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FOIA Request
Commander, INSCOM
ATTN: IAMG-C-FOI
2600 Ernie Pyle Street
Fort Meade, MD
20755-5995

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

Freedom of Information/
Privacy Office

This is in reponse to your Freedom of Information Act (FOIA) request of February 28, 2022, and supplements our letter of March 8, 2022.

We have completed a mandatory declassification review of the INSCOM information in accordance with Executive Order (EO) 13526. As a result of our review, information has been sanitizied that would result in an unwarranted invasion of the privacy rights of the individuals concerned. This information is exempt from the public disclosure provisions of the FOIA pursuant to Title 5 U.S. Code 552 (b)(3) and (b)(6). Exemption (b)(3) pertains to information that is exempt by statute. The applicable statute is 50 U.S.C. § 3024 (i), which protects intelligence sources and methods.

The withholding of the information described above is a partial denial of your request. This denial is made on behalf of Major General Michele H. Bredenkamp, Commander, U.S. Army Intelligence and Security Command, who is the Initial Denial Authority for Army intelligence investigative and security records under the Freedom of Information Act and may be appealed to the Secretary of the Army. If you decide to appeal at this time, your appeal must be post marked no later than 90 calendar days from the date of our letter. After the 90-day period, the case may be considered closed; however, such closure does not preclude you from filing litigation in the courts. You should state the basis for your disagreement with the response and you should provide justification for an additional reconsideration of the denial. An appeal may not serve as a request for additional or new information.

An appeal may only address information denied in this response. Your appeal is to be made to this office to the below listed address for forwarding, as appropriate, to the Secretary of the Army, Office of the General Counsel.

Commander
U.S. Army Intelligence and Security Command
Freedom of Information/Privacy Office (APPEAL)
2600 Ernie Pyle Street, Room 3S02-B
Fort George G. Meade, Maryland 20755-5910

If you have any questions regarding this action, feel free to contact this office at 1-866-548-5651, or email the INSCOM FOIA office at: usarmy.meade.usacic.mbx.inscom-foia-service-center@army.mil and refer to case #0148F-22. You may contact our FOIA Public Liaison, Ms. Crystle Poge, for any further assistance and to discuss any aspect of your request at 571-515-0306 or at her email address: usarmy.belvoir.hqda-oaaahs.mbx.rmda-foia-public-liaison@army.mil. Additionally, you may contact the Office of Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services they offer. The contact information for OGIS is as follows: Office of Government Information Services, National Archives and Records Administration, 8601 Adelphi Road-OGIS, College Park, Maryland 20740-6001, email at ogis@nara.gov, telephone at 202-741-5770; toll free at 1-877-684-6448; or facsimile at 202-741-5769.

Sincerely,

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Michael T. Heaton
GG-15, Director
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FSTC-CS-03-12-68 INT

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DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

CROP VULNERABILITY (R&D): WARSAW PACT AND ASIAN COMMUNIST COUNTRIES (U)

b3

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CROP VULNERABILITY (R&D): WARSAW PACT AND ASIAN COMMUNIST COUNTRIES (U)

FSTC-CS-03-12-68-INT

b3

October 1968

By
George N. Asai

WARNING

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws (18 USC 793, 794), the transmission or revelation of which in any manner to an unauthorized person is prohibited by law.

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PREFACE

(U)
~~(S)~~ This two-part study--published as a single document for the convenience of the reader--reflects the research and development work on selected crops of economic importance in the Warsaw Pact and Asian Communist countries and concerns naturally occurring crop pests and anticrop warfare agents. In addition to discussion of the biological warfare defensive capabilities of these countries, their offensive capabilities have been considered.

(U) North Vietnam has been omitted from the discussion of the Asian Communist countries because it was included in DIA publication ST-CS-03-2-67-INT, Anticrop Warfare (Crop Susceptibility)--Southeast Asia (U), November 1967. (Secret)

(U) This study updates a portion of study FSTC-CS-03-10-66, Foreign Crop R&D Activities Related to Anticrop Warfare (U), September 1966. (Secret) Some plant-protection information in the original study is still applicable, but has not been repeated because no updating information has been obtained.

(U) The cutoff date for information in this report is 15 April 1968.

(U) This document was prepared with the editorial assistance of Catharine S. Hower.

(U) Comments concerning this study should be forwarded to the Commanding Officer, US Army Foreign Science and Technology Center (Attn: ABC Division), Munitions Building, Washington, D.C. 20315.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES

SUMMARY

(U)
~~(C)~~ The USSR has a good capability for defensive anticrop biological warfare (BW). The quality of plant-protection research in the Soviet Union is not up to US standards, but it is improving. Evidence indicates that the USSR is engaged in offensive anticrop BW research; a good offensive anticrop BW capability is estimated.

(U)
~~(C)~~ Czechoslovakia has a moderately high defensive anticrop BW capability. The quality of plant-protection research among the Communist countries is highest in Czechoslovakia, but this country's resources are limited. Evidence indicates that the Czech military are engaged in offensive anticrop BW research. Czechoslovakia is estimated to have a moderate offensive anticrop BW capability.

(U)
~~(C)~~ Hungary, Poland, and East Germany have limited defensive and offensive anticrop BW capabilities. Some aspects of plant-protection research in each of these countries are well developed, but the resources are limited, and the quality of research is generally below that found in Czechoslovakia. No information indicates that these countries are engaged in offensive anticrop BW research.

(U)
~~(C)~~ Rumania and Bulgaria have almost no defensive or offensive anticrop BW capabilities. Their plant-protection research is very limited and not of high quality. Their resources also are limited.

(U)
~~(C)~~ Communist China has a limited defensive and offensive anticrop BW capability. A shortage of scientists exists, but many young people are being trained in scientific fields. The effects of the cultural revolution have clouded the scientific picture in Communist China, and no information has been received since mid-1966. Information indicating that Communist China is currently engaged in offensive anticrop BW research is lacking.

(U)
~~(C)~~ No new information is available on plant-protection research in North Korea or the Mongolian Peoples Republic.

Section I (U) ~~(S)~~

CROP VULNERABILITY (R&D): WARSAW PACT COUNTRIES

A. (U) ~~(S)~~ USSR

1. (U) General

a. The Soviet Union occupies about 5.5 billion acres--almost one-sixth of the earth's land surface. Of this area, about 523 million acres are cultivated. Agricultural production has been subject to sharp fluctuations in recent years, but the period since 1958 has generally been one of stagnation. The net agricultural output in 1965, according to the US Department of Agriculture Index, was 9% above the 1957-59 average, while net production per capita in 1965 was actually below the 1957-59 level. The USSR suffered a major agricultural failure in 1963 and a major grain-crop failure in 1965.

b. The diet of the average Soviet citizen consists mostly of grains, which account for more than 50% of the average daily intake of about 3000 calories. Potatoes are also important in the diet. Fruits and vegetables account for a very small portion of the caloric intake, and the use of meat in the diet is also relatively minor, although it has been increasing fairly rapidly over the past decade. The consumption of sugar and vegetable oils has been increasing, especially since 1964, and considerable success has been attained in the production of industrial crops. Present levels of consumption of most products except grains and potatoes are far below Soviet standards for an appropriate diet.

2. (U) Major Crops

a. Wheat. The largest single crop in the Soviet Union, in both acreage and food value, is wheat. The 1960-66 average was 163,650,000 acres, with a production of 58,500,000 tons. In 1966, 173 million acres were sown, and a bumper crop produced 88,184,000 tons of wheat. The US 1960-66 average was 48,830,000 acres, with a production of 27,308,000 tons. Winter and spring wheat distribution in Europe and Western Asia, including the Soviet Union, are illustrated separately (figs 1 and 2) since the seasons and locations of the crops differ.

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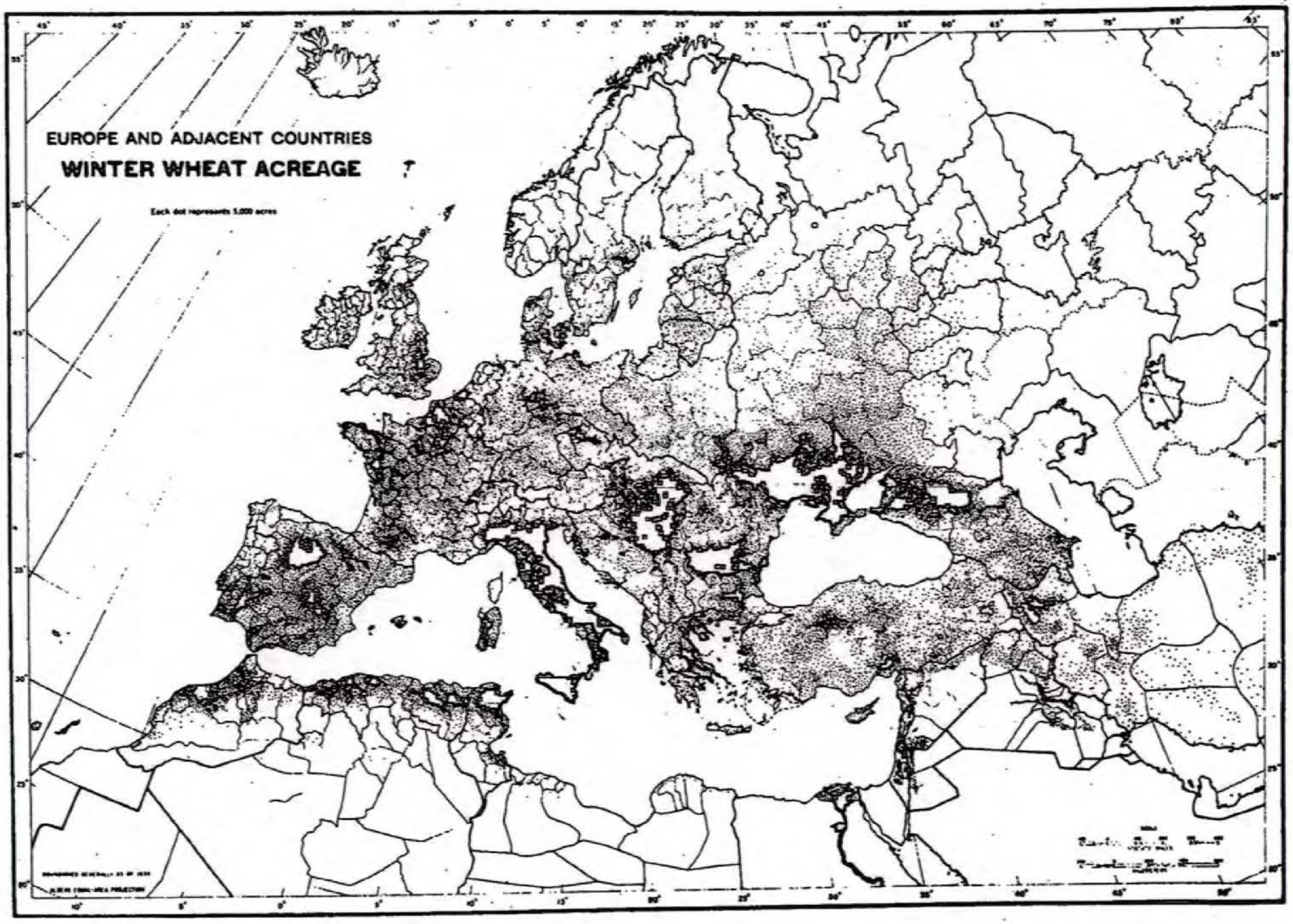

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Figure 1. Distribution of winter wheat in Europe and Western Asia (U).

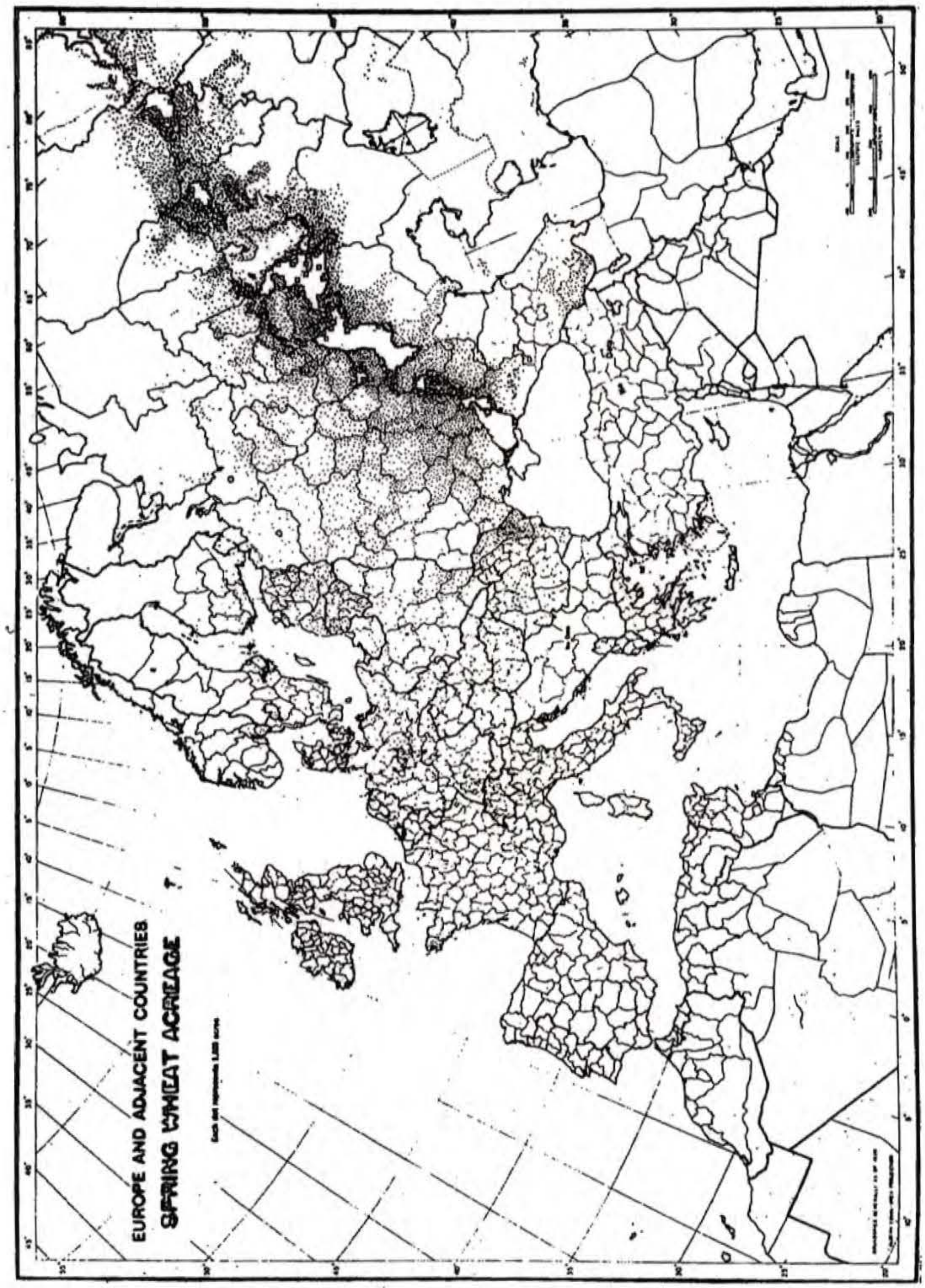

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Figure 2. Distribution of spring wheat in Europe and Western Asia (U).

b. Other Major Crops. Other major crops grown in the USSR, with corresponding acreage and production figures, are listed in table I. One should remember that the production figure for potatoes represents fresh weight, with much lower caloric value per unit weight than that of the other crops. The distribution of rye, oats, barley, corn, potatoes, and sugar beets in Europe and Western Asia, is illustrated in figures 3 through 8, respectively.

Table I. Acreage and Production of Major Crops in the Soviet Union (1960-66 Average) (U)

Crop	Acres	Production (tons)
Wheat	163,650,000	58,500,000
Barley	43,278,000	19,304,000
Rye	40,010,000	14,980,000
Corn	13,311,000	10,251,000
Oats	19,660,000	6,834,000
Potatoes	21,500,000	81,908,000
Sunflower seed	---	5,130,000
Sugar, centrifugal	---	8,464,000
Cotton	5,911,000	1,884,000

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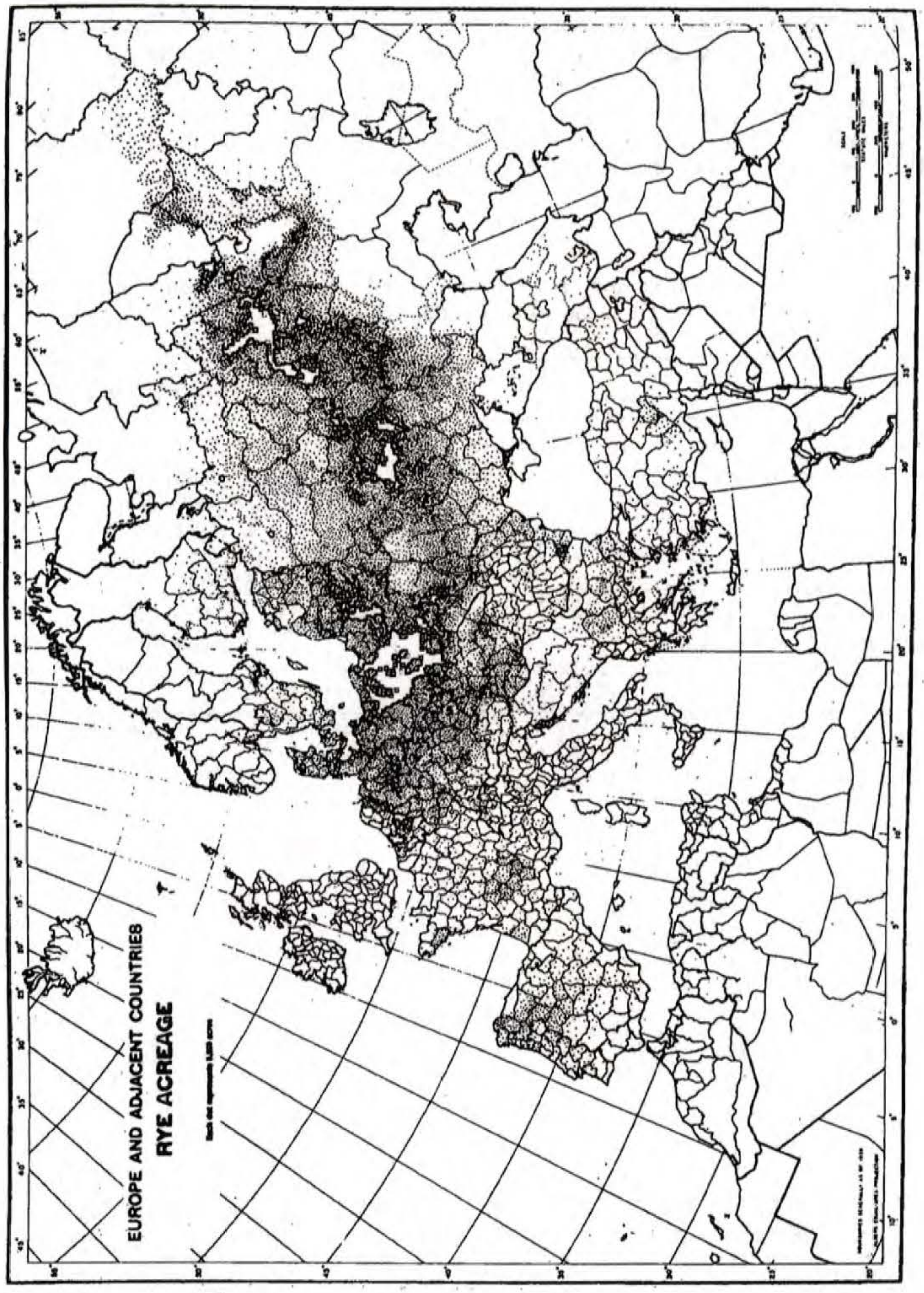

Figure 3. Distribution of rye in Europe and Western Asia (U).

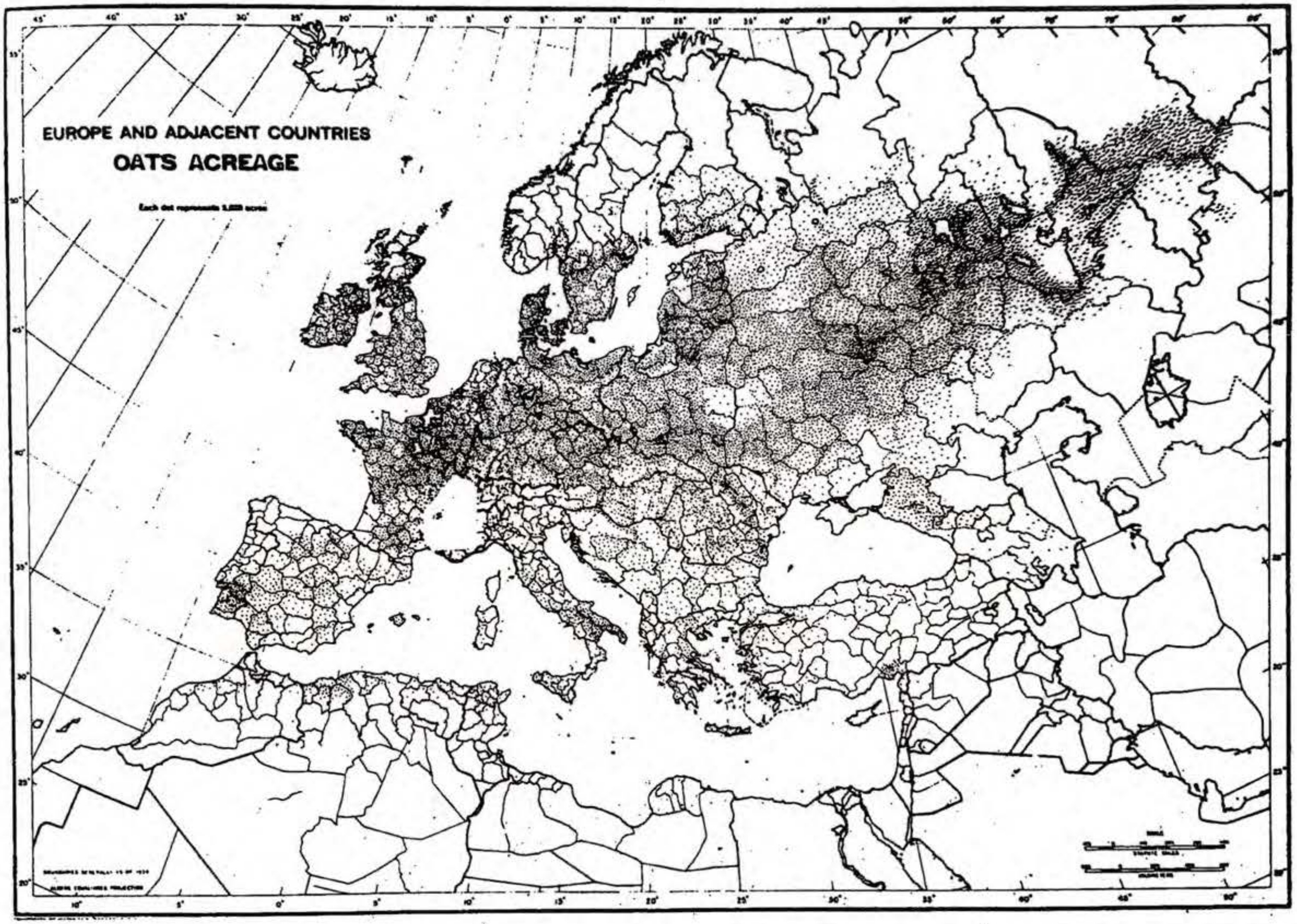

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Figure 4. Distribution of oats in Europe and Western Asia (U).

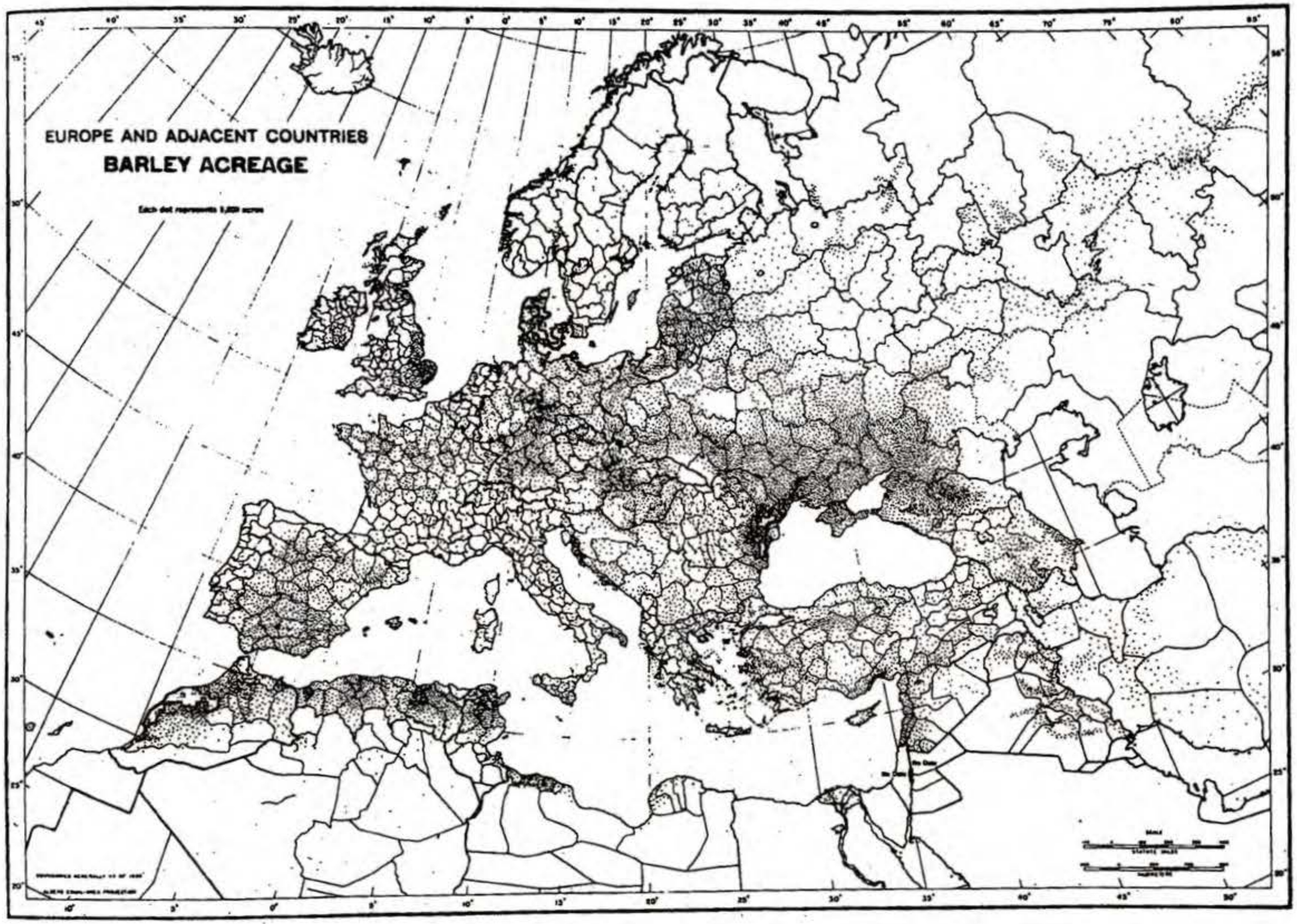

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Figure 5. Distribution of barley in Europe and Western Asia (U)

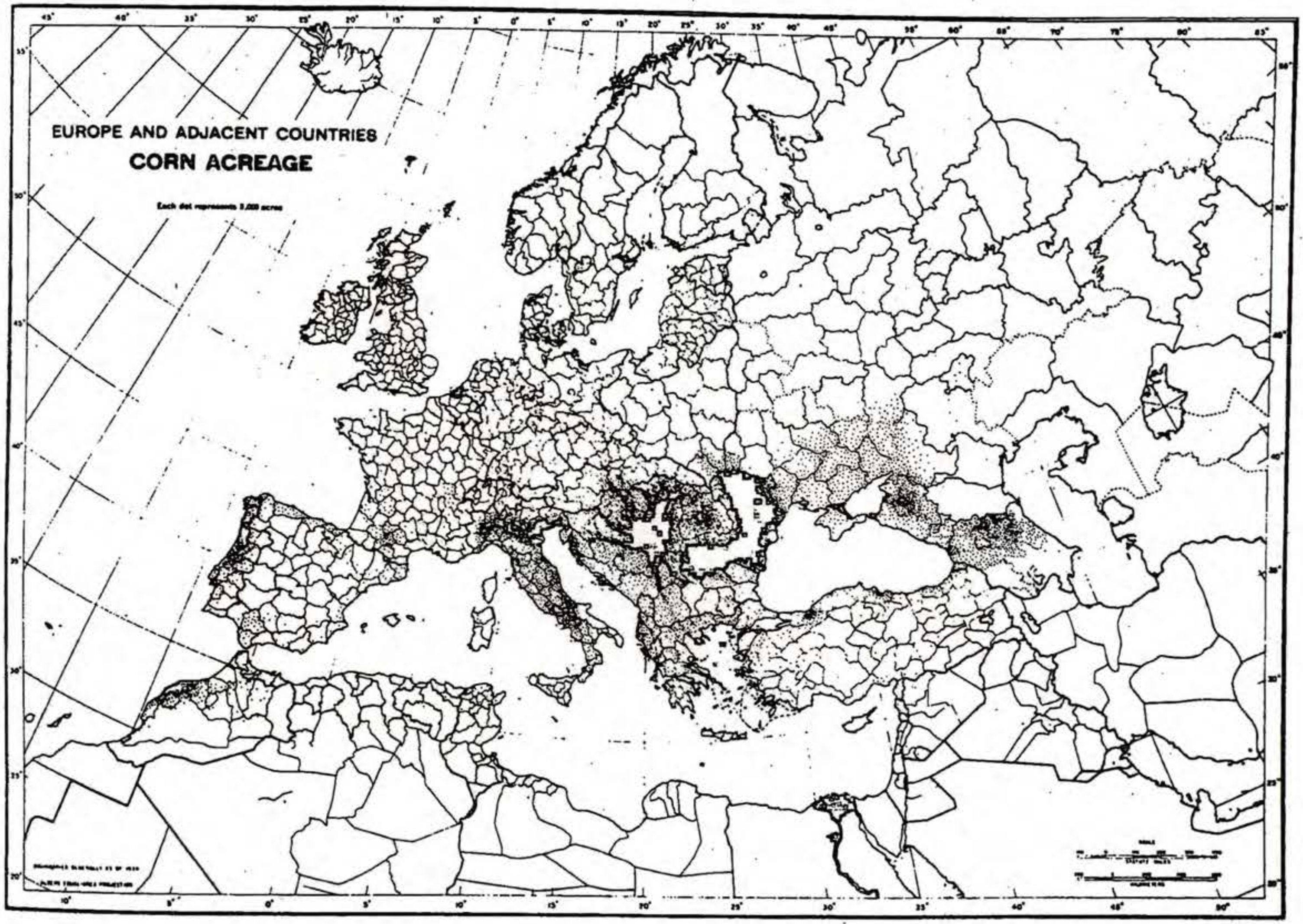

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Figure 6. Distribution of corn in Europe and Western Asia (U).

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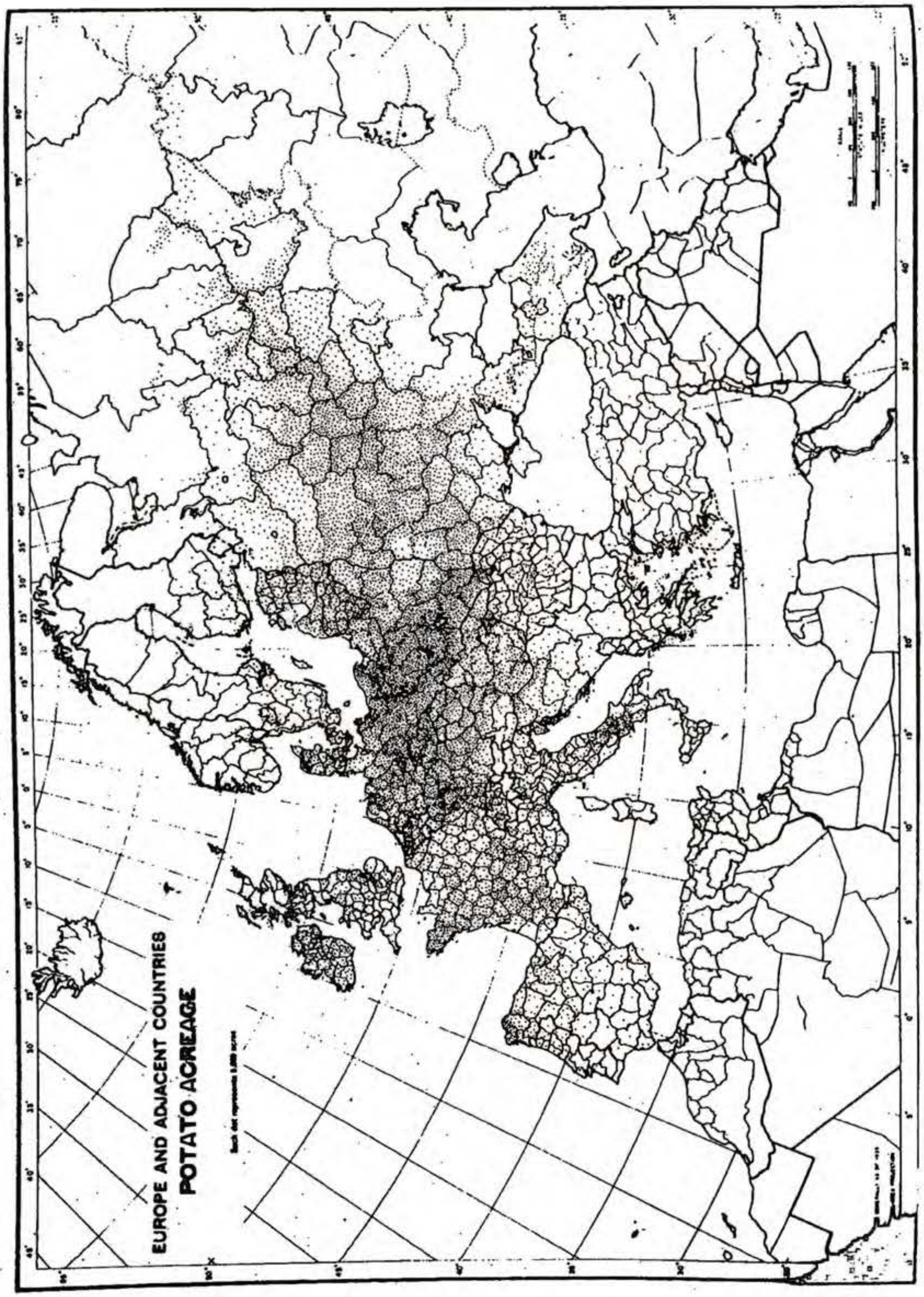

Figure 7. Distribution of potatoes in Europe and Western Asia (U).

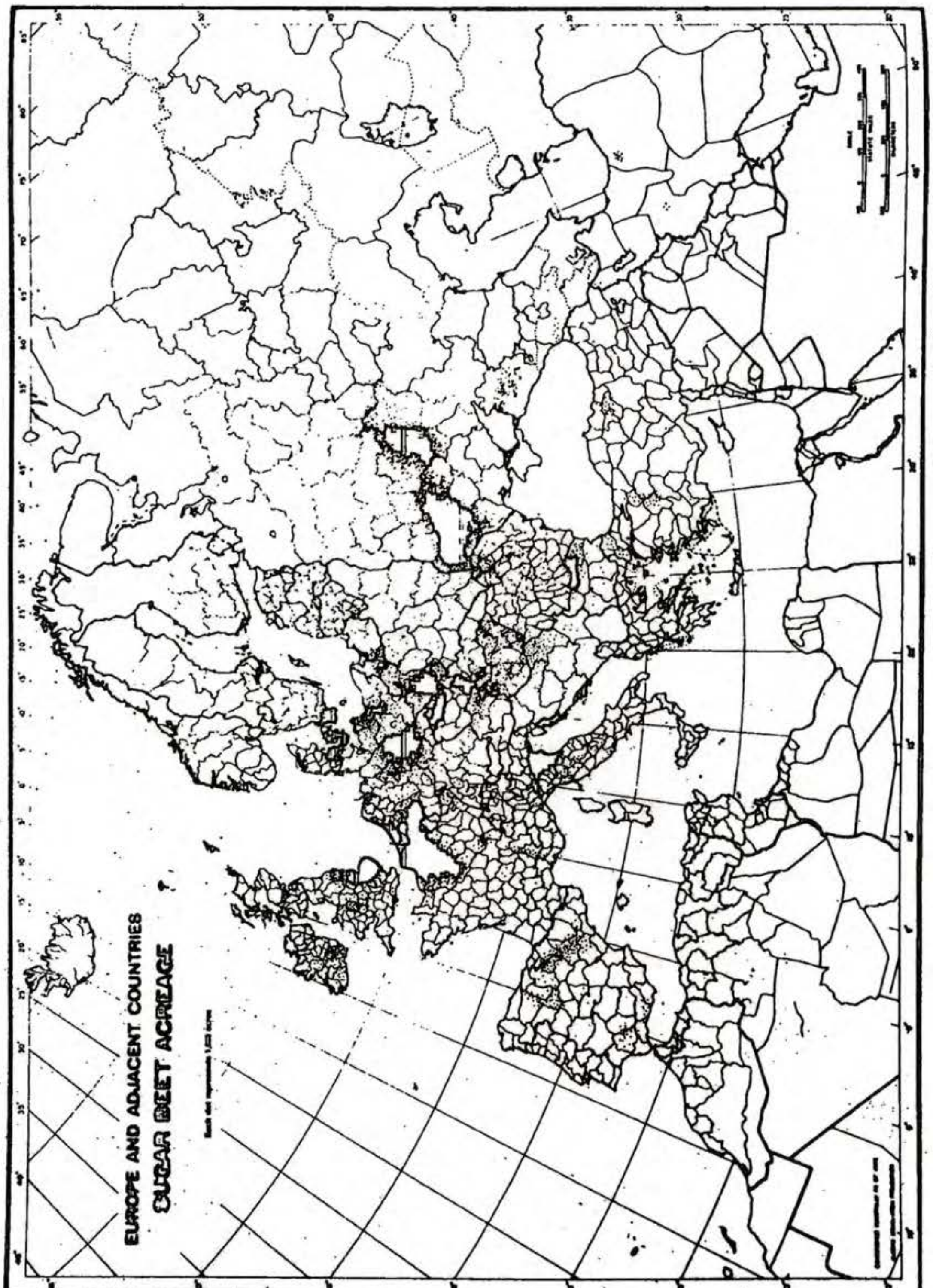

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Figure 8. Distribution of sugar beets in Europe and Western Asia (U).

3. (U) ~~(S)~~ R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents

a. (U) ~~(C)~~ Suspected Anticrop Warfare Research at the Dzhambul Scientific Agricultural Research Institute.

(1) (U) ~~(C)~~ The Dzhambul research institute is located at Otar (43 32 N, 75 12 E), Dzhambul Oblast, Kazakh SSR, near Alma Ata, in southern Kazakhstan. The scope and quality of research, the rapid buildup in the intensity of research, and the location of the facility indicate that this institute is probably conducting anticrop BW research. A great deal of agricultural and industrial development has been conducted in this region, probably because of its close proximity to Communist China. Extensive weather research in the area surrounding Otar has been conducted by Moscow scientists, and they have found that the weather is quite predictable--a very favorable condition for aerosol dissemination tests.

(2) (U) ~~(C)~~ Research on rice, wheat, corn, and soybeans and their diseases has been conducted at this institute. These four crops are the most important food crops of the United States and Communist China--the chief potential enemies of the Soviet Union--but only a small percentage of the crops are grown in the Dzhambul Oblast. Considerable spring wheat is grown in Northern Kazakhstan, some 700 miles across the desert and semidesert from Otar. The most important crop in Kazakhstan is cotton, which has not been the subject of research at this institute. The high quality of the research at this institute would be more logically expected in Moscow, Leningrad, or Kiev, and not at Otar, which is in a region not noted for the crops being investigated.

(3) (U) In all the following published papers, Yu. V. Peruanskii is the author or coauthor. The first paper appeared in 1963, two papers were published in 1964, two in 1965, five in 1966, and at least one in 1967. The individual papers are discussed below.

(a) (U) The 1963 publication, On the Biochemistry of Piricularia oryzae, was coauthored by Peruanskii and I. N. Miusov. They reported that for liquid carrot decoction, semisynthetic and synthetic media met the nutrient requirements of five strains of P. oryzae under artificial aeration. The mycelium energetically absorbed inorganic phosphate and amino nitrogen. Cellobiose and sugars containing glucose radicals were the best carbohydrate sources. A definite correlation was established between the accumulation of ribonucleic acid (RNA) in the mycelium and the virulence of the strain to rice. This work compares very favorably with US research[1*].

(b) (U) ~~(C)~~ The fact that this agricultural institute is conducting research on P. oryzae is unusual since the the occurrence of this fungus has

*Reference numbers appearing throughout this publication identify citations to be found in the Bibliography (p. 57).

never been reported in Kazakhstan. P. oryzae was observed in the Caucasus in 1900, in the Soviet Far East in 1925, in Kuban in 1937, and in Uzbekistan in 1938. Some rice is grown in Kazakhstan under irrigation, but the dry climate of the area is not favorable for the development of P. oryzae. Apparently the interest in this organism is only in its possible use as an anticrop BW agent.

(c) (U) Two papers were published in 1964 on herbicides, both by Peruanskii: The Influence of Simazine on Phosphorus Metabolism in Corn and the Influence of Derivatives of 2,4-D and 2,4,5-T on the Accumulation of Nucleic Acids and Other Compounds of Phosphorus in Soybean Leaves[2,3]. Corn is tolerant of simazine, while soybeans are injured by 2,4-D and 2,4,5-T in relatively low concentrations. Clearly, these studies are aimed at determining the biochemical basis of herbicidal action.

(d) (U) ~~(C)~~ Peruanskii published a paper in 1965 on the Relation Between the Resistance of Wheat to Stem Rust and Amount of Glucosides. He found no quantitative relation between the amounts of individual glucosides, the degree of their disintegration, and the rust resistance of wheat varieties. The biological characteristic of rust resistance could not be explained by the presence of any particular substance toxic to the rust fungus. The objective of this research undoubtedly was to find a rapid chemical means of determining rust resistance of wheat varieties, which would be a useful tool in anticrop BW research[4].

(e) (U) ~~(S)~~ An interesting and revealing paper, On a Method of Submerged Cultivation of Piricularia oryzae and Helminthosporium turcicum, was published in 1965 by Peruanskii and Miusov. They described and illustrated (fig 9) a mass-cultivation apparatus for phytopathogenic fungi.

(f) (U) ~~(S)~~ By this method, large quantities of spores of P. oryzae and H. turcicum were produced[5]. H. turcicum is the agent causing the northern leaf blight of corn, a disease of major importance in corn in the United States. The method is very similar to the US method recently developed for the production of P. oryzae spores. Since these two agents could be only of minor importance in Kazakhstan, it appears that the research there is concerned with the offensive use of anticrop BW.

(g) (U) ~~(C)~~ The following papers by Peruanskii, published in 1966 and 1967, are representative of the type of basic research that would support the development of wheat rusts as anticrop BW agents.

Infrared Spectra of Rust-Resistant and Rust-Susceptible Wheat Varieties[6].

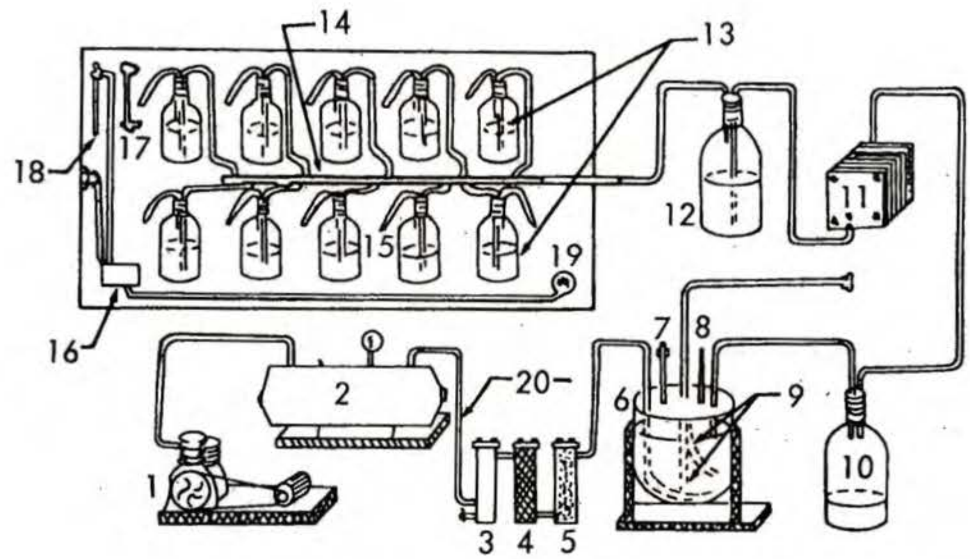
Lipid Fractions in Uredospores of Wheat Stem Rust[7].

Accumulation and Distribution of Some Substances in Wheat Leaves During Development of Rust[8].

Cytochemical Changes in Germinating Uredospores of the Wheat Brown-Rust Pathogen[9].

Uredospores of Stem Rust of Wheat[10].

Qualitative Biochemical Variations in Uredospores of Rust Fungi[11].



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1. Garage-type compressor
2. Receiver
3. Settling tank for collecting condensate
4. Carbon filter
5. Cotton filter
6. Device for sterilization and heating air in winter
7. Contact thermometer
8. Control thermometer
9. Heating elements
10. Settling tank (collection of condensate)
11. Seitz filter
12. Air humidifier
13. Cultivation vessels (5- to 10-liter capacity)
14. Air distributor
15. Cotton filters
16. Electronic relay
17. Control thermometer
18. Contact thermometer
19. Heater
20. Tubing

Figure 9. Arrangement of devices and units for the submerged cultivation of Piricularia oryzae and Helminthosporium turcicum (U).

(U)
b. ~~(C)~~ Aerosol Research With Anticrop BW Implications

(U)
(1) ~~(C)~~ V. F. Dunskii and his colleagues, under the auspices of the Main Geophysics Observatory imeni A. I. Voyeykov, Leningrad, conducted a series of tests on the settling of coarsely dispersed aerosols on vegetation. They hypothesized that, within the plant cover, as well as above it, the wind velocity may exceed by one or two orders of magnitude the velocity due to gravitational settling of the particles. Consequently, the group studied inertial settling, or settling by impaction, of a coarsely dispersed aerosol by comparing the amount deposited on horizontal or vertical glass surfaces. The results showed that the inertial settling may exceed the gravitational effect. Dunskii developed the pertinent theoretical formulae for inertial settling as a function of plant height, leaf size, wind velocity, and other factors. The values calculated by exact and approximate expressions compared favorably with the experimental data. The technique of determining the proportion of chemicals landing on the ground (loss) and the proportion settling on plants (useful fraction), permitted by the new calculative approach, could be very useful in anticrop BW research[12].

(2) (U) Dunskii and coworkers conducted field experiments on the diffusion of coarsely dispersed aerosols ejected from linear sources into the surface boundary layer of the atmosphere and the settling of the dispersed phase on the surface of the ground. The investigations involved flights (at 170 kilometers per hour and heights of 100 to 600 meters) of an An-2 airplane, fitted with spraying equipment, above a flat 10- by 20-kilometer area covered with rather homogeneous but not dense vegetation averaging 20 to 30 centimeters in height. The spray was a water-glycerin, 60% technical-grade mixture. The airplane was flown along the windward side of the test field, at a given height, approximately perpendicular to the direction of the wind. A total of 200 to 400 checkpoints were spaced 500 meters apart in transverse rows 500 to 1000 meters apart. Curves were constructed of the total droplet density versus the distance from the source.

(U)
(3) ~~(C)~~ The most important fact determined during the experiments was that such aerosols may settle over areas as large as hundreds of square kilometers during periods measured in tens of minutes or in hours; that is, when meteorological conditions are functions not only of height, as is usually assumed in the theory of atmospheric diffusion, but of all three spatial coordinates and time. Dissemination of the aerosol at 100- to 600-meter altitudes over such a large area is not consistent with agricultural practices but is more suited to the dissemination of anticrop BW or chemical agents[13].

(4) (U) Since 1965 or earlier, Dunskii has been conducting aerosol research at the All Union Scientific Research Institute of Phytopathology, Moscow. Some of the papers he and his co-workers have published are:

Spraying of a Liquid With a Rotating Disk and the Question of Secondary Atomization of Drops, 1965[14].

A Portable Logarithmic Sprayer, 1966[15].

Method of Determining the Droplet Size Distribution in the Atomization of Liquids, 1967[16].

c. ~~(C)~~ (U) Research on Cereal Crop Diseases

(1) (U) Virus diseases

(a) (U) Cereal viruses. A group headed by I. G. Atabekov from the Department of Virology, Moscow State University, has published a series of papers on virus diseases of cereals. One of the most interesting papers of the series concerns the properties of the nucleoprotein of barley mosaic virus and its structural components. The molecular weight of barley stripe mosaic virus (from sedimentation and viscosity data) was 26×10^6 and that of the RNA 1×10^6. Several substructure protein components were formed from the degradation of the virus nucleoprotein. The "salt" method of deproteinizing the virus in concentrated solutions of Mg, Ba, and Ca chlorides is described as the technique by which the virus RNA can be isolated. The authors claim that the infectivity of RNA preparations of the virus often exceeded that of the RNA in the intact virus. Active RNA was isolated from some completely noninfectious virus preparations[17].

(b) (U) Other papers published by the Moscow University group include the following:

Wheat Dwarf Virus in the Krasnodar Region, 1965[18]

Conformational Changes in Molecules of Wheat Mosaic Virus Antigen in Solution, 1965[19]

Transfer of Winter Wheat Mosaic Virus to Cicadas by Injection, 1966[20]

Comparative Serological Analysis of Rod-Shaped Viruses, 1966[21]

(c) (U) Wheat-streak mosaic virus has been investigated by the Laboratory of Electron Microscopy, Academy of Sciences, USSR, and by the Institute of Microbiology, Academy of Sciences, USSR. The group at the Laboratory of Electron Microscopy found that ticks of the family Eriophyidae (mites) carry wheat-streak mosaic virus particles. Electromicrographic study showed that the particles are carried intracellularly as well as on the surface of the tick. Laboratory induction of the carrier state in the tick vector was accomplished by coating the vectors with a buffered leaf extract[22]. Scientists at the Institute of Microbiology carried out electron microscopy studies of wheat plants affected by streak mosaic. They described an agent of the disease as virus particles in the form of long, slightly winding or bent filaments, 15 to 18 millimicrons wide[23].

(d) (U) Wheat-streak mosaic virus, observed on winter wheat in 1965 in the Rostov, Krasnodar, and Kharkov regions, Central Asia and Moldavia, was also transmitted by the same mites. The early symptoms appeared in the autumn, 2 to 3 weeks after germination, and became more conspicuous in the spring[24].

(e) (U) Pale green dwarf virus (wheat dwarf virus), found in the Moscow area, was transmitted to spring and winter wheats by Psammotettix alienus. Winter-wheat striate mosaic virus was also isolated and found to be transmitted by Psammotettix provincialis[25].

(2) (U) Rust diseases of cereals

(a) (U) Z. A. Rubin and N. B. Popova, at the University of Moscow, investigated the effect of brown leaf rust on the respiration of wheat. The respiration level of healthy leaves of wheat Triticum timopheevi, which are resistant to the rust Puccinia recondita, was higher than that of similar leaves of the susceptible wheat Triticum persicum. Respiration intensity was higher in the susceptible wheat than in the resistant wheat species in all stages of development of the disease. Following inoculation, respiration resistance to malonate was increased in T. persicum, while in T. timopheevi sensitivity slightly increased. The pentosephosphate pathway played a greater part in respiration during the period approaching active sporulation in susceptible wheat, while in the resistant-wheat species the glycolytic pathway became more important[26].

(b) (U) The biochemical characteristics of the resistance of wheat to brown rust were determined by the Ukrainian Institute of Plant Protection, Kiev. Leaves of varieties resistant to P. recondita had less aspartic acid. Just before the inoculation, the free amino acid content of all the plants varied between 100 and 190 micrograms per gram (μg/g) dry weight. Six days later, when the content in the control plants rose to 300 μg/g, the acid content of the leaves inoculated with the nonaggressive race 168 fell by about 30%, and the acid content of the leaves inoculated with the aggressive race 77 fell even below this[27].

(c) (U) V. A. Markasova and V. A. Federova (affiliation unknown) determined the races of the causal agent of brown rust of wheat in the Ukraine. Races 48, 77, 116, 117, and 150 of P. recondita were detected in the Ukraine and the Crimea as well as six new races (provisionally, 184 through 189) that were not aggressive to the standard wheat varieties. Susceptible varieties were suggested as being chiefly responsible for the formation of nonaggressive races. Race 77 was the most widespread, attacking all local varieties of wheat. Apparently no relation existed between ecological or geographical factors and racial composition[28].

(d) (U) In 1965 several papers reported the results of testing wheat varieties for resistance against rusts in various regions of the Soviet Union. The Agricultural Experiment Station, Ternopol, listed wheat and rye-wheat hybrids that are highly resistant to stripe and brown rusts[29]. The Institute of Genetics and Selection in Azerbaidzhan found wheat varieties that were satisfactory for the subtropical region, were resistant to stripe rust, and showed a low infection rate for leaf rust as compared with standards. Moreover the yield exceeded standard yields by 9.5% to 150.5%. The test years 1961-63 had unfavorable weather in all zones, affording a good opportunity to determine the best hybrids for subsequent introduction and cultivation[30]. At the Kuban Experiment Station, only 12 of 412 Bulgarian wheats showed relative resistance to leaf, stripe, and stem rusts[31].

d. (U) Research on Potato Diseases

(1) (U) Soviet research reported since the beginning of 1965 on potato virus diseases is summarized in table II. The table shows that extensive research on potato viruses is being conducted at many institutes, but no institute is conducting outstanding research on potato virus diseases.

Table II. Soviet Research on Potato Diseases: Publications Since 1965 (U).

Facility	Scientists	Subjects and reference No.
Lithuanian Institute of Botany, Academy of Sciences	Z. B. Stasevicius	Rugose mosaic virus[32]
Experimental Station for Plant Protection, Moscow	B. G. Boyarskii	Sera, potato virus Y[33]
Pushkin Experimental Station, Leningrad	A. Ya. Kameraz	Breeding virus resistance[34]
Estonian Institute of Experimental Biology, Academy of Sciences	P. Tamm	Mosaic virus infection[35]
Estonian Institute of Experimental Biology, Academy of Sciences	B. Nurmiste	Virus control problems[36]
Ukrainian Institute of Microbiology and Virology, Academy of Sciences	I. P. Zhuk	Potato virus X antigen[37]
Ukrainian Institute of Microbiology and Virology, Academy of Sciences	M. I. Mendzhul	Rugose mosaic virus[38]
Timiryazev Agricultural Academy, Moscow	M. F. Ouf	Control of potato virus X[39]
Baltic Department, All Union Institute of Plant Protection	V. Duda	Potato virus in Latvia[40]
Blagoveshchensk Pedagogical Institute imeni Kalinin	A. Maksimova	Viruses in Amur Oblast[41]
Forest and Timber Department, Siberian Section, Academy of Sciences	N. G. Kharin	Disease aerial photography[42]
Institute of Biochemistry imeni Bakh, Moscow	V. E. Sokalova	Resistance to *Phytophthora infestans*[43]
Institute of Biochemistry imeni Bakh, Moscow	L. V. Metlitskii	Fungitoxic potato phenols[44]
Institute unknown	Author unknown	Potato nematode[45]

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(2) (U) Investigators at the Institute of Biochemistry imeni Bakh Moscow, have conducted research related to late blight of potatoes caused by Phytophthora infestans. They measured chlorogenic and caffeinic acids in tubers of relatively resistant and susceptible potato varieties inoculated with spores of P. infestans. In the tuber of the relatively resistant variety, the chlorogenic acid content dropped sharply in storage, but the pattern was reversed in the susceptible variety. The caffeinic acid rose in both varieties, but was somewhat higher in the susceptible variety.

(3) (U) Kharin and his coworkers at the Forest and Timber Department, Siberian Section, Academy of Sciences, determined by spectrophotometry and aerial photography that the curves of the spectral luminosity of potato leaves infected by P. infestans differed from the curves of healthy plants.

(4) (U) Reportedly, the potato nematode (Heterodera rostochiensis Wall) is an extremely dangerous pest, more harmful than the Colorado potato beetle. The nematode appeared in the Baltic regions of the USSR after World War II and is now moving on a wide front from West to East. It has already taken over Estonia, Latvia, Lithuania, Belorussia, and some land in the western rayons of Leningradskaya Oblast. Intensive breeding work is being conducted with potatoes to produce varieties resistant to nematodes as well as to other diseases and pests[45].

e. (U) ~~(C)~~ Research on Cotton Diseases. The wilts of cotton caused by Verticillium and Fusarium appear to be the only cotton diseases of any concern to the Soviets. Numerous papers on factors affecting these wilts and methods of control have been published. The wilts are soilborne diseases and are not considered to be potential BW agents.

f. (U) ~~(C)~~ Research on Sunflower Diseases and Pests. The All Union Scientific Research Institute for Oleaginous and Essential Oil-Bearing Plants, Krasnodar, has selected sunflowers that are resistant to broomrape, the sunflower moth, and most rusts. Downy mildew and sclerotinina still are problems in the wet regions, and crosses are being made to develop varieties resistant to both fungi. Efforts are also being made to develop a biochemical technique for determining the resistance of sunflowers to downy mildew.

g. (U) ~~(C)~~ R&D Plant Protection Agents

(1) (U) ~~(C)~~ General. Research in the Soviet Union has not resulted in any new or promising pesticides. The All Union Scientific Research Institute for Chemical Means of Plant Protection (VIKLSZR), Moscow, the All Union Scientific Research Institute of Phytopathology, Moscow, and other institutes have published numerous papers describing the synthesis and initial screening of fungicides, insecticides, and herbicides. No evidence shows that any of these pesticides have proved in field tests to be superior to comparable pesticides already developed in the West.

(2) (U) ~~(C)~~ Field testing. The VIKLSZR tests only its own formulated compounds. Foreign materials are tested in Leningrad at the All Union Institute for Plant Protection (VIZR). Field testing is done by the Ministry of Agriculture. Apparently communications and a unified direction of effort between the various units are poor.

(3) (U) ~~(C)~~ Biological control. The Soviets continue to emphasize biological control of insects, and, although the United States may be somewhat behind the Soviet Union in the development of biological control, few solid research results on this subject have come from the Soviets. Perhaps the Soviets are trying to conceal their deficiency in chemical activity by expressing great concern about unsubstantiated accomplishments in biological controls.

(4) (U) ~~(C)~~ Chemical control. The Soviets have made significant advances in academic chemical technology (for example, in phosphates), but they lack the chemical engineering background and production facilities to translate research into actual compounds. The Soviets have formulated a number of organophosphorus insectofungicides, but apparently none of them have been adopted for field use[46]. They have also synthesized a number of carbamate esters with herbicidal, fungicidal, and insecticidal properties[47].

(5) (U) ~~(C)~~ Chemosterilants. The Soviets have only recently initiated research on insect chemosterilants. The chemosterilants currently used are those developed by physicians working on cancer chemotherapy. Evidently, work on insect sterilization by irradiation has also only recently been started.

4. (U) ~~(C)~~ Plant-Protection Research Institutes

a. All Union Scientific Research Institute of Chemical Means for Plant Protection, Moscow

(1) Staff. The following list includes some of the staff members of the VIKLSZR:

N. M. Ukhtin, Director

Dr. N. N. Melnikov, Assistant Director, Head of Scientific Staff, and Chief of Laboratory of Synthesis of Organophosphorus Insecticides.

M. D. Trichanov, Chief Engineer

Yu. A. Bashakov, Chief of Laboratory for Herbicide Synthesis

P. V. Popov, Chief of Laboratory for Organophosphorus Insecticide Testing

L. D. Stonov, Chief of Laboratory for Herbicide Testing

N. M. Golyshin, Chief of Laboratory for Fungicide Testing

Dr. Y. A. Mandelbaum, Chief of Laboratory on Technical Problems of Pesticide Production

Dr. (fnu) Vasilyev, Chief of Physicochemical Analytical Laboratories

J. D. Pilmenshtein, Chief of Laboratory of Formulations

(2) Research activity. This institute synthesizes new compounds (organophosporus and carbamates) for evaluation as insecticides, herbicides, or fungicides. These compounds are first screened in the laboratory on fungi, insects, and plants.

(a) Fungicide testing. Fungicide tests, under Golyshin, are made first in vitro with agar, distilled water, and spores; then on plants with obligate parasites. In the field, small plots with host plants are used.

(b) Insecticide testing. The actions of organophosphorus compounds were tested on Hypoderma bovis, Hypoderma lineatum, Dermacentor variabilis, and other mites and lice. The effects of various types of insecticides on plants in the laboratory and in the field are under investigation. Studies on the effects of insecticides on soil flora have also been started. Laboratory biochemic studies are being made concerning the effect of insecticides on the respiration of insects.

(c) Physicochemical studies. The physicochemical laboratories, headed by Dr. Vasilyev, are studying the structure of compounds synthesized at the institute, using spectrometric (infrared, ultraviolet, and Raman) and gas chromatographic methods. The institute also studies the composition of formulations and residues and investigates the kinetics of reactions, stability, and molecular interactions. The Soviets, using infrared, are investigating hydrogen bonding in herbicides. Under study are the kinetics of decomposition of formulations of organophosphorus insecticides and herbicides.

b. All Union Scientific Research Institute of Plant Protection, Leningrad

(1) Staff. The following list includes some of the staff members of the VIZR:

Dr. I. M. Polyakov, Director

Dr. K. V. Novozhilov, Deputy Director for Scientific Affairs, Chemical

Dr. Ye. M. Shumakov, Deputy Director for Scientific Affairs, Biological

Dr. S. V. Andreev, Chief of Research on Biophysics

Dr. P. V. Sazanov, Chief of Laboratories for Pesticides

Dr. I. G. Shapiro, Chief of Research on Plant Resistance to Insects

Dr. (fnu) Shumakova, Chief of Laboratory for Fungicides

Dr. T. I. Fedotova, Chief of Laboratory for Immunity of Plants to Diseases

Dr. V. V. Shopina, Deputy to Dr. Fedotova

Dr. N. A. Shipinov, Herbicide Laboratory

Dr. (fnu) Meyer, Chief of Laboratory for Biological Methods of Insect Control

(2) Biophysics research. In their investigations on the development of biophysical methods, the Soviets employ the latest achievements of physics for research, direct control of insects, and development of special apparatus for use in laboratory and field.

(a) Radioisotopes. Radioisotopes are widely used in studying the many problems of plant protection, the toxic action of insecticides, and new methods of synthesis. A special atomic center synthesizes new compounds labeled with radioisotopes. Radioisotope-labeled pesticides are used to study deposits in airplane spraying exercises. They are also used to study the biological characteristics of insects; for example, how far they migrate and the magnitude of insect population.

(b) Radiation. Ultraviolet radiation is utilized to obtain mutant forms of microorganisms for use against insects. Ultraviolet rays, gamma rays, or X-rays will produce new forms of more aggressive or virulent organisms. Extensive experiments are being conducted to determine which insects can be controlled through the use of gamma-radiation sterilization.

(c) Other biophysical methods. Luminescence analysis and radiospectroscopy are being used to detect free radicals in the biological action of toxicants, viruses, and microorganisms. The presence or absence of free radicals can be used to distinguish between sick and healthy plants. Light traps are used for forecasting insect infestations. Devices for microthermometry in leaves and insects are used. A fountain-pen-size device for measuring illumination or humidity has also been developed.

(3) Immunity of plants to disease. Research in this field is conducted in the laboratory headed by Professor Fedotova. The experimental work is carried out mainly at Pushkin, near Leningrad; the work with cotton, in Uzbekistan; and the work on wheat, in Leningrad and the Caucasus. One direction of work is the study of resistance in wheat, cotton, and potatoes; rust on wheat, grain smut, cotton wilt, potato viruses, and scab. Another direction is the study of resistance and change in races of diseases. Strains previously resistant can later be infected by new races of diseases. Some strains of rust can retain their activity for 6 or 8 years when kept at room temperature in a vacuum. A third direction of study is the mechanism of positive reactions of plants to diseases.

(4) Plant resistance to insects. Dr. Shapiro, who conducts the work on plant resistance to insects, is concerned mainly with resistance of grain to harmful pests. Considerable attention is directed toward the study of nutrition of insects and their digestive systems. The laboratory is also investigating the progress of damage to plants by insects, and is gaining clues to understanding the reactions of the plants. Insects under investigation are the Eurygaster, which is causing difficulties in Soviet Central Asia; the European corn borer; the Swedish fly; and the Ostinella frit.

(5) Biological methods of insect control. Research on entomophagous insects and microbiological organisms is being conducted to control harmful insects of fruits, vegetables, and grains.

(a) Entomophagous insects. The control of the insect pest, Eurygaster, is of much concern to the Soviets. They have sent special expeditions to Central Asia to study the habits and conditions of indigenous entomophaga. The Soviets have also obtained Swedish fly parasites from Canada and have attempted to adapt them in the Soviet Union. Other insect-parasite studies concern cutworms on grains, California scale, and forest pests. Mass-rearing of a whole series of entomophorum is receiving attention, particularly the predatory beetles Cryptolaemus, Trichogramma, and Phytoselus persicae obtained from Canada, and predators of mites and insect eggs. In this connection, the Soviets are studying the sexual control of insects to obtain greater production.

(b) Microbiological organisms. A bacterial preparation, "entobakterin," probably Bacillus thuringiensis, has been developed and is effective against 60 types of harmful insects. It has been mixed with insect viruses and chemical insecticides. Research is being conducted on polyhedrosis and on granulosis viruses wherein several strains of granulosis have been multiplied and introduced on cotton cutworms and have controlled the insects. A practical method for using the granulosis viruses needs to be developed. Fungal and nematodal diseases are also under investigation.

(6) Fungicide research. The general plan for the fungicide work is similar to that for insecticides. Fungicides to be used on seeds, in plant sprays, in fumigants, and in the soil are being investigated. Chemical immunization of plants receives special attention because small quantities of chemicals on seeds

and tubers may provide resistance to fungi for 3 to 4 years. Reportedly, plant resistance increases in future generations, and increased plant yields are obtained. The method also avoids an accumulation of residues in soils. Winter wheat crops are healthier and resistance is increased in subsequent generations. Similar work was done with rice, potato Phytophthora, and cotton Verticillium and and Fusarium. The most promising chemical immunizers are the commercial products Zineb, TMTD, and Maneb.

(7) Insecticide research. Insecticide research at this institute is chiefly concerned with testing insecticides developed in the West. The insecticides are tested on various crops in different parts of the USSR to determine the most suitable ones; important considerations are applied to the degree of control and the amount of toxic residues.

(8) Herbicide research. The main work of the institute scientists in this field is coordination of the phytotoxicological work on herbicides by the various laboratories in the USSR. This group studies the literature, selects compounds, establishes crops, and develops methods of treatment. The testing of herbicides is decreasing. Some research is carried out (in water cultures and in soil) on methods of application and on the effect of herbicides on the physiology and biology of plants. Sensitive and resistant plants are used. The workers have found that more herbicide is taken into sensitive plants than into the resistant ones. The amount of herbicide entering the individual organs of plants is determined. In resistant plants, it apparently accumulates in the roots; in sensitive plants, in the leaves.

c. Ukrainian Institute of Plant Protection (UNIZI), Kiev

(1) Staff. The following list includes some of the staff members of the UNIZI:

Dr. I. I. Merchenko, Scientific Director

Dr. Ye. S. Kosmatyi, Chief, Analytical Laboratories

Dr. N. P. Dyadechko, Chief, Division of Agricultural Entomology.

E. N. Kititsyn, Researcher on Insecticides

N. M. Dobrokhotova, Researcher on Insect Toxicology

V. A. Sanin, Researcher on Aerial Application of Insecticides

(2) Mission. This institute conducts the main investigation of methods for plant protection in the Ukrainian Republic. The institute carries out its field tests on kolkhozes and sovkhozes and does not have field stations under its jurisdiction. It tests new chemicals and develops ways of using them to control the

principal pests on the main crops. The institute does four main lines of work: (a) agricultural entomology, (b) biological methods, (c) agricultural phytopathology and immunity, and (d) the development of methods for determining residues of chemicals in soils and crops.

(3) Insect control research

(a) Colorado beetle. The Colorado beetle is the most vexatious insect in the Ukraine, and research on both insectides and biological control is being conducted at the UNIZI. The beetle is attacked by the bacterium Beauveria bassiana, and the institute has developed a scheme to produce it in the laboratory. The institute produces 400 to 500 kg a year of boverin, a laboratory preparation of B. bassiana, and has tested it widely against pests. Mixtures of boverin and insecticides were found to have a synergistic effect. Production plants for boverin are planned, and if this preparation is widely used, the Colorado beetle will be suppressed within 3 or 4 years.

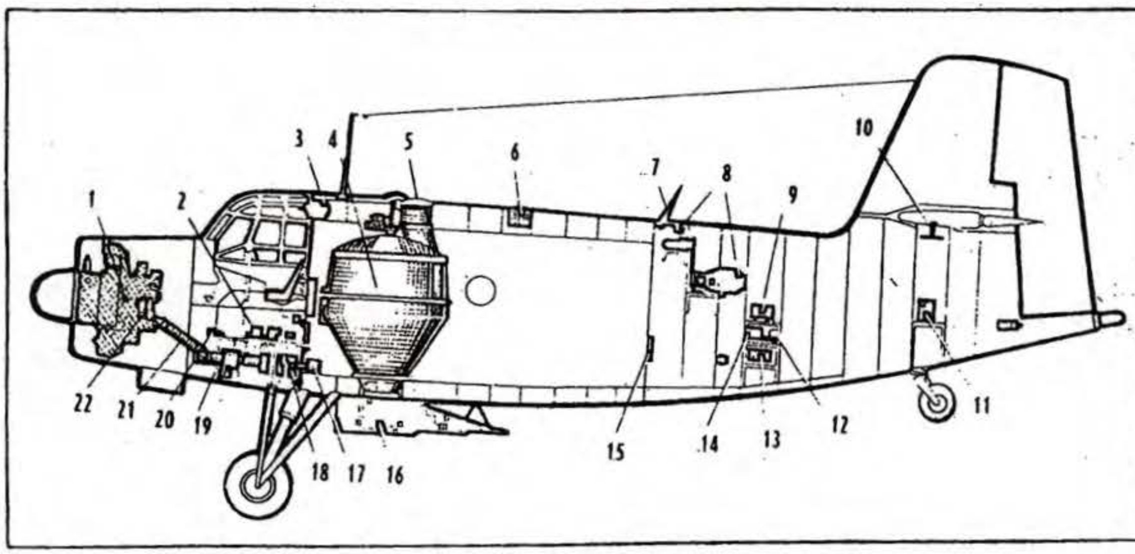
(b) Seed treatment. Research on the treatment of seeds with insecticides was started in 1940. Toxicity to insects has been effective up to 12 days. The synergistic effect of a combination of insecticides has been noted, of which the most successful has been heptachlor plus organic phosphorus compounds. The Soviets have also investigated ways of introducing insecticides into the soil by using organophosphorus compounds in combination with mineral fertilizers. Toxicity to insects was found to be high, lasting 25 to 35 days.

(c) Aerial application of insecticides. Research on aerial application is being conducted by Sanin. Types of aircraft and kinds of nozzles for low-volume applications are being investigated.

5. (U) Agricultural Spray Aircraft Development

a. Late in 1965, the An-2M agricultural aircraft (fig 10) was introduced to replace the widely used An-2. The Soviets claim that the An-2M is the most efficient aerial-application plane in the world. Its tanks hold 1800 kilograms of dry chemicals or 1960 liters of liquid chemicals. For dust applications the effective swath is 30 to 31 meters, and for liquid chemicals it is 38.42 meters. Chemicals are discharged at a rate of 60 kilograms per second for granulated materials, up to 37 kilograms per second for dust, and up to 28 liters per second for liquid chemicals[48].

b. The most significant improvement in the An-2M is single-pilot operation. The need for two pilots of the An-2 has long received adverse comment from Western operators. The An-2M is aerodynamically similar to the An-2, but has an increased stabilizer area. Electric trimmer control for stabilizer and ailerons is provided on the control column. Operation of the spray gear and spreading gear is electropneumatic from a switch on the control column. Power



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1. 1000-hp Shvetsov ACh-62M engine
2. Windshield defroster control
3. Condenser of air-conditioning system
4. Hopper for chemical
5. Hopper filler
6. Radio-compass loop antenna
7. VHF antenna
8. Air-conditioning unit
9. Radio set
10. Rawin antenna
11. Battery
12. Converter of radio compass
13. Radio altimeter
14. Radio-compass receiver
15. Control panel for agricultural equipment's pneumatic system
16. Chemical dispenser
17. Reduction gear
18. Converter (torque?)
19. Transmission gear
20. Converter (torque?)
21. Transmission shaft
22. Power takeoff from engine

Figure 10. Interior of the An-2M agricultural aircraft, showing internal spray mechanism (U).

can be set well in advance of starting the spray run; the pilot then can keep both hands on the control column and can operate the agricultural gear at the same time.[49] Another advanced feature of the An-2M is the hermetically sealed and air-conditioned cockpit, which allows the pilot to work without a respirator when handling toxic chemicals and to remain comfortable in extremes of climate.

c. In 1966 the An-2M was only beginning service with Aeroflot, whose An-2 fleet--thought to number 2500 in the agricultural role alone--treats 98 million acres a year.

6. (U) ~~(C)~~ Assessment of Defensive Anticrop BW Capabilities

a. Organization for Plant Protection. The Soviet Union has a large, well-staffed organization for plant-protection R&D. Soviet efforts toward developing new and more effective fungicide and insecticide compounds have not been very successful, probably owing to the lack of flexibility and vertical integration in the plant-protection organization. For example, the VIKLSZR, which is subordinate to the Ministry for the Chemical Industry, synthesizes and screens pesticide compounds, but final field testing of the pesticides is left to the plant-protection institutes under the Ministry of Agriculture. Liaison between the institutes appears to be rather inadequate; the same can be said of Soviet R&D progress in the biological control of insect pests. Therefore, some doubt exists that the Soviet plant-protection organizations can react rapidly and effectively against an anticrop BW attack.

b. Pesticide Production Capacity. In recent years, the Soviet central planning organization has allocated increased funds for investment in agriculture. These funds have been going into the construction of new plants for the production of machinery, fertilizers, and pesticides. Judging from the "trumpeting and little action" of the Soviets on biological control of insects, and continued Soviet interest in the purchase of chemical pesticide production plants from the West, a shortage apparently still exists in the chemical pesticide production capacity of the USSR.

c. Pesticide Application. A definite plus in Soviet anticrop BW defense is the relatively large fleet of effective agricultural aircraft. The widespread use of the An-2 and the An-2M agricultural aircraft simplifies maintenance and spare-parts problems.

d. Defensive Anticrop Capability. Analysis of the foregoing factors shows that the Soviet Union has good capability for effective anticrop BW defense.

7. (U) ~~(C)~~ Assessment of Offensive Anticrop BW Capabilities

a. Research in Offensive Anticrop BW. The type and nature of research being conducted at the All Union Scientific Research Institute of Phytopathology, Moscow, and at the Dzhambul Scientific Agricultural Research Institute, Otar, provide good evidence that the Soviet Union is engaged in offensive anticrop BW research. The work may be limited, but it appears to be of high quality.

b. Development of an Anticrop BW Weapon System. No evidence is available indicating that the Soviets have developed an anticrop BW weapon system.

c. Offensive Anticrop Capability. Little information is available on Soviet offensive anticrop BW research; however, the Soviet Union is estimated to have a good capability to wage offensive anticrop BW.

B. (U) ~~(S)~~ CZECHOSLOVAKIA

8. (U) General

a. Czechoslovakia covers an area of 49,369 square miles--about the size of New York. More than half of the acreage is agricultural land, of which 71% is arable, 25% is used for pastures and meadows, and 4% is used for permanent vineyards, hop fields, and miscellaneous purposes. Of the total labor force, approximately 1.2 million (19%) has worked in agriculture.

b. Since the complete socialization of agriculture, production has stagnated in Czechoslovakia. To stimulate production, control over agriculture has relaxed slightly, prices for farm products have been raised, and mechanization and increased fertilizer consumption have received more emphasis. Present plans call for higher priority in agriculture and in the economy without any change in present structure.

c. Food consumption has increased since the prewar period, with the greatest increase shown in the consumption of meat. The 1963 average daily caloric intake of 3120 calories was 22% above the 1936 average daily intake of 2545 calories. Meat consumption increased 74%--from 75 pounds per person in 1936 to 130 pounds in 1963. Grain consumption between 1936 and 1963 declined by only 1%.

9. (U) Major Crops

Grains occupy half of the sown area, with the greatest share (about 16%) in wheat. Chief grains besides wheat are barley, rye, and oats. Potatoes and sugar beets are the major root crops; and rapeseed, flax, poppyseed, and tobacco are the major industrial crops. The acreage and the production of the major crops in Czechoslovakia are given in table III. The distribution of wheat, rye, oats, barley, potatoes, and sugar beets, is shown in figures 1, 3, 4, 5, 7, and 8, respectively, in subsection A.

Table III. Acreage and Production of Major Crops in Czechoslovakia (U)

Crop	Acres	Production (tons)
Wheat ----------------------------	1,837,000	1,970,000
Rye ------------------------------	1,048,000	970,000
Oats -----------------------------	1,048,000	895,000
Barley ---------------------------	1,703,000	1,743,000
Potatoes -------------------------	1,277,000	6,525,000
Sugar beets ----------------------	---	1,096,000
Rapeseed -------------------------	---	60,000

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(U)
10. ~~(C)~~ R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents

a. (U) Research on Grain Diseases. The Institute of Cereal Crops, Kromeriz, and the Central Research Institute of Plant Production, Prague-Ruzyne, have conducted studies on the effect of rusts on wheat yields. Losses as high as 80% have been recorded. Another Prague-Ruzyne study concerned race and varietal specificity of teleutospore formation in wheat stem rust. Other studies covered the relation between the redox potential in obligate parasites and that in host tissue, isozymes of malate dehydrogenase in uredospores of P. recondita, testing of resistance in wheat to Puccinia striiformis, and transmission of wheat streak mosaic virus by leafhoppers, especially Delophacodes pellucida[50-56]

b. (U) Research on Potato Diseases. Jermoljev and coworkers at Prague-Ruzyne have published a series of papers on potato viruses, X, Y, and S. One paper concerns the distribution of virus X in potato plants. The other papers describe research on the substance in potato leaves that inactivated these viruses[57-61]. Research at other institutes has included experiments on the heat treatment of potato leaf roll virus and studies on the influence of artificial interruption of dormancy in tubers, on the reliability of the diagnosis of potato viruses, and on the fungitoxicity of cold aerosols for P. infestans under field conditions.

c. (U) Research on Sugar Beet Diseases. The principal diseases of sugar beets appear to be Cercospora leaf spot and yellows disease virus. The papers published on these diseases cover the effects of heat and humidity on conidial germination of Cercospora beticola, the influence of varieties and fungicides on Cerocospora leaf spot, and the determination of yellows disease virus in sugar beets[64-67].

(U)
d. ~~(C)~~ Research on Plant Viruses at the Institute of Virology, Bratislava. Although chiefly concerned with human and animal viruses, the Institute of Virology has a plant virus group, headed by Dr. Vik Valenta. The very capable Valenta is specializing on the stolbur group of viruses of the yellows type. Working with the stolbur group is difficult; the diseases caused by these viruses are devastating. Valenta is also secretary of Acta Virologica, and the following papers are some of those published by his group in 1965, 1966, and 1967:

Some Relationships Between Pea Mosaic Virus and Its Vector, Myzus persicae Sulz.[68]

Serological Relationship Between Vectors of Yellows-Type Viruses and Some Other Leafhoppers.[69]

Thermal Inactivation of Parastolbur Virus in Extracts From Viruliferous Euscelis plebejus Leafhoppers.[70]

The Effect of Inoculum Concentration on Virus Multiplication in Cucumber Cotyledons. I. Lucerne Mosaic Virus.[71]

Vector-Virus Relationship of Two Less Well-Known Aphid Vectors of Pea Mosaic Virus.[72]

e. (U) ~~(C)~~ Research On Insecticides

(1) (U) ~~(C)~~ Organophosphorus compounds. The Research Institute of Agrochemical Technology, Bratislava, has developed two organophosphorus insecticides, "Metation" and VU AG T-1-3, which is a systemic insecticide. Metation has a broad spectrum of activity and is of very low toxicity to warm-blooded animals and to bees. VU AG T-1-3 is very effective against red spider mites. The formula of VU AG T-1-3 is O-methyl-O-ethyl S-(2-ethylsulfinylethyl) phosphorodithioate. US and Japanese companies have shown an interest in both products.

(2) (U) Juvenile hormone insecticides. Research is conducted by a group of workers at the Institute of Organic Chemistry and Biochemistry, Prague, led by Academician Frantisek Sorm and Engineer M. Romanek. Dr. Sorm is also the director of this institute and President of the Czechoslovak Academy of Sciences. Both have identified and synthesized one of six active components of Law's mixture (prepared by John H. Law, who is now at the University of Chicago) by a simple one-step process in which hydrogen chloride gas was bubbled through an alcoholic solution of farnesenic acid. Without any purification, this mixture was 1000 times more effective than crude Cecropia oil and fully effective in killing all kinds of insects. Cecropia oil, extracted from Cecropia moths, contains the natural juvenile hormone which prevents the maturation of insect larvae.

(a) (U) Recent studies at Harvard University by L. M. Riddiford and the Czech biologist Karel Slama have resulted in the surprising additional finding that juvenile hormones must be kept away from insect eggs so that the eggs can undergo normal development. Slama and C. M. Williams, also working at Harvard, have isolated a juvenile hormone from the balsam fir which has a selective action against only one kind of insect, the family Pyrrhocoridae, which includes some of the most destructive pests of the cotton plant.

(b) (U) The research on the juvenile hormones reported in Third Generation Pesticides appears to be very significant. The juvenile hormone was found to be highly effective against insects and completely harmless to vegetation and higher organisms. In addition, it can be selective against the destructive insects. Insects probably do not develop resistance or insensitivity to their own hormone without involuntarily committing suicide. One gram of the hormone is sufficient to prevent the development of 1 billion larvae, and a dose of 10 grams will clear all insects from $2\frac{1}{2}$ acres of land[73,74].

f. (U) ~~(C)~~ Research on Insect Chemosterilants. Dr. Vladimir Landa, a Czech entomologist, heads a group of entomologists at the Institute of Entomology, Prague--apparently the largest organization outside of the United States doing work on chemosterilants. The research is of high quality and is approached differently from that conducted in the United States. The Czechs concentrate on the effects of chemosterilants from a physiological point of view; for example, how the chemosterilants distort chromosomes.

11. (U) Development of the Z-37 "Cmelak" Agricultural Plane

a. The Z-37 is a two-seat, all-metal, cantilever, low-wing monoplane, designed and manufactured in Czechoslovakia (fig 11) for the dispersal of chemicals over fields and forests. A special varnish is applied to the entire airframe to protect it from the chemicals. The plane is being produced, for export as well as domestic use by the Moravian Airplane Works in Otrokovice[75,76]. The aircraft specifications are as follows:

Empty weight, 918 kg; weight of agricultural equipment, 79 kg; payload, 447 to 847 kg; maximum aircraft weight, 1665 to 1765 kg; takeoff and landing run, 120 meters; optimum takeoff speed, 120 km/hr; cruising speed (with a total weight of 1558 kg), 180 km/hr; working speed, 110 to 210 km/hr; maximum speed, 200 km/hr; minimum speed at the ground, 75 km/hr; service ceiling with a takeoff weight of 1585 kg, 4000 meters.

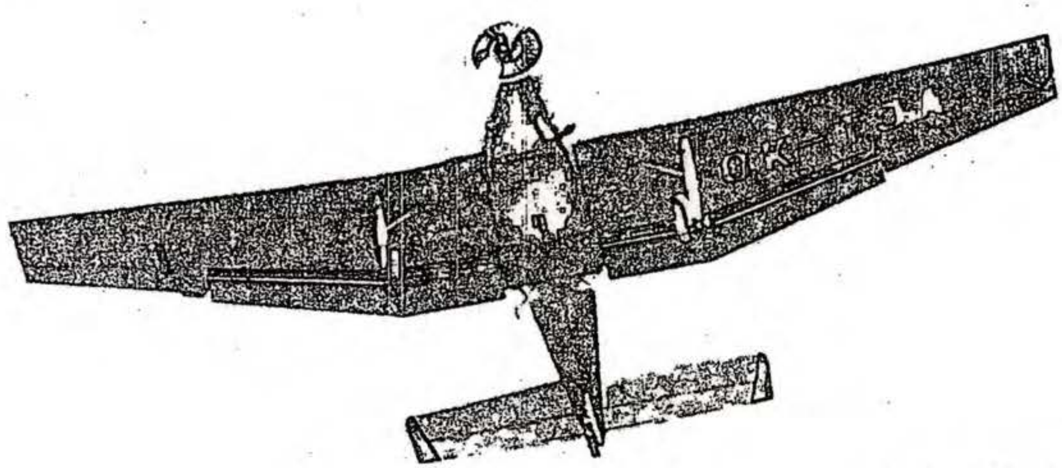

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Figure 11. Czech agricultural aircraft Z-37 "Cmelak" (U).

b. The cockpit is fully sealed, and its air ventilating and heating system is equipped with a chemical filtering device. For agricultural applications, the Z-37 is equipped with a tank for chemicals and a mechanically driven sprayer, duster, or spreader. A 700-l. tank, made of a rustproof sheet material, is used for all types of chemicals, whether liquid, powdered, or granulated. The chemical payload weight is controlled by a special measuring device. The dusting equipment is made of duraluminum sheet coated with a special protective film. The same spraying equipment (except for the nozzles) is used for both water and oil base solutions. Four central nozzles under each wing open under the pressure of the liquid and close pneumatically. The granulated chemical spreader is actually a shovel wheel mounted under the tank. The dusting, carried out at a height of 5 meters, produces a dust swath 60 meters wide while discharging material at 0.7 to 0.8 kg/sec; granulated chemicals, spread at a height of 15 meters, cover a strip 45 meters wide and discharge at a rate of 2 to 15 kg/sec. The flight speed of both is 120 km/hr. Liquid chemicals are loaded into the Z-37 aircraft by means of an RA-1-00 loader, operated by one or two workers, which can fill the tank in 1 minute. The loader can be transported aboard the Z-37 airplane to the work area. The NON-050 self-propelled hydraulic loader is equipped with a 50-hp engine and a 900-kg-capacity bucket attached to a long arm. The bucket measures the supply of dry chemicals as it fills the aircraft's tank. The loader can be outfitted with a removable cabin and equipment for breaking loose caked powdered chemicals.

12. (U) ~~(S)~~ Institute of Agrochemical Technology, Bratislava (U) ~~(S)~~

A Czech biochemist who recently defected to the West stated that his institute had conducted research for the military. He was employed at the institute from 1949 to 1952. After 1952, he kept in touch with his many contacts at the institute by occasional visits[77].

a. (U) ~~(C)~~ Resources

(1) (U) ~~(C)~~ Subordination. This institute is under the Ministry of the Chemical Industry and is physically located in the same compound with the Dimitrov Chemical plant.

(2) (U) ~~(C)~~ Institute security. The institute was staffed, as a rule, only by persons considered politically reliable. None of the research work done at the institute was published openly; all research projects were classified "secret". The institute was guarded, and the entrance to it was restricted.

(3) (U) ~~(C)~~ Organization. Stefan Truchlik was the director of the institute, which included the 10 departments listed below, with their heads:

Analytical Chemistry, Dr. Vojtech Batora

Physical Chemistry, Josef Kovac

Biology, Dr. (fnu) Toman

Inorganic Chemistry, Robert Nadvornik

Product Technology, (fnu) Ullrich

Chemical Machine Engineering, Dionyz Urzgula

Plot Production, (fnu) Obertas

Insecticides, Joseph Drobek

Herbicides, Dr. Zdenek Mueller

Pesticides, Tedor Magdolen

(4) (U) ~~(C)~~ Relationship with the military. Between 1956 and 1966, military personnel had visited the institute several times for a number of months, either to supervise operations or to obtain information. Between 1960 and 1963, the Herbicides Department developed for the military a universal herbicide which could kill all plants. The herbicide was put into production at the Dmitrov plant about 1963. In addition, the military very possibly had an interest in the organophosphorus research at the institute.

(5) (U) ~~(C)~~ Facilities. The institute complex consisted of two main buildings and a number of smaller ones. The pilot plant was housed in one of the main buildings. The laboratories were well equipped, and the institute had the best chemical library in Slovakia.

b. (U) ~~(C)~~ Plant Protection Research

(1) (U) ~~(C)~~ Biology Department. This department was primarily a service department. It tested the toxicity of new products (insecticides, herbicides, pesticides, and fertilizers) on insects, rodents, and plants. Several aircraft and pilots were available for testing spray methods. Limited research was also done to determine how insecticides affect the central nervous system. The institute had some experimental forms for testing new products. The department also developed biological methods of combating insects.

(2) (U) ~~(C)~~ Insecticide Department. Beginning in 1948, this department developed and released for production chlorophenothane (DDT), hexachlorocyclohexane (HCH), pure gamma isomer of HCH, parathion, thallium slats, and several derivatives of nicotine. It also synthesized more efficient derivatives of parathion and developed polyphosphate compounds, some chlorosulfonates against termites, and at least five or six other insecticides. After about 1960, it concentrated more on the development of systemic and more specific insecticides rather than general-contact insecticides.

(3) (U) ~~(C)~~ Herbicide Department. This department was established about 1957. By 1966 it had developed about six different selective herbicides for agricultural use, all manufactured at the Dimitrov plant.

13. (U) ~~(C)~~ Assessment of Defensive Anticrop BW Capabilities

The quality of biological and agricultural research in Czechoslovakia appears to be the highest of any found in Communist countries, partly because of close liaison and cooperation with scientists in the West. Because Czechoslovakia is a small country, however, the resources are limited, and the breadth of research is not as great as that found in the United States or the Soviet Union. The results obtained on the juvenile hormone insecticides at the Institute of Organic Chemistry and Biochemistry, the organophosphorus insecticides at the Institute for Agrochemical Technology, and the development of the Z-37 "Cmelak" agricultural plane indicate that Czechoslovakia has a moderately high capability for defensive anticrop BW.

14. (U) ~~(C)~~ Assessment of Offensive Anticrop BW Capabilities

No information has been received that Czechoslovakia has developed an anticrop BW weapon system, but there are some indications that offensive anticrop BW research is being done. The security measures adopted and the development of a universal herbicide at the Institute for Agrochemical Technology indicate that the Czechoslovak Army is sponsoring offensive anticrop BW research. Although the resources are limited, the quality of Czech research is high, and Czechoslovakia is estimated to have a moderate capability for offensive anticrop BW.

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

15. (U) General

a. East Germany has an area of 41,700 square miles, of which 46% is arable. Of the total labor force of 8.5 million, 16% is engaged in agriculture.

b. Although the growing number of fixed investments in agriculture have increased agricultural production, East Germany is still the major food deficit area of the Warsaw Pact countries. Per capita food consumption averages 3000 calories per day.

16. (U) Major Crops

The main crops are wheat, rye, oats, barley, sugar beets, and potatoes; shortages exist in all crops except sugar beets and potatoes. Acreage and production figures of the major crops in East Germany are given in table IV. The distribution of wheat, rye, oats, barley, potatoes, and sugar beets is shown in figures 1, 3, 4, 5, 7, and 8, respectively, in subsection A.

Table IV. Acreage and Production of Major Crops in East Germany (U)

Crop	Acres	Production (tons)
Wheat ----------------------------	1,076,000	1,562,000
Rye ------------------------------	2,071,000	1,989,000
Oats -----------------------------	801,000	944,000
Barley ---------------------------	1,062,000	1,389,000
Sugar beets ----------------------	---	856,000
Potatoes -------------------------	1,822,000	13,735,000

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17. (U) ~~(C)~~ R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents.

a. (U) Research on Grain Diseases. E. Proll, at the Institute of Phytopathology, Aschersleben, has published a series of three papers on the multiplication and spread of bromegrass mosaic virus in summer barley. The virus was investigated in vivo with the aid of biological and spectrophotometric concentration and determination techniques for the full period of vegetation. Also, at the same institute, observations in field trials revealed the mode of action and the damage done to wheat, rye, and barley by *Cercosporella herpotrichoides*, the cereal eyespot agent. At the Phytopathology Institute, University of Halle, studies have been conducted on barley stripe rust and on corn rust[78-83]

b. (U) Research on Potato Diseases. Potato virus investigations in East Germany include the following: studies on the aphid vectors of leaf roll virus, symptom development of potatoes inoculated with tobacco-vein browning virus, factors which influence the serological diagnosis of potato virus S in field and greenhouse tests, differentiation of potato virus S and M, and the occurrence of virus M in the potato varieties of East Germany. One study on late blight concerns a laboratory testing method to ascertain tuber resistance to P. infestans[84-89].

c. (U) Research on Sugarbeet Diseases. Studies conducted at the Institute of Phytopathology on the relationship between the beet-leaf aphid Piesma quadratum and the beet leaf curl virus are described in a paper published in 1966[90].

d. (U) Plant Virus Studies. Investigators at this institute are working on basic studies of plant-virus relationships. One phase concerns the inhibitory mechanisms in virus-infected plants and another phase concerns the metabolism of virus-diseased plants[91,92].

e. (U) ~~(C)~~ Pesticides. VEB (Peoples Owned Factory) Farbenfabrik Wolfen prepared and tested dithiocarbamic acid esters of alkylaminodimethylols; they were effective against Fusarium, Phytophthora, and Peronospora with low phytotoxicity. The fungicidal action of heavy metal chelates was studied at the Friedrich Schiller University, Jena. Reports in 1967 stated that Farben had developed a new organophosphorus pesticide, but no data were presented concerning its effectiveness or uses[93,94].

18. (U) ~~(C)~~ Assessment of Defensive Anticrop BW Capabilities

The quality of plant-protection research in East Germany is lower than that found in Czechoslovakia. The well-developed, research-oriented, chemical-pesticide industry could be effective in producing plant-protection chemicals needed for anticrop BW defense. East Germany is estimated to have a limited defensive anticrop BW capability.

19. (U) ~~(C)~~ Assessment of Offensive Anticrop BW Capabilities

No information has been received that East Germany has developed an anticrop BW weapon system. Because of limited resources and the relatively low status of plant-protection research, East Germany is estimated to have only a limited offensive anticrop BW capability.

(U)
D. ~~(C)~~ POLAND

20. (U) General

a. Poland has an area of 120,356 miles--about the size of New Mexico. Of the total land area, 50% is arable, 13% is pastures and meadows, 26% is forests, and 11% is orchards and other lands. About 57% of the arable land produces grain and 18% produces potatoes. Mixed crops and livestock farming are predominant.

b. About 86% of the agricultural land is in private farms averaging about 12 acres each; 13% of the acreage is in state farms averaging 1000 acres; and 1% is in collective-type farms averaging 400 acres. Compared with state and collective farms, most private farms (about 3.6 million) are badly equipped. Total fertilizer consumption in 1963-64 was a little more than 57 pounds per acre.

c. Both the quality and the quantity of food consumption have increased during the past decade, with rising consumption of livestock products and declining consumption of cereals and potatoes. The average daily caloric intake for 1959-61 was 3100 as compared with an average of 2800 in prewar Poland. Livestock products were 29.2% of the total daily caloric intake as compared with 26.1% during 1956-58.

21. (U) Major Crops

Rye accounts for nearly one-third of all the sown area and one-half of the grain area. Wheat, oats, and barley are important grains. Potatoes are important as food for both humans and animals. Sugarbeets and rapeseed are major industrial crops. The major crops grown in Poland, along with acreage and production figures are listed in table V. The distribution of wheat, rye, oats, and barley is shown in figures 1 through 5, subsection A.

Table V. Acreage and Production of Major Crops in Poland (U)

Crop	Acres	Production (tons)
Rye	11,471,000	8,411,000
Wheat	3,780,000	3,496,000
Oats	3,796,000	2,903,000
Barley	1,756,000	1,506,000
Potatoes	7,022,000	47,259,000
Sugar beets	---	1,662,000
Rapeseed	642,000	455,000

UNCLASSIFIED

22. (U) R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents

a. Research on Grain Disease. The activity in this field apparently is very limited. One paper concerns a study of the biology of *Ophiobolus graminis* Saccardo, the pathogen of the take-all disease of wheat in Poland[95]. Two other papers describe the techniques and results of breeding for resistance to stem-leaf and stripe rusts[96,97].

b. Research on Potato Diseases. Of 14 papers on potato viruses, six concern detection of the viruses, four the effect of environment on development of the viruses, two the effects or damage caused by the viruses, and two concern breeding for resistance to potato viruses[98-111]. At a conference in August 1964, papers were presented on the physiology, biochemistry, variability, and races of *P. infestans* (the agent of late blight), and the breeding of resistant potato varieties[112]

c. Insect Pest Research. Three years of investigating the field resistance of inbred lines and hybrids of maize to the European corn borer larvae are discussed in a report published in 1967. An earlier paper describes field trials against *Aphis fabae*, the vector of beet yellows virus. The control of the Colorado potato beetle has been tried through the use of nematodes of the *Mermithidae* family. A Canadian insect has also been investigated for this purpose.

23. (U) ~~(C)~~ Research Institute of Plant Protection, Poznan

a. (U) ~~(C)~~ The scientists at this institute, directed by Dr. W. Wegorek, conduct basic research and offer advice to numerous specialists on methods of controlling diseases and pests of cultivated plants.

b. (U) ~~(C)~~ Several new well-equipped laboratories and an excellent library are available to the scientists. Well-designed and modern greenhouses are located near the laboratories. Modern residences have been constructed for research personnel.

c. (U) ~~(C)~~ The Institute is composed of three departments: Zoology, Phytopathology, and Control of Diseases and Pests. Each department consists of divisions, which are subdivided into laboratories. The staff is composed of 65 senior and associated research employees, 125 technicians, 25 administrative personnel, and 50 service-staff employees.

d. (U) ~~(C)~~ Personnel

(1) The Vice Director for Administration is Dr. B. Micinski.

(2) The Head of the Division of Plant Pests is Dr. Zofia Golebiowska, who has the reputation of being a very capable scientist. This division consists

of eight laboratories including entomology, acarology, helminthology, field rodents, stored product pests, ecology, biochemistry, and radioisotopes.

(3) The head of the Laboratory of Virology is Dr. T. Grela. This laboratory is well equipped with modern instruments including an electron microscope donated by the Rockefeller Foundation. Dr. Grela spent a year in the United States under a Rockefeller Fellowship. The scientists in the virus laboratory conduct experiments on virus diseases of potatoes and sugar beets. They also initiated some work with viruses on leguminous plants and hops.

(4) The head of the Laboratory of Helminthology is Dr. A. Wilski. This laboratory is chiefly concerned with the parasitic nematodes of cultivated plants in Poland. Some work concerns the losses of resistance of plants to nematodes. The control of nematodes by the use of various nematocides is also being investigated.

(5) Other personnel include Dr. I. J. Krzymanska, who is on the research staff of the Laboratory of Biochemistry and Dr. Jerzy Lipa, a well-known Polish scientist.

24. (U) Development of the PZL-104 "Wilga-3R"

This new model of a Polish agricultural aircraft has a laminated container for chemical materials; a drive mechanism from the engine; a duster in the form of a perforated wing; a tube system installed in the fuselage and in the wings; and a spraying unit at the middle span, at the end of each wing, and also on the fuselage[113].

25. (U) ~~(C)~~ Assessment of Defensive Anticrop BW Capabilities

The Research Institute of Plant Protection, Poznan, has well-equipped laboratories and a few well-trained researchers. Poland also has an effective plane for disseminating agricultural spray. The limited resources of the country, the lack of a well-developed pesticide industry, and the lack of depth in R&D facilities and personnel limit the defensive anticrop BW capabilities of Poland.

26. (U) ~~(C)~~ Assessment of Offensive Anticrop BW Capabilities

Poland has only a limited R&D potential to develop an offensive anticrop BW capability.

E. (U) ~~(C)~~ HUNGARY

27. (U) General

a. Hungary has an area of approximately 35,900 square miles--about the size of Indiana. Of this area, 61% is arable. The active labor force is estimated at 4,700,000, of which 35% is engaged in agriculture.

b. Agricultural output has increased little since 1957-59. The level of output in 1965 was only 6% above that of 1957-59 and 2% above that of 1940. Only East Germany and Czechoslovakia showed a slower rate of growth. This poor performance has caused some significant changes in agricultural policy, designed to increase production. The input of new tractors and fertilizers has increased, and capital investment in Hungarian agriculture has accounted for about 20% of the total investment in the past 3 years.

28. (U) Major Crops

Wheat and corn are grown on 46% of the arable land. Sunflower seed and sugar beets are the major industrial crops. The major crops grown in Hungary are listed in table VI. Distribution of wheat, rye, barley, corn, and sugar beets is shown in figures 1, 3, 5, 6, and 8, respectively, in subsection A.

Table VI. Acreage and Production of Major Crops in Hungary (U)

Crop	Acres	Production (tons)
Wheat	2,595,000	2,168,000
Barley	1,263,000	1,065,000
Corn	3,175,500	4,036,300
Rye	609,000	298,200
Sunflower seed	---	114,000
Sugar, centrifugal*	---	483,000

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*Centrifugal sugar, as distinguished from noncentrifugal, includes cane and beet sugar produced by the centrifugal process, which is the principal kind moving in international trade.

29. (U) ~~(C)~~ R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents

a. (U) Research on Grain Diseases

(1) (U) Wheat disease. Z. Kiraly of the Research Institute for Plant Protection, Budapest, found that large amounts of ammonium nitrate fertilizer tended to increase the susceptibility of wheat to stem rust and to decrease the phenol content of healthy wheat plants, particularly at the heading stage[114]. B. I. Pozsar and Kiraly demonstrated also that infected leaves of wheat are able to mobilize a substance that increases the transport of nutrients to the infection site[115]. J. Lilley of the Agriculture Research Institute, Szeged-Kiszombor, conducted studies to determine resistance of wheat to leaf rust[116]. The Research Institute of Plant Protection has undertaken a broad study on the pathomechanisms and detailed recognition of yellow dwarf in wheat, barley, rye, and oats[117].

(2) (U) Corn disease. M. Petho of the College of Agriculture, Debrecen, has investigated the relationship between nitrogen metabolism in corn and susceptibility to corn smut. The results supported the hypothesis that nitrogen metabolism is a deciding factor in determining susceptibility[118].

(3) (U) Rice disease. Research has shown that low and falling temperatures increase the susceptibility of the rice plant to blast[119]. Races of rice blast have been investigated at the Agrobotanical Research Institute, Tapioszele[120].

b. (U) Research on Potato Diseases. J. Horvath of the Research Institute for Plant Protection, Budapest, has conducted a series of studies on the strains of potato virus Y, incidence and control of potato leaf roll, and potato viruses S, X, and Y[121-123].

c. (U) Research on Sugar Beet Diseases. Investigators at the Research Institute of Plant Breeding, Sopronhorpacs, have been conducting studies on sugar-beet diseases. One paper describes the damage caused by virus yellows, and another paper describes the results of testing the tolerance of the beet to the same disease[124,125]. Biotypes of C. beticola, the agent of Cercospora leaf spot, were investigated, and seven physiological races have been isolated[126].

d. (U) ~~(C)~~ Research on Pesticides. In the fall of 1967, a continuing and increased research effort on pesticides, directed at uncovering new plant-disease chemicals, was indicated. Joseph Voros of the Plant Protection Institute, Budapest, was conducting a screening and testing program for antifungal antibiotics. The institute was producing actidione for application on grain diseases, particularly rust. G. Matolcsy, also of the Institute, was working on herbicides. In 1967-68, Matolcsy's major interest included the synthesis of new herbicides and the discovery of a "marketable product." Both Voros and Matolcsy implied an increased pressure to produce items with positive application and market value, presumably outside of Hungary. To date, Hungary has imported most of her pesticides. Atrazine, a herbicide, is produced but is called Hungazin. The Institute has also worked with several Bacillus thuringiensis preparations for the control of insects.

30. (U) ~~(C)~~ Assessment of Defensive Anticrop BW Capabilities

The Hungarian plant-protection service is well organized and staffed by highly qualified personnel. This service is placing considerable emphasis on the development of more-effective plant-protection chemicals. For these reasons, Hungary is estimated to have a moderate defensive anticrop BW capability.

31. (U) ~~(C)~~ Assessment of Offensive Anticrop BW Capabilities

Because of limited available resources, Hungary is estimated to have only a limited offensive anticrop BW capability.

F. (U) ~~(C)~~ RUMANIA

32. (U) General

a. Rumania's total area of 59.3 million acres includes about 24.7 million acres of arable land, nearly all of which is sown. More than 90% of the agricultural land and 95% of the arable land is in the socialized sector, which includes state and collective farms but not the private plots of individual farmworkers.

b. The total agricultural production of 1965 exceeded that of 1964 by 4% and that of 1957-59 (average) by 21%. Per capita production of 1965 increased 4% over per capita production of 1964 and 14% over that of 1957-59 (average). Rumania's agricultural progress in this decade ranks among the highest in Eastern Europe.

c. The agricultural program for 1966-70 calls for higher farm prices; increases in machinery, fertilizer, and capital inputs; and a reorganization of farm management. Government investment is also being used to establish additional machinery and fertilizer plants. Further, a 988,400-acre expansion of irrigated land is to be effected through state investment.

d. Rumania ranks second to Bulgaria in per capita consumption of cereal in Eastern Europe and is a major exporter of agricultural products in Eastern Europe. Outside the USSR, Rumania is the only significant Communist net exporter of grain. The value of agricultural exports has increased significantly since the late 1950's, and accounts for about 20% of the total value of exports.

33. (U) Major Crops

Major crops include corn, wheat, barley, oats, potatoes, sweet potatoes, and sunflower seed. The acreage and production of major crops in Rumania are listed in table VII. The distribution of wheat, oats, barley, corn, and potatoes is shown in figures 1 and 4 through 7, respectively, in subsection A.

Table VII. Acreage and Production of Major Crops in Rumania (U)

Crop	Acres	Production (tons)
Corn ----------------------------	8,299,000	6,917,000
Wheat ----------------------------	7,307,000	4,096,000
Oats ----------------------------	447,000	205,000
Barley --------------------------	597,000	457,000
Potatoes ------------------------	773,000	2,968,000
Sweet Potatoes -------------------	181,000	3,461,000
Sunflower seed -------------------	---	584,000

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34. (U) ~~(C)~~ R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents

a. (U) ~~(C)~~ Research on Grain Diseases. Near Timisoara, Rumania, some experiments were conducted for the purpose of determining the resistance of different corn hybrids to Ustilago maydis, which causes smut disease of corn, and to H. turcicum, the agent of northern leaf blight of corn. D. M. Stewart, of Minnesota, St. Paul, has collaborated with Rumanian scientists in carrying out investigations on the physiological specialization of P. recondita, Puccinia graminis var tritici, and P. striiformis, as well as sources of resistance for breeding new rust-resistant wheat varieties[127-129].

b. (U) Research on Sugar Beet Diseases. Studies on beet yellows virus during 1961-64 concerned symptoms, experimental transmission of virus to various hosts, serological tests in the field and in glasshouse plants, purification of the virus, and electron microscopy[130,131].

c. (U) Research on Pesticides. Two papers on pesticides have been noted: One describes a method of determining the adherence of pesticide dusts; the other concerns the synthesis of derivatives of 2,4-dichlorophenoxyacetic acid, a common herbicide[132,133].

35. (U) ~~(C)~~ Assessment of Defensive Anticrop BW Capabilities

Rumania has very limited facilities and trained personnel for plant-protection functions; therefore, she has only a very limited defensive anticrop BW capability.

36. (U) ~~(C)~~ Assessment of Offensive Anticrop BW Capabilities

Rumania has almost no capability to conduct offensive anticrop BW.

G. (U) ~~(C)~~ BULGARIA

37. (U) General

a. The total land area of Bulgaria is 42,800 square miles, of which approximately 52% is devoted to agriculture. The arable area is 11.9 million acres, and of this amount about 9.7 million acres are sown.

b. Irrigation is used extensively in Bulgaria because of recurring droughts. In 1964, 3 million acres were irrigated, with watering of an additional 138,000 acres planned for 1965. Thus, roughly 20% of the country's farming land has some kind of irrigation.

c. Agricultural production in 1964 and 1965 was 18% above the 1957-59 average; per capita output was 11% above that level. The number of livestock in Bulgaria was up substantially in 1965 over the 1957-59 level, especially of hogs and sheep. Meat production was up by 20%, milk production by 23%, and egg production by more than 50%.

d. The average daily caloric intake for Bulgarians in 1959-61 was 2910, including 2.85 ounces of protein and 2.0 ounces of fat. Two-thirds of the consumption was in cereal grains, 5% in meats and dairy products, 10% in fats, and 7% in sugar. The remainder of the consumption was in vegetables and fruits, or 40% to 60% above that of any other country in the region. Cereal consumption in Bulgaria is also higher than in other East European countries, but consumption of potatoes, meat, fish, and eggs is much lower.

38. (U) Major Crops

Bulgaria has major grain crops in wheat, corn, and barley. Tobacco, sunflower seeds, and sugar beets are important industrial crops. Also produced are large quantities of fruits, grapes, and vegetables. The major crops grown in Bulgaria, with acreage and production figures are listed in table VIII. The distribution of wheat, barley, corn, and sugar beets can be seen in figures 1, 5, 6, and 8, respectively, in subsection A.

Table VIII. Acreage and Production of Major Crops in Bulgaria (U)

Crop	Acres	Production (tons)
Wheat ----------------------------	2,990,000	2,600,000
Barley ---------------------------	832,000	806,000
Corn -----------------------------	1,596,000	1,999,500
Tobacco --------------------------	309,000	136,000
Sunflower seed -------------------	660,000	386,000
Sugar beets ----------------------	---	200,000

UNCLASSIFIED

39. (U) R&D Against Naturally Occurring Crop Pests and Anticrop BW Agents

a. Research on Grain Diseases. At the Wheat and Sunflower Institute near Tolbukhin, investigations were conducted on the race composition of P. recondita (the causal agent of leaf rust of wheat) and the relation of some wheat varieties to established disease-causing races in Bulgaria[134]. The virus diseases of corn and sorghum observed in Bulgaria are described in a paper published in 1964. The virus diseases observed were sugar cane mosaic, ring mottle, and red stripe[135].

b. Research on Potato Diseases. Although potatoes are not listed as a major crop of Bulgaria, potato diseases have received considerable attention. Bailova-Yankulova of the Institute of Plant Protection, Kostinbrod, has conducted investigations on potato viruses S, X, and Y[136-138]. Two 1966 reports describe the breeding of potatoes that are resistant to virus[139,140]. The evaluation systems of forecasting potato blight (P. infestans) in Bulgaria are presented in a paper published in 1966[141].

c. Tobacco Disease Research. Well-known fungicides and bactericides were tested in Bulgaria for the control of Pseudomonas tabaci, the causal agent of wildfire on tobacco, and of Peronospora tabacina, the tobacco blue mold fungus[142].

d. Pesticide Research. The Institute of Plant Physiology has investigated the chemical structure and herbicidal activity of some thiourea derivatives[143]. The Research Institute for Plant Protection and the Central Laboratory for Plant Protection have been testing herbicide, fungicide, and insecticide compounds from all over the world as well as those produced in Bulgaria[144].

40. (U) ~~(C)~~ Assessment of Defensive Anticrop BW Capabilities

Bulgaria has only a very limited defensive anticrop BW capability.

41. (U) ~~(C)~~ Assessment of Offensive Anticrop BW Capabilities

Plant-protection research in Bulgaria is generally of poor quality because of limited facilities and lack of trained personnel. For this reason, the offensive anticrop BW capabilities of Bulgaria are estimated to be almost nonexistent.

(U)
Section II ~~(C)~~

CROP VULNERABILITY (R&D)--ASIAN COMMUNIST COUNTRIES

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

1. (U) General

a. Communist China, the world's third largest country, with an area of 3.7 million square miles, is the world's second largest agricultural producing country after the United States. Communist China, with only 7.8% of the world's cultivated area, supports almost one-fourth of the world's population.

b. This unfavorable population-land balance, which provides less than 0.4 acre of cultivated land per person, has been a major deterrent to the country's economic progress. Between 80% and 85% of the population is engaged in farming, and agriculture currently supplies one-third to one-half of the national income. Agriculture also supplies the bulk of the raw-material base. Farm products and the finished (manufactured) agricultural raw-material products constitute 60% to 70% of total exports.

c. During the first decade of Communist rule, gains in agricultural production were registered almost every year. Then 4 years of devastating reverses in agriculture, due to the reckless adventure of the Great Leap Forward (1958-60) and unfavorable weather during 1959-61, dropped farm output to a dangerously low level and resulted in a near collapse of the economy.

d. Under the guise of central planning during the Great Leap Forward, officials had ignored traditional farming cultures--thereby badly upsetting one of the most intricate farming systems in history. Because of the successive crop reverses, the regime beat a hasty retreat and announced a new policy of giving priority to agriculture. Since that time, gains have occurred in numerous industries designated to support agriculture.

e. Although sufficient justification exists for official claims that the current level of food consumption exceeds that of the 1959-61 period, agricultural production in the socialist sector has failed to make a net per capita gain since 1964, and is substantially below production before the Great Leap Forward. Large imports of grain and substantial production increases on private plots of land account for most of the increased consumption since 1961. On socialist farms, the production of food crops in 1966 failed to meet consumer needs for the eighth consecutive year.

f. Although exports of agricultural commodities have increased significantly since 1962, they apparently have not regained the 1959 level. Thus, almost a decade after the Great Leap Forward, which was supposed to solve China's economic problems within a few years, the country's agriculture is still in a state of stagnation. As one authority observed, "It may turn out that the Great Leap Forward will have cost the Chinese economy roughly a decade of growth."

2. (U) Major Crops

Rice is by far the most important crop in Communist China. The production of rice is more than three times that of all the other major crops combined; wheat is next in acreage and production. Other principal crops are soybeans, peanuts, rapeseed, and cotton. The major crops grown in Communist China, with acreage and production figures, are listed in table IX. The distribution of rice, wheat, soybeans, and cotton is shown in figures 12 through 15, respectively.

Table IX. Acreage and Production of Major Crops in Communist China (U)

Crops	Acres	Production (tons)
Rice	---	91,800,000
Wheat	62,114,000	22,927,000
Soybeans	20,433,000	8,100,000
Peanuts	4,339,000	2,209,000
Rapeseed	2,830,000	965,000
Cotton	10,950,000	1,241,000

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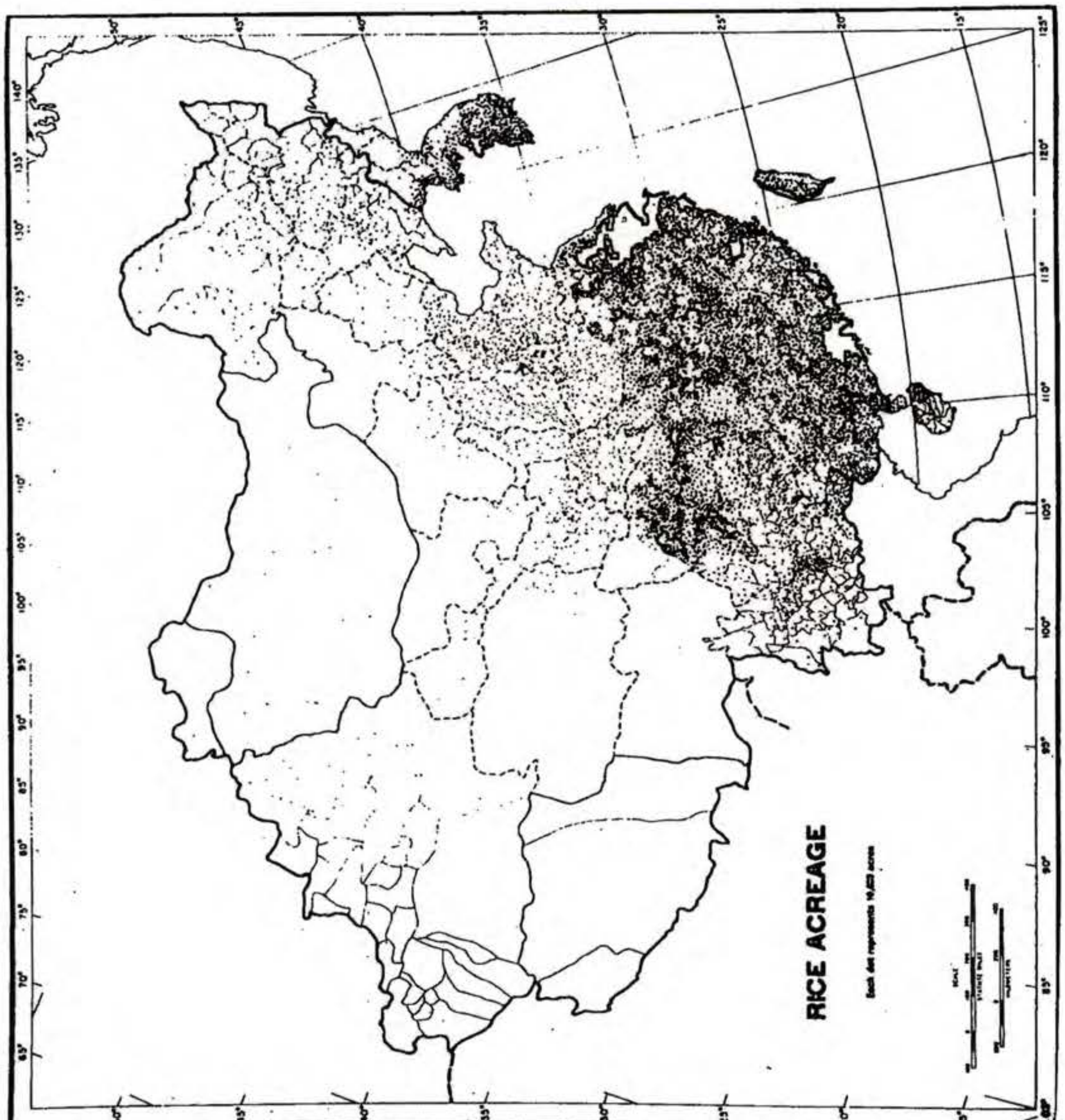

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Figure 12. Distribution of rice acreage in Communist China (U).

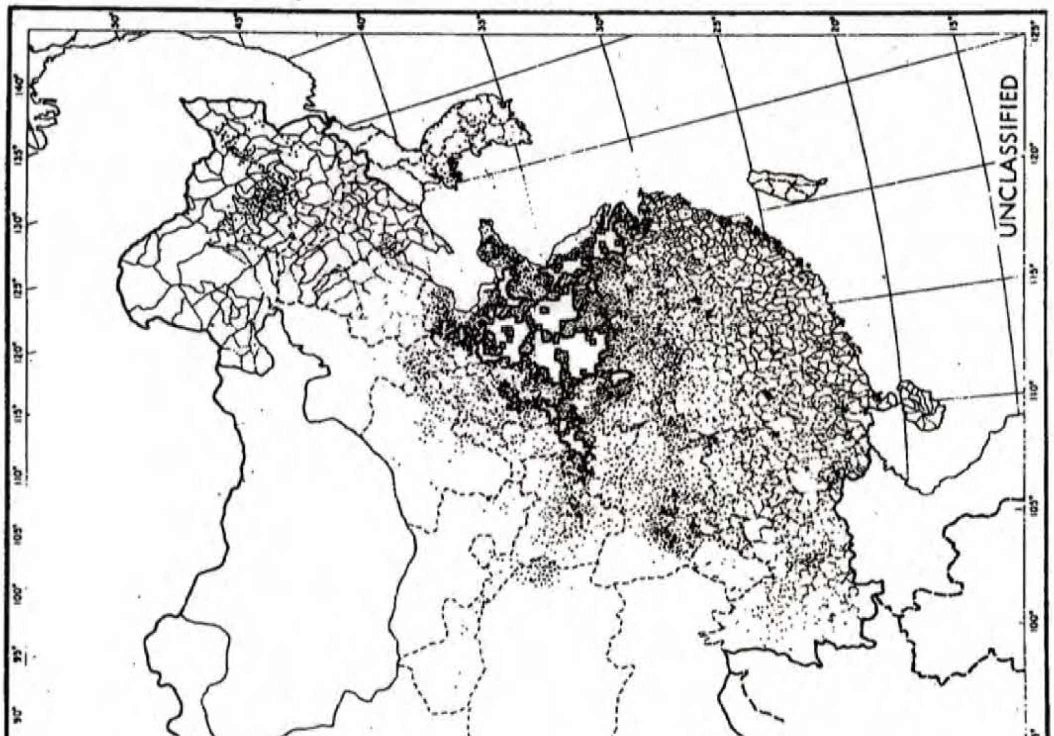

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Figure 13. Distribution of wheat acreage in Communist China (U).

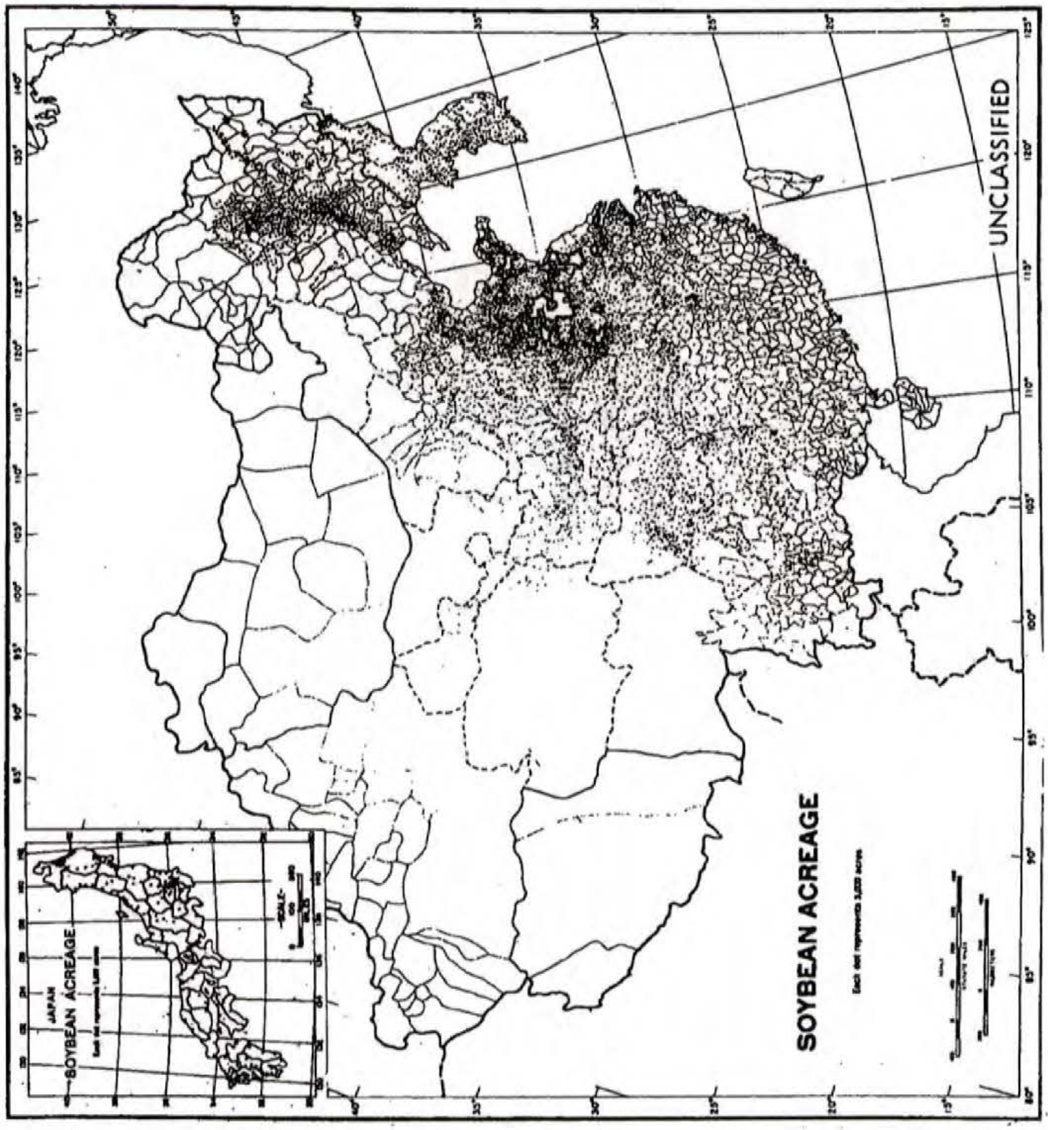

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Figure 14. Distribution of soybean acreage in Communist China (U).

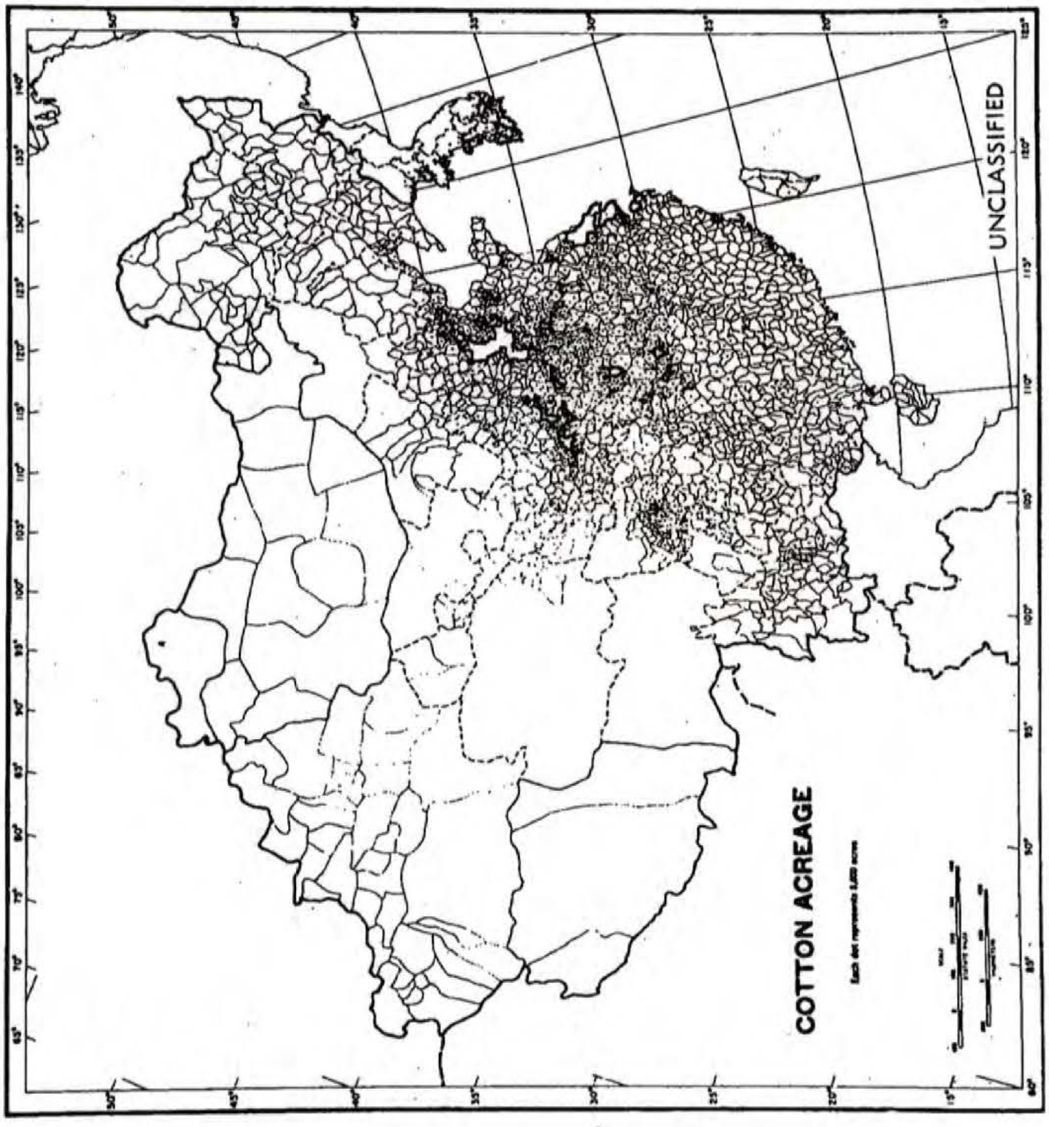

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Figure 15. Distribution of cotton acreage in Communist China (U).

(U)
3. ~~(C)~~ R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents

(U)
a. ~~(C)~~ Sources of Information. Articles in Chinese Communist scientific publications have been the source of almost all information concerning research on crop diseases and pests in Mainland China, but this source "dried up" during the latter half of 1966. The availability of papers published in Communist China decreased drastically after the February 1966 issues, and no 1967 publications are available. The presses have been diverted to printing propaganda booklets for the "Cultural Revolution." Since February 1966, no information has been available concerning the present status of agricultural and biological research in Communist China.

b. (U) Research on Rice Diseases and Insects. Since rice is the most important source of food in Communist China, its diseases would be expected to receive the greatest attention of ChiCom scientists. This opinion seems to have no basis in fact, however, since the rust diseases of wheat apparently are the object of much more research.

(1) (U) Investigations on rice diseases. Rice blast is a serious disease in Communist China, especially in the northeast, but only one article--concerning the application of kasugamycin, a Japanese antibiotic, for the control of rice blast--has been noted in a Chinese Communist publication since the beginning of 1965[145]. The study on which the article was based was conducted by a Japanese scientist. During the same time period, three papers on other rice diseases appeared:

The Mycelial Activities of The Rice Sheath Blight Fungus in Relation to the Disease Development[146]

Studies on the Spore Dispersal of Helminthosporium oryzae[147]

Field Control of Bacterial Leaf Streak (Xanthomonas oryzicola) of Rice on Kwangtung[148]

(2) (U) Rice insects. The following two papers on rice insects have been noted; both concern research on the control of the paddy borer:

Outbreak, Rhythm, and Control Technique of Paddy Borer (Tryporyza incertellus Walker) in Huang, Hsin, Hsi, and Demonstration Regions in Hopeh Province[149]

Forecasting the Third Generation Paddy Borer (Tryporyza incertellus Walker) and Chemical Control Techniques[150]

c. (U) Research on Wheat Disease and Insects

(1) (U) Races of wheat stem rust. The physiological races of stem rust of wheat were analyzed in 1964. Stem rust was epiphytotic in all areas of China in 1964, being generally more serious in the north than in the south. In 1964 a total of 2835 samples of stem rust spores were collected from 229 cities and districts of 26 provinces; 2006 of them have been identified. The identifications were conducted indoors from November 1964 to March 1965 according to the usual international procedure and rules. The races and types found were: 17, 19, 21, 21C1, 21C2, 21C3, 34, 34C1, 34C2, 40, and 194. The superiority of race 21 has been gradually decreasing, whereas race 34 has been increasing, as seen from the analysis of the physiological races from 1962 to 1964. This survey was conducted by personnel from the Mukden Agricultural College, Heilungkiang Agricultural Research Institute, and the Kirin Agricultural Research Institute, all in Northeast China[151].

(2) (U) Control of wheat diseases. Four effective means of stripe rust control have been developed in China: (a) breeding of rust-resistant varieties, (b) postponing the sowing time from 100 days to 80 days before the winter solstice, (c) destroying disease-infested plants, and (d) applying fungicides like sodium fluorosilicate and sulfanilamide[152]. According to available statistics, 6 million acres were sown with about 100 varieties of good rust-resistant strains of wheat in the autumn of 1964 in Shansi, Hopeh, Shantung, Honan, Shensi, Kansu, and Northern Kiangsu[153]. The variety Nei-hsiang 36 was reported as immune to stripe rust but susceptible to leaf and stem rusts. Hopeh Agriculture University 3 is almost immune to stripe rust and is resistant to stem rust. Hsu-chou 4 is almost immune to all three types of rust[154].

(3) (U) Development of chemical rust fungicides. Sulfonic acid, a systemic fungicide, has been tested in the field against wheat rust. The optimum concentration found was 6.5 to 13 pounds per acre of 65% acid. Methods for producing the acid have been developed[155,156].

(4) (U) Development of antibiotic fungicides. During 1965, seven papers were published on antibiotic fungicides. All but one concerned the fungicide "Nung-K'ang-101" and isocycloheximide isolated from Streptomyces aureus by the Pharmacology Institute, Chinese Academy of Sciences, Shanghai. This fungicide was tested and found to be effective against wheat rust and Gibberella disease of wheat[157-163].

(5) (U) Research on control of wheat insect pests. The oriental army worm Leucania separata Walker is the pest most destructive of cereal crops in Kirin Province, Northeast China. Studies have been conducted on its life history and the effects of microclimate on its population density. The wheat stem fly Meromyza saltatrix Linn is a serious pest of wheat in Shensi. Differences in varietal susceptibility have been noted; plants growing in fertile soils sustain

less injury. Benzene hexachloride (BHC) or parathion provide very effective control of the adult fly. One paper describes the development of the aphid Macrosiphum granarium--the chief wheat pest in the province of Hsi-Nan[164-168].

d. (U) Research on Soybean Diseases and Pests. Although the soybean is a major crop in Communist China, research on its diseases and pests is sketchy. Only three papers have been noted: one on the analysis of the soybean mosaic virus, and two on the soybean pod borer. The latter is a serious pest of soybeans in Northeast China. Recommended control methods are the use of resistant varieties of soybean, proper cultural practices, and insecticides like BHC plus DDT[169-171].

e. (U) Research on Rape Disease and Pests. The Institute of Microbiology has conducted an intensive study of the rape mosaic viruses. The Chinese Communists have identified and characterized 40 strains of the virus. A partial purification of the virus has been accomplished, and its properties have been described. Another institute has studied the epidemic relations between the aphid Myzus persicae Salz and the virus[172-174].

f. (U) Research on Cotton Disease and Pests. Analysis of the published research papers indicates that the principal diseases and insects of cotton are: fusarium wilt, verticillium wilt, and pink bollworm. Stopping the spread of fusarium wilt and verticillium wilt appears to be the principle difficulty. BHC and DDT are recommended to control the bollworm[175-177].

g. (U) Insect Pest Control Research

(1) (U) Chemosterilants. Two forestry institutes have been investigating the use of the chemosterilants to control Dendrolimus punctatus Walker, Bombyx mori, and other insects. Chemosterilants selected from screen tests included Thio-TEPA, 5-fluorouracil, 5-fluorourotic acid, colchicine, nitrogen mustards, and thiocarbamide. The effects of the various chemosterilants on the different insects are described[178-181].

(2) (U) Organic insecticides. Research on chemical insectides in Communist China appears to concern chiefly the testing of Western-developed organophosphorus and organochloro insecticides on Chinese crops. The development of synthetic processes for producing the desired insecticides for Chinese crops also is of concern.

(3) (U) Biological control. Spores of the bacteria B. bassiana and B. thuringiensis are used to control such insects as D. punctatus Walker, the pine caterpillar Grapholithe glycinivosella, and Cylas formicarius. The entomogenous fungus Spicaria fumoso-rosea has been considered for the control of a wide range of insects, including L. separata Walker and Pyrausta nubilalis

Huebner. The use of Chinese bees and the insect Trichogramma australicum to control sugar cane borer has been investigated and has produced satisfactory results[183-185].

h. (U) Herbicides Research. Two new herbicides (2,4-dichloro-4-nitrodiphenyl ether and N-3,4-dichlorophenyl carbamate) were produced jointly by the Mukden Chemical Industry Research Institute, the Mukden Insecticide plant, and the Peking Insecticide plant in 1964. These herbicides proved to be highly effective in ridding rice paddies of weeds since they have a high killing effect against paddy-weed grasses[186,187]. Most herbicides used in China are those adopted from the West.

4. (U) ~~(C)~~ Assessment of Communist China's Anticrop BW Capabilities

Assessing the present BW capabilities of Communist China is difficult since no information has been forthcoming for more than 2 years. Determining the effect of the political upheaval on scientific progress in Communist China also is difficult. According to estimates based on the meager information available, Communist China has a limited defensive and offensive anticrop BW capability.

B. (U) ~~(C)~~ NORTH KOREA AND MONGOLIAN PEOPLES REPUBLIC

5. (U) Major Crops

The principal crops of North Korea are rice, corn, and vegetables. Wheat, oats, and barley are the main crops in Mongolia. Acreage and production statistics are not available.

6. (U) ~~(C)~~ R&D Against Naturally Occurring Crop Pests and Anticrop Warfare Agents

The resources of these two communist countries are very meager, and agricultural research is very limited. No papers have appeared in the open literature on research relating to crop diseases, crop pests, herbicides, or anticrop warfare agents. It is estimated that these two countries have no anticrop BW capabilities.

BIBLIOGRAPHY

1. Peruanskii, Yu. V., and Miusov, I. N. "(U) On the Biochemistry of Piricularia oryzae," (U) Vestn. Sel'skokhoz. Nauki, Min. Sel'sk Khoz. Kaz. SSR 6 (3) 1963, 39-43. (Unclassified)

2. Peruanskii, Yu. V. "(U) The Influence of Simazine on Phosphorus Metabolism in Corn," Vestn. Sel'skokhoz. Nauki, Min. Sel'sk Khoz. Kaz. SSR 7 (3) 1964, 147-148. (Unclassified)

3. Peruanskii, Yu. V. "(U) Influence of Derivatives of 2, 4-D and 2, 4, 5-T on the Accumulation of Nucleic Acids and Other Compounds of Phosphorus in Soybean Leaves," Vestn. Sel'skokhoz. Nauki, Min. Sel'sk. Khoz. Kaz. SSR 7 (4) 1964, 72-75. (Unclassified)

4. Peruanskii, Yu. V., and Peruanskaya, O. N. "(U) Relation Between the Resistance of Wheat to Stem Rust and Amount of Glucosides," Agrobiologia 1965 (6), 913-915. (Unclassified)

5. Miusov, I. N., and Peruanskii, Yu. V. "(U) On a Method of Submerged Cultivation of Piricularia oryzae and Helminthosporium turcicum," Vestn. Sel'skokhoz. Nauki, Min. Sel'sk Khoz. Kaz. SSR 8 (12) 1965, 20-24. (Unclassified)

6. Peruanskii, Yu. V., and Baibekov, R. A. "(U) Infrared Spectra of Rust-Resistant and Rust-Susceptible Wheat Varieties," Sel'skokhoz. Biologiya 1 (3) 1966, 421-425. (Unclassified)

7. Peruanskii, Yu. V., and Run'kovskaya, N. G. "(U) Lipid Fractions in Uredospores of Wheat Stem Rust," Dokl. Akad, Nauk SSSR 169 (4), 1966, 962-964. (Unclassified)

8. Peruanskii, Yu. V. "(U) Accumulation of Some Substances in Wheat Leaves During Development of Rust," Vestn. Sel'skokhoz. Nauki, Min. Sel'sk. Khoz. Kaz. SSR 9 (11), 1966, 72-78. (Unclassified)

9. Peruanskii, Yu. V., and Mezentsev, E. G. "(U) Cytochemical Changes in Germinating Uredospores of the Wheat Brown-Rust Pathogen," Obmen Veshchesty u Zhivotn. i Rast., Akad. Nauk Kirg. SSR 1966, 86-89. (Unclassified)

10. Peruanskii, Yu. V., and Topolovski, V. A. "(U) Specific Binding of Certain Dyes by the Polar Regions of Uredospores of Stem Rust of Wheat." Vest. sel'-khoz. Nauki, Alma-Ata, 9 (10), 1966, 104-105. (Unclassified)

11. Peruanskii, Yu. V. "Qualitative Biochemical Variations in Uredospores of Rust Fungi," Izv. Akad. Nauk Kazakh. SSR. Ser. Biol. 1967 (3), 1967, 27-33. (Unclassified)

BIBLIOGRAPHY (Continued)

12. Dunskii, V. F. "Inertial Settling of a Coarsely Dispersed Aerosol on Terrestrial Vegetation," AN SSSR Doklady 159 (6), 1964, 1276-1279. (Unclassified)

13. Dunskii, V. F., Yevdokimov, I. F., Krasil'nikov, V. M., Mikulin, K. P., Khol'kin, Yu. S., and Yuzhnyi, Z. M. "(U) Settling of Coarsely Dispersed Aerosols on the Underlying Surface of the Ground," Leningrad. Glavnaya geofizicheskaya observatoriya Trudy 185, 1966, 148-161. (Unclassified)

14. Dunskii, V. F., and Nikitin, N. V. "(U) Spraying of a Liquid With a Rotating Disk and the Question of 'Secondary' Atomization of Drops," Inzhenerno-fizicheskii Zhurnal 9 (1), 1965, 54-60. (Unclassified)

15. Shcheglov, Yu. V., Mikhailov, V. I., Dunskii, V. F., and Mikityuk, (?). "(U) A Portable Logarithmic Sprayer," Khimiya v sel'skom khozyastve, 4 (11) 1966, 30-34. (Unclassified)

16. Dunskii, V. F., and Nikitin, N. V. "(U) Method of Determining the Droplet Size Distribution in the Atomization of Liquids," Inzhenernofizicheskii Zhurnal 12 (2), 1967, 254-262. (Unclassified)

17. Atabekov, I. G., and Novikov, V. K. "Some Properties of the Nucleoproteid of Barley Mosaic Virus and Its Structural Components," Biokhimiya, 31 (1), 1966, 157-166. (Unclassified)

18. Pridantseva, Ye. A. "(U) Wheat Dwarf Virus in the Krasnodar Region," Nauch. Dokl. vyssh. Shk. Biol. Nauki, 1965 (3), 1965, 153-157. (Unclassified)

19. Atabekov, I. G., Popova, G. A., and Kalamkarova, M. V. "(U) Conformational Changes in Molecules of Wheat Mosaic Virus Antigen in Solution," Dokl. Akad. Nauk SSSR 163 (6), 1965, 1499-1502. (Unclassified)

20. Pridantseva, Ye. A., Popova, G. A., and Atabekov, I. G., "(U) Transfer of Winter Wheat Mosaic Virus to Cicadas by Inspection," Voprosy virusologii 1966 (3), 1966, 340-343. (Unclassified)

21. Kuvshinova, Ye. V., Atabekov, I. G., Shaskol'skaya, N. D., Novikov, V. K., and Popova, G. A. "Comparative Serological Analysis of Rod-Shaped Viruses," Voprosy virusologii 1966 (3), 1966, 343-348. (Unclassified)

22. Shteyn-Margolina, V. A., Cherni, N. Ye., and Razvyazkina, G. M. "(U) Wheat-Streak Mosaic Virus in Plant Cells and Its Tick Carrier," AN SSSR Doklady, 169 (6) 1966, 1446-1448. (Unclassified)

BIBLIOGRAPHY (Continued)

23. Protsenko, A. E., and Legunkova, R. M. "(U) Electron Microscopy of Wheat-Streak Mosaic Virus," Voprosy virusologii 1965 (1), 1965, 23-? . (Unclassified)

24. Zemlina, A., Nikulina, N., and Belyanchikova, N. "Distribution of Streak Mosaic Virus of Wheat," Zashch. Rast., Mosk., 11 (8), 1966, 44. (Unclassified)

25. Agarkov, V. A. "(U) Virus Diseases of Winter Wheat at Nemchenovka, Moscow District," Biol. Nauki 10 (6), 1967, 126-130. (Unclassified)

26. Rubin, B. G., and Popova, N. B. "(U) Effect of Brown Leaf Rust on the Respiration of Wheat," Vestn. sel'-khoz. Nauki, Mosk., 10 (3), 1965, 61-67. (Unclassified)

27. Peresypkin, V. F., and Gotsulyak, V. D. "(U) Biochemical Characteristics of the Resistance of Wheat to Brown Rust," Izv. Akad. Nauk SSSR, Ser. biol., 1965 (3), 1965, 442-447. (Unclassified)

28. Markas'ova, V. A., and Federova, V. A. "(U) Races of the Causal Agent of Brown Rust of Wheat in the Ukraine," Visn. sil'skohospod. Nauki, 1964 (11), 1964, 59-62. (Unclassified)

29. Semenko, N. I. "(U) Pair Selection of Winter Wheat According to the Type of Immunity From Rust," Sel. Seed-Gr., Moscow, 30 (1), 1965, 47-51. (Unclassified)

30. Mamedova, Sh. Ya. "(U) Wheat Hybrids Which Are Promising and Rust-Resistant Under the Various Ecologic Conditions of Azerbaidzhan," Doklady Akad. Nauk Azerb. SSR, 21, 1965, 85-88. (Unclassified)

31. Koblylyanskaya, K. A. "(U) Evaluation of Bulgarian Winter Wheats for Disease Resistance," Sb. Trud. Aspir. molod. nauch. Satrud. vses. Inst. Rast., 6 (10), 1965, 19-21. (Unclassified)

32. Stasevicius, Z. B. "(U) Potato Rugose Mosaic in the Lithuanian SSR and Measures Against It," Liet. TSR Mokslu Akad. Darb. Ser C 2 (37), 1965, 47-55. (Unclassified)

33. Bayarskii, B. G. "(U) Methods of Preparing and Storing Sera Specific to Different Strains of Potato Virus Y (Solanum Virus 2)," Izv. timiryazev. sel'-khoz. Akad., 1965 (3), 1965, 131-141. (Unclassified)

BIBLIOGRAPHY (Continued)

34. Kameraz, A. Ya., and Ivanova, V. N. "(U) Original Material for Breeding Virus-Resistant Potato." Trudy prikl. Bot Genet. Selek. 37 (3), 1965, 161-189. (Unclassified)

35. Tamm, P. "(U) Modes of Mosaic Virus Infectio: f Potato Seedlings," Eesti NSV Tead. Akad. Toim. 14 (2), 1965, 256-262. (Unclassified)

36. Nurmiste, B. "(U) Some Concepts Regarding Viruses and Control Problems Arising from Them," Eesti NSV Tead. Akad. Toim. biol. Seer, 15 (1) 1966, 3-15. (Unclassified)

37. Zhuk, I. P., and Kishka, Ya. G. "(U) Localization of the Antigen of Potato Virus X in Potato and Datura Tissues by the Method of Fluorescent Antibodies," Mykrobiol. Zh. 28 (2), 1966, 51-57. (Unclassified)

38. Mendzhul, M. I. "(U) Possibility of Growing Potatoes Free From Rugose Mosaic Viruses Under Carpathian Mountain Conditions," Mykrobiol. Zh., 28 (5), 1966, 39-45. (Unclassified)

39. Ouf, M. F. "(U) Role of Early Harvesting of Unripe Tubers in Controlling Virus X Infection in Potatoes," Izv. timiryazev. sel'-khoz. Akad., 1966 (4), 1966, 166-169. (Unclassified)

40. Duda, V. "(U) Virus Diseases of Potatoes," Zashchita rasteniy, 1966 (11), 1966, 23. (Unclassified)

41. Maksimova, A. "(U) Potato Viruses," Zashchita rasteniy, 1966 (11), 1966, 59. (Unclassified)

42. Kharin, N. G., Bogoyavlenskaya, R. A., and Kolovskii, R. A. "(U) Phytopathology, Spectrophotometry, and Aerial Photography, "Nauch. Dokl. vyssh. Shk., Biol. Nauki, 1965 (3), 1965, 111-117. (Unclassified)

43. Sokolova, V. E., Kazantseva, G. N., Zvyagnitseva, Yu. V., and Metlitskii, L. V. "(U) Change in the Content of Chlorogenic and Caffeinic Acids in Stored Potato Tubers Differing in Their Resistance to P. infestans," Dokl. Akad. Nauk SSSR, 165 (1), 1965, 237-240. (Unclassified)

44. Metlilskii, L. V., Ozeretskovskaya, O. L., Chalenko, G. I., and Strokova, G. A. "(U) On the Fungitoxic Effect of Phenol Compounds Formed in Injured Potato Tubers," Dokl. Akad. Nauk SSSR, 160 (4), 1965, 964-967. (Unclassified)

45. "(U) Prospects for Potato Breeding for Resistance to Potato Nematode," Genetika 1967 (7), 1967, 90-99. (Unclassified)

BIBLIOGRAPHY (Continued)

46. Lomakina, V. I., Mandel'baum, Ya. A., and Melnikov, N. N. "(U) Organic Insectofungicides. LXXXIX. Interaction of Triethyl Phosphite With Amides of Monochloroacetic Acid," Zhurnal obshchey khimii, 36 (3), 1966, 447-449. (Unclassified)

47. Anischenko, A. F., Volodkovich, S. D., and Melnikov, N. N. "(U) Organic Pesticides. 85. Synthesis of N-alkyl-and N-n-dialkyl 1,2,3,4,7,7-hexachlorobicyclo [2,2,T]-2-hepten-5-ylmethyl carbamates," Zhurnal obshchey khimii 35 (11), 1965, 1940-1945. (Unclassified)

48. Anonymous. "(U) The "An" Family [Antonov-designed Aircraft]" Grazhdanskaya aviatsiya, No. 2, 1966, 16-17. (Unclassified)

49. Anonymous. "(U) An-2M Demonstration," The Aeroplane and Commercial Aviation News, April 7, 1966, p. 29. (Unclassified)

50. Bartos, P., and Sebesta, J. "(U) The Influence of Rusts on the Weight of Wheat Grain Determined by the Use of Fungicides," Ochr Rost., N. S. 2(2), 1966, 85-90. (Unclassified)

51. Benada, J. "(U) Yellow Rust (P. striiformis) on Wheat. I. Harmfulness of Yellow Rust," Ochr. Rost. 1(2), 1965, 1-8. (Unclassified)

52. Sebesta, J., and Bartos, P. "U) Race and Varietal Specificity of Teleutospore Formation in Wheat Stem Rust," Ochr. Rost., N. S. 2(2), 1966, 91-98. (Unclassified)

53. Benada, J. "(U) The Gradients of Oxidation-Reduction Potentials in Cereals and the Dependence of Obligate Parasites on the Redox Potentials of the Host Tissue," Phytopath. Z. 55 (3), 1966, 265-290. (Unclassified)

54. Macko, U., and Novacky, Anton. "(U) Isozymes of Malate Dehydrogenase in Uredospores of Puccinia recondita Rob. Ex Desm.," Biologia 21 (6), 1966, 460-461. (Unclassified)

55. Slovencikova, V. "(U) Testing of Resistance in Wheat to Puccinia striiformis on Detached Leaves in Benzimidazole," Ochr. Rost., N. S. 2(4), 1966, 245-250. (Unclassified)

56. Prusa, V. "(U) Wheat Striate Mosaic Virus," Ochr. Rost., N.S., 1(4), 1965, 69-70. (Unclassified)

57. Jermoljev, E., and Klir, O. "(U) Distribution of Virus X in Potato Plants," Ochr. Rost. 1 (2), 1965, 31-38. (Unclassified)

BIBLIOGRAPHY (Continued)

58. Jermoljev, E., and Albrechtova, L. "(U) Research on Substances Inactivating the X Virus Present in Sap From Potato Leaves," Biologia Pl. 7 (1), 1965, 65-73. (Unclassified)

59. Jermoljev, E. "(U) The Inhibitory Effect of the Sap of Some Potato Varieties on Viruses X, Y, and S," Nachrbl. dt. PflSchutzdienst, Stuttg., 17 (4) 1965, 55-58. (Unclassified)

60. Jermoljev, E., and Brcak, J. "(U) Preventive Effect of Inhibitors From Potato Leaves on Local Infection With Virus X," Biologia Pl. 8 (5), 1966, 393-397. (Unclassified)

61. Jermoljev, E., Albrechtova, L. "(U) Investigation of the X Virus Inhibitor From Potato Leaf Sap. Serological Determination of the Amount of the X Virus Inhibitor in Potato Leaf Sap," Biologia Pl. 8 (6), 1966, 434-451. (Unclassified)

62. Sip, V. "(U) Experiments on Heat Treatment of Potato Leaf Roll Virus," Ochr. Rost. 1 (3), 1965, 35-42. (Unclassified)

63. Nohejl, J. "(U) Influence of Artificial Interruption of Dormancy in Tubers on the Reliability of the Diagnosis of Potato Viruses," Ochr. Rost. 1 (2), 1965, 47-50. (Unclassified).

64. Koula, V., and Taimr, L. "(U) Study on the Fungitoxicity of Cold Aerosols for Cercospora beticola and Phytophthora infestans Under Field Conditions," Ochr. Rost., N. S., 3 (1), 1967, 23-31. (Unclassified)

65. Brillova, D. "(U)" Effect of Heat and Relative Humidity on Conidial Germination of Cercospora beticola," Biologia, Bratislava, 20 (10), 1965, 749-762. (Unclassified)

66. Kocmid, V. "(U) Influence of Cercospora Leaf Spot on Quality of Sugar Beet Plants in Relation to Varieties and Chemical Protection," Listy Cukrovarnicke 82 (12), 1966, 289-293. (Unclassified)

67. Chod, J., Polak, J., and Klir, O. "(U) Dynamics of Yellows Disease Virus of Sugar Seed Beet Generation," Listy Cukrovarnicke 82 (11), 1966, 286. (Unclassified)

68. Kvicala, B. A. "(U) Some Relationships Between Pea Mosaic Virus and Its Vector Myzus persicae Sulz," Biologia, Bratislava, 20 (8), 1965, 610-618. (Unclassified)

BIBLIOGRAPHY (Continued)

69. Valenta, V., and Musil, M. "(U) Serological Relationships Between Vectors of Yellows-Type Viruses and Some Other Leafhoppers," Biologia, Bratislava, 21 (6), 1966, 453-456. (Unclassified)

70. Musil, M. "(U) Thermal Inactivation of Parastolbur Virus in Extracts From Viruliferous Euscelis plebejus Leafhoppers," Acta Virol. 10, 1966, 273-275. (Unclassified)

71. Havranek, P. "(U) The Effect of Inoculum Concentration on Virus Multiplication in Cucumber Cotyledons. I. Lucerne Mosaic Virus," Acta Virol. 11, 1967, 444-452. (Unclassified)

72. Kvicala, B. A. "(U) Vector-Virus Relationship of Two Less Well Known Aphid Vectors of Pea Mosaic Virus," Biologia, Bratislava, 22 (8), 1967, 566-571. (Unclassified)

73. Williams, C. M. "(U) Third Generation Pesticides," Sci. Amer. 217 (1), 1967, 13-17. (Unclassified)

74. Anonymous "(U) New Agent for Selective Biological Control of Insects Developed," Budapest, Nepszabadsag, 10 Nov 66, 8. (Unclassified)

75. Anonymous "(U) Agricultural Aircraft Z-37 'Bumble-Bee' of Czechoslovakia," Grazhdanskaya aviatsiya, No. 7, 1966, 29. (Unclassified)

76. Anonymous. "Czechoslovak Crop Duster," East Berlin Neues Deutschland, 1 Aug. 1965. (Unclassified)

77. "(U) The Research Institute of Agrochemical Technology, Bratislava," CSK-311/04301-67, 11 April 1967. (Secret)

78. Proll, E. "(U) Multiplication of the Bromegrass Mosaic Virus in Summer Barley," Acad. Sci. Berlin Monthly Bull. 7(9) 1965 645-657. (Unclassified)

79. Proll, E. "Studies on the Multiplication and Spread of Bromus Mosaic Virus in Barley," Phytopath. Z, 58(2), 1967, 175-192, 201-213. (Unclassified)

80. Lange-De La Camp, M. "(U) New Results on the Eyespot Disease of Cereals and Its Agent," Nachrbl. dt. Pflschutzdienst, Berl. N. F., 20(4), 1966, 100-105. (Unclassified)

BIBLIOGRAPHY (Continued)

81. Lange-De La Camp, M. "(U) The Mode of Action of Cercosporella herpatrichoides, the Cereal Eyespot Agent. III. Nature and Extent of the Damage and Possibilities of Control," Phytopath. Z. 56(4), 1966, 363-692. (Unclassified)

82. Nover, I., and Lehman, C. O. "(U) Resistance Properties in the Gatersleben Barley and Wheat Collection. 6. Testing Barleys for Their Reaction to Yellow Rust (Puccinia striformis)," Kulturpflanze 14, 1966, 257-262. (Unclassified)

83. Neuhaus, W. "(U) The Significance of the Intermediate Host of Puccinia sorghi," Pfl Schutz. 2(2), 1966, 147-154. (Unclassified)

84. Hamann, U. "(U) A Migration Box for Myzus persicae to Simplify Determination of Leaf Roll Virus In Potato Breeding Material in the Laboratory," Zuchter 35(3), 1965, 140-144. (Unclassified)

85. Hamann, U. "(U) Investigations on Symptom Development of Eye Shoots and Plants in the Open of 32 Potato Varieties After Inoculation With Tobacco Vein Browning Virus," Revue roum. Biol. Ser. bot. 11(1-3), 1966, 85-100. (Unclassified)

86. Hinz, B. "(U) Contributions to the Analysis of the Suitability of Some Economically Important Aphid Species and Races As Vectors. I. Tests to Determine the Suitability of Races of Myzus persicae As Vectors of Potato Leaf Roll Virus. II. Tests to Determine the Suitability of Races of Myzus persicae, Acyrthosiphon pisum and Myzus euphorbiae Races As Vectors of Pea Enation Mosaic Virus," Phytopath Z. 56(1, 2), 1966, 54-77, 123-140. (Unclassified)

87. Scholz, M. "(U) Differentiation of Potato Viruses S and M, and the Occurrence of Virus M in Potato Varieties of the DDR," Nachrbl. dt. Pflschutzdienst. Berl. 19(1), 1965, 5-8. (Unclassified)

88. Scholz, M. "(U) Factors Which Influence the Serological Diagnosis of Potato Virus S in Field and Glasshouse Plants," Phytopath. Z. 52(2), 1965, 166-187. (Unclassified)

89. Jeschke, S. "(U) Attempts to Elaborate a Laboratory Testing Method to Ascertain Tuber Resistance to Phytophthora infestans," arch. Pfl Schutz. 2(3), 1966, 217-223. (Unclassified)

BIBLIOGRAPHY (Continued)

90. Prolseler, G. "(U) The Relationship Between the Beet Leaf Aphid Piesma quadratum and Beet Leaf Curl Virus. I. Virus Transmission Tests and Vector Breeding. II. Injection Tests," Phytopath Z. 56(2), 1966, 191-211. (Unclassified)

91. Wolfgang, H., Hofferek, H., and Opel, H. "(U) Studies on Inhibitory Mechanisms in Virus-Infected Plants. I. Relationship Between Concentration and Infectivity of the Inoculum," Phytopath Z. 54(2), 1965, 105-121. (Unclassified)

92. Hofferek, H. "(U) Studies on the Metabolism of Virus-Diseased Plants. III. Changes in the Nitrogen and Carbohydrate Metabolism of Phaseolis vulgaris After Inoculation With Tobacco Necrosis Virus (TNV). IV. Influencing Metabolic Changes in P. vulgaris after Inoculation With TNV by Application of Nutrients." Phytopath Z. 58(2, 3), 1967, 141-174, 214-238. (Unclassified)

93. Waag, T., and Loettge, W. "(U) Metal-Free Fungicide," Germany (East), Patent No. 30, 335 (Cl. a. 01n), March 15, 1965; appl. June 1, 1961, 2pp. (Unclassified)

94. Bormann, E. I. "(U) Spectrographic Investigation of the Fungicidal Action of Heavy Metal Chelates (Silver, Cadmium, Nickel and Cobalt Dialkyldithiocarbamates," arch. mikrobiol. 53(1), 1966, 12-16. (Unclassified)

95. Gorska-Poczopko, J. "(U) A Study of the Biology of Ophiobolus graminis Sacc., the Pathogen of 'Take-All' Disease of Wheat in Poland," Pr. nauk. Inst. Ochr. Rost., 6(2), 1964, 5-57. (Unclassified)

96. Ruszkowski, H. "(U) Methods of Inoculations With Spores of Rust and Mildew in Breeding for Resistance," Biul. Inst. Hodowl. Aklim. Rosl. 1965(3-4), 1965, 11-22. (Unclassified)

97. Muszynska, K. "(U) Breeding of Wheat Resistant to Brown Rust (Puccinia recondita)." Biul. Inst. Hodowl. Aklim. Rosl. 1965(3-4), 1965, 57-60. (Unclassified)

98. Stahl, B. "(U) Studies on the Effectiveness of the Methods for the Detection of Viruses Y and X in the Sap of Etiolated Sprouts Using Foliar A-6 Test," Biul. Inst. Hodowl. Aklim. Rosl. 4(61), 1964, 47-50. (Unclassified)

99. Kozlowska, A. "(U) Problem of Potassium Absorption by Healthy and Virus X and Y Infected Potato Tubers." Acta biol. Cracov., 7(1), 1964, 55-69. (Unclassified)

BIBLIOGRAPHY (Continued)

100. Birecki, M., Gabriel, W., and Osinska, J. "(U) Effect of Mineral Fertilizers on the Spread of Virus Diseases of Potato," Pam. Pulaw. Prace IUNG 13, 1964, 163-178. (Unclassified)

101. Gabriel, W., and Pieniazek, P. "(U) Degeneration of Potatoes in 1959 and 1960," Pam. Pulaw. Prace IUNG 13, 1964, 149-161. (Unclassified)

102. Milewska, H., and Roguski, K. "(U) Search for Test Plants for a Rapid Identification of Virus Y," Biul. Inst. Hodowl. Aklim. Rosl. 4(61), 1964, 25-26. (Unclassified)

103. Dziewonska, M., Pochitonow Z., Butkiewicz, H., and Haze, G. "(U) Investigations Made at the Laboratory of Breeding for Resistance to Viruses," Biul. Inst. Hodowl. Aklim. Rosl. 1965(5-6), 1965, 53-56. (Unclassified)

104. Butkiewicz, H. "(U) Crossing Components Increasing Resistance to Leaf Roll Virus," Biul. Inst. Hodowl. Aklim. Rosl. 1965(5-6), 1965, 57-65. (Unclassified)

105. Roguski, K., Milewska, H., and Popiel, J. "(U) Investigations on Detecting Virus X in Potato Sprouts," Biul. Inst. Hodowl. Aklim. Rosl., 1965(5-6), 1965, 73-75. (Unclassified)

106. Chrzanowska, M., and Sniegowski, C. "(U) Tobacco Ring Spot Virus, Potato Stem Mottle Virus and Lucerne Mosaic Virus on Potato, and Means of Their Identification," Biul. Inst. Hodowl. Aklim. Rosl. 1965(5-6), 1965, 77-85. (Unclassified)

107. Kamienska-Zyla, M. "(U) The Detection of the Potato Virus X in Sprouts and Tubers of Potatoes, By Means of Paper Electrophoresis," Phytopath Z., 54(3), 1965, 299-303. (Unclassified)

108. Kozlowska, A. "(U) Development and Health of Potatoes in Southwest Poland in Relation to the Soil and Altitude Above Sea Level," Acta. agrobot. 17, 1965, 196 pp. (Unclassified)

109. Kamienska-Zyla, M. "(U) The Behavior of the Potato Virus X Protein in Electrophoresis," acta biol. Cracov., 8(1), 1965, 97-100. (Unclassified)

110. Gabriel, W. "(U) The Influence of Temperature on the Spread of Aphid-Borne Potato Virus Diseases," Ann. appl. Biol., 56(3), 1965, 461-475. (Unclassified)

BIBLIOGRAPHY (Continued)

111. Miczynski, K. A. "(U) The Influence of Parental Potato Varieties on Necrogenic Properties of the Potato Virus Y-Strains in the Leaf Test," Phytopath Z. 54(1), 1965, 40-52. (Unclassified)

112. Roguski, K. "(U) Current Views on the Problem of Potato Blight Based on Reports at the Symposium at Gross-Lusewitz, August, 1964," Biul. Inst. Hodowl. Aklim. Rosl. 1965(5-6), 1965, 131-141. (Unclassified)

113. Glass, A. "(U) PZL-104 Aircraft in Agriculture," Biuletyn informacyjny, No. 15, 1966, 3-7. (Unclassified)

114. Kiraly, Z. "(U) The Effect of Nitrogen Fertilization on the Phenol Metabolism and the Susceptibility of Wheat to Black Rust," Novenytermeles 12(4), 1963, 329-336. (Unclassified)

115. Pozsar, B. I., and Kiraly, Z. "(U) Phloem-Transport in Rust-Infected Plants and the Cytokinin-Directed Long-Distance Movement of Nutrients," Phytopath Z. 56(3), 1966, 297-309. (Unclassified)

116. Lelley, J. "(U) Three-Stage Selection for Determining Resistance in Wheat to Leaf Rust," Novenytermeles 16(1), 1967, 79-84. (Unclassified)

117. Szirmay, J. "(U) New Virus Disease of Cereal Plants--Yellow Dwarfism," Magyar Mezogazdasag 21(20), 1967, 19. (Unclassified)

118. Petho, M. "(U) Nitrogen Metabolism and Susceptibility to Smut in Different Maize Varieties," Acta phytopath. Acad. Sci. hung., 1(3-4), 1966, 193-201. (Unclassified)

119. Polgar, S. "(U) Relation of Water Metabolism in Rice Plant to Temperature With Special Reference to the Occurrence of Brusone," Indian J. agric. Sci., 35(4), 1965, 247-258. (Unclassified)

120. Lelley, J., and Sajo, Z. "(U) Investigations on the Pathogen of Brusone in Rice," Novenytermeles, 14(1), 1965, 85-90. (Unclassified)

121. Horvath, J. "(U) Studies on Strains of Potato Virus Y. 2. Normal Strain," Acta phytopath. Acad, Sci. hung. 1(3-4), 1966, 333-352. (Unclassified)

122. Horvath, J. "(U) Data on the Possibilities of Controlling Potato Virus: General Survey of the Methods of Control and the Virus Infection of Exprimental Potato Varieties," Acta agron. hung. 15(1-2), 1966, 177-186. (Unclassified)

BIBLIOGRAPHY (Continued)

123. Horvath, J. "(U) Studies on Strains of Potato Virus Y. 1. Strain C," Acta phytopath. Acad. Sci. hung., 1(1-2), 1966, 125-138. (Unclassified)

124. Csitkovics, A., and Virag, J. "(U) Damage Caused by Virus Yellows (Beta Virus 4) in Sugar Beet," Kiserl. Kozl., 57A (2), 1964, 47-56. (Unclassified.

125. Virag, J. "(U) Methods and Results of Testing the Tolerance of Beet to Yellows Virus," Novenynem. Novenytermesz. Kut. Intez. Kozl., Sopronhorpacs 2(2), 1966, 401-407. (Unclassified)

126. Kiss, E., and Hetzer, E. "(U) Differentiation of Cercospora beticola (Sacc.) Biotypes With Special Reference to the Host-Parasite Relationship," Abstr. 6th Int. Cong. Pl. Prot., Vienna 30 Aug. - 6 Sep. 67, 1967, 116. (Unclassified)

127. Stewart, D. M., Radulescu, E., and Negulescu, F. "(U) Some Recent Studies on Cereal Rusts in Rumania," Revue roum. Biol. Ser. Bot. 11(1-3), 1966, 209-214. (Unclassified)

128. Stewart, D. M., Radulescu, E., and Negulescu, F. "(U) Physiologic Races of Puccinia recondita and P. graminis in Rumania in 1964 and 1965: Reactions of Adult Wheats to Stripe, Leaf, and Stem Rusts in Rumania in 1965 and Reaction to Stem Rust of Seedlings of 6 Winter Wheats From Rumania to Cultures in the United States in 1966," Pl. Dis. Reptr. 51(5), 1967, 358-362, 362-366. (Unclassified)

129. Radulescu, E., and Negulescu, F. "(U) Physiological Races of Puccinia recondita Rob. ex Desm., Puccinia graminis var. tritici Erikss. et Henn. and Puccinia striiformis West in Rumania in 1964, 1965, and 1966, and Sources for Breeding Rust-Resistant Wheat Varieties," Abstr. 6th Int. Cong. Pl. Prot., Vienna, Aug-Sep 1967, 108. (Unclassified)

130. Savulescu, A., Ploaie, P. G., and Jinga, A. D. "(U) Investigations on Beet Yellows Virus in the Rumanian People's Republic," Revue roum. Biol. Ser. Bot., 10(4), 1965, 337-347. (Unclassified)

131. Ploaie, P. G. "(U) The Purification of Beet Yellows Virus for Electron Microscope Studies," Bucharest, Studii si Cercetari de Inframicrobiologie, 16(4), 1965, 339-348. (Unclassified)

132. Ilie, M. M. "(U) Determining the Adherence of Pesticide Dusts," Revista de chimie, 16(1), 1965, 16-18. (Unclassified)

BIBLIOGRAPHY (Continued)

133. Saucine, I.I., and Musta, M. "(U) Derivatives of 2,4-Dichlorophenoxyacetic Acid," Bul. Stunt. Technic Inst. Polytechnic Timisoara, 9(1), 1964, 41-46. (Unclassified)

134. Donchev, N. "(U) Investigations on the Race Composition of Brown Rust and the Relation of Some Wheat Varieties to Its Established Races," Rasteniev. Nauki 1(6), 1964, 103-110. (Unclassified)

135. Markov, M. "(U) Virus Diseases of Maize and Sorghum in Bulgaria," Rastit. Zasht. 12(6), 1964, 31-37. (Unclassified)

136. Bailova-Yankulova, M. "(U) Investigation on the Correlation Between the External Symptoms and Serological Reaction of Potato to Viruses X and Y," Rasteniev. Nauki 1(6), 1964, 79-88. (Unclassified)

137. Bailova-Yankulova, M. "(U) Tobacco Veinal Necrosis--a New Strain of Potato Virus Y," Rastit. Zasht., 13(5), 1965, 10-14. (Unclassified)

138. Bailova-Yankulova, M. "(U) Detection of Potato Virus S in Potatoes in Bulgaria," Rasteniev. Nauki 3(1), 1966, 127-133. (Unclassified)

139. Ivanova, V. N. "(U) Use of Wild Potato Species Resistant to Some Virus Diseases in Breeding," Sb. Trud. Aspir. molod. nauch. Sotrud vses. Inst. Rast., 7(11), 1966, 341-346. (Unclassified)

140. Vulchev, P. "(U) Suitability of Some Potato Varieties for Crossing in Breeding for Field Resistance to Virus Diseases," Rasteniev. Nauki 3(9), 1966, 25-31. (Unclassified)

141. Mikhailova, P. "(U) Possibilities of Using Certain Systems of Forecasting Potato Blight (Phytophthora infestans de Bary) in Bulgaria," Rasteniev. Nauki 2(11), 1965, 55-63. (Unclassified)

142. Krustev, K., and Karov, S. "(U) Effect of Some Fungicides on Pseudomonas tabaci (Wolf et Foster) Stapp., the Causal Agent of Wildfire on Tobacco" Nauchni Trud. vissh. selskostop. Inst. Vasil Kolarov, 14(2), 1965, 225-235. (Unclassified)

143. Karanov, E., and Vasilev, G. "(U) Chemical Structure and Physical Activity of Some Thiourea Derivatives," Izv. Inst. Fiziol. Rast. "Metodii Popov," Bulgar., akad. Nauk 14, 1964, 167-176. (Unclassified)

BIBLIOGRAPHY (Continued)

144. Anonymous. "(U) Bulgarian Laboratory for Plant Protection Making Tests for CEMA," Sofia, Zemedelska zname, 22 May 1966, p. 2. (Unclassified)

145. Ishiyama, T. "(U) The Application of Kasugamycin As an Agricultural Pesticide," Chung Kuo Nung Yeh Hua Hsueh Hui Chih, 4(3-4), 1966, A23-A30. (Unclassified)

146. Peng, S.-C., Tseng, C.-J., Tiu, C.-L., and Wang, T.-P. "(U) The Mycelial Activities of the Rice Sheath Blight Fungus in Relation to the Disease Development," Acta Phytophylac. Sin. 4(4), 1965, 347-354. (Unclassified)

147. Ch'en Li-jen, Ch'en Hui-Ch'in, and Sun Hui'hung."(U) Studies on Spore Dispersal of Helminthosporium oryzae," Acta Phytophylac. Sin. 4(1), 1965, 7-14. (Unclassified)

148. Fan, Huai-chung, and Wu Shang-chung."(U) Field Control of Bacterial Leaf Streak (Xanthomonas oryzicola) of Rice in Kwangtung," Acta Phytophylac. Sin. 4(1), 1965, 1-6. (Unclassified)

149. Anonymous."(U) Outbreak Rhythm and Control Technique of Paddy Borer (Tryporyza incertellus Walker) in Huang, Hsin, Hsi and O Demonstration Regions in Hupeh Province," Acta Phytophylac. Sin. 5(1), 1966, 35-40. (Unclassified)

150. Anonymous."(U) Forecasting the Third Generation Paddy Borer (Tryporyza incertellus Walker) and Chemical Control Techniques," Acta Phytophylac. Sin. 5(1), 1966, 41-49. (Unclassified)

151. Wu, Yu-san, Huang, Chen-t'ao, Feng, Shao-hsing, Jen, Yu-chen, and Hsueh, Li-hsin. "(U) An Analysis of Physiological Races of Stem Rust of Wheat in 1964," Acta Phytophylac. Sin. 5(1), 1966, 59-61, (Unclassified)

152. Anonymous."(U) Experiences in Controlling Stripe Rust of Wheat," Agricultural Technology (Peking) 1965(8), 27-29. (Unclassified)

153. Anonymous."(U) Rust-Resistant Wheat Acreage Being Expanded in China," Chin-jih Hsin-wen (Peking) 3 Jun 1965, 4. (Unclassified)

154. Ti, Mui-sen. "(U) On Several Rust-Resistant Wheat Varieties," Agricultural Technology (Peking) 1965(8), 12-13. (Unclassified)

BIBLIOGRAPHY (Continued)

155. Liu, H.-W., Xia, Y.-T., and Chang, Y.-L. "(U) Field Experiments on Application of Sulfanilic Acid for Controlling Stripe Rust of Wheat in Shensi Province," Acta Phytophylac. Sin. 4(4), 1965, 341-346. (Unclassified)

156. Anonymous. "(U) Calcium Sulfamate--a Chemical for Wheat Rust Prevention," Hua hsueh kung yeh, 1966(7), 1966, 32-33. (Unclassified)

157. Chang, H.-L., "Liu, Su." (U) Two Kinds of Antibiotics Produced by Actinomyces ahygroscopicus 508," Acta Microbiol Sin. 11(2), 1965, 153-160. (Unclassified)

158. Hua, C.-H., Chou, I.-C., and Hsieh, Y.-Y. "(U) Isolation and Determination of Effective Elements of Nung-k'ang-101," Collected Papers of the Third All-China Symposium on Antibiotics, vol. 4, December 1965, 37-40. (Unclassified)

159. Chen, C.-Y., Chen, H.-M., and Yang, C.-C. "(U) Experiment With Nung-k'ang-101 for the Control of Wheat Rust," Collected Papers of the Third All-China Symposium on Antibiotics, vol. 4, December 1965, 44-49. (Unclassified)

160. Chen, C.-Y., Wang, C.-S., and Chen, H.-M. "(U) Application of Nung-k'ang-101 for the Control of Gibberella saubinella Disease of Wheat," Collected Papers of the Third All-China Symposium on Antibiotics, vol. 4, December 1965, 50-54. (Unclassified)

161. Chiang, C.-H., and Hsieh, K.-C. "(U) A Preliminary Report on the Selection of Internal-Absorption Antibiotics and Their Effect on Gibberella saubinella Disease of Wheat," Collected Papers of the Third All-China Symposium on Antibiotics, vol. 4, December 1965, 25-26. (Unclassified)

162. Anonymous. "(U) A Study of Antifungous Antibiotics. III. Separation and Identification of the Actidione Produced by Actinomycete GF-455," Collected Papers of the Third All-China Symposium on Antibiotics, vol. I, June 1965, 91-95. (Unclassified)

163. Anonymous. "(U) Determination of the Effect of Nung-k'ang-101 on Wheat Rust Control," Collected Papers of the Third All-China Symposium on Antibiotics, vol. 4, December 1965, 55-58. (Unclassified)

BIBLIOGRAPHY (Continued)

164. Li, M.-C., Chen, J.-L., Tiu, T.-I., and Lu, C.-H. "(U) Studies on the Source of the Early Spring Generation of the Armyworm, Leucania separata Walker, in Kirin Province. I. Studies on the Hibernation and Problems of the Source," Acta Entomologica Sin. 14(1), 1965, 21-30. (Unclassified)

165. Chen, J.-L., Tu, C.-H., Liu, T.-I., Li, M.-C., and Hsiang, L.-Y. "(U) Studies on the Source of the Early Spring Generation of the Armyworm, Leucania separata Walker in the Kirin Province. II Studies on the Original Ground of the Immigrant," Acta Phytophylacica Sin. 4(1), 1965, 49-58. (Unclassified)

166. Ti, K.-P., Wang, H., Chao, S.-C., Tsao, S.-C., and Lin, C.-Y. "Field Studies on the Effect of Microclimate on the Population Density of the Armyworm," Acta Phytophylacica Sin. 2(1), 1963, 58-62. (Unclassified)

167. Liu, S.-Y., and Sun, I.-C.: "(U) Preliminary Studies on the Wheat Stem Fly Meromyza saltatrix (Linn.) in the Central Part of Shensi," Acta Entomologica Sin. 14(1) 1965, 32-44. (Unclassified)

168. Ting, H.-S., and Yu, Y.-Y. "(U) A Study of the Aphid Macrosiphum granarium (Wheat Pest)," Entomological Information, 10(1), 1966, 10-13. (Unclassified)

169. Liu, I. "(U) Preliminary Report on Analysis of Soybean Mosaic Virus Disease," Acta Phytopathologica Sin. 6(2), 1963, 209-213. (Unclassified)

170. Hsu, C.-F., Kuo, S.-K., and Han, Y.-M. "(U) A Preliminary Study of the Resistance of Soybean Varieties to the Soybean Pod Borer (Leguminivor) glycinivorella (Mats.) Obrazts," Acta Phytophylacica Sin. 4(2), 1965, 111-117. (Unclassified)

171. Hsu, C.-F., Kuo, S.-K., and Han, Y.-M. "(U) Study on the Soybean Pod Borer (Leguminivor glycinivorella (Mats) Obrazts," Acta Entomologica Sin. 14(5) 1965, 461-479. (Unclassified)

172. Li, T.-P. "(U) Preliminary Report on Viruses Causing Rape Mosaic Disease in Chekiang," Chih wu pao hu hsueh pao, 3(2), 1964, 199. (Unclassified)

173. Chang, C.-C., Wu, Y.-S., and Li, L.-H. "(U) Studies on the Properties of Chinese Rape Mosaic Virus 15 (YMV sub 15) and Its Nucleic Acid (YMV sub 15-RNA)," Acta Biochemica et Biophysica Sin. 5(2), 1965, 171-178. (Unclassified)

BIBLIOGRAPHY (Continued)

174. Pei, M.-Y., Tien, P., Chang, Y.-S., Chien, Y.-J., and Tsao, T.-C. "(U) Partial Purification of Chinese Rape (Brassica Campestris L., Youcai) Mosaic Virus, YMV Sub 6, and Some of Its Properties," Acta Biochemica et Biophysica Sin., 5(3), 1965, 303-310. (Unclassified)

175. Kuan, C.-H. "(U) Preliminary Observations on the Flight of Aphids on Cruciferous Crops," Acta Entomologica Sin. 14(1), 1965, 99-102. (Unclassified)

176. Liu, T.-S. "(U) Symposium on Fusarium Wilt and Verticillium Wilt of Cotton," K'o hsueh t'ung pao, 12, 1965, 1125-1126. (Unclassified)

177. Fu, S.-F. "(U) Control of Injurious Insects Infesting Cotton Balls along the Yangtze River," Collected Papers of the Twentieth Anniversary Scientific and Technical Symposium of the Entomological Society of China, Peking, 8-18 July 1964, 1966, 54-56. (Unclassified)

178. Ho, P., Shen, K.-P., and Tiu, Y.-H. "(U) Response of Dendrolimus punctatus Walker to Chemosterilants," Acta Entomologica Sin. 15(3), 1966, 239-241. (Unclassified)

179. Chang, T.-P. "(U) Insect Chemosterilants," Chung-kuo k'un ch'ung hsueh hui erh shih chou nien hsueh shu t'ao lun hui k'an, 1966, 17-27. (Unclassified)

180. Lin, Y. "(U) Insecticidal Effects and Safe Usage of 'Suhua 203' (containing sulfatepp)," Acta Phytophylacica Sin. 4(2), 1965, 191-194. (Unclassified)

181. Lin, L. "(U) 'Le-kuo'--a Highly Effective Internal Absorption Insecticide of Low Toxicity," K'o hsueh ta chung, 5, 1964, 182. (Unclassified)

182. Teng, C. "(U) Studies on the Biology of Beauveria bassiana (Bals.) Vuill. With Reference to Microbial Control of Insects," Acta Botanica Sin. 10(3) 1962, 210-232. (Unclassified)

183. Tsai, J. "(U) Preliminary Test on the Application of a Bacterial Insecticide, Bacillus thuringiensis, to Control the Pine Caterpillar, Dendrolimus punctatus Walk.," Acta Entomologica Sin. 13(6), 1964, 855-861. (Unclassified)

184. Tseng, S., Yin, H.-Y., and Chao, Y.-C. "(U) Studies on the Entomogenous Fungus -- Spicaria fumoso-rosea (Wize) Vassilijevsky," Acta Phytophylacica Sin. 4(1), 1965, 59-68. (Unclassified)

BIBLIOGRAPHY (Continued)

185. Liu, C.-L. "(U) Problems Concerning Insect Resources," Chung-kuo k'un ch'ung hsueh hui erh shih chou nien hsueh shu t'ao lun hui hui k'an, 1966, 63-66. (Unclassified)

186. Anonymous."(U) New Weeding Agent Being Introduced," People's Daily, 8 July 1965. (Unclassified)

187. Lei, S.-S. "Weed-Removing Ether and Weed-Killing Agent (New Herbicides)," Hua hsueh kung yeh, 8, 1966, 32-33. (Unclassified)

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This report describes and analyzes plant-protection or related research in the Warsaw Pact and Asian Communist countries on major crops that are vulnerable to anticrop biological warfare (BW). Also included are estimates of offensive and defensive anticrop BW capabilities for each of the countries covered in the report. (U)

Principal sources of data were open literature and intelligence information reports. (U)

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C471 CBR WPNS ORIEN CRS
C533 FT RITCHIE DET F
C587 CDC EXP CTR
C601 WALT REED MED CTR (2)
C661 CDC MED SVC AGCY
C749 OACSI ADMIN IDB
C760 OACSI PLANS OPS BR

ARMY (Continued)

C763 OACSI S&T DIV
C764 OACSI SC ADV
C768 OACSI USAITAG
C787 OACSI EASTERN BR
C788 OACSI SOV BLOC BR
C639 CD COMD ARTILLERY AGCY

AIR FORCE

E408 AFWL
E420 FTD (5)
E429 SSD
E436 AFSCC (AFSS)
E451 AIR U (LIB)
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K007 COMUSJAPAN
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K010 COM USKOREA
K020 COM USTAIWAN DEF COMD
K100 PACAF (2)

DISTRIBUTION DIRECT TO RECIPIENT (Continued)

U & S COMMANDS (Continued)

K105 67TH RTS
K111 13TH AIR FORCE
K115 5TH AIR FORCE
K120 6499TH SUP GP USAF
K300 USARPAC (3)
K305 USARYIS
K320 USAR JAPAN
K340 EIGHTH US ARMY
K040 7TH PSY OPS GRP
L040 SAC 544TH ARTW (13)
N005 CINCSTRIKE
N100 USAF STRIKE
N305 18TH ABN CORPS USA
N307 CONTIC

ARMY MATERIEL COMMAND

AMCRD-I
AMCRD-T
AMCRD-B
AMXDO-TI
AMXRES-TPI
AMCPM-DESE
AMSMI-YD (2)
AMSAV-ER
SAVFE-ADBS

ARMY MATERIEL COMMAND (Continued)

AMSMU-RE
AMSMU-OI
SMUFD-PR-I
AMSTE-ADE (2)
STEAP-FI (8)
STEDP-PA-I
STEJP-AD-O
STEBD
ARMOR AND Engr. Board
STEBA-AJ
STEBG-SE
STEBC
AMSWE-RDF-3 (5)
SWEWV-RDF-FIO
UK (2)
CAN (2)
C591 FSTC (39)
AMXST-SD-AF
AMXST-SD-PB (2)
AMXST-SD-TD (29)
AMXST-AB
AMXST-WS (3)
Sig TI Team EUR
Sig TI Team FE
FSTC Ln Ofc, WPAFB

Total printing 382