

# SEEDS and FRAGILE HARVEST

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Study Guide  
by  
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# SEEDS

(28 minutes film/videocassette)

and

# FRAGILE HARVEST

(48 minutes film/videocassette)

## Subject Areas

- agriculture
- biotechnology
- economics
- geography
- plant genetics
- science, technology & society

## Topics and Themes

- history of seeds
- advances in modern agriculture and plant genetics
- consequences of monocultures
- biotechnology and profits
- preservation of agricultural heritage

## SYNOPSIS

SEEDS is a concise explanation of the importance of genetic diversity to the world food supply. In Third World countries, indigenous varieties of food crops are rapidly disappearing from genetically rich areas, replaced by seeds produced by multinational chemical companies, seeds now bred to be dependent on agrichemicals. The future of our food supply depends on our ability to conserve genetic resources and redirect the goals of today's plantbreeding.

Mechanized farming, biotechnology, and the production of seeds with special attributes for fast growth, high yield, and large fruit provide the new focus for modern agriculture.

Farming has been redesigned to accommodate large, distant populations and the mass production technologies of the food industry. The tomato, for example, has been bred to produce high yields, low moisture content, and tough skins for mechanical harvesting. A reduced nutritional value, lower vitamin C, is the unfortunate side-effect.

The ancient origins of wheat are traced to the agricultural lands of Turkey; the tomato to Peru. Here, seeds have been selected over centuries of traditional farming because of their suitability to the soil and climate of the particular region. Where these conditions vary within the same region, different varieties of seeds have evolved, each adapted to regional conditions.

The genetic cross-breeding of crop plants has moved from the fields into the greenhouses and laboratories. Advances in plant cloning and in DNA transfer are beginning to produce varieties of seeds that have the characteristics to resist each new threat in the fields. But they are still vulnerable to others. Examples of corn blight and citrus canker disasters show the vulnerability of crops developed for high yields through hybridization and genetic engineering.

Biological research may be fueled by profit motivation. Food processing companies anticipate large profits from high consumer demand for highly refined food products. Seeds, dependent on pesticides and chemical fertilizers to achieve their maximum potential yield, guarantee higher profits for petrochemical-controlled seed companies. Toxic quantities of chemicals, however, are beginning to show up in water supplies across the continent.

Emphasis on profits and priorities of mass production is reducing the vital seed resources available to world agriculture. An inadequately funded but energetic attempt is being made to save the heritage of agriculture through the formation of an international network of seed banks.

The narrator poses two open ended questions:

“Should the economics of the assembly line decide the nature of our food?”

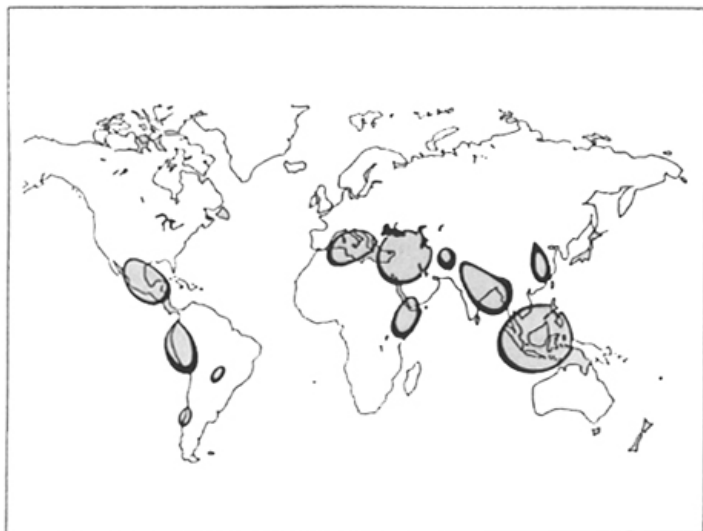
“Can we achieve an agriculture to feed the world without destroying it?”

## ACTIVITIES

### JUNIOR HIGH

- Seeds are produced by flowering plants. Choose a large flower, such as a petunia; dissect and examine the reproductive organs. Explain how function fits structure for each part of the flower.
- What purpose does pollen serve in the formation of seeds? Use a microscope to examine and draw the pollen grains from various flowers.
- What is "cloning"? Investigate the current research on the cloning of plants and animals. In small groups make notes on the political, moral, economic, and social implications of cloning. What would be the implication of cloning humans?
- Organize a seed science fair. Design experiments with proper control of variables to investigate the following questions about seeds:
  - What parts make up a seed?
  - Do seeds need water to sprout?
  - Will seeds sprout in the cold?
  - Will seeds sprout if they are not right side up?
  - Do seeds need soil to sprout?
  - Will seeds sprout in soil under water?
  - Do seeds need light to sprout?
  - Does the depth of planting affect whether or not seeds will sprout?
  - Do different seeds sprout at different rates?
- Most of the world's seeds evolved in a narrow area of land near the equator, stretching from the highlands of the Peruvian Andes, through the Kirghiz Steppe, and on to the tropical forests of Malaysia. Use an atlas to locate this seed belt. Research the climate and soil conditions of Peru and Turkey. Make an illustrated presentation to the class.

## Vavilov Centres



Source: *Genetic Conservation*. FAO Genetic Conservation Training Programme, Crop Ecology and Genetic Resources Unit, FAO, PI/F7460.

- Compare the new look of farming in Peru with the traditional ways. Display your points of comparison in a chart.
- The tomato is often thought of as a vegetable, but it is really a fruit. Using a library reference, find out what distinguishes fruits from vegetables.
- Hold a contest in class to grow the largest radishes. Use information from the program and from your own research to help determine the best growing strategies. Prepare a science project display of your results.
- Seed banks serve a vital role in preserving our agricultural heritage. In small groups work on an advertising campaign to heighten public and government awareness and to solicit support for the seed banks.
- Interview local farmers and gardeners to find growers who plant heirloom seeds in your community. Present your findings to the agriculture editor of your local newspaper for a feature article in a harvest edition at Thanksgiving on preserving local seed heritage. Find out which families bring native vegetables or fruits to their harvest feast.

## SENIOR HIGH — COLLEGE

- In 1970, 15% of the U.S. corn crop was lost to corn blight. In 1984, citrus canker virtually wiped out Florida's orange harvest. In small groups discuss ways in which these natural disasters could have been minimized or avoided.
- Examine the list of ingredients on the label of a ketchup bottle. Locate a recipe for making ketchup, and make your own. Compare the two ketchups by as many different standards as you can. Perform a consumer preference taste-test using several commercial brands of ketchup as well as your own. Write up a research report complete with conclusions and recommendations.
- Trace the historical foundations of plant genetics from Gregor Mendel's studies over 150 years ago on inheritance patterns in garden plants, to the present activities in plant genetics. Present your findings in a bulletin board display.
- Hold a formal debate on the topic: "Can we achieve an agriculture to feed the world without destroying it?"
- Interview local government officials at various levels to find out the legal controls and restrictions on the use of herbicides and pesticides in your immediate community and beyond. Check with environmental and ecological groups for their opinions on these regulations. Write up your findings in an editorial suitable for a local daily newspaper.
- Research the various theories of evolution. In what ways do mutation and natural selection affect changes in plants? Cite specific examples. Give an illustrated class talk to report your findings.
- In small groups discuss the profitability of biotechnology as applied to food crops.
- Role-play a scenario where the executives of a "Vegi-Snack" company are brainstorming to find new products and new markets for their existing products.

- Write an argumentative essay to answer the narrator's question: "Should the economics of the assembly line decide the nature of our food?"
- Plan a field trip to a farm that practices monoculture production. Discuss with the farmer the kind of machinery needed; the reason for the crop choice; the measures of protection against crop and economic loss. Write up your trip in a feature article for a local weekly newspaper.
- Investigate the effect of corporate monoculture farming upon:
  - the small, family farm
  - soil preservation practices
  - the level of debt of the individual farmer
  - government influence in farming
  - number of farm bankruptcies
  - consumption of agricultural chemicals
  - ground water pollution
- Invite a botanist from a nearby university, college or commercial laboratory to talk to the class about recent developments in plant biotechnology and agrigenetics.
- Hold an open class discussion on the use of such words as "advance," "achievement" and "progress" in reporting the developments of agricultural science.
- Read the novel, *THE DAY OF THE TRIFFIDS*, by John Wyndham, Ballantine, 1986. Give a book talk to the class, linking the themes of the novel to those of the film.

## QUOTATIONS FOR DISCUSSION

"From seed time to harvest, it's a constant battle to protect crops."

★ ★ ★

"We've engineered a new kind of agriculture."

★ ★ ★

"A single crop, often a single variety of seed, is dangerous uniformity."

★ ★ ★

"The farmer here is a manager with a well planned assembly line."

★ ★ ★

"Biotechnology offers great potential for profit."

★ ★ ★

"The healthy crop is bought at the expense of the environment."

★ ★ ★

"The crop is defenseless unless it is wrapped from seed to harvest in a petrochemical shield."

★ ★ ★

"The small farmer is being driven off the land."

★ ★ ★

"Technology is altering the face of the Earth to suit a new human purpose."

★ ★ ★

"Seed is our past and our future."



## ADDITIONAL RESOURCES

### BOOKS and ARTICLES

- ALTERED HARVEST. Jack Doyle. Viking Press: 1985
- CONSERVATION AND EVOLUTION. Frankel & Soule. Cambridge University Press: 1981
- CROPS AND MAN. Jack Harlin. American Society of Agronomy & The Crop Science Society of America: 1975.
- DOUBLE DIVIDEND? U.S. BIOTECHNOLOGY AND THIRD WORLD DEVELOPMENT. John Elkington. World Resources Institute, 1735 N.Y. Ave., NW, Washington, D.C. 20006.
- EXTINCTION: THE CAUSES AND CONSEQUENCES OF THE DISAPPEARANCE OF SPECIES. Paul and Anne Ehrlich. Random House: 1981.
- GENE BANKS AND THE WORLD'S FOOD. Don L. Plucknett, N.J.H. Smith, J.T. Williams, and N.M. Anishetty. Princeton University Press: 1987
- PLANT GENETIC RESOURCES: THE CONSERVATION IMPERATIVE. Christopher W. Yeatman, et al. Westview Press: 1985.
- RESEARCH THROUGH BIOTECHNOLOGY: INSTITUTIONAL IMPACTS AND SOCIETAL CONCERNS. (Bibliographies in Technology and Social Change Series, No. 1) Brian J. Reichel, William F. Woodman, and Mark C. Shelley. Iowa State University Research Foundation: 1987.
- SEEDS AND SOVEREIGNTY. Jack Kloppenberg. Duke University Press: 1988.
- THE 1985 SEEDS CONFERENCE PROCEEDINGS. Vicky Congdon, ed. The National Gardening Association: 1987.
- SEED AND NURSERY DIRECTORY. Cary Fowler and Elaine Chiosso. The Graham Center, Rural Advancement Fund: 1983.

- SEEDS OF THE EARTH: A PUBLIC OR PRIVATE RESOURCE?** Pat R. Mooney. Inter Pares, Canadian Council for International Cooperation and the International Coalition for Development Action: 1979.
- TECHNOLOGIES TO MAINTAIN BIOLOGICAL DIVERSITY.** Office of Technology Assessment. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
- THE USE OF PLANT GENETIC RESOURCES.** A.H.D. Brown, O.H. Frankel, D.R. Marshall, and J.J. Williams (eds.) Cambridge University Press: 1987.
- THE VALUE OF CONSERVING GENETIC RESOURCES.** Margery L. Oldfield. National Park Service, Superintendent of Documents, Washington, D.C.: 1984.
- Conservation of Traditional Agroecosystems.** M.L. Oldfield and J.B. Alcorn. *BIOSCIENCE*, Vol. 37, no. 3, March 1987, pp. 199-208.
- Current Status of Crop Plant Germplasm.** Dr. Garrison Wilkes. *CRITICAL REVIEWS*, Vol. 1, Issue 2: 1983.
- Jack Doyle: A Warning Voice Amid the Biogenetic Revolution.** W. Sinclair. *THE WASHINGTON POST*, March 2, 1987, p. A9.
- The Law of the Seed.** P.R. Mooney. *DEVELOPMENT DIALOGUE*. Dag Hammarskjold Press: 1985.
- Preserving the Stuff of Life.** S. Berberich. *ATRICULTURAL RESEARCH*, April 1987, pp. 6-9.
- Rescuing America's Seed: Preservationists Cultivate a Movement.** W. Sinclair. *THE WASHINGTON POST*, March 16, 1987, p. A4.
- SOS - Save Our Seeds!** L. Ponte. *READER'S DIGEST*, July 1987, pp. 118-122.

## GROUPS AND RESOURCES

- DESERT BOTANICAL GARDEN, 1201 N. Galvin Parkway, Phoenix, AZ 85008 Dr. Gary Nabhan
- DIVERSITY, a quarterly news journal for the plant genetic resources community published by Genetic Resources Communications Systems, Inc., 727 8th St., SE, Washington, D.C. 20003
- ENVIRONMENTAL POLICY INSTITUTE, 317 Pennsylvania Ave., SE, Washington, D.C. 20003 Jack Doyle, Director, Biotechnology Project
- INSTITUTE FOR FOOD AND DEVELOPMENT POLICY, 149 9th St., San Francisco, CA 94103
- THE KEYSTONE CENTER, Box 606, Keystone, CO 80435 The Keystone Biological Diversity and Germplasm Project, Science and Public Policy Program, Abby P. Dilley, Coordinator
- NATIONAL ACADEMY OF SCIENCES, JH 550, 2101 Constitution Ave., Washington, D.C. 20418 Michael Strauss, Board on Agriculture
- NATIONAL AUDUBON SOCIETY, 950 Third Avenue, New York, N.Y. 10022 Maureen Hinkle, Director, Agricultural Policy
- NATIONAL GARDENING ASSOCIATION, 180 Flynn Ave., Burlington, VT 05401
- NATIONAL SEED STORAGE LABORATORY, USDA - ARS, Colorado State University, Fort Collins, CO 80523 Dr. Steve Eberhart, Director
- NATIONAL WILDLIFE FEDERATION, 1412 16th St., NW, Washington, D.C. 20036 Margaret Mellon, Biotechnology Project
- RURAL ADVANCEMENT FUND, P.O. Box 1029, 101 E. Salisbury St., Pittsboro, NC 27312 Cary Fowler, Program Director
- SEED SAVERS EXCHANGE, Route 3, Box 239, Decorah, IA 52101 Kent Whealy, Director
- TECHNOLOGY AND SOCIAL CHANGE PROGRAM, Iowa State University, 318 Curtiss Hall, Ames, IA 50011 Dr. D. Michael Warren, Director

## RELATED BULLFROG FILMS

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### GENETICS

#### **THE LAST CHANCE** 28 minutes

**CINE Golden Eagle Winner.** The National Zoo's endangered species project at the research station in Front Royal, Virginia, presents a positive course of action.

#### **LIGHTS BREAKING** 59 minutes

**Best Science and Technology Film, San Francisco International Film Festival.** Brings together three world-class scientists, a poet, a theologian and an ordinary citizen to discuss the ethical and practical concerns raised by recent technological breakthroughs in genetic engineering.

#### **THE NORTHERN ELEPHANT SEAL** 15 minutes

After a dramatic recovery of a formerly endangered species, the Northern Elephant Seal is still living on the edge of extinction because of the species' lack of genetic diversity.

### AGRICULTURE

#### **CIRCLE OF PLENTY** 27 minutes

Biointensive agriculture, producing the maximum amount of food from a small plot using the minimum amount of energy inputs and water, offers hope for solving part of the world hunger problem.

#### **ON AMERICAN SOIL** 28 minutes

**CINE Golden Eagle.** Explores the nature and extent of soil erosion and American agriculture from The Conservation Foundation.

#### **POTATOES** 28 minutes

Like most small farmers, potato growers are in an economic squeeze—expensive machinery, chemicals and debt on one hand, and low prices for their product on the other. Food processing corporations gain control of the potato market and replace family farmers.

#### **A SENSE OF HUMUS** 28 minutes

In this well-made film, organic farmers outline the arguments for (and contest those against) an agriculture based on ecological principles.