Assess	64	43	7	17

4.1.2 *Banksia brownii* Seedlings (1989/90 fire). Cheyne Beach Road.

Phytophthora - infected site.

Date	Operation	No. of live plants	Decline (%)
June 1993	Spray/Assess	41	-
Jan. 1994	Assess	15	63
Jan. 1996	Assess	15	0

4.2 STIHL MIST BLOWER USED TO APPLY 0.2% PHOSPHONATE TO RUN OFF STAGE.

4.2.1 *Banksia brownii.* Vancouver Peninsula.

Partly infected by *Phytophthora.*

Date	Operation	No. of live plants	Decline (%)
Jan. 1994	Spray/Assess	310	-
June 1994	Assess	274	*
May 1995	Assess	250	9

*Accurate assessment not possible as observed mortalities considered to be drought related.

4.2.2 *Isopogon uncinatus.* Vancouver Peninsula.

Phytophthora - infected site.

Date	Operation	No. of live plants	Decline (%)
Jan. 1994	Spray/Assess	9	-
May 1994	Assess	9	0

4.2.3 *Banksia brownii.* Hassell National Park.

Partly infected by *Phytophthora.*

Date	Operation	No. of live plants	Decline (%)
Jan. 1994	Spray/Assess	87	-
June 1995	Assess	58	33
Jan. 1996	Assess	57	2

4.2.4 *Isopogon uncinatus.* Mutton Bird Island.

Not infected by *Phytophthora.*

Date	Operation	No. of live plants	Decline (%)
Feb. 1994	Spray/Assess	96	-
Jan. 1994	Assess	96	0

4.2.5 *Lambertia fairallii.* Stirling Range National Park.

Phytophthora - infected.

Date	Operation	No. of live plants	Decline (%)
June 1994	Spray/Assess	11	-
August 1994	Assess	11	0

4.2.6 *Andersonia* sp. (GJK8992). Goodga River Reserve.

Phytophthora - infected.

Date	Operation	*Treatment	**Mean no. of live plants	Decline (%)
August 1995	Spray/Assess	Control	142	-
August 1995	Spray/Assess	0.5%	139	-
August 1995	Spray/Assess	1.0%	151	-
August 1995	Spray/Assess	2.0%	131	-
March 1996	Assess	Control	113	20
March 1996	Assess	0.5%	72	48
March 1996	Assess	1.0%	39	74
March 1996	Assess	2.0%	6	95

*Treatments included unsprayed (control) and application of phosphonate at three stated concentrations.

**Each value is the mean number of living plants for three replicate plots.

4.2.7 *Andersonia* sp. (GJK8992). Boulder Hill.

Phytophthora - infected.

Date	Operation	*Treatment	**Mean no. of live plants	Decline (%)
August 1995	Spray/Assess	Control	29	-
August 1995	Spray/Assess	0.5%	53	-
August 1995	Spray/Assess	1.0%	45	-
August 1995	Spray/Assess	2.0%	55	-
March 1996	Assess	Control	27	7
March 1996	Assess	0.5%	48	9
March 1996	Assess	1.0%	28	38
March 1996	Assess	2.0%	20	64

*Treatments were the same as those listed under 4.2.6.

**Each value is the mean number of living plants for four replicate plots.

4.3 AIRCRAFT DELIVERY

An aircraft equipped with a Micronair ultra low volume boom spray was used to spray populations of threatened flora with 40% phosphonate at 30l ha^{-1} per pass (equivalent to 24 kg phosphite per hectare).

4.3.1 *Andersonia* sp. (GJK8992). Boulder Hill.

Phytophthora - infected.

Date	Operation	Treatment	*No. of live plants	Decline (%)
May 1996	Spray/Assess	Control	528	-
May 1996	Spray/Assess	24 kg ha^{-1}	284	-
May 1996	Spray/Assess	48 kg ha^{-1}	234	-
Oct. 1996	Assess	Control	496	5
Oct. 1996	Assess	24 kg ha^{-1}	275	3
Oct. 1996	Assess	48 kg ha^{-1}	114	51

*Each value is the number of living plans in a 0.24 hectare plot.

5 DISCUSSION

5.1 EFFECT OF PHOSPHONATE ON DECLINE OF THREATENED FLORA.

In preliminary trials established during 1993 and 1994, plants were sprayed with 0.2% phosphonate using portable hand pumps (Hardi RY2 or Stihl Mist Blower). The results of this work were inconclusive. In one trial with *Andersonia,* mortality of unsprayed controls was more than twice that noted for plants treated with phosphonate. In three trials with *Banksia brownii,* percentage decline of sprayed plants ranged between 9% and 63%. However, a substantial proportion of treated plants have persisted for up to two years (at the current time) after spraying. This suggests that phosphonate treatment may enhance long term survival of species in areas affected by *P. cinnamomi.*

In more extensive trials established in 1995, *Andersonia* was sprayed (manually) with phosphonate at concentrations of 0.5, 1.0 and 2.0%. Mortality of plants was least in the unsprayed control treatment and increased progressively with increasing concentrations of phosphonate. In 1996, the same species of *Andersonia* was sprayed aerially with 40% phosphonate to provide delivery of 24 kg or 48 kg of phosphite per hectare. Here, mortality was least for plants receiving phosphite at 24 kg ha^{-1}, though the result was not significantly different to that noted for unsprayed, control plants. Plant mortality in the 48 kg ha^{-1} treatment was considerably greater than that recorded in the other two treatments. The results of this work might suggest that application of phosphonate is detrimental to plant health, at least at higher concentrations. However, there are strong indications that the species of *Andersonia* studied in this work is particularly sensitive to phosphonate and that mortalities were often due to a phytotoxic effect of the applied chemical. This is supported by frequent observations of leaf necrosis or probable chemical burning on plants treated with high concentrations of phosphonate. It is notable in this regard that the practice of hand-spraying to the run-off stage can also result in delivery of excessive phosphite to plant tissues.

5.2 METHODS OF PHOSPHONATE APPLICATION.

The Hardi RY2 spray unit was found to be suitable for treatment of small numbers of moderately tall plants. However, it was not practical for spraying plants that exceeded 1.5 m in height. Moreover, the 20l unit is bulky and unsuitable for use on target species located at significant distances from vehicle access points. Another disadvantage of the Hardi unit lies in its' restriction to application of low concentrations of phosphonate and this may necessitate repeated spraying.

By comparison, the Stihl Mist Blower was more suitable for effective spraying of target species irrespective of plant height. This unit was utilised in the 1994/95 District programme. However, the Stihl Mist Blower is also restricted to delivery of dilute solutions, again resulting in excessive bulk and unsuitability for use on remote targets or in hilly terrain.

An ultra low volume hand spray applicator, the Microfit Herbie, has recently become available. This unit has been used to spray concentrated phosphonate (40%) and has the advantage of

light weight, even when fully loaded. On the other hand, use of this applicator carries increased risks of overdosing and chemical burning of foliage. Nevertheless, the Microfit Herbie is ideal for trial spraying of phosphonate at different rates to determine that most suitable for aerial spraying.

Trials carried out within the District have indicated that aerial spraying is the most practical approach for application of phosphonate to entire populations of flora. By comparison with manually operated units, the aircraft delivery system ensures a more even distribution of spray over target populations, treatment of entire plant communities and improved persistence of the active ingredient (phosphite) through the use of relatively concentrated sprays. Although these advantages are partly offset by logistical considerations such as compliance with Government regulations for aircraft hire, co-ordination of aircraft arrival and pre-spray site inspections, aerial spraying is justified by the marked increase in persistence of post-spray effectiveness.

5.3 PHOSPHONATE APPLICATION RATES.

The results obtained with *Andersonia* suggest that preliminary experimentation should be conducted to determine appropriate rates of phosphonate application for individual species prior to treatment of entire plant communities. Extensive trials have recently been established in selected communities on or near the south coast of Western Australia to examine the effects of phosphonate on plant growth and reproduction. Other aspects include investigation of phytotoxicity and sensitivity of selected flora to application of phosphonate at a broad range of concentrations. Details of the latter study are provided in Part C of this project.

5.4 MANAGEMENT STRATEGIES AND PROTOCOLS.

Management strategies and protocols for the use of phosphonate are currently at a developmental stage and will not be precisely defined until the results of on-going trials become available.

6 OUTCOMES

- Treatment of entire plant communities in order to reduce post-spray decline of rare or threatened species.

- Aerial spraying is considered to be the most practical and effective method of applying phosphonate to entire plant communities.

- Determine future sources of funding for operational spraying of threatened flora and staff for subsequent monitoring and implementation of a programme.

- Finalise management strategy and protocols to provide a consistent approach to the use of phosphonate within the Department. Consider the establishment of a working committee to oversee standards of practice and compilation of results to assist continual refinement and review of the programme.

CONTROL OF *PHYTOPHTHORA* AND *DIPLODINA* CANKER IN WESTERN AUSTRALIA

FINAL REPORT

TO THE THREATENED SPECIES AND COMMUNITIES UNIT, BIODIVERSITY GROUP

ENVIRONMENT AUSTRALIA

MAY 1997

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