



Zentrum für Entwicklungsforschung  
Center for Development Research  
ZEF Bonn

Economic and Ecological Restructuring of Land  
and Water Use in Uzbekistan/Khorezm:  
A Pilot Program in Development Research



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## ZEF Work Papers for Sustainable Development in Central Asia

No. 11

# Alternative Crops for Khorezm (Uzbekistan) and their Sales Opportunities as well as Risks on the European Market

by

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Urgench, December 2007

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ZEF-Uzbekistan working papers contain preliminary material and research results from the ZEF/BMBF/UNESCO-Project on Economic and Ecological Restructuring of Land- and Water Use in the Region Khorezm (Uzbekistan). They are circulated prior to a peer review process to stimulate debate and to disseminate information as quickly as possible. Some of the papers in this series will be reviews and eventually be published in some other form, and their content may also be revised. The sole responsibility for the contents rests with the authors.

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## **ABSTRACT**

The present study examines the possibilities of introducing alternative food and non-food crops in the region Khorezm (Uzbekistan) with special regard to the prevailing temperatures (hot dry summers, very cold winters), drought tolerance, frost tolerance, salt tolerance and soil type (sandy, loamy, pH 7-8). For selected crops, the opportunities and risks for marketing these crops on the European Market are considered, presenting alternatives to present income generation of marketing crops such as cotton, which currently dominates the Uzbek agricultural sector.

A total of 30 theoretically suitable plants were identified by extensive literature research. The list contains 26 food plants: 10 plants which produce fruit, 2 which produce vegetables, 11 carbohydrate-, and 2 protein-delivering plants, and 1 fat-delivering plant). In addition 4 non-food plants could be identified including 2 dyes, 1 fibre plant and 1 nicotine-producer. The most promising alternatives are gooseberry, sour cherry, pistachio, jujube date, fig, almond, barley, topinambur, safflower and tobacco. Fish cultivation would be another alternative, as well as cut flower.

Preliminary information about Europe as a possible market for Uzbek agrarian products is summarized and selected aspects of the European food law and food quality, of customs legislation as well as of the market situation of the crops in question are illustrated. Based on these data sets, an analysis of the sales opportunities of crops, fruit and vegetables, fish and cut flowers is given.

This study presents a rough overview of the situation on the European market, but it has to be realized the food law and food quality requirements of the European Union are in constant change. The situation described by this study could therefore only outline the basic conditions, but had to exclude many details which however could become crucial when actually intending to export goods into the EU. As the European single market is highly protected, any import will become difficult as soon as negative influences on the European Market are to be expected. Therefore, final statements about the import of food- and non-food products from Uzbekistan into the EU could not be addressed in this study.

## **АННОТАЦИЯ (RUSSIAN ABSTRACT)**

В данной научной работе изучаются возможности выращивания альтернативных продовольственных и непродовольственных культур в Хорезмской области Узбекистана с учётом таких особенностей, как температура воздуха (жаркое

сухое лето, очень холодная зима), засухоустойчивость, морозоустойчивость, солеустойчивость, а также виды почв (песок, суглинок, рН 7-8). Для отдельных культур рассматривается потенциал и возможный риск при сбыте на Европейском рынке, что представляет альтернативу формированию в настоящее время доходов от реализации таких культур, как хлопчатник, который в настоящее время доминирует в сельскохозяйственном секторе Узбекистана.

На основе обширных литературных исследований было выявлено, в целом, 30 видов теоретически пригодных культур. Список включает 26 видов продовольственных культур, из них: 10 видов фруктовых, 2 вида овощных, 11 видов углеводных культур, а также 1 вид, из которого выделяют жиры. Кроме того, есть 4 вида непродовольственных культур, состоящих из: 2 видов красильных, 1 вида волоконных и никотин- производящих культур. Самыми многообещающими альтернативными культурами являются крыжовник, вишня, фисташник, финик, фи́га, миндаль, ячмень, земляная груша, сафлор и табак. В дополнение к цветам, рыбное производство тоже может быть послужить хорошей альтернативной.

В работе проанализирована предварительная информация о Европейском рынке в качестве возможного рынка сбыта сельскохозяйственной продукции с Узбекистана, проиллюстрированы соответствующие аспекты европейских законов по качеству продуктов питания, таможенное законодательство, а также состояние данных культур на рынке. На основе вышеизложенных данных представляется анализ возможности реализации сельхозкультур, фруктов и овощей, рыбной продукции и цветов.

В данной научной работе представляется краткий обзор ситуации на европейском рынке. Однако, следует принять во внимание тот факт, что законы и требования Европейского Союза о качестве продуктов питания регулярно меняются. Следовательно, ситуация, описанная в данной научной работе, определяет лишь основные условия и исключает многие детали, которые могут быть очень важными при фактическом экспортировании товаров в ЕС. В связи с тем, что европейский единый рынок строго защищен, импортное усложняется, как только появляются прогнозы негативного влияния на европейский рынок. Следовательно, окончательные предложения импортирования продовольственной и непродовольственной продукции из Узбекистана в ЕС в данной работе не рассматриваются.

## 1 INTRODUCTION

Since its independence in 1991, Uzbekistan pursues a gradual transition from planned to market economy (Wehrheim & Martius 2007). Agriculture is one of Uzbekistan's most important economic sectors - yet this sector is still characterized by agricultural production systems typical for a planned economy (ZEF 2003). The four main cultured crops are cotton, wheat, rice and fodder maize (in this order; Djanibekov 2006). The intensive production of these crops over the last century in vastly extended irrigation systems led to an overuse of agrochemicals, presumably to soil degradation, and to a continuous stress on sustainable water supplies. The effect of these large-scale interventions is the lack of sustainability of land and water use – most visibly exemplified in the drying out of the Aral Sea, resulting in desertification and ensuing rural poverty and losses of rural livelihoods.

One of the oldest agricultural regions of Middle Asia is the region Khorezm, an administrative district situated in the northwest of the Republic Uzbekistan, downstream of the Amu Darya River. The local agro-climatic conditions of this region are harsh; the prevailing climate being continental with very hot summers and very cold winters. The soils are sandy and loamy sandy and are of high salinity. A re-structuring of the land- and water use is necessary, not only because of the increasing upstream water use and the natural fluctuation of water supply associated with the mentioned ecological and economic consequences, but also in the context of the ongoing privatization of the former communal farms, This re-structuring should address the ecological agricultural sustainability at the same time as the economic efficiency and attractiveness of farming, to ensure a sustained flow of rural income and a more ecological natural resource use.

As part of the research project “Economic and Ecological Restructuring of Land- and Water Use in the Region Khorezm (Uzbekistan)” of the Center for Development Research (ZEF) of the University of Bonn (cf. Vlek 2003, ZEF 2003), the present study examines the possibilities of introducing alternative food and non-food crops in this region. This would represent one approach to initiate a diversification in the crop portfolio of farmers of the region, make them less dependent on world market fluctuations of single crops and their products, and, if judiciously chosen, allow for better resource management.

This study furthermore addresses the sales opportunities and risks of certain (alternative and common) crops on the European Market, as one alternative for foreign earnings generation other than the present cotton production and marketing that dominates the Uzbek agricultural sector. The focus was not laid on the difficulties of transport like

appropriated cost-extensive transport possibilities with special regard of Uzbekistan as a doubly landlocked country, neither to the existing Uzbek export prohibitions by law.

The aim of this study is therefore two-fold: (1) it provides an analysis of alternative crops which can withstand the harsh agro-climatic conditions in the region Khorezm of Uzbekistan, and (2), it explores the potential for export of agricultural products into the European Union. In order to do this, first suitable crops are selected that would grow under the specific conditions in Khorezm (characterized by winter-cold continental climate, sandy and in part highly saline soils). Then, their markets in Europe are examined. Furthermore, the European food law, food quality and customs legislation are analyzed.

The study is structured as follows: Chapter 2 describes the approach used to select the list of alternative crops, presents the list of crops, and assesses their suitability to enter the European Market. Chapter 3 gives introductory information about Europe as a possible sales market for Uzbek agrarian products and illustrates selected aspects of the European food law and quality, of customs legislation as well as of the market situation of the crops in question. Finally, in the last chapter, an overall conclusion is drawn and prospects for further studies are given.

As this study was developed within the scope of a two-month internship at ZEF, it can only give an introductory overview of the possibilities and difficulties in finding suitable alternative crops and exporting into the EU from a third country. Due to the limited time available for this research none of the chapters are exhaustive. The study also benefited from interaction with other scholars of the project.

## **2 ALTERNATIVE CROPS FOR THE REGION KHOREZM**

### **2.1 List of alternative crops for the region Khorezm**

In addition to the crops already presently cultivated in Khorezm, further crops could be cultivated as well. This section will give an introductory overview about which crops can grow under the prevailing local conditions. The methodical approach focused on crops usable for food was designed as follows:

With the aid of a guide to plants tolerant of arid and semi-arid conditions (Weiss 1987), first a list of crops usable for food was made. The result was a list of 272 crops (table 5.1; Appendix A). In the next step, these crops were analyzed under special consideration of the prevailing determinants of the local conditions in Khorezm. These determinants are

temperature (summer: up to 40° C; winter: down to minus 25-40°C), drought, frost, salt tolerance and soil (soil type: sandy, loamy-sandy; pH 7-8). For this, two databases for crops (NewCROP 2005; ISWS 2005) were used as well as two standard books (Rehm & Espig 1991; Franke 1991). To finalize the list, those crops which are already cultivated in Khorezm were deleted from the list, using a listing of presently cultivated crops in Khorezm (Kohlschmitt et al. 2006; cf. Table 13, Table 14, Appendix B).

Furthermore, several additional crops not provided in the first listing were selected based on some expert knowledge (regarding potential for the region or declared interest by locals to grow these crops) and examined in the same way.

The tables 1 and 2 show the result of this analysis. A total of 30 plants theoretically suitable to be grown in Khorezm were identified. The list contains 26 plants that produce food (10 plants that produce fruit and 2 that produce vegetables, plus 11 carbohydrate-, 2 protein-, and 1 fat-delivering plants), and 4 non-food plants (2 dyes, 1 fiber plant, 1 nicotine-producer). Some plants are included in the list, although they are produced already in the region: Sour cherry and mulberry trees (mainly for silkworm fodder) and barley already exist in Khorezm but their share of the total planted area is very low; therefore these crops are listed in the tables.

Table 1: Sample Size, Gender and Farm Typology: March 2003

| Potential alternative crops for Khorezm |                         |             |       |        |             |                  |              |
|---|-------------------------|-------------|-------|--------|-------------|------------------|--------------|
|   | Botanic name            | Temperature |       |        |             | Drought          | Frost        |
|   |                         | Opt.        | Max.  | Min.   | Winter min. |                  |              |
| carbohydrate delivering plants          |                         |             |       |        |             |                  |              |
| starch                                  | Eragrostis tef          | 17-27 °C    | 35 °C | 7.5 °C |             |                  |              |
|   | Eleusine coracana       | 17-27 °C    | 35 °C | 7.5 °C |             | very adaptable   |              |
|   | Pennisetum americanum   |             |       |        |             | resistant        |              |
|   | Secale cereale          | 10-20 °C    | 30 °C | 5 °C   | -40 °C      |                  |              |
|   | Hordeum vulgare         |             |       |        |             | tolerant         |              |
| inulin                                  | Helianthus tuberosus    | 15-27 °C    | 30 °C | 7 °C   | -42 °C      | needs irrigation |              |
| thickening agent                        | Cyamopsis tetragonoloba | 25-35 °C    | 45 °C | 10 °C  |             | quite            |              |
| gum delivering                          | Acacia karroo           |             |       |        |             | resistant        | resistant    |
| fat delivering                          | Carthamus tinctorius    | 20-32 °C    | 45 °C | 5 °C   | -14 °C      | moderate         | some species |
| Vegetable/Salad delivering              | Scorzonera hispanica    |             |       |        |             |                  | tolerant     |
|   | Tragopogon porrifolius  | 13-19 °C    | 24 °C | -33 °C |             |                  |              |
| Fruit delivering                        |                         |             |       |        |             |                  |              |
| seeds from drupe                        | Prunus dulcis           | 12-35 °C    | 40 °C | 10 °C  | -17 °C      | resistant        |              |
|   | Pistacia vera           | hot, dry    |       |        |             | quite            | cool winter  |
| edible episperm                         | Punica granatum         | hot         |       |        | -11 °C      | extremely        |              |
| berries                                 | Ribes uva-crispa        | 15-25 °C    | 40 °C | 3 °C   | -28 °C      |                  |              |
|   | Phoenix dactylifera     | 32 °C       |       |        |             | quite            | moderate -°C |
| drupes                                  | Prunus cerasus          | 15-25 °C    | 30 °C | 4 °C   | -29 °C      |                  |              |
|   | Ziziphus jujuba         | hot         |       |        | -29 °C      | tolerant         | tolerant     |
| union drupes                            | Ficus carica            | 16-26 °C    | 38 °C | 4 °C   | -12 °C      | resistant        |              |
|   | Morus rubra             | 12-25 °C    | 32 °C | 12 °C  | -36 °C      |                  |              |

The list represents plants that should be considered and further tested for production. Not all of the listed crops may be planted advantageously under the prevailing conditions, but some of the crops represent promising alternatives (e.g. barley, topinambur, almond, pomegranate, jujube, mulberry, safflower, etc).

However, besides the capability of the land to grow these products, also eventual special knowledge needed for their production, such as the needs for storage, processing and transport, and the size and location of the potential markets to sell these products should be further investigated before production is taken up in large areas. In view of possibly high transport costs for exportation to long-distance markets, further processing of certain fruit and vegetables in Khorezm is very promising, and would also increase the job offer in the region. The methods of freezing, drying, and canning as well as fruit juice production are some possibilities. One avenue for export-oriented products would be to investigate possible markets in the neighboring countries, China, Russia or the EU.

In this regard, it should be mentioned that flowers for export could potentially be planted in greater share of the land (cheap and rapid air transport to the markets guaranteed). In addition, fish (from aquaculture) as another high-yielding agricultural product could be produced in the region.

Table 2: Potential alternative crops for Khorezm - part 2

| Potential alternative crops for Khorezm |                |                |                           |   |
|---|----------------|----------------|---------------------------|---|
| Botanic name                            | Common name    | Salt tolerance | Soil                      | Comments                                |
| <i>Eragrostis tef</i>                   | Teff           | tolerant       | pH 6-6.5                  | Lysin (most limit. AS), minerals        |
| <i>Eleusine coracana</i>                | African millet | tolerant       | pH 6-6.5; very adaptable  |   |
| <i>Pennisetum americanum</i>            | Pearl millet   | tolerant       |                           | replaces rice, bread, beer brewery      |
| <i>Secale cereale</i>                   | Rye            |                | pH 5.5-7.5; several types |   |
| <i>Hordeum vulgare</i>                  | Barley         | resistant      |                           | bread, fodder, beer brewery             |
| <i>Helianthus tuberosus</i>             | Topinambur     |                | pH 4-7; several types     | winning of alcohol (in France)          |
| <i>Cyamopsis tetragonoloba</i>          | Clusterbean    | tolerant       | pH 7.5-8; sandy loams     | stabilizer, gum, soil improver, fodder  |
| <i>Acacia karroo</i>                    | Sweet thorn    |                |                           | forage, fiber, gum/resin, tanning agent |
| <i>Carthamus tinctorius</i>             | Safflower      | tolerant       | pH 5.4-8.2                | oil/fat, coloring, fodder               |
| <i>Scorzonera hispanica</i>             | Black Salsify  |                | moderate on lean soil     |   |
| <i>Tragopogon porrifolius</i>           | Salsify        |                | pH 6-7.5                  | taste of oysters (in England loved)     |
| <i>Prunus dulcis</i>                    | Almond tree    |                | pH 6-7; sandy loams       | food, lipids, flavoring                 |
| <i>Pistacia vera</i>                    | Pistachio      | relatively     | modest                    |   |
| <i>Punica granatum</i>                  | Pomegranate    | tolerant       |                           |   |
| <i>Ribes uva-crispa</i>                 | gooseberry     |                | pH 5.5-7; deep loam       |   |
| <i>Phoenix dactylifera</i>              | Date palm      | tolerant       | sand, sandy loam, others  | even pH up to 8                         |
| <i>Prunus cerasus</i>                   | Sour Cherry    | sensitive      | pH 6-7; loamy             | sensitive to high soil pH               |
| <i>Ziziphus jujuba</i>                  | Jujube         | highly         | sandy, well drained       | silkworm fodder                         |
| <i>Ficus carica</i>                     | Fig            | moderate       | pH 6-7.5                  |   |
| <i>Morus rubra</i>                      | Mulberry       |                | pH 5.5-7.5                |   |

## 2.2 Elaboration of suitable alternative crops with respect to their sales opportunities on the European Market

For further investigation regarding exportation into the EU, the crop group fruit and vegetables was selected, as it represents the most promising group of crops. The prevailing Uzbek trade restrictions were considered as well (based on information provided by Sandjar Djalalov, Tashkent, and Peter Wehrheim, Brussels). They ban, for example, the export of grain and vegetable oil.

Some crops already cultivated (e.g. potato, beans, etc) are comprised in the export potential analyses as well. Furthermore, fish and cut flowers will be investigated, as they also may find a market in the EU.

Table 3: Further alternative crops for Khorezm - part 1

| Further alternative crops for Khorezm |                         |             |          |       |             |                            |                   |
|---------------------------------------|-------------------------|-------------|----------|-------|-------------|----------------------------|-------------------|
|                                       | Botanic name            | Temperature |          |       |             | Drought                    | Frost             |
|                                       |                         | Opt.        | Max.     | Min.  | Winter min. |                            |                   |
| dye delivering plants                 | Indigofera suffruticosa |             | 22-28 °C | 32 °C | 7 °C        | resistant                  | suffers frosts    |
|                                       | Isatis tinctoria        |             |          |       |             |                            |                   |
| fibers delivering plants              | Corchorus olitorius     |             | 27-32 °C |       |             |                            |                   |
| nicotine containing plants            | Nicotiana tabacum       |             |          |       |             |                            |                   |
| starch                                |                         |             |          |       |             | sensitive to high          | sensitive         |
| delivering plants                     | Fagopyrum esculentum    |             | 17-27 °C | 40 °C | 7 °C        | temp., drought             | to cold           |
|                                       | Solanum tuberosum       | 15-25 °C    | 30 °C    | 7 °C  | -1 °C       | likes high temp.           |                   |
|                                       | Sorghum bicolor         | 27-35 °C    | 40 °C    | 8 °C  |             | needs heat, moderate water | sensitive to cold |
| protein delivering plants             | Glycine max             | 20-32 °C    | 38 °C    | 10 °C | 0 °C        |                            |                   |
|                                       | Vicia faba              | 18-28 °C    | 32 °C    | 5 °C  | -10 °C      | Not tolerant               |                   |
| fruit delivering plants               | Pyrus communis          | 20-35 °C    | 37 °C    | 10 °C | -28 °C      |                            |                   |

*These crops were investigated due to expert information suggesting their potential for the region.*

Table 4: Further alternative crops for Khorezm - part 2

| Potential alternative crops for Khorezm |             |                |                                |  |
|---|-------------|----------------|--------------------------------|--|
| Botanic name                            | Common name | Salt tolerance | Soil                           | Comments   |
| Indigofera suffruticosa                 | Indigo      |                | pH 6-7, sandy                  | rich dye: I.arrecta/ sumatrana; artificial dye preferred in industry |
| Isatis tinctoria                        | Madder      |                | calcareous loess, limestone    | low demand for soil, climate; essential oils in leaves: coat of wood |
| Corchorus olitorius                     | Jute        |                | pH 6-7; loams, sandy loams     | needs rain 1500 mm, high air humidity                                |
| Nicotiana tabacum                       | Tobacco     | highly         | pH 5-5.6; sandy, sandy-loams   | tolerates high temp., needs water                                    |
| Fagopyrum esculentum                    | buckwheat   |                | pH 5-6.5; Sand, silt loam      | prefers cool moist climate   |
| Solanum tuberosum                       | potato      | some           | pH 5-6.5; sandy loams          | high biological value  |
| Sorghum bicolor                         |             |                | pH 5.5-7.5; loams, heavy clays | high biological value  |
| Glycine max                             | Soybean     |                | pH 5.5-7.3; fertile loams      | Doesn't survive excessive heat                                       |
| Vicia faba                              | Faba bean   |                |                                | best: cool temp. above freezing                                      |
| Pyrus communis                          | pear        |                | pH 5.1-6.7; sandy, clay loams  |  |

*These crops were investigated due to expert information suggesting their potential for the region.*

### 3 THE EUROPEAN UNION AS A POSSIBLE SALES MARKET FOR UZBEK FISHERY, AGRICULTURAL, AND PROCESSED PRODUCTS

#### 3.1 Introductory information

50 years ago, the common agricultural policy (CAP) was introduced to stop food shortages in the founding member countries of the EU. The objectives of the CAP were to improve production and productivity, stabilize the markets, and to guarantee supply and a fair standard of living for farmers (protection against world prices). To achieve these objectives, a common organization of the agricultural markets (COM) was created. The CAP has gradually replaced national market organizations and now exists for most EU agricultural products. With the COM, obstacles to the intra-Union trade of agricultural products are eliminated and a common customs barrier with respect to third countries is maintained. Nowadays, other objectives are met. Food safety and quality, environmentally sustainable production and the term value for money are now all key concepts (LW 2005, GMO 2005, GAP 2005).

To import goods which have their origin in third countries, the European Community enacted a regulation on common rules (Council Regulation (EC) No3285/94 of 22 December 1994). Uzbekistan, as a former communist country, falls under the council regulation (EC) Nr. 519/94 on common rules for imports from certain third countries. This regulation is in many respects very similar with the common rules for imports Regulation (EC) No 3285/94, namely the principle of freedom to import products originating in third countries, subject to possible safeguard measures. Furthermore, the council regulation on

common rules for imports from certain third countries emphasizes the consideration of the specific economic system in the countries in question. The surveillance measures for these certain third countries as well as the conditions for the use of safeguard measures can be stricter in detail (CR (EC) 519/94 1994).

Indeed, since the breakdown of the communist bloc, Uzbekistan made movements towards the liberalization of the economy and foreign trade, but has not yet advanced far enough to be removed from the list of countries which are in the scope of the regulation applicable to state trading countries and brought under the standard procedure. Uzbekistan is an observer government of the WTO and started accession negotiations in 1994. Uzbekistan is yet to initiate bilateral market access negotiations with interested Members (Status of accession Uz 2005).

Since 01.07.1999 there is a partnership and cooperation agreement between the European Communities and their Member States, of the one part, and the Republic of Uzbekistan, of the other part in force (EU and Uzbekistan 2005; Partnership and Cooperation Agreement: PCA 2005).

### **3.2 Relevant conditions for the import of fishery, agricultural and processed products**

In this section, some requirements for the import of fishery-, agricultural- and processed products into the European Community (EU) are addressed. Because a thorough discussion would go beyond the scope of this study, only an introductory overview of the prevailing import conditions for selected products can be given.

Every import has to meet the import- and food regulations of the European Community (EU) and also the food law of the member country of destination. Furthermore, national and international standards (e.g. Codex Alimentarius) apply. Next to the regulations of the EU, there are also EU-directives, which have to be enacted (i.e. law, regulation) by each member state and to be considered by the importing third country as well. Horizontal directives define general facts concerning several or all kinds of food and vertical directives basically regulate the composition of food (recipes) for a narrow range of products (Peter Lips 2000, p.23-26). Furthermore, the respective member countries can also have national principles and guidelines, which have to be considered by third countries.

Once imported in a member state of the EC, the mutual recognition principle in the single market is in force as well (confirmed by the Center for European Consumers, Kiel). Mutual recognition is not always automatically applicable but can be affected by the right of

the Member State of destination to verify the equivalence of the level of protection provided by the product under scrutiny, compared with that provided by its own. For example the Member State of destination imposes its own technical rules on the product in question, like the composition of the product, quality level, safety, and presentation of the product (sales name, packaging, labeling) (BM 2005; Amtsblatt 2003).

### 3.3 The EU food, food quality and customs legislation

#### Hygiene of foodstuffs

To provide a high level of protection of human health and consumers' interests, while ensuring the effective functioning of the internal market, food safety is of special importance for the European Community and its Member States.

The food scandals in the 90s highlighted the limitations of EU legislation and gave reasons for an improved recast of legislation. A legal framework covering the entire food chain through a comprehensive and integrated approach should be developed.

At present, the EU legislation passes through a compilation process. On January 28, 2002 the European Parliament and the Council passed the regulation (EC) No 178/2002 on general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. It is the linchpin of the new legislation governing food safety, forming the basis of the new approach. It establishes definitions, principles and obligations to all stages of food- and animal feed production and distribution. This regulation for the production of secure foods is in force since 2005 and replaced the guideline EWG 93/43.

On the basis of regulation No 178/2002 new controls and food hygiene rules are developed. This hygiene package will be applicable from January 2006 onwards and replace the former rules on controls and food hygiene. The new hygiene package includes:

- a new regime relating to food hygiene (Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs)
- official controls on products of animal origin intended for human consumption (Regulation (EC) No 854/2004 of the European Parliament and of the Council laying down specific rules for the organization of official controls on products of animal origin intended for human consumption; see amending acts)
- animal health rules governing the production, processing, distribution and introduction of products of animal origin for human consumption (Council

Directive 2002/99/EC of 12 December 2002 laying down the animal health rules governing the production, processing, distribution and introduction of products of animal origin for human consumption)

- official feed and food controls (Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules)

These regulations/ directive will not be analyzed in detail, because this would go beyond the scope of this study. Special attention to the new hygiene package will only be given with regard to the imports from non-EU countries: For imported products of animal origin, lists of non-EU countries from which imports are authorized are to be created. Additionally, the conditions a country need to meet to be included in these lists is to be defined. For feed and food of non-animal origin the Community can define comparable lists or other measures, if necessary. For the import of fishery products special provisions exist. Non-EU countries which wish to export goods to the EU have to undergo a compulsory Community audit on the health surveillance system. The Community inspections/ audits can be carried out throughout the food chain (LM 2005; LMhyg 2005).

### **Preparation of foodstuffs**

In the framework of the preparation of foodstuff there are several horizontal directives (per definition they define general facts concerning several or all kinds of food). Special consideration will be given to the additives. They will be listed but not analyzed in the following (selection):

- a general scheme of additives (Council Directive 89/107/EEC of 21 December 1988 on the approximation of the laws of the Member States concerning food additives for use in foodstuffs intended for human consumption (Official Journal L 40 of 11.02.1989)
- authorized colorants (European Parliament and Council Directive 94/36/EC of June 1994 on colors for use in foodstuffs; see amending acts)
- authorized sweeteners (European Parliament and Council Directive 94/35/EC of June 1994 on sweeteners intended for use in foodstuffs; see amending acts)  
– other authorized additives (European Parliament and Council Directive

95/2/EC of 20 February 1995 on food additives other than colorant and sweeteners; see amending acts)

- specific purity criteria for emulsifiers, stabilizers, thickeners and gelling agents (Council Directive 78/663/EEC of 25 July 1978 laying down specific criteria of purity for emulsifiers, stabilizers, thickeners and gelling agents for use in foodstuffs).

Some vertical directives concerning the preparation of foodstuff exist. As they regulate a narrow range of products, the relevant ones will be discussed in the following subsections of the selected single products (LMzub 2005).

### **Presentation and labeling of food**

There are some general schemes to observe concerning the presentation and labeling of food. That is e.g. the labeling, presentation and advertising of foodstuffs (directive 2000/13/EC of the European Parliament and of the Council of 20 March 2000 on the approximation of the laws of the Member States relating to the labeling, presentation and advertising of foodstuffs for sale to the ultimate consumer (Official Journal L 109 of 6.05.2001). Compulsory labeling particulars are e.g. the name under which the product is sold, a list of ingredients, the net quantity, the date of minimum durability, place of origin or provenance et al. Furthermore, it has to be paid attention to the labeling in particular. For foodstuff there exists a nutrition labeling (Council Directive 90/496/EEC of 24 September 1990 on nutrition labeling rules for foodstuffs). For alcoholic beverages other provisions apply. For some foodstuffs specific schemes exist. There are also directives, which regulate the packaging of liquids and other products (LMpres 2005).

#### **3.3.1 Fruit and vegetables**

Fruit and vegetables are covered by a common market organization. The products concerned are fresh fruit and vegetables and certain types of dried fruit. The exceptions or products not covered by this regime are potatoes, grapes, bananas, sweet corn, peas, fodder beans and olives (GMO 2005). The basic provisions are specified in the Council Regulation (EC) No 2200/96 of 28 October 1996 on the common organization of the market in fruit and vegetables; e.g. standardization of products, intervention arrangements, and arrangements concerning trade with third countries (O&G 2005). Marketing standards are enacted per regulation by the European Commission. They apply directly for every Member State and in all trade levels. Marketing standards exist for several fresh fruit and vegetables, e.g. apricots,

pears, beans, peas, cherries, carrots, tomatoes, watermelons etc. (marktO&G 2005). They regulate provisions concerning quality (e.g. the products have to be intact, sound clean, practically free from pests, free of any foreign smell and/or taste), classification (Extra Class, Class I, Class II), quality- and size tolerances, presentation, amongst others. Table 5 lists some relevant fruit/ vegetables and their respective regulations on marketing standards. To protect EC-producers from cut-price imports from third countries, an additional tax (similarly to duties) is collected, if imports are beneath a (political) desired import price. The so-called Entry-price-system<sup>1</sup> is of most importance in the sectors of fruit and vegetables. It applies for the following products (selection) named in Table 6.

Table 5: List of some relevant fruit and vegetables and their respective regulations on marketing standards

|             |   |
|-------------|---|
| Apricots    | Commission Regulation (EC) No 851/2000 of 27 April 2000 laying down the marketing standard for apricots                 |
| Pears       | Commission Regulation (EC) No 86/2004 of 15 January 2004 laying down the marketing standard for pears                   |
| Beans       | Commission Regulation (EC) No 912/2001 of 10 May 2001 laying down the marketing standard for beans                      |
| Peas        | Commission Regulation (EC) No 2561/1999 of 3 December 1999 laying down the marketing standard for peas                  |
| Cherries    | Commission Regulation (EC) No 214/2004 of 6 February 2004 laying down the marketing standard for cherries               |
| Carrots     | Commission Regulation (EC) No 730/1999 of 7 April 1999 laying down the marketing standard for carrots                   |
| Tomatoes    | Commission Regulation (EC) No 790/2000 of 14 April 2000 laying down the marketing standard for tomatoes                 |
| Watermelons | Commission Regulation (EC) No 1862/2004 of 26 October 2004 laying down the marketing standard applicable to watermelons |

Source: (marktO&G 2005; EUR-Lex 2005)

Table 6: The entry-price-system for selected products

| Product                                      | Time, when entry-prices apply |
|--|-------------------------------|
| Tomatoes                                     | all-season                    |
| Apples (pippins)                             | all-season                    |
| Pears ("pippins")                            | 01.07.-30.04                  |
| Apricots                                     | 01.06.-31.07.                 |
| Cherries, differentiated between sweet/ sour | 21.05.-10.08.                 |

Source: (EntryPrice 2005; EUR-Lex 2005)

<sup>1</sup> entry price: measurement of the average price development of all goods, which are imported into the EC by third countries

### Processed fruit and vegetable products

Processed fruit and vegetables are covered by a common market organization as well. The basic provisions are specified in the Council Regulation (EC) No 2201/96 of 28 October 1996 on the common organization of the markets in processed fruit and vegetable products (OGVerarb 2005). At present, marketing standards merely exist for dried grapes (marktO&G 2005). For processed products certain directives have to be considered additionally, depending on the processed end product. These include horizontal as well as vertical directives. In Table 7, some directives which may be of importance for the study are listed.

Table 7: Council directives for processed fruit and vegetables

|                          |   |
|--------------------------|---|
| Quick frozen products    | Council Directive 89/108/EEC of 21 December 1988 on the approximation of the laws of the Member States relating to quick-frozen foodstuffs for human consumption          |
| Fruit jams, jellies, etc | Council Directive 2001/113/EC of 20 December 2001 relating to fruit jams, jellies and marmalades and sweetened chestnut purée intended for human consumption              |
| Fruit juices             | Council Directive 2001/112/EC of 20 December 2001 relating to fruit juices and certain similar products intended for human consumption                                    |
| Making-up by volume      | Council Directive 75/106/EEC of 19 December 1974 on the approximation of the laws of the Member States relating to the making-up by volume of certain prepackaged liquids |

*Own representation (Source: EUR-Lex 2005)*

### Maximum quantity of residues (pesticides)

The maximum quantity of residues (pesticides) that can be contained in products of plant or animal origin intended for human or animal consumption will be laid down by the Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in products of plant and animal origin. Up to now, maximum quantities that apply in all Member States of the European Community are regulated on the basis of four different directives: fruit and vegetables (Directive 76/895/EEC), cereals (Directive 86/362/EEC), foodstuffs of animal origin (Directive 86/363/EEC) and plant products, including fruit and vegetables (Directive 90/642/EEC). Member States can determine higher maximum residue levels, than applied on European Community level. The future Regulation will repeal all these Directives, proposing harmonized maximum limits for all foodstuffs instead. It will include the same level of protection for animal feeding stuffs (OGPest 2005). The new regulation lays down a priori

'default' limit below 0.01 mg/kg. The respective maximum pesticide levels will be listed in the annexes. Because the completion of the annexes will last up to 12 months, a list of EU Maximum Residue Levels in force is provided in (Residue 2005). When establishing the common maximum residue levels, the maximum residue levels laid down by the Codex-Alimentarius-Commission should be observed (CR(EC)396/05 2005).

### **Trade with non-EU countries**

Imports (and exports) may be subject to an import (or export) license. The basic provisions governing license procedures are determined by the horizontal Commission Regulation (EC) No 1291/2000 of 9 June 2000 laying down common detailed rules for the application of the system of import and export licenses and advance fixing certificates for agricultural products. Furthermore, multiplicities of sector regulations, which determine license obligations for individual products, are to be considered (O&G 2005; OGVerarb 2005; general hints: ImpExp 2005).

### **Customs legislation**

The Customs legislation for fruit and vegetables is very specific and slightly complicated. The third country duty differentiates depending on the type of fruit/ vegetable. For some, tariff quotas<sup>2</sup> exist. Furthermore, some countries have tariff preferences, when importing into the EC (this could also be possible in the case of Uzbekistan). Actually, there are no import restrictions in force. Table 8 gives a rough overview of the duty rates of selected fruit/ vegetables. The listing is generalized. This was necessary, since otherwise it would have ended up in a complex table with explicit classifications (Examples: it is differentiated between sour cherries and other cherries. Dried fruit are classified in sugared and not sugared fruit. Among the sugared dried fruit it is differentiated on the basis of the amount of sugar (higher duty when a given limit is exceeded, sugar levy). On the basis of this classification, further partitions for the single fruit or group of fruit exist. In the case of mixtures more classification possibilities are given depending on the different types of fruit and nuts in the mixtures). For more detailed information (e.g. certain fruit/ vegetable, certain preparation) see also database of TARIC Consultation under (Taric 2005).

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<sup>2</sup> tariffs quota: a total or partial waiver of the normal duties applicable to imported goods, which applies to a limited quantity of goods

### 3.3.2 Fish

The common fisheries policy (CFP) has the same legal basis as the common agricultural policy. However, in contrast to the agricultural over-production, fishery suffers a scarcity of resources (Fishery 2005). The objectives of that policy are e.g. to increase the productivity, stabilize markets, supply consumers with moderate prices, assure the availability of supplies and ensure that supplies reach consumers at reasonable prices. The first common regulations for the fishery sector were established in 1970. Since then, the regulation has developed considerably. Actually, the Council Regulation (EC) No 104/2000 of 17 December 1999 on the common organization of the markets in fishery and aquaculture products is in force. The products covered by the market organization are "fishery products", which embraces catches taken at sea and in inland waters and aquaculture products. These include live, fresh or chilled, frozen, dried, salted and smoked fish and fish in brine together with crustaceans, mollusks, meal, powders, etc. The market organization regulates, amongst others, the common marketing standards and rules governing trade with non-member countries. Fishery products are allowed to be sold, if the common marketing standards concerning classification by quality, size or weight categories, packaging, presentation and labeling apply (there are new additional labeling provisions for fishery products since 2002 (FIZ 2005)). To protect the Common market, special customs arrangements concerning trade with non-EU countries apply. Furthermore, a reference price is set each year by the Commission in order to avoid disturbance of the market caused by supplies from non-EU countries. Safeguard measures may apply as well, if necessary.

Table 8: Duty rates of selected fruit and vegetables

|                         | third country duty                           | tariffs quota       |
|-------------------------|--|---------------------|
| Vegetables              |  |                     |
| Potatoes, fresh, cooled | 4,5%   |                     |
| new potatoes            | 9,6%   | 3% (up to 15/5/05)  |
| tomatoes                | standard imp. value: 113€/100kg <sup>3</sup> |                     |
| carrots, turnips        | 13,6%  | 7% (up to 31/12/05) |
| peas                    | 8%   |                     |
| beans                   | 10,4%  |                     |

<sup>3</sup> Corresponds to the third country duty of 8,8% +(2-9 € /100kg, depending on the respective entry price

## Alternative Crops for Khorezm and Opportunities on the European Market

|  |                                  |               |
|--|----------------------------------|---------------|
| vegetables, frozen   |                                  |               |
| beans  | 14,4%                            |               |
| tomatoes   | 14,4% (other vegetables similar) |               |
| Fruit  |                                  |               |
| almonds, in shell  | 5,6%                             | 2% (31/12/05) |
| almonds, shelled   | 3,5%                             | 2% (31/12/05) |
| pistachios   | 1,6%                             |               |
| dates  | 7,7%                             |               |
| figs, fresh  | 5.60%                            |               |
| figs, dried  | 8%                               |               |
| melons   | 8,8%                             |               |
| pears  | 60,7 €/100kg <sup>4</sup>        |               |
| apricots   | 20%                              |               |
| cherries   | 12%                              |               |
| mulberries   | 9,6%                             |               |
| gooseberries   | 9,6%                             |               |
| fruit/ nuts, frozen, sugared                                     | 20,8%                            |               |
| fruit/ nuts, frozen with a sugar content exceeding 13% by weight | 20,8% + 8,4 €/100kg              |               |
| other fruit/nuts, frozen (not sugared)                           | around 12-14,4%                  |               |
| dried fruit  |                                  |               |
| apples   | 3,2%                             |               |
| pears  | 6,4%                             |               |
| Others   | 2,4%                             |               |
| mixtures of nuts or dried fruit                                  | around 6,4-9,6%                  |               |

*Own representation (Source: Taric 2005).*

Various other policies also have an impact on the common fisheries policy, e.g. health and consumer protection, especially concerning quality of aquaculture and fishery products on the Community market (e.g. the Council Directive 91/67/EEC of 28 January 1991

<sup>4</sup> Corresponds to the third country duty of ca. 2,5% +(1-24 €/100kg; depending on the respective entry price

concerning the animal health conditions governing the placing on the market of aquaculture animals and products, including its amendments or specific hygiene rules). Furthermore, improvements on security- and hygiene conditions for fishers apply as well.

In the field of aquaculture, the guarantees for food safety and animal protection as well as the solution of environmental problems have top priority. As already mentioned, the Community legislation on food safety will be recasted. Regulations on residues of antibiotics and dioxin in food will be stricter. European veterinary legislation concerning animal health will be updated and the legislation on veterinary medicine will be changed. Additionally, the problems caused by the proliferation of toxic algal blooms and animal diseases have to be solved by promoting research.

As already mentioned, international standards apply as well. There exist several standards governing fishery products adopted by the codex alimentarius commission. These are e.g. Recommended International Codes of Practice for Fresh Fish, canned fish, frozen fish, smoked fish, salted fish, etc. Also, e.g. General Principles of Food Hygiene are internationally standardized by the codex alimentarius commission (Codex 2005).

Concerning customs legislation, the third country duty depends on the kind of fishery product. For fresh, cooled and frozen fish it is 8% in general (may differ in particular cases depending on the specie of fish). The third country duty for dried fish, salted fish or fish in brine as well as smoked fish goes from 12% up to 16%. Actually, there are no import restrictions in trade with fish. For more detailed information (e.g. certain specie of fish, certain preparation) see also data base of TARIC Consultation under (Taric 2005).

### **3.3.3 Cut Flowers**

Flowers are covered by a common market organization (Regulation (EEC) No 234/68 of the Council of 27 February 1968 on the establishment of a common organization of the market in live trees and other plants, bulbs, roots and the like, cut flowers and ornamental foliage; last amended by the regulation (EC) Nr. 3290/94). To facilitate their marketing within the EC quantitative standards and detailed rules for trade were laid down. Imports from third countries have to fulfill these standards/ rules (or comparable standards). Marketing standards (quality specifications) exist for fresh cut flowers and fresh foliage (Regulation (EEC) No 316/68) as well as for bulbs, tubers and tuberous roots (Regulation (EEC) No 315/68) (Flowers 2005; BluMar 2005).

The trade with this products is liberalized, that means, neither an authorization concerning foreign trade and payments law, nor a license according to EC-Law is needed,

assumed that fresh cut flowers comply with the quality specifications of the Community (BluMar 2005). The following live plants and floricultural products will be spot-checked by the Federal Agency for Agriculture and Food (BLE) when imported (a selection):

Table 9: Live plants and floricultural products which are spot-checked by the Federal Agency of Agriculture and Food (BLE), when imported

| <b>Commodity Code</b> | <b>Identification</b>  |
|-----------------------|--|
| 0603 10 10            | roses, fresh   |
| 0603 10 20            | pinks, fresh   |
| 0603 10 30            | orchids, fresh   |
| 0603 10 40            | gladioluses, fresh   |
| 0603 10 50            | chrysanthemum, fresh   |
| 0603 10 80            | Other fresh cut flowers and flower buds of a kind suitable for bouquets or for ornamental purposes |

Source: (BluMar 2005)

The third country duty for cut flowers is normally 8.5%, tariff preference is 5% (exact information under TARIC, see address below). There are no restrictions. Protective measures - but not trade barriers - may be taken in case the Community market might be disturbed. For further information about single types of cut flowers et al. please use the TARIC Consultation offered at the webpage of the EC (Taric 2005).

### 3.4 The EU market situation

#### 3.4.1 Fruit and vegetables

Information, giving an overview of the European fruit and vegetable market, was associated with some difficulties. The *Centre of Market and Price Report* (Zentrale Markt und Preisberichtsstelle - ZMP) has detailed information of the fruit and vegetable market as well as of certain fruit and vegetables and for certain Member States. On the basis of the few data and mainly specific information available for free, it was unfortunately not possible to get a good overview. Nevertheless, the ZMP has very good detailed data, which would be very useful for a detailed analysis. For example, a market balance 2004 for vegetables and fruit within Germany, the European Union and the World Market is published. Furthermore, there is a publication on the European Union and the acceding countries representing the agricultural commodity markets in digits as well as a publication comparing the agricultural commodity markets. Another publication about agriculture in the Commonwealth of Independent States (CIS), describing status and development in the twelve Member States, could be an informative lecture for further research. All these publications are with costs (30-35 €).

Fortunately, on the basis of the report from the Commission of the European Community 2001 on the agricultural situation of the European Union 2001, some non-exhaustive statements regarding the European market of fruit and vegetables can be made. Data of only few single fruit/ vegetables are noted. According to this report, the European Union is a net importer of fresh fruit and vegetables. In 2000, only about 74% of the total import volume was exported (60% in 1999, 65% in 1998). This corresponds with 3.9 million tones exported and 5.3 million tones imported. Regarding exports of fruit (excluding citrus fruit), it reported only 49% of the total imports. In 2000/2001 the production of pears was around 2.6 million tones and therewith went 5.8% up from 1999/2000. Because the author has no data about production from 2000/2001 onwards, it is not possible to make a statement concerning the tendency, although the production increased since 1997/1998. The production of apricots fell about 13% in 2000 in comparison to 1999 (but went 52% up from 1998). The tomato production in 2000/01 fell slightly (2%) related to 199/2000, but went up by 3% for Italy only (7.5million tones). The potato is a major crop in the EU. The Union is self-sufficient in potatoes excluding early varieties. In case of limited or unavailable Community output in winter and early spring, early varieties are imported from Mediterranean countries (mainly Cyprus, Egypt, Morocco and Israel). During the past few years, an annual average of some 400 000 tones of early potatoes has been imported from non-member countries (RepAgr 2005).

Regarding processed fruit and vegetables, the report states that information available remains patchy. As far as the Community is concerned, it relates almost exclusively to products qualifying for processing aid. The EC-production of tomatoes for processing was 8.4 million tons in 2000/2001 (8 million tons in 1999/2000) and therewith is second in the ranking of world production (30 million tons) behind the United States (10.2 million tons/ 11.6 million tons) and before Turkey (1.3 million tons/ 1.6 million tons). Thereafter, Community output dropped. This was the result of the reduction of concentrate (-11%) and peeled tomatoes (-6%). By contrast, production of "other products" (sauces, tomatoes in pieces, etc.) rose slightly. This product group now accounts for almost 21% of processed tomato production. Community aid was paid on only 6.9 million tons (out of 8.4 mill. t) of processed tomatoes.

### **3.4.2 Fish**

Fisheries and aquaculture are important sectors of the economy in the European Union. Their contribution to the gross national product of the Member States is approximately

1%. The European Union produces about 8 million tons of fish from fishing and aquaculture and therewith ranks third behind China and Peru. Nevertheless, the European Community remains the world's largest importer with an annual trade deficit of 7 billion Euros (Fishery 2005). Main suppliers for fishery products are Denmark, China, Norway, USA and the Netherlands (BLE 2005).

### **3.4.3 Cut Flowers**

It was very difficult to get market information about the European flower market. There exists the International Flower Trade Organization called *Union fleurs* in Brussels (<http://www.unionfleurs.com/>). Unfortunately, there are no data available concerning the international or European flower market except the statistical yearbook which was not available to us. In the Report 2001 from the Commission of the European Community on the agricultural situation on the European Union some relevant information was given. According to the Report 2001, production and trade have grown significantly in the sector of bulbs, live plants, cut flowers and foliage. The main producer in EC is the Netherlands. Regarding cut flowers, the EC is the largest market in the world. Approximately 80% of Community imports from non-member countries (they totaled 338 000 tons in 2000) are exempted from customs duty under agreements with non-member countries (e.g. with Central and South American countries, ACP States). Cyprus, Israel, Jordan, Morocco and the West Bank are free from tariffs for certain cut flowers (roses, carnations). The prevailing conditions therefore are set quotas subject to minimum import price. The European Community is mainly supplied fresh cut flowers from Kenya (around 40 000 tons), followed by Israel (around 24 300 tons) (RepAgr 2005). Some further information was given by the internet presentation of the German Association of wholesale, flower- and import trade (BGI) (BGI 2005). According to the association, flower production is outside of Germany. However, Germany is the most important country in the world concerning consumption of flowers. Considering the fact, that data about the European flower market are sparsely and that Germany is the country of highest flower consumption, the market information given in the following will merely refer to Germany. This will be skimp, because it should not be focused on Germany, but should give a brief introductory overview of the current market situation. Germany's consumption of cut flowers is about 1.8 billion Euros (BGI 2005). Admittedly, the German market for cut flowers is decreasing, which can be seen on the development of the sales volume throughout the years 1999-2002, shown in the following table 10:

Table 10: Development of the cut flower market in mill. € (sales volume)

| <b>Development of the cut flower market in mill. €(sales volume)</b> |                                    |
|--|------------------------------------|
| <b>total sales volume (mill €)</b>                                   | <b>per-capita expenditures (€)</b> |
| 1997   | 3.396 41                           |
| 1998   | 3.395 41                           |
| 1999   | 3.234 39                           |
| 2000   | 3.290 40                           |
| 2001   | 3.228 39                           |
| 2002   | 3.090 38                           |
| 2007*  | 3.089 38                           |

*Source: (BluBu 2005).*

The rate for captive flowers is stable (about 17% of the total sales in 2002). The consumption in the east of Germany is noticeable lower. Furthermore, while in the east of Germany bunch of flowers are preferred, the west favors bouquets.

Generally, mixed bunches of flowers are preferred. Considering single types of flowers, the rose is the most liked flower since years. Pinks and tulips decreased slightly (see <http://www.bgi-ev.com/direktimportstatistiken.html> for more information about German import data from third countries).

Since the 90s the BGI developed the Flower Label Program to guarantee quality and the image of cut flowers. The Flower Label Program determines directives. It comprises social and ecological standards. Still, pesticides cannot be forgone, but the measures are very strict, and problematic pesticides are excluded. More information is given on the website <http://www.flower-label-program.org/index2htm.htm>.

Many cut flowers imported into Germany are from the Netherlands. However, nearly half of the cut flowers marketed in Germany have their origin in other countries, like Ecuador, Colombia, Kenya, Zimbabwe, Israel, Spain, Turkey etc. (Label 2005). The following table gives an overview of the most important countries of production concerning import into the EC, Germany and the Netherlands.

A more detailed table is given on the webpage from (BGI 2005). It shows the development of cut flower imports from third countries to Germany. Additionally, imports from selected EC-countries are listed. As a supplement, the development of German import data of greens from third countries is available as well. Furthermore, the ZMP has published an analysis of the trade channels for flowers, ornamental plants and tree nursery products (30 e), which surely would be worth sifting through when engrossing the research on cut flowers.

Table 11: The most important countries exporting flowers into the EU - flowers in total and tons (1.000 kg)

| from:        | to: EC | to: Germany | to: The Netherlands |
|--------------|--------|-------------|---------------------|
| Kenya        | 42.263 | 2.942       | 29.793              |
| Israel       | 28.236 | 1.673       | 23.447              |
| Zimbabwe     | 19.505 | 359         | 18.745              |
| Colombia     | 17.373 | 1.752       | 3.213               |
| Ecuador      | 13.412 | 1.998       | 7.915               |
| Turkey       | 4.223  | 29          | 877                 |
| Thailand     | 3.528  | 239         | 264                 |
| Zambia       | 3.255  | 175         | 3.079               |
| Uganda       | 2.779  | 33          | 2.611               |
| Tanzania     | 2.406  | 790         | 1.604               |
| South Africa | 1.879  | 342         | 1.019               |

Source: (BGI 2005).

#### 4 RESULTS, COMMENTS AND OUTLOOK

One aim of this study was to illustrate the possibilities of alternative crop cultivation in the region Khorezm/ Uzbekistan with special regard of the prevailing local conditions temperature (hot dry summers, very cold winters), drought tolerance, frost tolerance, salt tolerance and soil type (sandy, loamy, pH 7-8).

Among the crops in question are, first of all, several kinds of fruit:

- **Mulberries** could be very interesting as they already exist for the production of silk. Especially in view of further processing (e.g. fruit juice) they could be considered, as in Europe (in particular Germany) there is a trend towards uncommon fruit and fruit juice combinations.
- **Pomegranates** could be possible for the same reason. Experts from the region named their frost sensibility, because of which they are mulch-covered in the winters.
- Other fruit may be **gooseberries** and **sour cherries**, both in natural and processed form. Concerning gooseberries, their tolerance against drought, frost and salt still has to be found out. Sour cherries are considered only because they are already cultivated. As the cultivation methods are already known, an extension would be possible. However, the data found during the research represent sour cherries as a salt- and high soil-pH sensitive crop.
- **Pistachios** may be possible, too. They prefer cool, moderate winters though, which could be a problem. Detailed data about favored temperature as well as estimations by adepts are missing. It remains unknown, if they already exist in the region.
- Also possible would be **Jujube date**, although it is slightly exotic. This date is only of economic importance in India and China. It is eaten raw, dried or candied. In view of an eventual export into the Asian market, this crop could be of interest. Additionally, their applicability as silkworm fodder is another

advantage, as silkworms are already bred for silk production. The common date palm, although salt- and high soil-pH tolerant, does not seem to be suitable, mainly because of the occurring winter frosts. The same is possibly true for **fig** trees. The winters are possibly too cold. Nevertheless, in some places of Khorezm fig trees are found, but they need to be particularly treated during the winter season (they have to be covered with soil and straw), which is very labor intensive.

- Another opportunity could be **almond** trees, which already exist, mainly in gardens. It may become too hot in the summer. Also, their salt- and frost tolerance is unclear.
- **Barley** could be an option, too - yet, normally produces low yields. It is already cultivated, and an extension could be pursued with special regard to further processing in future breweries. Additionally, it could be a good cover crop for soil conservation in agriculture. However, export is banned by the state.
- **Topinambur** is another interesting option, e.g. the utilization for the winning of alcohol by fermentation (large-scale run in France). It also gives the highest results in the fish feeding trials. Information about frost tolerance and salt tolerance are still lacking. Irrigation during drought would be necessary, although it remains unclear if it can withstand the very high temperature. Besides, already cultivated crops that are suitable under the prevailing conditions in Khorezm and for export into the EU, are options as well.

Also, **processed fruit and vegetable products** are a possibility. Factories for e.g. fruit juice, ketchup, beer, wine and vodka already exist in the region Khorezm. No research was made concerning the different types of processing, e.g. canning, drying, freezing, or concerning suitable fruit/ vegetables. A list of existing processing industries in Khorezm would be useful for a better decision making.

Furthermore, attention should be given to **safflower**. Safflower has a double utility, namely the red dyestuff of the blossoms and the oil of the embryos. The oil consists to 74% of essential linolic acids, which is highly nutrient. However, oil out of plants is banned from export. Another option could be **tobacco**, but it may be too hot during summer.

**Fish** would be possible, too. Yet it is to think of a suitable transport form. Kipper was once a flourishing industry, nevertheless the processing only works with special fish, which is specially treated. Other possibilities are cut flowers. However, further research is needed to find out suitable types of flowers, who can withstand the harsh agro-climatic conditions in Khorezm. Nevertheless, all these crops should undergo another careful attention as confirmation.

Another focus of this study was an analysis of the sales opportunities of fruit, vegetables, fish and cut flowers. Only a rough overview of the market situation was given. No trends or estimations concerning a possible demand can be made. Furthermore, the EU-legislation on food, quality and customs was investigated governing the above named product groups. Presently, the food law and food quality is in a changing process. Therefore, statements are hardly to give. Before exporting into the EU, there are a great number of regulations to observe. Import duties can easily be found with the aid of the database available on the website of the European Union. In general, import gets difficult, as soon as the European Market would be influenced negatively. The internal market is highly protected. Altogether, a concluding statement about the import of food- and non food products from Uzbekistan into the EU is not possible.

### **Comments**

The present evaluation focused on food crops. However, also nonfood crops and crops suitable for fodder or further processing should be regarded. This would possibly open further perspectives.

Furthermore, certain kinds of herbs should be observed. This investigation was excluded for this study, because herbs represent only a small market niche with low importance for the world market. Nevertheless, it would be of interest for the locals' daily diet.

In view of a possible cultivation of cut flowers it has to be mentioned that cut flowers have to be cooled continuously, meaning on site and during the transport. Both cooling procedures could be a problem for Uzbekistan.

Another comments concerns transport costs. Considering the location of Uzbekistan (doubly landlocked) the transport cost will generally be high. The more processed a product the more its value and the lower the share of the transport cost. Therefore, processed products seem to be a good option regarding export. However, import costs into the EU increase the more processed a product.

### **Outlook**

The first part of this study provides a first evaluation regarding the cultivation of alternative crops in the Khorezm region (Uzbekistan). Nevertheless, supplementary scientific research is absolutely necessary. Beneath the prevailing local conditions, special regard has to be given to further conditions of cultivation of the crops in question (e.g. vegetation period,

dormancy period, etc) and lacking data of the tables 1-4 have to get completed. Also, data about the potential yield as well as production price would be necessary. Furthermore, the acceptance by the farmers of the respective alternative crops has to be investigated in order to not only get theoretical alternatives.

The second part of this study provides a first evaluation regarding sales opportunities for selected product groups on the European market. The focus lies on giving an overview of the conditions governing food law and quality as well as customs legislation and the market situation of these groups. Nevertheless, it is absolutely necessary to make a specific and exact investigation of the respective products themselves (not only for the product group). This includes import regulations as well as a complete market analysis. This seems to be essential for more reliable statements about opportunities of Uzbek agrarian products in the EC.

In addition, special attention should also be given to the traditional agrarian products planted in the region Khorezm, because these have the advantage of already being accepted by the farmers. Furthermore, other sales markets would also be worth investigating, e.g. the markets of Uzbekistan's neighboring countries or the Asian market. Further research must also focus on the transport systems and transport costs.

## 5 APPENDICES

## APPENDIX A

Table 12: Plants tolerant of arid and semi-arid conditions: crops usable for food.

| Plants tolerant of arid and semi-arid conditions: Crops usable for food |                                 |
|---|---------------------------------|
| Botanic name  | Common name                     |
| <i>Acacia albida</i>  | Applering acacia; Gao           |
| <i>Acacia karoo</i>   |                                 |
| <i>Acanthosicyos horrida</i>  | Narra; Narra melon              |
| <i>Acanthosicyos naudiniana</i>   | Herero cucumber                 |
| <i>Adansonia digitata</i>   | Baobab                          |
| <i>Agave angustifolia</i>   |                                 |
| <i>Albizia chevalieri</i>   |                                 |
| <i>Albizia harveyi</i>  |                                 |
| <i>Alhagi graecorum</i>   | Manna tree, Camel thorn         |
| <i>Aloe secundiflora</i>  |                                 |
| <i>Amaranthus spp., e.g. A. edulis</i>                                  | Amaranth (grain amaranth)       |
| <i>Amygdalus communis</i>   |                                 |
| <i>Anacardium occidentale</i>   | Cashew nut tree                 |
| <i>Annona chrysophylla</i>  | Wild custard apple              |
| <i>Annona reticulata</i>  | Custard apple, Bullock's heart  |
| <i>Annona squamosa</i>  | sweet sop; sugar apple          |
| <i>Anogeissus leiocarpus, syn. A. schimperi</i>                         |                                 |
| <i>Antidesma venosum</i>  |                                 |
| <i>Apodanthera undulata</i>   | Melonloco; wild cucurbit        |
| <i>Argania spinosa</i>  | Argan tree                      |
| <i>Balanites aegyptiaca</i>   | desert date                     |
| <i>Bauhinia esculenta; syn. Tylosema esculentum</i>                     | marama bean                     |
| <i>Bauhinia rufescens</i>   |                                 |
| <i>Bauhinia thonningii</i>  | camel foot                      |
| <i>Benincasa hispida</i>  | wax gourd                       |
| <i>Bombax buonopozense</i>  | Kapok tree                      |
| <i>Bombax costatum</i>  | kapok tree; silk cotton         |
| <i>Borassus aethiopum</i>   | Borassus palm; African fan palm |
| <i>Boscia senegalensis</i>  |                                 |

## Alternative Crops for Khorezm and Opportunities on the European Market

|  |                               |
|--|-------------------------------|
| <i>Brassica carinata</i>                               | Ethiopian mustard, cabbage    |
| <i>Brassica juncea</i>                                 | Indian mustard                |
| <i>Bridelia ferruginea</i>                             | Bridelia                      |
| <i>Bridelia micrantha</i>                              | Bridelia                      |
| <i>Bridelia scleroneuroides</i>                        | Bridelia                      |
| <i>Brosium alicastrum</i>                              | Ramon                         |
| <i>Bussea massaiensis</i> ; syn. <i>Peltophorum m.</i> |                               |
| <i>Butyrospermum paradoxum</i>                         |                               |
| syn B. Parkii; B.niloticum                             | shea butter tree              |
| <i>Cadaba farinosa</i>                                 |                               |
| <i>Cajanus cajan</i>                                   | Pigeon pea; Red gram          |
| <i>Canavalia ensiformis</i>                            | Horsebean; Jackbean           |
| <i>Canavalia gladiata</i>                              | swordbean                     |
| <i>Capparis decidua</i>                                | capers                        |
| <i>Capparis kirkii</i> ; syn. <i>Maerua kirkii</i>     |                               |
| <i>Capsicum anuum</i>                                  | chillies; chiltepine          |
| <i>capsicum minimum</i> ; syn. <i>C. frutescens</i>    | chillies; birdts eye chillies |
| <i>Carissa edulis</i>                                  |                               |
| <i>Carthamus tinctorius</i>                            | Safflower                     |
| <i>Cassia occidentalis</i>                             | Coffee senna; stinking weed   |
| <i>Ceiba parvifolia</i>                                | pochot; kapok                 |
| <i>Ceratonia siliqua</i>                               | Carob                         |
| <i>Cercis sliquastrum</i>                              | judas tree                    |
| <i>cicer arietinum</i>                                 | chick pea, yellow gram        |
| <i>citrullus colocynthis</i>                           | bitter apple, thumba          |
| <i>citrullus lanatus</i>                               | matira                        |
| <i>Citrus grandis</i>                                  | Pummelo                       |
| <i>Cnidoscolus chayamansa</i>                          | Chaya; Tree spinach           |
| <i>Colocasia esculenta</i>                             | Taro; Cocoyam; Dasheen        |
| <i>Combretum altum</i>                                 | Landaga                       |
| <i>Combretum fragrans</i>                              |                               |
| <i>Combretum micranthum</i>                            | Landaga                       |
| <i>Combretum nigricans</i>                             |                               |
| <i>Copernica cerifera</i>                              | Carnauba was plam             |

## Alternative Crops for Khorezm and Opportunities on the European Market

|  |                                 |
|--|---------------------------------|
| <i>Cordeauxia edulis</i>   | Yeheb                           |
| <i>Cordia abyssinica</i>   |                                 |
| <i>Cordia ovalis</i>   |                                 |
| <i>Cordia rothii</i>   |                                 |
| <i>Cordia sinensis</i>   |                                 |
| <i>Coriandrum sativum</i> ; syn. <i>C. majus</i> ; <i>Selinum coriandrum</i> | Coriander                       |
| <i>Crambe abyssinica</i>   | Abyssinian kale; Crambe         |
| <i>Crambe kilimandscharica</i>   |                                 |
| <i>Crataeva adansonii</i>  |                                 |
| <i>Crocus sativus</i>  | Saffron                         |
| <i>Cucurbita digitata</i>  | Finger gourd                    |
| <i>Cucurbita foetidissima</i>  | Buffalo gourd                   |
| <i>Cuminum cyminum</i>   | Cumin                           |
| <i>Cyamopsis tetragonoloba</i> Guar;   | cluster bean                    |
| <i>Cyphostemna maranguensis</i>  |                                 |
| <i>Dactyloctenium aegyptium</i>  |                                 |
| <i>Daniella oliverii</i>   |                                 |
| <i>Digitaria exilis</i>  | Hungry rice                     |
| <i>Diopyros barteri</i>  | Flintbark                       |
| <i>Diopyros mespiliformis</i>  | West African ebony              |
| <i>Dobera glabra</i> ; syn. <i>D. roxburghii</i>                             |                                 |
| <i>Dolichos lablab</i> ; syn. <i>Lablab purpureus</i>                        | Bonavist bean; Lablab bean      |
| <i>Dolichos uniflorus</i>  | Horse gram                      |
| <i>Dovyalis abyssinica</i>   |                                 |
| <i>Echinochloa frumentacea</i>   | Japanese barnyard millet        |
| <i>Echinochloa turnerana</i>   | Channel millet; Channel sorghum |
| <i>Ehretia cymosa</i> ; syn. <i>E. silvatica</i>                             |                                 |
| <i>Eleusine coracana</i>   | Finger millet; African millet   |
| <i>Emblica officinalis</i> ; syn. <i>Phyllanthus emblica</i>                 | Emblic; Indian gooseberry       |
| <i>Ephedra foliata</i>   | Persian ephedra                 |
| <i>Eragrostis tef</i>  | Teff                            |
| <i>Erythrina mildbraedii</i> ; syn. <i>E. altissima</i>                      | Senegal coral tree              |
| <i>Erythrina rotunda-obovata</i> ; syn. <i>E. melanacantha</i>               | Flame tree                      |
| <i>Erythrina verna</i>   | Mulungu                         |

Alternative Crops for Khorezm and Opportunities on the European Market

|   |  |
|---|--|
| <i>Eucalyptus melliodora</i>  | Yellow box                                   |
| <i>Eucalyptus oleosa</i>  | Giant mallee                                 |
| <i>Fagara zanthoxyloides</i> ; syn. <i>Zanthoxylum zanthoxyloides</i> |  |
| <i>Feretia apodanthera</i>  | Feretia                                      |
| <i>Feretia canthioides</i>  | Feretia                                      |
| <i>Ficus capensis</i> ; syn. <i>F. sur</i>                            | Bush fig; Wild fig                           |
| <i>Ficus gnaphalocarpa</i> ; syn. <i>F. sycomorus</i>                 | Bush fig; Sycomore fig                       |
| <i>Ficus ingens</i>   | Parasite fig; Strangling fig; Bark cloth fig |
| <i>Ficus nekbuda</i> ; syn. <i>F.utilis</i>                           | Bark cloth fig                               |
| <i>Ficus platyphylla</i>  | Flake tree; Red cane rubber tree             |
| <i>Ficus sycomorus</i> ; syn. <i>F. gnaphalocarpa</i>                 | Sycomore fig; Bush fig                       |
| <i>Ficus vallis-choudae</i>   |  |
| <i>Ficus vasta</i>  |  |
| <i>Ficus vogelii</i>  |  |
| <i>Ficus wakefieldii</i>  | Wild fig                                     |
| <i>Fluggea virosa</i> ; syn. <i>Securinega virosa</i>                 |  |
| <i>Fouquieria splendens</i>   | Coachwhip; Devils walking stick              |
| <i>Gardenia jovis-tonantis</i>  | Gardenia                                     |
| <i>Gardenia ternifolia</i>  | Gardenia                                     |
| <i>Grewia bicolor</i>   |  |
| <i>Grewia carpinifolia</i>  |  |
| <i>Grewia fallax</i>  |  |
| <i>Gerwia lilacina</i>  |  |
| <i>Grewia mollis</i>  |  |
| <i>Grewia retinervis</i>  |  |
| <i>Grewia tenax</i> ; syn. <i>G. populifolia</i>                      |  |
| <i>Grewia villosa</i>   |  |
| <i>Guizotia abyssinica</i>  | Niger seed                                   |
| <i>Gypsophila rokejeka</i>  | White soap root                              |
| <i>Helianthus annuus</i>  | Sunflower                                    |
| <i>Hibiscus cannabinus</i>  | Kenaf; Deccan hemp                           |
| <i>Hibiscus sabdariffa</i>  | Sour-sour; Roselle                           |
| <i>Hymenocardia acida</i>   |  |

Alternative Crops for Khorezm and Opportunities on the European Market

|   |                                  |
|---|----------------------------------|
| <i>Hyphaene coriacea</i> ; <i>Hyphaene compressa</i>            | Doum palm                        |
| <i>Hyphaene thebaica</i>  | Egyptian doum palm; Ginger bread |
| <i>Hyphaene ventricosa</i>                                      | Fan palm; Vegetable ivory palm   |
| <i>Indigofera cordifolia</i>                                    | Indigo                           |
| <i>Ipomoea batatas</i>  | Sweet potatoe                    |
| <i>Jatropha phyllacanta</i>                                     | Favela                           |
| <i>Kerstingiella geocarpa</i>                                   | Haussa groundnut                 |
| <i>Lannea acida</i>   |                                  |
| <i>Lannea alata</i>   |                                  |
| <i>Lannea discolor</i>  | Live long; Treegrape             |
| <i>Lannea microcarpa</i> ; syn. <i>L. oleosa</i>                |                                  |
| <i>Lannea triphylla</i>   |                                  |
| <i>Lannea velutina</i>  |                                  |
| <i>Lathyrus sativus</i>   | Grass pea; Chickling vetch       |
| <i>Launaea taraxacifolia</i>                                    | Wild lettuce                     |
| <i>Lens culinaris</i> ; syn. <i>L. esculenta</i>                | Lentil                           |
| <i>Leptadenia hastata</i> ; syn. <i>L. Lancifolia</i>           |                                  |
| <i>Lycium depressum</i>   |                                  |
| <i>Lycium fremontii</i>   | Desert wolfberry                 |
| <i>Maerua angolensis</i> ; syn. <i>M. tomentosa</i>             | Bead maerua                      |
| <i>Maerua crassifolia</i> ; syn. <i>M. senegalensis</i>         |                                  |
| <i>Maerua kirkii</i> ; syn. <i>Capparis kirkii</i>              |                                  |
| <i>Mangifera indica</i>   | Mango                            |
| <i>Manihot esculenta</i> ; syn. <i>M. utilissima</i>            | Cassava                          |
| <i>Martynia parviflora</i> ; syn. <i>Proposcidea parviflora</i> | Devilts claw                     |
| <i>Maytenus senegalensis</i>                                    |                                  |
| <i>Medemia argun</i>  | Argoun palm                      |
| <i>Mimosa dulcis</i> ; syn. <i>Pithecellobium dulce</i>         | Madras thorn; Manila tamarind    |
| <i>Momocordia foetida</i>                                       |                                  |
| <i>Momocordia trifoliolata</i>                                  |                                  |
| <i>Moringa oleifera</i>   | Drumstick; Horse-radish tree     |
| <i>Moringa peregrina</i>  | Ban tree; Egyptian ban-oil tree  |
| <i>Moringa stenopetala</i>                                      | Cabbage tree                     |
| <i>Nauclea latifolia</i> ; syn. <i>Sarcocephalus esculentus</i> | African peach; Country fig       |

## Alternative Crops for Khorezm and Opportunities on the European Market

|  |  |
|--|--|
| <i>Neocarya macrophylla</i>  |  |
| <i>Neurada procumbens</i>  |  |
| <i>Olea europaea var. africana</i>   | Wild olive                             |
| <i>Olea europaea</i>   | Olive                                  |
| <i>Opuntia coccinillifera</i>  | Nopal                                  |
| <i>Opuntia dilenii</i>   | Prickly pear                           |
| <i>Opuntia ficus-indica</i>  | Indian pear; Prickly pear              |
| <i>Opuntia moniliformis</i>  | Prickly pear; Tuna                     |
| <i>Opuntia nigricans</i>   |  |
| <i>Opuntia vulgaris</i>  | Barberry fig; Sour prickly pear        |
| <i>Ornithogalum trichophyllum</i>  | Ornithogalum; Star of Bethlehem        |
| <i>Ornithopus sativus</i>  | Seradella                              |
| <i>Panicum</i> spp.  | Panic grass                            |
| <i>Panicum miliaceum</i>   | Millet; Proso millet; Broomcorn millet |
| <i>Panicum miliare</i> ; syn. <i>P. sumatrense</i>                           | Little millet                          |
| <i>Parinari curatellifolia</i>   |  |
| <i>Parinari excelsa</i>  |  |
| <i>Parkia clappertoniana</i> ; syn. <i>P. filicoidea</i>                     | African locust bean                    |
| <i>Paspalum scrobiculatum</i> ; syn. <i>P. commersonii</i>                   | Kodo millet; Scrobic                   |
| <i>Peltophorum massaiensis</i> ; syn. <i>Bussea m.</i>                       |  |
| <i>Pennisetum glaucum</i>  | Pearl millet                           |
| <i>Pennisetum typhoides</i> ; syn. <i>P. americanum</i> ; <i>P. spicatum</i> | Bulrush millet                         |
| <i>Peponium vogelii</i>  |  |
| <i>Phaseolus aconitifolius</i> ; syn. <i>Vigna aconitifolia</i>              | Moth bean                              |
| <i>Phaseolus acutifolius</i>   | Tepary bean                            |
| <i>Phaseolus filiformis</i>  | Desert bean                            |
| <i>Phaseolus lunatus</i>   | Lima bean                              |
| <i>Phaseolus mungo</i> ; syn. <i>Vigna mungo</i>                             | Black gram; Urd                        |
| <i>Phaseolus radiatus</i> ; syn. <i>Vigna radiata</i> ; <i>Vigna aureus</i>  | Green gram; Mung bean                  |
| <i>Phaseolus ritensis</i>  | Desert bean                            |
| <i>Phaseolus trilobus</i>  | Pillepesara                            |
| <i>Phaseolus vulgaris</i> ; syn. <i>P. esculentus</i>                        | Common bean; Roko bean; Haricot bean   |
| <i>Phoenix dactylifera</i>   | Date palm                              |

Alternative Crops for Khorezm and Opportunities on the European Market

|   |                                  |
|---|----------------------------------|
| <i>Phoenix reclinata</i>                                    | Wild date palm                   |
| <i>Phyllanthus floribundus</i> ; syn. <i>P. muelleranus</i> |                                  |
| <i>Phyllogeiton discolor</i>                                |                                  |
| <i>Pisum sativum</i> ; syn. <i>P. abyssinicum</i>           | Abyssinian pea                   |
| <i>Prosopis cineraria</i> ; syn. <i>P. spicigera</i>        | Ghaf; Jand                       |
| <i>Prosopis pallida</i> ; syn. <i>P. limensis</i>           | Algarrobo                        |
| <i>Prunus arabica</i> ; syn. <i>P. spartioides</i>          |                                  |
| <i>Prunus microcarpa</i>                                    | Little cherry                    |
| <i>Psidium guajava</i>                                      | Guava                            |
| <i>Psophocarpus tetragonolobus</i>                          | Winged bean; Goa bean            |
| <i>Pterocarpus lucens</i>                                   |                                  |
| <i>Rhus natalensis</i> ; syn. <i>R. incana</i>              | red currant                      |
| <i>Ricinodendron rautanenii</i>                             | Mongongo tree                    |
| <i>Rosmarinus officinalis</i>                               | Rosemary                         |
| <i>Rumex hymenosepalus</i>                                  | Wild rhubarb                     |
| <i>Saba florida</i>   |                                  |
| <i>Sabal mexicana</i>                                       | Mexican palmetto; Texas palmetto |
| <i>Salsola kali</i> ; syn. <i>S. iberica</i>                | Russian-thistle; Tumbleweed      |
| <i>Salvadora persica</i>                                    | Toothbrush tree                  |
| <i>Sclerocarya birrea</i> ; syn. <i>Spondias birrea</i>     |                                  |
| <i>Sclerocarya caffra</i>                                   | Cider tree; Morula               |
| <i>Securinega virosa</i> ; syn. <i>Fluggea virosa</i>       |                                  |
| <i>Sesamum indicum</i> ; syn. <i>S. orientale</i>           | Simsim; Sesame; Til              |
| <i>Sesbania sesban</i> ; syn. <i>S. aegyptiaca</i>          | Sesban                           |
| <i>Setaria glauca</i>                                       | Cat-tail millet                  |
| <i>Setaria italica</i>                                      | Fox-tail millet                  |
| <i>Solanum incanum</i>                                      | Asind; Sodom apple               |
| <i>Solanum nigrum</i>                                       | Black nightshade                 |
| <i>Sorghum bicolor</i> ; syn. <i>S. vulgare</i>             | Sorghum                          |
| <i>Sorghum cernuum</i>                                      | Egyptian millet; White durra     |
| <i>Sorghum durra</i>  | Durra                            |
| <i>Sphenostylis stenocarpa</i>                              | African yam bean; Gierigieri     |
| <i>Spondias birrea</i> ; syn. <i>Sclerocarya birrea</i>     |                                  |
| <i>Sterculia setigera</i>                                   | Sterculia                        |

## Alternative Crops for Khorezm and Opportunities on the European Market

|  |                                    |
|--|------------------------------------|
| <i>Sterospermum kunthianum</i>                                     |                                    |
| <i>Syzygium guineense</i>  |                                    |
| <i>Talinum portulacifolium</i> ; syn. <i>T. cuneifolium</i>        |                                    |
| <i>Tamarindus indica</i>   | Tamarind                           |
| <i>Tecoma stans</i>  | Trumpet bush; Yellow elder         |
| <i>Telfairia occidentalis</i>                                      | Fluted gourd; Fluted pumpkin       |
| <i>Thymus vulgaris</i>   | Common thyme                       |
| <i>Tribulus terrestris</i> ; syn. <i>T. saharae</i>                | Caltrops; Puncture vine            |
| <i>Trigonella</i> spp.   |                                    |
| <i>Trigonella foenum-graecum</i>                                   | Fenugreek                          |
| <i>Triticum durum</i>  | Durum wheat                        |
| <i>Uapaca kirkiana</i>   | Wild loquat                        |
| <i>Uapaca togoensis</i> ; syn. <i>U. somon</i>                     | Wild loquat                        |
| <i>Vangueria</i> spp.; e.g. <i>V. edulis</i> ; <i>V. tomentosa</i> |                                    |
| <i>Vangueria infausta</i>  | Wild medlar                        |
| <i>Vatovaea pseudolablab</i>                                       |                                    |
| <i>Vernonia amygdalina</i>   | Bitterleaf                         |
| <i>Vicia equina</i> ; syn. <i>Vicia faba</i>                       | Horse bean; Faba bean              |
| <i>Vicia sativa</i>  | Common vetch                       |
| <i>Vigna friesiorum</i>  |                                    |
| <i>Vigna membranacea</i>   |                                    |
| <i>Vigna unguiculata</i>   | Cow pea; Long bean; Marble pea     |
| <i>Vigna vexillata</i>   |                                    |
| <i>Vitex doniana</i> ; syn. <i>V. cuneata</i>                      | Black plum                         |
| <i>Voandzeia subterranea</i> ; syn. <i>Vigna subterranea</i>       | Bambara groundnut                  |
| <i>Washingtonia filifera</i>                                       | Desert fan palm                    |
| <i>Washingtonia robusta</i>  |                                    |
| <i>Xanthium pungens</i>  | Cocklebur                          |
| <i>Xanthium spinosum</i>   | Cocklebur                          |
| <i>Xanthium strumarium</i>   | Cocklebur                          |
| <i>Ximenia americana</i>   | Tallow wood; Wild lime; Wild olive |
| <i>Ximenia caffra</i>  | Sour plum; Wild plum               |
| <i>Yucca baccata</i>   | Blue yucca                         |
| <i>Yucca brevifolia</i>  | Joshua tree                        |

## Alternative Crops for Khorezm and Opportunities on the European Market

|   |  |
|---|--|
| <i>Yucca filifera</i>   | Soapweed; Yucca                        |
| <i>Yucca glauca</i>   | Soapweed; Yucca                        |
| <i>Yucca schidigera</i>   | Mohave yucca                           |
| <i>Zanthoxylum spinifex</i>   |  |
| <i>Zea mays</i>   | Maize                                  |
| <i>Zizyphus lotus</i>   |  |
| <i>Zizyphus mauritiana</i> ; syn. <i>Z. jujuba</i> , <i>Z. abyssinica</i> | Chinese date; Indian plum; Jujube tree |
| <i>Zizyphus mucronata</i>   | buffalo thorn                          |

*With the aid of the nomenclature and potential uses in the guide to plants tolerant of arid and semi-arid conditions from (Weiss 1987), this list of 172 crops usable for food was selected. Data taken from (Weiss 1987).*

APPENDIX B

Table 13: Presently cultivated crops in Khorezm (by John Lamers)

| Presently cultivated crops in Khorezm (by John Lamers) |                        |            |
|--|------------------------|------------|
| Food crops   | Fodder crops           | Cash crops |
| Winter wheat   | Alfalfa                | Cotton     |
| Sorghum  | Maize                  | Sugarbeet  |
| Rice   | Fodder beet            | Sunflower  |
| Potato   | Fodder oats            |            |
| Soya beans   | Fodder wheat (rainfed) |            |
| Tomato   |                        |            |
| Cucumber   |                        |            |
| Black raddish  |                        |            |
| Carrot   |                        |            |
| Cabbage  |                        |            |
| Onion  |                        |            |
| Bean   |                        |            |
| Mung bean  |                        |            |

Source: table from John Lamers (sent by Email). The table shows food- and fodder crops which, according to John Lamers, are presently cultivated in Khorezm

Table 14: Presently cultivated crops in Khorezm (by Ihtiyor Bobojonov)

| Presently cultivated crops in Khorezm (by Ihtiyor Bobojonov) |                    |                          |
|--|--------------------|--------------------------|
| 1. Cotton  | 12. Sunflower      | 22. Flowers              |
| 2. Wheat   | 13. Cucumber       | 23. Turnip               |
| 3. Rice  | 14. Cabbage        | 24. Radish               |
| 4. Maize   | 15. Pumpkin        | 25. Pepper               |
| 5. Sorghum   | 16. Black eye bean | 26. Egg plant, aubergine |
| 6. Potato  | 17. Sugar-beet     | 27. Barley               |
| 7. Tomato  | 18. Mung-been      | 28. Oats                 |
| 8. Melons, watermelons                                       | 19. Fennel         | 29. Tobacco, domestic    |
| 9. Onion   | 20. Parsely        | 30. Chick-pea            |
| 10. Carrot   | 21. Garlic         | 31. Strawberry           |
| 11. Alfalfa  |                    |                          |

Source: table from Ihtiyor Bobojonov. The table shows presently cultivated crops in Khorezm according to the share of the total planned area (decreasing order). As the ranking is set by Bobojonov's estimations, it may differ from rankings according to statistical data

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