Small-fruit and Tree-fruit Research Centers in Ukraine

PROLOGUE

The dissolution of the former Soviet Union (FSU) in 1991, and the subsequent formation of the Newly Independent States (NIS) and the Baltic States, ended Soviet isolation from the rest of the world. It also opened the doors to an increased exchange of scientists and scientific information. Ukraine is one of 12 states that constitute the NIS. Ukraine was the FSU's main producer of many small fruits and tree fruits. For example, 30% of all apple orchard area of the FSU was located in Ukraine, and this area produced 40% of the apples consumed in the FSU.

The soils and climate of Ukraine, other than the area near the Black Sea, are similar to those of Iowa, and for that reason, the College of Agriculture at Iowa State Univ. (ISU) has pursued the development of scientific exchanges with Ukraine. The central scientific organization for agriculture in Ukraine is the Ukrainian Academy of Agricultural Sciences, headed by Olexiy O. Sozinov. Administrators from the academy and the Institute of Horticulture in Kiev have visited the United States and ISU, and personnel from the College of Agriculture and the Dept. of Horticulture at ISU have visited Ukraine. Now, these organizations are exchanging scientists and scientific information. This report details a recent trip to Ukraine by R.J.G., D.J.H., and M.V.K.

To a Ukrainian, horticulture means all aspects of fruit science and ornamental horticulture only; vegetable production and viticulture are separate disciplines. Because of food shortages in the FSU, most horticultural research at this time is devoted to fruit production technology, with little effort devoted to ornamental horticulture. To the average Ukrainian, the most popular and necessary form of agriculture consists of horticulture (as fruit

science) and vegetable production, because many Ukrainians, whether in a city or in a rural area, have their own plot of land on which they produce as much of their own food as possible. Because their subsistence depends on their individual capability to produce their own horticultural products, many Ukrainians are tied inextricably to the land. As we traveled through the villages in Ukraine, virtually every house had at least one fruit tree planted in the yard.

In Ukraine, there are 13 major fruit-crop research centers in diverse geographical locations (Fig. 1). The primary intent of the research directors in establishing the centers was to identify specific production areas with appropriate soil and climate for each crop. At this time, nearly all crops are produced in each region of the country, but crops will be produced only in designated regions once systems to transport commodities within and out of Ukraine are developed. A secondary intent in establishing the 13 research centers was to develop a system of outlying research and extension centers that could help local growers of small-fruit and tree-fruit crops. These research centers work closely with the public, and upon privatization of the collective farms from the FSU, these centers will work with large commercial producers of these fruit crops.

Ukrainian horticulturists are working to establish their own fruit crops germplasm repository system. The intent is to establish each of these in the appropriate region for the given fruit, with only several "acclimatized" species being held in any one repository (similar to the U.S. Dept. of Agriculture system). During the time of Soviet influence, the fruit germplasm repository for all fruit crops was the Vavilov Center for Plant Industry in St. Petersburg, Russia, and its local stations. The FSU now is

divided into separate states, and access to germplasm resources is limited. Thus, Ukraine is interested in developing its own germplasm repository system.

The 13 fruit-crop research centers consist of botanical gardens, institutes, filials (the Ukrainian name for a particularly large research station), and research stations. The two botanical gardens and three institutes have the largest organizations and the most personnel and funding. Each of these five units is independent of the others. However, methodological leadership comes from the Institute of Horticulture in Kiev (Kyiv in Fig. 1), the largest horticultural research unit in Ukraine. This institute controls the budget, the number of scientists and support personnel, and the type of research projects conducted at the two filials and six research stations that we discuss in this article. Control of the filials and research stations is exercised through semiannual reviews of the progress and future directions of each unit. Information about these centers is summarized in Table 1; species discussed in this article are listed in Table 2.

BOTANICAL GARDENS

Central Botanical Garden

The Central Botanical Garden, also known as the Botanical Garden of the Academy of Sciences, contains a pomology section, but the major purpose of the garden is general public education and appreciation of plants by the citizens of Kiev. The garden has an excellent collection of ornamental plants and tree-fruit cultivars, with exhibits on fruit tree topiary and espalier systems. It also has an outstanding walnut collection. The main focus of its research is the selection, breeding, propagation, and introduction of alternative crops.

Contact: Tatjana Mikhajlovna Cherevchenko (director), Central Botanical Garden, Timiryazevska st. 1, 252014, Kiev-14, Ukraine; phone 011-7-044-295-41-05 or 011-7-044-295-26-27.

(continued on p. 1393)

Received for publication 4 Oct. 1994. Accepted for publication 6 Oct. 1994. Journal Paper no. J-16050 of the Iowa Agriculture and Home Economics Experiment Station, Ames. Project no. 0186. Travel to several of these institutions was supported in part by a grant from the Newly Independent States/Baltics Research Exchange Program of the Iowa Agriculture and Home Economics Experiment Station. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

¹Associate Professor of Horticulture.

²Doctoral Student.

³Director.

⁴Deputy Director.

⁵Biotechnology Laboratory Director.

Front cover: The red currant, *Ribes rubrum* L., is representative of the red, black, and white currant and other small fruits studied at L'viv. Photographed by David J. Hannapel at the L'viv filial.

Fig. 1. Map of Ukraine that shows major cities, botanical gardens, institutes, filials, and research stations.

Table 1. Characterization of the 13 small-fruit and tree-fruit research centers in Ukraine.

Type	Research center		Year founded	Approx. area (ha)	No. labs.	Scientific personnel			General climate type	General soil type	Avg annual rainfall (mm)	Temp sum ^z
	Name	Location				DSc	PhD	Tech. & suppl. personnel				
Botanical garden	Central Botanical Garden	Kiev	1946	250	10	4	40	60	Mild continental	Gray forest	610	3020
	Nikita Botanical Garden	Nikita ^y	1812	1000	11	2	30	63	Dry subtropical	Sandy, black, HOC ^s	500	3900
Institute	Inst. of Irrigated Horticulture	Melitopol ^r	1937 ^w (1970)	3500	10	1	46	57	Sharp continental	Sandy, gray forest	443	2730
	Mliev Inst.	Mliev ^v	1918 ^w (1989)	2500	7	0	20	28	Sharp continental	Deep black, HOC	610	3020
	Inst. of Horticulture	Kiev	1930	2200	17	7	95	140	Mild continental	Gray forest	610	3020
Filial	L'viv	L'viv	1959	800	3	1	8	20	Continental	Gray forest	670	2695
	Donets'k	Artemivsk ^u	1938	1500	7	0	32	40	Sharp continental	Deep black, HOC	480	3230
Research station	Prydnistrovska	Prydnistrovska ^t	1970	450	2	0	14	14	Mild continental	Deep black, HOC	624	3100
	Podil'ska	Podil'ska ^s	1969	800	2	0	7	10	Mild continental	Deep black, HOC	544	2825
	Crimean	Symferopol ^r	1932	1500	8	0	28	36	Mild continental	Sandy, black, HOC	501	3635
	Krasny Kut	Krasny Kut ^r	1968	600	2	0	14	12	Sharp continental	Deep black, HOC	528	3070
	Chernihiv	Chernihiv	1996	1200	N/A	N/A	N/A	N/A	Sharp continental	Gray forest	N/A	N/A
	Sevastopol ^r	Sevastopol ^r	1935	230	4	0	7	33	Mild continental	Light clay	501	3635

^zTemperature sum corresponds to the sum of the number of degrees the daily average temperature is >5C during an entire year.

^yNear Yalta.

^sHOC = high organic content.

^wEarlier year was foundation as a research station and year in parentheses is year converted to an institute.

^vNear Cherkasy.

^uNear Donets'k.

^tNear Chernivtsi.

^sNear Vinnytsia.

^rNear Kharkiv.

Nikita Botanical Garden

Nikita Botanical Garden was established in 1812 and is located just east of Yalta in the Crimea. Its program focuses on the breeding and selection of nearly all fruit and ornamental crops, and it is a major repository for apple, apricot, peach, plum, sweet cherry, and walnut species. Scientists breed apricots, *Prunus dominicata*, sweet and sour cherries, peaches, pears, quince, and apples. Collaborative work with U.S. scientists in botanical gardens has been established, mostly as a mechanism for germplasm exchange. The garden also introduces subtropical fruit and nut species into the region, and it has large breeding and selection programs for these crops. With the removal of political barriers in the NIS/Baltics, scientists at Nikita Botanical Garden are eager to exchange information and share germplasm with collaborators throughout the world.

Contact: Adolf I. Lischuk (director), Nikita Botanical Garden, 334267, Yalta, Crimea,

Ukraine; phone 011-7-0654-33-55-97 or 011-7-0654-33-55-30; fax 011-7-0654-33-53-86.

INSTITUTES

Institute of Irrigated Horticulture

This institute is located in Melitopol^r, in southeastern Ukraine, and as its name implies, all crops are grown on irrigated land. Its research specialties are the breeding, selection, and production technology of sweet cherry and other stone fruits, with a small amount of research dealing with pears and apples. This center has developed many Ukrainian cultivars of sweet cherry, such as 'Melitopol'ska Rannya', 'Prysadybna', and 'Bigaro Aratovskogo', and it possesses an excellent collection of sweet cherry germplasm. One successful research project conducted at this institute was the development of the technology to obtain dukes, an interspecific hybrid between sour cherry and sweet cherry.

Contact: Fedir Kalenich (director), Institute of Irrigated Horticulture, Vakulenchuk st. 99, 332311, Melitopol^r, Zaporizhia Oblast, Ukraine; phone 011-7-06142-3-13-78.

Mliev Institute

This former research station was the first fruit research station in the FSU (established in 1918); it became an institute in 1989. It is the smallest of the three institutes, but it is well known because it was established and developed by the most famous of Ukrainian pomologists, Lev Symyrenko (Fig. 2). Symyrenko worked almost his entire professional career in this geographical area. He selected many apple cultivars used in the FSU, including 'Symyrenko', one of the most popular cultivars in Ukraine, Russia, and eastern Europe because of high yield and excellent dessert quality. This institute now specializes in the breeding, selection, cultivar screening, and production technology of apple, pear, black

Table 2. Common name, genus, specific epithet, and authority of species cited in the text. Table is organized alphabetically by common name. These species are used in breeding and selection programs at the various research units.

Common name	Genus	Specific epithet	Authority
Actinidia	<i>Actinidia</i>	<i>arguta</i>	(Siebold & Zucc.) Planch
		<i>kolomikta</i>	(Rupr. & Maxim) Maxim
		<i>deliciosa</i>	(A. Chev.) C.F. Liang et
		var. <i>deliciosa</i>	R. Ferguson
Apple	<i>Malus</i>	× <i>domestica</i>	Borkh.
		<i>floribunda</i>	Sieb.
		× <i>atrosanguinea</i>	Schneid
		× <i>umi</i>	Rehd.
		<i>pumila</i>	Mill.
Apricot	<i>Prunus</i>	<i>armeniaca</i>	L.
		<i>cerasifera</i>	Ehrh.
Cherry, duke	<i>Prunus</i>	× <i>effusus</i>	(Host) C.K. Schneid.
Cherry, sour	<i>Prunus</i>	<i>cerasus</i>	L.
Cherry, sweet	<i>Prunus</i>	<i>avium</i>	L.
Currant, black	<i>Ribes</i>	<i>nigrum</i> var. <i>europeum</i>	L.
		<i>nigrum</i> var. <i>sibiricum</i>	L.
		<i>dikusha</i>	Fish.
		<i>petiolare</i>	Dougl.
		<i>atrosanguineum</i>	Pursh.
		<i>bracteosum</i>	Dougl.
Currant, red and white	<i>Ribes</i>	<i>rubrum</i>	L.
		<i>vulgare</i>	Jancz.
Gooseberry, green	<i>Ribes</i>	<i>grossularia</i>	Michx.
Gooseberry, red	<i>Ribes</i>	<i>hirtellum</i>	Michx.
Peach	<i>Prunus</i>	<i>persica</i>	(L.) Batsch
Pear	<i>Pyrus</i>	<i>communis</i>	L.
		<i>ussuriensis</i>	Maxim.
Plum	<i>Prunus</i>	<i>americana</i>	Marsh.
		<i>domestica</i>	L.
		<i>dominicata</i>	---
Quince	<i>Cydonia</i>	<i>oblonga</i>	Mill.
Raspberry	<i>Rubus</i>	<i>idaeus</i> var. <i>vulgatus</i>	L.
		<i>odoratus</i>	L.
Sea Buckthorn	<i>Hippophae</i>	<i>hamnoides</i>	L.
Strawberry	<i>Fragaria</i>	× <i>ananas</i>	Duch.
		<i>chiloensis</i>	L.
		<i>ovalis</i>	Lehn.
Walnut	<i>Juglans</i>	<i>regia</i>	L.

currant, and several stone fruits. Some post-harvest technology and processing research also is done here. There are only a few controlled-atmosphere storage units in Ukraine, and a small unit exists at Mliev. Most of the fruit crops produced at the institute and the surrounding collective farms are processed into juice or wine, with a small amount used for preserves. Recently, V. Laskavyi has developed several new plum cultivars that are well adapted to mechanical harvest and can be dried readily.

Contact: Ivan I. Khomenko (director), Mliev Institute, v. Mliev, Horodische rayon, Cherkasy Oblast, 258532, Ukraine; phone 011-7-04734-2-24-40.

Institute of Horticulture

The Institute of Horticulture at Kiev is the center of fruit-crop research in Ukraine. This facility was established in 1930 and is the largest Ukrainian fruit-crop research unit. It employs 242 professionals, with a distribution of 7 DSc, 95 PhD, and 140 technicians and professional staff. This institute oversees the research conducted at the two filials and six research stations described later in this article. Research projects conducted at the institute span all ranges of fruit-crop physiology, and

the breeding, genetics, and selection of almost all fruit crops grown in Ukraine. Future research will include molecular biology and genetic engineering of targeted species. The institute is divided into 17 departments that range from breeding, production technology, and economics to biotechnology. Great emphasis is placed on plant pathology research, because there is a scarcity of protective chemicals that can be used on fruit crops. The institute also includes three research farms in metropolitan Kiev. The institute building is located just south of the Kiev city limits on a farm that has fertile soil high in organic matter. One farm is in Dmytrivka, an area with sandy soil, where research focuses on new technology for orchards planted in sandy soil. The other farm, in Fastiv, will become the germplasm repository for apple for all Ukraine. The locations of these three farms provide a wide range of soil types. This institute possesses the largest collection of germplasm of tree-fruit crops in all Ukraine. In the past, this germplasm collection was used only by Ukrainian scientists for their breeding projects; now, this germplasm collection is open to scientists around the world. The best breeding and selection programs developed at the institute are in apple, pear, and strawberry. For example, 80% of the plants used for commercial strawberry

production in Ukraine are cultivars that V. Kopan and K. Kopan developed at the institute. Examples of these cultivars are 'Rusanivka', 'Festval'na Romashka', and 'Prysvjata', whose berries are large, ripen uniformly, and produce high yields and are resistant to pests, respectively.

Contact: Mikhaïlo V. Andriyenko (director), or Petro V. Kondratenko (deputy director), Institute of Horticulture, 252027, Kiev-27, Novoselki, Ukraine; phone 011-7-044-266-65-48 (MVA) or 011-7-044-266-65-58 (PVK); fax 011-7-044-266-65-49. Contact with any of the directors or scientists at the filials or research stations should be initiated through the office of the director of the Institute of Horticulture in Kiev.

FILIALS

L'viv

This filial, located ≈30 km northeast of L'viv, contains ≈800 ha devoted to fruit-crop research. It is located near the Carpathian Mountains and has ample rainfall (Table 1) and mild weather. This unit specializes almost solely on small-fruit research, with some work on apples and pears. The main small-fruit crops are red, black, and white currants; strawberries; gooseberries; and raspberries. In particular, the gooseberry cultivars Neslukhivsky, Kamenjar, and Visoki Zamok, developed at this filial, are the best in Ukraine due to their disease resistance, high yield, and ease of mechanical harvest. This filial also is known for its pear cultivars, such as 'Zolotovorits'ka', 'Etude', 'Vyzshnytsia', and 'Stryis'ka'. The research laboratories at L'viv focus on small-fruit breeding, genetics, and selection, soil chemistry, and production technology. This filial has the largest collection of small-fruit germplasm in Ukraine and welcomes inquiries from scientists from around the world.

Donets'k

This filial is northeast of the city of Donets'k, in the city of Artemivsk. It is the easternmost fruit research unit. Its main production specialization is nursery production of all species of fruit trees, and Ukrainians compare this unit with some of the major fruit-tree nurseries in the world. At this filial, the main scientific research work involves apple rootstock breeding and selection and plant propagation. This unit has an extremely large laboratory complex that propagates virus-free, small-fruit and tree-fruit plants for commercial use. Lilia Taranenko, a scientist at this filial, has developed many cultivars of tree fruits. Among her many achievements are the apple cultivar Kalvil Donets'ki, 'Annushka' sour cherry, 'Chudovyshnia' duke, and 'Donchanka', 'Ugolek', and 'Sestrienka' sweet cherries. The main crops grown here are sour cherry and plums. The largest repository (≈500 cultivars) of sour cherry germplasm in Ukraine is at this filial. Rainfall in this area is limited (≈480 mm) and, therefore, most of the filial is under irrigation. Donets'k filial has 72 scien-

**FIG. 2, HALFTONE
SHOOT at 100%
CROP AS SHOWN
DROP KEYLINE**

Fig. 2. Monument to Lev Symyrenko, Ukraine's most famous pomologist, in the formal rose display garden at the Mliev Institute. (Photographed by D.J.H.)

tific personnel and is more than twice as large as the L'viv filial.

RESEARCH STATIONS

Prydnistrovska

This research station, located near the city of Chernivtsi, is the farthest west. Its specialty is walnut, pear, and peach production research. Research also is directed toward breeding, cultivar and variety screening, and production technology of other fruit crops, such as apple and sweet cherry. This research station is known around the world for its walnut collection. Collaborative research on walnut is an excellent possibility for international researchers to interact with Ukrainian scientists from this research station.

Podil'ska

This station is near the city of Vinnytsia, which is close to central Ukraine. The main crop produced in the Podill'a region is apple, which is well suited to this area's optimum rainfall, soil type, and temperature fluctuations. Much of the research focuses on apple production technology, with projects related to orchard ground cover management, pruning techniques, and training systems. This

research station has developed pruning techniques for apple that allow old, established orchards to be renovated. A secondary research focus involves production technology for sour cherries, strawberries, and other small fruits.

Crimean

This unit is the southernmost Ukrainian research station. Located just north of Symferopol', it specializes in research on production technology of peaches, apricots, pears, and apples. This station tests and has developed production technology for "warm climate" fruit trees, especially apples, that normally are grown only in more temperate areas. These apple cultivars are grown only in southern Ukraine and differ from cultivars grown in the northern part. In addition, much work has focused on high-density growing systems for apple. Breeding and selection programs are in place for apples, pears, and small fruits. This station has developed the apple cultivars *Avrora*, *Solgirs'ke*, and *Tavriya*, and the pear cultivars *Desertna*, *Tavrychanka*, and *Akimovs'ke*. Because the climate is warm and slightly arid, some research concerns irrigation practices, especially drip irrigation with fertigation. This unit also does limited postharvest work, mostly related to storage systems.

Krasny Kut

This station is in northeastern Ukraine, west of the city of Kharkiv, and is the most northerly and easterly station at this time, but a new station is being established to the north (see Chernihiv). Krasny Kut focuses on the "northern culture" of various crops, especially apple. Important apple cultivars developed at this station are 'Kalvil Krasnokuts'ky', 'Shafran Krasnokuts'ky', and 'Kalvil Berendey' and important pears are 'Progress', 'Zymova Krasnokuts'ka', and 'Lymonka Osinna'. A new, rapidly expanding area of emphasis is research and development of alternative fruit crops. The center specializes in the introduction and testing of all types of alternative crops throughout Ukraine. Some examples of new alternative crops are sea buckthorn and *Actinidia*.

Chernihiv

This research station is under development. Once it is operational in 1996, it will be the northernmost unit. Much of its work will focus on strawberry, black currant, and other small-fruit production technology, because the soil type and climate are well suited for production of these crops.

Sevastapol'

Originally, this research station was not part of the Ukrainian system, but rather it was a station of the Vavilov Institute of Plant Industry in St. Petersburg. As such, this station is one of many that once belonged to the FSU but now belongs to Ukraine. This unit specialized in the maintenance and introduction of the complete collection of tree-fruit germplasm from the Vavilov Institute, and will continue as a germplasm repository. Sevastapol' is a military-based city that is closed to foreign visitors.

EPILOGUE

Agricultural research and development personnel in Ukraine now can be open and communicative about their research, and horticulturists the world over will benefit. Ukrainian researchers are eager to discuss the results of their work, and they are particularly eager to develop international collaborative research projects. For many small fruits and tree fruits, the germplasm holdings of Ukraine are large and varied, and they may be very valuable to researchers throughout the world.

RICHARD J. GLADON¹, DAVID J. HANNAPEL¹,
and MIKHAILO V. KOLOMIETS²
Dept. of Horticulture
Iowa State Univ.
Ames, IA 50011-1100

and MIKHAILO V. ANDRIYENKO³, PETRO V.
KONDRATENKO⁴, and VOLODYMYR KOPAN⁵
Institute of Horticulture, Kiev
252027, Kiev-27, Novoselki, Ukraine