

## THE DANGERS OF USING PHENOXYALKYL HERBICIDES ON COCONUT PALMS\*

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Hormone weed-killers such as 2, 4-D and 2,4, 5-T are extremely dangerous and often lethal to young coconut palms and should not be used for weed control around young palms. Palms are killed by concentrations of herbicides much less than those used in weed-killing.

Serious and costly damage to the bunches and fruits of bearing coconut palms can be caused by hormone weed-killers. Only nonvolatile formulations should be used, and spraying performed only in still weather to ensure that no herbicide reaches the coconut crowns. Brush control is most safely and most effectively done by painting freshly cut stumps with 2, 4-D and 2,4, 5-T in oil.

The coconut palm, being a monocotyledonous plant like sugar-cane and grasses, was expected to show resistance to phenoxyalkyl (or "hormone") herbicides such as 2, 4-D, 2, 4, 5-T, MCPA etc. Such materials had been used in Fiji for many years (Grogory), apparently without ill effect. 2, 4-D in particular is a cheap and therefore attractive herbicide. It was also hoped that one of the phenoxyalkyl herbicides, such as 2, 4, 5-TP, or possibly a material such as fenac (2, 3, 6-trichlorophenyl acetic acid) might prove useful in controlling creeping and climbing dicotyledons (broad-leaved plants) such as hog meat (*Ipomoea-tiliacea*).

### EFFECT ON YOUNG COCONUT PALMS

Screening experiments have been done (Romney—1964, 1965) using various concentrations of the following herbicides: the lowest concentration used in each case is shown in brackets:—

2, 4-D ester	(0.045 % W/V)
2, 4-D amine	(0.13 % „ )
MCPB	(0.072 % „ )
2, 4, 5-T esters	(0.045 % „ )
2, 4, 5-TP „	(0.172 % „ )
fenac	(0.021 % „ )

In all cases except fenac, these low concentrations caused very severe damage to young palms. Growth measurements, performed before and after spraying, showed that growth of the younger leaves either ceased completely or was negligible. The older leaves usually died. The pinnae (leaflets) of the young growing leaves were bunched together and shortened because herbicide prevented the petioles (leaf stalks) from lengthening in the normal way to free the pinnae from the stipules (baskets) of the outer leaves. Many of the palms developed a lean, sometimes as much as 30° from the vertical, due to the irregular growth brought about by these "hormone" herbicides. Concentrations greater than those listed above usually resulted in an immediate and complete cessation of growth and death of the young palms. Only MCPB allowed the palms to continue growing normally for 10-14 days before also bringing growth to a halt: it is recognised that phenoxybutyric acid needs to be degraded by beta-oxidation to phenoxyacetic acid to become herbicidal, and this 10-14 day interval presumably represents the time taken for this conversion. It is unfortunate that the coconut apparently performs this conversion readily.

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Fenac used at 0.021% W/V reduced growth of young palms to about two-thirds of normal, and also caused the palms to lean and the pinnae of young leaves to be bunched and shortened. The palms recovered after about 4 months.

A herbicide such as 2, 4-D would not normally be used for weed killing at concentrations less than about  $1\frac{1}{2}$  pints per acre of a formulation containing 7.2 lbs. a.e. per imperial gallon in about 30 gallons of water, i.e. a concentration of 0.45% W/V. It is clear that all the hormone-type herbicides used in screening trials with young coconut palms caused very severe damage and often death at concentrations very much lower than those required to control weeds. The author has performed several repeated applications of 2, 4-D amine sprayed in circles round young palms, the spraying of the weeds being done within a few inches of the petioles of the coconut plants. Using this non-volatile formulation in completely still weather, no damage was suffered by the coconut palms. However, in view of the extreme sensitivity of young coconut palms to phenoxyalkyl herbicides, such herbicides should not be used in farm practice around coconut palms.

### EFFECT ON BEARING COCONUT PALMS

At about the time when the above screening trials were in progress, several instances were found of damage to bearing coconut palms by 2, 4-D and/or 2, 4, 5-T. The most serious of these were at Boston, the Mount, Drax Hall and Caymanas. At Boston, a non-volatile formulation was sprayed on to perennial weeds in natural pasture under bearing coconut palms approximately 15 years old in a 30 acre field. Some of the weeds present such as sisumber (*Solanum ficifolium*) and wild guava were 5 to 10 ft. high and, in an attempt to cover the foliage adequately, the spray lance was often raised: the wind also helped to carry the herbicide up to the coconut crowns. The herbicide affected the coconut bunches: the percentage set of female flowers increased from the normal figure of 25% to 75% or more. The fruits, almost without exception, were quite abnormal: the nuts within the fruits were reduced in size or absent, so that the husk tended to collapse during development of the fruit resulting in a trilobed cross-section: where a nut was present, either the shell or the meat or both were incomplete. The most serious characteristic of the damage was that this excessive set of distorted and useless fruit continued to occur for 12 to 18 months after spraying as each new bunch was produced.

At the other 3 sites, volatile formulations were used and, at the Mount at least, it was the volatility which caused the damage since spraying was performed on low weed in still weather: again, damage to the bunches continued for many months after spraying. Presumably the length of time over which damage persists is related to the quantity of herbicide absorbed by each coconut palm. Only at the Mount was the growth of the palms affected: one palm died, and another grew for about a year in a horizontal direction before once again growing normally i.e. vertically. The author applied 2, 4, 5-T in diesel oil as a basal spray to woody perennials (including sisumber, wild guava and almond) under approximately one acre of bearing coconut palms 12-15 years old at Boston: spraying was performed in completely still weather. There was no subsequent damage whatsoever to the coconut bunches.

It is clear that the phenoxyalkyl herbicides should be used under bearing coconut trees only if the user understands fully the risks involved and how to avoid them. Volatile formulations should never be used under or near bearing coconut palms. Spraying should be done in still weather and the spray lance directed downwards. Nozzles which produce very fine spray droplets should be replaced with nozzles of the 'no-drift' type. A mist blower should—never be used. If proper precautions are taken then no harm will be done: spraying with "hormone" weed-killers under bearing coconut palms is still common practice in Fiji (Mune). However, the instances of damage listed above point to the need for Agricultural Chemical Salesmen and Advisory Workers to inform farmers fully so that the farmer can appreciate the risks and decide for himself whether he can rely upon his spray-men to take the necessary care.

The use of "hormones" in pastures in Jamaica is usually effective and economically worthwhile only for two specific weed control problems: the first is to control relatively soft broad-leaved weeds in recently established pangola or guinea grass pastures using 2, 4-D in water as an overall spray: the second is for control of brush by painting the freshly cut stumps with 2, 4-D and 2, 4, 5-T in oil.

### PHENOXYALKYL HERBICIDES AS A STIMULATING HORMONE

Workers in India (Gangolly *et al*) have attempted to use various hormones to increase fruit set of coconuts and therefore increase yield. Various chemicals have been used, including 2, 4-D, sprayed on to each bunch 4 times at weekly intervals, commencing immediately after the pollination of the female flowers has occurred. They obtained approximately twice the number of nuts per bunch but the nuts were reduced in size to 50-75% of normal, and occasionally there was some distortion of the fruits. The hormones were used at a concentration of approximately 30 p.p.m. Improved fruit set by this method may indeed be possible, but the concentration used and the frequency of spraying are critical if damage is to be avoided: there is danger in a crop such as coconuts, which produces regular bunches of fruit at approximately monthly intervals throughout the year, that the hormone concentration in the palm may build up to an undesirable level. If individual bunches have to be sprayed whilst avoiding other bunches previously sprayed, then there will be practical problems.

An experiment was performed in Jamaica (Whitehead) to, study the possibility of increasing fruit setting using 2, 4-D at 30 p.p.m. in coconut water. We were particularly concerned with increasing the setting of bunches which had been hand-pollinated to produce various crosses: the nuts from these bunches are valuable seed and the high cost of applying hormone sprays on palms 40 ft. high would be likely to be worthwhile. It was found, however, that the percentage setting in these bagged inflorescences was not improved by the hormone. The technique needs considerable research if a safe method is to be developed. Possibly trunk injections or painting would be suitable. In all events, it is not likely that a permanent yield increase will be obtained unless fertilizer application and other cultural techniques are also performed.

#### REFERENCES

- Gangolly, S. R., Gopalakrishnan, T. P., Lakshmanachar, M. S. and Pandalai, K. M., 1959 "Studies on Shedding of Buttons in the Coconut, III" Proceedings of First Conf. Cocon. Res. Workers, India.
- Gregory, G. B., Personal Communication.
- Mune, T. L., 1967 "Weed Control in Coconut Plantations" Tech. Meeting on Cocon. Production, South Pacific Commission, Rangoa.
- Romney, D. H., 1964 "Observations on the Effect of Herbicides on Young Coconuts", *Weed Research*, 4, 1, 24-30.
- Romney, D. H., 1965 "Further Experiments with Herbicides on Young Coconuts", *Trop. Agriculture Trin.* 42, 2, 177-181.
- Whitehead, R. A., 1964 4th Rep. Res. Dept. Cocon. Ind. Bd., Jamaica p. 37.

#### DISCUSSION

- Harries — Are there any differences between coconut varieties in their susceptibility to growth-regulating substances?
- Sidrak — There seems to be less susceptibility in older palms.
- Romney — I do not know of any varietal differences. Most of the screening work was with Malayan Dwarfs, but the field experiences reported were with bearing Jamaica Talls. With bearing trees one might imagine 2, 4-D being taken up and the level slowly falling until, after many months, it is too low to have any further effect.
- Lord — If uptake is by direct contact, application by a low-slung bar at low pressure may be safer.
- Sessing — If sprayed on to banana leaves, 2, 4-D causes the pseudostems to split and topple.