Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Journal of the Department of Agriculture, Western Australia, Series 3

Volume 5
Number 5 *September-October, 1956*

Article 23

9-1956

The eradication of insect pests - Some observations on the Argentine Ant campaign in Western Australia

P. N. Forte

Fig. 1.—Spraying a paper-bark swamp on the Swan River foreshore to eradicate Argentine ants

THE ERADICATION OF INSECT PESTS

Some observations on the Argentine Ant Campaign in Western Australia

TO an entomologist, and especially an economic entomologist, the word "eradication" means the destruction of all members of a species of insect in any particular area. It means the perfection of a project in the control of an economic insect pest.

Adapted from an address given before the Australian Institute of Agricultural Science (West Australian Branch), by the Retiring President (Mr. P. N. Forte, B.Sc., Agric.) on April 13, 1956.

Over a period of years the whole attitude to insect pest eradication has changed. There has always been a school of thought which maintained that it was impossible to find and kill the last insect of a species in any particular habitat or country.

However, with modern research methods and the newer lasting insecticides, it is evident that we can answer the question "Can insects be eradicated?" with a confident "Yes."

It is possible and desirable to wipe out destructive insects. When a new insect pest is introduced into a locality or country, it should be completely eradicated even if the expense involved is large, as this is usually much less than the economic loss which the pest can cause in subsequent years.

The success of a scheme for eradication of a pest depends on:—

(1) Devising an effective method of control. This can only be achieved by an appropriate research programme.

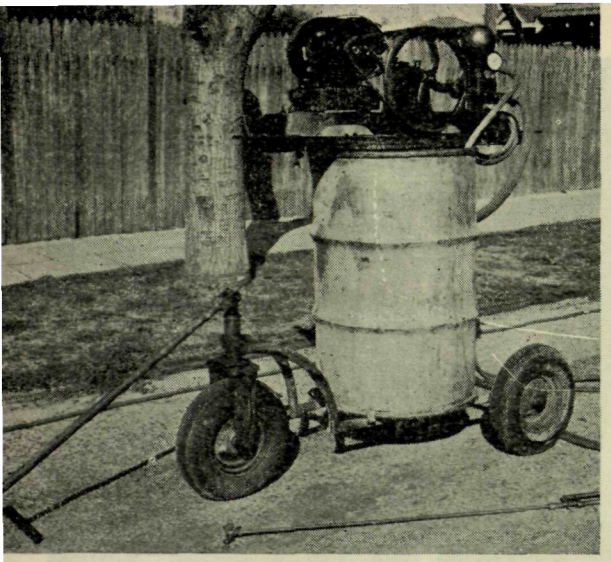

Fig. 2.—One of the mobile spraying units used in Argentine ant eradication.

(2) Implementation of a plan by legislation, i.e., once an effective scheme has been devised, it must have the backing of the Government and authority to operate. This is usually under an Act, e.g., Plant Diseases Act, Health Act.

(3) Co-operation of all States affected, so it may not spread back into the areas it has been eliminated from, i.e., implementation of Quarantine regulations.

(4) Full co-operation of the persons affected by the pest and the people conducting the campaign. This is usually assured by legislation but if people are willing to co-operate and legal action is not required, the scheme proceeds much more smoothly.

ERADICATION SUCCESSES

On this basis, successful eradication campaigns have been carried out in various places in the world.

For example, the Mediterranean fruit fly was completely eliminated from parts of 20 counties in Florida in about a year. The cost was 7,000,000 dollars but was considered well worth while, but it could not have been accomplished without the willing assistance of all concerned.

In other countries successful attempts have been made to eradicate insect pests from specified areas. These include such pests as the white garden snail, the citrus white fly, and the Colorado potato beetle.

The malaria-carrying mosquito (*Anopheles gambiae*), which caused 20,000 deaths in Brazil in 1938 and 130,000 deaths in Egypt in 1943, by transmitting this disease, has been reported eradicated from these areas. (The Governments of these countries were assisted financially by the Rockefeller Foundation in this enormous project.)

In Western Australia, we have had singular success in the eradication of 16 separate outbreaks of codling moth which has been of enormous benefit to the fruitgrowers and the State.

This has been achieved by discovering the introductions of the moth before the areas had become large and applying rigid control and quarantine measure to the orchards and surrounding areas.

THE ARGENTINE ANT

In Australia today, and particularly in Western Australia, we are in a position where we are able to contemplate the eradication of one of the most successful insect pests ever introduced into a country —the Argentine ant.

Since its arrival in Western Australia, it has, as in other States and countries of the world, exasperated housewives, caused gardeners to be constantly vigilant and reduced orchards to the stage where fruit production has become uneconomical.

When one stops to contemplate the area in this country which could become infested and calculate the money that people could spend annually on attempting control measures, it is staggering. I conservatively estimate it at £100,000 per annum on the present area of infestation in Western Australia.

THE HISTORY OF THE ANT IN AUSTRALIA

It was first recorded in Australia in Melbourne in 1939 and found then to be well established in several areas. The total area of infestation today in Victoria is approximately ten square miles.

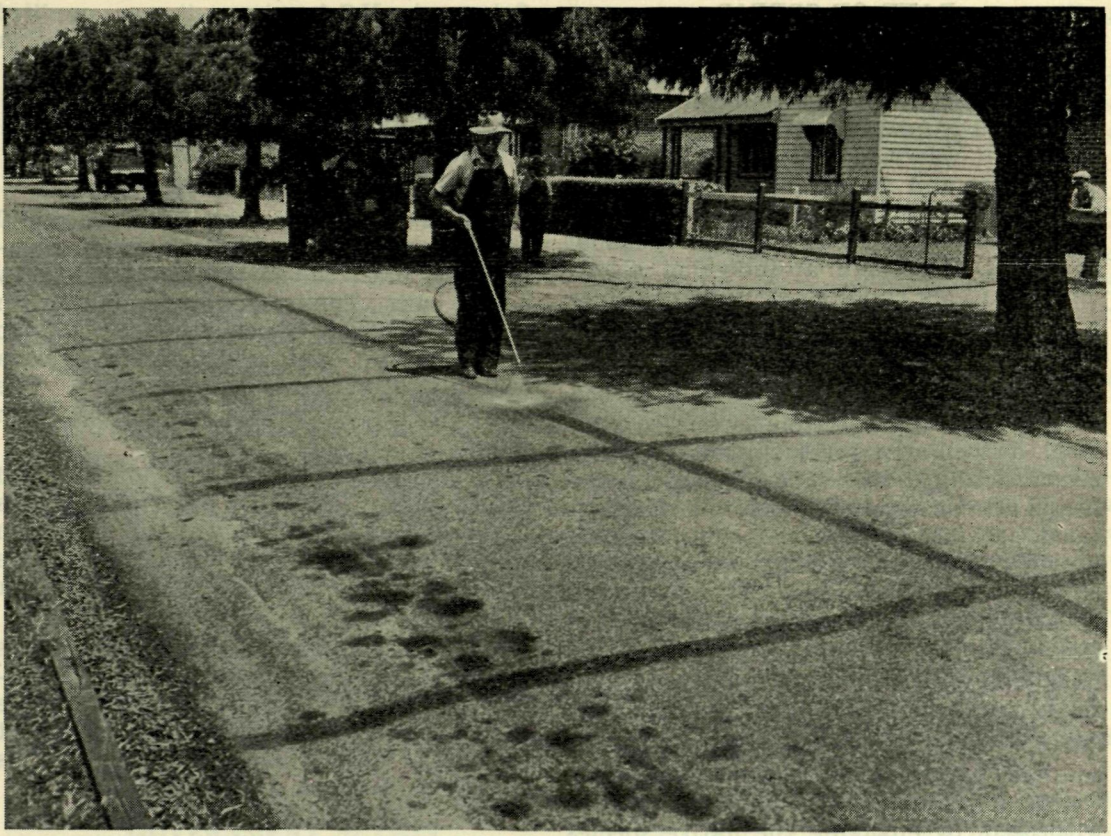

Fig. 3.—"Gridding" a road with spray bands in 10ft. squares. All lawns and open spaces were treated in this manner

The next record was from Western Australia where in 1941 it was identified and found to be well established at Albany and Perth. Since then it has spread rapidly and by 1955 had reached a total area of approximately 42 square miles.

Finally it was recorded in Sydney in 1951 and found to be present in several areas. The total area discovered infested in New South Wales is approximately 3½ square miles.

There is no doubt that since its establishment in these parts of Australia the ant has found conditions ideal and it has spread rapidly.

It is a lover of moisture and would undoubtedly be able to infest all the towns in Australia, all the rivers, swamps and irrigated areas and this would include almost all of our orchard areas in Western Australia alone.

The possible area which could become infested in Australia runs into thousands of square miles.

ORIGIN AND SPREAD

The Argentine ant was first named from specimens of the species collected from Buenos Aires, Argentina, in 1868. But its country of origin is almost certainly Brazil. From there it has been recorded to have been transported in shipments of coffee to New Orleans in North America, and it was first established there by this method and for a while was called the "New Orleans ant."

It seems probable that the ant has been spread in this way to most countries of the world and we have a record of it being brought into Western Australia in a shipment of cacao beans from the Gold Coast in South Africa.

Fortunately it was only introduced into an infested area.

RATE OF SPREAD

The natural rate of spread of the Argentine ant is relatively slow, mainly because the queens do not have a nuptial flight and a new nest is established by a queen ant selecting a site with a number of workers and developing and expanding a nest there. In Western Australia it has been observed to be at the rate of about five acres a year from an individual colony under suitable conditions.

It is obvious that the rate of spread in Western Australia from its first record in 1941 to 10,000 acres in 1950 and 30,000 acres at the present time is due to artificial, as well as natural, spread. In Western Australia it uses such mediums as infested stable manure, pot plants, firewood, etc. These transportable materials provide ideal nesting sites for Argentine ants and transporting them from infested to uninfested areas has undoubtedly been responsible for the rapid expansion of the ant in the metropolitan area.

It should always be remembered that during its natural spread it has to encounter and eliminate the native ants in the area it invades. This it does, as I have witnessed, by engaging the native species in battle with an enormous number of workers while a further trail of Argentine ants raids the nest and carries off the developing ants therein so that the nest is destroyed.

DISTRIBUTION OF ARGENTINE ANTS

It is now firmly established in most countries in the world and in all is regarded as a serious household and agricultural pest.

Few people in Western Australia need to be reminded of this as they have heard or seen of Argentine ants raiding refrigerators, and people's beds and of protecting aphides and scale insects on garden plants and orchards to such good effect that the control of such insects is well nigh impossible.

BENEFICIAL ASPECTS

Only one benefit have I seen recorded that the Argentine ant had conferred and that was in the slum section of New Orleans in U.S.A. where it was credited with exterminating bed bugs and other vermin in the houses of the poor.

ATTEMPTS TO COMBAT THE ARGENTINE ANT

Poison Bait.

One of the earliest and most successful methods devised for combating the Argentine ant until the last ten years was by poison baits. The baits were made up with honey and sugar which was attractive to the ants, and contained arsenite of soda or thallium sulphate as the poison. The most successful formula was developed in U.S.A.

In 1924 in Mississippi the Plant Board exterminated Argentine ants in 1½ blocks by using a bait and this was the first town in the world where Argentine ants were eradicated. Subsequently, some other towns succeeded in the same way.

However, in many other places baits have been tried and where there is alternative food supply, it is often impossible to get the Argentine ants to touch a bait no matter how attractive it is made. This applies in Western Australia.

NO IMPORTANT NATURAL ENEMIES

There are no known important natural enemies of the Argentine ant and the attractive method of using biological control in handling this pest cannot be tried. Nor is there any information available of its economic status in the probable home of its origin—Brazil.

The commonest predator here in Western Australia would be the ant lion, an insect which in the immature stage constructs a conical hole in the sand so designed that ants falling into it cannot escape and are then eaten by the insect.

This then briefly was the state of our knowledge when Argentine ants were first discovered in Western Australia and, although the area was relatively small compared with that infested today, we did not have sufficiently good control measures to submit a plan for eradication of them.

This is the answer to those people who complain that the campaign we are conducting today should have been initiated when the ants were first found here.

However, some good results were obtained by people using baits and usually ants could be kept outside with them.

NEWER CONTROL MEASURES—RESEARCH ON ARGENTINE ANTS IN WESTERN AUSTRALIA

When DDT first became available in Western Australia it was tried against the Argentine ant (1945-46).

The results were almost as effective and spectacular as those obtained by using it in controlling mosquitoes and flies.

It was found that using a 2 per cent. concentration of DDT and spraying nesting sites, trees, and around the house foundations and boundary fence, it was possible to reduce ant activity to the minimum and prevent invasions of the house.

However, if an all-over cover spray was applied, ants could be eliminated for all intents and purposes from a household block. This method of application was more costly and subsequently "places sprayed" have been selected and reduced to a minimum after a further study of the ant's activity.

GOVERNMENT ACTION

So promising was DDT and so widespread had the ant become that by 1950 the Government had made funds available to spray 2 per cent. DDT on a large scale.

The control of these funds lay with the Public Health Department and the scheme was launched in co-operation with the Entomology Branch of the Department of Agriculture.

It was proposed to spray the whole of the infested area in Fremantle. This was done and, although the ants were not eliminated, their numbers were very considerably reduced. This was particularly noticeable when the present campaign embraced Fremantle where a survey (five years later) showed that the infested area had not spread appreciably since 1950, whereas in other areas it had.

NEW INSECTICIDES TRIED

At this time a new insecticide called chlordane become available in Australia and tests with it in New South Wales showed it to be very useful in controlling Argentine ants.

It was then tried experimentally in Western Australia and compared with DDT and mixtures of both at various strengths.

Although carefully planned, failure to use a treated buffer area around each plot to prevent ants entering from untreated or ineffectively treated areas permitted re-invasions and so affected the results of the experiment.

However, the general indications were that chlordane was superior to DDT

The failure to obtain significant differences between treatments in the first experiment resulted in a change in design. In addition, the observed quick kill and lasting qualities of 2 per cent. chlordane made it possible to change the aim of the experiments from control to eradication.

Chlordane kills the ants by direct contact when it is sprayed on them, but it also remains after spraying and ants crossing a sprayed area up to six months afterwards can obtain a lethal dose.

This also applies to insecticides, referred to later, and resulted in the modification of spraying plans.

In spraying, a power plant is used giving 150 lb. pressure and the spray lance is held about 8in. off the ground which gives a 6in. wide band of insecticide. When the liquid dries, the insecticide is left as a persistent band of material. The fact that the ant habitually forages for food in trails, makes it susceptible to treatment with a persistent insecticide.

PLACES TO SPRAY

The method of spraying was modified and the positions sprayed reduced to nesting sites and places where ants trail. These were the foundation walls of all buildings, the rails and posts of fences, the edges of paths and lawns and garden beds, the bases of shrubs, the trunks of trees up to 6ft., compost and rubbish heaps and grape vines, etc. The rest of the open area such as lawns and backyards was sprayed across at 10ft. intervals—at right angles—making it impossible for ants to trail anywhere without crossing a sprayed area.

The next experiment involved a complicated layout which used 146 household blocks totalling over 30 acres. The areas selected were in Shenton Park and Nedlands and the experiment was initiated in 1951.

The results of this experiment showed that after two applications, chlordane gave complete control of the Argentine ant and DDT was inferior.

ALDRIN, DIELDRIN AND CHLORDANE

Also during 1951, samples of aldrin and dieldrin—two new insecticides—were made available by Shell Chemical Coy. of Australia and were compared with chlordane in trial blocks of nine houses.

Used at high concentrations (2 per cent.) aldrin and dieldrin compared more than favourably with chlordane. In fact today—4½ years after spraying—the houses sprayed with 2 per cent. dieldrin are still free of ants and invading ants still die. This seems fantastic but the observations have been made by myself and an entomologist who lived in one of the houses for this period. What was happening was that ants invaded the fronts of household blocks almost nightly and could be seen trailing up to perhaps the front steps first thing in the morning. However, by the afternoon the trailing had ceased, and dead and dying ants were present where the trial had been.

This is because the ants take some hours to die after they have obtained a lethal dose of the insecticide.

The next logical step was to try aldrin and dieldrin at lower concentrations and to compare them with 2 per cent. chlordane which was now the yardstick for complete control. On a cost basis, it was desirable to use dieldrin no stronger than 1 per cent. as its price compared favourably with chlordane at 2 per cent.

Therefore in 1953 an experiment was designed and initiated using aldrin and dieldrin at ½ per cent. and 1 per cent. strengths and comparing them with 2 per cent. chlordane. Here again the layout was on a statistical basis allowing the results to be statistically analysed. In all, 108 household blocks totalling 20 acres were used in this experiment and the results showed that after 8 months ½ per cent. and 1 per cent. dieldrin and 2 per cent. chlordane had all eradicated the ants on the houses treated with them and, further, at the end of 12 months 1 per cent. dieldrin was still killing invading ants.

PRACTICAL SPRAYING ON A LARGE SCALE

At this stage of the work (1953) the practicability of repeating these experimental findings on a large scale was tested by spraying about a square mile in South Perth twice during the summer with 2 per cent. chlordane.

I think everyone has heard what a great success that was. There were no ants, flies, mosquitoes, cockroaches or fleas to be found in the area after spraying.

Besides proving that the ants could be eliminated on such a scale, very valuable information was obtained on operating costs, suitability of spray plants used, pitfalls in organising such a campaign and training spraying personnel.

The most important point from the research side was that it was shown that the cost of the insecticide made up half the cost of the campaign. Therefore, any saving in cost of this item—by buying it more cheaply or reducing the concentration without losing the efficiency to kill ants—was of paramount importance.

Therefore, the next step was to find the threshold value, or lowest concentration of dieldrin that would give eradication. Accordingly, an experiment was designed to test dieldrin at ½ per cent., ⅜ per cent., ¼ per cent. and ⅛ per cent. strength. This experiment involved the use of 112 household blocks covering 20 acres.

It was initiated in 1954 and sampled throughout the year. At the end of 15½ months the ½ per cent and ⅜ per cent. dieldrin treatments were still completely free of ants and this had been the case for ten months.

The experiment showed quite conclusively that the threshold value of dieldrin for eradication of Argentine ants is about ⅜ per cent., and ½ per cent. can be recommended as having a good safety margin and being much cheaper than 2 per cent. chlordane. It should be remembered that in any campaign the success

also depends on the spray operator. If he does not apply the spray carefully to all the recommended areas, then a hazard to the success of the campaign necessarily arises.

BASIC RESEARCH COMPLETED

At this stage then the basic research for a successful eradication campaign had been completed. The following information had been gained or worked out:—

(1) Experience in conducting large scale spraying.
(2) Perfection of mechanised equipment for such work.
(3) An effective and cheap method of application.
(4) An effective insecticide.
(5) An excellent research background for a scheme to be a success.

Finally, it has been demonstrated and is well known that the average householder is not able to cope with the Argentine ant problem even with these improved insecticides available to him.

THE ARGENTINE ANT ACT

In 1954 then, with this background, the Argentine Ant Act came into being. This gave a Committee the power to collect and spend £105,000 per annum for five years to attempt to rid the State of Argentine ants; a tremendous task, as the known area of infestation was approximately 42 square miles.

The Department of Agriculture was co-opted and entomologists began the job of surveying the areas proposed to be sprayed in the first year, viz., south of the Swan River. Other tasks were the purchase of plant and equipment and insecticides, the establishment of a central depot and training personnel.

All this was accomplished and a start was made in November, 1954.

By May, 1955, 7,200 acres had been treated, and this included all known infestations south of the Swan River and all country infestations except Albany, these included Bunbury, Harvey, Waroona, Yarloop, Wagerup, Manjimup, Katanning and Cranbrook. The immediate results were very satisfactory.

As too much time is lost through wet days and the ants are less active during the winter, the campaign was suspended until November, 1955, when the area north of the Swan River was tackled and a start was made at Albany.

To date this season over 11,500 acres have been treated in the Metropolitan Area and over 600 acres in the Albany area.

SUCCESS OF THE CAMPAIGN

A preliminary survey and check of householders' reports in last season's ½ per cent. dieldrin sprayed areas has been most encouraging and supported the experimental results.

Most reports have shown the ants concerned to be native species which have returned to the area. The subject of native species of ants living in association with Argentine ants in certain situations is an interesting one. But when Argentine ants are eliminated from an area, it is surprising how soon the native species reappear.

Where Argentine ants have survived, it is only as single nests which can be easily treated at little cost, and some of these have been killed without further treatment owing, I believe, to the persistency of dieldrin.

New areas of infestation have been found south of the River this season but these seem to be new introductions from north of the River. They are all small areas and can be treated simultaneously with the current year's programme.

SUBTERRANEAN CLOVER SEED

The recent certification of 35 tons of Dwalganup subterranean clover seed in the Narrogin area has brought the season's production (for all strains) to the record figure of 1,997 tons. The previous highest production figure was 1,616 tons in 1954.

Applications for the inspection of pastures with a view to certification next season are lower than for 1955—850 properties as compared with 1,200. About 450 of these are in the South-West with the remainder in the Great Southern and lower Midlands. The reduction follows over-production of Dwalganup and Yarloop seed last season when the price was the lowest for many years. Interest in the Mt. Barker or midseason strain has been well maintained.