

Institute, Coimbatore, during 1945—'46. The author is greatly indebted to Sri H. Shiva Rao, B. Sc., Dip. Agri. (Cantab), the then Agricultural Chemist, to Dr. S. Kasinath, B. A., Ph. D., (Lond.) the Assistant Agricultural Chemist and to Dr. A. Mariakulandai, M. Sc., Ph. D. (Washington) for their valuable guidance. The author also acknowledges the help given by the then Government Mycologist Sri K. M. Thomas and the Assistant Mycologist Sri C. S. Krishnaswamy Iyer during the course of this work.

#### LITERATURE CITED :

1. Onodera I. J. Sci. Agri. Soc. No. 180, 606, 1927 (Japanese—Cited by Suzuki H. 7).
2. Miyako, Y. and Adachi, M. J. Bio. 1, 223, 1922 (Cited by Suzuki, H. 7)
3. Kawashima, R. J. Of Sci. and Manure 11, 86, 1927 (Japanese—Cited by Suzuki, H. 7)
4. Ikari and Kubota. J. Sappor. Soc. Agri. and For. XXI, 97, 92, 1930 (Japanese Cited by Suzuki, H. 7)
5. Miyako, Y. and Ikoda, J. S. Sci. Sol. and Man. VII, 53, 1932 (Japanese—Cited by Suzuki, H. 7)
6. Ito. S. and Hyashi, H. J. Sappor. Soc. Agri. and For. XXI, 103, 78, 1931 (Japanese—Cited by Suzuki, H. 7)
7. Suzuki, H. J. Coll. Agri. Tokyo, 13, 45—236, 1934 (*English*)

<https://doi.org/10.29321/MAJ.10.A04311>

## Recent Advances in Agriculture with Special Reference to Weed Control

by

T. R. NARAYANAN

Plant Physiologist, Agricultural Research Institute, Coimbatore

**Introduction:** Taking "recent" to mean within the past ten years, a number of new developments can be enumerated as constituting advances in the field of agriculture. But from the view-point of plant physiology, these developments can be narrowed down to just three or four, viz., in the field of plant nutrition with special reference to micro-nutrients, photoperiodism, hydroponics, dormancy and growth-hormones. The last one is perhaps the most outstanding, but within the scope of this paper it is proposed to discuss only a single aspect of growth hormones, namely their potentialities as weedicides.

\*Paper read at the 1954 College Day and Conference Symposium on "Recent Advances in Agriculture,"

**Growth Hormones:** The discovery of the hormone system in plants and the later isolation and synthetic production of numerous substances which regulate growth in plants, has been one of the outstanding achievements in Plant Physiology. The term "Hormones" has been used for these substances (From the Greek *Hormacin*: to set moving) as they were believed to be produced in one portion of the plant body and manifest their effects in other portions, but it is preferable to use the term "growth-regulators" or "growth-regulating substances" when the group of synthetic chemicals is referred to. These compounds have an astonishingly diverse range of effects upon plants and new uses are being constantly added to, as more is known about the nature of the responses that these compounds can produce. They are capable of regulating growth in some part or other of the plant body, and in contrast to the indirect effects of insecticides and fungicides that merely serve to protect the plants from injury, these compounds act directly upon the plant metabolism in a physiological sense, although in a manner that is distinct from fertilizer materials that supply major or minor nutrient elements.

A large-scale use of plant growth-substances has fostered within the last ten years, a million-dollar business in the United States of America, Great Britain and other countries of the West. Thus "2, 4-D," which was once used only in minute doses in the laboratory was produced in 1948 to a total of nearly thirty million pounds, mainly for weed eradication.

The use of growth-regulating chemicals for encouraging better and quicker rooting of plant cuttings is now quite well-known and is used generally by gardeners in other lands. The main limitation to a still wider use of these chemicals (among which  $\beta$ -indole-butyric acid is the most popular) lies in the fact that most of the horticulturally valuable plants come under the group of "difficult to root" plants, where growth-regulators have only a moderate effect.

**Weed Control by growth-regulating chemicals:** In 1943—1944 chemicals of the "phenoxy" type were studied intensively as part of secret, war-time research in Great Britain, towards perfecting chemicals for destroying enemy crops. These chemicals act by overstimulating the plants' physiological processes so much as to "burn themselves out", so to speak. The compounds "2, 4-D" and "MCPA" were the most effective; they were able to kill off all broad-leaved dicotyledonous weeds growing in cereal crops when used at dosages of 1 to 4 lb. per acre without affecting the cereal crops and thereby came to be known as selective weedicides. Weed killing is at present by far the most important practical use of these "hormone" chemicals.

There has been in recent years quite a phenomenal increase in the use of "2, 4-D" as a weedicide all over the world (except perhaps in

India). The second in importance is the use of alpha-naphthalene-acetic acid to prevent pre-harvest drop of apples. "2, 4-D" alone has a potential annual market of more than 500 tons and can soon be expected to top the list of all organic agricultural compounds.

Since "2, 4-D" and allied compounds are less effective against grass weeds, new weedicide chemicals are being tested and very recently one or two have been claimed to be quite effective.

**Indian work:** "2, 4-D" or its near analogue, "M.C.P.A." have been found extremely effective in destroying water hyacinth by a number of workers viz. Mitra. (1948), Thomas and Srinivasan (1949) Lal and Scott-Padwick (1948). Prasad (1952) found that Crag Herbicide was effective in killing *Orobancha* in tobacco without injury to tobacco plants. "2:4-D" and "MCPA" formulations like Agroxone, Fernoxone, and Dicotox were found very effective against *Convolvulus arvensis* (Bindweed) and *Chenopodium album* but they were ineffective at the strengths tried, against Spurrey. Against grass type weeds, Kalamkar and Ekbote (1953) found that "CMU" at 20 lb. per acre was effective against *Saccharum spontaneum*, but "TGA" was not effective.

At Coimbatore, work is proceeding since 1953 on weed control by chemical herbicides. A mixture of "2, 4-D" and "MCPA" in the form of the sodium salts at 5 lb. rate in 50 gallons per acre gave 90 to 100 % mortality in *Cyperus rotundus* (Nut grass) in the course of 3 to 4 weeks from spraying date and regrowth was prevented for a period of nearly three months. A combination spray of these two chemicals mixed with diesel oil gave a complete kill of *Cyperus* within two weeks. Against *Hariali* (*Cynodon dactylon*) too, well-established stands could be killed off in 4 to 5 days time by "2, 4-D" and pentachlorophenol (PCP) in diesel oil. "PCP" is unable to kill off the underground portions, but "2, 4-D" can destroy them to some extent. The plots so treated were free of *hariali* for over two months. For complete eradication a combination of herbicidal and cultural measures seems to be necessary.

A good deal of valuable information has been gathered already on the effect of numerous weedicide chemicals on a wide variety of weeds and the work is being continued.

A new method has been devised and used for the detection of toxicity left in the soil when the land is sprayed with herbicides, to see when it is safe to use that land again for cropping. The method is based upon the reduction of growth in cucumber seedlings by varying concentrations of growth-regulating substances. From these studies it was noted that residual toxicity was less persistent in "MCPA" than with "2, 4-D".

Work is also in progress at Coimbatore on the control of *Striga* by the use of the hormone type of weedicides.

It is hardly necessary to stress the fact that a great deal of work still remains to be done, in testing the latest herbicides against the major weeds in India and especially in Madras, in the case of troublesome and persistent weeds like Hariali, Kikuyu grass and Cyperus. Spurrey and Oxalis are two bad weeds on the Hills for which effective and inexpensive control measures are yet to be found. Woody weeds like Lantana and Gorse are also quite a problem in certain areas. These require a different type of herbicides and much work is needed before effective control measures can be suggested.

A vast unexplored field of work lies before us in this weed control problem. The importance of fundamental research is also to be kept in mind, if any large-scale use of chemicals is envisaged for weed control purposes. In fact it may be said that even in the advanced countries of the West, real knowledge on the fundamental aspects as to how exactly these hormone chemicals act on plants, to bring about such multifarious effects ranging from weed control to prolonging the cold storage life of fruits; has somewhat tended to lag behind their commercial exploitation for agricultural purposes.

The future prospect would seem to be a vigorous search for a chemical that would be as effective on grasses as 2:4-D is on broad-leaved weeds. The next development would be a particular best weedicide for a particular weed in a particular crop. Better formulations of herbicides to minimise spray-drift damage and increase lethal effect on weeds, are other desirable developments.

#### REFERENCES

1. Kalamkar, R. J. and R. B. Ekbote, 1953 — Proc. of the Ind. Sci. Congress, Part III, p. 147.
2. Lal, K. B., (1948) — Indian Farming, Dec. 1948, p. 493.
3. Mitra, G. P., (1948) — Science and Culture, 14.
4. Prasad, N., (1952) — Current Sci. 21, (11) p. 325.
5. Scott - Padwick, G., (1948) — Indian Farming, Dec. 1948, p. 497.
6. Thomas, K. M. and A. R. Srinivasan, (1949) — Indian Farming, March 1949, p. 101 - 6.