OPERATIONAL USE OF HERBICIDES IN VIETNAM 1962-1971

Alvin L. Young

418 Harlowe Ln, Naperville, IL 60565; Center for Risk Excellence, US Department of Energy, 9800 South Cass Ave., Argonne, IL 60437, USA.

Introduction

The introduction of herbicides in 1962 into the armed conflict in Vietnam represented an application of a new technique for modern warfare. No element of the Vietnamese environment was more detrimental to base defense than the plant life that flourished in over-whelming and unwanted profusion.[1] Prior to 1962, a large and useful amount of information about vegetation control, especially woody species control, existed in American agriculture.[2] Thus, the use of herbicides in South Vietnam removed foliage along thoroughfares, defoliated areas surrounding bases and communication routes, improved visibility in heavily canopied jungle, and destroyed enemy subsistence crops. The chemicals of choice were the phenoxy and arsenical herbicides.

Methods

A significant amount of information and mission data have been published on the use of herbicides in the Southeast Asia Conflict. Literature sources provided the type of herbicide, pattern of use, dates and location of spraying, aircraft or ground equipment used, the approval process for deployment of aircraft and herbicides, and the use of insecticides. Data were available on the concentrations of TCDD in the various herbicide formulations.

Results and Discussion

Following World War II, synthesis technology, efficacy data, and field application techniques were developed for the two major phenoxy herbicides 2,4-dichlorophenoxy-acetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). In 1961, the United States military began studies to determine the technical feasibility of defoliating jungle vegetation in the Republic of Vietnam. The choice of herbicides was based upon proven performance, availability in large quantity, costs and known or accepted safety in regard to their toxicity to humans and animals.[3] The iso-butyl esters of 2,4-D and 2,4,5-T, code-named "Purple" and the sodium salt of cacodylic acid (an organic arsenical) code-named "Blue" were received at Tan Son Nhut Air Base, Republic of Vietnam, on 9 January 1962. The colored bands, which were painted around the centers of the 208-liter drums, served as an aid to the identification by support personnel. Herbicides Purple and Blue were the first military herbicides used in Operation RANCH HAND, the tactical military project for the aerial spraying of herbicides in South Vietnam.[4] By January 1965, two additional military, code-named "Orange", subsequently known as "Agent Orange", and "White". Orange was a 50:50 mixture of the n-butyl esters of 2,4-D and 2,4,5-T. "White" was a 1:4 mixture of the triisopropanolamine salt of picloram and 2,4-D. Agent Orange became the most widely used military herbicide in South Vietnam.[5]

Use Patterns of Individual Herbicides: Each of the three major herbicides (Orange, White, and Blue) had specific uses. About 90% of Herbicide White was applied in defoliation missions. Approximately 50% of all Blue was used in rice-destruction missions in remote or enemy-controlled areas with the remainder being used as a contact herbicide for control of grasses around base perimeters.[1] Approximately 85% of all Agent Orange was used for forest defoliation. The remaining 15% was used around base perimeters, cache sites, waterways and communication lines, and for destruction of broadleaf crops.[6] The total quantity of herbicides disseminated in South Vietnam is uncertain. Procurement records account for 67 million liters, while mission records (HERBS Tape and Service HERBS Tape) account for 8,930 missions and a total of 72.7 million liters of herbicide. Approximately 45 million liters (62%) was Agent Orange and was used in 4,698 missions. Approximately 20.6 million liters of White were used in 2,194 missions, while Blue accounted for 4.7 million liters and 981 missions. The remaining missions and liters of herbicides were either the herbicides used early in the operation or were incompletely documented.[6]

Combat Tactical Zones: For purposes of military operations, South Vietnam was divided into 4 Combat Tactical Zones (CTZ) or Military Regions. These 4 Combat Tactical Zones were identified as I, II, III, or IV Corps and became administrative areas for RANCH HAND and other tactical operations. I Corps was located in the region nearest North Vietnam and adjacent to the Demilitarized Zone (DMZ), while IV Corps was in the Mekong Delta region. Although spraying occurred in most provinces of Vietnam, certain areas of the country were subject to more intensive spraying. The herbicide maps (HERBS tapes) indicated that defoliation missions were not uniformly distributed but were concentrated in certain geographical areas, for example along transportation routes, in occupied areas around Saigon, and on infiltrations routes along the Laotian and Cambodian borders and the DMZ where enemy attacks were likely.[7] Primary target areas for crop destruction missions were in I Corps and along the upland and mountain valleys of II Corps.

Deployment of Aircraft: Following World War II, the United States Air Force assumed responsibility for the Special Aerial Spray Flight, a military unit that provided control of insect pests through the use of aerial applications of insecticides.[8] In early 1960, the Special Aerial Spray Flight phased out the C-47 and selected the Fairchild-built C-123B "Provider" as its replacement. This high-wing, twin-engine assault transport had excellent low-speed maneuverability, and the high-mounted wings allowed convenient positioning of wing spray booms. The large cargo compartment and load capacity were ideal to receive a modular spray system for internal carriage. The module consisted of a 3,785- liter tank, pump, and engine, which were all mounted on a frame pallet. An operator's console was an integral part of the unit. Wing booms (3.8 cm in diameter, 6.7 m in length) extended from outboard engine nacelles toward the wing tips. A short tail boom (7.6 cm in diameter, 6.1 m in length) was positioned centrally near the aft cargo door. Each aircraft had a pilot, co-pilot (navigator), and flight engineer (console operator).[6] During the peak activity of RANCH HAND operations (1968-69), approximately 30 UC-123 aircraft were employed.

Approximately 10 –12 % of all herbicides used in South Vietnam were disseminated by helicopter or ground application equipment.[4] The military UH-1 series of helicopters, deployed by the Air

Force, the Army, and Navy units, generally sprayed the herbicides. The most common spray systems used were the Hidal and Agrinautics units. These units were installed in or removed from the aircraft in a matter of minutes.[6] Each unit consisted of a 760-liter tank and a collapsible 9.8 m spray boom. The unit was operated by manual controls to control the flow valve and a windmill brake.

Development, testing, evaluation, and calibration of the spray equipment were critical to successful vegetation control. Hundreds of such tests occurred between 1962 and 1970 for the UC-123 and helicopter spray systems, at Eglin AFB, FL, and to a limited degree at the Pran Buri Calibration Grid in Thailand.[5,9] Field tests of the herbicides established a "minimum biological effective ground deposition rate". For Agent Orange, the optimum application parameters and spray characteristics of the UC-123 modular internal spray system were as follows: 130 KIAS (knots indicated air speed) at an altitude of 50 m AGL [above ground (or tree-top) level] producing a spray swath of 80 m (plus or minus 6 m) with a mean deposition of 28 liters/hectare and treating a total area/tank of 130 hectares. These parameters allowed the aircraft to be on target for 3.5 to 4.0 minutes, and resulted in a particle size where 98% were greater than 100 microns.[9]

Mission Requests: Overall policy for herbicide operations in Vietnam was set forth in directives by the Military Assistance Command, Vietnam (MACV) and based on guidelines from the Departments of State and Defense.[8] Final approval authority over targets belonged to the Commander, US Military Assistance, and the American ambassador, after consultation with the Vietnamese. Initial requests for crop and defoliation missions usually came from province officials or field commanders. RANCH HAND operations and targeting personnel met weekly with the chemical operations section of MACV to discuss these requests and schedule survey flights over proposed areas. After flying reconnaissance over the proposed area, a coordination meeting was held in the field with the province chief, local military commanders, MACV and ARVN (Army of the Republic of Vietnam), representatives of the Seventh Air Force and RANCH HAND. Details of target requests, intelligence data, and target particulars were worked out. Following the meeting, formal targets requests were prepared and forwarded to Saigon for clearance by Vietnamese and US authorities.[8]

Once a particular target area (referred to as a target box) was approved, the RANCH HAND commander and his targeting officer, together with MACV staff members, determined the most effective missions dates and requested implementing orders. The targeting officer determined the type of fighter support needed for the particular area, planned the individual missions, prepared necessary target charts, and drafted the order requests for submission to TACC (Tactical Air Control Center). The day prior to the mission, TACC coordinated fighter and rescue support and issued the approved mission order. TACC also sent out warning messages to field forces of the impending mission. Response to a warning message forced cancellation or modification of the spray mission if imminent operations or the presence of friendly forces in the area precluded use of heavy suppression. This action precluded accidental attack on friendly forces by the escorting fighters, and kept field forces from entering the area after the use of CBU (cluster bomb unit) munitions[8]. Defoliating a zone around the outside circumference of an installation/base became the responsibility of the Allied ground commander who had responsibility for the base. The herbicidal/ defoliation request documented the target area, justification, leaflet information for

civilians, contingency plans for crops accidentally damaged and certification by the province chief. These requests were processed through military channels. Free World Military Forces were subject to the same requirements as those for US Forces.[1]

Insecticides: From 1966 through 1972, three UC-123 RANCH HAND aircraft were used to spray malathion, an organo-phosphate insecticide, for mosquito and malaria control.[4] These aircraft were not camouflaged, and routinely sprayed insecticide adjacent to military and civilian installations, as well as in areas where military operations were in progress, or about to commence.

TCDD Contamination: The level of TCDD found in any given lot of 2,4,5-T, and hence Agent Orange, depended on the manufacturing process of the herbicide.[4] TCDD concentrations in individual shipments to Vietnam were not determined. Analysis of the Johnston Island Inventory of Agent Orange returned from Vietnam (Project PACER IVY), or the surplus inventory stored at Gulfport, MS, varied widely in concentrations (from 0.02 to 47 ppm).[4] Thus, there is significant uncertainty as to the amount of TCDD disseminated.

Allied Forces: Four nations provided combat troops to support the Army of Vietnam, 1962-1973. Australia/New Zealand deployed 46,852 combat troops. Korean deployed 312,853 combat troops, and the United States deployed 2.64 million military personnel.[6,7,8]

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