



PARAQUAT

I N P E R S P E C T I V E

PARAQUAT + PLUS

CUSA-00019356

PARAQUAT in PERSPECTIVE

Paraquat is an agricultural herbicide discovered by Imperial Chemical Industries PLC (ICI) in the late 1950s and marketed in the United States by Chevron Chemical Company since 1966.

In the past few years, many Americans have become aware of Paraquat, not because of its essential role on the farm, but because the U.S. and foreign governments have used it to destroy illegally grown marijuana crops in their countries. The result is a heightened awareness of the herbicide by the non-farm public and a fear that Paraquat-contaminated marijuana could pose health hazards to those who smoked or ingested the substance.

Although there have been no cases of injury to humans by the smoking of Paraquat-treated marijuana, the fear of damage remains. And with each new development in the government's effort to control the illegally grown substance comes another wave of adverse and misleading media attention about Paraquat. The facts are these:

- **There have been no cases of poisoning resulting from the proper agricultural use of Paraquat;**

- Paraquat is one of the most commonly used and versatile herbicides on the market today. It is used annually on 10 to 12 million acres of U.S. cropland and in more than 100 countries around the world;
- It is an environmentally sound product and does not adversely affect health when used in accordance with label directions;
- It is a restricted use herbicide in the United States and must be applied by trained and licensed applicators or persons under their direct supervision;
- Paraquat use on the farm can actually improve the environment when used in soil-saving, conservation-tillage programs. At the same time, it enables farmers to conserve energy, time, labor and capital.

Whether or not the U.S. or other governments decide to use Paraquat to eradicate marijuana obscures the basic question of its originally intended use on the farm. It is this broader question of environmental and health risks of Paraquat in the agricultural community, measured against benefits, that this booklet will address.

Information for this brochure was provided by The United States Department of Agriculture, the United States Bureau of Health Statistics, The Soil Conservation Service, the National Agricultural Chemicals Association and other sources. It is based on the best scientific evidence available in July, 1984. Since scientific research is always continuing, be sure to refer to the most current information and label available. Always use products strictly in accordance with

label danger statements and directions and with applicable state and federal regulations. If you have further questions about Paraquat, write to:

Manager Public Affairs
Chevron Chemical Company
575 Market Street
San Francisco, CA 94105

RISKS vs. BENEFITS

The benefits of introducing any chemical compound into an organism or the environment—to increase agricultural production, to improve health, or for any other reason—cannot logically or sensibly be discussed without also looking at potential risks involved with its use.

In daily life, drugs such as aspirin are regularly taken to ease relatively minor pain. In addition to this beneficial effect of aspirin, it is



Few products we use every day, even common household cleaners and polishes, are completely risk free.



Farm chemicals—like all potentially dangerous products—must be used carefully and in accordance with label directions.

fairly clear that this drug can also injure certain elements in our blood.

Doctors acknowledge that virtually all drugs, even vitamins or other painkillers, can cause adverse reactions. The point is, few, if any, beneficial products are completely risk free.

In the case of Paraquat, there are potential risks involved with its use. Paraquat is highly toxic. If, through careless use, there is prolonged or repeated skin contact with Paraquat, the risk of absorption and poisoning is increased. Paraquat is only slowly absorbed through the skin so that incidental

Product Stewardship

Paraquat is highly toxic, and swallowing even a small amount of the concentrated product can result in death if the individual does not receive prompt, proper medical treatment.

For that reason, Chevron Chemical Company, ICI and selected formulators who sell the herbicide under Chevron's trade name, Paraquat + Plus, have taken a number of steps to protect users and the public from potential health and safety risks. These are:

- A clearly marked label lists precautionary statements and worker safety rules. It also warns in very strong language the dangers that can result by applicator misuse of the product.
- Paraquat + Plus is packaged in plastic containers to protect against breakage and is topped with a child-resistant overcap.
- Paraquat + Plus is now formulated with a distinctive odor and an emetic (to induce vomiting) in case the product is swallowed.
- As a result of a proposal by Chevron to the Environmental Protection Agency (EPA), Paraquat + Plus can be legally purchased only



by licensed pesticide applicators or persons under their direct supervision who are certified as having received training in the safe use and handling of agricultural pesticides.

- Based on information from poisonings and from medical research, an effective treatment for Paraquat poisoning has been developed. Treatment must be carried out promptly and requires hospitalization. In order to provide information on this treatment to those who need it, Chevron has established an Emergency Information Center telephone number, (415) 233-3737, that is listed on the product label and can be called day or night. A toxicologist will give an assessment of the exposure to Paraquat, first aid, toxicology and medical treatment

recommendations. Arrangements can also be made for free analysis of the patient's urine and blood for Paraquat. The toxicologist and attending physician maintain daily consultation during the course of the poisoning with regard to Paraquat blood levels and the patient's medical management.

contact with label-recommended dilutions has not been associated with systemic injury. The effect of swallowing Paraquat, however, is far more severe than that which usually results from skin contact or from inhalation. Swallowing even a small amount of the concentrated product can cause prolonged suffering and death.

However, since Paraquat was introduced in the U.S. in 1966, no poisonings or deaths have occurred as a result of its use in the recommended manner.

Although there have been deaths resulting from the swallowing of concentrated Paraquat, more than 90 percent of these were suicides. The few other poisonings were the tragic result of accidents caused by complete disregard of the

explicit directions on the label.

Poisonings have occurred, for instance, when an unsuspecting adult or child has swallowed Paraquat from a soda bottle or other inappropriate container that had been used for measuring or mixing.

According to the U.S. Bureau of Health Statistics, in 1980, 20 people died from household insecticides; 40 as a result of penicillin injections; 87 from antibiotics in general; and 212 from cleaners, polishes, petroleum products and other poisons regularly found around the house.

In fact, approximately six times more Americans died in one year from these common products than from Paraquat in the 18 years it has been used in the U.S.

PARAQUAT'S ESSENTIAL ROLE in AGRICULTURE

There is a revolution taking place on America's farms today. Though largely unrecognized by the urban public, it represents nearly as dramatic a change in the way farmers grow crops as did the adoption of tractors early in this century. Welcomed by farmers, heralded by agricultural scientists and endorsed by soil conservationists, it is the trend toward less and less field tillage. For thousands of farmers, the revolution means the elimination of tillage altogether—or no-till farming.

The trend began two decades ago and has been increasing dramatically since. The USDA

estimates that by the year 2000, 90 percent of all cropland will be farmed with some form of conservation tillage, and no-till acreage is projected to double. By 2010, more than half of all cropland will be no-tilled.

More than any other factor, it was the development of modern herbicides that made reduced tillage farming possible, and it was the development of Paraquat in particular that made no-tillage farming possible. Paraquat became known as the chemical foundation of no-till farming and was dubbed "the plow in a jug," because weed control was made possible without turning up the soil with a plow.



The wheat stubble left in no-till fields conserves moisture and prevents the soil from being washed away by the wind or heavy

rainfall. Moisture-holding plant residue from the previous crop is left on the surface, which benefits the emerging soybean crop.



No-till farming saves time, allowing farmers to harvest two crops in one year. Here, soybeans are being planted into undisturbed

soil directly behind the wheat combine. Paraquat is being applied at the same time, so the new crop can emerge in a weed-free environment.

Saving Soil

Soil conservation is probably the number one reason farmers are parking their plows. Of the roughly 413 million acres of land that are cropped intensively in this country, at least one-fourth are experiencing soil loss that is excessive, according to the Soil Conservation Services (SCS). In many

areas, there is an average of 15 to 20 tons loss per acre per year. Where losses run 10 tons per acre, one-fifteenth inch of topsoil is lost every year. In 15 years, an inch is lost.

To environmentalists, these losses represent damaged habitats that protect wildlife, vanishing

prairie land and destruction of other scenic and recreational areas.

To farmers, soil erosion and economic loss are synonymous. Fertilizer and pesticides are washed away with eroded soil and must be replaced, and yield drops of three bushels per acre or more can be expected for every inch of Corn Belt topsoil that is lost. Worse yet, an estimated 1.25 million acres of U.S. cropland are taken out of production each year as a result of soil erosion.

Excessive tillage and poor tillage practices are the primary causes of soil erosion. When

farmers reduce tillage, they reduce erosion; when they eliminate tillage, they can virtually stop erosion dead in its tracks. The SCS says no-till farming can cut erosion and water runoff 95 percent or more.

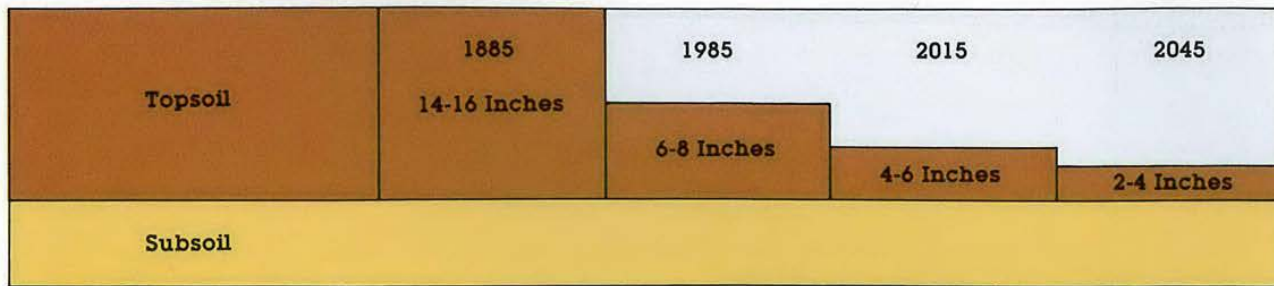


Farmers can cut fuel consumption dramatically using no-tillage techniques.

Saving Oil:

A reduction in fuel consumption is another direct benefit of no-till farming. Most experts agree that it takes less than one gallon of fuel per acre to plant and spray a no-till crop, whereas a full-tillage program will require approximately nine gallons per acre for soil preparation and planting. Herbicides such as Paraquat make this dramatic energy saving possible.

No-tillage not only saves farmers fuel costs, but cuts the nation's diesel and gasoline consumption by approximately 80 million gallons per year.



Unprotected topsoil is being washed away at the rate of 15 to 20 tons per acre per year in some farming areas. Even a

10 tons per acre loss per year will remove an inch of topsoil in only 15 years.

Saving Toil:

Farming is one of the most heavily capitalized of all businesses. Hundreds of thousands of dollars worth of land, equipment and supplies are needed to produce food and fiber on even average-sized farms; larger operations require millions of dollars of assets.

Despite this huge investment, a farmer's greatest asset is his own management skills, for without them, the biggest tractors and the most productive land would be useless.

Until the adoption of no-tillage practices, farmers were prisoners of their tractors, serving hundreds of hours per season plowing, disking, chiseling, planting and cultivating their fields. No-tillage has commuted their sentences. An often-quoted rule-of-thumb estimate is that no-till farming reduces time spent on a tractor by 50 percent. It can also reduce the need, and therefore the expense and overhead, of numerous tractors and large tillage tools.

In terms of hard, cold cash, no-tillage serves up a number of economic benefits. A study conducted by the Agricultural Extension Service in Tennessee figures production costs for no-tilling corn and soybeans are about \$17 per acre less than conventional tillage, due mainly to reduced equipment and labor costs. Similar studies throughout the country are consistent with the Tennessee findings.

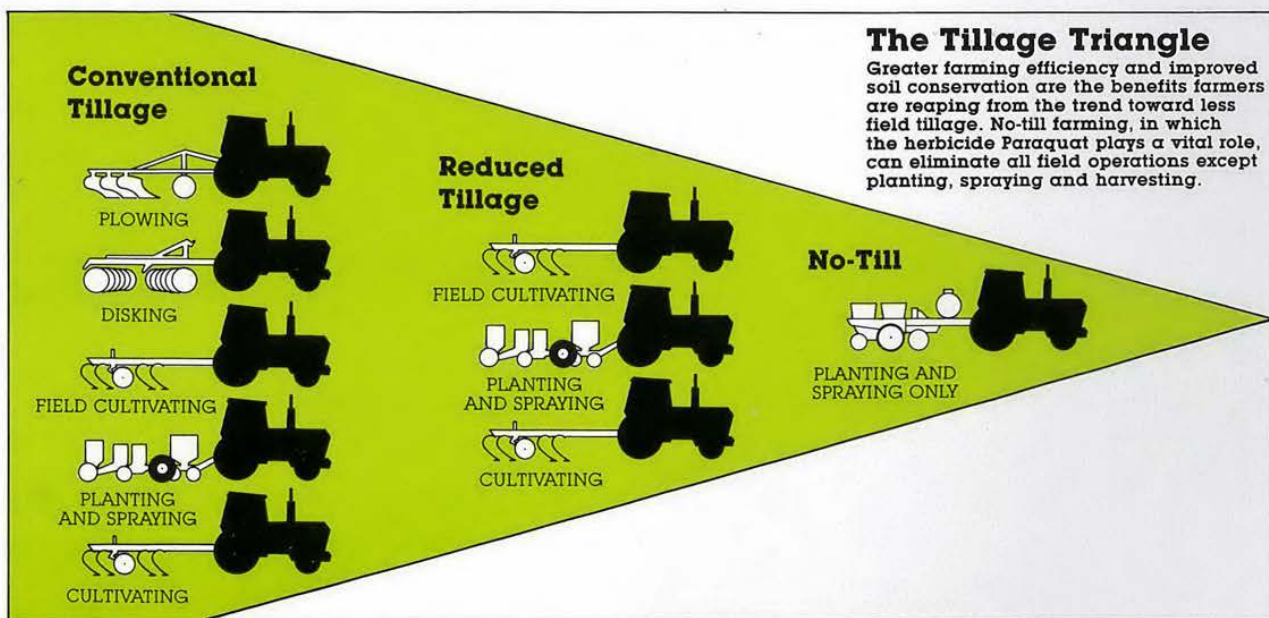
No-till farming is but one example of how herbicides such as Paraquat are being used by American farmers. There have also been immense



Conventional plowing, disking and cultivating can double the time a farmer must spend on the tractor compared with no-till systems.

benefits worldwide from its use. Paraquat is probably used on a broader range of crops and in more countries than any other pesticide. Millions of farmers are becoming aware that Paraquat can increase yields while reducing production costs and erosion.

These are vivid examples of the benefits side of the herbicide question. It is this side that the non-farming public should weigh against potential risks when evaluating the worth of these products in our society.



A FLEXIBLE FARM TOOL

Paraquat has been used on more than 90 million acres of U.S. crops since its introduction in 1966, and dozens of different crops benefit in some way from its use.



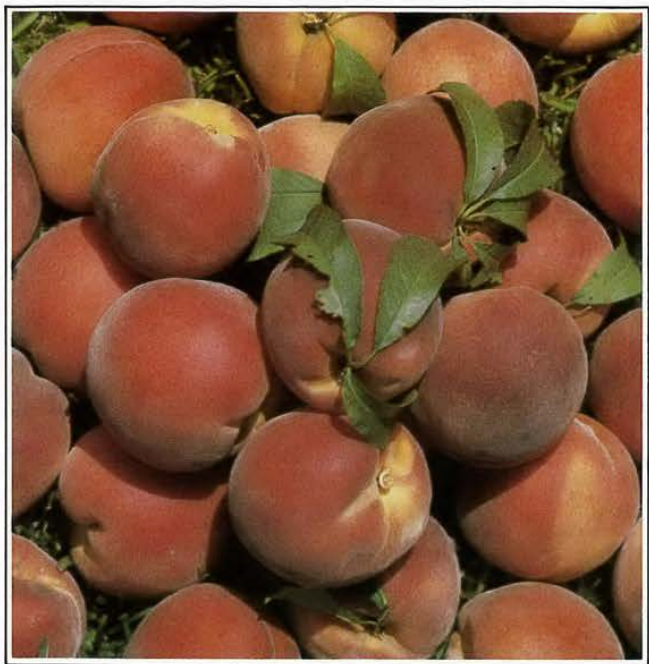
Doublecropping

Growing two crops in one season allows farmers to double the productivity of their land. But to allow the second crop time to mature before frost, farmers can waste no time between harvesting the first crop and planting the second. Herbicides such as Paraquat allow them to eliminate time-consuming tillage steps. And by not disturbing the soil with tillage, they are conserving valuable moisture that the second crop will need to germinate and grow.



Cover Crop Farming

No-tillers don't always plant into the stubble of the previous year's crop. Often they will plant a cover crop of rye or a legume to protect soil from erosion during the winter. Just before or immediately after planting in the spring, the cover crop is burned back with Paraquat, allowing the new crop to emerge in a clean field.



Harvest Aid

A special, and in some cases unique, Paraquat use is as a harvest aid. Harvest aid can mean many things, depending on the crop, but the end result is the same: crops can be harvested faster, easier or more economically.

Paraquat's usefulness extends beyond farmers' cropland. In noncrop areas, it is also used to burn back unsightly weeds and grasses around buildings and industrial sites.



Vineyards and Orchards

Paraquat is also widely used in weed control programs in orchards and vineyards because it can be sprayed near woody trunks of trees and vines without damage to the plant or uptake by roots. Controlling moisture-robbing weeds in orchards and vineyards makes harvesting easier and increases the amount of water available to the crop—an especially important benefit in irrigated areas.

PARAQUAT and the ENVIRONMENT



The use of Paraquat on American farms has improved the environment rather than harmed it. This is a difficult concept to be grasped by those outside the agricultural community, but that is exactly the case when Paraquat is used in a no-tillage or reduced tillage farming program.

The major environmental pollution problem attributable to agriculture is soil erosion. When soil washes into waterways, it creates silting problems and also carries with it chemicals and fertilizers applied to the land. When Paraquat is used in a no-till situation, erosion, and the subsequent pollution problems, are reduced dramatically.

To get a better understanding of Paraquat's relationship with the environment, let's take a look at what it is and how it works.

Paraquat is a nonselective contact herbicide that kills vegetation when it comes in contact with green plant tissue. It is absorbed rapidly by plant cells where it interacts with the photosynthetic process. This causes the plant cells to collapse, and the plant dies.

Paraquat reaching the ground is bound to clay particles in the soil within minutes and is biologically inactivated; that is, it no longer has any activity on plants, the soil, or other organisms. In the longer-term, it is slowly decomposed in the soil. It is possible that Paraquat that is bound to the soil could be washed into streams or ponds. But it would be biologically inert, tightly bound to clay particles or bottom mud. It is this characteristic, in fact, that makes Paraquat valuable to agriculture—

the ability to kill weeds quickly without leaving soil residues that will harm succeeding crops.

There is a wide margin between the amounts of Paraquat that will be applied and the soil's ability to deactivate the chemical through binding and decomposition.

Paraquat spray droplets that are allowed to drift during application will burn any green plant tissue that is contacted. Proper application, which is the responsibility of trained, licensed operators, will control drift and reduce any potential hazard to animals or nontarget plant life.

Earthworms and other beneficial soil organisms are not adversely affected by Paraquat, even in trials where it was applied at 100 pounds per acre. Paraquat residues do not accumulate in earthworms or other organisms. In fact, earthworms seem to increase in Paraquat-treated, no-till fields. The increase is not due to Paraquat. Instead, populations grow because tillage operations—which do disturb habitats of soil organisms—are not used in no-tillage systems.

Similarly, habitats are enhanced for pheasant, deer, quail and other wildlife, because corn stalks or other protective crop residues are left standing in the field after harvest. In conventional systems, where ground is plowed or disked, this residue is buried, resulting in the destruction of nesting sites and wildlife shelters.

Paraquat is water soluble and does not accumulate in the body. Fish, birds and mammals excrete residues very quickly. The degradation products of Paraquat are noncumulative and are further degraded in the environment.

PESTICIDES and the PRICE OF FOOD and FIBER

There is no shortage of facts and figures to back up the contention that agricultural chemicals are vital to feed the world.

The National Agricultural Chemicals Association says the price of food would increase from 50 to 75 percent without the use of agricultural chemicals. Without them, the world food supply would drop as much as 40 percent, according to the United States Department of Agriculture. And crops such as fruits and vegetables could not be produced in commercial quantities. Even with pesticide use, the USDA estimates that billions of dollars worth of food and fiber are lost each year to insects, weeds and diseases.

What do these rather mind-boggling figures mean to the average consumer? Precisely this: Without pesticide use, a \$1.29 box of breakfast cereal could cost \$1.83 to \$2.25; a 59¢ can of green beans, 88¢ to \$1.03; and a 35¢ bag of potato chips could cost 52¢ to 61¢.

To bring the point home to consumers, an

Arizona cotton grower, working with his local Farm Bureau and the Arizona Agricultural Chemicals Association, grew side-by-side, three-acre plots of cotton in 1982. The plots were similar, except one was treated conventionally, using normal rates of chemical fertilizers and pesticides; the other was left untreated.

The untreated cotton produced 1.38 bales per acre, compared with 2.22 bales per acre on the chemically treated plots.

After figuring yield increases and extra production costs for the treated plots (61 percent and 55 percent, respectively), and basing income on a good cotton market price of 83¢ per pound, the grower figures the treated field produced a profit of \$152.47, as compared with only \$73.72 for the untreated field.

To make the message clear to consumers, yields were translated to the number of pairs of blue jeans each plot was able to produce. The result? The treated field yielded enough cotton to make 721.5 pairs of jeans; the untreated field, 448.5.

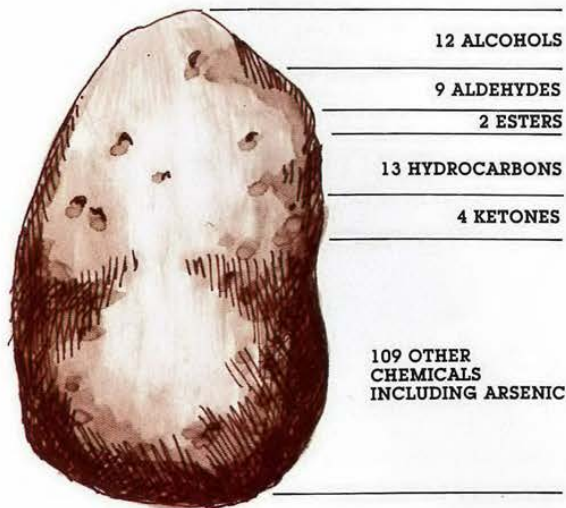


CHEMICALS in BALANCE

Many factors influence whether a particular substance will cause poisoning. The most critical of these factors is the amount of the toxic substance compared to the amount required to cause illness. Substances present in relatively small quantities will most likely have no ill effect.

Those who oppose the use of chemicals to

The Potato



produce food should consider that food is nothing more than different combinations of chemicals. Potatoes, for example, organically grown or not,

contain some 150 chemicals, according to the National Academy of Sciences. They include 12 alcohols, nine aldehydes, two esters, 14 hydrocarbons and four ketones. They also contain arsenic.

Arsenic, incidentally, is not unique to potatoes. It is so widely dispersed in nature that virtually all fruit, vegetables, fish and animal meat contain at least a few atoms of it. There are about three billion pounds of it in ocean water. It hasn't been added by mankind. Ocean water just happens to be made up of many elements and chemicals, of which arsenic is one.

Do we "hold the potatoes" and stop swimming at the beach? Of course not. A swimmer would have to swallow a few hundred gallons of sea water daily to be affected by the arsenic. Of deeper concern should be the sodium chloride (table salt) he ingests, because the salt in the first quart or two of sea water would most likely prove fatal.

Current research indicates that many of the most abundant and nutritious foods we eat every day have evolved the ability to synthesize chemicals that are poisonous to insects, animals and other predators.

That's good for the plant. But these chemicals are also known to induce genetic changes and even cancer in animals and humans. Plants that produce these natural pesticides are so widespread in nature that no human diet could be made entirely free of them.

In fact, human consumption of these natural pesticides is probably 10,000 times higher than the dietary intake of man-made pesticides.

For protection against potential dangers from man-made substances introduced into the environment, proper scientific study and a sensible assessment of risks and benefits—followed by moderation and safe handling—is the rational answer.

PARAQUAT / PLUS



ORTHO

Chevron Chemical Company

575 Market Street
San Francisco, CA 94105

**Avoid Accidents: For safety, read the entire label, including
precautionary statements. Use all chemicals only as directed.**

In a medical emergency, call the Chevron Emergency
Information Center (415) 233-3737.

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