Spray planes are seldom heard these days over the fields of the Canete Valley in Peru. The farmers are getting bigger harvests than ever before ... and they are using a minimum of chemical pesticides.

The growers of cotton, maize, beans and sweet potatoes in this Peruvian valley have now learned to live with pests ... and to control them.

But that was not always so.

In 1948, there was a severe pest infestation ... coinciding with the availability of the popular insecticide, DDT. The Canete Valley farmers spread a blanket of DDT over the valley ... with miraculous results. The cotton crop, for instance, nearly doubled.
The DDT destroyed the pest insects in the fields ... but it also killed the natural enemies of the pests which helped keep them in check.

In time, some of the pests became resistant to DDT ... and new pests emerged because they had no natural enemies. So, spraying was increased and new chemical pesticides were introduced ... until economic disaster struck again ... eight years after the start of DDT spraying, the Canete Valley harvest dropped to a new low.

CAMPOS-GALVEZ
ON CAMERA

ROBERTO CAMPOS-GALVEZ: (In Spanish-English VO)
The cotton crop of the Canete Valley suffered a catastrophe several years ago because of the indiscriminate use of chlorinated and phosphate insecticides.

As a consequence, the beneficial animal life completely disappeared from the fields, to such an extent that even the frogs were gone. Almost all of the insects could be found in greater numbers in the village than in the fields.

This happened approximately between the years 1950 and 1956 or 57. Then, at the suggestion of the experimental station of the Canete Valley, regulations were created for the use of these insecticides, and permits were required for the application of this type of organic insecticide.

EXPERIMENTAL STATION
INTERIOR

In addition, the station began breeding trichogramma wasps, which parasitize lepidoptera pests.
NARRATOR:

In the research lab, wasps and other natural enemies of the cotton pests are raised. They will be released in the fields where they will feed on the eggs and larvae of the pests ... thereby controlling the pest population biologically.

GERMAN DELGADO-SISNEGAS
ON CAMERA

The scientists at the experimental station keep a careful check on the balance of pest and parasite in the fields.

DELGADO-SISNEGAS (In Spanish-English VO)

Here in the Canete Valley, we always monitor pests in relation to their natural enemies.

We never recommend the application of organic pesticides because this contaminates the environment, creates resistance to insecticides in the pests, and starts new pest populations from insects already in the fields. In the specific case of cotton, we work 100% with biological control.

By releasing and cultivating parasites in the fields, farmers help to restore the natural enemies of the cotton pests throughout the whole growing cycle of the plant.

NARRATOR:

The use of natural enemies is only one part of an overall "integrated control" plan for the Valley. The plan includes other changes.
in agricultural practices ... such as planting dates, plowing methods, instituting fallow periods, alternating crops in which pest and natural enemies thrive, and a return to old-fashioned pesticides such as arsenic and nicotine sulphate. These are applied with care at that period in the crop's growing cycle when minimum amounts bring maximum results.

(MUSIC)

The results of the Canete Valley "integrated control" program have been rapid and striking. The first year brought harvests up to a satisfactory level ... and they have increased ever since ... to become the highest in the history of the region. The success of these Peruvian farmers in moving from total reliance on chemical pesticides to a system based on ecological balance has become a classic story of pest control.

On the campus of the University of California at Berkeley, research has been going on for a number of years to develop practices of pest control that are consistent with ecological principles.
In university laboratories, specialists in entomology, parasitology and agriculture search for ways to manage pests which will not disrupt the environmental balance.

They never aim at elimination of a pest species. The objective is to control pest populations so that crop destruction is limited.

Pesticides are one important tool — but there are others.

PINNOCK:
This is an oak tree that has been defoliated by tent caterpillars. And here is an example of one of the caterpillars that caused the devastation.

This entire area, several square miles, has been totally defoliated by this particular insect.

Insect pathologist, Dudley Pinnock and his students are surveying an experimental plot of California oak where bacterium is used to fight tree-destroying tent caterpillars.

The bacteria spraying kills only the caterpillars; other insects ... birds ... and mammals ... are
unharmed. The bacterium called bacillus thuringiensis, is made commercially and already is being used on a wide range of crops and trees. This method of control is now being considered as a potential weapon against the Gypsy Moth, whose devastation is spreading westward from the forested areas of the New England states.

In an experimental area beside a California freeway, students staple bits of tissue paper covered with insect eggs to acacia trees.

Spraying had failed to stop the spread of the psyllid pest to neighboring citrus groves ... and the California Highway Department turned to the University for help.

University entomologists went as far as Australia to find natural enemies of the flea-sized psyllid pests which draw the sap out of the acacia leaves.

The harmless Australian lacewing keeps down the pest population as it searches the acacia leaves for psyllid eggs, nymphs and adults to
devour. The habits of both the lacewing and the Australian ladybug were carefully studied before their release, to be sure that they would attack and feed on only the pest -- without upsetting the balance of other insect life.

Timber pines are an important resource in the northwestern United States ... but beetleless which gnaw invisibly beneath the bark of the pines kill many of these beautiful and commercially valuable trees.

Biological technician, Paul Tilden, is in charge of a forest service research station in the California mountains.

TILDEN:
On the underside of the bark, you can see the egg galleries constructed by the female bark beetles. The adults bore in, construct their galleries on the under side of the bark, the female lays her eggs along here, the larvae bore out and live in the bark where they develop, and then they in turn bore out of the bark as adults and fly on to attack green trees.

NARRATOR:
A sex attractant ... with an odor resembling a bark beetle's scent ... is being tested at a University of California laboratory.
The greater the rush of beetles toward the
target, the closer the man-made sex attractant
in the vial resembles the beetles' own pheromone
excretion.

Although they are not yet commercially produced,
synthesized insect pheromones may one day serve
to trap -- and thereby help control -- insects
like the bark beetle.

And other work is in progress behind the
University walls ... research in new pesticides,
studies in the use of viruses and fungi, and
still more "integrated control" approaches --
all aimed at maintaining the balance of nature.

SMITH:
For many years we have taught farmers to
have an absolutely clean field or a clean
orchard, and as a result, he wants to see
no insects in his field.

In integrated control, we want to have
insects, the pest insects, present in the
field because it is necessary to have the
pest present if there is going to be food
for their natural enemies.

Our goal is to keep the level of the pest
insects low enough so there is no economic
damage.

In those integrated control programmes that
we've had the most experience so far, the
level of pesticide use has dropped. There
are several reasons for this, but the main
One is that pesticides are not used according to a rigorous schedule but are applied just in those places and at those times where the pesticide is needed, based on a population count.

Narrator:

Pesticides are no longer needed in the vineyards of grape grower Dick Chooljian. With the help of farm advisor, Curtis Lynn, Chooljian keeps the destructive grape leaf hopper in check by natural means.

Lynn:
Hopefully you can again go through the season without treating. I think this is your fifth year now that you haven't...

Chooljian:
Actually six years. I have had five years of successful non-treatment.

There are chemicals to treat for hoppers and your spider mites come in, and they raise havoc, so if a person can get by without treating at all, it's the best.

Lynn:
Well, the egg parasite which controls the hoppers mostly for you -- it is probably 10 or 15 miles to the north and east where they must come from, along the rivers and natural streams, usually in July.

Chooljian:
In July, usually we see these little red eggs on the leaves and then we know that we are getting this help from the natural predators.
LYNN:
We have set levels of something about 15 leaf hoppers per leaf, in other words, if we were to take a leaf in July, a couple of months from now and count the small hoppers, if we had 15 or more we might want to treat, and it seems every year in the last five years you always get about 15 and you worry but so far it has worked out.

CHOOLJIAN:
It seems that if the vines are strong and we just have a little patience, it seems like these predators take over and we have this natural control again.

(MUSIC)

NARRATOR:
There is progress being made in the search for pest management methods to reduce the need for chemical insecticides in agriculture.

But there is less progress in devising new ways to fight disease-carrying insects.

INSPECTOR ON BICYCLE
On the island of Ceylon, the population has known malaria for centuries. It not only kills — it so weakens survivors that they easily become the victims of other illness. During the latest epidemic, in 1967, one person in every six suffered from this mosquito-borne disease.
Ceylon is a land where bicycles are a common mode of transportation. Homes are scattered among the tea, rubber and cocoanut plantations — so regional health inspectors do not find it easy to locate the sick and the disease carriers of the country.

In a cluster of houses near the village of Gokarelle, this inspector found a child who was running a high fever ... probably malaria. For the time being, the inspector can only help by giving the child drugs to combat the high temperature — only a blood smear will tell for us if malaria has struck this home.

The child's blood smear is one of hundreds received every day at the National Malaria Eradication Center ... which is trying to locate every victim and carrier of malaria in the country.

The Center is researching genetic and biological control methods ... but so far Ceylon's health officials find no substitute for DDT spraying as the most effective way of combating the disease.
It was a regular feature in this country, when the disease was prevalent, unchecked and before the use of DDT, for people to die in thousands. The number is so high that actually the accurate records were not kept.

The biggest epidemic occurred in 1934-1935, when about 80,000 people died within about two and a half to three million people of the population of 5 1/2 million at that time suffered from the disease and even afterwards every three to five years there were epidemics and thousands of people died from Malaria.

(MUSIC)

NARRATOR:

The use of DDT and other persistent organic insecticides during the last 25 years nearly eliminated epidemics of insect-borne diseases such as typhus fever, yellow fever and plague.

DDT spraying began in Ceylon soon after World War II -- and by 1963, endemic malaria had virtually disappeared from the island -- so the DDT spraying programme was stopped.

The mosquito eradication programme had brought other benefits to Ceylon's fast-growing population.
It opened up to farming large tracts of land which formerly were uninhabitable because of the disease. In one district, over 200 square miles were irrigated and then settled by previously landless farmers.

After the seemingly miraculous elimination of malaria, the eradication programme was maintained of a surveillance basis only -- with tragic results.

The premature halt in DDT spraying -- combined with weather conditions and administrative problems -- to bring about a rapid upswing in malaria cases from 1967 onward. To stem the new epidemic, DDT spraying had to be reinstituted on a large scale.

**BRUCE-CHWATT:**
DDT may be a luxury for rich countries, it is an absolute need, an imperative need, for those developing countries that want to get rid of malaria and other insect-born diseases.

And I want to stress the problem of cheapness and economy of DDT.

In developing countries you can afford using only an insecticide the price of which will be commensurate with the amount of money that the government and the United Nations agencies are prepared to spend and at the present time there is no substitute for DDT.
There are other insecticides that have been developed and the WHO has been testing at least 1,500 candidate insecticides that could perhaps be used instead of DDT, and out of this very excellent programme of testing not more than about 3 or 4 insecticides emerged. Even those that are emerged and that are bio-degradable, which means that they disappear from nature quicker than DDT, cannot be used in developing countries because they are very much more expensive.

NARRATOR:
The controversy over whether DDT should be banned internationally is a complex one -- as these malaria victims attest. In some nations, such as Sweden and the United States, DDT is being banned for most uses. Disease-ridden countries such as Ceylon fear that such bans might result in cutting off their supply of DDT.

There is also concern that resistance to DDT will develop in malaria-carrying mosquitoes -- as happened with the cotton pests of the Canete Valley.

The presence of DDT in the environment during the last quarter century has produced two especially serious effects ... contamination of fish in streams, lakes and coastal waters ...
and impairment in the reproduction of certain predatory birds.

Supporters of Ceylon's DDT programme argue that it is environmentally sound because only interior walls of dwellings are sprayed -- for it is on these walls that the female mosquito rests after taking blood from a malaria victim, but before transmitting the malaria parasite to a healthy person. Since only interiors are sprayed, the pesticide is not spread indiscriminately over the land where it can contaminate water systems or come in contact with wildlife.

BORIAUG:
I am against a ban on any sort of a product.

Better to have realistic regulations to control the application and use, but ban is a word that I'm against.

Insecticides should be used and fungicides, seed disinfectants, should be used wisely. It is no different than medicine. Medicine properly prescribed by a doctor and properly administered will cure a person of disease or at least alleviate one from suffering. Whereas if they are improperly used, of course, they can make you more ill or even cause death. And so it is with all of these agricultural chemicals.

BROWER:
Yes, I am very much in favor of banning these persistent hydrocarbons and the pesticides, primarily because we don't
really know what they are doing to the environment. We are just into the mystery of it all. We know a few of the side effects, but we seem to be very slow about learning what the overall effects are.

I think we have got to hear in mind that a side effect is a result we don't want, the existence of which we deny as long as possible. That's the problem we are up against with the pesticides industry.

**KAPIAN:**
But I think that we have to look at the overall picture in this. When I am saying to use DDT, I am saying to use it under very carefully prescribed circumstances. We say it is not a thing to be spread around indiscriminately. If there are substitutes for crops, certainly, use the substitutes. What we are saying, in the World Health Organization, is DDT, as used for malaria control, namely, to spray the walls of the dwellings of people that can be exposed to malaria and that can be carriers of it, if used in the correct way, then we have no evidence whatsoever, and we have a lot of evidence in the other direction, that no harm will come not only to the human beings, but actually, to the surrounding environment.

**BROWER:**
What we don't know, of course, is the end result of leaving something in the environment that keeps persisting, gets collected by minor forms of wild life and concentrated and concentrated until, instead of having it diluted throughout the world's bio-systems, we find it back on our tables. It is on the tables really of other living things and we don't know what its doing to them. We have only begun to have enough experimentation.

So I think that the burden of proof has got to be on the people who want to sell all of this material. They have got to try to something else, something better, something safer in the long run.
BORLAUG ON CAMERA

BORLAUG:
The situation in the developed nations such as the U.S.A., Canada, Western Europe, is entirely different than what it is in the developing nations. In the affluent, or developed nations, food is taken for granted, it's automatic, it comes out of the supermarket as everyone knows. They have no feel for the problems of the land, of the farmer, of the lumberman, timberman, and the rancher, and it's understandable.

In the developing nations, 80% of the people live on the land in a subsistence agriculture. The agriculture is very inefficient. Now what seems to me to be very unjust, is for the people in the privileged nations, the affluent, developed nations to project their thinking on the developing nations and say, "do as we say", when they are already very underprivileged people, short of food, parasitized by all sorts of diseases such as malaria. I think it's immoral to use this kind of an approach.

KAPIAN ON CAMERA

KAPIAN:
A developed country that is wealthy can afford, for example, not to take any chances whatsoever on any chemical, whereas, in a poorer country, it may be very essential for the industrial development of that country, to use a certain chemical. And it is up to them to judge on the basis of the laboratory tests that they know whether a risk is worth taking, and to the extent that risk is worth taking.

I think that the public alarm about DDT from Rachel Carson's book onward, has had a very salutary effect, a beneficial effect, in many ways. DDT was used far too indiscriminately before.

So I'm all for any questioning, any public questioning, and I think that this first alarm allowed a real scientific examination of the pros and cons.