CONTROL OF BERTAM (*EUGEISSONA TRISTIS*), A FOREST WEED, BY CHEMICAL MEANS

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Received September 1987

MANOKARAN, N. & MOHAMAD ALI HAJI HAWARI. 1987. Control of bertam (*Eugeissona tristis*), a forest weed, by chemical means. A trial was carried out to test the efficacy of various chemicals in controlling the bertam palm (*Eugeissona tristis*), considered a weed in the hill forests of Peninsular Malaysia. Tordon 101, Dowpon MS, 2,4,5-T butyl ester, Velpar-L and sodium arsenite were applied to the growing points of bertam clumps cut to ground level. With the exception of sodium arsenite, they were also applied into the soil at the base of uncut clumps. At two years after treatment, Tordon 101, 2,4,5-T butyl ester and sodium arsenite showed satisfactory control of the cut clumps. However, this method of control is deemed impracticable on a large scale because of the high cost of labour. In the case of uncut clumps, only Velpar-L showed effective control and is considered promising for the control of bertam. However, an unfortunate side-effect of soil injection of Velpar-L was that trees in close proximity to the treated clumps either died or were almost killed. Further investigations are necessary to determine at lower dosages of the chemical to bring about satisfactory control without affecting neighbouring vegetation.

Key words: Bertam palm - forest weed - chemical control

Introduction

Eugeissona tristis, or bertam, the stemless clump-forming palm belonging to the subfamily Lepidocaryoideae, is commonly found in the hill forests of Peninsular Malaysia. Where it occurs gregariously, it hinders the establishment of seedling regeneration of economic species, and poses serious problems to the efforts of the Forest Department to regenerate forests which

have been logged. Attempts to control the palm date back several decades (Sanger-Davies 1935, Strugnell 1937, Durant 1940), and Wyatt-Smith (1959) reviews the experimental work carried out on its control in the pre-war and immediate post-war years. In recent times, Burgess and Lowe (1971a, 1971b) experimented with chemical control. Until today, however, there is no effective control of bertam. A study was therefore initiated to investigate the efficacy of some chemicals in controlling the palm. Of the five tested, three, that is Velpar-L (hexazinone as active ingredient at a concentration of 240 *g* acid equivalent per litre of product), Tordon 101 (2,4-D TIPA salt plus picloram TIPA salt as active ingredients at concentrations of 240 and 65 *g* acid equivalents respectively per litre of product) and Dowpon MS (dalapon, sodium salt plus dalapon, magnesium salt as active ingredients at a combined concentration of 740 acid equivalent per of product) are recent chemicals that have not been used in such trials before. The remaining two, sodium arsenite and 2,4,5-T butyl ester (10 acid equivalent per imperial gallon), have been used in trials against bertam in the past (Strugnell 1937, Wyatt-Smith 1959).

Materials and methods

The trial was carried out at Compartment 62 of Bubu Forest Reserve near Bruas, Perak, Malaysia. Bertam grows gregariously in the hills here.

A total of eighteen 20 × 20 *m* quadrats were demarcated. In each of these adjacent quadrats, five bertam clumps were selected. The basal diameter of each clump was then obtained by measuring the diameter twice at right angles to each other and then calculating the mean.

Two quadrats were assigned to each of the five chemical treatments, and here the selected clumps were completely cut as close to the ground as possible. The cut growing points were then spiked with a sharp stake and solutions of the chemicals were mixed and poured in as outlined in Table 1.

Of the remaining eight quadrats, two were assigned to each of the four chemicals excluding sodium arsenite. The selected clumps here were not cut, only the dead and dying fronds removed. Table 1 shows the rate of mixing of the chemicals and the method of application, the solution being applied to the soil at the clump base for uptake through the roots.

The trial was initiated in January 1982. During the period and immediately after chemical application the weather remained sunny.

Assessments on the effect of the chemicals were carried out at one and two years after application.

Table 1. Application of chemicals to the uncut and cut bertam clumps

Chemical	Rate and method of application	
	Uncut clumps (5 clumps/quadrat ——> total of 10 clumps	Cut clumps (5 clumps/quadrat —> total of 10 clumps
Dowpon MS	(i) 600 cm^3 chemical + 20 *l* water (ii) Continuous culvert, 15-30 *cm* depth, cut around clump base (iii) Volume of 20.6 *l* solution poured into culvert of each clump (iv) 20.6 *l* solution per clump	(i) 600 cm^3 chemical + 20 *l* water (ii) Clump cut, growing points spiked with sharp stake (iii) Volume of 20.6 *l* solution poured into spiked growing points of all five clumps in quadrat (iv) 20.6 *l* solution per quadrat
Tordon 101	As above	As above
Velpar-L	(i) 120 cm^3 chemical injected through spot gun about 15 *cm* into soil at base of each clump (ii) Injected at 4 points (30 cm^3 per shot) around clump base spiked growing points (iii) 120 cm^3 chemical per clump	(i) 120 cm^3 chemical poured into spiked growing points of each cut clump (ii) 120 cm^3 chemical per clump
2,4,5-T butyl ester	(i) 408 cm^3 chemical (10 *lb* acid equivalent) + 20 *l* diesel (approximately 2%solution) (ii) Application as for Dowpon MS (iii) 20.4 *l* solution per clump	(i) 408 cm^3 chemical (10 *lb* acid equivalent) + 20 *l* diesel (approximately 2% solution) (ii) Application as for Dowpon MS (iii) 20.4 *l* solution per quadrat
Sodium arsenite	NO TREATMENT	(i) 2 *lb* chemical + 1 *gall* water (20% aqueous solution) (ii) Application as for Dowpon MS (iii) Just over 1 *gall* solution per quadrat

Results and discussion

Cut clumps

The bertam clump, which fronds may attain a length of 6 to 9 *m* and a width of 1 *m*, perpetuates itself by forming an underground rhizome that branches repeatedly. At each branching an aerial shoot is produced that eventually gives rise to a subsidiary plant of the clump. Therefore, the ultimate killing of the clump, as Wong (1959) has pointed out, depends very much on killing the rhizome and its buds.

In this trial the chemicals most effective when applied to cut clumps were Tordon 101 and 2,4,5-T butyl ester (Table 2). Sodium arsenite, whose effect was similar to these two chemicals at one year after application, was less effective at two years. Velpar-L has no effect whatsoever while Dowpon MS had only

marginal effect at the concentration used.

Table 2. Effect of various chemicals on bertam clumps at one and two years after application

Chemical	Uncut clump			Cut clump		
	Diameter (*m*)	Effect at 1 year	Effect at 2 years	Diameter (*m*)	Effect at 1 year	Effect at 2 years
Dowpon MS	1.4 (0.8-2.05)	No effect; all clumps healthy	No effect; all clumps healthy	1.7 (1.1-2.65)	Moderate regrowth; no clumps dead	30% of clumps dead; others moderate to weak regrowth
Tordon 101	1.7 (0.6-2.75)	No effect; all clumps healthy	No effect; all clumps healthy	1.7 (0.55-2.7)	30% of clumps dead; weak regrowth of others	75% of clumps dead; weak regrowth of others
Velpar-L	1.2 (0.4-2.65)	20% of clumps (smallest clumps) dead. 50-90% of fronds of remaining clumps dried up; clumps appeared to be dying	80% of clumps dead; others weak to moderate regrowth	1.8 (0.75-3.25)	Vigorous regrowth; no clump dead	Weak through moderate to strong regrowth; no clump dead
2,4,5-T butyl ester	2.2 (1.25 3.75)	No effect; all clumps healthy	No effect; all clumps healthy	1.6 (1.0-2.75)	30% of clumps dead; weak re-growth of others	70% of clumps dead; others weak to strong regrowth
Sodium arsenite	-	-	-	1.9 (1.5-2.75)	30% of clumps dead; weak re-growth of others	50% of clumps dead;others weak through moderate to strong regrowth

Note: Regrowth classified as weak, moderate or vigorous based on the number of new shoots and the rate of their growth

A great disadvantage of this method of application of chemicals is that

much labour is involved in cutting the clumps and piling the fronds on one side. It is necessary to pile the cut fronds as otherwise the fronds litter the ground and if there is fruit fall from timber trees, prevent falling seeds from reaching the mineral soil for successful germination. On present day labour costs, this method of bertam control will be very expensive.

Another disadvantage is that there is a sudden increase in light at ground level due to all the fronds being cut. When the density of bertam is high and canopy cover is insufficient, the openness becomes excessive and the result is a proliferation of weeds.

Uncut clumps

In the case of uncut clumps, five times the volume of solution of Dowpon MS, Tordon 101 and 2,4,5-T butyl ester were applied to each clump compared to the cut clumps (Table 1). As the results in Table 2 show, these chemicals had no effect whatsoever on the bertam clumps, and it appears that there had been very little or no uptake by the root system. In the case of Velpar-L, similar volumes were applied to the uncut clumps as for the cut ones. Effects were noticeable at one year when two of the treated clumps were dead and 50-90% of the fronds of the remaining eight clumps had dried up and the clumps appeared to be dying. At two years after application, eight of the ten clumps were dead and the remaining two were only showing weak to moderate regrowth. It appeared that even these two clumps would die soon.

Velpar-L is a herbicide that is used in some parts of the world to control weeds and brush. It is in liquid form and needs no further solvent prior to application. This is an advantage over the other chemicals used in these trials. When applied to the soil there is uptake of the herbicide by the root system of plants. It is then translocated throughout the plant to the photosynthetic areas where it then inhibits this vital process. The leaves yellow and then turn brown and drop off, and the plant gradually dies.

Velpar-L is said to work effectively during periods of warm, humid conditions for efficient uptake by roots. These conditions prevail in a tropical forest. The herbicide is also said to be relatively low in toxicity and does not persist in the soil for long periods.

The method of application of Velpar-L to the uncut clumps has advantages over the method of application of Tordon 101, 2,4,5-T butyl ester and sodium arsenite to cut clumps. Labour cost is reduced to the minimum as there is no necessity to cut fronds and pile them on the side. Also, the clumps die slowly and provided there is sufficient canopy cover, weeds will be kept in check.

The encouraging results shown by Velpar-L in killing the uncut bertam clumps were however marred by what appeared to be ill-effects to a few trees in the vicinity of the treated clumps (Table 3). No such effects were observed in that part of the trial where Velpar-L was applied to cut clumps. It is likely

that some roots of the affected trees grew to that part of the soil around the uncut clumps where the herbicide had been injected and that a certain amount of the herbicide had been uptaken by the tree roots. Three of the seven affected trees were dead by the end of the second year.

Table 3. Apparent effects of Velpar-L to trees in vicinity of treated uncut bertam clumps

Tree	Location	Size	Effect at 1 year	Effect at 2 years
Tampang (*Artocarpus* sp.)	1 *m* from Clump 2	15 *cm* diameter	75% of leaves shed	50% of the crown bearing green leaves
Medang (Lauraceae)	2 *m* from Clump 2	45 *cm* diameter	Crown bare; wood wet-tree alive	Crown bare; wood wet-tree alive
Identity unknown	1.5 *m* from Clump 5	6 *m* height	All old leaves shed; new flush now	Crown bare; sapling dead
Minyak berok *Xanthophyllum* sp.)	3 *m* upslope of Clump 7	50 *cm* (Big diameter root growing into base of clump)	All old leaves shed; new flush to 50-60% of crown	Green leaves in 50% of crown
Minyak berok *Xanthophyllum* sp.)	4 *m* downslope of Clump 7	12 *cm* diameter	All old leaves shed; a few flushes present	Crown bare; coppicing towards stem base
Minyak berok (*Xanthophyllum* sp.)	2.5 *m* upslope of Clump 8	8 *cm* diameter	Crown bare; wood wet-tree alive	Crown bare; tree dead
Tampang (*Artocarpus* sp.)	0.5 *m* upslope of Clump 10	8 *cm* diameter	Crown bare; tree dead	Crown bare; tree dead

Other trials

A trial carried out by the Forest Department of Perak state in early 1982 to determine the efficacy of Velpar-L in controlling bertam also showed similar ill effects to adjacent trees. In this trial 80 to 120 *ml* of Velpar-L were applied to each of the selected clumps, the two methods of application employed here being soil injection and spraying at the base of the clumps. The trial was carried out at Compartments 11B and 13A of the Tapah Hills Forest Reserve where enrichment planting had been carried out several years previously with species of meranti tembaga (*Shorea leprosula*) and meranti sarang punai (*Shorea parvifolia*). Within eight months of treatment, at the time when none of the bertam clumps had died, several trees in the vicinity of the treated clumps had been affected (Table 4). Twenty-eight months after Velpar-L application to the bertam clumps, most of the trees that had shed their leaves previously, were dead. However, the bertam clumps sprayed at the base with Velpar-L were not

affected by the herbicide.

Table 4. Apparent effects of Velpar-L to trees in vicinity of treated bertam clumps in Tapah Hills Forest Reserve

Species	Number of trees	Size	Planted/Natural	Effect at 8 months
Shorea leprosula (Meranti tembaga)	3	Varying from 8-12 *cm* dbh	Planted	Dead
Shorea leprosula (Meranti tembaga)	2	Not measured	Planted	Shed most of or all leaves
Shorea parvifolia (Meranti sarang punai)	7	Varying from 13-27 *cm* dbh	Planted	Dead
Shorea parvifolia (Meranti sarang punai)	1	79 *cm* dbh	Probably natural	Dead
Shorea parvifolia (Meranti sarang punai)	5	Not measured	Planted	Shed most of or all leaves
Macaranga gigantea (Kubin)	8	Not measured	Natural	Shed all leaves, appeared dying
Sapium baccatum (Ludai)	1	Not measured	Natural	Shed all leaves, appeared dying

Probably the herbicide was trapped by the litter debris at the base of the clumps but was later washed away from the clump by rain and subsequently into the soil to affect some of the trees mentioned earlier. Clumps with Velpar-L applied to the base by the soil injection method were found to be still alive but with 50-90% of their leaves dried up completely.

Another trial with Velpar-L had also been carried out by the Forest Department of Perak in May 1982 at Compartment 27B, Bubu Forest Reserve. Here, bertam clumps of varying sizes had been treated with Velpar-L by the soil injection method, and volumes of 40, 60, 80 or 100 cm^3 had been applied depending on the size of the clump. On a visit there in May 1984, exactly two years after application of the herbicide, most of the clumps were dead. Within the 0.1 *ha* area of the bertam trial here, Velpar-L had also been applied to various species of trees. For some of the trees complete frill girdles had been cut on the stem and the chemical poured in. For the remaining trees, the chemical was injected into the soil at the base of the stem. Volumes of the chemical varied from 10-60 cm^3 per tree. During the visit in May 1984, many of the trees were dead. It is very likely that the herbicide applied to the soil at the base of the surrounding bertam clumps had been uptaken by the tree roots and helped to bring about the death of the trees.

At this particular trial, there was a high degree of canopy opening due to both bertam and tree deaths. The result was a proliferation of herbaceous weeds.

Conclusion

The results of the trial at Compartment 62 of Bubu Forest Reserve show that bertam could be controlled to some extent by 2,4,5-T butyl ester, Tordon 101 and sodium arsenite applied to the cut and subsequently spiked growing points of bertam clumps, all other fronds having been completely cut to ground level. Alternatively, bertam could also be controlled by application of Velpar-L by soil injection at the base of uncut clumps. The former method is however labour intensive and with present-day labour costs, will be impracticable on a large scale. The latter method using Velpar-L is very attractive since the time consuming and high cost incurring step of cutting the fronds is unnecessary. Also, Velpar-L is in liquid form and needs no further solvent prior to application, and the estimated end-user cost of the chemical in early 1984 was only M$0.025 cm^3 (Chang personal communication). However, side effects were shown by Velpar-L used in the way mentioned. Trees in close proximity to the treated clumps died, or were almost killed, there being likelihood of the chemical being taken up by the roots of the trees concerned. Further investigations are therefore necessary to determine at what lower dosage than that used here could bertam be controlled without affecting trees in the vicinity. As pointed out by Wyatt-Smith (1959), it may not be necessary to kill bertam, only to check its growth sufficiently to release regeneration beneath, where it occurs. Perhaps it may not even be necessary to treat every clump but rather one in two or even one in three.

Acknowledgements

We wish to thank the Forest Department of Perak and the District Forest Office, Kinta/Dinding, Perak for cooperation and assistance in establishing and monitoring the trial. We also wish to thank Dow Chemical Pacific Ltd. for the supply of Tordon 101 and Dowpon MS samples, Du Pont Far East Inc. for the supply of a Velpar-L sample, and I.C.I. (M) Sdn. Bhd. for the 2,4,5-T butyl ester sample. Thanks are also due to field staff of FRIM Kepong for assistance in the field and L. V. Rajoo for having typed this report.

References

BURGESS, P.F. & LOWE, J.S. 1971a. The control of bertam (*Eugeissona tristis* Griff.), a stemless palm in hill forests of the Malay Peninsula. *Malaysian Forester* 34:36-44.

BURGESS, P.F. & LOWE, J.S. 1971b. Assisting the regeneration of dipterocarp rain forest. *Down to Earth Midland, Michigan* 26:28-32.

DURANT, C.C.L. 1940. The control of some common forest weeds. *Malayan Forester* 9:157-165.

SANGER-DAVIES, A.E. 1935. Three Malayan forest weeds. *Malayan Forester* 4:80-90.

STRUGNELL, E.J. 1937. The control of bertam, resam and bamboo by chemical means. *Malayan Forester* 6:32-34.

WONG, Y.K. 1959. Autecology of the bertam palm - *Eugeissona triste* Griff. *Malayan Forester* 22:301-313.

WYATT-SMITH, J. 1959. The control of the bertam palm - *Eugeissona triste* Griff. *Malayan Forester* 22:314-326.