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PESTS, PESTICIDES, PESTICIDE LEGISLATION AND MANAGEMENT IN MAURITIUS

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Abstract—This paper considers the status of pests and pesticides in Mauritius, including pesticide legislation and flow.

Climatic factors, namely altitude, temperature and rainfall, influence the spatial and seasonal distribution and population dynamics of economically important pests as well as their hosts (crops and livestock). The case histories of a few selected pests (leaf miner, fruit flies, stable flies), their control measures as well as research efforts in this connection are reviewed.

An appraisal is also made on some aspects of pesticide legislation along with the distribution pattern of pesticides, in relation to pesticide management. The setting up of a recent Pesticides Management Advisory Committee is regarded as a move in the right direction to safeguard pesticide misuse and abuse. Food crop production is at the expense of huge pesticides input. A series of recommendations are made with a view to improving pesticide practices in the country.

Key Words: Pests, leaf miner, fruit flies, *Stomoxys*, pesticides, pesticide flow, pesticide management, pesticide legislation

Résumé—L'auteur fait état de la situation à Maurice des ravageurs agricoles et des pesticides, y compris la législation et la distribution des pesticides. La répartition dans le temps et dans l'espace et la dynamique des populations des espèces économiquement nuisibles ainsi que leur hôtes (végétaux et animaux domestiques) sont fonction des conditions climatiques tels que l'altitude, la température et la pluviosité. Des cas spécifiques dont la mineuse des feuilles *Liriomyza trifolii*, les mouches des fruits et les mouches d'étables (*Stomoxys* spp.), sont considérés tant sur le plan de leur répartition insectes-hôtes que sur le plan des efforts de recherches entreprises en vue de leur contrôle. Quelques aspects de la législation et de la gestion sont soulevés en relation avec le découlement des pesticides sur le marché. Un comité a récemment été mis sur pied afin de permettre une rationalisation de l'utilisation des pesticides. D'après des données recueillies sur l'importation des pesticides et la production maraîchère, il ressort que celle ci se fait aux dépens d'une utilisation intensive des pesticides chimiques. Des recommendations sont faites afin d'améliorer la pratique courante de l'utilisation de ces produits toxiques.

Mots Clefs: Insectes nuisibles, mineuse de feuilles, mouches des fruits, *Stomoxys*, pesticides, législation sur les pesticides, marketing

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INTRODUCTION

With the world food situation becoming grimmer year by year, every effort is being envisaged by various international and national governmental and nongovernmental organisations to produce more food in order to postpone, if not avoid, an impending generalised worldwide famine. Agricultural experts from all sectors including those from the FAO state that more food production will necessarily require more fertilizer and pesticide inputs.

It is also a fact that independence from pesticides is not for tomorrow. Furthermore, we cannot deny the side effects of pesticides to the environment and wildlife generally, and to human health in particular. Bearing these "man-made" problems, efforts have to be made to reduce our dependence on toxic chemical pesticides, for how much can the farming community sacrifice their personal health and at the same time condone the health of the consumers and that of the environment?

Traditional pest control practices by organochlorine, organophosphate and carbamate pesticides should gradually give place to integrated pest management (IPM) and pesticide management. Developed countries are well ahead in IPM programmes, whereas developing countries are becoming greater consumers of pesticides. Pesticide usage has necessarily to be rationalised, and means and ways have to be found to attain this objective. This is not possible unless groundtruth data-base is available on pesticide practice and on the perception of pests and pesticides at the level of the rural grassroots. Specific improvements can be made and careful attention paid once the various factors hampering good pesticide practice are identified and their intensity assessed.

This paper briefly considers pest and pesticide status in Mauritius, including pesticide legislation, management and flow. It should be mentioned here that proper and solid legislation with regards pesticide sale, handling, storage and disposal, as well as worker protection from occupational hazards does exist but its implementation leaves much to be desired.

GENERAL CONSIDERATIONS

Geographical description of Mauritius

Mauritius is a volcanic island in the Indian Ocean with a surface area of about 1600 km^2 (length 52 km

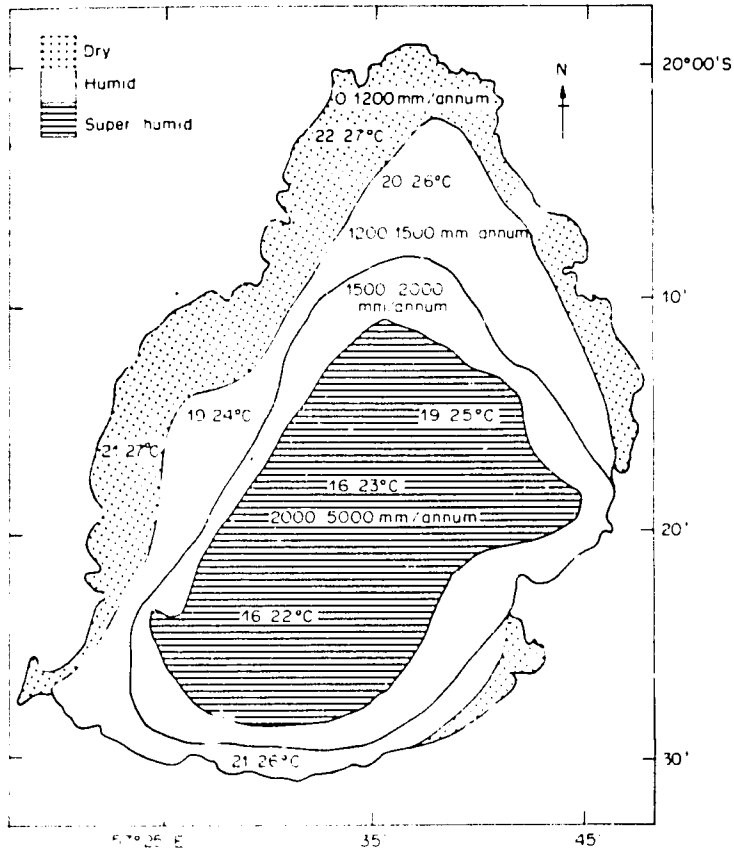

Fig. 1. Map of Mauritius showing its geographical position, mean rainfall distribution and mean temperatures in winter and summer months respectively in different localities and as a function of altitude (winter/summer means).

and width 45.6 km). It lies between latitudes 19 59' and 20 32' S and longitudes 57 18' and 57 6' E. Its topography depicts a coastal plain which rises to a central plateau (maximum height *ca* 610 m) with several mountainous ranges and peaks of which the highest in the south west of the island is about 825 m above sea level. Being subtropical and tiny, land and sea breezes coupled almost all the year round with south east trade winds influence its climate. Figure 1 gives the ecological zones divided into a superhumid central plateau, a humid slopy region and a dry coastal belt. The mean winter and summer temperatures are also given. The climate is therefore moderate with both mild winter (May August) and summer (September April) months.

Climatic factors and pest distribution

The above climatic conditions, partly also influenced by the island's relief features have marked effects on the distribution of vegetation, crops, livestock and their insect pests.

Sugar-cane which is our economic backbone (constituting about 75% of our export earnings) is however cultivated all over the island. This means that its pests are normally distributed along with the crop (covering 50% of the island's surface), though some species, e.g. *Aulacaspis tegalensis* (scale insect) may preferentially occupy the coastal zone rather than the upland plantations. The seri[illegible] in 1970 of the cottony scale *Pulvinaria*

Insecticides are not usually resorted to for cane protection, but are now more and more used for interline crops such as maize, potatoes, tomatoes, green beans, groundnut and a few others. If the cane crop has not so far necessitated pesticidal treatments, except for herbicides, with the intensification of agricultural diversification in cane interlines, heavy pesticide usage is expected. This might disrupt the existing biological equilibrium between sugar cane pests and their natural enemies (entomophagous insects, fungi, nematodes and birds).

Humidity and temperature do influence to a great extent the distribution of stable flies *Stomoxys nigra* and *S. calcitrans* in Mauritius (Kunz and Monty, 1976). *S. calcitrans* is localised in the drier localities of the coastal belt, thriving best during the cooler months on decaying straw contaminated with animal urine and faeces near cow stables. In contrast *S. nigra* is most abundant in the superhumid highlands of the central plateau (Fig. 1), the humid and dry zones having medium and low fly densities respectively. This species thrives best during warmer months on uncontaminated cane straw which is abundant after cane harvests all over the island.

The coconut rhinoceros beetles *Oryctes rhinoceros* and *O. tarandus* are distributed along with their host plant (coconut) on the coastal drier regions. They also cause damage to sugar-cane. This pest is currently kept under control by a Malaysian virus *Rhabdiomvirus oryctes* which was introduced in [illegible]

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The serpentine vegetable leaf miner *Liriomyza trifolii* breeds abundantly all the year round in the warmer coastal regions, whereas during the winter months, it has a low popultion density in the central highlands.

Fruit flies constitute another serious group of pests. The main species are *Pardalaspis cyanescens* on Solanaceae (tomato, eggplant), *Dacus cucurbitae* and *D. ciliatus* on Cucurbitis, *Ceratitis capitata* (Mediterranean fruitfly) and *Pterandus rosa* (Natal fruitfly) on fruits generally (guavas *viz. Psidium goyava* and *P. cattleianum*, mango, peach, pawpaw, chillies, etc.) (Orian and Moutia, 1960). From the climatic point of view, high fly densities of *P. rosa* breed during the colder and cooler months (May–October) in the so called "Chinese guava zone" which occupies about 10% of the island's surface in the higher central superhumid uninhabited zone. Another 10% of the island is for the purpose of fruitfly control called the "orchard zone" which groups all the other fruit trees grown in or around the villages all over the country; here the fruits ripen in the warmer months whence *C. capitata* and *P. rosa* breed fast (December to April May). It is interesting to note that the "guava" and the "orchard" populations do not migrate (C. Hammes, ORSTOM, personal communication) from one zone to the other, and seem to have adapted themselves to the climate and their host plants in their ecozones.

MAJOR PESTS AND THEIR CONTROL

The major local pests will be considered, with some case histories, under the following headings:

(a) pests of food crops;
(b) pests of fruits;
(c) pests of livestock.

Pests of food crops

The food crops that necessitate intensive pesticide input together with their pests and diseases are listed in Table 1. A wide variety of other crops are also grown, namely carrots, chillies, lettuce, onion, some cassava, sweet potato, ginger, mixed vegetables, etc. which have more or less the same pests (and diseases) listed and which also require chemical pesticides. These are dealt with later. It should be mentioned here that pre-emergence herbicides are finding increasing usage (to reduce post-emergence labour in weeding), especially for onion and carrot plantations.

Case of L. trifolii

The leaf miner *Liriomyza trifolii* needs a special mention. It is a new agricultural pest in Mauritius, being first recorded in October 1979. Not only does it breed very fast, but it is also polyphagous; more than 65 host plants—crops, ornamentals and weeds—have been identified. Urgent chemical control measures had to be improvised, if not developed, in order to save total crop loss, in particular potato, tomato, haricot beans, crucifers and onions. *L. trifolii* is resistant to most insecticides (Vercambre, 1980) including DDT, toxaphene (campheclor), several organophosphates (parathion, diazinon, dibrom, dimethoate, parathion-methyl). Dipterex (trichlorphos), actellic (pirimiphos-methyl), and mixtures of either tamaron (methamidophos) plus gusathion (azinphos-methyl) or tamaron plus thiodan (endosulfan) were not found to be efficacious enough. The pyrethroid decis (decamethrin) was the only insecticide to have brought relief for some time for this pest; it is now very popular.

A few natural parasites have been identified, namely three Eulophidae [*Hemiptarsenus semialbiclava* Girault (commonest), *Maruana* sp., and *Chrysonotomyia* sp.] and one unidentified cynipid (Cynipoidea).

Intensive chemical treatment of the leaf miner will no doubt seriously impair biological control. Various studies are now being undertaken with a view first to understanding the biology, ecology and behaviour of this pest and secondly to finding alternative control measures, if possible before resistance to decis develops whence there will be no proper substitute for it. In California for example, *L. trifolii* has already developed cross resistance to synthetic pyrethroids (Parrella *et al.*, 1981).

Pests of fruits: case history

The Natal fruitfly *Pterandus rosa* is economically more important than the Mediterranean fruitfly *Ceratitis capitata* (Monty, 1973). These flies cause immense damage to all fruits (about 25 types) including the avocado, mango, peach, litchi, pawpaw and several other typically tropical and subtropical fruits. Their marketable value is considerably depreciated. In the case of peaches, trees that are disappearing are not being replaced as no single fruit can be harvested in a good state. Control of these flies poses serious problems by virtue of the patchy distribution of "orchard" zones (there being no industrial scale orchards in Mauritius) with tall trees, and the vast extense (*ca.* 150 km²) of shrub-type bushes of guava trees.

Biological control of fruit flies in general has not yet proved to be successful. Various parasites have in the past been tentatively introduced: *Opius phaeostigma* (Braconidae), *O. oophilus*, *O. longicaudatus*, *O. incisi*, *O. tryoni*, *O. formosus*, *O. concoloren*, *S. indicum* and *Dhirinus auratus* (Chalcididae). None became established.

Mauritius being small, the possibility of genetic control of the fruitfly with the release of sterile males was envisaged in 1977 by the Ministry of Agriculture, Natural Resources and the Environment. As from August 1980 and throughout the following year, sterile male *P. rosa* pupae were released in the "orchard" zones at the tune of 10 million per month. Population dynamics were monitored by sampling fruits for larvae and soil for pupae, as well as fly captures by the use of the pheromone Trimedlure (Hammes, personal communication). The effect was dramatic (Fig. 2) and there was an overabundance of fruits in 1981. Release was stopped in November–December 1981 for some reason or the other, and population density monitoring this year would definitely show a demographic explosion of *P. rosa*.

Pests of livestock

Case of Stomoxys nigra. The most important pest of livestock in Mauritius that must be controlled is *Stomoxys nigra*; *S. calcitrans* has never been de-

Table 1. List of selected major food crops and their pests and diseases which necessitate intensive chemical control

Host crop(s)	Pest(s)	Part of plant attacked
Tomato (*Lycopersicon esculentum*)	*Pardalaspis cyanescens* (fruitfly)	fruits
	Heliothis armigera (borer)	fruits
	Liriomyza trifolii (leaf miner)	leaves
	Tetranychus urticae (red spidermite)	leaves
	Nematodes (bacterial wilt)	roots
	Late blight and leaf spots	leaves
Potato (*Solanum tuberosum*)	*Phthorimaea operculella* (tuber moth)	tubers
	Prodenia litura (cutworm)	leaves
	Plusia orichalcea (climbing cutworm)	leaves
	Agrotis spp (cutworm)	stem
	Liriomyza trifolii	leaves
	Aphids	leaves
	Leaf hoppers	leaves
	Gryllotalpa africana (mole cricket)	roots
	Potato blight	leaves
	Nematodes (bacterial wilt)	roots
Eggplant (*Solanum melongena*)	Mites and Red Spider mites	leaves
	Mealybugs	leaves
	Nematodes	roots
	Leaf spots	leaves
	Powdry mildew	leaves
Crucifers (cabbage, cauliflower, etc.)	*Agrotis* spp	seedlings
	Spodoptera spp (cutworm)	seedlings
	Liriomyza trifolii	leaves
	Liriomyza brassicae (leaf miner)	leaves
	Crocidolomia binotalis (webworm)	leaves
	Plutella xylostella (diamondback moth)	leaves
	Hellula undalis	leaves
	Aphids	leaves
	Black rot	seeds
Beans (*Phaseolus vulgaris*)	*Liriomyza trifolii*	leaves
and peas (*Pisum sativum*)	*Melanagromyza phaseoli* (beanfly)	stems, leaves
	Spodoptera mauritia	seedlings
	Other cutworms	stem, leaves
	Maruca testulalis (podborer)	pods
	Heliothis armigera	pods
	Lampides boeticus (podborer)	pods
	Tetranychus urticae	leaves
Cucurbits (squash, creepers, etc.)	*Dacus cucurbitae* (fruitfly)	fruits
	D. ciliatus	fruits
	L. trifolii	leaves
	Powdery mildew	leaves
Maize (*Zea mays*) (for large scale plantations)	*Heliothis armigera*	cobs
	Spodoptera mauritia	seedlings
	Several weevils	mature and stored cobs
Groundnuts (*Arachis hypogea*) (for large scale plantations)	*Aphis craccivora* (aphid)	leaves
	Mealy bugs	leaves and "nuts"
	Taeniothrips sp (thrips)	leaves
	Damping off	leaves
	Leafspots	leaves

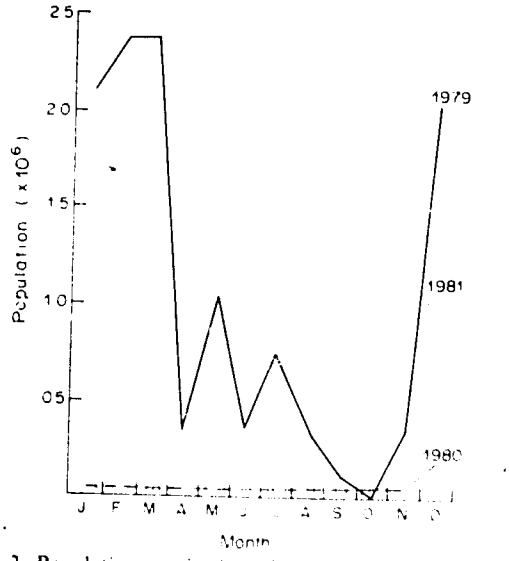

Fig. 2. Population monitoring of Natal fruitfly (*Pterandus rosa*) pupae in "orchard zones". The very low density in 1980 is due to the effect of a severe cyclone in December 1979 when all fruits and flies were destroyed. The release of sterile male pupae started in August 1980 and continued throughout 1981 up until November.

scribed in large numbers (Kunz and Monty, 1976). In the past it has been reported to be a vector of the deadly surra disease (caused by *Trypanosoma evansi* Steel) which was fortunately eradicated by the year 1947 (Monty, 1972). Livestock development (cattle, deer, pigs, goats) is seriously impaired by the stable flies in Mauritius. The wound caused by the flies *S. nigra* to cattle, for example, is though small, used by secondary myaisis flies such as *Chrysomia megacephala*. The control of *S. nigra* is inherently difficult since the environment is conducive to its development all the year round. Intensive studies were carried out locally for the eradication of *S. nigra* by the sterile insect technique, and despite satisfactory prospects of this method, the project was closed down due to high costs involved in mass rearing the flies. *S. nigra* is a good candidate for this technique as the males are polygamous and females monogamous. The main drawback however is that both sexes are haematophagous, and massive releases of sterile flies would cause considerable irritation to mammalian populations, including man, leading eventually to serious blood loss and secondary infections via bite lesions.

Various predators and parasites have been introduced at different times to control *S. nigra*. Three species *Tachinaephagus stomoxicida* (Encyrtidae), *Trichopria* sp. (Diapriidae) and *Spalangia* sp. (Pteromalidae) have become more or less established. *T. stomoxicida* is the dominant one; the average monthly parasitism in *S. nigra* pupae was 33.2% (range 6.5-60.2%) in 1979 and 39.4% (range 20.2-60.2%) in 1980 (Anon, 1979, 1980).

Chemical control brings temporary relief in pastures, deer parks, animal pens and barns, and by direct spray on host animals. Some insecticides used are: dieldrin, to destroy maggots in manure heaps; ciodrin, sprayed on bulls; dichlorvos, used for fogging deer parks; baygon (arprocarb), as a surface spray in dairy barns; and barricade (cypermethrin), frequent fogging or spraying gives relief to cattle.

Case of ticks. The ectoparasite *Amblyomma variegatum* attacks principally cattle and stags raised on pastures situated in the coastal regions of the island. Dippings in toxaphene and organophosphorus insecticides are carried out.

PESTICIDE LEGISLATION

Pesticide flow in Mauritius is governed by the Pesticides Control Act, 1970 which makes provision for the establishment of a Pesticides Control Board (P.C.B.) and, through which to regulate the control, manufacture, use, storage, packaging, sale and importation of pesticides and to provide for matters connected therewith and incidental thereto. The P.C.B. is composed of representatives from various sectors concerned, including the Ministries of Health, Agriculture and Labour and also representatives from the Mauritius Sugar Industry Research Institute, the commercial importing firms, the Mauritius Standards Bureau and the Central Water Authority.

There is no industrial pesticide plant in Mauritius. All pesticides are therefore imported. No person is authorised to import, sell or distribute any pesticide unless he holds a permit for that purpose from the P.C.B. Figure 3 shows the national flow chart for pesticides.

The private commercial importers (and some other private companies, e.g. those involved in wood and furniture treatment and non-governmental institutions for research purposes, etc.) should provide the P.C.B. with technical bulletins of the product(s) they wish to import, with respect to reference standard materials, chemical composition, residue analysis methods, determination of active ingredient in formulations, toxicity, mode of action, directions for safe use and antidotes. The P.C.B. is also concerned with the proper packaging, labelling, handling, transport, storage and disposal of all pesticides and their containers.

Recently, a Pesticides Management Advisory Committee (P.M.A.C.) has been set up to complement and strengthen the activities of the P.C.B. Its terms of reference are:

(a) to find means and ways of rationalising the use of pesticides for crop and health protection, and of improving efficiency and safety in the use of pesticides in integrated pest management systems;

(b) to advise the monitoring of projects concerning investigations or surveys on pest status, crop loss assessment, pest and pesticide behaviour in the environment, decision taking on pesticide use, socio-economic effects of pesticide use in developing agriculture;

(c) to recommend corrective measures for irrational use of pesticides in order to reduce potential side effects of pesticides to health, to the agro-ecosystem, and to the environment generally;

(d) to make recommendations for restricted use, or for the ban on the import and the use of pesticides.

The priorities of the P.M.A.C. are currently the following:

(a) to collect ground truth data on the perception and usage of pesticides from a maximum number of

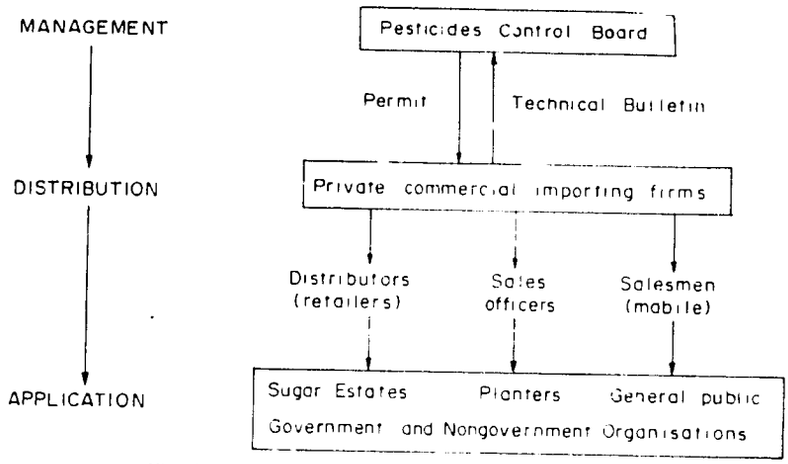

Fig. 3. Distribution pattern of pesticides in Mauritius.

small planters by regions in order to come out with a national profile;

(b) to recommend a restricted list of pesticides that could be imported;

(c) in order to draw such a list [as in (b)], systematic experimentations have to be designed for finding out the status of resistance to pesticides by the local economically important pests;

(d) to obtain information on environmental side effects of pesticides;

(e) to study the drift problems caused by herbicidal applications.

The membership of the P.M.A.C. is appointed by the Minister of Agriculture after recommendations of a national Board of Agriculture. It is composed of representatives from the Ministry of Agriculture, Ministry of Health, the University of Mauritius, the Chamber of Agriculture, the Mauritius Sugar Industry Research Institute, the Mauritius Sugar Cane Planters Association and the Mauritius Cooperative Agricultural Federation Ltd.

PESTICIDE MANAGERS

There is no proper systematic pesticides research nor any pesticide bioassay unit in the country. However, the Entomology Divisions of the Ministry of Agriculture and the Mauritius Sugar Industry Research Institute do from time to time carry out a limited number of pesticide trials for recommending certain new products to be used on different crops. Generally the recommendations of the foreign manufacturing firms with respect to dosage, frequency of spraying, safety interval and target pests are adhered to. The University of Mauritius gives training in Applied Entomology to diplomates and degree students in Agriculture; they are in fact equipped for integrated pest management and once they are in the fields, all they can do is advise on judicious management of pesticides and preach as much as possible on improved cultural practices. In addition, the University undertakes research with a medium and long term bearing; the overall aim is to reduce our future dependence on chemical pesticides.

Consequently, the pesticide managers proper comprise the representatives of the Pesticides Control Board, the agrochemical managers of the pesticide importing firms, the entomologists and agronomists at post, the extension officers and also some of the users. The Pesticides Management Advisory Committee will justifiably step in as an overall "watchdog".

The extension services, however, play the major role: the officers are regularly given appropriate briefings; they attend seminars and workshops locally and overseas. They are equipped with appropriate means of communication down to the level of planters: radio, television, pamphlets, farming news bulletins, etc. The overall intention is to transmit all information to the pesticide users: planters, non-agricultural firms, sanitary officers and the general public. But how far the message of good practice transpires down to the level of the user is considered elsewhere (Fagoonee, 1984).

Recently (1979), a Pesticide Control Unit (P.C.U.) was set up at the Ministry of Agriculture and is officially attached to the agricultural extension services. It is a 10-year project financed by the UNDP. It aims at increasing agricultural production (maize, potato, groundnuts) not only in sugar-cane, but also food crops, vegetables and livestock generally through better and more efficient pest control practices amongst small planters. The P.C.U. wishes to attain certain achievements through thorough and intensive control of pests in large scale plantations of crops such as maize and groundnut, as well as pests (such as stable flies, body ticks, lice and mites) tampering livestock production. The Unit is equipped with two vans, motorised power sprayers, 3 knapsack sprayers, pesticides and protective clothings and equipment. These are utilised to give on-the-spot demonstration of pest control techniques to the small planters.

NATIONAL PESTICIDE BILL AND FOOD CROP PRODUCTION

Over the past decade, Mauritius has imported a surplus of over 186,000 kg of pesticides (insecticides, fungicides, herbicides and rodenticides) (Fig. 4), the cost borne by us has been increasing continuously from over Rs 3.5 million to over Rs 18 million (5-fold

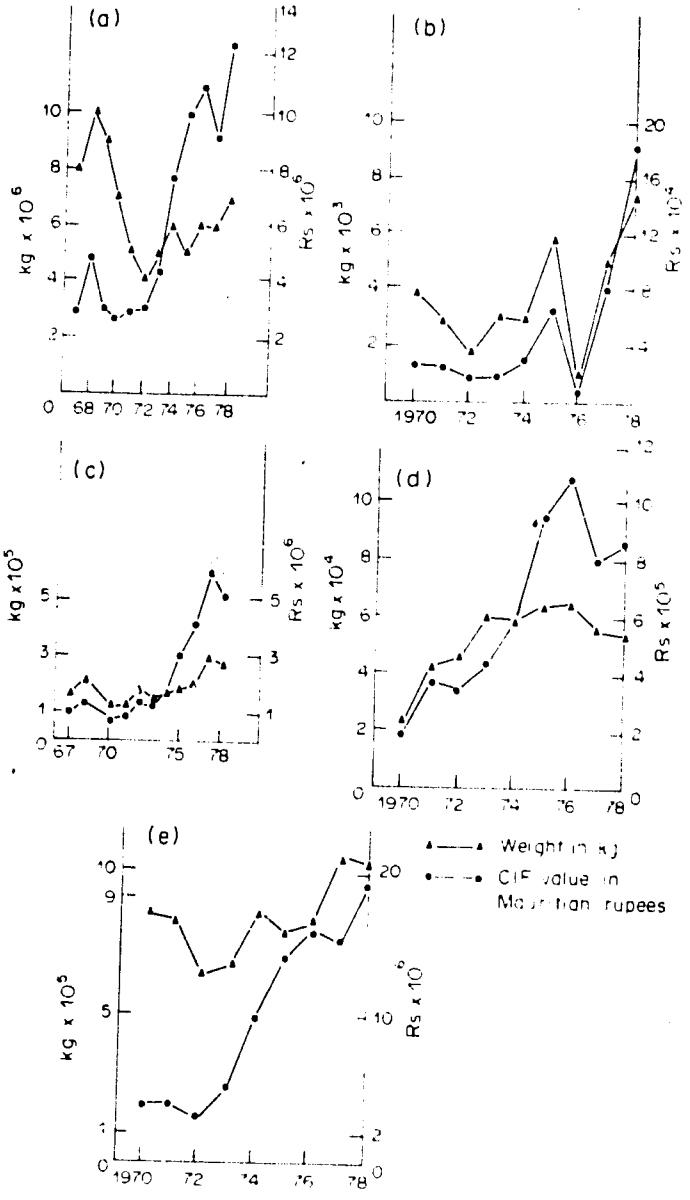

Fig. 4. Import of pesticides for Mauritius (1967–1978). (a) Herbicides; (b) rodenticides; (c) insecticides; (d) fungicides; (e) total pesticides (from Fagoonee, 1980)

increase) during 8 years. The cost of insecticides alone has gone up considerably and, whereas the amount of imported fungicides has trebled, the cost has gone up 5-fold. The use of herbicides and rodenticides is also increasing.

Table 2 shows that in only 4 years, about 7000 acres of land cultivated with crops that need intensive use of insecticides and fungicides have borne a 2-fold increase in their pesticide load. The paradox however is that total food crop production (including egg-plants, ginger, maize, cassava, rice, sweet potato, banana, pineapple, and others all of which need comparatively little or no pesticides) and the total acreage under crops have remained almost constant over the last 10 years (1971–1980), the figures being 40,000 to 50,000 tons (mean 44,348 ± 3377 tons) for less than 10,000 acres cultivated (mean 9446 ± 436 acres). This means that our food production is at the cost of huge inputs in terms of pesticides (and fertilizers). One's immediate reaction is that there is abuse of pesticides through overuse. Indeed this is the case (Fagoonee, 1984).

Table 2. Acreage under food crops* needing intensive use of insecticides (I) and fungicides (F)

Year	Area under crops (acres)	(I + F) acre (kg)	Cost of (I + F) acre (Rs)
1973	6984	30.2	240
1974	6823	33.5	353
1975	7317	35.08	581
1976	7369	35.45	704
1977	7301	63.97	948

*Examples are tomato, potato, creepers, crucifers, beans and pulses, mixed vegetables.

RECOMMENDATIONS

Although the existing legislative and management mechanisms for pests and pesticides control have

departed on a sound footing, the prevailing situation augurs for substantial improvements. The main problem lies in the implementation of the legislation at the grassroots level, whilst not forgetting control at the pesticide imports level. Consequently the following recommendations are made.

The work of the Pesticides Management Advisory Committee should take off as soon as possible, and its findings, decisions and recommendations should be made known to the appropriate bodies for policy decisions and implementations. There is need to strengthen R and D efforts in alternative pest management methods (biological, genetic, behavioural) with a view to framing integrated pest management (I.P.M.) programmes. Only implementation of I.P.M. programmes can help reduce our pesticide import bills. The publication of a restricted list of pesticides to be imported would provide a control on pesticide usage at the topmost level. For, if a product is not available on the market, nobody will use it. Recycling and day-to-day briefing of extension officers in touch with the planting community are considered vital.

National and regional surveys on pesticide practices should be kept under periodic review in order to monitor efforts deployed in bringing about a change in the attitudes of planters with regards pesticide usage. Systematic and continuous residue analyses should be a compulsory exercise in order to assess environmental hazards. Systematic research has to be carried out for all economically important pest species. This is wanting in Mauritius. So far investigations have been geared towards immediate pest control measures without proper indepth search for understanding the ecological behaviour and life tables of specific pests.

Everybody – manufacturer, importer, distributor, scientist and user alike – should view pesticides flow and usage with much concern. Pesticides are the commonest chemicals labelled "poison" most readily available without any medical prescription and at almost comparatively "no" price. Every coin has two sides. Pesticides too, if we misuse or overuse them, hardly miss us. The legislation is there; its implementation has to be reinforced. And a little civism will contribute significantly towards rational pesticide usage.

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