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DEPARTMENT OF THE ARMY
UNITED STATES ARMY INTELLIGENCE AND SECURITY COMMAND
FREEDOM OF INFORMATION AND PRIVACY ACT OFFICE
2600 ERNIE PYLE STREET
FORT MEADE, MD 20755-5995

May 19, 2023

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Privacy Office

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Commander
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Sincerely,

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Michael T. Heaton
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Freedom of Information/Privacy Act Office

Enclosure

FSTC-CS-03-10-66

ARMY MATERIEL COMMAND

U.S. ARMY
FOREIGN SCIENCE AND TECHNOLOGY CENTER

FOREIGN CROP R&D ACTIVITIES RELATED TO ANTICROP WARFARE (U)

DATA HANDLING PAGE

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Topic Tags: Plant science, anticrop warfare, biologic agent, disseminating system, plant disease, insect vector, herbicide, defoliant, fungicide, plant breeding.

Abstract: This study presents foreign R&D activities in the plant sciences related to the development of anticrop warfare agents and disseminating systems, including research on plant and insect diseases, effects of chemicals, disseminating devices and techniques, protective measures, and assessment of overall anticrop biological warfare (BW) capabilities. Information from intelligence reports, intelligence studies, and open literature was used to assess the overall anticrop BW R&D capability and trend for each country covered in this study.

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CODED

Project 6021

FSTC-CS-03-10-66

FOREIGN CROP R&D ACTIVITIES RELATED TO ANTICROP WARFARE (U)

September 1966

(Based on information available as of April 1966)

This is a Department of Defense intelligence product prepared and published by the U.S. Army Foreign Science and Technology Center of the Army Materiel Command. This product has been reviewed and approved by the Director, Defense Intelligence Agency.

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PREFACE

(U)
~~(C)~~ This study describes some existing and near-future foreign R&D activities in the plant sciences related to the development of anticrop warfare agents and disseminating systems in Communist and non-Communist countries. The countries covered are the U.S.S.R., Czechoslovakia, East Germany, Hungary, Poland, Communist China, the United Kingdom, France, the Netherlands, West Germany, and Japan. Information on Rumania, Bulgaria, Yugoslovia, North Vietnam, North Korea, Egypt, Israel and certain other countries of possible interest in this field was not included due to inadequate data.

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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

LIST OF TABLES

LIST OF ILLUSTRATIONS

FOREIGN CROP R&D ACTIVITIES RELATED TO ANTICROP WARFARE (U)

SUMMARY

(U)
~~(C)~~ The U.S.S.R. has an excellent organization for the development of an anticrop BW program. Unconfirmed reports indicate that the Soviet Army already has a defoliant and anticrop program. The quality of plant protection research in the U.S.S.R. is not up to U.S. standards, but, by 1971, increased emphasis on agricultural research should result in the recruitment of more highly qualified personnel, better equipment and facilities, and closer liaison with Western researchers.

(U)
~~(C)~~ The quality of plant protection research is found to be highest in Czechoslovakia and Hungary among the Communist countries, but Czechoslovak resources are limited.

(U)
~~(C)~~ Although Poland has some well-equipped plant protection laboratories and a few well-trained personnel, it has only a limited R&D potential to develop an offensive anticrop BW capability.

(U)
~~(C)~~ East Germany has a well-developed, research-oriented chemical herbicide industry, and its universities and institutes are conducting basic research in phytopathology.

(U)
~~(C)~~ Communist China possesses a sound research organization for plant protection and adequate industrial resources. At present, it is handicapped by a shortage of trained scientists, but the quality of those it has is high and the number is rapidly increasing.

(U)
~~(C)~~ The United Kingdom possesses a relatively small plant protection research establishment in which the number of agents investigated is relatively small; however, the quality of research is high, and the research program is well balanced.

(U)
~~(S/NFD)~~ The French Army has a definite interest in developing a chemical anticrop offensive capability. The effort appears to be relatively small, but is well planned and effective in achieving desired objectives.

(U)
~~(C)~~ The plant protection research effort in the Netherlands, although small, is of very high quality and is well balanced.

(U)
~~(C)~~ The quality of plant protection research, research facilities, and equipment is high in West Germany, where there also exists an advanced chemical industry for the production of anticrop chemicals.

(U)
~~(C)~~ Japan has a well-integrated research organization plus many competent scientists for the study of potential anticrop agents. Its plant protection research has been of high quality, and the reservoir of knowledge gained in the field is high, particularly regarding rice diseases.

FOREIGN CROP R&D ACTIVITIES RELATED TO ANTICROP WARFARE (U)

Section I. (U) ANTICROP WARFARE RESEARCH

1. (U) PLANT PEST RESEARCH

a. Anticrop warfare research is indistinguishable, in many respects, from agricultural plant pest research, particularly among research descriptions in open scientific literature.

b. Certain phases of plant pest research are peculiar to anticrop warfare and others are preculiar to agricultural research. The table on page 2 points out the areas of commonality and the areas where the two types of research differ. This table is by no means complete, but it points out how the two types of research compare.

2. (U) HERBICIDES

Research on anticrop chemicals, a counterpart of agricultural herbicides, was omitted from the table. The object of most herbicide research is to develop sprays which destroy weeds, but are noninjurious to crop plants and leave no toxic residues. An ideal anticrop chemical is one that is liquid and relatively nonvolatile, and destroys all crop plants.

Section II. (U) ~~(S/NFD)~~ FOREIGN CROP R&D ACTIVITIES IN COMMUNIST COUNTRIES

A. (U) ~~(S/NFD)~~ U. S. S. R.

3. (U) ~~(C)~~ GENERAL

a. (U) The Soviet Union is one of the leading agricultural countries of the world, with agricultural lands spread over vast areas having varied climates, terrain, and crops. As a result, it has a sizable research establishment covering a wide area concerned chiefly with crop plant protection.

b. (U) Russia ranked high in agricultural research before the Communist revolution. The Communists, however, concentrated on industrialization of the country, keeping their investment in agriculture to a minimum. The Communists have now greatly increased their investment in agriculture after experiencing food crop production shortages in recent years, and after their failure to significantly expand production by cultivating new lands in Siberia.

Table. (U). Similarities and Differences Between Anticrop Warfare Research and Agricultural Plant Pest Research (U)

	Applicable to	
Phases of plant pest research	BW research	Agricultural research
Study of life cycle of the pest	X	X
Morphology and physiology of the pest	X	X
Morphological and physiological effects of pest on host plant	X	X
Natural spread and buildup of plant pests and factors affecting them	X	X
Vector research	X	X
Yield reduction studies	X	X
Study of the natural biotypes of plant pest species	X	X
Morphological and physiological resistance of host plant to the pest	X	X
Studies on methods for large-scale production and storage of agent	X	
Studies on timing, equipment, and procedures for large-scale dissemination of plant pest	X	
Studies to increase infectivity, virulence, or destructiveness of plant pest	X	
Chemical and biological control of plant pests		X
Genetics and plant breeding research to develop resistant crop varieties		X

c. (U) ~~(C)~~ For the 5-year plan 1966-70, a 95-percent increase is scheduled in agricultural investment over the 1961-65 plan. According to the 1966-70 plan, agricultural production is expected to increase by 25 percent, with increased yields believed to be a major factor in this growth.

d. (U) Increased yields are to be obtained by increased agricultural research, as well as by increased use of fertilizers, pesticides, and farm machinery.

e. (U) The quality and quantity of Soviet agricultural research have fallen behind the West's because of Soviet neglect of agriculture. This gap, however, will probably be narrowed with the present increased Soviet emphasis on agricultural production.

f. (U) Soviet production of plant protection chemicals has increased from 59,700 tons in 1963 to approximately 125,000 tons in 1965. In 1970, the U.S.S.R. is expected to produce 450,000 tons of these chemicals. Where 20 different preparations were used for plant protection in 1956, 125 were used in 1965, and in the next 2 years this number is expected to double.

g. (U) Another factor which has seriously hampered Soviet agricultural research has been the official adoption of "Lysenkoism." T.D. Lysenko advocated a theory of inheritance* which most scientists found unacceptable, but the advocacy of this theory by Lysenko and its acceptance by the Soviet authorities was, to a large degree, politically motivated. The acceptance of this theory, however, wrought much damage to Soviet agricultural science, not only because of its basic insufficiency, but also because it lowered the morale and efficiency of Soviet agricultural scientists. Soviet agriculture had suffered critical reverses by the time Lysenko was officially discredited, and the effects of Lysenkoism still linger in Communist countries.

4. (U) ~~(S)~~ MILITARY ANTICROP R&D ACTIVITIES

a. (U) ~~(S)~~ Information concerning Soviet military anticrop R&D activities is quite meager. A source who attended the chemical, biological, and radiological school in 1960 stated that the Soviets have a defoliant program.

b. (U) ~~(C/NFD)~~ According to a report from an Italian source, the Soviets established a large installation in the TIPI (or IPI) Plains--about 150 kilometers from Merv (Turkestan)--for conducting experiments in biological warfare. In 1955 these tests included destruction of crops by sprays from aircraft flying at altitudes of 200 to 300 meters and contamination of livestock herds by means of infected pigeons.

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* The theory states that, by control of environments of plants, the life of the plant can be altered to create a variety with the innate hereditary factors that are required. This analysis is contrary to the classical Mendelian genetic theory of inheritance.

(U) c. ~~(C)~~ The TIPI Plains facility was equipped with a large laboratory for the preparation of contaminated or infected substances. The laboratory was directed by biologists of the Soviet Army, and German biologists transferred from Moscow. The entire area was protected by the same security measures adopted for Soviet atomic research facilities. The principal mission of the facility allegedly was the development of methods for destroying food sources rather than populations.

(U) 5. ~~(C)~~ ORGANIZATION AND FACILITIES FOR ANTICROP BW-RELATED R&D

(U) a. ~~(C)~~ The various Soviet agencies concerned with plant protection research can be grouped into two major divisions: those connected with GOSPLAN (State Planning Commission) and those connected with the Ministry of Agriculture (fig. 1).

(U) b. ~~(C)~~ Under GOSPLAN is the State Committee for the Chemical Industry, attached to which are the All-Union Research Institute for Plant Protection Chemicals and the All-Union Research Institute for Fertilizers, Insecticides and Bactericides (NIUIF). The State Committee for the Chemical Industry establishes policy on research, development and procurement of chemical products and substances. This committee directs research at the two aforementioned research institutes, where important activities include research on synthesis and industrialization.

(U) c. ~~(C)~~ Under the Ministry of Agriculture are the Academy of Agricultural Sciences imeni Lenin and its attached institutes, and the Science Bureau and its attached institutes. Based on the policies of the Ministry of Agriculture, the Academy of Agricultural Sciences plans scientific research covering agriculture; guides research activities, plans and trains researchers; and allocates research funds provided by the Ministry of Agriculture. The All-Union Research Institute for Plant Protection (under the Academy of Agricultural Sciences) is, by the nature of its research, one of the key research centers in the Soviet Union. This institute conducts evaluation tests of chemicals, and classifies and studies the physiology, ecology and outbreak probabilities of destructive organisms. The Science Bureau controls research institutes not attached to the Academy of Agricultural Sciences. These research institutes can be divided into three types: those specializing in specific crops (tobacco, cotton, corn, tea and subtropical crops); regional research institutes; and the agricultural testing stations concerned with plant protection. The research activities of the Science Bureau institutes, compared to those of the All-Union Research Institute for Plant Protection under the Academy of Agricultural Sciences, are quite limited.

(U) d. ~~(C)~~ Closely allied with research and also concerned with plant protection is the Plant Protection Inspection General Bureau (PPIGB), which supervises plant protection activities in the U.S.S.R., specifically the enforcement of programs for plant protection and epidemic control, and the investigation of plant damages. PPIGB determines the types and quantities of agricultural chemicals needed to carry out the programs for plant protection and prevention of epidemics, and reports these decisions to GOSPLAN, which then decides whether the required chemicals should be domestically produced or imported.

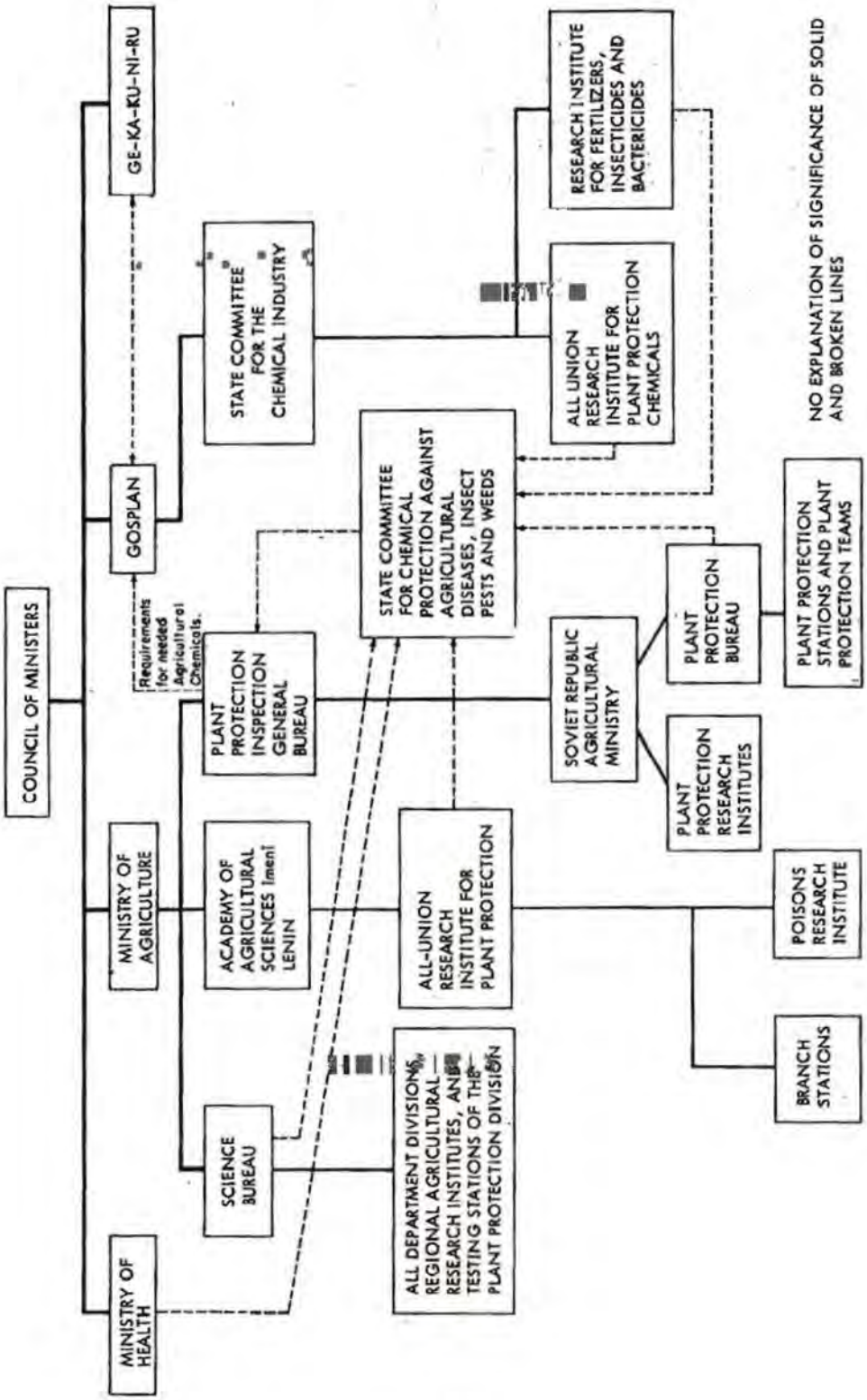


Figure 1 (C). Organization of agencies concerned with plant protection and research in the U.S.S.R. (U).

e. (U) ~~(C)~~ The plant protection bureaus of each of the agricultural ministries of the 15 Soviet Republics are under the PPIGB. These bureaus are the plant protection stations and the sovkhoz and kolkhoz production administration bureaus in each oblast. Each of these bureaus has a plant protection team linked to the plant protection stations. Specialists on plant protection are assigned to each sovkhoz or kolkhoz to provide leadership, but they may receive necessary aid from the oblast level.

f. (U) ~~(C)~~ Figure 1 shows the organization of the various agencies and institutes concerned with plant protection.

g. (U) ~~(C)~~ The All-Union Research Institute for Plant Protection in Leningrad is the coordination center for all agricultural-chemical research in the Soviet Union, and is the training agency for researchers in the plant protection field. The institute, commonly abbreviated VIZR, controls 43 toxicology laboratories and 18 agricultural testing stations throughout the Soviet Union. The total number of personnel, including those at the 43 toxicology laboratories and the 18 agricultural testing stations, is about 1100. The institute has 20 laboratories, listed as follows:

Agricultural-Chemical Microanalysis Laboratories (two)
Biological Control Laboratory
Biophysics Laboratory
Cereal-Crop-Destroying Insects Laboratory
Disease-Resistant Crops Laboratory
Entomology Laboratory
Germicide Laboratory
Herbicide Laboratory
Insecticide Laboratory
Mechanization Laboratory
Microbiology Laboratory
Microorganism Laboratory
Outbreak Forecasting Laboratory
Pathology Laboratory
Pentatomidae Laboratory
Quality Control Laboratory
Stored-Grain-Destroying Insects Laboratory
Virus Laboratory
Zoology Laboratory

h. (U) ~~(C)~~ The All-Union Research Institute for Plant Protection Chemicals, Moscow, was established about 1963 for the synthesis and development of insecticides and bactericides, and for research on manufacturing techniques. The institute is divided into three departments --Synthesis Technology Department; Physics, Chemistry, and Analysis Department; and Testing Department--and has branches and field test sites in various parts of the country.

i. (U) ~~(C)~~ The All-Union Research Institute for Fertilizers, Insecticides and Bactericides, also known as the Scientific Research Institute for Fertilizers and Insectofungicides imeni Ya. V. Samoylov (NIUIF), was reorganized recently. The institute's Insectofungicide Department has apparently become the All-Union Institute for Plant Protection Chemicals, of which Dr. N.N. Melnikov, former Director of NIUIF, is now Deputy Director. NIUIF has been left with only the fertilizer function.

j. (U) A few other institutes, at the All-Union and Republic levels, engaged in plant protection are: All-Union Scientific Research Institute of Phytopathology, Soviet Academy of Agricultural Sciences; Institute of Plant Physiology, Soviet Academy of Sciences; research institutes of the [redacted] Academy of Sciences; and the universities.

6. (U) ~~(S/NFD)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. (U) ~~(C)~~ Agents R&D.

(1) (U) ~~(C)~~ Viral, microbial, and plant.

(a) (U) In recent years, the potato viruses have been the subject of considerable Soviet research, with studies conducted in various parts of the Soviet Union--from the Baltic Republics to the Uzbek Republic and the Siberian Far East. Phases of these studies include virus-free planting materials; the nature of mosaic viruses K, X and Y, and trends in controlling potato degeneration; the effects of mineral fertilizers and trace elements on virus diseases and on yield of potatoes; the dynamics of propagation of potato viruses X and S; serological reaction of potato viruses X and Y; and the biochemical characteristics of potatoes infected by virus diseases.

(b) (U) ~~(C)~~ Relatively few studies have been made on wheat rusts in the Soviet Union; most of them concern leaf and stripe rusts, and only a few are on stem rust. The limited stem rust studies are understandable, since stem rust causes less damage in the Soviet Union than do the leaf or stripe rusts. Although fewer investigations have been reported on stem rust of wheat, the results appear to be of greater anticrop BW significance. One program, conducted by Ye. G. Rassadina at the All-Union Institute for Plant Protection, concerns the biology of stem rust uredospore germination. Another project conducted by Rassadina (also probably at the All-Union Institute for Plant Protection), which would be essential to the development of wheat stem rust as an anticrop BW agent, concerned the gradation of wheat specimens of the world collection according to their resistance to the race complex of stem rust. Also of interest is a report on the resistance of the causal agent of wheat stem rust to protective fungicides. Resistance was preserved in the following generation, and in the case of two fungicides, Phygon and Captan, a sharp increase in virulence of resistant spores occurred.

(U)
(c) ~~(C)~~ Studies on organisms causing verticillium wilt of cotton, and soybean, rice blast and nematode diseases, have also appeared in Soviet literature in recent years. Freeze-drying of phytopathogenic bacteria, covered in one of these studies, is of special interest. Optimal conditions for preserving the viability of freeze-dried phytopathogenic bacteria were investigated in three groups of bacteria: Xanthomas, Pseudomonas, and Erwinia. In a series of experiments, the effects of freezing, drying, storage, and reconstitution conditions were studied. Findings showed that, with freeze-drying at temperatures of -18° C., -30° C., and -75° C., the most unfavorable temperature for cell survival is -75° C. and the most favorable and convenient temperature for freezing before drying is -30° C. All representatives of the three phytopathogenic bacteria groups well tolerated the freeze-drying process. Storage under vacuum conditions at low temperatures is preferable to storage at room temperature. A 1- to 2-percent residual humidity is optional for preserving the viability of freeze-dried phytopathogenic bacteria cultures. (This study was conducted at the All-Union Institute of Phytopathology, Moscow.)

(2) (U) Herbicides and plant growth regulators.

(a) Research on plant hormones (growth regulators), defoliants and herbicides is being conducted in the Soviet Union. Anti-gibberillin was synthesized at the Chemical Institute, Moldovian S. S. R. Academy of Sciences. Tested in wheat, it was found to reduce growth without affecting yield, to increase resistance to lodging, and to decrease moisture requirements. Interesting new compounds of a structure simpler than kinetin (a new growth hormone with quininelike properties) have been found, but no synthesis was accomplished. Basic research at the Institute of Organic Chemistry, Academy of Sciences, U. S. S. R., produced more than 600 preparations for herbicides and defoliants, which were delivered to the All-Union Institute for Plant Protection (1963-64) for screening. The Institute of Organic Chemistry of the Ukrainian S. S. R. established a new laboratory for herbicide chemistry in 1964.

(b) Research on herbicides, defoliants and growth regulators is being conducted at the All-Union Institute for Plant Protection Chemicals, Moscow; the Timiryazev Institute of Plant Physiology, Moscow; the Academy of Sciences, Moscow; and others.

(U)
b. ~~(S/NFD)~~ Disseminating Systems R&D.

(U)
(1) ~~(S/NFD)~~ Aerosology.

(a) N. A. Fuks, of the Scientific Research Institute for Fertilizers and Insectofungicides (NIUIF), Moscow, is one of the leading Soviet theorists in the science of aerosols; he has been working in this field since 1934. His book, The Mechanics of Aerosols, is the most definitive treatment of its kind and is an excellent contribution to the establishment of aerosols as a sophisticated science.

(b) NIUIF had a small but excellent aerosol program and probably the best facilities available in the U. S. S. R. for the development of aerosol dispersal equipment. This institute might have been assigned the task of developing devices for the dissemination of aerosols, but its aerosol personnel and facilities probably were transferred to the All-Union Institute for Plant Protection Chemicals when NIUIF was reorganized.

(c) Few Soviet aerial crop-spraying experiments have been described sufficiently to provide information on particle size, ranges, and areas covered by the equipment used. This lack of information is in contrast to the large number of publications, usually of poor quality, on ground crop-spraying techniques and equipment, which is significant in view of the importance the U. S. S. R. attaches to aerial spraying. The Soviets may have been keeping such work classified because of its actual or possible military value, but recent articles indicate the initiation of a more liberal publication policy.

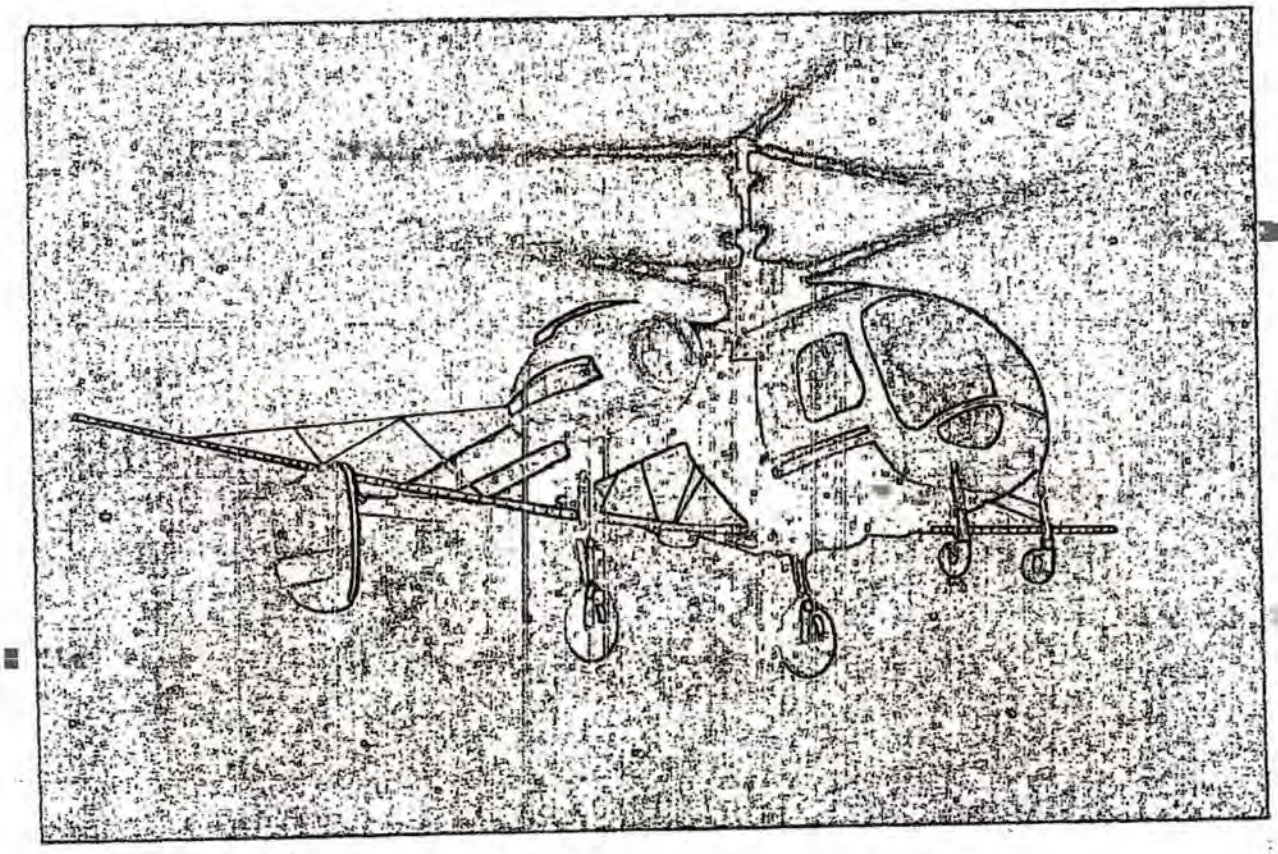
(2) (U) ~~(S/NFD)~~ Agricultural spray systems.

(a) (U) ~~(S/NFD)~~ The Moscow station of the All-Union Institute for Plant Protection has a large, practical program to develop agricultural sprayers. G. I. Korotkikh, who is reportedly the head of aerosol generator research, developed the AG-L6 aerosol generator with V. F. Stepanon.

(b) (U) ~~(S/NFD)~~ The AG-L6, which is mounted on a truck bed, is a rather complex thermomechanical generator for agricultural spraying. It uses its own gasoline engine to produce a highly dispersed aerosol (particles of less than 1 micron). The engine also produces a powerful fog formation, spraying up to 1 gallon per minute--only about one-third the volume needed for effective military use.

(c) (U) ~~(S/NFD)~~ The EAU-1 experimental aerosol generator, designed at the same institute as the AG-L6, produces aerosols by thermal, mechanical and thermomechanical methods. This device shows originality in combining a number of aerosol generation principles in one machine. The degree of particle dispersion can be altered within wide limits by varying the operating conditions, making it an excellent experimentation device. The primary advantage is flexibility in experimental field tests to determine optimum particle sizes and generation of methods for various meteorological conditions and liquids. This machine has no tactical military value, since it is too bulky (at least 6 feet long) and too heavy (one-half ton) for operational use.

(d) (U) In the Soviet Union, the helicopter is considered superior to the airplane for agricultural spraying operations; helicopters provide a greater profit per flying hour. Helicopters were first introduced to Soviet agriculture during the current 7-year plan, and the KA-15 is being used on an increasingly larger scale. Last year, helicopters were used in spraying operations involving 1,045,000 hectares of farmland. Although the KA-15 proved valuable for agricultural spraying, it will be succeeded by the more economical KA-26 (fig. 2).



(U)
Figure 2. ~~(C)~~. KA-26 helicopter to be used primarily in agriculture (U).

(e) (U) ~~(C)~~ The KA-26 is a multipurpose helicopter--in 1 to 5 hours, it can be re-equipped for agricultural use as a crop-duster and sprayer, as well as for geological survey and cargo and passenger transportation. This helicopter is equipped to protect the aircrew from chemical sprays; its chemical payload is 900 kilograms.

(f) (U) ~~(S)~~ For spraying cotton, large two-engine planes are used, with pilot, copilot and crew, carrying 3 metric tons of spray materials. The aerial tanks have mechanical agitation.

(g) (U) ~~(C)~~ Low-speed aircraft and ground sprayers have limited offensive anticrop BW applications, but may play an important role in defensive operations. The results of research conducted with agricultural sprayers on the effect of particle-size distribution and meteorological conditions on deposition of sprays would also be applicable in many respects to anticrop BW sprays.

(3) (U) ~~(S/NFD)~~ Anticrop BW disseminating systems. Information is practically nonexistent on the Soviet policy and capability to produce aerosols, and on aerosol-producing equipment for high-performance aircraft. In 1956, the Soviets reportedly sprayed an unknown chemical from wing tanks of a MIG-15 during uprisings in Poland. During World War II, the Soviets developed a series of wing tanks, one or more of which may be adaptable to jet aircraft. The Soviet have mentioned the dissemination of a 10- to 15-ton payload of toxic munitions from a modern heavy airplane; if such a spray system does exist, it could probably be used for the dissemination of anticrop agents (fig. 3).

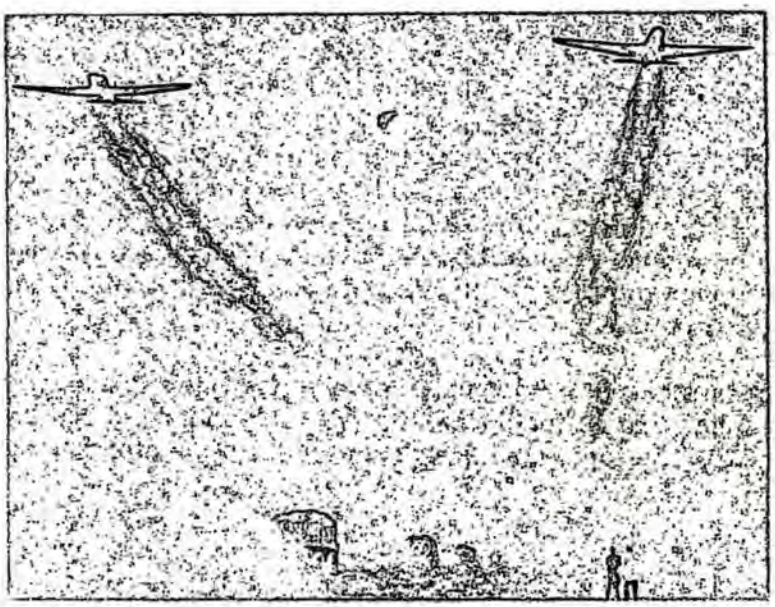


Figure 3. (U). Soviet airplane-spray field exercise (U).

7. (U) ~~(C)~~ PROTECTIVE MEASURES

a. (U) ~~(C)~~ General.

(1) (U) ~~(C)~~ Plant protection measures which are applicable to ordinary agricultural operations may also apply in defensive anticrop BW situations. Measures such as crop rotation and timing the planting of the crop to avoid certain seasonal pests, however, would probably be ineffective in defensive anticrop BW situations.

(2) (U) Many pesticides are used in anticipation of a regularly occurring pest, while others are used only after a pest is discovered. A prognostication or warning service is especially valuable when the prevalence or intensity of the pest varies from year to year. A warning service may be valuable in giving advance notice for the stockpiling of pesticides and in eliminating the necessity for maintaining continuous stockpiles of pesticides. In anticrop warfare situations, the pesticides would probably be applied after the arrival of the pest.

(3) (U) In an ordinary agricultural or anticrop BW situation, the ideal protective measure would be the development of resistant varieties, although most crop plants are susceptible to some variety of plant pest.

(4) (U) There is no known practical antidote for anticrop chemicals.

b. (U) ~~(C)~~ Pesticides.

(1) (U) ~~(C)~~ Research on chemical compounds used as fungicides, insecticides and herbicides is conducted mainly at the All-Union Research Institute for Plant Protection Chemicals, with close coordination from the All-Union Research Institute for Plant Protection. The latter tests foreign and domestic compounds for effectiveness, phytotoxicity, human toxicity, and purity, and screens newly compounded chemicals. Similar research may be conducted at plant protection research institutes existing in certain Soviet Republics. Each institute tends to be characterized by specialized research on certain crops--for example, the Armenian Research Institute for Plant Protection controls research relating to cotton.

(2) (U) A number of Soviet papers have been published on the synthesis and use of organophosphorus insecticides. The organophosphorus compounds are particularly effective against insects which act as vectors for plant virus diseases.

(U) ~~(C)~~ (3) Fungicides effective against verticillium wilt of cotton, blue mold of tobacco, and wheat rusts are being sought through Soviet research. Reported results in scientific literature have been very scanty regarding this research, probably because only limited success was achieved.

(U) ~~(C)~~ c. Forecasting Services. The All-Union Research Institute for Plant Protection, Leningrad, maintains the Outbreak Forecasting Laboratory. With 30 specialists, this laboratory is the largest in the institute. Research is conducted on the control and forecast of outbreaks of diseases, on crop-damaging insects and on destructive animals. Each year, data on problems are collected from farms and research institutes all over the Soviet Union. Studies are then made on the outbreak situation of harmful insects and pests, and a forecast for the following year is prepared, with special attention to those animals, insects, and diseases inflicting heavy damage. The intensity of concern over indigenous crops is reflected by the carefully coordinated efforts involving numerous duties, such as preparing outbreak forecasts for the following year, both for the entire Soviet Union and by regions; deciding on the needed quantities of agricultural-chemical supplies; and establishing methods of spraying (e.g., from the air or from the ground) and the type of machinery to be used.

(U) ~~(C)~~ d. Breeding of Resistant Varieties.

(U) ~~(C)~~ (1) The Disease-Resistant Crops Laboratory of the All-Union Research Institute for Plant Protection selects disease-resistant strains of crop plants, including those strains resistant to virus diseases. This laboratory also conducts research on the mechanism of disease resistance in plants.

(2) (U) Plant-breeding research and development for the production of rust-resistant wheats is being conducted at the All-Union Institute for Plant Culture, Pushkin; the Institute of Genetics and Selection of the U.S.S.R. Academy of Sciences; regional agricultural experiment stations; and others. These institutes undoubtedly are also selecting disease-resistant strains of all major crop plants grown in their regions of responsibility, since this approach has been the most fruitful in disease control throughout the world.

(U) ~~(C/NFD)~~ 8. GENERAL TREND OF CROP R&D ACTIVITIES

a. (U) Since expanded cultivation of the "new lands" in the late fifties and early sixties failed to eliminate the food production deficit in the Soviet Union, agriculture is now receiving higher priority vis-à-vis industry than in previous years. In agriculture, first priority was given to fertilizer production and then to the production of herbicides. In the past few years, when chemical insecticides and fungicides have been in short supply due to limitations in the chemical industry, the procedure was to emphasize biologic control of pests and the dangers of toxic chemical pesticides.

b. (U) With the discrediting of Lysenkoism in the Soviet Union, conventional genetics and plant-breeding have been on the ascent. In the breeding of rust-resistant wheat, disease-resistant strains have been collected by the Soviets from all over the world, especially from the United States.

c. (U) ~~(C/NFD)~~ Soviet plant pathologists have been slow in studying strains of plant diseases; they have only recently recognized the importance of these strains in plant pathological research.

9. (U) ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

a. The Soviet Union is capable of developing and initiating anticrop warfare based on plant diseases and herbicides.

b. The Soviet Union has an excellent organization for the development of an anticrop BW program. The quality of research is not up to U. S. standards, but increased emphasis on agricultural research should result in the recruitment of more highly skilled personnel, in better equipment and facilities, and in closer liaison with Western researchers.

c. The results of a good share of the anticrop research at the U. S. Army Biological Center is available in open literature for the Soviets to exploit, and the Soviet technological level in pesticide research is believed to be adequate for this exploitation. According to reports, the Soviet Union already has an active anticrop BW program.

B. (U) ~~(C/NFD)~~ CZECHOSLOVAKIA

10. (U) GENERAL

Czechoslovakia's principal crops are the grains, potatoes, and sugar beets. The value of agriculture imports closely approximates the value of exports, and no serious food shortages have occurred.

11. (U) ~~(C)~~ ANTICROP BW ORGANIZATION

In the event of biological warfare, the Czechoslovak prognostication service (the basis of which is the Inspectorate for Quarantine and Plant Protection of the Central Agricultural Control and Testing Institute) would be the principal defensive component and would use the prescribed procedures. Individual inspectors were equipped for this purpose in 1964 with the necessary equipment for collection and trapping of the parasites. The equipment may be used only in the case of biological warfare or similar extraordinary circumstances.

12. (U) ~~(C)~~ ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

Czechoslovak plant protection activities are centered at the Central Agricultural Control and Testing Institute, the highest decisive organ in this sector. Other institutes, such as the Central Research Institute for Plant Production, Ruzyne; the Institute for Experimental Botany, Czechoslovak Academy of Sciences (CAS), Prague; the Institute of Virology (CAS), Bratislava; and the Institute for Agricultural Technologic Research, Bratislava, conduct research on plant diseases.

13. (U) ~~(C/NFD)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. (U) ~~(C)~~ Agents R&D.

(1) (U) In 1964, two papers were published on research conducted at the Institute of Virology, Bratislava--one was on the persistence of infectivity of yellows-type plant viruses in extracts from viruliferous leafhoppers, and the other was on the multiplication of yellows-type plant viruses in leafhoppers. The yellows-type viruses affect many crop plants and can be easily transmitted by leafhoppers.

(2) (U) At the Central Institute for Plant Production, research has been conducted on substances which inactivate the X-virus present in sap from potato leaves.

(3) (U) ~~(C)~~ The above examples of plant virus research in Czechoslovakia indicate the high quality of the research. A visitor at plant virus laboratories in the Soviet Union and Czechoslovakia reported that the Czechoslovaks are doing much higher quality, more significant work in the field of plant viruses than the Soviets, and have better equipped laboratories.

b. (U) ~~(C)~~ Disseminating Systems R&D.

(1) Aerosology. Dr. K. Spurny, one of the world's leading authorities on aerosols, is working on technological concepts of aerosol stabilization, dispersion, immunization and detection. He is the author of the book Aerosology.

(2) Agricultural spraying systems. A former worker in the East German agricultural spraying program reports that East Germany and Czechoslovakia lead in the field of aerial spraying. In 1962, East Germany purchased twenty-five L-60 aircraft from Czechoslovakia for aerial spraying. Presently, East Germany has fifty L-60 and twenty-five AN-2 aircraft (fig. 4), all equipped for aerial application of liquid insecticides and powdered chemicals. These aircraft are presumed to have been purchased from Czechoslovakia, since all replacement engines are supplied by them. The East Germans are planning to replace their present aircraft with new Z-37 aircraft from Czechoslovakia by 1967; these aircraft are presently on order.

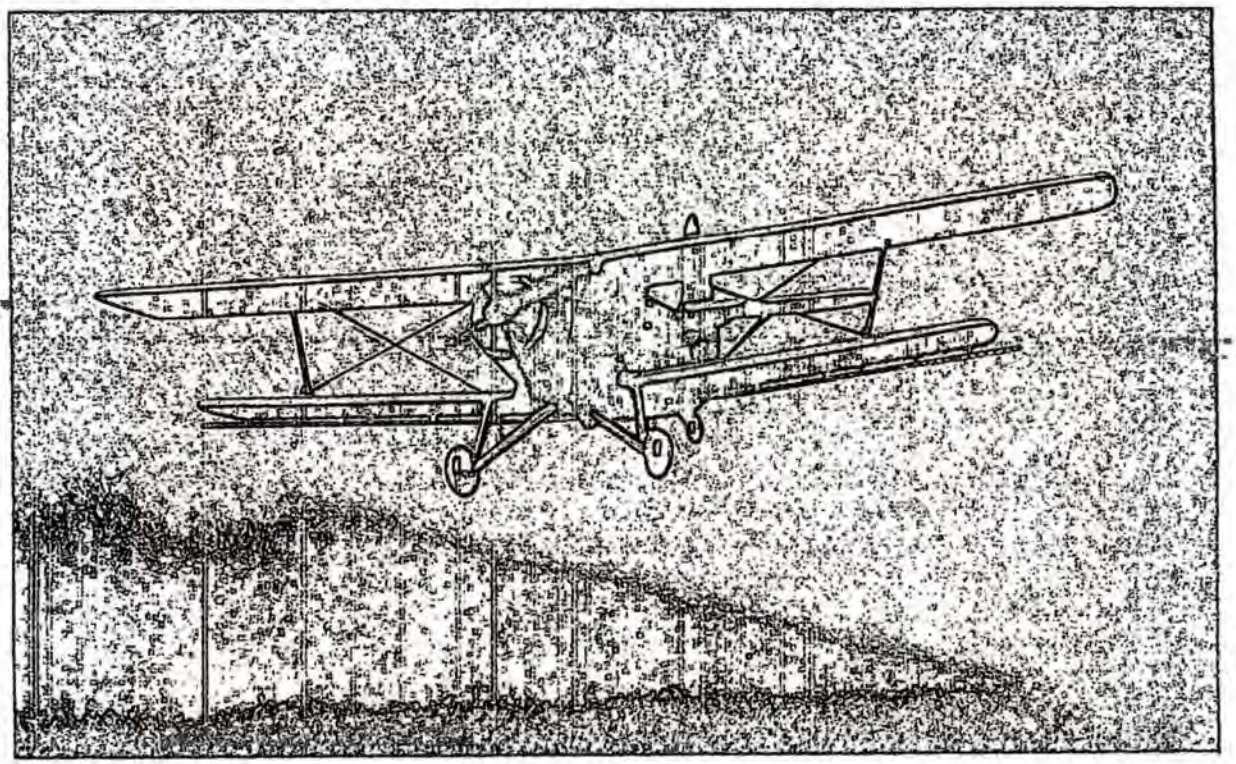


Figure 4. (U) AN-2 COLT spraying crops (U).

(U)
14. ~~(C)~~ PROTECTIVE MEASURES

a. Pesticides. The Jiri Dimitrov (Dynamitka) plant in Bratislava specializes in organophosphates which it supplies to all countries of the Eastern Bloc, particularly Poland and the U.S.S.R. The Spolana plant in Neratovice near Kralupy nad Vltavou produces a wide assortment of herbicides.

b. Warning Service. The Czechoslovak prognostication service is operated by the Inspectorate for Quarantine and Plant Protection of the Central Agricultural Control and Testing Institute mentioned previously. A book entitled Prognosy has been prepared to provide plant protection workers with a handbook on the current state of prognostic methods incorporated into the Czechoslovak plant protection services.

(U)
15. ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

Information on Czechoslovak activity in the anticrop BW field is rather vague, but the high quality of plant virus research, together with the well-organized plant protection warning service, indicates that Czechoslovakia has an R&D potential to develop a limited offensive anticrop BW capability.

(U)
C. ~~(C/NFD)~~ EAST GERMANY

16. (U) GENERAL

a. Before World War II, East Germany was an exporter of food; today, it is a large-scale importer. In 1955-56, the value of all agricultural imports amounted to $500,000,000. Before the war, East Germany was an exporter of grains, potatoes, sugar and vegetables, and an importer of meat, fats and oils, dairy products, eggs, and cotton and tobacco. Throughout the postwar years, East Germany has had to import significant amounts of all agricultural products, except sugar.

b. While East Germany was able to export about 15 percent of the domestic grain output during 1936-38, the situation was reversed after the war. In 1955-56, for instance, grain imports equalled over 20 percent of the total supply; imported bread grains accounted for almost one-third of the grain available for human consumption.

c. East Germany has greatly increased its fixed investments in agriculture in an effort to produce higher crop yields and to eventually improve its agricultural research capability.

(U)
17. ~~(C)~~ ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

a. The East German Academy of Agricultural Sciences, subordinate to the Ministry of Agriculture, is the center of all agricultural research in East Germany, including research on plant protection. The Academy's institutes were reportedly equipped with the best, most modern equipment available, and had no trouble getting additional supplies, finances or new equipment.

b. The following are some of the Academy's subordinate institutes where plant protection research is being conducted:

Institute for Phytopathology, Aschersleben
Institute for Phytopathology, Naumburg
Institute for Plant Research, Gatersleben
Institute for Agricultural Testing and Research Matters, Rostock

Between the Institute for Phytopathology, Aschersleben, and the Academy of Agricultural Sciences, Berlin, there is another echelon called the Central Biological Institute, Kleinmachnow, Berlin, of which the detailed organization is not known.

c. Plant protection research is also conducted in educational institutions, such as the Institute for General Botany, Friedrich Schiller University, Jena; the Institute for Tropical-Subtropical Agriculture, Leipzig; the Institute for Phytopathology and Plant Protection, University of Rostock, as well as at certain chemical plants.

18. (U) ~~(C)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. Agents R&D.

(1) Microbial.

(a) Basic research on the physiology and chemistry of viruses and virus diseases is being conducted by the Biochemistry Department of the Institute of Phytopathology, Aschersleben. The Virus Department has conducted studies on virus-causing diseases of potato and other crops. The Microbiology Department is investigating cereal diseases, with emphasis on organisms attacking the stem.

(b) At the Botanical Institute of the University of Jena, basic research is being conducted on the biology of phytopathogenic fungi and viral diseases of the potato.

(2) Herbicides. At the VEB Leuna Werke, R&D is in progress on the effectiveness of various derivatives of the dichloroproprionic and trichloroproprionic acids as herbicides; the latter substance has been officially tested and approved by the Central Biological Institute, Berlin. R&D for production of Dalapon herbicide, made from acrylic nitrile, has been completed.

b. Disseminating Systems R&D.

(1) Aerosology. Dr. Karlheinz Lohs, Director of an East German CW research organization with laboratories in Leipzig and Altenburg, has been conducting research on aerosols which could also be applicable to anticrop BW aerosols.

(2) Agricultural spray systems. A new aircraft-mounted liquid spraying device is being developed by the East German Gas Turbine Plant, Pirna. To date, prototypes have been completed and tested, with 20 scheduled for delivery to the Agricultural Aviation Service by April 1966. East Germany plans to replace all of the present spray units with new equipment. Except for the spray nozzles and and the main drive gear within the spray pump, the spray unit is made of nylon. Spraying equipment, with a spraying capacity from 3 to 100 liters per minute, is designed to spray liquids with viscosities ranging from water to heavy engine oils. Tests were conducted to determine equipment performance and to establish nozzle settings for various liquids. The equipment was tested by placing papers on the ground, flying over them, and spraying them with dyed water and various viscosities of oils up to heavy engine oil. Aircraft was flown at a fixed altitude of 8 meters and a fixed speed of 120 kilometers per hour.

19. (U) ~~(C)~~ PROTECTIVE MEASURES

a. Except for a few minor suppliers, East German pesticide-producing plants are listed below:

VEB Berlin-Chemie, Berlin Adlershof
VEB Fahlberg-List, Magdeburg
VEB Elektrochemisches Kombinat, Bitterfeld
VEB Farbenfabrik, Wolfen
VEB Fettchemie, Karl-Marx-Stadt
VEB-Werke, Leuna

The above-listed plants are also the main R&D centers on pesticides in East Germany. In addition, research on pesticides is carried on under the direction of Professor Hans Fuerst at the University of Dresden, and under Professor Martin Schmidt's direction at the Biologische Zentralanstalt (Central Biology Institute) in Berlin-Kleinmachnow, where all East German pesticide products must be officially tested before being released for sale.

b. At VEB Berlin-Chemie, Berlin Adlershof, research was in progress in 1960 on insecticides and a red-spider repellant formulated from urethane compounds. Experimental work was underway to find an effective systemic fungicide. A pilot plant for production of 36 tons per year of Zineb fungicide was under construction.

c. VEB Fahlberg-List, Magdeburg, has an extensive R&D program. In 1960, development was in progress on an improved mercury seed disinfectant; construction of a plant to produce 3000 tons of this product annually was expected to be completed by 1964. Production facilities for Captan and Phaltan, fungicides which have wide usage in the West, were being developed. Research was in progress for an improved Toxaphene product, for an insecticide derived from heterocyclic disulfides, and for a sulfur fruit-wetting agent containing 75 to 85 percent sulfur.

d. Research on herbicides, insecticides and aerosols is in progress at VEB Elektrochemisches Kombinat, Bitterfeld.

e. VEB Farbenfabrik, Wolfen, which produces Wofatax (an organophosphorus insecticide), conducts research on new organophosphorus insecticides.

f. Professor Hans Fuerst, a recognized pesticides specialist and a professor of organic technological chemistry at the University of Dresden, has conducted systematic examinations of benzene chlorination processes towards an improved method of producing hexachlorocyclohexane (HCH). Professor Fuerst has succeeded in working out a continuous process system whereby crude HCH containing 18 to 20 percent gamma isomer can be produced, and has also successfully implemented a continuous process for producing Aldrin, Dieldrin, and Isodrin insecticides.

20. (U) GENERAL TREND OF CROP R&D ACTIVITIES

At the universities and at the Institute for Phytopathology, Aschersleben, basic research is conducted on phytopathogenic fungi and viruses. At the industrial plants, research is directed toward the development of new chemical herbicides, fungicides, and insecticides, and the development of facilities to produce pesticides already produced in the West.

21. (U) ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

The well-developed research-oriented chemical herbicide industry in East Germany and the basic research in phytopathology conducted at the universities and institutes indicate that East Germany has the R&D potential to develop an offensive anticrop BW capability.

D. (U) ~~(C/NFD)~~ HUNGARY

22. (U) GENERAL

Hungary is a small country with a relatively large proportion of highly productive agricultural land.

23. (U) ~~(C)~~ ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

a. (U) ~~(C)~~ The Hungarian Plant Protection Service, Ministry of Agriculture, has under its organization the Research Institute for Plant Protection, Budapest, and 19 plant protection stations--one in each major subdivision of the country.

b. (U) Research on plant diseases and plant pests is also conducted at educational institutions such as the Institute of Plant Physiology, Eotvos University, Budapest.

c. (U) ~~(C)~~ The Research Institute for Plant Protection, Budapest, is one of the world's leading institutes doing fundamental research on the pathology and physiology of plant microbial infections. The caliber of personnel is extremely high, and the laboratories are well equipped.

24. (U) ~~(C)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. (U) Hungarian research papers have recently been published on virus diseases of potatoes, rice blast, black stem rust of wheat, and wildfire toxin of tobacco produced by the bacterium Pseudomonas tabaci.

b. (U) ~~(C)~~ Hungary produces its own 2, 4-D and Triazine herbicide.

(U)
25. ~~(C/NFD)~~ PROTECTIVE MEASURES

a. Many of the fungicides and insecticides used in Hungary are purchased in the West, particularly in the United Kingdom.

b. Hungarian researchers are concentrating on the breeding of polyploid varieties of sugar beets resistant to Cercospora beticola (an important disease agent in Hungary) at Sopronhorpacs, a special plant-breeding station near the Austrian border. Research on wheat rust resistance is being conducted at Kompolt (about 60 miles east of Budapest), the main center for this work; some minor wheat rust studies are also underway elsewhere in Hungary.

(U)
26. ~~(C)~~ GENERAL TREND OF CROP R&D ACTIVITIES

In Hungary, the trend is toward high-quality basic research on the host-parasite relationship, with a relatively small group of highly qualified individuals, equipped with modern facilities and equipment.

(U)
27. ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

The well-organized Hungarian plant protection service, with its highly qualified personnel and well-equipped laboratories, has the R&D potential to develop a limited offensive anticrop BW capability.

(U)
E. ~~(C/NFD)~~ POLAND

(U)
28. ~~(C)~~ GENERAL

Much of the crop research conducted in Poland is supported by grants from the United States under PL480, and from the Rockefeller Foundation; many researchers have recently received training in the United States.

29. (U) ~~(C/NFD)~~ ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

(U)
a. ~~(C/NFD)~~ The Research Institute of Plant Protection, Poznan, is excellently equipped and possesses fine general greenhouse facilities.

(U)
b. ~~(C)~~ Plant protection research is also being conducted at the Research Institute of Pomology, Skierniewice; the Forest Research Institute, Warsaw; the Institute of Ecology, Warsaw; the College of Agriculture, Poznan; and the Plant Breeding and Acclimatization Institute, Warsaw.

(U)
30. ~~(C/NFD)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. A U.S.-supported research project entitled "Studies on Cereal Rusts" is being conducted at the Plant Breeding and Acclimatization Institute in Poland. Under the direction of Professor Eugeniusz Ralski, surveys were conducted of leaf and stem rusts of cereals in Poland, occurrence and losses due to rusts, the physiological races of the rusts, and the source locations of rust resistance in cereals. Assistance has been received from Dr. J. G. Moseman, U.S. Department of Agriculture, cereal disease specialist.

b. At the Institute of Ecology, Warsaw, Dr. (fnu) Kozlowski is conducting mechanical as well as biological research on the transmission of viruses by insects.

(U)
31. ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

Although Poland has some well-equipped plant protection laboratories and a few well-trained researchers, it has only a limited R&D potential to develop an offensive anticrop BW capability.

(U)
F. ~~(C)~~ COMMUNIST CHINA

32. (U) GENERAL

Although Communist China is predominantly an agricultural country with 80 percent of its population classified as rural, between 1949 and the late 1960's it gave priority to industrial expansion and succeeded in increasing its industrial output several times. As a result of poor harvests during 1959-61, and the breakdown of the commune system plus the mistakes of the "Great Leap Forward," Chinese authorities reversed their policy and placed primary emphasis on agricultural production. The shift in emphasis from industrial to agricultural production should result in increased agricultural research and increased production of agricultural chemicals.

(U)
33. ~~(C)~~ ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

a. (U) The Chinese Academy of Sciences (CAS) is the major basic research organization in Communist China. CAS is directly subordinate to the State Council--the controlling authority on policies concerning scientific research. The best agricultural research on China's food resources is conducted by several institutes within CAS, where most of the outstanding agricultural scientists apparently exist.

b. (U) The Chinese Academy of Agricultural Sciences (CAAS), subordinate to the Ministry of Agriculture, emphasizes applied research and has a more direct influence upon food production.

c. (U) The China Agricultural Research Institute, a major agricultural science research organization, is independent of CAAS, and performs special tasks and basic research for the Ministry of Agriculture. Headquartered in Peking, this institute has six departments and its research fields include bacteriology, veterinary science, agricultural meteorology, crops, and animal husbandry. The Crops Research Department has five subdivisions concerned, respectively, with soy beans, peanuts, rice, cotton and sweet potatoes.

(U)
d. ~~(C)~~ The following CAS research institutes, all located in Peking, are concerned with plant protection:

Biology Research Institute
Botanical Research Institute
Entomology Research Institute
Genetics Research Institute
Microbiology Research Institute
Zoology Research Institute

(U)
e. ~~(C)~~ CAAS institutes, also located in Peking, concerned with plant protection are:

Cotton Institute
Crop-Breeding and Cultivation Institute
Plant-Breeding Institute
Plant Pathology Institute
Plant Protection Institute
Pomology Institute
Rice Institute
Wheat Institute

(U)
f. ~~(C)~~ In addition, CAAS has branches in the provinces, some of which are regional institutes.

g. (U) Plant protection research is also being conducted at various universities and colleges.

(U)
34. ~~(C)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. (U) Agents R&D.

(1) Microbial.

(a) Two studies on stripe rust of wheat which would have direct application to anticrop BW research have been reported on recently. One--a study of dispersal distance by Tseng, Shih-mai, at the Plant Protection Department, Peking Agricultural University--concerns a mathematical analysis of epiphytotics of wheat stripe rust in the spring. The other study is on the physiologic specialization of the wheat rust Puccinia glumarum by researchers at the Plant Protection Institute, CAAS.

(b) At the Microbiology Research Institute (CAS), Peking, some excellent basic research has been conducted on the physiology of rust parasitism, with special reference to Puccinia triticina.

(c) Because rice blast causes considerable yield reduction in China, the Chinese appear well aware of the cultural and meteorological conditions which favor rice blast and the importance of selecting resistant varieties of each rice-producing district. From a recent basic study on the carbon and nitrogen nutrition of Piricularia oryzae (the agent of rice blast), it has been concluded that the sensitivity of P. oryzae to the nutritional status of the host is partly due to its specific nutritional requirements. Spore dispersal of a different agent, Helminthosporium oryzae, was the object of another study.

(2) Viral. Research, with particular regard to the physical chemistry and latency of viruses, is undertaken in the Laboratory of Virology, one of three laboratories in the Wuhan Institute of Microbiology. The institute is headed by Kao Shang-yin (Ph.D. Yale, 1935), who is a noted virologist currently occupying the Chair of Virology at Wuhan University.

(3) Chemicals. Research on the utilization of herbicides to control weeds is just beginning in China. The Chinese have experimented with 3,4-dichloropropionanalide (DPA); sodium 2-methyl-4-chlorophenoxy acetic acid (MCPA); 2,4-D; simazine; and other Western-formulated herbicides on the reclaimed lands along the North China coast. These herbicides were apparently produced indigenously.

(U)

b. ~~(C)~~ Disseminating Systems R&D. No R&D reports have been received concerning dissemination systems. In 1962, the agricultural squadron of the Civil Aviation Bureau had two hundred AN-2 aircraft. The AN-2 from the Soviet Union was equipped with one device for spraying liquid and one for spraying powder. The powder dispensers operated at the rate of 1000 kilograms per 370 seconds; the liquid dispensers sprayed at 1000 kilograms per 120 seconds.

35. (U) PROTECTIVE MEASURES

a. Pesticides. In general, relatively few research studies are underway on the formulation and use of fungicides to control plant disease, but a number of reports are available on the chemical control of wheat rusts by p-aminobenzene sulfonic acid (also known as sulfanilic acid) and its sodium, calcium and ammonium salts. The chemical, which is absorbed by the plant and serves as a systemic fungicide, provides effective control of stripe, leaf and stem rusts. The product "Destroy Rust No. 1," manufactured by the Organic Chemistry Research Institute of Nankai University, is probably the same chemical. This compound is reportedly being tested over large areas of wheat cultivation.

b. Breeding of Resistant Varieties.

(1) Crop-breeding research is probably the most advanced of China's agricultural sciences. As a result of the efforts of competent Western-trained geneticists and plant breeders who now dominate the Chinese Academy of Agricultural Sciences, several newly introduced crop plant strains and hybrids have given significantly increased yields in many areas. The Academy President, Ting Ying, and the Vice-President, Chin Shan-pao, are Western-trained crop-breeders.

(2) In a number of publications on research conducted to produce rust-resistant varieties of wheat, of primary concern was the resistance to stripe rust. A conversion of hereditary spring wheat into winter wheat was accomplished by the Institute of Genetics, Chinese Academy of Sciences. Three new forms were high yielding, as well as resistant to rust and lodging.

(3) Studies on the inheritance of resistance of stripe rust in wheat are being conducted jointly by the Plant Protection Research Institute, CAAS, and the Plant Protection Research Institute at Hopeh Province Academy of Agricultural Sciences.

(4) The rust-breeding program has been expanded, and a number of rust-resistant varieties have been developed and distributed with a notable effect on increasing the yield. Most of the varieties are resistant to stripe rust, and only a few are resistant to stem rust and leaf rust.

(5) Research on the physiologic races of stripe and stem rusts has been conducted by the Institute of Plant Protection, CAAS; Peking Agricultural University; Mukden Agricultural College; and the Kiangsu Branch of CAAS. Greenhouses have been used to accelerate breeding.

36. (U) ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

Communist China is capable of developing an offensive anticrop BW weapon system, and both the quality and quantity of biological research are increasing. After the Communist takeover in 1949, the highly qualified Western-trained scientists were suspect and had little influence. From the failure of the "Great Leap Forward," authorities learned that greater progress could be achieved by giving scientists a freer hand in their program. This restored confidence proved successful--the present research program is properly oriented and the quality is high; younger people are being trained; and rapid progress is being made.

(U) Section III. ~~(S/NFD)~~ FOREIGN CROP R&D ACTIVITIES IN NON-COMMUNIST COUNTRIES

(U) A. ~~(S/NFD)~~ UNITED KINGDOM

37. (U) GENERAL

a. Agriculture, though a major industry in the United Kingdom, forms a smaller part of the general economy than in any other industrial country. It employs about 900,000 people--about 3.5 percent of the active population--and contributes less than 5 percent to the gross domestic product. The United Kingdom has one of the world's most highly mechanized farm economies, with about 1 tractor for every 30 hectares.

b. The United Kingdom is the world's leading importer of agricultural products, which averaged about 40 percent of its $13 billion total annual imports in recent years. In 1964, the leading agricultural imports were meat and meat preparations, fruits and vegetables, cereals and cereal preparations, natural fibers, dairy products, eggs, sugar, tea and spices, and tobacco.

38. (U) MILITARY ANTICROP R&D ACTIVITIES

In 1965, a special representative for the Ministry of Defense, United Kingdom, visited the Biological Laboratories, Fort Detrick, Maryland, to study every facet of the defoliant program in order to advise the U.K. on establishment of a cooperative research effort without duplication. This representative explored objectives, background history, screening methods, nature of compounds being synthesized, promising "lead" compounds, basic mechanisms, field tests, field evaluations, data retrieval, formulations, and other areas.

39. (U) ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE RELATED R&D

a. The Rothamsted Experiment Station, Harpenden, Hirts, England, is one of the world's oldest agricultural experiment stations and has an excellent reputation for agricultural research. Started on a grant from a private individual, it is now supported by the British Government.

b. Other national institutes involved in plant protection research are the Plant Breeding Institute at Trumpington, Cambridge, England; and the National Institute of Agricultural Botany.

c. Research on plant diseases are conducted at the following educational institutions:

University of London
University of Southampton
Imperial College of Science and Technology, London
University of Aberdeen, Scotland

d. Research and development on new fungicides, insecticides and herbicides is also being conducted at research laboratories of large industries, such as the Imperial Chemical Industries, Ltd.

40. (U) ~~(S/NFD)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. (U) ~~(C/NFD)~~ Agents R&D.

(1) (U) Microbial.

(a) Puccinia striiformis, the agent of stripe rust, is the subject of considerable research in the United Kingdom; the cool, moist summers favor its development. At Rothamsted, studies are underway on the dissemination of spores of this agent. Investigations of stripe rust on wheat, rye and barley are being conducted at the Plant Breeding Institute, Cambridge, where studies on races, genes for resistance in the host crops, preservation, and storage of inoculum are included. Epidemiology studies on stripe rust are being conducted at the Imperial College of Science and Technology, London. At the University of Southhampton, yield reduction and changes in carbon assimilation and translocation caused by this agent have been investigated.

(b) Research on the potato viruses, sugar beet yellows, stem rust, powdery mildew of wheat, and cercosporella rye spot of cereals is being carried out at Rothamsted and at the Plant Breeding Institute, Cambridge.

(c) Studies on Piricularia oryzea, the agent of rice blast, are underway at the University of London. At the University of Aberdeen, Scotland, the adaptation of the immunofluorescence technique is being investigated for use in plant bacterial identification. Dr. Sidney Dickenson, Cambridge University, has been studying the physiology of rust fungi.

(2) (U) ~~(C/NFD)~~ Chemicals.

(a) (U) ~~(C)~~ Information concerning R&D of new herbicides in the United Kingdom is sparse. The Imperial Chemical Industries have developed two new herbicides, paraquat and diquat, which are very effective in killing plants under certain conditions. Diquat is especially effective in killing submerged or floating water weeds.

(b) (U) ~~(C/NFD)~~ The British have a production capability for the phenoxyacetic acid derivatives employed by herbicides. In 1960-61, the British negotiated a contract with the U. S. S. R. to build a production plant near Moscow for the manufacture of phenoxyacetic acid derivatives.

b. (U) ~~(S/NFD)~~ Disseminating Systems R&D.

(1) (U) ~~(S/NFD)~~ Aerosology.

(a) (U) Dr. H. H. Gregory, Rothamsted Experiment Station, is probably the world's foremost authority on the aerosolization and travel of fungal spores. Dr. Gregory's recent book on aerobiology is an authoritative monograph on the subject.

(b) (U) ~~(C)~~ Spore trapping of stem rust spores over the English Channel was carried out by Dr. J. M. Hirst, Aerobiologist, Rothamsted Experimental Station, with the cooperation of the Air Ministry. The Rothamsted Experimental Station has collaborated, in recent years, with the Meteorological Research Flight of the RAF in an investigation of the distribution of fungus spores in the air. The interest in stem rust of wheat was twofold: first, to assist the British Agricultural Service in Bristol to pinpoint the source of attacks arising in southwest England, and second, to use the uredospores as "recognizable immigrants" in studying the general problems of the distant dispersal of pathogens.

(c) (U) ~~(S/NFD)~~ Since 1958, the Microbiological Research Establishment, Porton, has been conducting field trials on the long-distance travel of particulate clouds. In the first trial, the specified target was 10,000 square miles. The aerosol cloud was dispersed over the English Channel and studied as it drifted over England and Wales. The aerosol cloud consisted of fluorescent particles and was released as a line source at 500 feet altitude. Since the first trial, the height of release and the meteorological conditions, among other conditions, have been varied.

(U)
(2) ~~(S/NFD)~~ CBR disseminating systems.

(a) Spray tanks for high-speed aircraft have been designed and manufactured for spray trials by the Chemical Defense Experimental Establishment (CDEE). The tanks, each with a capacity of 100 gallons, are modified overload fuel tanks fitted to the Hunter aircraft. Although the tank was developed to spray toxic CW munitions, it no doubt can be modified to spray herbicides or defoliants.

(b) CDEE has also successfully developed a system whereby aerosols can be liberated from a submerged submarine. Although only liquid aerosols were generated in the first trial, solid particle aerosols will probably be liberated in later trials.

41. (U) PROTECTIVE MEASURES

a. Most of the crop protection research appears to be centered on the breeding of disease-resistant strains of crop plants and is conducted at the Plant Breeding Institute.

b. Control of potato virus diseases is accomplished chiefly by the use of virus-free seed stock grown in Scotland. Without clean stocks, losses may be as high as 10 percent of the crop the first year and 60 percent the second year. Organophosphorus insecticides, the use of which is being investigated, may control the aphid vectors and alter the practice of using disease-free stock. Control of sugar beet yellows may be accomplished in the same way.

(U)
42. ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

The United Kingdom possesses a relatively small plant protection research establishment, with a minimum of agents investigated. The quality of research is high, however, and the research program is well balanced. With the research already conducted on aerosols by the Rothamsted Experimental Station and the Microbiological Research Establishment, and with the development of spray systems by the Chemical Defense Experimental Establishment, the United Kingdom possesses the capability for the development of an offensive anticrop BW weapon system with a minimum of delay.

(U)
B. ~~(S/NFD)~~ FRANCE

43. (U) GENERAL

France is the largest agricultural producer in western Europe, with the production of grain in 1965 estimated at 28.6 metric tons--over half of which was wheat. About 4 million people, or nearly one-fifth of the labor force, are employed in agriculture. This labor force cultivates 18.5 million hectares, producing the bulk of domestic agricultural needs, and supplying additional amounts which account for about one-sixth of the total exports.

(U)
44. ~~(S/NFD)~~ MILITARY ANTICROP R&D ACTIVITIES

a. In a 1962 report, the French Army described tests in which commercial herbicides were applied with backpack sprayers on various food crops such as grains, beets and potatoes, grown on 9-square-meter or 20-square-meter parcels of land. Only the herbicides with a 3-(p-chlorophenyl) 1,1-dimethylurea (Monuron) and 3 amino-1,2,4-triazole (Amitrol or Aminotriazole) base proved to be of interest. The products 2,4-D and 2,4,5-T were effective only in proportions and volumes high enough to be prohibitive for aerial treatment (30 to 50 kilograms of product in 800 liters of water per hectare of rice field).

b. From the work as a whole, the conclusion was drawn that 90-percent destruction of a crop is obtained with an average of 2 kilograms of herbicides Monuron or Amitrol per hectare, if administered evenly and at the appropriate time.

c. In 1957 and 1959, at the request of the High Command of the Armed Forces in Algeria, the Chemical Weapons Group treated a narrow strip of land extending along the Algerian-Tunisian and Algerian-Moroccan frontiers with herbicides to destroy all vegetation. Ten plant-destroying agents were tested, and Telvar (containing 80 percent Monuron) appeared most effective; however, up to 50 kilograms per hectare in two applications was required to destroy all vegetation for one year.

45. (U) ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

Research in plant pathology is conducted at the following institutions:

Central Plant Pathology Station, National Center for Agronomic Research, Versaille

National Agricultural School, Grignon

Plant Virus Laboratory, Institute of Botany, University of Strasburg

(U)
46. ~~(C/NFD)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

(U)
a. ~~(C/NFD)~~ Agents R&D.

(1) (U) Research on stripe rust, Cercosporella rye spot, powdery mildew, and septoria leaf spot of wheat are being conducted at Versaille. At Grignon, studies on black stem rust of wheat, stripe rust, virus diseases of sugar beets, and cercospora on sugar beets are underway.

(U)
(2) ~~(C/NFD)~~ At the Plant Virus Laboratory at the University of Strasburg, Professor L. Hirth is studying the problem of virus nucleic acid synthesis, using plant viruses, including turnip yellow mosaic virus. Radioactive materials are used to study the structure of virus and nucleic acids in the virus. RNA special structures are also being studied.

(U)
b. ~~(C/NFD)~~ Disseminating Systems R&D. The French Army has been interested in developing, for use with jet aircraft, a spray tank that will be capable of spraying either chemical or biological agents by changing the jets or orifices on the tank. They have also expressed a desire to investigate the possibility of using drone aircraft to disseminate chemical and biological agents. Dissemination of herbicides, defoliants, or biological anticrop agents from such spray tanks should present no special problems.

(U)
47. ~~(S/NFD)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

The French Army has an interest in developing a chemical anticrop offensive capability. The effort appears relatively small, but well planned and effective in achieving desired objectives.

(U)
C. ~~(C/NFD)~~ NETHERLANDS

48. (U) GENERAL

a. In the Netherlands, the expansion of agriculture production during the past decade resulted from increased output per unit of land, livestock, and labor. Some new land has been reclaimed, but it was more than offset by urban expansion.

b. Because of its excellent environment for scientific research, the Netherlands is one of the few countries that continues to attract scientists from the United States for a temporary or permanent stay. The faculty of the University of Nijmegen includes many members from other countries, including former residents of England, Germany, Switzerland, and the United States.

(U)
49. ~~(C)~~ ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

a. (U) The Netherlands plant protection institutes--the Institute for Organic Chemistry and the Institute for Phytopathology--are centered at Wageningen. Also located at Wageningen are the National Agricultural University and the International Agricultural Center Library.

(U)
b. ~~(C)~~ Dutch laboratories are well equipped and compare favorably with the most modern facilities in the United States. Procurement of chemical and laboratory supplies is efficient, and a good pool of skilled technicians is available.

50. (U) ~~(C/NFD)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. (U) ~~(C/NFD)~~ Agents R&D.

(1) (U) Microbial.

(a) The Netherlands Grain Center is sponsoring a cooperative study of stripe rust in Europe, with the major part of the study conducted at the Institute of Phytopathology, Wageningen, and the Institute for Botany at Braunschweig, Germany. The former institute maintains stripe rust lines and races, and supplies seed to the cooperators for the international European rust nurseries. In addition, it keeps abreast of rust developments throughout the country and compares notes with the institute at Braunschweig.

(b) At a meeting at the Pathology Section of the European Association of Potato Research held at Wageningen (9-11 June 1965), four papers were presented on Dutch research conducted on Phytophthora infestans, the agent causing late blight in potatoes. The papers covered germination of sporangia, forecasting blight infection, Phytophthora resistance in haploid potatoes, and assessment of resistance to Phytophthora in potatoes.

(2) (U) ~~(C/NFD)~~ Chemical. At the Institute for Biological and Chemical Research on Field Crops and Herbage, Wageningen, the facilities and scope of work in weed control are impressive. There is a balance of interest and effort between field-type research and fundamental physiological studies. The herbicide, Amitrol, is under investigation. New research is also underway on the influence of one herbicide on the translocation of another, and the effect of a herbicide upon its own translocation. Basic research is being conducted at this institute on such problems as the inhibition of photosynthesis and destruction of plant tissue by herbicides.

b. (U) Disseminating Systems R&D. No information is available on disseminating systems research and development in the Netherlands.

51. (U) ~~(C)~~ PROTECTIVE MEASURES

a. (U) ~~(C)~~ Pesticides.

(1) Dr. (fnu) Van der Kerk, Director of the Institute for Organic Chemistry, Wageningen, is active in the area of fungicide degradation in plants. He and his associates are world leaders in the area of carbamate fungicide metabolism in plants.

(2) At the Institute for Phytopathology, Dr. (fnu) Dekker is doing some interesting research with the potential fungicide 6-azauracil. He found that this compound is converted in the organism to 6-azauridine, which interferes with the synthesis of some precursors of protein.

b. (U) Breeding of Resistant Varieties. Breeding of stripe rust-resistant varieties of wheat is in progress at the Institute for Phytopathology, Wageningen, in conjunction with studies on races of stripe rust and resistant lines of wheat.

(U)
52. ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

The research effort in the Netherlands is small in the anticrop BW-related field, but the quality is high and the program is well balanced; therefore, the Dutch appear to possess the R&D capability to develop a limited offensive anticrop BW weapon system.

(U)
D. ~~(S/NFD)~~ WEST GERMANY

53. (U) GENERAL

Agriculture, including forestry and fishing, contributed about 4.5 percent of the 1965 gross national product (GNP), which is estimated at around $112 billion; about 10 percent of the labor force is employed in agriculture. Agriculture's relative contribution to the GNP and the proportion of the labor force employed in agriculture are continuing their long-term decline. As tariffs between Common Market countries are reduced, German farmers will face keener competition from their counterparts in other member nations.

(U)
54. ~~(C/NFD)~~ ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

(U)
a. ~~(C/NFD)~~ Most of the German plant pathological research is done at the Max Planck Institute and at the Federal Biological Institutes for Agriculture and Forestry, Braunschweig.

(U)
b. ~~(C/NFD)~~ West Germany has 41 Max Planck Institutes, most of which are housed in new, elaborate facilities; most of the support funds come from government sources. In 1966, German Government subsidies to the Max Planck Society and the German Research Association will amount to $37.5 million, of which the former will probably get a major share.

(U)
c. ~~(C/NFD)~~ Three of the 41 Max Planck Institutes are located at Tubingen, adjacent to and a part of the University of Tubingen: Institutes of Biology, Biochemistry, and Virus Research. The University of Tubingen is considered one of the great virus research centers of the world and, with the new facilities being added, will undoubtedly become the world's leading virus research center.

(U)
d. ~~(C/NFD)~~ The Botany Unit of the Institute of Biology, which does pathological research, consists of 8 or 10 scientific personnel who are conducting a program in general plant pathology, genetics, virology, and physiology-biochemistry. The Institute of Biology has superb equipment and facilities, such as ultracentrifuges, amino acid analyzers, electrophoresis rooms, chromatographic rooms, a preparative centrifuge, a photographic laboratory, growth-control rooms, machine and electronic shops, as well as adequate greenhouse space. The Botany Unit is quite strong in basic research, with good leadership and research production.

(U)
e. ~~(C/NFD)~~ The Federal Biological Institutes at Braunchweig consist of the following institutes: Virus Serology, General Virus, Agricultural Chemical, and Botanical. The Botanical Institute has a good greenhouse and elaborate field equipment for recording dew, rainfall, and air and soil temperature. For the Virus Institutes, two new air-conditioned houses, similar to four existing buildings, were being constructed in 1959. Laboratory equipment for the virus groups is good, but does not begin to match that at Tubingen.

f. (U) Plant pathological research is also being conducted at the following:

Bavarian Crop-Breeding Institute, Weihenstephan

Farbenfabriken Bayer A. G., Leverkusen

Federal Biological Institute, Berlin-Dahlem

Hoechst A. G., Farbwerke, Frankfurt

Institute for Plant Protection, Hohenheim Agricultural High School, Hohenheim

Institute of Plant Physiology and Plant Protection, University of Goettingen, Goettingen

Technical High School, Munich

(U)
55. ~~(S/NFD)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

(U)
a. ~~(C/NFD)~~ Agents R&D.

(U)
(1) ~~(C/NFD)~~ Microbial.

(U)
(a) ~~(C/NFD)~~ One of the most outstanding programs at the Institute of Biology, Tubingen, is headed by Dr. G. Wittman on the nature of mutation in tobacco mosaic virus and other biochemical aspects of plant virology. The Institute of Virus Research, Tubingen, is conducting research on the biochemistry of virus synthesis.

(U)

(b) ~~(C/NFD)~~ Dr. Kurt Hassebruk, head of the Botanical Institute, Braunschweig, has published 75 papers on cereal rusts and is considered an authority in this field. He is working on race identification in cooperation with the Institute for Phytopathology, Wageningen, the Netherlands. Dr. Hassebruk's group also works on races of the potato wart organism, the source of resistance to them, and a program on epidemiological studies in relation to late blight forecasting.

(U)

(c) ~~(C/NFD)~~ The Virus Serology Institute, Braunschweig, headed by Rudolf Bercks, is concerned primarily with research in the development of serological techniques, as well as the production for sale to private plant-breeders of antisera for the more important potato viruses. In cooperation with the General Virus Institute, headed by Otto Bode, the Virus Serology Institute carries a broad program in virus research. In Bode's group are Erich Kobler, who has published extensively on virus multiplication in plants; J. Brandes, on electron microscopy; H. L. Paul, on physiochemical studies; and Josef Voelk, who works on insect transmission. Bode personally works on viruses, primarily from the disease standpoint, and handles the institute contacts with the seed certification group.

(d) (U) W. Hunnius at the Bavarian Plant-Breeding Institute, Weihenstephan, heads a group who are conducting an intensive study of potato viruses. H. Forster, Technical High School, Munich, has also published on potato virus Y.

(e) (U) Research on the enzymes of carbohydrate metabolism in wheat seedlings infected with Puccinia graminis tritici was conducted at the University of Goettingen.

(U)

(2) ~~(C)~~ Chemicals. The Soviet Union has purchased large quantities of DEF, a cotton defoliant, from Farbenfabriken Bayer A. G., Leverkusen, West Germany. Despite the lack of specific information, this concern and a number of others are believed to be conducting herbicide and defoliant research in West Germany.

(U)

b. ~~(S/NFD)~~ Disseminating Systems R&D.

(1) Aerosology. The Institute of Aerobiology, Grafschaft, a Ministry of Defense facility organized to study CBR defense, has an aerosol research program. Planes have been flown daily across Germany, using various devices to sample air. Particulates from air were studied for number, size and identity. Dr. (fnu) Petras is interested in the ecology of air up to a height of 10,000 feet.

(2) CBR disseminating systems. The West Germans have standardized two types of aircraft spray tanks which are used with helicopters and jet fixed-wing aircraft, respectively, for simultant persistent chemical agent dissemination. The spray tank for the Alouette II Helicopter was first made by Sud Aviation, Paris, and is currently manufactured by Helicopter-Dienst, Kretz bei Andernach, West Germany. The spray tank for the Fiat G-91 jet aircraft is made by Siebel, Donanworth, Germany. Research on persistent chemical agent spraying is closely related to anticrop chemical agent spraying.

(U)
56. ~~(C/NFD)~~ PROTECTIVE MEASURES

Research on pesticides is being conducted at Farbenfabriken Bayer A.G., Leverkusen and Hoechst A.G. Farbwerke, Frankfurt; the latter is producing pilot-plant batches of Bacillus thuringiensis, a biological insecticide. West Germany has the chemical industry to produce all the pesticides it needs, and some for export. Extensive research is probably being conducted, but detailed information is not available.

(U)
57. ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

West Germany's excellent plant protection research, research facilities and equipment, and advanced chemical industry indicate a potential offensive anticrop BW capability with such agents as stripe rust, stem rust, potato viruses and herbicides.

(U)
E. ~~(C)~~ JAPAN

58. (U) GENERAL

a. Japan is one of the world's leading markets for farm products; its agricultural imports were approaching an annual $2 billion in 1962, with bright prospects for continued increases. The value of farm imports climbed from $1,305 million in 1952 to a high of $1,983 million in 1961.

b. Japan produces only about 80 percent of its food requirements, even though most of its limited land area is devoted to crop production. There is little opportunity to expand the cultivated area, with nine-tenths of the agricultural land devoted to food crops. By use of multiple cropping, irrigation, heavy applications of fertilizers, intensive cultivation, improved seeds, and other modern practices, Japan achieves high yields per acre, but is hard pressed to maintain about 80 percent self-sufficiency in food.

59. (U) MILITARY ANTICROP R&D ACTIVITIES

Japan is not known to be engaged in military anticrop R&D, but during World War II, the Japanese conducted extensive crop-destruction experiments. Despite the small size of the group engaged in this work (one botanist, one plant physiologist, and a small group of assistants), research was actively carried out for 9 years. No studies were made on growth hormones, but plant pathogens were extensively investigated. Most of the plant pathogens studied at Fort Detrick, Maryland, as well as many others had been investigated by the Japanese. Fungi, bacteria and nematodes were explored, mainly for their effects on practically all grains and vegetables, particularly those grown in Manchuria and Siberia.

60. (U) ORGANIZATION AND FACILITIES FOR ANTICROP WARFARE-RELATED R&D

a. Japan has a well-organized, flexible system for agricultural research. Its national and prefectural experiment stations and its research at educational institutions and chemical companies give it a well-rounded program in plant protection research.

b. The National Institute of Agricultural Science (NIAS) is subordinate to the Ministry of Agriculture and Forestry. At the Nishigahara Station, Tokyo, one of several departments is the Department of Plant Pathology and Entomology, which deals with problems concerning control of diseases and insect pests of crop plants.

c. Researchers at NIAS are engaged in fundamental research in agriculture and agricultural techniques, are examining problems common to several regions and/or relating to the whole country, and are conducting studies for which concentrated use of necessary facilities at a centralized location is most effective.

d. The Ministry of Agriculture and Forestry also operates regional agricultural experiment stations. Each region may comprise one or more prefectures with similar climate and crops; there are eight of these regional stations in Japan, each having departments or units concerned with disease and insect pest research and plant breeding.

e. Each of the 46 prefectures has a prefectural agricultural experiment station whose departments are concerned with applied plant protection research.

f. Many of the universities have faculties of agriculture or departments conducting basic research on plant diseases and pests.

61. (U) ~~(C)~~ R&D ACTIVITIES CLOSELY RELATED TO ANTICROP WARFARE

a. (U) Agents R&D.

(1) Microbial.

(a) A great deal of research is centered around rice in Japan, inasmuch as rice is Japan's principal crop. Extensive research is also being conducted on rice diseases, especially rice blast which is caused by Piricularia oryzae.

(b) Since 1962 or earlier, Dr. Kazao Goto has been heading a special project in the Ministry of Agriculture and Forestry on identifying races of P. oryzae in Japan. Dr. Takuje Kosaka, NIAS, is working on the fundamental aspects of the Piricularia race problem. In 1964, a U. S. -Japan conference was held at Beltsville, Maryland, where 12 candidate varieties from international blast differentials were selected. Another conference was held between U. S. and Japanese representatives in Tokyo, during October 1965, to make a final selection of varieties for international blast differentials. On the third day of the conference, both parties agreed to a group of eight varieties. Dr. S. H. Ou, International Rice Research Institute, Los Banos, Philippines, pledged his support in the acceptance of these varieties for use as international rice blast differentials.

(c) NIAS is conducting many other studies, including the following, on rice diseases:

Drug-resistance of P. oryzae

Resistance of cultivated and wild rice to the blast disease

Pathogenesis and ecology of panicle branch blast of rice

Insect transmission of rice virus diseases

Natural occurrences of streptomycin-resistant Xanthomonas oryzae

Resistance of leaf blight disease to dihydrostreptomycin sulfate

Reactions of rice cells to Piricularia oryzae

Hemagglutination test for titration of plant virus

(d) NIAS has reported on the following studies on wheat and barley:

Soil-borne virus diseases of wheat and barley

Accumulation of radioactive calcium and strontium in lesions of barley powdery mildew

Strains of barley scald fungus

Physiological specialization of wheat stripe rust in Japan

Physiological specialization of barley stripe rust in Japan

(e) The Tohoku National Agricultural Experiment Station, Morioka, reported research on teleutospore formation of leaf rust, Puccinio recondita (f. sp. tritici) and the relationship between metabolism of the rice plant and its resistance to blast disease.

(f) Japan's universities, which restrict themselves mainly to basic research, have much more to report in scientific literature than do the experiment stations. Many of the universities have conducted excellent research on the microbial agents of plant diseases, including the following:

1. From the College of Agriculture, Kyoto University, Kyoto--catalase activity of rice leaves infected with Cochiobolus miyabeanus; respiration and carbon-assimilation in rice leaves infected by Cochiobolus miyabeanus; influence of growth hormones on disease-producing fungi; and physiological studies on formation and germination of sporangia.

2. From the Faculty of Agriculture, University of Miyazakii--influence of various water drops of germination and germ-tube development of Puccinia coronata; relation between the resistance of crown rust and the precipitation reaction by the leaf sap of oat plants; influence of pressed-out sap from oat leaf to the germinating power of Puccinia coronata uredospore; and relation between oat leaf-pigment and uredospore germination of Puccinia coronata affecting varietal resistance to crown rust.

3. From Tokyo University of Agriculture and Engineering--heterocaryosis in Piricularia oryzae; and mechanism of infection and ecology of blast and stem rot of rice plants.

4. From the Faculty of Agriculture, University of Kagawa--formation of fusion bodies in uredospore germ-tubes of Puccinia coronata; and formation of fusion bodies in spore germ-tubes of rust fungi on artificial media.

5. From Hokkaido University--immune fluorescence studies on synthesis and distribution of virus antigen in plants; and physiological studies on Piricularia oryzae.

(2) Chemicals.

(a) Most R&D on new herbicides is done by chemical companies, some of which are: Ihara Chemicals Co., Ltd.; Yamamoto Agricultural Chemicals, Ltd.; Yashima Chemical Industry Co., Ltd.; and Hokkai Sankyo Co., Ltd.

(b) The Agricultural Chemistry Section of Nagoya University, Nagoya, has a research program on the synthesis and physiological action of modern herbicides.

b. (U) ~~(C)~~ Disseminating Systems R&D. Little or no information is available concerning R&D on aerosols, agricultural aerial spraying systems, or CBR disseminating systems. The Kawasaki Aircraft Co., Kawasaki, manufactures the Kawasaki-Bell 47G-2 Helicopter, under a license from Bell Helicopter Co., which was adapted to crop spraying.

62. (U) PROTECTIVE MEASURES

a. R&D on new fungicides and insecticides is being conducted at NIAS, the universities, and especially at the chemical companies. Some of the new fungicides and insecticides are as follows:

Kitazin, a new nonmercuric fungicide developed by Ihara Chemicals Co., Ltd.

Dithane Stainless, a fungicide developed by Tokyo Organic Chemical Co., Ltd.

Blasticidin-S, an antibiotic fungicide developed by NIAS

b. Studies are underway at NIAS on prediction of disease and insect pest occurrence, leading to effective control before their outbreak.

c. Genetics research has been reported from the Genetics Section, Department of Physiology and Genetics, NIAS, Hiratsuka. Breeding of new disease-resistant varieties is being conducted at the National Regional Experiment Stations and at the Prefectural Experiment Stations. The Japanese have been very successful in breeding high-yielding, disease-resistant varieties of crop plants.

63. (U) ~~(C)~~ ASSESSMENT OF OVERALL ANTICROP BW CAPABILITY

Japan has a well-integrated research organization, plus many competent scientists, for the study of potential anticrop agents. Its plant protection has been of high quality, and the reservoir of knowledge is high, especially in the field of rice diseases. Japan is believed to have the R&D capability and industrial potential to develop an offensive anticrop BW weapon system.

(U)
Section IV. ~~(S/NFD)~~ COMPARISON OF ANTICROP BW-RELATED CAPABILITIES

(U)
64. ~~(C)~~ COMMUNIST COUNTRIES

a Of the Communist countries, the Soviet Union possesses the best organization and the greatest resources for the development of an anticrop BW program. Communist China also has a sound organization and considerable resources, although it is presently handicapped by a shortage of trained scientists; however, the quality of the few it does have is high, and the number is rapidly increasing.

(U)
b. ~~(C)~~ Among the Communist countries, the quality of plant protection research is found to be highest in Czechoslovakia and Hungary, but the resources of these two nations are limited.

(U)
65. ~~(S/NFD)~~ NON-COMMUNIST COUNTRIES

(U)
a. ~~(C)~~ Among the non-Communist countries (excluding the United States), the United Kingdom, where the quality of plant protection research is high and the resources are adequate, has the greatest capability for developing a well-rounded offensive anticrop BW weapon system.

(U)
b. ~~(S/NFD)~~ The French Army has already conducted field tests on chemical anticrop BW-related and defoliation research, and could develop weapon systems along these lines.

(U)
c. ~~(C)~~ In the Netherlands, research quality is high, but resources are limited.

(U)
d. ~~(C)~~ The Brussels Treaty of 1954 prohibits West Germany from developing a BW weapon system. However, the quality of West German research is high and resources are available for developing a well-balanced potential offensive anticrop BW weapon system.

(U)
e. ~~(C)~~ Japan has the organization, well-trained research personnel, and the industrial potential to develop sound anticrop weapon systems.

FSTC-CS-03-10-66

66. (U) ~~(C)~~ COMPARISON OF COMMUNIST WITH NON-COMMUNIST COUNTRIES

a. The quality of published plant protection research in the Communist countries is much lower than in advanced countries of the free world, because of the priority given to industrial, as opposed to agricultural, development by the Communists and their stress on practical research. Lysenkoism also has contributed to this condition by inhibiting essential classical research to provide sound, basic data in the plant sciences field.

b. Greater freedom in the non-Communist world has permitted more basic research; consequently, scientific returns have been greater.

c. The ability of the Communist countries to channel and conceal their efforts may more than counterbalance some of their apparent shortcomings in anticrop BW-related research and its application to military objectives.

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