

CAST's role concerning contentious issues related to weed control

Lowell S. Jordan

Department of Botany and Plant Sciences,
University of California, Riverside, CA 92521,
U.S.A.

Summary

The Council for Agricultural Science and Technology is a consortium of 29 food and agricultural science societies. CAST's purpose is to publish unbiased, scientific information concerning food and agricultural issues of broad public interest. CAST has developed procedures for recruiting leading scientists to author manuscripts within definite guidelines for accuracy, impartiality, and clarity. CAST has published over 200 articles; about 50 are directly or indirectly related to weed science. Representative CAST publications; *Phenoxy Herbicides*, *Herbicide-resistant Crops*, and *Alternative Agriculture: Scientists' Review*, are examples of how CAST approaches contentious issues.

Introduction

The Council for Agricultural Sciences and Technology (CAST) has had an important role and significant impact concerning contentious issues related to weed control. Before illustrating actual cases with which CAST has been involved, it is best to outline the nature of CAST, its purpose, and its method of approaching issues of broad public and governmental concern.

Council for Agricultural Science and Technology (CAST)

Nature of CAST

The organization was incorporated in 1972 as a consortium of food and agricultural science societies. The consortium now involves 29 scientific and technical societies. Each society appoints one or more persons to serve on the Board of Directors (Board), the governing and policy-making body of CAST. The Board

elects an Executive Committee, and officers, and employs an Executive Vice President to manage the headquarters office.

Purpose of CAST

Its purpose is 1) to advance the understanding and use of food and agricultural sciences and technology (FAST) by serving as an unbiased source of information for the public, government, and news media, 2) to identify issues of broad public interest about which FAST can provide information, 3) organize task forces of qualified FAST individuals to assemble the most recent information related to the above issues, and 4) to disseminate the information in an effective form to the public, news media, and government. CAST provides leadership in the food and agricultural community by promoting and practising established scientific methods for developing and reporting information.

Publications: Task force reports are CAST's primary publications. Task forces are ad hoc, multidisciplinary groups of recognized scientists established to respond to publication proposals made to, and approved by, the Board of Directors.

Over the years CAST has developed, and the Board of Directors has approved, procedures and policies concerning publication of information; these will be summarized below. Further information may be found in the *CAST Policies and Guidelines*; copies are available by request from CAST headquarters.

Selection of topics: Each CAST parent society, the other members of CAST, and also the government can recommend subjects for CAST publications. Task force proposals from all sources are first considered and prioritized by ad hoc working groups of the Board of Directors (Board), and then by the National Concerns Committee which makes the recommendation for adoption by the Board. The Board must approve all major projects which

will result in publications as Task Force Reports, Comments from CAST, or Special Publications.

Selection of chairman: After a task force project is adopted, the next critical step is to select a task force chair who is a leading expert in the subject matter area. The chair has the responsibilities to co-ordinate the work, maintain the scientific accuracy of the document, and insure that differing scientific opinions regarding the subject matter are adequately and honestly represented.

Appointment of members: Selection of task force members is also important since the report will largely reflect their combined expertise and ability to equally address all aspects of the subject. Each parent society is entitled to be represented, on each publication, by a member qualified to address the subject matter area. When possible, task force members are chosen to represent the various scientific member societies of CAST, and any additional expertise needed is recruited from the scientific community at large.

Task force members serve as scientists, not as employees of an organization. They are reimbursed by CAST for travel expenses, but receive no honoraria. Cost of publishing and distributing reports are borne by CAST.

Preparation of manuscripts: Generally, reports are of two types, (a) original documents amassing relevant scientific information concerning an issue, and (b) a review of the scientific content of a public document. Comments from CAST are observations of broad interest, written by one or more individuals, and Special Publications contain two or more documents, each with one or more authors, published within one cover.

Task force documents are expected to be concise, objective, and scientific evaluations of all pertinent facts from all disciplines concerned are represented. Controversial issues are to be addressed forthrightly within the scientific basis of the controversy. The task force is not to make recommendations for societal action, but to set forth alternative means for resolving controversial issues, while indicating possible consequences of the various alternatives.

Editing of manuscripts: Task force reports are edited by the Editorial Committee and the Executive Committee to ensure that CAST policies, standards, and procedures as determined by the Board of Directors, are followed. The Executive Vice President, the Scientific Editor, and the office staff work closely with each work group to ensure that CAST publications are of the highest quality.

CAST and Weed Control

About 25% of the over 200 CAST publications have been either directly or indirectly concerned about weed control, especially the use of herbicides. Topics include weed control and herbicides as they affect the environment, nonpoint pollution, groundwater, human health, food quality, chemical residues in food, weed resistance, alternative agriculture (organic farming, sustainable agriculture), integrated pest management, and cropland and soil preservation.

Selected issues that are controversial and contentious will be briefly discussed here to illustrate how CAST has approached and presented them using different publication vehicles. Task force reports will be illustrated with *The Phenoxy Herbicides*, Comments from CAST with *Herbicide-Resistant Crops*, and Special Publications with *Alternative Agriculture: Scientists' Review*.

Task Force Report: The task force recruited to discuss phenoxy herbicides (1) was chaired by Dr. Boysie E. Day. The phenoxy herbicides are selective herbicides widely used in many areas of the world. In spite of almost 50 years of safe use worldwide, there are claims that the phenoxy herbicides damage the environment, poison animals and humans, and cause cancer in humans. CAST has published articles concerning the phenoxy herbicides. The subject was generally approached by discussing herbicidal properties, practical uses, hazards, and socioeconomic factors of herbicides.

- a) **Herbicidal properties.** The phenoxy herbicides are related to naturally occurring plant growth regulators, and kill plants by causing malfunctions in the growth processes. Broad-leaved plants are generally susceptible to the phenoxy herbicides; whereas most grasses, conifers, and some legumes are relatively resistant.

- b) Practical uses. The phenoxy herbicides are used to control many broad-leaved weeds in cereal grains, coniferous forests, grazing lands, aquatic sites, and industrial and suburban areas.
 - c) Hazards. The principal hazard in the use of phenoxy herbicides is to crops and other valuable plants, either within or near the treated area. The herbicides are predominantly toxic to green plants and are much less toxic to any other form of life. They neither concentrate in food chains nor persist in croplands; are rarely detected in food and then only in insignificant amounts. A highly poisonous kind of dioxin (TCDD) is a contaminant in 2,4,5-T and silvex. The amount of TCDD is too low, in currently produced formulations of these phenoxy, to alter their topological properties or to endanger human health or to affect plants or animals in the environment.
 - d) Socioeconomic factors. The phenoxy herbicides are widely used because they are usually less hazardous and less injurious to the environment than alternative methods. They reduce the cost of crop production by about 5%. As a result, the cost of food, forest products, electric power, transportation and government services is reduced.
- b) Potential impacts. Herbicide use will potentially decline if crops are altered to resist non-selective, foliarly applied and highly active herbicides. This event will reduce the need for many soil applications and low activity herbicides. Environmentally more desirable herbicides with greater management efficacy would become available. More use of the lower rates of foliarly applied herbicides would reduce soil erosion, groundwater contamination, and herbicide residues in food. Interestingly enough, the authors claimed that careful introduction of herbicide resistance into crops will likely preclude transfer of the resistance to weeds. Also, escape of herbicide-resistant crops, to become weeds where they are not presently a problem, is not likely to occur since they will not usually survive in nature.
 - c) Economics. Herbicide-resistant crops will not "revolutionize" agriculture. For major crops, such as corn and soybeans, there is no economic need for new herbicide-resistant crop technology. However, there is an economic need for herbicide-resistance in minor crops, such as vegetables. Seed suppliers for herbicide-resistant crops would have a potential advantage from 1) increased prices and 2) increased market share for that seed. Suppliers of the affected herbicide would also benefit economically. Farmers would be able to use fewer and less herbicides and benefit from lower costs and less injury to crops and the environment. In spite of negative publicity, consumers would benefit from higher quality and lower priced food.

Comments from CAST

Herbicide-Resistant Crops (2). The ability of scientists to induce crop resistance to herbicides through biotechnology, rather than by normal genetic selection, has created controversy. Some people express opinions that such plants are not natural and that they may become super weeds. The CAST group discussion, chaired by Dr. Stephen O. Duke, of the subject matter included research and development, potential impacts, economics, regulation, and recommendations.

- a) Research and development. Two physiological mechanisms by which plants can be tolerant or resistant to a herbicide are employed by biotechnologists to generate herbicide-resistant crops. These mechanisms are 1) reduced sensitivity at the site of action, and 2) degradation of the herbicide by metabolic processes. Site-of-action alterations have been used in some cases. Microbial genes for herbicide degradation have been successfully transferred to crops.
- d) Regulation. There is adequate herbicide and herbicide-resistance regulation in the U.S.A. at the federal and state levels to ensure consumer and environmental safety.
- e) Recommendations. In spite of the CAST policy of not making recommendations, the authors on herbicide-crop resistance made several of them: 1) unnecessarily high levels of resistance should not be engineered into plants, 2) funding of scientific research on herbicide-resistance and tolerance should not be restricted, 3) resistance to environmentally suspect herbicides should not be commercialized, 4) crops with weeds that freely interbreed with them should not be made herbicide

resistant, without introducing barriers to outcrossing, 5) complete weed management systems should accompany the use of herbicide-resistant crops to prevention of section and spread of weeds resistant to herbicides, and 6) guidelines for transgenic food crops should be followed with herbicide-resistant crops.

Special Publication: Alternative Agriculture Scientists' Review (3). The National Research Council of the National Academy of Sciences published a book *Alternative Agriculture*. The chairman of the Congress of the United States-Joint Economic Committee requested that CAST "undertake a review of the methodology and findings of the publication. Dr. Lowell S. Jordan chaired a group of 44 scientists which prepared independent reviews which were summarized and published by CAST. A team of three scientists each from CAST and the National Research Council testified before the Joint Economic Committee concerning the two publications. Methodology and findings of the CAST review of *Alternative Agriculture* will be reviewed below.

The report, *Alternative Agriculture*, by the National Academy of Sciences-National Research Council (1989), proposes systems for environmentally sound and economically viable agricultural production emphasizing minimal external inputs and diversification. These systems would substantially reduce or eliminate herbicides and increase tillage and cover crops. The spectrum of farming systems being promoted as available and superior to conventional agriculture are neither well defined nor supported by adequate, current, scientifically based information. Similarly, conventional agriculture is not defined, except that herbicides, pesticides, and inorganic fertilizers are used. The report uses few case studies to support its proposition that alternative agriculture without agricultural chemicals is more profitable and desirable. However, no equivalent studies on conventional farms with normal use of chemicals is presented. The few cases presented are of limited applicability and not tested congruently with generally accepted scientific methods.

Alternative agriculture, without inputs of herbicides, pesticides and fertilizers, is viable in some situations, under certain economic conditions, at specific locations, under appro-

priate management expertise, and with a receptive market. In addition, the choice of farming systems is influenced by a wide range of federal policies, including price supports. Alternative agriculture relies on various techniques that are innovative when first introduced and which become common practices when adapted as part of conventional agriculture (e.g., herbicides, crop rotation, minimum tillage, and integrated pest management [IPM]). Hence, delineation between alternative and conventional agriculture becomes indistinct. Therefore, neither can be clearly defined as a separate entity with advantages over the other in all agricultural enterprises.

Practicability of alternative agriculture, without chemical weed and pest control and commercial fertilizers, is not well established; thus, its national adoption at the expense of conventional agriculture using the specified chemicals is controversial. The possible additional costs for equipment, buildings, labour and management expertise for diversified systems have to be absorbed by increased commodity prices if yields are lower.

Both benefits and risks are involved in converting from conventional (with herbicides) to alternative (without herbicides) agriculture or vice versa. It will eliminate or alleviate some problems, but create or enhance others. Problems associated with either alternative or conventional agriculture are both real and perceptual; their levels of importance varies with factors including location, economics, society, environment, social values and attitudes, governmental policies and management.

The publications referred to above illustrate CAST's approach to contentious issues. Other publications can be obtained from the headquarters office: CAST, 137 Lynn Avenue, Ames, IA 50010-7197.

References

1. Day, B.E. *et al* (1978). The phenoxy herbicides. 2nd edition. 28 pp. CAST Task Force Report R77.
2. Duke, S.O., Christy, A.L., Hess, F.D. and Holt, J.S. (1991). Herbicide-resistant crops. 24 pp. Comments from CAST 1991-1.
3. Jordan, L.S. *et al*. (1990). Alternative agriculture: Scientists' review. 182 pp. CAST Special Publication No. 16.