AT THE CROSSROADS BETWEEN EAST AND WEST
IN THREE HOSPITABLE COUNTRIES
AGRICULTURE AND BREEDING HAVE BEEN DEVELOPED SINCE THE NEOLITHIC
COPING WITH THE RHYTHMS OF THE SEASON

A TREASURY OF GENETIC RESOURCES IS MAINTAINED IN GARDENS

TO MAKE BREAD, CHEESE AND WINE
PASTORALISTS AND FARMERS MANAGE THE LANDSCAPES
RURAL PEOPLE KNOW AND USE WILD PLANTS AND ANIMALS

COMBINING BIODIVERSITY, HEALTHY ECOSYSTEMS AND SMALLHOLDERS' DEDICATION:
A PATHWAY INTO THE FUTURE

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Genetik ehtiyatlar xəzinəsi bağlarda saxlanılır

ბაღებში შემორჩენილი გენეტიკური საგანძური

5

INTRODUCTION

IN THE SOUTHERN CAUCASUS THERE IS A HIGH PERCENTAGE OF RURAL POPULATION (36 PERCENT IN ARMENIA, 48 PERCENT IN AZERBAIJAN AND 47 PERCENT IN GEORGIA). FAMILY GARDENS ARE AN IMPORTANT SOURCE OF FOOD PRODUCTION AND, ALTHOUGH THEY ARE NOT EVIDENT IN NATIONAL AND INTERNATIONAL STATISTICS, THEY PLAY A VITAL ROLE IN FOOD SECURITY AND RURAL LIVELIHOODS.

Food production in gardens depends on solar energy, biomass use and, to a very limited extent, fossil energy. The purchase of inputs such as fertilizers and pesticides is low because of the limited availability of ready cash. All family members are involved in garden production and have strategies to maintain soil fertility, and a large variety of crops and animals to satisfy their food needs and for manure production. They use legumes and crop rotations, annual and perennial species, and adapted animal breeds in an intelligent mix that often results in limited energy consumption and high efficiency.

The family of Tengo Akopashivili in Adigeni district, with beans in their garden. The family garden represents the basis of agricultural production in the Southern Caucasus: a symbol of a lifestyle, deep knowledge of a territory and its resources, a continuous search for balance between exploitation and maintenance of soils and water, and an agricultural system adaptable to varying climatic and economic conditions

AGRICULTURAL PRODUCTION AT THE FAMILY LEVEL

A large part of production in gardens is consumed directly by family members and sold at local markets; it is difficult to estimate the actual amount of food produced in gardens and its contribution to the gross national product (GNP).

Family gardens are pillars of the social structure in the Caucasus countries because they also produce services for their communities (farmers maintain common goods through beekeeping, cleaning of irrigation channels and rural roads, and weeding of communal pastures and forests). Moreover, they provide work (part- or full-time) for the many people who live in rural areas but are not directly accountable as part of the agricultural labour force.

The need to increase and standardize agricultural production in the region has often led to neglecting plants selected by the family for specific needs (such as plums suited for jam production or apricots to be dried) and replacing them with higher-yielding varieties, or those with larger fruits. One of the main objectives of family farming is to obtain sufficient income to pay for good education for children. Yet many of these gardens no longer offer an attractive lifestyle for young people who do not see many economic prospects in looking after their gardens and making a living from them. If food produced in the gardens is not well appreciated by consumers and supported by local policies, a significant portion of biodiversity and the ecosystem equilibrium that has been maintained for millennia will be disrupted.

HORTICULTURE AND FRUIT TREES IN THE GARDEN

Today, some of the genetic heritage of the Southern Caucasus has been dispersed throughout the territory, and some has been lost. Other genetic information has been preserved only in germplasm collections by the dedicated work of scientists, but plants must also be kept alive *in situ*, and many valuable food seeds have been perpetuated, unknown to the rest of the world, in private gardens.

Haricots and beans are grown in gardens, as well as various coloured forms and indigenous varieties of lentils. Local eggplants, cabbages and potatoes together with garlic, celery, dill, basil, tarragon, mint and spinach are grown for the preparation of sauces and spices and to be sold at local markets. Many fruits are also grown to complement family diets and as a source of income. Gardens are a wise mixture of perennial and annual species, legumes, tubers and cereals that contribute to a healthy and varied diet as well as to maintaining good soil fertility, while distributing family labour throughout the year.

A few vegetables, fruits and legumes maintained in the gardens of the Southern Caucasus are described in the following pages.

Spinach (*Spinacia* spp.)

Armenian	*Spanakh, Shomel*
Azeri	*Ispanakh, Shomu*
Georgian	*Ispanakhi*

The natural habitat of spinach in the Southern Caucasus is primarily in dry climate zones, i.e. in warm sandy and clay soils and on southern slopes, which warm up early in spring. All conditions allow the early plants to start

Small farmers maintain a variety of genetic resources in their gardens for their food security and livelihood – a heritage that should be better known at national and international levels

and end their growth before the end of summer. Besides the cultivated variety of spinach (*Spinacia oleracea* L.), there are many other wild types that grow in Armenia, Azerbaijan and Georgia, such as *S. tetrandra* Stev. (tetrastamen), a wild variety of spinach, which could have great selective value. The crop was described for the first time in 1809 by Kh. Steven, a Russian botanist, while studying Caucasian flora. Observations revealed that in Armenia (especially in those regions where wild spinach grows), even elderly people use spinach as an early spring herb, picking it in the fields.

Bean (*Phaseolus* L.)

In the Southern Caucasus, beans have been cultivated in gardens for centuries and have been an important and inexpensive source of protein for the rural population. Beans are a valuable part of a healthy diet because they are low in fat, do not contain cholesterol, have a significant amount of fibre and a high protein content. In addition to their high nutritional value, beans return nitrogen to the soil for the benefit of nearby plants, and legume cover crops are ploughed into the soil as valuable green fertilizer to maintain the soil fertility of the garden. In Armenia, populations belonging to two species (*P. vulgaris* L. – ordinary bean and *P. coccineus* L. [*P. multiflorus* Willd.]) are widely spread almost everywhere and are still in cultivation.

There are many endemic populations known and described with very different biological and economic characteristics. There are semi-climbing and climbing beans of different length, with or without strings, and with different resistance to parasites.

The Elkana NGO provides farmers with seeds and information on crops adapted to local conditions, such as *Lathyrus sativus*, with the aim of increasing the self-reliance of the population

LEGUME RECOVERY, CONSERVATION AND SUSTAINABLE USE OF GEORGIA'S AGRICULTURAL BIODIVERSITY

Through a Global Environment Facility (GEF) project, "Recovery, Conservation and Sustainable Use of Georgia's Agricultural biodiversity", implemented by the United Nations Development Programme (UNDP) and executed by the Georgian Biological Farming Association Elkana, Georgian farmers are reclaiming neglected legume varieties and landraces to diversify their agricultural production systems. The project has established a seed multiplication system to encourage farmers to use and sow local landraces and in 2009 many households were cultivating them.

Farmers are reporting diversification of the family diet and higher nutrition levels.

In addition, they are obtaining higher prices at local markets and increasing the fertility of their home gardens thanks to the N-fixing legume bacteria that lives in legume root systems.

ON-FARM MANAGEMENT OF PLANT GENETIC RESOURCES

Thanks to their valuable traits, ancient crop varieties adapted to local conditions are widely cultivated today by farmers and amateur gardeners in ten natural economic regions of Azerbaijan, meeting both their need for food and the conservation of these crops. There are farmer groups that have established the collection of some crops and are busy with multiplication and dissemination of their seedlings and seeds. A farmer in the Astara region cultivates and maintains more than 25 rice varieties on his farm. Another in the Khanlar region has collected more than 88 grape varieties. In the Shamkir region, in a similar household, a farmer has a fruit collection representing local and valuable cultivars of peaches, raspberries and other berries. Farmers in Chayly village in the Gobustan district cultivate and preserve more than 50 different melon varieties in their homesteads. In the Quba region, which has always been famous for its pome fruits, fruit orchards have been established by grafting wild fruit species with indigenous cultivars.

A farmer in Alpan village in the same region maintains 90 varieties and 175 forms of fruits and berries in his garden. In the Talish region, food legumes (chickpeas and lentils) are widely grown, since they are considered important in the diets of the local population.

Dishes using these legumes are characterized by their flavour, nutrient quality, calories and variety. Farmers in the Lankaran, Khachmaz and Shamkir regions are engaged in the collection, cultivation and utilization of decorative bushes and trees. In several regions, particularly in southern Talish and northern Quba-Khachmaz, farmers cultivate and maintain many kinds of plants that they use for different purposes (for making sheets, blankets, clothes, plates and packaging). The Genetic Resources Institute is collaborating with these farmers, providing them with scientific and technical advice.

More than 800 genotypes of melon (including both wild and cultivated varieties) have been identified in the Southern Caucasus. One particular variety is the Shamam melon, which is inedible, but is appreciated for its scent and colour

Shamam melon and other Cucurbitaceae

The Shamam melon (*Cucumis melo* var. *microcarpus*) is inedible, but is used for decorative purposes because of the striking nature of its skin, which has alternating yellow, black and green stripes. Perfume houses also use it for its strong scent. The fruit is small, weighing no more than 200–500 g, and contains around 300 seeds. This melon is a member of the Cucurbitaceae family and widely represented in the Southern Caucasus. At least 800 genotypes of Cucurbitaceae melons have been catalogued from both indigenous and cultivated varieties. Among them are watermelon (*Citrullus edulus* Pang., *C. vulgaris* Schrad.), gourd (*Cucurbita pepo* L.), cushaw (*Cucurbita moschata* Duch., of which there are dozens of local varieties), the hard-rinded gourd (*Cucurbita maxima* Duch., of which there are more than 100 local varieties) and the cucumber (*Cucumis sativus* L.). Not all of these have survived the genetic erosion that has taken place over the years, but a considerable number still exists today. As for the musk melon (*Cucumis melo* L.), 67 varieties have been catalogued, of which 25 have died out and some are extremely rare (*Sineyvaz*, *Haji Salim*, etc.). Some varieties of folk selection once considered as lost have been found and regenerated through the efforts of the Genetic Resources Institute of Azerbaijan. The *Dostujan*, *Narinji* and *Hasanbayi* varieties keep for an entire winter. The fruit of the *Bilerjhin* variety lasts even longer, keeping from one year to the next.

In Shahtakhti village, Nakhchivan, the small fruits of the musk melon are covered with earth to protect them from insects. One side-effect of this practice is that the fruit has high sugar levels. This technique, known as *tutma*, is used to produce melons for export, among them *Alamdar*, *Hamkar*, *Agbad*, *Narinji* and *Hasanbayi*.

In Armenia, species of Cucurbitaceae are found in their wild state, and there are more than 45 varieties of cultivated melon. The wild species are highly resistant to attacks by insects, a feature which makes them valuable in genetic improvement programmes. Attempts to produce hybrids from local cultivars of edible melon (*C. melo* var. *dutmase* x *C. melo* var. *agrestis*) have produced an F_1 – a first-generation hybrid, which has a bitter-tasting fruit. Subsequent crossing between this and the edible cultivar has produced fruit with a good flavour, together with the precious ability to resist attacks by insects.

Melons filling rows and rows in local markets generally come from family orchards. The income from this production is often used to pay for good education for children

THE FARMER MIHRABYAN AND HIS FAMILY

At Salvard village – in the Sisian district of Syunik Marz, Armenia – which is a mountainous border village 10 km from Azerbaijan at 2 000 m above sea level, the hospitable Mihrabyan family invited us to visit their farm. The family is composed of mother, father and three sons. With hard work, this family has managed to make a living in the harsh mountain areas but, more important, the parents have managed to give a full education to their children.

One son is at present studying for his Ph.D. in Moscow and the other two sons work and live in Sisian.

In their garden, they grow apples, plums, spinach and carrots, and harvest walnuts, berries and wild vegetables from the nearby forest. The family looks after three cows that produce milk throughout the year, and bees that produce honey, which provides most of the yearly family income.

The family does not use external labour; the mother transforms over half of the garden production into conserves that will give the family sufficient and quality food during long winter periods.

The family preserves with care the winter apples that grow in the garden and that are an important genetic resource adapted to grow under the local extreme conditions.

During our visit, we were impressed by the family's ecological knowledge and understanding of the biological processes of their farm.

We learned about the importance attributed to education, the awareness of belonging to a community, hospitality and the consciousness of contributing with their daily good farming to the future of their children.

Pomegranate (*Punica granatum* L.)

Armenian	*Nur*
Azeri	*Nar*
Georgian	*Brotseuli*

The pomegranate is one of the fruit trees that exist in the wild in the Southern Caucasus and has adapted perfectly to growing in its different ecosystems. It is a highly nutritious and versatile food that has been used and selected for millennia in the region. It is considered the symbol of fertility and is often used in songs, poetry and painting for its beauty and delicate shape. The pomegranate is among the many genetic resources that deserve to be maintained and cultivated because it is so well adapted to local conditions and is an important income resource for smallholders who cultivate it in their gardens, often as a welcome symbol at the entrance to their houses. Pomegranates are highly appreciated at local markets and may be consumed fresh or processed.

The pomegranate originated from an area that includes the Islamic Republic of Iran and the Caucasus, and it was from here that the fruit was later exported to the Mediterranean region, at the time of the Phoenicians. The fruit was cultivated in the gardens of tribespeople from the Kingdom of Urartu, between 880 and 610 BC. The remains of the temple of Garni, in Armenia, built in the second century BC, clearly show images of pomegranate fruits and branches, which were carved on

The Southern Caucasus is a centre of origin of the pomegranate. It is cultivated in lowlands and hills, both in large orchards and in family gardens, as in the Goychay region. The fruit contains hundreds of seeds that are juicy and delicious but can only be separated by hand: a characteristic that has always limited its diffusion

blocks of stone and adorned the exterior of the building. The pomegranate is widely cultivated in Armenia, Azerbaijan and Georgia, in lowlands, hills and at lower mountain altitudes. Wild varieties can also be found, especially in Azerbaijan, along the river valleys, in dry and loose terrain, and on mountain slopes. The pomegranate can be eaten fresh, distilled to make liqueurs or used as a concentrated juice known as *nar-sharab* (*sharab* means wine in Azeri), which is used as a condiment. In Azerbaijan, the wild varieties are used to produce citric acid. The tree is also used as an ornamental plant.

In Azerbaijan, many places are named after the pomegranate, such as Narinj village in Gakh district, Narlidara in Samukh and Nardaran on the Apsheron peninsula. A lot of men also have the word "nar" incorporated in their names, for example, Naringül, Nargile, Narxanim and Naride. Pomegranates are often found in the patterns of old carpets, on rock carvings and in miniatures. The famous poet of the East, Nizami Ganjavi, described the pomegranate in his poems as an especially valuable crop.

In the hot areas of the Southern Caucasus in summer, the pomegranate is a potential victim of insects that lay their eggs inside the fruit. The pomegranate skin is hard and insects therefore enter through the weakest point of the fruit, i.e. the membrane of the flower chalice which they can easily penetrate.

Pomegranates on sale at the Teze bazaar in Baku. A clay plug is put on pomegranate chalices when the fruit is small and still on the tree in order to prevent insect attacks in summer

In Azerbaijan, this problem is resolved by a traditional and ingenious technique. Pomegranate fruits that are intended for conservation (in order to be consumed fresh during the winter) have their chalices plugged with clay while they are small and still on the tree. This prevents parasite attacks. The operation is undertaken in July and the clay plug is left on the fruit all through the winter-spring season as a guarantee to the consumer.

The pomegranate tree is both productive and adaptable, with fruits that keep well. Yet as fruit growing has become more intensive, the pomegranate has not been able to compete with other major species, such as apples, pears and peaches.

This is partly explained by the nature of the fruit itself, which contains hundreds of seeds that are full of flavour but very difficult to separate from the chambers in which they are housed. The only way of removing the seeds is by hand and this, naturally, is reflected in the cost. The pomegranate is certainly a difficult fruit to serve ready to eat, particularly in restaurants, and this militates against its use, even though the actual taste of the fruit is delicious. Better prospects exist in the industrial sector, where mechanization, while it can do little to solve the problem of removing the seeds, could at least help produce good-quality juices that do not suffer from the aftertaste of tannin extracted from the skin.

The pomegranate is a symbol of fertility and is often used in paintings and decorations because of its beauty and delicate shape

Since wine was formerly made from pomegranates, and since today varieties exist that would be highly suitable because of their high juice and sugar content, it may be worth reinstating this tradition in a bid to create a valuable niche market.

One particularly suitable variety for wine-making is *Azerbaijan Juloscia* pink. The thorns covering the branches of most cultivated varieties offer another explanation for the limited commercial success of this fruit. But some varieties have very few thorns, and these deserve to be better known. They include *Rosovi', Kirmizi kabuk* and *Balamursal*. In a few cases, most notably that of *Slatkii rannii*, the tree has no thorns whatsoever.

Given that the fruit's good handling and keeping qualities are shared by a number of varieties grown in the Caucasus, it seems a shame that such sought-after characteristics should not have a larger audience. It is quite likely that these genotypes could find a niche in much wider markets.

Germplasm collections should be created to select the varieties that are characterized by few thorns and a juicy fruit that is suitable for transformation.

Farmers' associations could be encouraged to produce these varieties with organic techniques.

Photo by E. Cattaneo

THE URBAN GARDENS OF MUSAYEV FAMILY

In many cities and villages of the Southern Caucasus, small family gardens continue to provide an important safety net, as well as significant supplemental food of high quality, which is available independently from the family's income. In the city of Sheki, hidden behind tall walls and an iron gate, we entered a beautiful mixed garden, with a striking diversity of food plants, layered to mimic a natural forest.

In a small area near their house we discovered the impressive garden of the Musayev family, comprising Ilyas, the father, who is an engineer, Sebire, the mother, a physics professor, the son Murad, a young doctor, and the daughter Sevinc, who is studying biology. A wide diversity of plants are grown including parsley, tomato, cucumber, pepper, potato, pomegranate, mulberry, pear, apple and plum, as well as beautiful roses and chickens.

They manage their soils wisely by alternating an herbaceous layer near the ground, a tree layer at upper level, and an intermediate layer in between of climbing horticulture crops. Their garden is an integrated unit in which the solar energy is channelled through the different layers of plants to animals and humans, cycling and recycling all organic matter, protecting the soils from exhaustion and erosion, and managing every drop of water carefully. Their gardens are thus managed according to the principles of organic agriculture.

Despite their daily work in the office or at school, the family is glad to spend a lot of time and energy in the garden and is proud of the quantity, quality and availability of their own food. They are also enlarging their house in case the son might wish to stay with his new family, and the garden will certainly produce good food for all of them and their friends.

Sebire has a sister, Rúbaba, who is teaching literature, and together with her three children, Vúqar, Vúsale and Shahla, she also maintains an urban garden. The father, Nazim Ismayilov, who is Chief Agricultural Adviser for the region of Sheki and the surrounding areas, guided us through his garden and invited us for a wonderful dinner made from his own chickens, tomatoes, cucumbers, mulberries and plums.

Whoever visits the Southern Caucasus will soon learn that behind many walls and many gates there are rich gardens of biodiversity contributing to healthy and nutritious diets for the benefit of their owners, for local and national markets, and for the environment. And whoever will make friends in the Southern Caucasus will also soon learn to appreciate the hospitality and the food produced in these gardens.

Photo by E. Cattaneo

Photo by E. Cattaneo

Photo by E. Cattaneo

Ilays Musayev grows bananas, potatoes, pomegranate, cucumbers, persil and many other fruits and vegetables, managing with experience solar energy and soil organic matter

Photo by E. Cattaneo

Peach (*Prunus persica* L. Batsch.)

Armenian	*Deghdz, Deghdzeni*
Azeri	*Shaftali*
Georgian	*Atami*

Peaches are found throughout the Southern Caucasus, even in their wild form. The species is generally held to have originated in northern China, but in the Caucasus it has adapted to local conditions and is still widely grown in family gardens. Rural people have prepared various peach-based products such as *alana* and *mianpur* for many years. *Alana* is made as follows: the peach is cleaned, the stone removed and, in its place, crushed walnut with sugar is inserted. The fruits are then dried and the result is the delicious *alana*.

In Armenia, the peach is most commonly found in dry warm zones and in the north of the country. It grows well at elevations of up to 800–900 m. For centuries, it has been propagated from seed, such as the group of *Narindgi, Tchoughuri, Tchgovi* and *Zafrani* peaches. Peach growing in Armenia is based on a large number of varieties whose fruit ripens mainly in August and September. Several of them have a white or red streaked skin and are suitable for niche markets and breeding programmes. Some peaches have crossed spontaneously with almonds and produced an edible kernel.

Some Azeri peach varieties are also characterized by resistance to leafcurl (*Taphrina deformans*) and could be used both for marketing and in genetic improvement programmes. *Salami*, developed in Ordubad, is one of the most valuable and ancient peach varieties. The fruit quality can be preserved intact for up to 20 days after harvesting. *Narindgi* is an old variety with round, large fruits. *Kahraba (sari hulu)* is another excellent old variety with a thick and furry skin. It is grown in Ordubad and Garabagh and is one of the best for consumption.

Nani Merabishvili with a branch of nectarines from her garden. There is a large amount of genetic material that could be used in cross-breeding programmes in order to obtain varieties with specific pulp, skin and disease-resistance characteristics. >>*Right:* a farmer shows a *Narindgi* peach

Peaches in Georgia ripen in September, bear small fruits (that are either round or long), and have a flavoursome flesh. Traditionally, the fruit was dried or used for jams. However, the most interesting feature of *Kartuli atami* peaches is their high cold tolerance, as a result of selection, mostly by fruit growers living in cold areas. In Georgia, the Institute of Horticulture, Viticulture and Oenology has carried out studies on local varieties and on those introduced from other areas, including Europe, the United States of America, Crimea and the rest of the Caucasus. It has created a genetic database to preserve these valuable selections for the future. However, not every local variety has been included in the collection. Some varieties have been lost, while others have been dispersed in remote villages, grown as single trees in household gardens or in small plots that were divided up as a result of reform. Nevertheless, the genetic heritage of peach varieties local to Georgia has a wealth of characteristics that should be preserved. For example, the *Vazhuri* and *Berebis* varieties both produce fruit that handles well. *Khirsuli, Bestavashvili, Gudauta canning* and *Kakhuri tetri* all bear fruit suited for transformation purposes. *Gavazuri* has a strong resistance to drought, while early *Gori*, as its name suggests, ripens early.

Vazhuri peaches keep fresh for long periods, while *Eristavis vardisperi* and *Nobati* fruit have superb tastes and aromas. The *Vazhuri* variety is also valuable for the unusual white colour of its flesh, a genetic quality that has been requested in Europe in recent years. *Pioner* and *Kezevadze* are both resistant to leaf curling, while *Kezevadze* is also valuable for its adaptability to humid conditions. *Pioner, Salami pozdnij, Malik* and other varieties, on the other hand, are useful for their resistance to clasterosporiosis.

The groups of peaches obtained by seedling selection (*Zafrani, Narindgi, Tchoughuri* and *Kartuli atami*) could be used to produce uniform progenies suitable as clonal rootstock. Certain varieties such as green *Tchgovi* could be used to obtain fruit with green flesh. Some dwarf varieties (*Vagaas Khahzrakoriz* and *Cioccikanskii Krasnii*) could be suitable for high-density orchards because of their low vigour. Selections of peach crossed with almond may also have nursery potential for use as peach rootstock on calcareous soils. There is a large amount of genetic material that could be used in cross-breeding programmes and for specific characteristics of the pulp and skin, and disease resistance.

A late fruiting apricot tree in Syunik Marz. This feature could be a key factor to increase the export of this fruit into Europe

Apricot (*Prunus armeniaca* L.)

Armenian	*Tsiran*
Azeri	*Erik, Gaysi*
Georgian	*Gargari, Cherami*

The apricot is one of the symbols of the Southern Caucasus because it is very common and farmers make use of all parts of the plant: the fruit is used fresh, dried, as syrup, or in jam.

The wood of the tree is used to make furniture. The seeds are used for oil and as the basis of a liqueur called *Ratafià*. They may also be burned to produce charcoal for drawing.

The apricot almost certainly reached the Caucasus via Iran and has been growing in the Southern Caucasus for thousands of years. In Armenia and Azerbaijan, apricots grow everywhere.

The origin of the botanical classification of this species, *Prunus armeniaca*, witnesses how deeply entwined is the history of apricot with that of Armenia, where the season runs from the first ten days of June to early August, but most varieties mature in July. At altitudes over 1 600 m, ripening is delayed by a month, a factor that enables some varieties to continue producing until the end of August.

The *Shalakh Erevani* variety of apricot is cultivated at different altitudes, thus enabling the prolongation of the harvesting season

The valuable local types of apricot are *Shalakh, Arjanabad* and *Sateni*. Apricot varieties developed through folk selection in Azerbaijan include *Abutalibi, Khosrovshahi, Gaysi, Ag Novreste, Girmizi Novreste* and others.

In Georgia, the apricot is mainly grown in the eastern parts of the country. In the west, the wetter climate tends to foster disease and early flowering, which makes the plant vulnerable to frost. Since they are not commonly grown in this part of the Southern Caucasus, apricots do not have much genetic diversity and the number of varieties is limited.

Thanks to current breeding and selection practices by farmers, especially in Armenia and Azerbaijan, a rich apricot genetic diversity now exists. This diversity could help improve cultivation in both these regions and in other apricot-producing countries. The apricot is, in fact, a plant prone to problems, many of which could be solved through genetic improvement.

The varieties of apricot grown in the Southern Caucasus are resistant to drought and certain pests and diseases, which could be exploited.

Photo by E. Cattaneo

A delicious dish prepared with apricots, lamb, chestnuts, raisins and rice *(left)*. **Homemade jam sold at local and international markets** *(right)*

The most adaptable apricots are those grown from seed. These have a good resistance to early frost and disease, though they do have the disadvantage of bearing small fruit.

Caucasian fruit growers could become the first to establish the production of apricots with sweet kernels and low levels of amygdalin. These apricots would be easy to transport and would have good potential in the confectionery and cake industry.

A promising avenue for research and marketing is the production of varieties with flesh that is not classic yellow. Producing fruits with certain unusual characteristics such as different colours is a growing niche market.

Genetic improvements could create varieties with particular qualities. For example, the combination *Amban* x *Kanaceni* produces drought resistance, and the combination *Deghanusci* x *Amban*, *Abutalibi* (or *Sateni*) x *Kanaceni* produces late flowering.

Natural hybrids between *P. armeniaca* x *P. cerasifera* classified as *Armeniaca dasycarpa* Ehrh. and named *Ziran-salor*, *Shlor-ziran* black and *Shlor-ziran* yellow by Miciurin could be exploited to select rootstocks having high graft compatibility with apricots and plums.

Medlar (*Mespilus* spp.)

Armenian	*Zkereni*
Azeri	*Ezgil*
Georgian	*Mushmala, Zghmartli*

The medlar is a deciduous shrub or small tree that grows wild in the Southern Caucasus. The forms of the common medlar (*Mespilus germanica*) that have been identified are *f. gigantea* Kirchn., *f. macrocarpa* Kock and *f. abortive* Kirchn. (characterized by the absence of stones). Its fruits can be eaten fresh or used to prepare ciders or liqueurs.

In Armenia, medlars can be found in the hills, mainly bordering forests.

Many varieties of medlar are found in Azerbaijan, mainly in the regions of Talish and Zagatala. There are two species with agronomic value: *M. xerophyllous* L., which thrives in dry areas, and *M. mesophyllous* L., which grows in more humid areas.

In Georgia, the medlar is frequently found in gardens. Because of its lack of commercial value, the fruit is not usually cultivated in plantations but is grown on a small scale by rural families. It grows as a shrub. It is thorny in its wild state, although less so if it is grafted on to quince or hawthorn.

The few cultivated varieties have been selected from wild forms and are divided into two groups: the round-shaped *Meretula* and the pear-shaped *Pyriform*.

The species is useful as an interspecific rootstock, given that it is propagated by grafting on to hawthorn (genus *Crataegus*) and is, in turn, also a rootstock for the loquat (*Eriobotrya japonica*).

Many species and varieties of plums are maintained in gardens, differing in colour, size, ripening period and biochemical characteristics

THE PLUM GROUP

The generic term "plum" groups together several species of *Prunus* that grow spontaneously in many parts of the Caucasus region. Of these, local communities have traditionally made extensive use of *P. domestica* L., *P. spinosa* L., *P. insititia* L. and *P. cerasifera* Ehrh.

Plum (*Prunus domestica* L.)

Armenian	*Salor*
Azeri	*Gavali, Albukhara*
Georgian	*Qliavi*

The plum thrives in a variety of different conditions – in semi-desert zones as well as in mountainous areas up to altitudes of 1 800 m above sea level. In Armenia, before the 1930s local cultivars (propagated easily by suckers) were extremely popular.

Photo by E. Cattaneo

***Goycia* is a wild plum used in Caucasian cuisine predominantly for the preparation of sauces**

These were subsequently neglected as intensive fruit farming took over, based mainly on imported varieties. Most plums ripen in August and September but the *Deghnashlor* selection has the unusual trait of being able to stay fresh until January.

In Azerbaijan, numerous plum varieties have been developed through folk selection and scientific methods. They are distinguished by colour, size, ripening period and biochemical characteristics. In Georgia, plums grow in the warm, wet areas of the Black Sea coast. The most common varieties are *Chanchuri, Damaski, Shavkliava, Tetrkliava* and *Tskalkliava*. Many of them have high resistance to both insect and fungal parasites.

Varieties have been selected for their ratio of sugars to acids and for their high fruit yield. Plum-based products, such as concentrated jam, could be exported for the European market, vacuum packing them to ensure sterile conditions. Other local varieties deserve to be more widely grown because of their resistance to parasites. Some varieties of plum have characteristics that could help produce clonal rootstocks.

Elmira is on her way to plant her plum seeds on the outskirts of the village. She has two very sweet plum trees in her garden and knows the value of her genetic material and the importance of recycling all agricultural products. So she finds time to render a service to her community and her environment by planting her seeds along the roadside so that other people will be able to eat her plums in a few years' time. The garden is an open system: besides producing for self-consumption, farmers provide services to the environment by maintaining the common land

Myrobalan (*Prunus cerasifera* Ehrh.)

Armenian	*Shlor, Alucha*
Azeri	*Alcha*
Georgian	*Tkemali, Alucha*

Myrobalan is a versatile plant, and its fruits are commonly consumed in the Caucasus. It has valuable agronomic traits, such as its resistance to the cold and an ability to thrive on poor soils. It has played an important role in the intensification of agriculture, serving as an interspecific rootstock for apricot and peach trees, enabling these to be cultivated on heavy soils. Myrobalan also grows in the Ararat Valley and, in some areas, at altitudes as high as 2 000 m. In the northern part of Armenia, the *Prunus divaricata* variety predominates, while the *P. cerasifera* var. *nachichevanica* Koval., which has particularly large leaves, grows in the south. Varieties such as *Ashnan Shlor* keep fresh on the tree for as long as two months.

In Azerbaijan, some local varieties of myrobalan are found in Nakhchivan. Local people call them *goyja*. The fruits are very soft and juicy and are eaten when they are green, because they crack upon ripening.

In Georgia, myrobalan is found in both the western and eastern parts of the country, mainly at altitudes of between 200 and 1 200 m. It is used to prepare jams, fruit in syrup and juices to accompany dishes such as roast meat. One exception is *Alycia* (classified as *P. vachuschtii*), which can be eaten fresh and is used to prepare a popular sauce of the same name, served as a side dish with meat courses.

The myrobalan is a versatile and rustic plant, capable of growing on poor soils

The rich diversity of fruit species and varieties combined with small farmers' traditional production and processing methods contributes to their livelihood, health and income [*Source*: ՀԱՅԱՍՏԱՆԻ ՊՏՈՒՂՆԵՐԸ, «ՀԱՅԱՍՏԱՆ» ՀՐԱՏԱՐԱԿՉՈՒԹՅՈՒՆ, ԵՐԵՎԱՆ. Հատոր I. 1958, ՎԵՐՄԻՇՅԱՆ, Ա. Մ., ԳԻԼԱՆՑԱՆ, Է. Հ. & ՍԱՆԱՀՅԱՆ, Մ. Բ. Հատոր V. 1981, ԱԳՈՒԼՅԱՆ, Ս. Լ., ԱՍԱՏՐՅԱՆ, Ա. Ս., ԲԵԿԵՏՈՎԿԻ, Ա. Ն., ԲԵԿԵՏՈՎԿԱՅԱ, Ա. Ա., ԳԱԲՐԻԵԼՅԱՆ-ԲԵԿԵՏՈՎԿԱՅԱ, Է. Հ., ԿԱՐԱՆՅԱՆ, Պ. Գ., ՍԿՐՏՉՅԱՆ, Գ. Գ., ՍԱՆԱՀՅԱՆ, Մ. Բ. & ՎԵՐՄԻՇՅԱՆ, Ա. Մ.]

Small farmers such as Ibrahimov Saodulla grow a wide range of crops including vegetables and citrus fruits and raise a small number of animals. These farmers would benefit from technical and economic support to sustain and improve their livelihoods

THE FARMER IBRAHIMOV SAODULLA

by Marzio Marzot

Shuvi village, southern Azerbaijan, near Astara.

Ibrahimov Saodulla is full of enthusiasm in managing his farm. Part of his land is in the hills behind his home, and the rest in the plain just in front, on the other side of the road. His work is very tiring, particularly because none of his nine children, who live all over the world, has decided to continue their father's activity. But he is happy because, besides his wife and a daughter-in-law, there is his friend Aliyev Hamid who is ready to help him on every occasion.

They are like brothers, after so many years of work side by side, from old times in the *kolkhoz*. Saodulla's small farm is self-sufficient, but the activity he is most proud of is beekeeping. With his faithful friend Hamid, he dedicates himself to honey production.

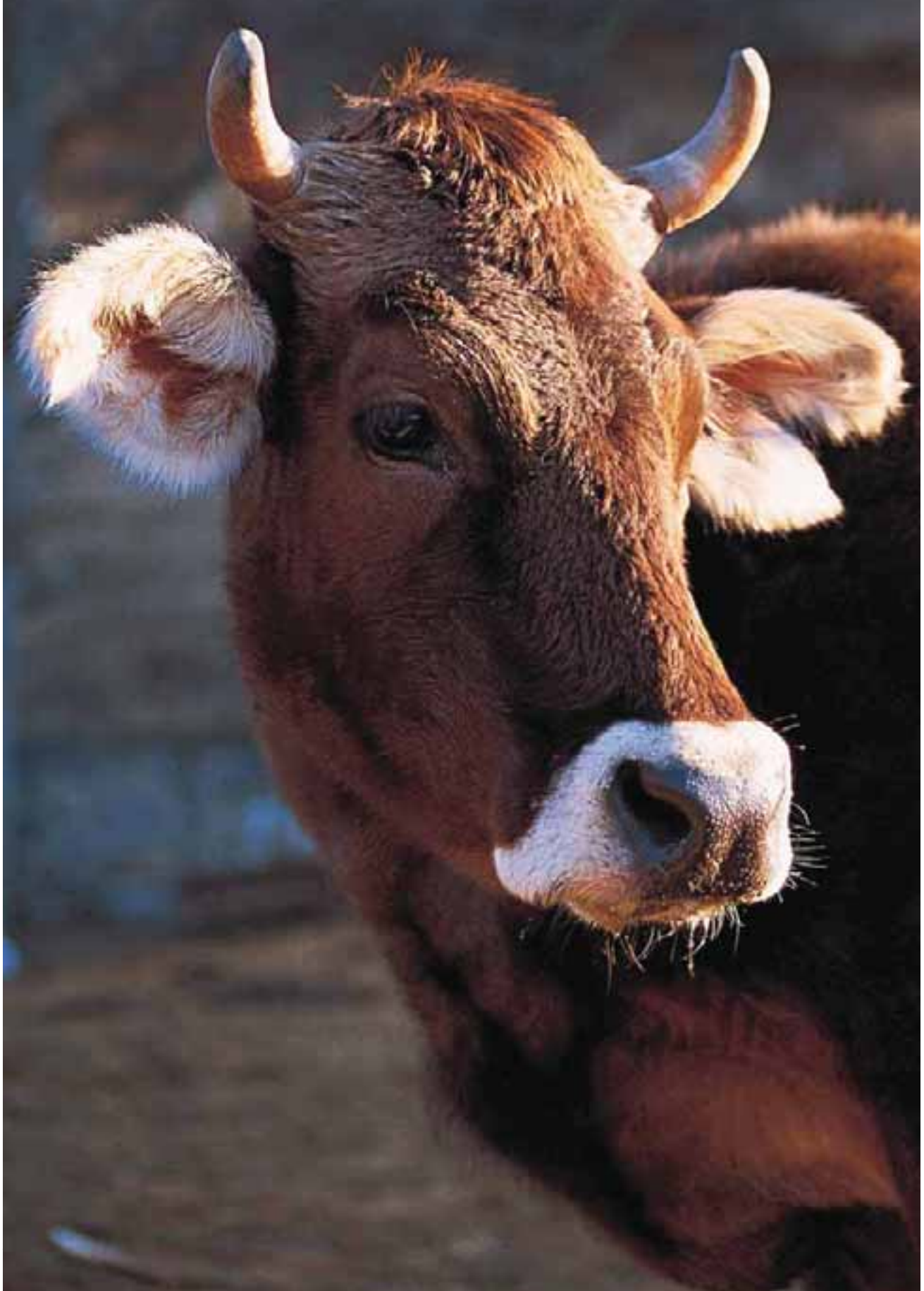
Each one of their ten beehives, scattered among fruit trees, gives them about 8 kg of honey every year. Their honey is delicious and sweet. Almost all the production is sold at the Teze bazaar, the new central market in Baku, more than 300 km away. Sales go well, because about 90 percent of folk medicines are based on honey.

They also sell wax to make candles and honeycomb, while the production of propolis and royal jelly, which is more complex and expensive, is done only on request. For the well-being of their beehives, they replace the queen every other year. The activity stops for three months each year, between December and March.

During this period, Saodulla does not feed their bees with sugar, as other beekeepers do. He would like to have some financial help to improve and increase his production, and he is waiting for the government to introduce a law to facilitate access to loans for honey producers.

On the farm, there are gardens for various types of vegetables, small cultivated fields and many fruit trees.

The production of lemons, oranges and mandarins is excellent, and all the fruits are large, sweet and seedless. Besides fruits and vegetables, the farm has some animals. There is a stable with a three-year-old zebu, of a local breed. A dozen hens, a few cocks and ten turkeys, all of a local breed, scratch freely and are a source of meat and eggs. Near the house is a buried *tandir* oven. Saodulla's mother, Ibrahima Rafiga, makes the traditional bread, *ciorayi tandir*, which is consumed by the family.



Klara Bukia with her hens in the Samegrelo region. Animals in gardens represent not only a source of food when crops fail, but are also a financial resource for the family

ANIMALS IN THE GARDEN

Livestock kept by small farmers in their gardens contribute to food security as well as playing multiple roles, providing manure for sustainable crop production and meat, milk, eggs, feathers and draught power. However, animals also build social capital in rural areas. Crop residues are often used to feed small ruminants, which are in turn sold to finance the basic needs of a family, including costs for education, health and social occasions. Animals are an important financial resource where formal credit is not easily accessible and when there is a poor harvest. When crops fail, animals provide a cushion against food insecurity. Systems are therefore more stable, reliable and adaptable in the face of external climatic and economic changes, and they are also more efficient in terms of sustainable use of local resources and energy management. Typical of the gardens in the Caucasus are geese, chickens, pigs, cattle and turkeys.

Zaza and Maia Zaridze work in their family garden. Hens feed on crop residues and their waste is used to fertilize the soil. Recycling and reusing resources are becoming increasingly important also in modern agricultural production because of their contribution to the sustainability of the system

Chicken

by Professor Roza Nozadze, Georgian Zootechnical-Veterinary University

Armenian	*Trchnabucutjun*
Azeri	*Toyug, juje*
Georgian	*Frinveli*

Chicken breeding is a very old practice in Georgia. In the past, hens and eggs were the main way for Georgian rural folk to pay taxes. This is evidenced by the historical document "Tax List of Kutaisi Province Church", dated 1578. According to this list, people in the Kutaisi province had to give hens and eggs to the church. At that time, women were the main chicken breeders. By the second half of the nineteenth century, chicken breeding was well developed and played a significant role in the Georgian national economy.

Bartering with chickens became an active occupation and source of income. Rural people began to breed many chickens in their homesteads; they bred only local breeds because they were considered to be the best in terms of hardiness, efficiency in the use of the resources, and taste.At the beginning of the twentieth century, chicken breeding accounted for 3.8 percent of total agricultural production costs in the agricultural economy of the Caucasus and 5.1 percent in Georgia. However, the First World War destroyed the international chicken market which, in turn, hindered chicken breeding. During the Soviet period, many chicken breeds were brought to Georgia in order to improve chicken production: among them Leghorn, Rhode Island red, *Plimutrok*, *Viandot*, Cornish, *Australop*, New Hampshire and Russian white. The chicken intensification process caused a chaotic diffusion of hybrid chickens, which did not adapt well to local conditions.

Megrula

The *Megrula* hen is widespread mostly in the Samegrelo region of Georgia. The hen is well adapted to local conditions and does not need additional heating of buildings even during the cold period. Some farmers build small wooden coops called *karia* in their gardens, to help *Megrula* hens withstand high temperatures in summer and low temperatures in winter. The hen has delicious meat and a coloured eggshell. *Megrula* is a dual-purpose, meat-producing/egg-laying breed.

Conserving Georgia's local chicken gene fund is important for farm and household chicken development. Chicken production in the country is competitive, because the market is full of imported chicken meat and eggs that are cheaper than local products. But local chicken production will always have its own consumers, mainly thanks to Georgia's culinary traditions.

The development of household chicken breeding would be impossible without local chicken breeding by small family farmers. Highly productive hybrids need ideal husbandry conditions, which the present economic crisis does not allow. Therefore, conservation and breeding of Georgian local chicken will significantly support household and farm development.

***Megrula* hen in the Samegrelo region**

Local black hen

A.S. Serebrovsky indicates that these hens were brought to the Southern Caucasus some 2 500–3 000 years ago. F.A. Melikov thinks that Azerbaijan hens originated from the Gilan hens of the Islamic Republic of Iran. Other researchers state that local hens were brought to the western zone of Azerbaijan from Iran, they adapted well to the local climate of the territories along the banks of the River Araz and bred in large areas, although their egg productivity was low. Local black hens are now bred in chicken yards in all regions of Azerbaijan. They tolerate the climate, require minimum care and can forage for themselves.

Local black hens have a high laying ability; five- to six-month old hens lay eggs. The quality of their meat and eggs is high and they are extremely profitable for farmers and chicken yards.

Planned scientific research activities on poultry in Azerbaijan began on an experimental farm at the Azerbaijan Livestock Scientific Research Institute between 1956 and 1958.

At present, research is being carried out on a collection of local hens at the Genetic Resources Institute, Azerbaijan National Academy of Sciences.

Geese are a valuable resource: they are cheap to maintain, being rustic and grazing on pasture, but provide high-quality feathers, meat and eggs

Geese

Armenian	*Bad*
Azeri	*Gaz*
Georgian	*Bati*

In Azerbaijan, geese are reared for meat and egg production. Local breeds of geese are light grey. On average, a local goose produces 15–20 eggs per year. Most of the time the geese graze on local pastures and thus consume very little concentrated feed; they are consequently extremely cheap to maintain. The average live weight of a gander (male goose) is 4–6 kg, and that of a female is 3.5–4 kg. Geese have high fertility.

In the Javakheti region of southern Georgia, the Javakhuri goose has been bred from the wild grey goose. Eye colour is related to its feather colour. White geese have blue eyes and orange beaks, ash-grey geese have brown eyes and greyish spotty beaks and motley geese have dark ash-grey eyes and light orange beaks.

Geese generally start laying eggs at the age of 11–12 months. The average oviposition is 8–12 eggs in the first year, which increases to 12–15 eggs in the second year. The Javakhuri goose is capable of giving high-quality feathers twice a year, in August and October.

Photo by S. J. Hovsepyan

Sheep grazing on crop residues contributes to the production of meat, milk and wool and converts organic "wastes" into organic matter

SOIL FERTILITY FOR FOOD PRODUCTION

Maintaining soil fertility is vital for agricultural production, especially in gardens and small farmers' systems. In the Southern Caucasus, permanent arable farming started many thousands of years ago, and family gardens have been cultivated continuously for centuries. Soil fertility is maintained through a mixture of crops, including annual and perennial species, intensive use of legumes in rotations and mixed crop animal systems. In addition, farmers have also managed and improved soil fertility by recycling all forms of organic "wastes" (that should rather be regarded as "organic treasures") and have produced compost to increase soil organic matter. Compost is produced through the biological decomposition of organic materials by bacteria and other organisms. It is an important source of nutrients and organic matter.

To ensure sufficient nutrient availability for plant growth, farmers also use chemical fertilizers when available, and if they can afford the costs. The risk of nitrate leaching depends very much on farming practices; however, synthesis of chemical fertilizers requires large amounts of fossil energy (around 27 GJ/tonne NH_3). By contrast, biological nitrogen fixation (BNF) by legumes is based on solar energy and can contribute to reducing the environmental footprint of crop production. Scientists should increase their work on legumes as part of cropping systems especially tailored for small farmers or in situations where fertilizers are scarce. Farmers in the Southern Caucasus keep animals in their gardens not only for milk, meat and eggs, but also to obtain manure, which forms an integral part of their production system.

Recycling organic wastes in the form of manure and compost and cultivating legumes contribute to the maintenance of soil fertility in areas of agricultural production

Ruminant livestock convert a general range of only 15–30 percent of their feed into meat and milk (poultry and swine do better) and manure is a precious "by-product" that may actually exceed the value of what is usually perceived as a "product".

Farmers have a great respect for the properties of manure in all its forms and plan its management well because they know that their livelihoods are linked to this important resource. Small farmers use manure to improve soil quality, increase crop production and as a fuel source (dried manure/straw).

Manure provides, in varying proportions, the three main plant nutrients (nitrogen, phosphorus and potassium) as well as secondary ones (calcium, sulphur and magnesium).

Sometimes manure has trace elements with a role in plant or animal nutrition: boron, chlorine, manganese, iron, zinc, copper, molybdenum and selenium. Manure stimulates plant root growth, increases nutrient uptake, decreases evaporation from the soil, increases soil water-holding capacity, reduces surface water runoff, facilitates drainage, regulates soil temperature and provides substrates for soil microbes. The composition of cow, pig, chicken and horse manure is quite different. Moreover, the quality varies according to processing (type and length of maturation and drying). Small farmers traditionally know these differences and how to manage them. Today, science is helping farmers to improve the quality of their manure by investigating the possibilities of reducing diseases caused by, for example, *Phytophthora cinnamomi*.

Manure is regarded by farmers as an organic treasure rather than a waste. Farmers know that their livelihood is linked to this important resource. Additional scientific knowledge should be developed to understand better the contribution of manure to livelihoods and climate change

Researchers are also investigating which changes in soil characteristics (including pH, nutrient levels, total and specific biological activities) after compost application help to reduce the effects of incorrect manure management on greenhouse gas emissions and climate change. Organic matter provided by manure is of a high quality because of its cellulosic content and level of available energy and because it supports the growth of suppressive microbes. This activity, however, is complex because disease suppression depends on the dynamic qualities of composts of different maturities, and on different environmental conditions. This is why the direct experience and knowledge of farmers must be combined with scientific analysis in order to improve manure quality. Many production problems encountered by farmers are linked to soil fertility. Therefore, farmer training in soil fertility and compost and manure production and management should be encouraged and farmers' knowledge of biological processes that sustain farming practices should be enhanced. Organically based fertilizers such as livestock manure should be recommended, where these materials are proven to be free of toxins such as heavy metals, in gardens where animals are an integral part of the food production cycle.

Agronomic operations should avoid overapplying manure and consequently dispersing nutrients into the atmosphere through surface runoff or by leaking into groundwater. Farmers should receive training and information related to: improving the stacking and protection of dry manure on fields; applying manure to the fields; improving transportation of liquid manure to distant fields; increasing coverage of solid manure, enabling it to contribute to reduce greenhouse gas emissions; and reducing pathogen numbers during anaerobic composting.

Small farmers maintain soil fertility through wise management of crop rotations. On-farm recycling reduces production and energy costs and consumption of fertilizers, and improves soil structure and biodiversity. Well-managed gardens use reduced inputs for weed control. Today, recycling should no longer be considered a practice of farmers living in isolation, but a modern agricultural production practice

5 BIBLIOGRAPHY A TREASURY OF GENETIC RESOURCES IS MAINTAINED IN GARDENS

Adighesal, B.M., Alakparov, U.K., Aliev, G.A., Hajiyev, V.D., Isirafilov, S.A., Musaev, M.A., Mustafaev, I.D. & Safarov, I.S. 1989. *Red Book of Azerbaijan*. 544 pp. [in Azeri and Russian]

Agulian, S.L., Asatrian, A.S., Bechetovskii, A.N., Bechetovskaja, A.A., Vermiscian, A.M., Gabrielian- Bechetovskaia, E.A., Karagnan, P.G., Mikritician, G.G. & Sanaghian, M.B. 1981. *Armenian flora: fruits*. Vol. V. Yerevan, Ayastan Publishers. 185 pp. [in Armenian and Russian]

Akhundov, M. 1959. Naked neck chickens in Azerbaijan. *Transactions of Azerbaijan State University (ASU) III*, 3–10.

Aliyev, J.A. 1998. *Plant genetic resources of the Azerbaijan Republic*. Report. 86 pp. [in English]

Avanzato, D., Barbera, G., Bargioni, G. & Bellini, E. 1991. *Frutticoltura speciale*. Rome, Reda Publishers. 784 pp. [in Italian]

Beketovskii, A.N., Gabrelian-Beketovskaia, E.A. & Migritan, G.G. 1976. *Armenian flora: subtropical plants*. Yerevan, Ayastan Publishers. 126 pp. [in Armenian and Russian]

Biodiversity of livestock in Azerbaijan (genus, breeds). Joint Book. 2004. Baku, Elm Publishing House. 308 pp.

Borrini, T. 1958. *Segreti della frutta*. Turin, Italy, Minerva Publishers. 208 pp. [in Italian]

Cappelletti, C. 1976. *Botanica sistematica*. Vol. II. Turin, Italy, UTET Publishing House. 1078 pp. [in Italian]

Crimean Botanic Institute, Nikiski. 1961. *Catalogue of pomegranate varieties*, pp. 6–87. Yalta Publishers. [in Russian]

FAO. 2010. FAOSTAT. http://faostat.fao.org/

Gabrielian, E.Z., ed. 1988. *Red Data Book of Armenia*. Yerevan, Ayastan Publishers. 283 pp. [in Armenian, English and Russian]

Goghia, M. 2001. *Everything about Georgian dishes*. Doneski Publishers. 220 pp. [in Russian]

Grossheim, A.A. 1945, 1950, 1952, 1962, 1967. *Flora of the Caucasus*. Vols III, IV, V, VI, VII. Moscow-Leningrad. [in Russian]

Grossheim, A.A. 1949. *Determinator for flora in the Caucasus*. Moscow, Nauka. 747 pp. [in Russian]

Hajiyev, H.M. 1993. *Productivity and pedigree quality of local poultry breeds being raised in Azerbaijan*. Azerbaijan Scientific Technical Information Institute. Information Leaflet, 96. Ganja.

Hajiyev, V.D., Aliev, D.A., Kuliev, V.S. & Vagabov, Z.V. 1990. *The plants of high mountains growing in the Lesser Caucasus*. 212 pp. [in Russian]

Homesurishvili, N. & Heristavi, E. 1939. *Varieties of local Georgian fruits*. Vol. I. 116 pp. [in Georgian and Russian]

Homesurishvili, N. & Heristavi, E. 1941. *Varieties of commercial fruits*. Vol. II. 217 pp. [in Georgian and Russian]

Idrisov, G.A. 1999. *Study of varieties and research of some issues of technology for growth sapling of plum in the northwest zone of Azerbaijan*. 141 pp. [in Russian]

Imamaliyev, G.N. 1988. *Germplasm of pome and small fruits in the region of Shaki-Zagatala in Azerbaijan*. 68 pp. [in Russian]

Kasumov, M.A. 1941. *Fruits for dry regions in Azerbaijan*, pp. 10–15. Baku. [in Russian]

Khomizurashvili, N.M. 1970. *Horticulture of Georgia*, pp. 195–477. Vol. II. Tbilisi, Metsniereba Publishers. [in Georgian and Russian]

Khomizurashvili, N.M. 1973. *Horticulture of Georgia: pome fruits*. Vol. III. 626 pp. [in Georgian and Russian]

Khomizurashvili, N.M. 1978. *Horticulture of Georgia: stone fruits, nuts and subtropical fruits*. Vol. IV. 950 pp. [in Georgian and Russian]

Kovaliov, N.B. 1955. *Alycha in nature, culture and breeding*. Tashkent. Academy of Sciences of Uzbekistan. 212 pp. [in Russian]

Lessiuk, E.A., Kazzura, O.P., Kursakov, L.E., Smirnov, A.G. & Kusmin, A.J. 1965. *Description of fruit varieties*. Moscow. 150 pp.

Mamedov, F.M., Dzigarevich, I.A. & Ahmedov, P.M. 1983. *The Horticultural Research Institute of Azerbaijan*. 22 pp. [in Russian]

Maqashvili, A. 1991. *Lexicon botanicum (Nomina plantarum)*. 3rd ed. Tbilisi, Metsniereba Publishers. 246 pp. [in English]

Melikyan, A. 2001. *Biological peculiarities and possibilities of use of a number of wild vegetable plants growing in Armenia*. Primus Inter Pares. 170 pp. [in English]

Nesterenko, G.A. & Strebkova, A.D. 1949. *The pomegranate*. Baku, Selhorgiz. [in Russian]

Nozadze, R. 2005. *Diversity of poultry local breeds in Georgia*. Tbilisi. [in English and Georgian]

Quba Research Station. *Catalogue of pomegranates in the germplasm collection of the research station of Gheocchiciai in Azerbaijan*. 12 pp. Manuscript received from Quba Research Station. [in Russian]

Quba Research Station. *List of fruit varieties in the germplasm collection of the Horticultural Institute of Quba in Azerbaijan*. 10 pp. Manuscript received from Quba Research Station. [in Russian]

Rajably, A.D. 1966. *Fruit crops of Azerbaijan*. Baku. 246 pp.

Ramachandra, T.V. 1994. Efficient wood energy devices for cooking and water heating purposes. Cited in *Integrated farming systems for efficient use of local resources*, by L. Rodríguez, T.R. Preston & N. Van Lai.

Rollov, A.H. 1908. *Wild plants in the Caucasus*. Tbilisi, Caucasian Committee of Phyllosera. 600 pp. [in Russian]

Scialabba, N. El-Hage & Müller-Linderlauf, M. 2010. Organic agriculture and climate change. *Renewable Agriculture and Food Systems*, 25 (02): 158–169, Cambridge, UK, Cambridge University Press. http://journals.cambridge.org/repo_A76L6QYs/

Stefanian, A. 2002. *The main species, varieties and fruit forms in Armenia*. Manuscript received from the author. [in Russian]

Sulakveldze, T.P. 1988. *Georgian dishes*. Tbilisi, Sapciota Sakartvelo Publishers. 353 pp. [in Russian]

Talibov, T. & Babayeva, S. 1997. *Apricot*. Baku, Elm Publishing House. 92 pp.

Tassinari, G. 1976. *Manuale dell'agronomo*. Rome, Reda Publishers. 3237 pp. [in Italian]

The Nature of Armenia Encyclopaedia. 2006. Yerevan, picture. 692 pp.

Veniaminov, A.N. 1953. *Fruit varieties*. Moscow. 440 pp. [in Russian]

Vermischyan, A.M., Dilanian, G.H. & Sanaghian, M.B. 1958. *Armenian flora: stone fruits*. Vol. 1. Yerevan, Armenioski Publishers. 410 pp. [in Armenian and Russian]

Zhukovsky, P.M. 1964. *Crops and their wild relatives*. Leningrad, Kolos Publishing House. 790 pp.

RECYCLE AND REUSE

IN A WELL-KEPT GARDEN, FARMERS BALANCE THE PRODUCTION OF CROPS, ANIMALS AND ENERGY. RECYCLING AND REUSING ARE BASIC MANAGEMENT PRINCIPLES FOR BALANCED AND SECURE FOOD PRODUCTION.

RECYCLING FOR A FARMER MEANS PROCESSING USED MATERIALS SUCH AS CROP RESIDUES (STRAW), PLANT RESIDUES (WEEDS, PRUNED MATERIAL, FRUIT STONES), ANIMAL WASTE (COW, POULTRY AND PIG MANURE, GEESE FEATHERS, SKIN AND BONES) INTO NEW PRODUCTS (SUCH AS FERTILIZERS, FUEL AND BIOGAS).

This recycling decreases inputs and reduces production costs, energy costs and consumption of new material (introduced fertilizers), and improves soil structure and biodiversity. Recycling used agricultural materials also reduces air and water pollution, prevents the waste of organic material and lowers greenhouse gas emissions.

Farmers know their gardens and are aware that if nutrients leave the soils they must be replaced if crop production is to remain abundant.

Therefore, recycling today is no longer considered a practice of farmers who live in isolation, have little relation with markets or are reluctant to use new technologies. Recycling is now an integral part of modern agricultural production systems.

Recycling combines benefits for the farmer (income), for the consumers (clean and quality food) and for the environment (sustainable waste management and maintenance of the natural resource base).