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OPERATION RANCH HAND

The Air Force and Herbicides in Southeast Asia 1961-1971

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'OPERATION RANCH HAND' is the government's official "bible" of Vietnam Era Herbicides.

There is not even one reference to "Tactical Herbicides" in the entire 257 pages! The reason is because the name "Tactical Herbicides" was invented from the term "tactical use of herbicides" after the fact in an effort to hide the truth. This is of course the corner stone used to cheat veterans out of just compensation for their illnesses caused by these herbicides.

Excerpt from "Operation Ranch Hand" page 196:

"None of the herbicides used in Southeast Asia were of a new or experimental nature. They had all been used for several years in commercial agriculture both in the United States and in other countries. By way of illustration, in 1961, the year before the Ranch Hand program began, about 40 million acres plus hundreds of thousands of miles of roadsides, railroads, and utility rights of way were treated with phenoxy herbicides in the United States. Of this total, more than ten million acres, an area about one-fourth the size of South Vietnam, received aerial spray applications. The herbicides used in Southeast Asia were familiar agricultural chemicals, and aerial spraying of them was common.³"

Excerpt from "Operation Ranch Hand" page 133:

"Freeman foresaw tight supplies of herbicide for American agriculture and, consequently, reduced crop yields with accompanying complaints from farmers and other civilian users. At the same time, Freeman wrote to the Director of the Office of Emergency Planning, Farris Bryant, to ask him to assume a role of leadership in allocating existing supplies of 2,4-D and 2,4,5-T and in increasing their production. McNamara's response was to ask the Secretary of the Army to develop a plan to increase production while at the same time asking Bryant to allocate all commercial production capacity for agent orange and its critical components to military use. Bryant agreed to this request and took steps to insure that the entire U.S. output of 2,4,5-T, the limiting component in the production of orange, would be diverted to military requirements."

Appendix 1

Characteristics of Herbicides Used in Southeast Asia

The chemicals present in the defoliant mixes employed by the United States Air Force in Southeast Asia were developed originally to control weeds, that is, plants growing in places where man does not want them to be. Weeds present serious problems to agriculture because they compete with crops for available sunlight, moisture, and nutrients. For millenia the only weapons farmers had to use against weeds were mechanical, such as the hoe and plow. In 1896 the modern use of chemicals to control weeds began with the work of a French scientist named Bonnet. He observed that the seedlings of wild mustard, a common weed in Western Europe, died when sprayed with a fungicide developed for use on grape vines. Bonnet later found that copper sulfate, a component of the fungicide, would selectively kill the wild mustard growing in a cereal crop. Other research showed that chemical compounds such as sodium nitrate, ferrous sulfate, and dilute sulfuric acid also acted as selective herbicides against broad-leafed weeds in fields of cereal plants with narrow, upright leaves. These compounds were dessicants and worked by extracting water from plant tissues. Their selectivity depended on the broad, level surfaces of the weeds collecting more of the chemical spray or dust than cereal leaves. The performance of these chemicals, except for dilute sulfuric acid, was, however, erratic.

Synthetic plant hormones or plant growth regulators, precursors of the primary herbicides used in Vietnam, were discovered in the 1930s. The first synthetic plant hormone herbicides were quite expensive and therefore impractical as agricultural chemicals. A search undertaken to find less expensive and more active artificial plant hormones in 1942 identified 2,4-dichlorophenoxyacetic acid (2,4-D) as one of the most promising. Field trials during the World War II years provided that a related compound, 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) could also be used as a selective herbicide. These two compounds later became important agricultural chemicals, and they were primary components of several of the herbicides employed in the Ranch Hand program.¹

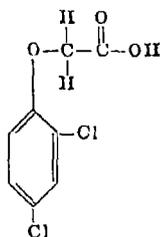
Three terms used throughout this study need to be defined: "herbicide," "defoliant," and "dessicant." An herbicide is a chemical which will kill or injure a plant when applied to air, soil, water, or the plant itself. The defining characteristic of defoliants is that they cause the leaves of a plant to fall prematurely, although the plant may or may not die as a result. A dessicant is a drying agent which causes a plant's tissues to lose their moisture,

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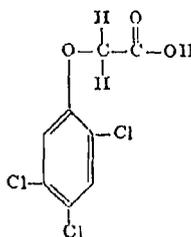
thereby killing or damaging the plant. The use of a desiccant may or may not result in subsequent defoliation. Thus, a given chemical may fall into one or more of these categories. Two of the terms, "herbicide" and "defoliant" are used practically interchangeably in discussions about the Ranch Hand program, but sometimes the differences in meaning may be important.²

None of the herbicides used in Southeast Asia were of a new or experimental nature. They had all been used for several years in commercial agriculture both in the United States and in other countries. By way of illustration, in 1961, the year before the Ranch Hand program began, about 40 million acres plus hundreds of thousands of miles of roadsides, railroads, and utility rights of way were treated with phenoxy herbicides in the United States. Of this total, more than ten million acres, an area about one-fourth the size of South Vietnam, received aerial spray applications. The herbicides used in Southeast Asia were familiar agricultural chemicals, and aerial spraying of them was common.³

2,4-D



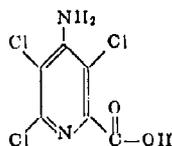
2,4,5-T



The compounds 2,4-D and 2,4,5-T are chlorinated phenoxy acids, and herbicides contain them in the acid form, as salts, and as esters. Which form is chosen for a specific application depends on desired characteristics such as solubility, volatility, and melting point. The persistence of 2,4-D and 2,4,5-T in soil is limited to only a few weeks, and high dosages are necessary to produce any overt effects in humans. However, considerable concern has developed over the potential danger from 2,3,7,8-tetrachlorodibenzo-pa-dioxin, commonly known as dioxin, an impurity present in 2,4,5-T.

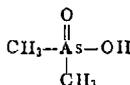
Phenoxy herbicides are growth regulators which have extensive effects on the structure of plants. Their action is generally rapid, and the fact that they may spread throughout a plant allows them to affect almost all of its biological activities. A plant's reaction to 2,4-D or 2,4,5-T may result in an abnormal production of buds or roots and the excessive growth of tissues. In lesser concentrations, the growth in tissues surrounding a plant's vascular system and the resultant restriction in the flow of nutrients may cause a slow death of the plant. In short, these two herbicides stimulate a proliferation of tissues.⁴

Picloram



A third compound used in the Ranch Hand herbicide formulations was picloram. Solid commercially as Tordon, it has the formal chemical name of 4-amino-3,5,6-trichloropyridine-2-carboxylic acid. In its pure state, it is a white powder with a smell like chlorine. Picloram's toxicity to man is thought to be lower than that of 2,4-D or 2,4,5-T. Like the phenoxy herbicides, picloram regulates plant growth, but the precise mechanisms involved are not known. It is an extremely mobile compound, being readily absorbed by both the leaves and roots and transported throughout the plant's tissues. Its mobility enhances its effectiveness against woody plants. Some of the effects of picloram are to stunt leaves and cause terminal growth to stop. Also, tissues along the stem proliferate, and the stem tends to bend and split. Roots may deteriorate, and the plant soon dies. Compared to 2,4-D, picloram is much more mobile, better able to penetrate roots, and more toxic to plants. One important difference between picloram and the phenoxy herbicides is that it is persistent in soils whereas the phenoxy compounds generally are not. Its persistence allows it to be used as a general soil sterilant under some conditions.⁵

Cacodylic Acid



Cacodylic acid, formally known as hydroxydimethylarsine oxide and sold as Phytar, is not a plant growth regulator like the other three herbicides. Rather, it functions as an "uncoupler," keeping the plant from using the products of its metabolism for growth and tissue maintenance. It is thought that the effectiveness of cacodylic acid, like other arsenic compounds used as herbicides, derives from its ability to substitute arsenic for phosphorus in biochemical reactions. Its effects on a plant are to stop growth, attack membrane integrity, and cause drying, yellowing, and, eventually, death. Because drying is its primary observable effect, cacodylic acid is often labeled as a desiccant. It is a contact herbicide and is rapidly rendered ineffective in soil. Cacodylic acid, an organic compound, can replace the highly toxic inorganic forms of arsenic such as sodium arsenite and sodium arsenate in an herbicide role. These inorganic arsenic compounds are very toxic to both man and animals and can cause accidental fatalities. Cacodylic acid itself is only slightly toxic to humans, with a probable lethal

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oral dose of one ounce or more, and it has little or no toxicity when applied to the skin.⁶

→ Combinations of these four herbicides were used to formulate the different color-coded agents used in the Ranch Hand operation in Southeast Asia. ← Appendix 2, Table 1 lists the composition of these mixtures.

Author's Acknowledgements

Many people assisted me in researching and writing this book and in preparing it for publication, and I owe a debt of gratitude to each of them. Doris E. Krudener initiated the research and collected many of the documents on which this study is based. Especially valuable were her research efforts in active files in the early 1970's which preserved much documentation, and which probably would otherwise have been lost. Many personal recollections about the early Ranch Hand operations were provided to me by Lt. Col. Carl W. Marshall, Major Charles F. Hagerty, Major Marcus B. Keene, Jr., and Dr. James W. Brown. Others who assisted my research included librarians and archivists at the Army Library, the Albert F. Simpson Historical Research Center, the Washington National Records Center, and the Office of Air Force History. At the latter location, Dr. George M. Watson and William C. Heimdahl were very helpful.

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I am indebted to each of these people, and many more, and I credit much of the improvement in the book to their help. Of course, I accept responsibility for all errors which remain.

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Saigon on December 15, 1961 and arrived on January 8, 1962. The remaining chemicals, 17,000 gallons of purple and 31,000 gallons of pink, were loaded on the USNS *S.O. Bland* which had a sailing date later in December. The drums carried no military markings and were consigned only to "Country 77," a shipping designation for Vietnam.²²

The option of airlifting some of these defoliation chemicals received consideration for a time. Headquarters, USAF alerted the Military Air Transport Service to ready twenty-five C-124 Globemaster transports to airlift, over the weekend of December 16-17, the chemicals awaiting shipment on the *Bland*. The airlift, however, was not ordered, perhaps because final mission plans for the use of the chemicals had yet to be developed and approved.²³

On December 16, 1961 Secretary McNamara held a conference in Hawaii with Pacific area military commanders. The conference provided him with another opportunity to examine Ranch Hand preparations and make further decisions affecting the operations. Background documents prepared for this conference noted that Thirteenth Air Force and the Ranch Hand detachment had been alerted and were capable of beginning defoliant operations in South Vietnam within 24 hours of receiving orders to do so. General McGarr, head of the MAAG in Saigon, informed Secretary McNamara during the conference that a joint U.S.-Vietnamese planning committee was selecting key routes to be defoliated and expected to complete its work by December 20. Vietnamese authorities had designated one individual from the J3 (operations) section of their Joint General Staff (JGS) to work with U.S. officials to develop detailed plans, and an initial meeting had taken place on December 8. He noted that the development of a final plan was being "aggressively pursued."

McNamara explained that the defoliants would be used initially in road clearing because the chemicals presented a "ticklish" problem and road clearance offered the least potential trouble. He stated his desire to see the project get underway quickly, but he did not think it would be necessary to airlift the defoliants. Secretary McNamara also observed that he would be liberal in interpreting the phrase "key routes." Defoliants could be applied, he said, around ammunition storage sites and Jungle Jim operating locations as well as along roads and trails. He anticipated quick approval of specific defoliation plans once they were submitted.²⁴

Obtaining the final approval for the initial defoliation missions was not as simple a matter as Secretary McNamara had indicated in his meeting with the Joint Chiefs on December 4. Admiral Feit forwarded the plan to the JCS on December 28, 1961, and the Chiefs added their approval in a memo to the Secretary of Defense on January 2, 1962. They noted that an implementing message was ready for dispatch upon the receipt of his approval and notice of final interagency coordination by the Assistant Secretary of Defense for International Security Affairs. The plan as finally approved by the Departments of State and Defense called for defoliating areas to a depth

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More liberal guidelines resulted from favorable Washington-level action on Lodge's request. The new authority Saigon received on August 7 continued the practice of requiring the U.S. Ambassador and a senior South Vietnamese official to approve, personally, each crop-destruction operation. The message extended the range of permissible targets to include less remote and more highly populated areas where the Viet Cong were experiencing significant food supply problems. The mountainous areas of Central Vietnam and the foothills and valleys immediately surrounding them were specifically included, while the flat coastal lowlands and the southern Delta area where food was plentiful were excluded. Very populous areas where guerrilla control was recent or not firm were to be evaluated on a case-by-case basis, and if the advantages of crop destruction were clearly overriding, Washington authorization for specific targets could be sought. This new authority continued the requirement for a thorough psychological warfare plan for every crop destruction operation.¹⁵

Ranch Hand flew crop destruction missions in Kontum and Binh Dinh provinces during the middle part of 1965. Between August 15 and September 13, 29 sorties sprayed crops in Quang Tri and Thua Thien Provinces. On October 20, extensive crop destruction operations began in War Zone D and continued until December 17. Ranch Hand flew 163 sorties and sprayed 137,650 gallons of herbicide during these operations. The C-123s received fighter support from F-100, F-5, and A-4 aircraft as well as the familiar A-1F. By November 13, 1965, three more C-123s, spray-modified at the Fairchild-Hiller facility at Crestview, Florida, were in place at Tan Son Nhut with trained crews. This brought the Ranch Hand complement of spray-equipped aircraft to seven. Their designation was changed in that same month to UC-123. By this time, the use of H-34 helicopters for crop spraying had almost totally ceased. **Ground forces, however, retained back pack sprayers for use against small plots.**¹⁶

Ranch Hand was steadily expanding its capabilities in line with the general buildup of U.S. forces and equipment in South Vietnam. The expansion brought changes in equipment and tactics. To add some additional protection from the effects of ground fire hits, Ranch Hand crews in late 1965 began using flying helmets with clear visors to reduce the hazard from shrapnel and other flying debris in the cockpit. The tactical changes were instituted to complicate the task of enemy gunners. When the spray aircraft flew over straight targets thought to be defended by undisciplined enemy forces, they flew in a close, nose-to-tail echelon formation. They did not offer such a compact target, however, when they encountered concentrated ground fire or when Viet Cong forces in the target area were well trained. Fighter tactics included prestrike and poststrike passes or a combination of the two. Still, there was the unsettled question of whether a fighter prestrike to disrupt enemy gunners was more valuable than the element of surprise which a fighter prestrike sacrificed.

HERBICIDES REACH THEIR PEAK

Due to its long, slow buildup, the herbicide program in Southeast Asia had no immediate effect on the herbicide market in the United States. From 1962 through 1964, only about 250,000 gallons of chemicals had been consumed in South Vietnam. The total U.S. herbicide production in 1965 was about 3.4 million gallons. Some 2.8 million gallons of the total went to agriculture and other non-military pursuits, while the Air Force requirement for that year was only about 400,000 gallons. The use of herbicides as a weapon in Southeast Asia increased, however, and in 1966 a shortage developed, causing projects to be postponed or completed over a longer period of time. Industrial production facilities in the United States, though taxed, were able to fill the fiscal year 1966 (FY 66, Jul 1, 65-Jun 30, 66) military requirement of 1.6 million gallons. The projected requirements for the next two years, FY 67 (5.6 million gallons) and FY 68 (11.9 million gallons) clearly exceeded the existing production capability.

To cover a projected FY 67 shortage of orange herbicide, the Air Force procured 1.5 million gallons of agent white, commercially known as Tordon. Chemically, it was 80% 2,4-D and 20% picloram in a water-soluble formulation. White had the same effect on vegetation as orange, but it acted more slowly. At first, this slow reaction made it less desirable than orange. Later, however, because of the erroneous belief that white was less volatile than orange, it became more popular than orange for targets where drift was a consideration. MACV studied and discarded other proposed remedies for the herbicide shortage, including diluting orange herbicide with 50% diesel fuel.⁴⁷

On January 26, 1967, Secretary of Agriculture Orville Freeman wrote to Secretary McNamara and asked him to have someone in his department look into the herbicide problem. Freeman foresaw tight supplies of herbicide for American agriculture and, consequently, reduced crop yields with accompanying complaints from farmers and other civilian users. At the same time, Freeman wrote to the Director of the Office of Emergency Planning, Farris Bryant, to ask him to assume a role of leadership in allocating existing supplies of 2,4-D and 2,4,5-T and in increasing their production. McNamara's response was to ask the Secretary of the Army to develop a plan to increase production while at the same time asking Bryant to allocate all commercial production capacity for agent orange and its critical components to military use. Bryant agreed to this request and took steps to insure that the entire U.S. output of 2,4,5-T, the limiting component in the production of orange, would be diverted to military requirements. The shortage of herbicides in Southeast Asia peaked in 1967, but the situation never became as bad as had been forecast, primarily because actual herbicide usage never reached the high levels predicted. By early 1969, herbicides were no longer a critical item of supply.⁴⁸

In October 1967, researchers from the RAND Corporation issued two

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stands of merchantable timber in War Zones C and D. Because the forests of Vietnam were among the country's most valuable renewable natural resources and a major source of employment, they were concerned that repeated applications of herbicides to these forests might retard their regeneration. Another economic cost cited was unintentional damage to crops, particularly in the II Corps area. Their investigations found that claims for crop damage from herbicides stemmed from a variety of factors, including plant disease, spray drift, defective equipment on the Ranch Hand planes, emergency herbicide dumps, inadequate care of crops by farmers, and errors in targeting and navigation. They could not specify how much of the actual damage was due to defoliation operations and how much should be attributed to other causes. Allegations of damage to rubber trees which had surfaced in a significant way in 1967 were found to be exaggerated. Herbicides had been responsible for rubber tree damage in only seven of the 16 sites examined, and most of the trees damaged by herbicides were expected to recover. Many of the allegedly damaged trees were found to be suffering from disease and poor maintenance by growers.²²

As had others, this committee also said that the ecological consequences of herbicides were not serious. The only significant ecological effects were the destruction of large stands of mangrove, which were expected to regenerate in 20 years, and damage to the tropical forests of War Zones C and D. Attached to the report were three appendices which examined herbicide toxicity and persistence in water and soil and the potential hazards from herbicide vapors.²³

The crop destruction program received some additional criticism. The review committee noted that crop destruction, which constituted 15% of the overall herbicide effort in 1967, had destroyed only about 1.75% of the South Vietnamese rice crop. Although there was some evidence that crop destruction had contributed to enemy logistics difficulties, the committee stated that the civilian population of the target areas bore the main burden. They called for further efforts to reduce the harm done by crop destruction to innocent civilians.

Another criticism concerned the length of time it took to process requests for specific herbicide projects. The committee called for the delegation of approval authority for helicopter defoliation operations to corps commanders and recommended area clearances for crop destruction operations so that targets of opportunity could be struck. They also recommended greater efforts to provide Saigon officials with the necessary information to manage and monitor the herbicide program effectively.²⁴

Other important recommendations concerned the psychological warfare and compensation efforts. The committee asserted that ". . . the use of herbicides is definitely and universally attributed to the U.S. The attempt to identify the GVN with the program has failed completely. . . ."²⁵ They said that even when Vietnamese personnel sprayed herbicide using truck-mounted sprayers, the local people attributed the spraying to the United

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Several high officials in the Department of Defense, including G. Warren Nutter (ASD/ISA), favored an alternate plan. This plan would transfer the six UC-123s to the VNAF right away for dual use as transport and spray aircraft. These officials thought that the most likely need for these spray planes would be along important lines of communication. The aircraft could spray herbicides blue or white, they said, regardless of what might be decided about orange. Nutter's group would also transfer fifteen rather than forty-three helicopter systems to the Vietnamese and only the eleven truck-mounted, eighty hand-operated, and two "Buffalo Turbine" sprayers then in Vietnam. If the South Vietnamese demonstrated a greater need, they said, the U.S. could then give them more equipment.¹⁶

Secretary Laird agreed with his civilian rather than his military advisors on the size and type of herbicide capability the United States would give to the South Vietnamese. On July 24, 1971, he wrote Secretary Rogers a personal letter informing him of the plan and asking for his support, or an indication of his contrary intentions. Laird said that the six UC-123s would be used along enemy infiltration routes or in border areas if the situation warranted, a position closer to that of the Joint Chiefs. He hoped the Vietnamization plan could be approved and implemented prior to December 1 to preclude another extension of the herbicide use deadline. (President Nixon, however, had not yet approved the first extension.) Laird felt ". . . this limited herbicide capability is vital to our objective of giving the South Vietnamese a reasonable opportunity to defend themselves and to determine their own future."¹⁷

Secretary Rogers replied that he felt the whole matter required further study. Of special concern to Rogers was the potential impact on the Geneva Protocol and pending legislation concerning Indochina. In his view:

This proposal would likely be viewed by some in the Congress and the public as inconsistent with the President's announcement of a rapid and orderly phase-out of our use of herbicides in Southeast Asia. The fact that their use would be under the exclusive control of the South Vietnamese could be looked upon as an evasion of the President's commitment and might draw special condemnation for that reason.¹⁸

Secretary Rogers queried Ambassador Bunker in Saigon for his views on Laird's plan. Bunker replied on August 7 that he was against the idea. The primary risk he saw was that once the Vietnamese had their own herbicide equipment, their use of it would be outside the formal control of the United States, but "world opinion" would nevertheless hold the United States responsible for any herbicide use or misuse by the South Vietnamese. Furthermore, Bunker felt that the military value of spraying herbicides over wide areas was not clearly established. He had no indication that the South Vietnamese wanted a spray capability for use beyond base perimeters and he doubted that they would spontaneously request the U.S. to provide them with one. Also, acquiring six UC-123 spray aircraft would strain the