Chapter 7

Environmental Applications of Biotechnology

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A number of potential applications of biotechnology in several areas (including agriculture, animal husbandry, and fisheries) require the release of genetically altered organisms into the environment. Researchers and manufacturers have applied for permission to test genetically altered plants or micro-organisms to produce disease-resistant crops, frost-resistant crops, and more effective pesticides. It is already technically feasible to use recombinant DNA techniques to genetically alter farm animals to improve their weight and other characteristics. A number of other environmental uses for genetically altered organisms (e.g., "oil-eating" bacteria to clean oilspills) are also being developed.

Although these applications are produced by the same techniques as those often used in human cell manipulations, it is possible that public opinions about the environmental uses of genetic engineering differ from opinions about human applications of biotechnology (see ch. 6). Moreover, the potential risks of human gene manipulation and environmental applications of genetically altered organisms are quite different. This chapter focuses on public perceptions and concerns about environmental applications and the deliberate release of genetically engineered organisms into the environment.

AGRICULTURAL USES OF GENETIC MANIPULATION

The American public is moderately aware that genetic engineering is used to produce altered plants and animals. Four out often Americans (41 percent) report that they have heard about gene splicing or recombinant DNA to produce hybrid plants and animals. This awareness rises with education from 29 percent of those with less than a high school degree to 62 percent of college graduates (table 39).

The public does not appear to be concerned about the morality of genetic engineering of plants and animals. A large majority (68 percent) says creating hybrid plants and animals through direct manipulation of DNA is not morally wrong. The quarter of the population (24 percent) who feel it is morally wrong are distinguished from the rest of the population by lower educational attainment or greater religiousness. However, a

Table 39.-Awareness of Applications of Genetic Engineering

Question (Q16a):[a] Have you heard about using gene splicing or recombinant DNA to produce hybrid plants and animals by direct genetic manipulation?				
		Yes	No	Not sure
Totai	**(1,273)**	**41%**	**58%**	**1%**
Education:				
Less than high school	**(165)**		**69**	**2**
High school graduate	**(456)**	**34**	**65**	1
Some college	**(300)**	**51**	**49**	**<1**
College graduate	**(347)**	**62**	**37**	1
Heard about genetic engineering;				
A **lot/fair amount**	**(514)**	**65**		**<1**
Relatively little	**(566)**	**33**	**65**	1
Almost nothing.	**(257)**	**16**	**63**	1

[a]The code number of the question in the survey instrument (see app. B.)
[b]percentages are presented as weighted sample estimates. The unweighed sample base is presented in parentheses so that the sampling variance for these estimates can be calculated,

SOURCE: Office of Technology Assessment, 1987.

Table 40.—Morality of Genetic Manipulation of Piants and Animais

Question (Q18b):. Do you believe that creating hybrid plants and animals through direct genetic manipulation of DNA is morallywrong, or not?				
	Morally wrong	Not morally wrong	Depends	Not sure
Total (585)[b]	24%	88%	4%	4940
Education:				
Less than high school (48)	41	49	2	8
High school graduate (180)	30	80		3
Some college (156)	14	79	3	4
College graduate (220)	13	81	3	3
Religious:				
Very (247)	*32*	*57*	*6*	*5*
Somewhat (215)	19	73	4	4
Not too/not at all. (117)		83	1	1
Heard about genetic engineering:				
A **lot/falr amount (358)**	20	70	4	5
Relatively little (179)	24	70	3	2
Almost nothing (42)	42	47	8	3

[a]The code number of the question In the survey instrument (see app. B.)
[b]Percentages are presented as weighted sample estimates. The unweighed sample base (number of individuals who have heard of technique) is presented in parentheses so that the sampling variance for these estimates can be calculated.
SOURCE: Office of Technology Assessment, 1987.

majority of even the very religious (57 percent) feels it is not morally wrong to use biotechnology techniques to produce hybrid plants and animals (table 40).

Of those who do feel that plant and animal applications of genetic engineering are morally wrong, religious issues do not seem paramount. Only 31 percent of those who say it is morally wrong explain their objections in terms of religious beliefs or God. In contrast, 35 percent object to such applications on the grounds that "people shouldn't tamper with nature." Other concerns that are expressed include: unforeseen or unintended consequences (8 percent) and opposition to scientific experimentation on animals (4 percent). Others expressed fears that monsters will be created (2 percent), or that the techniques will be used on humans (2 percent), or will harm the environment (1 percent). Thus, moral objections to genetic engineering of plants or animals covers a broad range of beliefs, concerns, and fears that go well beyond religious issues (table 41).

Tabie 41 .—Reasons Why Genetic Manipulation of Plants and Animals is Morally Wrong

Question (Q18c):[a] Why is that [genetic manipulation of plants and animals] morally wrong?	
	Total
	(113)[b]
Shouldn't interfere /tamper with nature	35°A
Religious beliefs/not what God intended	31
Unforeseen/unintended consequences	8
Acceptable for plants but not animals	7
Against scientific experimentation on animals	4
Would create monsters/freaks/mutants	2
Future use of humans	2
Harmful to environment	1
All other mentions	18
Don't know	7

[a]The code number of the question In the survey instrument (see app. B.)
[b]Percentages are presented as weighted sample estimates. The unweighed sample base (number of individuals who said technique is morally wrong) is presented in parentheses so that the sampling variance for these estimates can be calculated.
SOURCE: Office of Technology Assessment, 1987.

CLASSICAL BIOLOGICAL TECHNIQUES AND AGRICULTURE

Some proponents argue that the techniques of genetic engineering are simply more efficient methods of producing the same ends as classical biological techniques. Others argue that the direct manipulation of genetic material is intrinsically different from crossbreeding or cross-fertilization. Does the American public also distinguish between these two positions? To test pub-

lic perceptions of differences in the two approaches, parallel sections dealing with awareness, morality, and risk of the two different technologies were created in the questionnaire. To avoid an order bias in the assessment, a computer randomly assigned the order of the two sections in each interview. Approximately half of those surveyed were asked about classical biological techniques first and the other half about genetic techniques first.

The OTA survey found that the public is more generally aware of the classical techniques of plant and animal manipulation than of recombinant DNA techniques. Three-fourths of the public (76 percent) say they have heard of classical biological techniques such as cross-fertilizing plants and crossbreeding animals to produce hybrids (table 42). This is nearly twice the proportion of Americans who report they have heard of using gene splicing and recombinant DNA for these purposes (41 percent).

Table 42.—Awareness and Opinions About Classical Biological Techniques

Question (Q15a):[a] Have you heard about biological techniques, such as cross-fertilizing plants or crossbreeding animals to produce hybrids?	
Question (Q15b): Do you believe that creating hybrid plants and animals by crossbreeding is morally wrong, or not?	
	Total (I,273)[b]
Heard of cross-fertilization or crossbreeding:	
Yes	760/o
No	24
Not sure	1
Creating hybrid plants and animals by crossbreeding is:	
Morally wrong	26 %[c]
Not morally wrong	66
Depends	5
Not sure	3

[a] The code number of the question in the survey instrument (See aPP. B.)
b p$_{ercen}$t$_{age}$s are presented as weighted sample estimates. The unweighed sample base is presented in parentheses so that the sampling variance for these estimates can be calculated,
[c] These weighted sample estimates are based on an unweighed sample base of 999 individuals who had heard of cross-fertilizing or crossbreeding.

SOURCE: Office of Technology Assessment, 1987.

Despite the public's different awareness of the two technologies, Americans do not appear to hold different views about the morality of the two approaches. Among those who say they have heard of classical techniques, the majority (66 percent) believes that crossbreeding to create hybrid plants and animals is not morally wrong, essentially identical to the 68 percent who believe gene splicing to create hybrid plants and animals is not morally wrong. A quarter of the public believe it is morally wrong to create hybrids either by classical biological techniques (26 percent) or by gene splicing (24 percent).

A comparison of the perceptions of morality for the two technologies shows a strong degree of internal agreement. Three-fourths of the public who say they have heard of the two techniques give identical ratings to the morality of the two methods. Fifty-nine percent feel that neither technique is "morally wrong. " One percent feels that it '(depends" in both cases, and 16 percent believe that both methods are "morally wrong. " In addition to the 76 percent who do not shift their positions on the morality of the methods, 10 percent shift from a "not sure" or "depends" position to a "not morally wrong" position, or vice versa. This shifting is divided equally across the two methods. The only difference found between moral positions on the classical v. new techniques is that a slightly larger group of people feels that genetic manipulation is wrong, but classical techniques are not wrong (7 percent) compared to those who believe classical techniques are wrong, but genetic techniques are not wrong (4 percent) (table 43). To the extent that there is any moral issue in the public mind concerning the manipulation of plant and animal offspring, it appears that the moral issue lies in the objective (or end, i.e., the fact that manipulation of any kind is occurring), not the means by which it is achieved.

Table 43.-Comparison of Morality of Genetic Manipulation of Plants and Animals With Classical Biological Techniques*

Questlon (Q15b):~ Do you believe that mating hybrid plants and animals by crossbreeding IS morally wrong or not?
Question (Q18b): Do you believe that creating hybrid plants and animals through direct genetic manipulation of DNA Is morally wrong, or not?

	Genetic manipulation of plants and animals				
	Morally wrong	Depends	Not morally wrong	Not sure	Total
Classical biological manipulation of plants and **animals:**					
Morally wrong	16%	<10/0	4%	<1%	21%
Depends	1				5
Not morally wrong	7	2	59	<3	71
Not sure	<1	-		<1	3
Total	23	4	69	4	

[a]Percentages are presented as weighted sample estimates. The unweighed sample base is 541 (number of individuals who said they had heard of both techniques).
[b]The code number of the question In the survey instrument (sea app. B.)

SOURCE: Office of Technology Assessment, 1987,

OPINIONS ABOUT THE OBJECTIVES OF BIOTECHNOLOGY

To determine whether public acceptance of biotechnological applications is rooted in the end objectives and not the means, the OTA survey investigated how the publIc views some alternative uses of genetic techniques. The issue of differential risk was avoided by asking survey respondents to assume that none of these applications involved a direct risk to humans; there was no discussion of environmental risk. Hence, the survey responses reflect the willingness of the public to approve different types of applications of genetic engineering when risk to humans is not an issue; only later was risk introduced.

Seven uses of genetic engineering were presented to survey participants in random order. To represent a range of objectives that vary in terms of their extrinsic social utility, the uses range from cures for human genetic disease, to disease-resistant crops, to larger game fish. In each case, respondents were asked:

> If there was no direct risks to humans, would you strongly approve, somewhat approve, somewhat disapprove, or strongly disapprove of genetic manipulation to produce (ITEM)?

The OTA survey found that a clear majority of Americans says it approves all seven applications of genetic engineering in the survey. The rate of public approval of genetic manipulation ('(strongly approve" or "somewhat approve" under risk-free conditions) is: 96 percent to produce new treatments for cancer; 91 percent to produce new vaccines; 87 percent to produce cures for human genetic diseases; 87 percent to produce disease-resistant crops; 85 percent to produce frost-resistant crops; 74 percent to produce more productive farm animals; and 66 percent to produce larger game fish. Although the American public overwhelmingly says it approves the use of genetic engineering for each of the seven objectives tested, there is variation in enthusiasm. A majority states it "strongly approves" the use of genetic engineering for new treatments for cancer (75 percent), new vaccines (57 percent), cures for human genetic diseases (54 percent), and disease-resistant crops (53 percent). A plurality says it "strongly approves" genetic engineering for producing frost-resistant crops (48 percent). However, only a minority says it "strongly approves" the use of genetic manipulation for more productive farm animals (37 percent) or larger game fish (25 percent) (table 44).

The survey responses clearly indicate a broad level of public acceptance of the uses of genetic engineering for a wide range of purposes—when **risk to humans is not a factor.** The levels of posi

Table 44.—Opinions About Applications of Genetic Engineering Under Risk-Free Conditions[a]

Question (Q19):[b] If there was no direct risk to humans, would you strongly approve, somewhat approve, somewhat disapprove, or strongly disapprove of genetic manipulation to produce (READ ITEM)?

	Strongly approve	Somewhat approve	Somewhat disapprove	Strongly disapprove	Not sure
New treatment for cancer	75%	21%	2%	1%	1%
New vaccines	57	34		2	3
Cures for human genetic disases	54	33	6	3	3
Disease-resistant crops	53	34		3	4
Frost-resistant crops	48	37	8	4	4
More productive farm animals	37	37	14	9	3
Larger game fish	25	41	17	13	4

[a]Percentages are presented as weighted sample estimates. The unweighed base from which the sampling variance can be calculated is 1,273.
[b]The code number of the question in the survey instrument (see app. B).

SOURCE: Off Ice of Technology Assessment, 1987.

tive response also suggest what kind of social utility scale the public uses to evaluate the objectives of genetic applications. The uses with the most immediate human benefits are at the top of the list. And, within the category of human benefits, those that offer the greatest personal benefit (i.e., cancer treatments and new vaccines) head the roster. Outside of direct human applications, the approval rate of biotechnology drops with the degree of social utility-crop survival appears before farm productivity, which leads recreational uses (i.e., larger game fish).

The implicit scale of public utility illuminated by the survey appears to be founded less on utilitarian philosophy (i.e., the greatest good for the greatest number) than on the immediacy of personal benefit. Consistent with other findings (see ch. 4), the **survey reveals that the** public expects science and technological developments to bring personal benefits for them and their families.

LIKELIHOOD OF RISKS

The social acceptability of the objectives of bio - technology is one important factor in understanding public perceptions of genetic engineering, and is closely associated with the moral dimension of the issue. Other key dimensions affecting public perceptions of biotechnology are the degree, type, and likelihood of risk that could result from biotechnological applications.

While scientists argue about the specific degrees of risk associated with genetic applications, they seem to generally agree that two distinct types of risk exist. The first type results from the accidental escape of a genetically engineered organism from a laboratory setting. The survey did not examine this type of risk, The second type involves the deliberate release of a genetically engineered organism into the environment. Public perceptions of and reactions to this type of risk were assessed in the OTA survey.

As stated earlier, only **18** percent of the public report that they have heard of any potential dangers from genetically engineered products, and only 12 percent can articulate any type of specific dangers about which they had heard or read. A majority (52 percent) believes, however, that genetically engineered products are at least somewhat likely to represent a serious danger to humans or the environment.

While the public's fears of genetically engineered products are not well articulated, this does not mean they are undifferentiated. To examine the quality of different fears about genetically engineered products, the survey asked respondents to assess the likelihood of genetically engineered organisms in the environment producing each of seven negative outcomes. The seven outcomes were randomly ordered for each respondent to avoid order effects in responses.

Table 45.—Likelihood of Specific Dangers From Use of Genetically Altered Organisms in the Environment[a]

Question (Q22):[b] From what you have heard or read, how likely do You think it is that the use of genetically engineered organisms in the environment will (READ ITEM) —very likely, somewhat likely, somewhat unlikely, very unlikely?

	Very likely	Somewhat likely	Somewhat unlikely	Very unlikely	Not sure
Create antibiotic-resistant diseases	180/0	43%	21%	7%	11%
Produce birth defects in humans	18	39	24	10	9
Create herbicide-resistant weeds	15	41		11	11
Endanger the food supply	14	38	29	13	7
Mutate Into a deadly disease	13	33	30	14	10
Change rainfall patterns	12	30	30	16	12
Increase the rate of plant or animal extinction	11	34	31	15	9

[a]Percentages are presented as weighted sample estimates. The unweighed base from which the sampling variance can be calculated is 1,273.
[b]The code number of the question in the survey instrument (see app. B).

SOURCE: Office of Technology Assessment, 1987.

A majority of the public feels that four of the seven dangers of environmental release are at least "somewhat likely." The dangers from using genetically engineered organisms in the environment perceived most probable are: the creation of antibiotic-resistant diseases (61 percent); the production of birth defects in humans (57 percent); the creation of herbicide-resistant weeds (56 percent); and the endangerment of the food supply (52 percent). In contrast, a minority of the public believes it "somewhat likely" that the environmental release of these organisms will: mutate into a deadly disease (46 percent); change rainfall patterns (42 percent); or increase the rate of plant or animal extinction (45 percent) (table 45).

However, it should be noted that all of the risks surveyed are perceived as "somewhat likely" rather than "very likely." The proportion of the public who believes that any of these dangers will be very likely as a result of environmental release varies from less than one in five persons who think antibiotic-resistant diseases or birth defects (18 percent each) are very likely, to slightly more than one in ten who feel plant or animal extinction is very likely (11 percent). In short, many of the risks listed—particularly those with direct impact on humans-evoke concern from a majority of the public. But there is little perception that the risks are very likely.

Separate from the issue of what kind of risk could occur is the degree of danger posed by the release of different host organisms. The OTA survey measured the perceived likelihood of environmental danger posed by environmental release of genetically engineered plants and animals v. genetically engineered bacteria. The public splits evenly—at 47 percent-on whether the environmental release of genetically altered plants and animals is likely ((’very likely" or "somewhat likely") to pose a danger to the environment (table 46). A majority of American people (68 percent), however, believes it is at least "somewhat likely" that genetically altered bacteria could pose a danger to the environment (table 47).

ACCEPTABLE RISK

Assessment of technological risk is thorny for two reasons. First, there is a serious technical problem in estimating the level of risk associated with any new procedure. Second, there is an even more difficult normative decision of setting the acceptable level of risk. This normative decision

Table 46.—Likelihood of Environmental Risk From Genetically Altered Plants and Animals

Question (Q18d):[a] If new plants or animals produced by direct genetic manipulation can reproduce, how likely do you think this is to pose a danger to the environment—very likely, somewhat likely, somewhat unlikely, or very unlikely?

		Very likely	Somewhat likely	Somewhat unlikely	Very unlikely	Not sure
Total	(565)b	13%	340/0	320/o	15%	4%
Education:						
Less than high school	(48)	17	42	19	15	5
High school graduate	(160)	18	34	27	17	4
Some college	(113)	10	33	39	13	6
College graduate	(220)	6	30	43	17	3
Science orientation:						
Observant	(355)	15	33	32	15	4
Nonobservant	(230)	10	37	32	16	5
Heard about genetic engineering:						
A lot/fair amount	(358)	13	35	32	17	2
Relatively little	(179)	9	36	35	12	8
Almost nothing	(42)	31	22	25	17	5
Voters:	*(458)*	*13*	*33*	*33*	*16*	*5*

[a]The code number of the question in the survey instrument (See app. B).
[b]Percentages are presented as weighted sample estimates, The unweighed sample base (individuals who say they have heard of technique) is presented in parentheses so that the sampling variance for these estimates can be calculated.

SOURCE: Office of Technology Assessment, 1987

Table 47.—Likelihood of Environmental Risk From Genetically Altered Bacteria

Question (Q18e):[a] Some bacteria have been produced by direct genetic manipulation. If bacteria created by direct genetic manipulation can reproduce themselves, how likely do you think this is to pose a danger to the environment—very likely, somewhat likely, somewhat unlikely, or very unlikely?

		Very likely	Somewhat likely	Somewhat unlikely	Very unlikely	Not sure
Total	(585)[b]	2 9 %	39%	19%	8%	5%
Education:						
Less than high school	*(48)*	*37*	*25*	18	12	6
High school graduate	(160)	35	40	14	8	3
Some college	(113)	25	43		6	6
College graduate	(220)	18	46	25	7	4
Science orientation:						
Observant	(355)	29	38	19	9	4
Nonobservant	(230)	28	41	19	7	5
Heard about genetic engineering:						
A lot/fair amount	(358)	26	42	21	8	3
Relatively little	(179)	25	40	20	6	9
Almost nothing	(42)	56	21	9	14	0
Voters:	(458)	29	38	19	8	6

[a]The code number of the question in the survey instrument (See app. B).
[b]Percentages are presented as weighted sample estimates. The unweighed sample base (individuals who say they have heard of technique) is presented in parentheses so that the sampling variance for these estimates can be calculated.

SOURCE: Office of Technology Assessment, 1987

is the policymakers' dilemma of deciding what level of risk is acceptable to gain the expected benefits.

Although decisionmakers set the level, public perception of what constitutes acceptable risk is an important component of public opinion about using technological innovation. While the public's estimates of perceived risk often vary widely from actual risk rates (8), the OTA survey explored public perceptions of acceptable risk. Survey participants were asked:

> Suppose that a new genetically engineered organism had been developed which would significantly increase farm production with no direct risk to humans. Would you approve the environmental use of that organism if the risk of losing some local species of plants or fish was (RISK LEVEL)?

The initial risk level specified was 1 in 100. If the respondent did not approve at that risk level, he or she was asked about a more remote risk level. Once a respondent approved of environmental use at any specified risk level, it was assumed that he or she would approve at lower risk levels and so these were not presented. Regardless of the level of risk the respondent considered acceptable, all respondents were asked if they would approve if the risk were "Unknown," as well as "Unknown, but very remote."

Table 48.-Acceptable Levels of Risk for Environmental Application of Genetically Engineered Organism~

Question (Q23):[b] Suppose that a now genetically engineered organism had been developed which would significantly increase farm production with no direct risk to humans. Would you approve the environmental use of that organism if the risk of losing some local species of plants or fish was (READ ITEM)?[c]

	Approve	Not approve	Not sure	No answer
Risk level				
Unknown	31%	85%	3%	<1%
1 in 100	40			0
1 in 1,000	55	37	9	
1 in 10,000	65	27	3	5
1 in 100,000	71	21		
1 in 1,000,000	74	18	2	5
Unknown, but very remote	45	48	9	5

[a] Percentages are presented SS weighted sample estimates. The unweighed base from which the sampling variance can be calculated is 1,273.
[b] The code number of the question in the survey instrument (see app. B.).
[c] Approvals are cumulative. Pereons who approved at a risk level were not asked to approve at lower levels of risk.
[d] A. a result of a programming error, those who approved at "Unknown" risk level were not asked about specific risk levels. Those omitted were recontacted to complete the risk section, but the Harris firm was unable to obtain responses from 50/. of the sample. These are treated as "No Answer."

SOURCE: Office of Technology Assessment, 19S7.

The OTA survey found that the public is not risk averse--at least if the risk is local ecological disruption A majority of the American public (55 percent) says it approves of the environmental use of a genetically engineered organism designed to increase farm production if the risk of some local plant or fish extinction is no more than 1 in 1,000. At risk rates of 1 in 10,000, nearly two-thirds of the public say they approve. And, at risks of 1 in 1 million, three-fourths (74 percent) of the population approve of the environmental use of altered organisms. However, even at remote levels of risk (i.e., 1 in 1 million), nearly a fifth of the population (18 percent) say they do not approve of the environmental application of genetically engineered products (table 48).

Perhaps what is more important than the acceptable level of known risk is the way the public reacts to unknown risk. If the risk is truly unknown, nearly two-thirds (65 percent) of the public say they do not approve of the environmental application. In fact, **more people approve at a high level of known risk, such as 1 in 100 (40 percent) than at an unknown risk level (31 percent).**

The survey also demonstrates that the phrase "unknown, but very remote risk" (which is frequently used to describe risks of environmental impact) does not maximize public approval. Only 45 percent of the public say that they approve of the environmental release of genetically engineered organisms if the risk is unknown, but very remote. When compared to approval rates for known risks, this suggests that the public evaluates an "unknown, but very remote risk" (45 percent) as somewhere between 1 in 100 (40 percent) and 1 in 1,000 (55 percent).

ACCEPTANCE OF REMOTE RISKS

Earlier in this chapter, the acceptance—when there was **no direct risk to humans-of a number of uses of genetically engineered products was examined. Although not entirely realistic in terms of decisionmaking, the analysis permits an assessment of the American public's perceptions of the use of genetically engineered products outside the issue of risk.**

To factor in the **environmental risk component of public perceptions of environmental applications of genetically engineered organisms, the survey investigated the willingness of Americans to approve the environmental use of genetically engineered organisms, if there were no direct risk to humans, yet very remote risks to the environment. Under these risk conditions, a majority of the public says it approves of environmental uses of genetically altered organisms for all five of the purposes tested. The majority reports it approves the use of these products to** produce: disease-resistant crops (73 percent); bacteria to clean up oilspills (73 percent); and frost-resistant crops **(70** percent). Slimmer majorities say they approve the use of these products to produce: more effective pesticides **(56** percent) or larger game fish (53 percent)—at least under these risk conditions (table 49).

The OTA survey found that the specification of environmental risk, even if very remote, affects the willingness of the public to approve environmental uses of these products. The approval rate drops measurably from the description without reference to environmental risk to the description with the reference of very remote risk: disease-resistant crops (87 to 73 percent); frost-resistant crops (85 to 70 percent); and larger game fish (66 to 53 percent). The drop in the approval rate is almost identical, 13 to 15 percentage points, across the different types of environmental uses (table 44 and table 49).

Table 49.—Opinions About Environmental Uses of Genetic Engineering Under Remote Risk Conditions[a]

Question (Q24):[b] if there was no direct risk to humans and only very remote risks to the environment, would you approve or disapprove the environmental use of genetically engineered organisms designed to produce (READ ITEM)?

	Approve	Disapprove	Not sure
Disease-resistant crops	73%	23%	40%
Bacteria to clean oilspills	73	23	4
Frost-resistant crops	70	27	3
More effective pesticides		40	4
Larger game fish	53	43	4

[a]Percentages are presented as weighted sample estimates, The unweighed base from which the sampling variance can be calculated is 1,273.
[b]The code number of the question in the survey instrument (see app. B).

SOURCE: Office of Technology Assessment, 1987.