

Benefits of one of the World's most widely used herbicides

70 years have passed since the original patent was issued to Dr. Franklin D. Jones in 1945 for his discovery of the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D). A herbicide doesn't reach this milestone without an impressive, significant health and environmental safety record and many recognized benefits.

Low-cost, effective weed control

There are many reasons 2,4-D is one of the most widely used herbicides in the U.S. and worldwide protecting agricultural crops, non-crop and aquatic areas, turf grass and environmentally sensitive areas from weeds and invasive species. Most importantly, after 70 years on the market users trust the herbicide to effectively control a broad spectrum of broadleaf weeds. Given its wide range of weed control and uses, there are over 1500 products that have 2,4-D registered as the active ingredient.

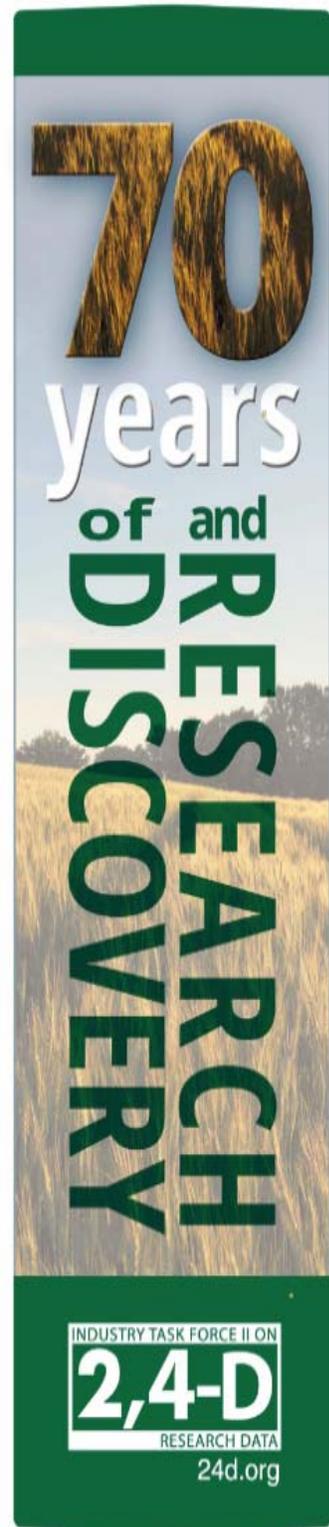
The value of 2,4-D to the U.S. economy

The value derived from a herbicide that has as many uses as 2,4-D can be difficult to quantify. But a U.S Department of Agriculture study did show the potential cost to society if 2,4-D were taken off the market. The 1996 study concluded that if 2,4-D were no longer available, the cost to growers and other users in terms of higher weed control expenses, and to consumers, in the form of higher food and fiber prices, would total *\$1.6 billion annually* in the U.S. alone. A 2007 study conducted in Canada concluded the costs would amount to \$338 million.

Protecting our crops

Weeds are the number one pest problem in crop production because they reduce crop yields and increase production costs. 2,4-D is effective and economical in controlling weeds and helps reduce manpower and machinery requirements that effect fuel consumption and erosion-producing tillage in crop production. Use of 2,4-D prior to planting soybeans and corn, for example, has been an important factor in making no-till production feasible in farming. No-till is a system for planting crops without pre-plant tillage, using herbicides to control weeds and resulting in reduced soil erosion and the preservation of soil nutrients.

2,4-D controls existing vegetation prior to planting no-till soybeans. The number of no-till soybean acreage has increased dramatically in recent years. This is to help



farmers comply with federal plant residue mandates for soil conservation and to reduce production costs. Use of 2,4-D prior to planting no-till corn helps ensure success of no-till crop production, resulting in significant conservation of soil, water, fuel, equipment, and labor.

Wheat and small grain weed control

Weeds may affect small grain production in many ways. Small grain yields of wheat, barley, oats, and rye may be reduced significantly when weeds compete with small grain plants for light, water, and minerals. Weeds may also inhibit crop growth by releasing allelopathic chemicals that are toxic to grain plants. Weeds or weed seeds contaminating harvested grain may reduce quality. In addition, weeds may interfere with harvesting or raise the moisture content of the harvested grain, leading to damage from heat and pests while in storage. 2,4-D controls a wide range of broadleaf weeds in all varieties of winter, spring and durum wheat; see Weed Susceptibility tables for weed listings.

Keeping vegetables, fruits and nuts weed-free

2,4-D herbicide economically and effectively controls broadleaf weeds growing in between rows of fruit and vegetable fields and on orchard floors. The herbicide is mainly used for weed control in asparagus, apples, peaches, almonds, pears, strawberries (dormant application), cherries, and cranberries; and as a growth regulator in potatoes. As Americans are encouraged to add more fruits, vegetables, and nuts to their diets, it's important that tools, such as 2,4-D herbicide, that aid in their abundant availability remain affordable and effective.

Range and pastureland weed protection

2,4-D eliminates broadleaf weeds from range and pastureland without damaging desirable grasses that livestock eat. The herbicide improves grass production by reducing weed competition, allowing for high quality grass and increased grazing options. It provides a healthier grazing environment to help ranchers reduce feed costs and feed more cattle. An abundant supply of high-quality livestock feed can deliver profitable results such as: enhanced body condition for faster breed-back and higher conception rates, healthier nursing calves, improved weaning weights, and overall better beef production.

70 years of and RESEARCH DISCOVERY

INDUSTRY TASK FORCE II ON
2,4-D
 RESEARCH DATA
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Controlling invasive, noxious and non-native weeds

The U.S. Geological Survey reports that some \$20 billion in damages can be linked to invasive plant life. This affects not only those who make their living directly off the land, but also citizens of cities, suburbs and rural America.

An *invasive species* is one that spreads into areas where they are not native. This includes non-native species that escape or otherwise grow outside cultivation. Not all non-native plants are invasive. *Noxious weed* is a legal term used by county, state, and federal agencies to mean non-native plants that pose serious threats to agriculture, wildlife, and roadsides. Since these weeds are not native, they have no natural competitors to keep them from overtaking the native environment.

Non-native species are defined as ones that were directly or indirectly introduced to a given region, were not present in the region before, and would not have spread into the area without outside interference (i.e., humans or animals.)

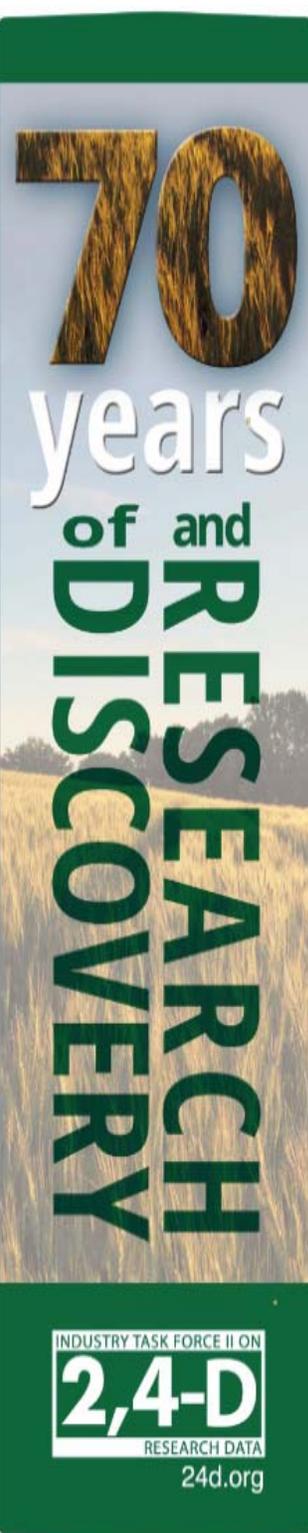
According to the U.S. Department of Agriculture, when invasive species enter new ecosystems, "*they can grow, adapt, proliferate and spread ... indefinitely, causing ever increasing economic and environmental damage.*"

2,4-D herbicide economically and effectively controls a number of invasive, noxious and non-native broadleaf weeds.

Protecting the turf we live, work, and play on

One misperception about lawn herbicides is that their use came about after initial discovery for agricultural crop protection. This is simply not the case with 2,4-D: The original patent for 2,4-D in 1945 was for weed control in lawns and field crops.

Initial tests of 2,4-D were conducted in 1944 on a lawn infested with dandelions and on a golf course, showing selective weed control with no injury to the turf grass. In 1945, a developmental program was conducted with the United States Golf Association and on turf grass of the National Capital Park Service, including the White House lawn. During the same year, workers at various state agricultural experiment stations began the first extensive field testing of 2,4-D on crops. Millions of acres of lawn and landscapes around homes, businesses, roadsides, parks, athletic fields, and golf courses improve our quality of life by providing open spaces,



recreation, enhanced property values, and the conservation of important natural resources.

2,4-D based herbicides help control weeds, giving turf grass a chance to grow into a healthy lawn, a vibrant landscape, or a cushioned playing field. Healthy turf grass filters groundwater, absorbs pollutants, hinders the spread of fire, and acts as a cooling agent around buildings, while also providing space for outdoor activities. The use of 2,4-D is also beneficial for controlling weeds such as common ragweed that cause allergies to humans. It also controls many weeds that are poisonous (e.g., poison ivy and poison oak) to humans and animals. 2,4-D protects our green spaces which allows us to live, work and play in weed-free, healthy environments.

Keeping weeds out of waterways

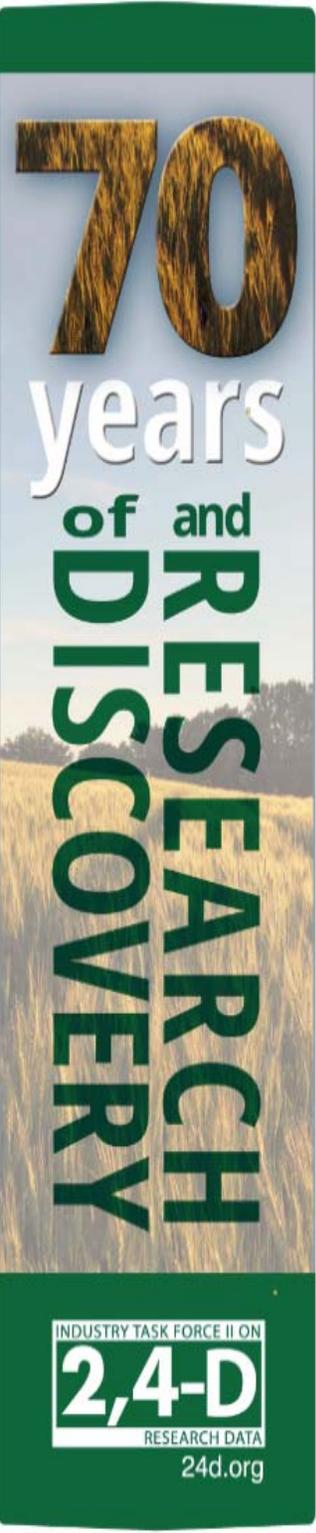
Aquatic weeds that grow in ponds, lakes, reservoirs, canals, streams, and rivers can have detrimental effects on water usage and the wetlands environment. The appearance of the water as well as recreational activities such as boating, fishing and swimming can be negatively impacted. Fish spawning grounds and wetlands habitat for wildlife can be destroyed, hydroelectric screens can be clogged, navigation lanes restricted, water quality can be significantly reduced and property values can fall sharply because of too much aquatic vegetation.

2,4-D is an effective and economical way to manage aquatic weeds. The herbicide is a relatively fast-acting, systemic, selective herbicide used for the control of Eurasian water milfoil, water hyacinth and other broad-leaved species, leaving native aquatic species relatively unaffected.

Protecting our forests

Herbicides became the vegetation management tool most widely applicable for forestry use because of their efficacy, safety, and low cost. Traditional mechanical methods of weeding forests are dangerous to workers, costly, and labor-intensive. They require cutting tools, heavy mechanical equipment, and heavy fuel usage.

2,4-D is an important tool for stump treatment, trunk injection, and selective control of brush in conifer forests. It is also a component of many mixtures for site preparation. 2,4-D is also used for many other purposes in forested areas including trail


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preservation, management of wildlife habitat, campground clearance, and weed control near outbuildings.

Vegetation management along highways, railroads and rights-of-way

2,4-D helps manage unwanted weeds and brush along roadways, rights-of-ways, and railroads.

Safety is paramount along highways and roads. Vegetation management using 2,4-D helps ensure motorist safety by controlling encroaching weeds and brush that can conceal road signs and affect driver visibility. Vegetation management also stops weeds and brush roots that crack and buckle road surfaces.

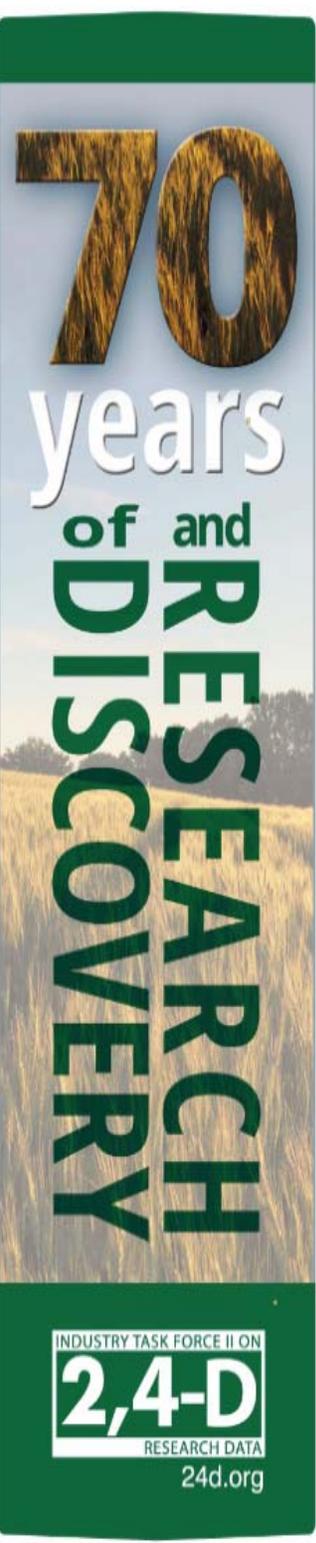
Safety is essential in railroad transportation which involves heavy equipment moving at high speeds. Weeds reduce train traction and hide damaged equipment during routine inspections. Encroaching brush can also limit motorist line-of-sight at railroad crossings. Vegetation can cause drainage problems that lead to deteriorating ties and destabilized track beds.

For an electrical utility to maintain its effectiveness, it must limit service interruptions along electric line rights-of-way. Vegetation management using 2,4-D plays a major role in ensuring that branches do not contact power lines and prevent electricity from reaching the consumer. Safety remains another problem when trees touch transmission and distribution lines. Finally, well maintained rights-of-way offer aesthetic value to the community and provide beneficial wildlife habitat.

A clear line-of-sight remains important for proper gas and oil pipeline maintenance. During regular inspections conducted from aircraft or ground vehicles, crews can spot leaks or other problems. Even routine maintenance becomes difficult if crews can't easily access pumps, gates and valves. Vegetation management also positively affects the safety of work crews that must access pipelines.

Herbicide Resistant Weeds

Herbicide resistant weeds are a pervasive concern to the agricultural community. Awareness of this issue has grown as a result of the evolution of weed



populations resistant to glyphosate, impacting the utility of this active ingredient. In addition, there are documented weed populations that have evolved resistance to multiple herbicide mechanisms-of-action (MOA) and which may have a propensity to develop additional resistances. The most effective means of conserving herbicide MOAs is integrating weed management programs by combining herbicides with different MOAs and incorporating nonchemical control tools. 2,4-D offers an effective, alternative Mode of Action to the popular glyphosate programs. A key component to this strategy is to use an efficacious use rate such that the target weed is well controlled. Repeated use of rates below those recommended on labels increases the probability of resistance. Below-labeled rates allow more weeds to survive treatment, and those weeds produce seed in the survivors that will lead to an accumulation of genes that confer resistance via multigenic mechanisms.

It's no wonder why in 2004, curators of The Henry Ford organization, a multi-venue destination founded by automotive pioneer Henry Ford, identified the discovery of 2,4-D as one of the 75 most important innovations in the past 75 years.

About the Task Force

The Industry Task Force II on 2,4-D Research Data is organized to provide funding for the on-going Good Laboratory Practice (GLP) research studies required to respond to the US EPA registration review and PMRA pesticide re-evaluation programs. The 2,4-D Task Force is comprised of those companies holding technical 2,4-D registrations: Dow AgroSciences (U.S.), Nufarm, Ltd. (Australia) and Agro-Gor Corp., a U.S. corporation jointly owned by Albaugh, LLC. (U.S.) and PBI-Gordon Corp. (U.S.).

March 17, 2016

