

THE USE OF DDT FOR THE CONTROL OF TSETSE FLIES IN RHODESIA

D.F. Lovemore

Formerly Assistant Director of Veterinary Services
(Tsetse and Trypanosomiasis Control), Department
of Veterinary Services, Rhodesia¹.

Summary →

The first two ever effective residual insecticides DDT and BHC became available for general use in insect control at the end of the Second World War and it was very soon thereafter (1st December, 1945) that the South African Government's Division of Veterinary Services began its successful campaign to eliminate Glossina pallidipes Aust. in Zululand by the application of insecticide from aircraft, initially using the first mentioned chemical, but later DDT was replaced by BHC, principally for reasons of economy (du Toit, 1954). In West and East Africa tsetse research workers began to experiment with these chemicals in their search for more satisfactory tsetse control methods during the late forties, by application to vegetation (DDT), by aerial application (DDT and BHC) and by application to the coats of cattle (DDT), (Mulligan, 1970). And in 1953 and 1954 the Pretoria based aerial spraying company, which the South African Government had employed latterly in the Zululand operations, was retained by Government in Rhodesia to carry out a control operation against predominantly G. morsitans Westw. in the western region of the Urungwe district. On the recommendation of the South African veterinary authorities responsible for the Zululand operations BHC was used. Two similar operations followed, one immediately to the east of Kariba township, Kariba district, in 1956 and the other in the Lubu Valley region of the Binga district in 1957 (Cockbill et al, 1963). The first tsetse control operation in which the basis of control was dependant on the residual properties of the insecticide to be carried out in Rhodesia was conducted at Kapondo in the north-western region of the Urungwe district, in 1958, followed by an outstandingly successful operation on the Maseme drainage, Binga district, in 1960. In each case the technique used was based on West and East African work involving the/2...

1. Now Director of Natural Resources, Rhodesia.

involving the application of the insecticide to the dry season resting and refuge sites of tsetse flies by means of knapsack sprayers, either motorized or pneumatic, operating from the ground, called "ground spraying". The insecticide used in both operations was dieldrin, a very much more toxic organo-chlorine compound than DDT.

Prior to the use of residual insecticides for the control of tsetse flies, tsetse control in Rhodesia was effected to the ^{largely} greater extent by the intensive shooting of game animals over extensive areas with the object of removing the food source of the tsetse fly. All game species occurring, other than rhinoceros and elephant in certain situations, were destroyed. Some bush clearing was also carried out, examples being the 84 km long Eastern border barrier clearing on the Mocambique/Rhodesia International boundary stretching between beacons 81 and 100, Chipinga district and discriminative clearing in the south-east of the country between the Mwangazi Gap in the north and the Rutenga-Vila Salazar railway line in the south, Chipinga and Chiredzi² districts, on the Ruenya and Gairezi drainages, Mtoko and Inyanga districts, on the Rekomitjie and Sanyati drainages, Urungwe district, on the Sessami and Sengwa drainages, Gokwe district and the Shangani drainages, Lupane and Wankie districts, but generally speaking, as has already been implied, greatest reliance was placed on game elimination operations to control tsetse flies in this country. The Government came under severe criticism as a result of this policy, both locally and internationally and it was urged to seriously investigate control by other methods, in particular by the use of insecticides (Thomas, 1955). It is noteworthy, however, that from 1964 onwards, as a result of advances in our knowledge of the food host preferences of the tsetse fly/3....

2. The area lying between the Lundi river and the Rutenga-Vila Salazar railway line which has been affected by the tsetse problem over the years was previously included in the Nuanetsi district. It was only recently, October 1976, that it was brought within the Chiredzi district. Literature prior to this date would therefore refer to it as being within the Nuanetsi district.

of the tsetse fly brought about by the development of a blood meal identification technique by Weitz (1956), (Weitz et al, 1956) and by the success of a large scale experiment conducted in 1962 and 1963, involving the rapid reduction of the preferred hosts of G.morsitans from an area of 559 km² in extent, embracing the headwaters of the Nagupande river, Binga district, shooting was restricted to warthog, kudu, bushbuck, bushpig, buffalo and elephant, generally within limited areas, demarcated by game fences. However, despite this major development, criticism persisted, although to a much lesser degree than previously.

The method of tsetse fly control involving the application of a residual insecticide to the dry season resting and refuge sites of tsetse flies and as stated above, known as "ground spraying", is dependant on getting the insecticide into position prior to the onset of the extreme dry season, which in Rhodesia extends on an average from about the middle of September to the end of October. Because of the large areas involved (see below) "ground spraying" operations are generally commenced at the beginning of June and concluded not later than the end of September. It is obvious therefore that the insecticide used must remain strongly lethal for a minimum of six months after being placed in position. Dieldrin and DDT both have this property.

Following the successful Maseme operation referred to above the use of the "ground spraying" technique was extended as rapidly as possible to all tsetse control operation areas within the country, consistent with the availability of finance and more particularly trained personnel, initially in support of the selective game elimination operations mentioned above, but as time progressed becoming the main means of control. Results have been spectacular with very considerable areas of country being freed from tsetse flies, in particular, the Sabi/Lundi infested area, Chiredzi district ^{(and also} see ^{footnote 2.} ~~previous footnote~~), extending to a depth of approximately 60 km into

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Mocambique, south of the Rio Save (Robertson et al, 1968 and Robertson et al, 1972), the Turgwe/Sabi and Sabi East bank infested areas, Bikita, Chiredzi and Chipinga districts (Cockbill, 1971, Lovemore, 1972 and 1973), the Ruenya and Gairezi infested areas, Mtoko, Mudzi, Makoni and Inyanga districts (Cockbill, 1966, Lovemore, 1967, and Cockbill, 1968, 1969, 1970 and 1971), the cattle areas of Gokwe and Gatooma districts which were so severely affected by trypanosomiasis during the 'sixties and early 'seventies (Lovemore et al, 1969, Cockbill, 1969, 1970 and 1971 and Lovemore, 1972 and 1973) and the Gwaai/Mlibizi regions of the Wankie and Binga districts (Lovemore, 1967 and Cockbill, 1968 and 1969). Very considerable control was also effected in the Masoso/Chimanda region of Mount Darwin and Rushinga districts (Cockbill, 1970 and 1971 and Lovemore, 1972 and 1973), the infested areas of Lomagundi and Sipolilo districts above the escarpment (Cockbill, 1970 and 1971 and Lovemore, 1972 and 1973), the Urungwe cattle areas and the Kariba lakeshore region between the Sanyati river and Kariba township, Urungwe and Kariba districts (Cockbill, 1966, Lovemore, 1967, Cockbill, 1968, 1969, 1970 and 1971 and Lovemore, 1972 and 1973), the areas immediately adjacent to the Gokwe cattle areas, including the "Sengwa Research Area" of the Chirisa Parks and Wild Life Land, Gokwe district (Cockbill, 1969, 1970 and 1971 and Lovemore, 1972 and 1973) and the Malundu/Tivuli/Nagupande/Maseme region of Binga district (Cockbill, 1968, 1969, 1970 and 1971 and Lovemore, 1972 and 1973).

Dieldrin applied as an emulsion at a concentration of 3,1 per cent. was used exclusively in all operations up until and inclusive of the 1967 "spraying season". During 1968 a start was made to convert to the very much cheaper DDT applied as a solution, at a concentration of 5 per cent., in the light of West and East African work, which change was completed during the 1969 spraying season. Since then DDT has been used exclusively at the concentration already stated. The decision to effect the changeover from dieldrin to DDT/5...

from dieldrin to DDT was only made after the longevity of the residual properties of the last-mentioned insecticide had been clearly demonstrated in trials conducted under the extreme conditions of the Zambezi Valley at Rekomitjie Research Station, Urungwe district, to be well in excess of eight months and, in fact, DDT proved to be superior to dieldrin, which was being tested simultaneously (Vale, 1968). It is noteworthy that the financial saving which resulted from the change enabled almost a doubling of the Branch of Tsetse and Trypanosomiasis Control's spraying effort. Consequentially it became possible to operate over very much more extensive areas of country than had hitherto been possible, which went a long way to overcoming the problem of subsequent reinvasion.

The level of application of DDT on a material to area basis over the period 1971 to 1975, inclusive, has been as follows:

<u>YEAR</u>	<u>TOTAL AREA COVERED IN KM²</u>	<u>TOTAL DDT APPLIED IN KG</u>	<u>AV. RATE OF APPLICATION ON BASIS OF KG/KM² ACTIVE INGREDIENT</u>	<u>KG/HA ACTIVE INGREDIENT</u>
1971	8 240	164 966	15,00	0,1500
1972	11 250	249 790	16,65	0,1665
1973	10 969	265 900	18,18	0,1818
1974	8 559	252 200	22,09	0,2209
1975	9 150	233 175	19,10	0,1910

and in view of the anxiety which is being expressed today about the danger of pollution of our environment by this only very slowly degradable insecticide, it is of interest to relate these figures to the application rates of agricultural users which pertained until recently. In particular, DDT was the insecticide of choice to control American Boll-worm in cotton production. The usual rate of application was 1,470 kg/ha of the 75 per cent. wettable powder or 1,102 kg/ha of active ingredient, four times per season, for as many years as the crops were grown. Applications were made to the foliage and fruits, but much, if not most of the insecticide fell to the ground,

or was lost/6...

or was lost in drift. DDT was also used in Cut-worm control in maize and tobacco production and Stalk-borer in maize production at relatively high levels, with similar losses to the environment. In tsetse control spraying, however, the minimal quantities applied are selectively placed, very often in situations where little wash can occur. It is also usual for there to be only one application ever to an area, although certain areas have had to be retreated several times over successive years before elimination was eventually achieved. Although DDT continues to be imported for agricultural purposes (300 tonnes for the 1977-78 growing season), it has been replaced to a large extent in cotton production by the very much more readily degradable organo-chlorine compound, endosulfan (Thiodan). Regrettably, however, trials with this insecticide to determine its potential as a substitute for DDT in tsetse control "ground spraying" operations, where the insecticide is applied to the dry season resting and refuge sites of tsetse flies, have proved it to be insufficiently persistent for this purpose (Mulligan, 1970 and Vale, 1974). It is also very much more costly than DDT.

No obvious effects on animal, bird, reptile, fish and other insect life have been observed during the very large scale spraying operations which have been conducted with DDT in Rhodesia. Field staff have been instructed prior to each operation to pay particular attention to this important aspect over the years, but nothing of interest has been recorded. Similarly, as regards the more insidious effects of the chemical the work done by Phelps and others at the University of Rhodesia has shown that no serious problem has developed as yet from tsetse control operations in Rhodesia (Whitwell, 1974). This work continues (Phelps, pers.comm.).

It is also noteworthy/7...

It is also noteworthy that in Nigeria where DDT has been used very extensively in tsetse control operations, in fact, probably very much more so than in Rhodesia, no serious "side-effects" have been noted (MacLennan, 1973).

It is probable that DDT will remain the insecticide of choice in tsetse control operations in Rhodesia for some years to come where the control method involves the application of a residual insecticide to the dry season resting and refuge sites of tsetse flies. There is no other insecticide available which is comparably as effective and sufficiently cheap to permit large scale operations. It is noteworthy that research continues in Rhodesia towards developing new control methods, in particular the sterilisation of wild flies after attracting them in large numbers by attractive odours (Vale, 1978). Good progress is being made (Vale, pers. comm.). Another method which shows promise is the ultra-low-volume (ULV) application of endosulfan by fixed wing aircraft operating at night (Chapman, 1976). But even in the event of one or both of these techniques being perfected tomorrow, it would be some years before one or other, or both, could be adequately applied in the field to replace the control which has been effected in Rhodesia to date with DDT. It is also likely that in the final event "ground spraying" with DDT will continue to be used in conjunction with the new methods, if these prove successful, in certain more difficult situations.

Acknowledgment →

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