

Control of *Salvinia molesta* on Tinaroo Falls Dam with "AF 101", an experimental material

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## SUMMARY

*Salvinia (Salvinia molesta)* is a floating fern that is spreading throughout Queensland, mostly near population centres. It is a particular menace to man-made lakes and large dams where it interferes with recreation.

Accepted control methods have been costly and not often successful. This situation has changed with the use of a new approach to control of floating plants using a mixture which reduces their buoyancy and kills survivors with herbicide. Application techniques have been greatly improved by the use of a hovercraft.

## INTRODUCTION

In March 1977 a large outbreak of *salvinia (Salvinia molesta)* was reported on the lake formed by the Tinaroo Falls Dam on the Barron River in North Queensland. It was estimated that 18 ha were affected. This was spread over some 40 km of shoreline which was partly timbered and difficult to reach by land or boat. The total area was variable, the inlets being permanently infested with dense mats while floating rafts on the open water varied in size and density according to the prevailing winds. There was also an area of 2 to 3 ha of heavily rafted *salvinia* not affected by wind or water currents in the main river channel (Plate 1).

Attempts were made to control the growth by spraying with the herbicides paraquat, diquat, 2,4-D, and amitrole with ammonium thiocyanate, but beyond some superficial browning of leaf tissue and reduction of growth no significant control was noted. This result agreed with previously unpublished reports, although a paraquat plus 2,4-D mixture showed some promise and had local success on the dam.

It was obvious by August 1977 that the situation could quickly get out of hand with the advent of warmer weather as this plant has the reported capacity under field conditions to double its volume in as little as 8 days (Mitchell and Tur, 1975).

A new mixture designated AF 101 was made available by the Sir Alan Fletcher Research Station, Queensland, for trial purposes at this time and it was decided that the situation at Tinaroo warranted a field trial of the mixture.

Details of the development of the experimental mixture are given by Diatloff (1978).

## MATERIALS AND METHODS

The mixture designated AF 101 is a kerosene - alkinate mixture

to which herbicides can be added if required.

It is essentially a material to be applied at a low volume and rates varying from 22  $\ell$ /ha to 220  $\ell$ /ha are used, depending on plant density. Therefore it was thought to be suitable for use from aircraft. Trial applications at Tinaroo, by aircraft and by handspray from a boat, were commenced in August 1977.

A major problem in the control of salvinia was the impenetrability of dense mats to boats and this has restricted areas which could be sprayed by this method. Trials with a small hovercraft in the Brisbane area showed that this machine could successfully traverse the mats, and front mounted booms could be used to apply herbicides at both high and low volumes, thereby overcoming most access problems.

The hovercraft was used in the Brisbane area to apply AF 101 to relatively small (less than 0.5 ha) stored water areas. Application rates varied from 22  $\ell$ /ha on light infestations to 135  $\ell$ /ha on denser areas.

The hovercraft proved ideal for the job, being able to travel over the weed or shallow water and to apply varying rates of mixture as the density of the plant required. It was not used at the Tinaroo Falls Dam because control had been achieved before development of the method was complete.

## RESULTS AND DISCUSSION

Spraying with AF 101 was effective in reducing the amount of plant growth on the Tinaroo Falls Dam.

Plants sank to just below the surface on being sprayed with AF 101, apparently by wetting water-repellent hairs which normally provide buoyancy. The light green colour of the leaves darkened as soon as they became wet so that sprayed plants were immediately obvious. This darkening process continued for about 20 hours by which time the leaves had taken on a brown-black appearance and the plants were soggy and flaccid when picked up (Plate 2).

A major advantage was the rapid surface dispersal of the mixture which moved up to 2 m laterally from the point of application. The mixture therefore penetrated between fringing grasses and other vegetation and killed salvinia plants in places which would not normally be accessible to spraying. Selectivity at the rates used was good and the only other plant apparently affected was *Azolla* spp.

An aerial application on the rafted section in the Barron River channel was not successful and no apparent damage was noted at rates of 110  $\ell$ /ha and 220  $\ell$ /ha, but loosely distributed salvinia was found to be readily controlled at 110  $\ell$ /ha on open water.

Hand applications of AF 101 were made on a compacted area where water from sewerage effluent entered the dam and salvinia growth was vigorous. This was applied by spraying with hand-guns from equipment mounted on a four-wheel-drive vehicle and on a boat. This compacted area rapidly broke up after treatment allowing boats to enter the previously matted area. The application rates could not be accurately determined but were estimated as averaging 250  $\ell$ /ha.

With AF 101 alone a reduction of 80 to 85% in density of the

weed in a few days was obtained, but because of the volatility and water-repellent qualities of AF 101, any portions of the plant submerged at spraying were not wetted. Consequently the normally submerged growing tips continued to develop and new leaves appeared on the surface in a short time. While many subsequently died, sufficient survived to form a nucleus for the eventual recovery of the mats. A second spraying controlled these survivors.

By early November the total area of salvinia in the lake had been reduced to less than one ha.

Following advice that the addition of low rates of herbicides would kill plants surviving the initial submergence, diuron at 0.5 kg a.i./ha was incorporated into the mixture used to spray the remaining mats. Results were much better than with AF 101 alone and the mats broke up very rapidly after treatment. All floating plants which could be found had been killed by early December.

Falling water levels assisted by stranding some of the marginal weed during the spraying program.

Aerial spraying was effective where the salvinia was loosely distributed. The pilot of the aircraft described the result of the first run over such an area as 'dramatic' because at the end of the first run the sprayed section was already clearly visible with the plants sinking. This method of application was obviously effective in treating loosely packed floating mats on open water.

Boats and land based equipment were found to be best for spraying small areas and cleaning up around the shoreline. It was not considered economical to spray scattered plants in a large infestation on open water. This was best done when the plants had been blown into small areas by the wind.

AF 101 used in conjunction with a hovercraft gave excellent results during trials both in the degree of kill and the obvious lack of damage to ornamental water plants and the semi-aquatic species. Further, the action of the air-blast from the machine forced salvinia plants under water after they had been sprayed increasing the effectiveness of the mixture. Control exceeding 99% has been obtained on small storages from a single application.

Considerable difficulty has been experienced in evaluating the effects of AF 101 under open water conditions. Although the effect of a treatment was visible immediately, which avoided over-spraying, the actual rate of sinking and extent of survival and regrowth of treated areas was almost impossible to assess on open water because of the mobility of the plant through wind movements. Assessment was only possible by noting the overall reduction of area following each spraying. Wave action caused the plant to sink completely in hours, but in calm water it floated just below the surface for up to 2 to 3 weeks.

In addition to salvinia, AF 101 was effective on *Azolla* spp. and when containing a herbicide appears to have promise on water lettuce (*Pistia stratiotes*), duckweeds (*Lemna* and *Spirodella* spp.), and *Myriophyllum* spp. where emergent. Trials on these weeds have been restricted to-date because of the need to concentrate on salvinia control.

## REFERENCES

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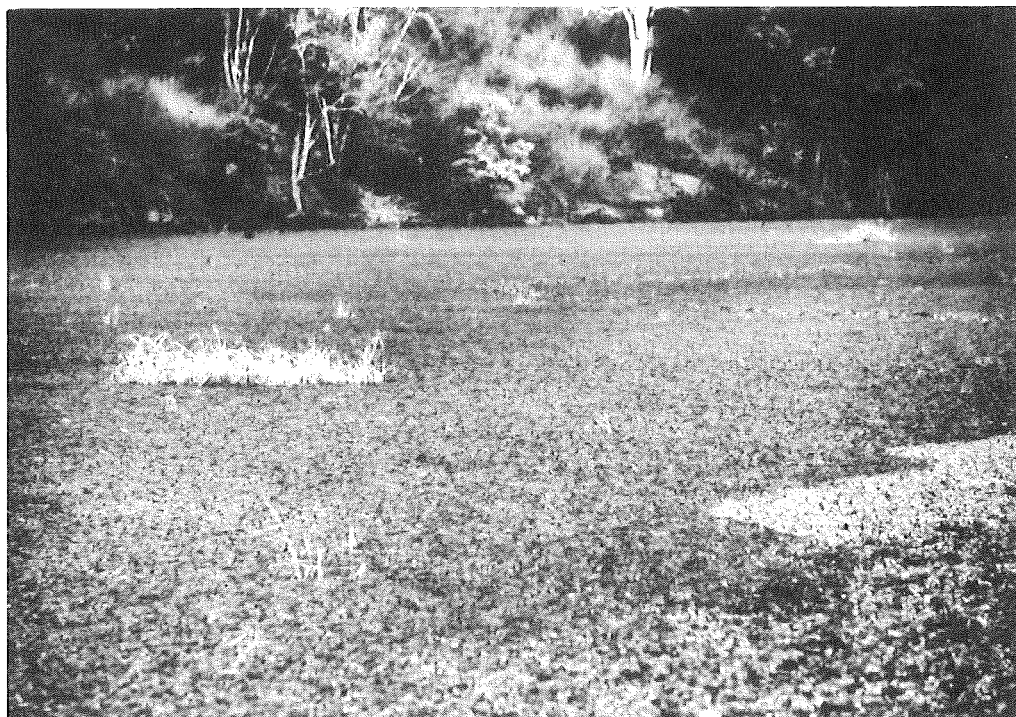


Figure 1. Salvinia covering river channel. Secondary growth of para grass is becoming established. Colour difference is result of spraying with paraquat.

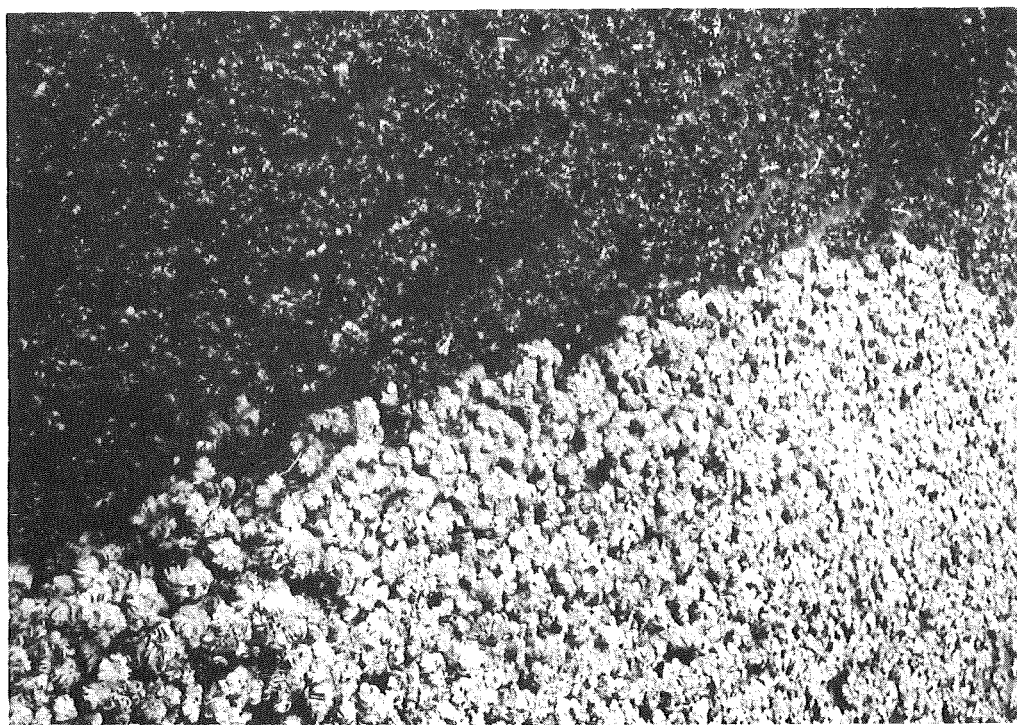


Figure 2. Salvinia sprayed with AF 101 20 hours previously. Affected plants (upper) have lost turgidity and have sunk to the water surface.

