THE INTEGRATED PEST CONTROL

by

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For centuries man has been growing crops for his own needs on this land. His crops neither suffered so heavily or regularly due to the insects' attack, nor their damage was being realised as much as it is today, except the occasional sporadic outbreaks of certain pests that damaged his crops heavily.

These sporadic outbreaks occurred perhaps due to the biotic potential or intrinsic rate at which such insects reproduced in the absence of environmental checks. But this happended only occasionally. Often the environmental complex of conditions *i. e.* biological and physical factors remained more or less unfavourable and caused the environmental resistance which suppressed the biotic potential of the species from being realised. The species existed but usually maintained a low level of population or equilibrium between the forces within the species and the environments.

All the pests that are present today were there 70 years or more ago. However, they did not matter much because their population density was always low.

The question arises that why during the past 70 years and specially the last 25-30 years the insects and mites problems have become so serious and of greater concern to our farmers. There are two answers to it.

First is that man has greatly improved his means of communication and transportation due to which the insects have gained access to new areas from their native places where they were perfectly fitted in a balanced ecosystem. They were eating plants and in turn being eaten up by their natural enemies. Now leaving behind their natural enemies in their native places these insects became established in new areas and in the absence of environmental resistance in respect of biological factors (*i.e.* natural enemies) these insects reproduced terrificly and acquired the ranks of pests, often serious.

The next answer is that the discovery and indiscriminate applications of chemicals against the pests during the last 25-30 years has although revolutionized the field of insect control but has also greatly intensified the pest problem for mankind.

At times when a decade of the rediscovery of the toxic properties of DDT to most of the insects was being celebrated, Pickett and his Associates (1946) experienced a new

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problem in the control of insect pests with chemicals after the very first year of the DDT use for agricultural purposes. "Some of the then minor pests have developed heavy outbreaks after the application of pesticides on apples in Canada."

Although since then the Biochemists,Chemists and Toxicologists were competing among themselves for the discovery and synthesis of new and more effective chemicals for pest control, the experience of Pickett and his Associates was being confirmed by the succeeding entomologists. However, this was being ignored due to the miraculus role which these insecticides played in suppressing the pests of agricultural and medical importance. But they could not keep quiet for very long.

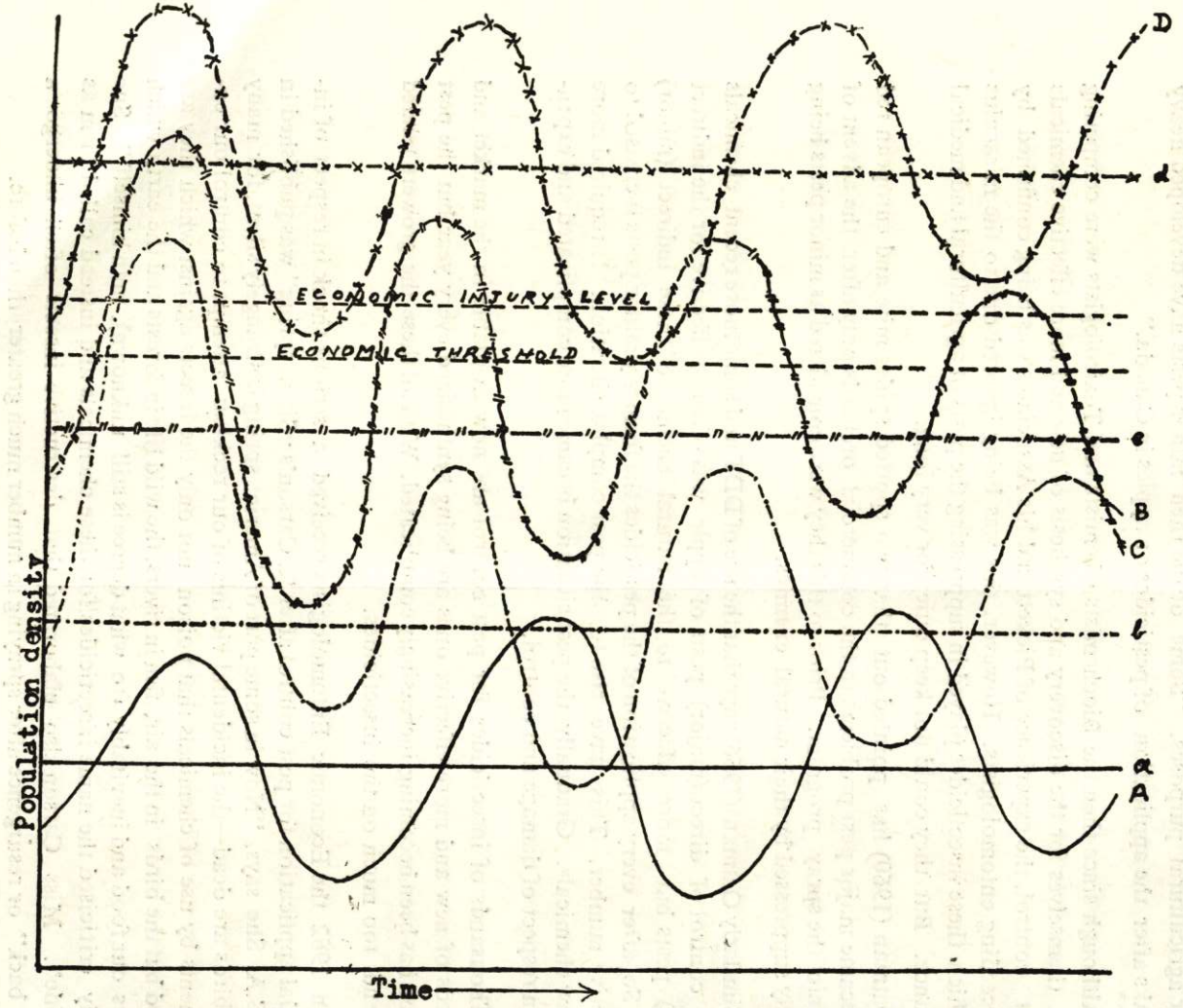
Oatman (1960) has pointed out that two spotted spider mite and european red mite became major pest problems in the commercial orchards only after the advent of DDT into the spray program. Prior to this they were considered as minor pests being normally suppressed by their natural enemies.

Similarly Oatman (1966) says that the use of DDT and some more recent chemicals for the control of direct (major) pests of apple was often ineffective for the indirect (minor) pests but more effective to the natural enemies of these indirect (minor) pests. So after every application of the pesticides the formerly minor pests increased to destructive number. This gave rise to the pest complex situation. It required more and new chemicals. Gradually the pest situation became more complicated and expensive in respect of damage and control.

Thousands of insecticides for pest control are now available in the market and hundreds of new and more effective ones are being synthesized every year but the pest situation has been becoming increasingly complicated. With all these the growers tended to depend too much on the insecticides.

In 1962 the Economic Entomologists received a serious shock in respect of insecticidal application for pest control after R. Carson's "Silent spring" was published in the U.S.A. She says, "Now in some part of America spring is strangely silent, for many of the birds are dead—the incidental victims of our reckless attempt to control our environments by use of chemicals that poison not only the insects against which they are directed but the birds in the air, fish in rivers, the wild life in forests and the earth which supplies our food and inevitably (to what degree is still unknown), man himself." She strongly criticised the name insecticides for these chemicals and instead called them as "Biocide". Miss Carson also elaborated that destructive insects often undergo a "flare back" or resurgence after spraying in number much greater than before.

Further she has pointed out that at the end of a decade or more of intensive chemical control, Entomologists were finding that problems they had considered solved a few years earlier had returned to plague them and new problems have arisen, as the insects once present in insignificant number had increased to the status of serious pests. By their



Schematic graph of the fluctuations of pest populations and their general equilibrium positions in relation to the economic threshold and economic injury level. A,B,C and D indicate the minor, occasional, perrenial and the severe pest populations while the straight lines a,b,c and d show their general equilibrium positions.

very nature chemical controls are, therefore, self defeating, for they have been devised and applied without taking into account the complex biological system against which they have been blindly hurled. The chemicals may have been pretested against a few individual species but not against the living communities as a whole. Many discussions, seminars and lectures were arranged by the American Entomologists during 1962-64 for the justification of chemical control in the past and future. The conclusion drawn by Rachel Carson was a fact and they soon admitted it. The scientists, therefore, gradually stopped thinking of depending too much or solely on insecticides for pest control.

This controversy primarily contributed towards the search and integration of all possible control measures against the insect pests.

The need for integrated control was, therefore, not due to the lack of effective chemicals for primary pest but it was due to the increase in number of secondary pests and the increased cost of control.

According to Fleschner's (1960) the integrated pest control includes the development of means for controlling outbreaks of a particular pest without disturbing the balance of other pest species in that environment.

In this connection the ARS Entomologists (1963) of the U.S.D.A. have proposed that the best control programmes achieve their highest efficiency when various control measures are employed concurrently or successively for example various cultural and mechanical measures can be used to get adequate control with limited chemical treatment or various measures, including chemical treatment, can be used together with parasite or predator in a single integrated pattern. The object is not to eliminate the pest completely but to keep the pest population down below the economic injury level and economic threshold position. This means that they have to be maintained only as minor pests.

Stern *et al* (1959) have fully explained the intensity of infestation in terms of minor pest, occasional pest, perrenial pest and severe pest as shown in the graph.

In minor pests the general equilibrium position and the highest fluctuations of population density are always below the economic threshold. In occasional pests the general equilibrium position is although below the economic threshold level but occasionally the highest fluctuations of the density of pest reach beyond the economic threshold where by their control becomes necessary. In perrenial pest the general equilibrium position of the pest is below the economic threshold but the population fluctations frequently exceed the economic threshold. Here the species will require frequent treatments so that the population is maintained below the threshold level. In severe pests the general equilibrium position and the lowest fluctuations of population density remain above the economic injury level. In this case regular treatments are required to keep the

the population density and its general equilibrium position below the economic threshold.

The idea of suppressing the unwanted insects and plant populations by using all possible cultural, biological and chemical means etc. is not a new one, however, the practice of integrated control on more scientific basis is a recent development.

Originally the idea was to combine and integrate chemical and biological or natural control in such a way that the hazards of insecticides to all the existing beneficial insects are avoided. Soon it was extended to include other control measures like the release of sterile insects, use of resistant varieties, traps and other cultural and physical methods. All these methods can be used concurrently or successively having little or no adverse effect on one another. However, since the biological (natural) and chemical control measures are strongly incompatable because the chemicals always destroy the balance of nature, therefore, these two methods have to be applied in an integrated pattern first by making them compatable for achieving maximum and permanent control. In this respect the following recommendations have been collected from the literature.

(a) About the insecticides

(1) Insecticides must be extremely specific and selective in action (Ripper 1960).

(2) They should have short residual effect. (ARS 1963 and Williams *et al* 1969)

(3) Use of systemic insecticides will kill the pest and save their natural enemies. (Metcalf and Flint 1962)

(4) Grannular Form of insecticides is most desirable because it does not come in direct contact with the natural enemies of the pests.

(5) Using Minimum dose of insecticide will kill the target species and may save other insect. (Stern *et al* 1960)

(6) Insecticides should be applied at time when the useful insects are not readily exposed or they are in a resistant stage. (Bartlett 1958 and Stern *et al* 1959)

(7) Leaving some areas untreated with chemical will serve as reservoir for beneficial insects. (ARS 1963)

(b) About the Natural enemies of pests.

Environments on the other hand can be modified for the existing parasites and predators as follows:—

(1) By providing them with better food. It also includes that complete extermination of the pests should be avoided. (ARS 1963)

(2) By protecting them against secondary parasitism. (Metcalf and Flint 1962)

(3) By protecting them in competition for antagonism. (Fleschner 1960)

(4) By protecting them from dusts. (Bartlett 1951)

REFERENCES.

ARS Entomologists (1963) Research on controlling insects without conventional insecticides. USDA. Publication No. ARS 22-85.

Bartlett, B.R. (1951) The action of certain inert dust material on parasite hymenoptera. J. Eco. Ent. 44 (6): 891-896.

Bartlett, B.R. (1958) Lab. studies on selective aphicides favouring natural enemies on Spotted alfalfa aphid. J. Eco. Ent 51 (2) : 334-378.

Carson, Rachel (1962) Silent spring, Houghton Mifflin Co. Boston. 368 pp.

Fleschner, C.A. (1960) Parasites and predators for pest control. Biological and chemical control of plant and animal pests. Am. Asso. Adv. Sci. Pub. No. 61.

Metcalf. F.L. and W.P. Flint. (1962) Destructive and useful insects. McGraw-Hill Book Company 1037 pp.

Oatman, E,F. (1960) Wisconsin apple insects. Wisconsin Agri. Expt. Sta. Bull No. 548. 29. pp.

Oatman, E.R. (1966) Studies on integrated control of apple pests. J. Eco. Ent. Vol 59 (2): 368-373.

Pickett, A.D., N.A. Patterson. H.T. Stultz and F.T. Lord. (1946).The influence of spray programs on the fauna of apple orchards in Nova Scotia. (Sci. Agric. 26:590-600) J. Eco. Ent. 59 (2): 369.

Ripper, W.E. (1956) Effect of pesticides on the balance of arthropod population.Ann. Rev. Ent. 1 : 403-438.

Ripper, W.E. (1960) Selective insect control and its application to resistance problem. Misc. Pub. Ent. Soc. Am. 2: 153-155.

Stern, V.M., R.E. Smith, R. Van Den Bosch and S. Hagan (1959) The integration of biological and chemical control of Spotted alfalfa aphid Pt. I. The integrated control concept. Hilgardia 29:81-101.

Stern, V.M., R. Van Den Bosch, and H.T Reynold (1960) Effect of dylox and other insecticides on entomophagous insects attacking field crops pests in California J. Eco. Ent. 53 (1): 67-72.

Williams, J.R., J.R., Metcalf, R.W. Mungmery and R. Mathes. (1969) Pests of sugarcane. Elsevier Publishing Co, N. York 550 pp.