

第 1 章 調査の概要

1 - 1 調査目的

スロヴァキア共和国政府の要請に基づき、同国西部のザーホラスカ低地（570km²）を対象に、同地域の農業生産の向上及び農業振興に資する計画策定に係る調査を実施する。今回は、本案件に係る要請背景及び実施調査の内容についてオロミア州政府と協議を行うとともに、我が国の協力の可能性を検討のうえ、調査の範囲、内容等に係る実施細則（S/W）に署名することを目的として事前調査団を派遣するものである。

先方実施機関：

土地改良ランドスケープエンジニアリング研究所

Research Institute of Melioration and Landscape Engineering: RIMLE

1 - 2 調査団の構成

担 当 分 野	氏 名	所 属
総 括	高橋 順二	農林水産省北陸農政局信濃川水系土地改良調査管理事務所所長
土壤保全	小川 吉雄	茨城県農業総合センター首席専門技術員
灌漑 / 土地利用	白谷 栄作	農林水産省農業工学研究所水工部水環境保全研究室主任研究官
調査企画	浅井 誠	国際協力事業団農林水産開発調査部農業開発調査課
通 訳	伊川久美子	（財）日本国際協力センター

1 - 3 調査日程

日順	曜日	時 間	調 査 内 容
7/31	月	成田発 17:20 プラハ着	移動
8/ 1	火	9:00 14:00	在チェッコ国日本大使館表敬 移動 プラチスラバ
8/ 2	水	9:00 11:00 14:30	外務省表敬 土地改良ランドスケープエンジニアリング研究所 (RIMLE) 表敬 土壤肥沃研究所表敬
8/ 3	木	8:30 11:00	農業省表敬 (農業次官表敬) S/W 協議 (於 RIMLE)
8/ 4	金	10:00 14:00 15:00	Malacky 郡役所表敬 灌漑農業地区視察 (Velke Levare) 有機農業地区視察 (Kostliste)
8/ 5	土	10:00 11:00 15:00	揚水機場及び灌漑施設視察 (Male Levare) 土壌状態の観察 (3 箇所) Morava 川視察 (Zahorska Ves)
8/ 6	日		休日
8/ 7	月	9:00 ~	S/W 協議 (於 RIMLE)
8/ 8	火	9:00 ~ 5:00	S/W 及び M/M 協議 (於 RIMLE)
8/ 9	水	11:00 ~	S/W 及び M/M 協議、署名 移動 プラハ
8/10	木	9:00 15:35 (OS646) 高橋、浅井 16:05 (LH2457) 上記以外	在チェッコ国日本大使館表敬 移動 ウィーン 帰国 フランクフルト 成田 (8/11 14:45 着)
8/11	金	9:00 13:50 (NH286)	JICA オーストリア事務所報告 帰国 成田 (8/12 08:20 着)

1 - 4 主要面会者

(1) 在チェッコ国日本大使館

石田 寛人	特命全権大使
荒木 俊博	参事官
鈴木 徹	一等書記官

(2) JICA オーストリア事務所

富本 幾文	所長
中井 正広	所員

(3) Ministry of Foreign Affairs

Stefan MORAVEK	Director,
	Department of International Economic Cooperation

Vladimir BUJALKA Department of International Economic Cooperation

(4) Ministry of Agriculture

Stefan PALACKA Director, Plant Production Department,
Section of Agriculture and Food Industry

(5) Research Institute of Melioration and Landscape Engineering (RIMLE)

Stefan REHAK Director

Jan HRIBIK Deputy Director

Michal SANTA Director Advisor

Jan ALENA Department of Irrigation and Drainage Systems

Vladimir ZAPOTOCNY Department of Sustainable Management on Irrigated
and Drained Soils

Jan BIZIK Department of Sustainable Management on Irrigated
and Drained Soils

Boris CAMBEL Department of Water regime of Soils

(6) Faculty of Natural Sciences, Comenius University

Miroslav KROMKA Director, Department of Soil Science

(7) Slovak Technical University, Bratislava

Andrej SOLTESZ Hydrotechnical Department, Faculty of Civil Engineering

1 - 5 協議結果（署名及び口上書）

本調査内容については、別添S/W、M/M及び第4章に記載したとおり基本的合意を得た。しかし、先方外務省より、現在夏期休暇期間中であり政府内での事務的な承認手続が完了していないため、本調査団滞在中に先方外務省はS/Wに署名ができないと説明があった。このため、S/W及びM/Mの署名・交換には至らなかった。

本件について、事前調査団及び鈴木一等書記官（在チェッコ大使館）は先方外務省に対し、S/Wに署名を行い、日本側へ提出された時点で、本格調査が実施されると説明し、先方の早急な対応を要請した。また、その旨M/Mに記載（6 . Implementation of the Study）した。

第 2 章 要請背景

2 - 1 要請の背景及び経緯

スロヴァキア国は、社会主義時代に軍事産業が発展し、現在に至っても農業のGDPに占める割合は約 5 %（1 人当たりGDPは約US \$ 3,778；1998）に過ぎない。しかしながら、同国は旧東欧諸国の中でも特に農地の集団化が進んだ国であり、集団農場で平均600ha、農家 1 人当たり20haの経営規模を有し、高度な灌漑施設（全国30万ha）及び排水施設（同50万ha）を備え同諸国内で有数の穀倉地帯として発展した。

1989年の社会主義体制の崩壊以降、農地は元の所有者に返還、分配されているが、彼らの多くは非農業従事者であり、農地を取得しても作付けを行っていない事例も見られる。現在、一部（20 %）個人農家、株式会社等の企業体で耕作されているほかは、農地の大部分は農業協同組合による営農が行われている。しかし、市場経済に十分に適応した経営ができていないことに加え、政府補助金の削減など資金不足による、営農資材の投入不足、または、不十分な灌漑排水施設の改修・監理が、生産量、生産性の低下の問題を引き起こしている。また、食糧自給の達成を開発目標に掲げながらも、国内農産物の競争力が不足しているため、近隣諸国からの農産物の輸入が増加し、国内産品がだぶつくといった状況も生じている。

調査対象地域であるザーホラスカ低地（570km²、6 万人）は、首都ブラスチラバの北側に位置し、チェッコ国境にあるMorava川に接しており、主に穀類、ジャガイモ、ビートが生産されている。降水量は年間500～700mm程度であるが、近年の温暖化・気候変動により年々減少しており、一部で生育期間における水不足が生じている。一方で、春先には周辺からの雪解け水が同低地に集まり湛水被害及び水食をもたらしているとともに、広範囲に広がる地力及び保水力の低い砂質土壌での農業生産は、困難を極めている。

また、社会主義体制時代に建設された既存の施設、機械はその供用開始から数十年を経過し、改修が必要になっているものの、前述のとおり農家は技術的、経済的に十分な維持管理ができておらず、営農環境は悪化する一途である。このため耕作放棄地が増加しており、長大な灌漑排水施設の機能低下、効率性低下に拍車がかかり、同地域の営農環境に更なる悪化をもたらしている。

このような状況の中、スロヴァキア国政府は1999年 8 月、同国農業の振興、生産量増加、作物の質の改善をめざし、生産性改善の可能性が高い同国西部のザーホラスカ低地を対象として、圃場内の水及び土壌管理、灌漑排水システム、土地利用などに関する問題分析、改善策の提示及び改善策のパイロットの実施のための調査を要請してきた。

2 - 2 先方関係機関概要

(1) RIMLE

本件実施機関は、ブラチスラバ市内にある土地改良ランドスケープエンジニアリング研究所（Research Institute of Melioration and Landscape Engineering、以下RIMLE）である。RIMLEは、1993年のチェコとの分離独立以後、前身である灌漑排水ランドスケープ研究所（Research Institute of Irrigation, Drainage and Landscape Engineering）に土地改良分野の業務を追加し、現在に至っている。業務内容及び部署構成を資料（P.6～P.12）及び図2-1に示す。各部署の名称は頻繁に変更になっている模様で、資料（P.6～P.12）に記載されているものが最新であるようであった。しかし、RIMLEに改称されたばかりで、現在のところ業務内容はほぼ以前と同様である。

RIMLEは農業省のSection of Policy and Budget, Department of Research and Scienceに属し、その活動内容は1) Research活動：農業生産環境のモニタリング（土壌水分、地下水位、土質、水質）、分析、実験圃場における基礎研究及び改善方策の検討（外部からの委託を含む）、2) Consulting活動：研究結果の情報提供、農民（農業経営体）、流域管理公社（灌漑排水施設のO&Mを実施）等外部からの問い合わせに対するアドバイスの提供、に要約される。農業省の組織図を図2-2に示す。

RIMLEは本庁舎内のラボラトリのほか、ブラチスラバ市内に農業機械整備施設、実験圃場を有し、上記活動を実施している。また、農業用水及び河川の水質、サンプルとして特定の圃場における土壌水分及び地下水位のモニタリングを行っている。

また、上記活動の実施に際し必要かつRIMLEに不足している情報（気象、水文、土壌分布）等は、他機関（大学を含む）から入手したり、意見を交換しているとのことであった。資料収集に関してはRIMLEを通じて必要なデータは収集できるものと思われる。

RIMLEの活動については3-1(1)、3-2(2)及び3-3(2)節にも記載しているので参照されたい。

(2) その他関係機関

スロヴァキア国には図2-3のとおり様々な研究所（Research Institute）又は公社が設立されている。社会主義の影響と思われるが、水質、水位、土壌等の分野ごとに独立した機関が設立されており、個別に定点観測、分析などの事業を行っている。

本調査に特に関連すると思われる機関としては、土壌科学・保全研究所（Soil Science and Conservation Research Institute）、流域管理公社（Slovak National Water Authority: Danube）、水管理研究所（Water Management Research Institute）等が挙げられる。3-1、3-2及び3-3節にも関連研究機関及び業務について記載があるので参照されたい。

Organizational Structure of the Research Institute of Irrigation, Drainage and Landscape Engineering

The Department of Director

The Department of Director helps Director to fulfil tasks, which come out directly from his competence.

The Department of Soil Water Dynamics

The Department of Soil Water Dynamics:

- Movement of a water in a system water-soil-plant-atmosphere;
- Evaluation of an aeration zone from the point of view of hydrophysical, retention and transport characters;
- Hydrodynamics in the framework of the theory of soil water potential and redistribution of water in aeration zone under irrigation conditions;
- Study of mechanism of primary surface distribution of water, accumulation, concentration and diffusion of surface outflow and arise of accumulation and erosion vector fields;
- Movement of soluble substances, their distribution and accumulation in soil;
- Evaluation of salt affected soils;
- Mathematical modelling of water regime in soil, nutrition and agrochemicals transport; theory of mixable flow.
- Monitoring of soil properties and evaluation of anthropic activity influence on water regime in soils
- National Climatic Programme of the Slovak Republic - Research of air changes, climatic changes and harming of protecting properties of atmosphere and evaluation of possible results of climate changes on elements of water balance in soil, irrigation need and irrigation regimes;
- Country Study SR 2ii focused on evaluation of possible impacts of climate change on irrigation management, and a proposal of adaptation measurements;
- Use of soil with emphasis on interaction agriculture - water management

The Department of Irrigation and Drainage Systems

Its activity is focused on solving both prospective and actual problems of applied research, elaboration of technical projects and advisory activities.

The field of activity is as follows:

1. Elaboration of concept and making prognosis of the development of irrigation and drainage technology. Here belong especially irrigation and drainage machines and systems (drip irrigation, micro irrigation, pumps, equipment for maintenance, etc.)
2. Optimization of irrigation and drainage systems designs in connection to water and soil management systems.
3. Proposing, verifying and applying new and innovated hydromelioration measurements and their influence on economy and landscape environment.
4. Verification, diagnostics, application and laying out water management equipment
5. Increase multipurpose use of water management systems also with respect to creation and protection of agricultural landscape.
6. Building a database and information systems on water management (especially irrigation) equipment and its use in order to improve performance and maintenance
7. Modernization and rehabilitation of water management systems, irrigation and drainage technology
8. Marketing, research and advisory-consultancy activity in the field of preparation of realization and performance of water management systems
9. Testing and expert evaluation of new home and imported water management equipment.

The Department of Irrigation and Drainage Economy

The research activity of the department is focused on:

- Concept of transformation and privatization of main water management equipment;
- Change of structure of agricultural production from the point of view of its economization and ecologization on irrigated and drained soils;
- Concept and macroeconomical analyses in the field of water management and application of regulating mechanisms both in irrigation, drainage, and measures for protection and improvement of agricultural land fund;
- Building of subsystem of database "Irrigation, Drainage" - technical and economical information;
- Problems of economy and management of irrigation performance;
- Rationalization of both flow and transformation of energy in intensive irrigation agriculture from the point of view of its effect, economy and influence on environment.

The activity of realization is focused on:

- Elaboration of models of transformation of main water management equipment;
- Economical projects - entrepreneurial ideas of production development on improved soils (irrigation, drainage, etc.);
- Monitoring of drought occurrence and need of irrigation in the Slovak Republic;
- Projects of evaluation of economical effectiveness of investment in water management and their financial resources;
- Projects of rationalization of irrigation performance from the point of view of both minimalization of inputs and optimization of evaluation of productive and economical effects of irrigation water;
- Concept studies in the field of water management;
- Advisory services in the field of investment, economy, organization, management of performance of irrigation;
- Purposive studies for producers, business network and users of irrigation equipment (marketing).

The Department of Chemistry

The Department of Chemistry focuses its activity on complex judgement of quality of irrigation water, soils, plants and their interaction. It researches both the influence of irrigation water on cycle of foreign materials (heavy metals, nitrates and organic pollutants) in process of plant production and its influence on changes of agrochemical properties of soils. Fields of problems:

1. Technologies and tools in agricultural production
- 1 Soil and water

- study of dynamics of inorganic forms of nitrogen in soil. In the framework of scientific and technical projects it monitors the influence of agricultural production on ground water contamination by foreign materials and nitrates.
- preparation of certified reference materials of waters.

Soils and soil fertility

- securing fertilisation plans for seeding courses based on agrochemical analyses of soils and chemical analyses of plants.
- elaboration of standpoints and expert opinions concerning ecological stabilization of agricultural soil damaged or threatened by water and wind erosion and human activity.

2. Monitoring of irrigation water quality and evaluation of its influence on crops and soil

In the framework of the monitoring it watches a quality of Slovak irrigation water and builds the database. The Department of Chemistry is involved in coordinated monitoring of foreign materials in food, where a contamination of food chain is being monitored.

The department is in the process of accreditation of chemical laboratories according to European Standards EN 45 000.

The Department of Sustainable Agriculture on Irrigated and Drained Soils

The department also includes research bases in Most at Bratislava (Danubian Lowland) and Somotor (East Slovak Lowland). Here the Research Institute of Irrigation executes small plots trials for either its own scientific and research projects or for customers. At both of bases there are meteorological stations with all over the year observation of climate data. These data are used for experiments.

The research basis Most at Bratislava serves for research and making accurate of crop growing conditions in the Danubian Lowland. The same makes basis at Somotor in the East Slovak Lowland where heavy or very heavy soils are typical. The institute can monitor the most productive agricultural regions with the help of both above-mentioned bases.

As far as the other regions, research is made in form of half performance trials in agricultural enterprises or directly on farms.

In the field of research, the department focuses its activity on:

- study of integrating effect of climatic conditions, soil moisture and crop characters in order to optimize irrigation regime
- research of possibilities of optimization of agrosystems functioning via synchronization of factors important for the yield with effort to quantificate their influence in order to make verifications of existing mathematical models
- research of optimizing irrigation regimes of field crops via making accurate of "critical phases" of particular crops from the point of view of water demand. In case of special crops (vegetables, hop, grapes) it cooperates with special workplaces
- study of effectiveness and effect of optimized irrigation regimes, study of possibilities of recycled and waste water use for field crops irrigation (in cooperation with the Department of Chemistry)

- research of mineral nutrition of irrigated crops, including their transformation and transport under concrete soil-climatic conditions with respecting limits coming out from protection of environment
- study of relation between crops and harming factors (weeds, diseases, pests) on soils with regulated water regime
- precise determination of parameters and demands of crop growing in regulated water regime and respecting environmental limits, in order to achieve continuously high yields.
- study of synergetic effect of irrigation regime, nutrition and other agrotechnical elements
- optimization of use of meliorated soil in regions and in particular agricultural enterprises in order to keep and increase a profitability of production in region (enterprise).

Besides above mentioned, the department participates not only at elaboration of concepts and research project in the framework of the institute, but also in cooperation with other research institutions home and abroad. In testing new hybrids of field crops from the point of view of their reaction on irrigation it collaborates with UKSUP, but also with other companies dealing with crop protection.

The department is involved in these scientific projects:

- Long term influence of irrigation and fertilization on yield of field crops, soil and their effect under new economical conditions
- Modelling of agroecological and economical limits of agriculture production intensification under irrigation condition
- Yield potential of various sorts of field crops under irrigation condition
- Possibilities of synergistic effect use of irrigation and fertilization in order to increase yield of selected crops
- Irrigation and fertilization effect on selected soil properties
- Agricultural part of Pre-Feasibility Study of the Multifunctional Pilot Project in the East Slovak Lowlands
- Yield potential of grain corn hybrids under irrigation conditions
- Verification of the irrigation influence on productional properties and qualitative indexes of sorts and new varieties of potatoes cultivated in Research Institute of Potatoes Cultivation in Veľká Lomnica

The Department of Extension Service

With respect to the change of political and economical system of society, new actual requests of users from agricultural practice have arisen. In the period of agricultural transformation, the assistance of scientific and research institutions in form of advisory has been found as necessary. The Department focuses on:

1. Advisory service: a) field
b) special

2. Implementation of scientific and research knowledge in practice

3. Advertisement and dissemination of new experience

- Ad 1. a) The field advisory service is focused on direct contact of expert advisor with entrepreneurial subject in process of production. The advisor proposes a solution based on actual state which increase an effectiveness of an entrepreneurial subject
- Ad 1. b) The special advisory service is focused on complex solution of entrepreneurial subject in a form of elaboration of an entrepreneurial idea, project of restructuralization and reconstruction from both technical and economical point of view. This activity uses to be done by a team of experts.
- Ad. 2 Transfer of scientific and research results in form of realization output projects into practice through a user (productive-entrepreneurial subject) under expert guaranty of contractor of realization output.
- Ad. 3 Making available the review of scientific and research activity of the institute in the form of publishing on various levels (scientific and expert publications, magazines, media, etc.)

The other direction of advisory and realization activity of the department corresponds to field of activity of the whole institute, which is solving problems of the cycle: Water - Soil - Plant.

The Scientific and Technical Information Centre

The Centre secures informative activities and gives data in the sphere of scientific, technical and economical information for needs of decision making and management, for the solution of other research projects in the field of irrigation, drainage, landscape engineering and further commission in the sphere of scientific and technical information. The centre obtains and provides scientific, technical, economical and special literature for needs of the institute as well as for those of external users (for example agricultural institutes, universities, agricultural enterprises, etc.)

It processes home and foreign information sources by means of ISIS/CDS, builds its own "IRRIGATION" database, elaborates translations, keeps the correspondence with foreign partners and institutions and prepares materials for scientific papers printing /for example Proceedings from scientific conferences, symposium and Scientific Works of Research Institute of Irrigation and mediates editors activity by publishing and advertising obtained results of the institute within the framework of its activity.

The centre manages a research library with 36 700 volumes and 80 titles of periodicals (30 foreign).

It also manages all database system of the Institute. The computer network, which has been created in 1992, is now being reconstructed and enhanced. This new network consisting of 25 computers will run under WINDOWS NT.

The Department of GIS

The Department is oriented especially to coordination of building of spatial information system on natural and anthropogenetic elements of a landscape from the point of view of modelling of regulated water regime, and providing information necessary for management of agricultural production, landscape engineering and land consolidation.

The Department also deals with concept and methodological problems connected to establishment of such complex GIS on each of its level. It includes problems regarding to level of first data collection, their processing and unifying in a database and their updating, up to level of their analyses and modelling, respectively their presentation. Besides that, the Department develops possibilities of application of methods of remote sensing, respectively other methods, e.g. satellite navigation systems in receiving data on particular components of a landscape.

The GIS database includes information layers on elements of natural and anthropic environment with such resolution level which comes out of the need of tasks solved by the Institute. The core of complex GIS system is the information layer of main irrigation and drainage equipment in the Slovak Republic.

International activities

Besides other, our institute is a headquarters of the Slovak National Committee on Irrigation and Drainage. Dr. Štefan Rehák Ph.D. (Director of the Institute) is the Chairman, Dr. Ján Hríbik, Ph.D. (Deputy Director) is the Vice Chairman. Peter Stradiot MSc is the Secretary and also the Country Manager of the programme IPTRID. Our institute is also member of CIGR and several workers attended in foreign stays in other research institutions.

Number of staff - 70

RESEARCH INSTITUTE of IRRIGATION, DRAINAGE and LANDSCAPE ENGINEERING

ORGANIZATIONAL STRUCTURE

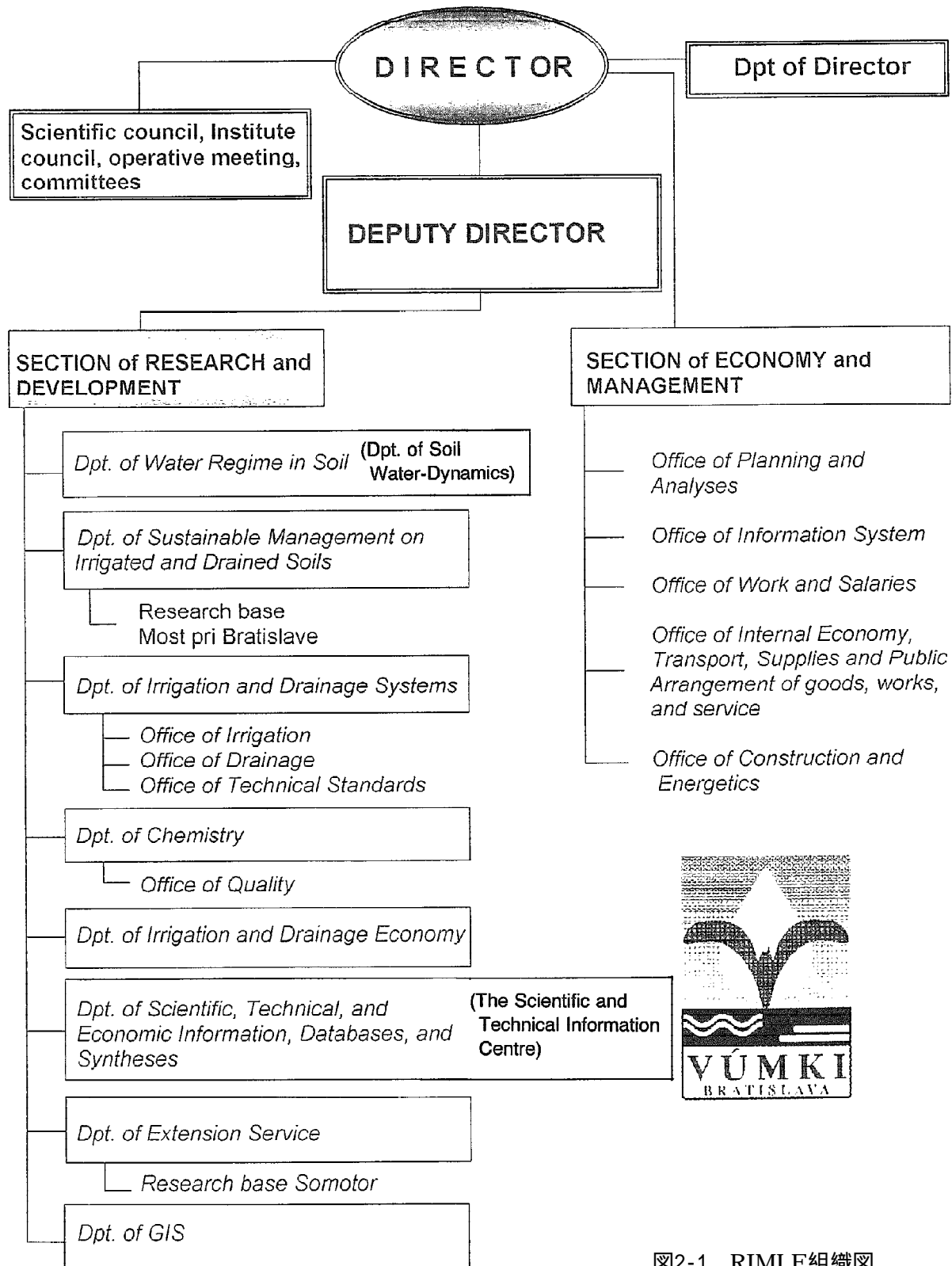


図2-1 RIMLE組織図

MINISTRY OF AGRICULTURE OF SLOVAK REPUBLIC

Organization chart

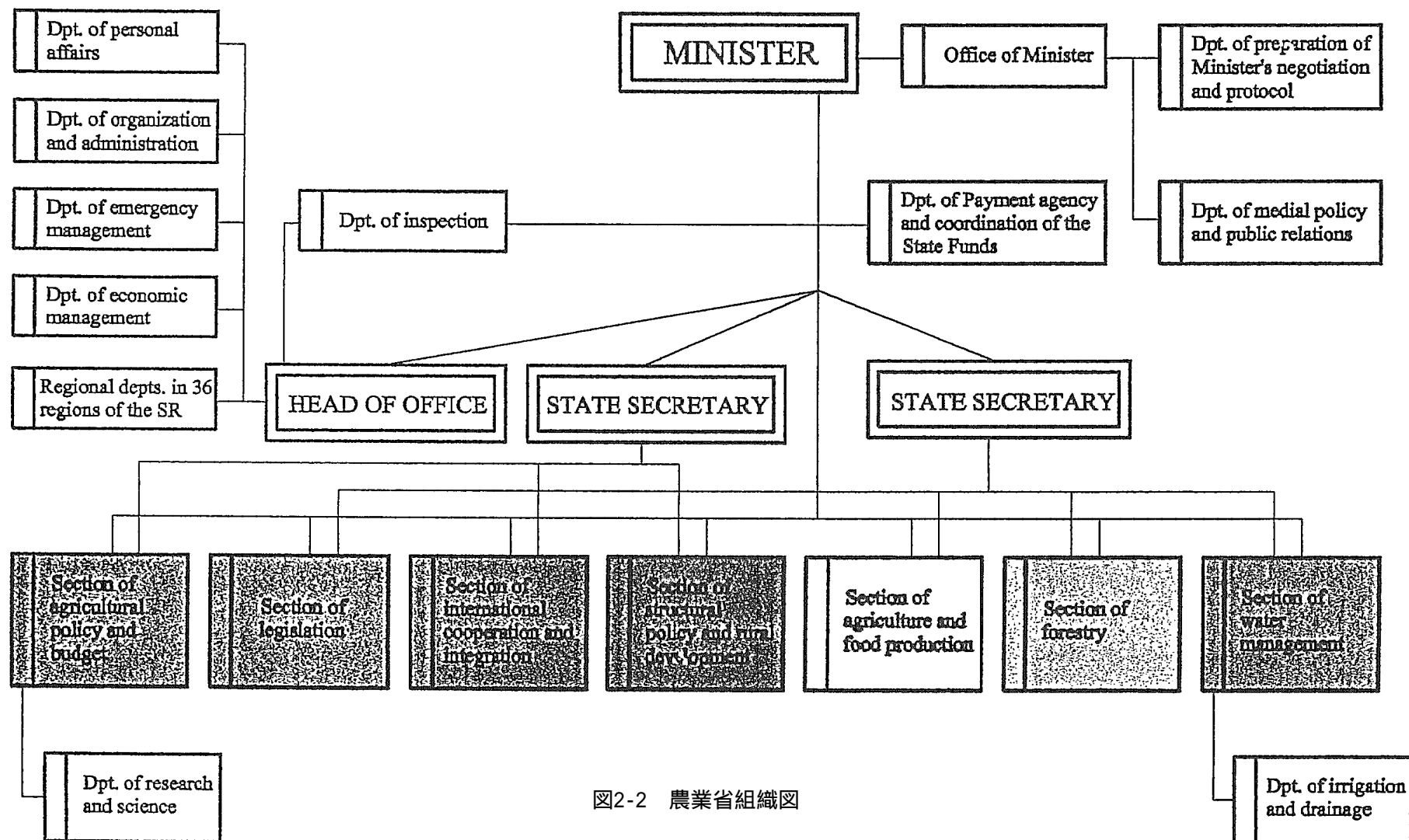
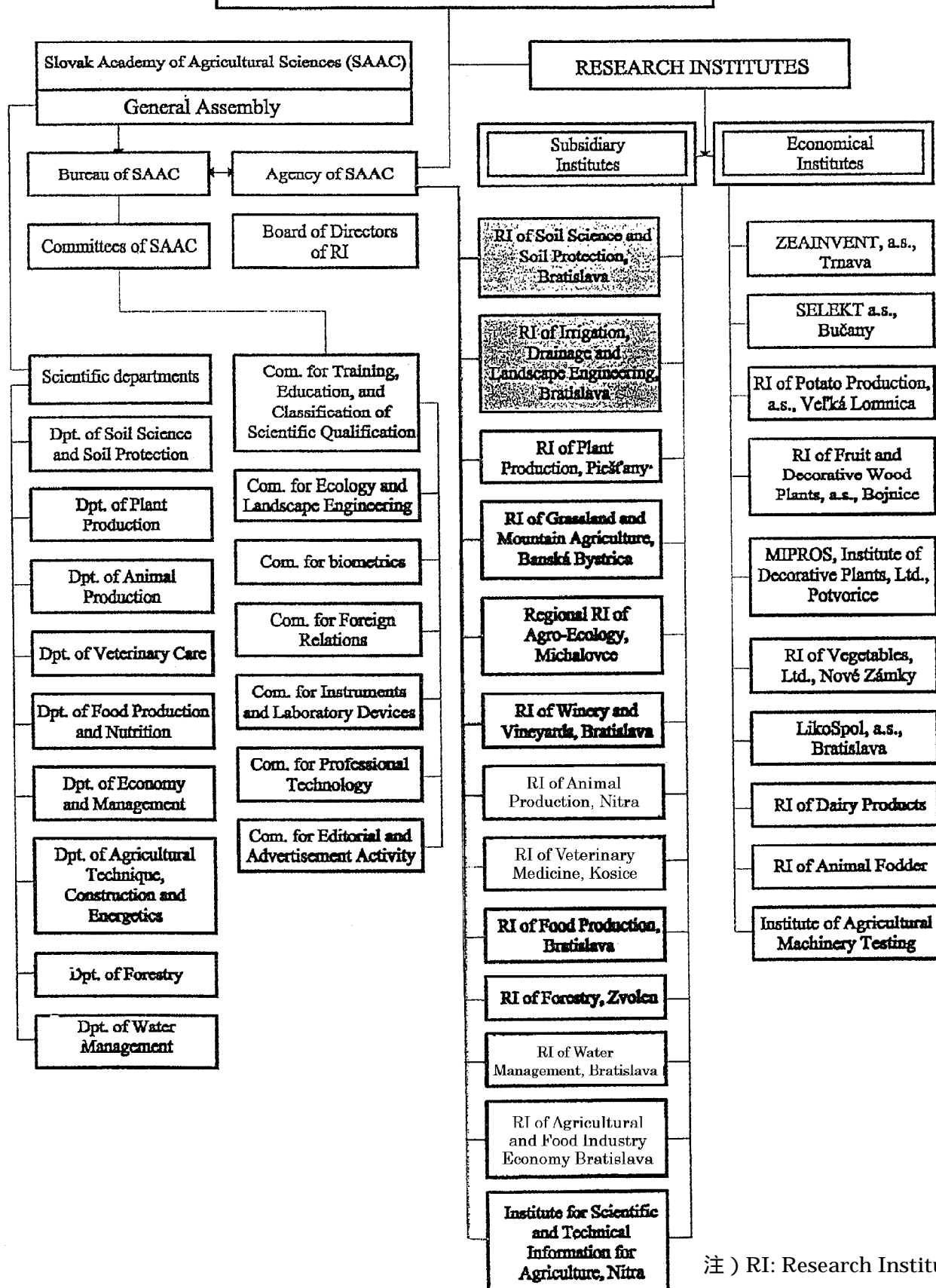


図2-2 農業省組織図

Ministry of Agriculture SR



注) RI: Research Institute

図2-3 農業省管轄の研究所