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KOSOVO NEW OPPORTUNITIES FOR AGRICULTURE PROGRAM

SAFFRON TECHNICAL ASSISTANCE REPORT



JULY 2011

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DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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BACKGROUND

USAID supports economic growth in Kosovo through programs that strengthen and improve competitiveness of Kosovo agribusinesses, improve the business environment, and encourage local economic development. Accordingly, USAID/Kosovo has awarded Tetra Tech ARD the task order for the New Opportunities in Agriculture in Kosovo Program. The goal of the Program is to increase economic growth in Kosovo through expanded, environmentally sustainable production and sales of value-added agricultural products by enabling producers and processors to compete regionally and globally.

One of the new crops recommended for introduction into Kosovo in USAID's Agricultural Strategy, the AgStrat report dated 2009, was saffron. Apart from cultivation by a very few smallholdings, there have been no attempts to grow saffron in Kosovo. Accordingly, the Program has sought technical assistance to promote and train growers on new technologies for the production of saffron in Kosovo.

PURPOSE OF ASSIGNMENT

The purpose of this STTA assignment was to provide technical assistance for the introduction of a new crop, namely saffron, and new production technologies for saffron in Kosovo. Saffron production will be promoted in four fields with four different growers each planting 0.25 hectare for a total of one hectare. Planting will begin in late July. Saffron corms will be purchased using grant funds and imported into Kosovo for distribution to the four saffron growers. The Program is supporting technical assistance to promote and train the growers on new technologies for the production of saffron.

Saffron is a new crop for Kosovo so the technical assistance must fully analyze the feasibility of planting saffron in the country to determine if saffron can be a viable and sustainable crop with a competitive advantage. Through this proposed activity the Program will promote the diversification of horticultural products in Kosovo and thereby contribute to the development of Program Component 2.

The Program has begun implementing this proposed activity by contracting an expert in saffron production, who has designed the plots, supplied the contacts to buy saffron corms and provided technical advice to selected producers at the beginning of the production season. This consultant has also developed a handbook for saffron producers.

Owing to procurement problems, the saffron corms were not delivered to Kosovo until after the departure of the consultant that provided the STTA. Accordingly the originally anticipated task of inspecting the corms, supplied by Green Garden Co. in Holland, was not performed.

EXECUTIVE SUMMARY

This assignment aimed to investigate the possibility of growth and development of saffron as a new crop under Kosovo environmental conditions, and to provide technical assistance in the use of new production technologies to the four farmers selected by the Program. A total area of 1ha (0.25 ha for each farm) is planned for this purpose. Corms will be purchased based on USAID grant funds and imported to Kosovo.

During the assignment, all of the proposed grantees to whom corms will be distributed were visited. The soil conditions and terrain were reviewed and all sites were deemed suitable for production. In cases where the soil was considered too heavy and with slow drainage, recommendations were given to the farmers to plant the corms on raised beds. As part of the survey, the consultant also visited the Dragash region of Kosovo which is at a higher elevation than the proposed plots; it was recommended that trials should also be carried out in that region, such elevation having lower humidity levels that are particularly conducive to good saffron production.

It is important when introducing saffron for the first time that detailed analysis is performed to assess the quality of saffron being produced. Accordingly leading laboratories were visited; some were short of essential equipment needed to fulfill this role. Recommendations were made as to additional equipment to be provided.

Technical and financial assistance are very important during the first years of saffron planting. Profitable saffron crops will only be achieved with a lot of care and patience. Training sessions must be held for farmers covering good growing practices, processing methods, storing and packaging materials, criteria for analyzing quality, factors influencing quality, traceability procedures, identification of market niches and development of international trade relations.

The risks or difficulties associated with creating a sustainable new crop are access to export markets, and market insecurity. If it is decided to produce high quality saffron in Kosovo for the international market, it is essential to improve the competitiveness of saffron spice at the international level by developing a brand name or an organic label. The latter implies producing saffron strictly according to organic agriculture techniques. The local market also has to be promoted to absorb production if surplus exists. Farmers need to guarantee an appropriate, regular quantity of high quality saffron so as to maintain the interest of saffron dealers.

If that is achieved, saffron could become a real source of income for small farmers in Kosovo.

FIELD ACTIVITIES TO ACHIEVE PURPOSES

1. Field visits

To meet the objectives of this assignment, surveys, field observations and diagnosis were conducted with the help of NOA Program's Value Chain Coordinator (VCC), Mr. Faton Nagavci. Those missions were conducted over five days to meet saffron producers and farmers interested in growing saffron, as well as to conduct diagnoses at the plot level. A separate visit was made to Dragash to assess the possibility of growing saffron at that altitude. For a report on the field data analysis, see Annex I. A detailed record of visits and activities carried out during the consulting period is attached in Annex II.

2. Laboratory visits

Some visits were made to soil and plant testing laboratories:

- Agriculture Institute of Kosovo, where saffron quality from Prizren was analyzed in 2006. This testing laboratory does not possess sufficient resources to conduct saffron analysis.
- Agrovet laboratory, where saffron analysis were done (Sulejman Hoti's saffron sample on 21 July 2011). Those analyses have to be repeated another time in another laboratory so as to have more accurate results.
- Laboratory of "Sara & Meti", where chemical soil analyses were done. This laboratory showed no interest in doing saffron analysis when contacted.
- Hydrometeorology Institute of Kosovo, from where some climatic data for Pristina and Peja were collected.
- The National Institute of Public Health. This laboratory could feasibly conduct saffron quality analysis given the scientific material they have. However, the Program would need to provide them with appropriate technical assistance and training to help them conduct an accurate saffron quality analysis.

A report on International Standards for Saffron compared to saffron samples taken from Kosovo is provided in Annex VI.

3. Meetings

A number of people were contacted during the three weeks assignment to discuss the introduction of a saffron crop. Important discussions were conducted with directors of laboratories, buyers and exporters of medicinal and aromatic plants, in order to have an overview of the feasibility and sustainability of saffron crop in the regions visited. In addition to the farmers selected for trial plots, others contacted included:

- Mr Nuridin Bajrami, Manager of Hit Flores- Bio Herb and Fruits in Dragash
- Mr Arafat Bajrami, Sales and Marketing, Hit Flores-Bio Herb and Fruits.
- Dr Sylë Tahirsylaj, Director of Hidrometeorologic Institute of Kosovo
- Mr Tony Papageorgiou, saffron trader from Greece
- Dr. Begolli Bardhi, Chief of Analytical Laboratory at Institute of Agriculture, Peja
- Dr. Xhevdet Elezi, Manager, AGROVET S.C., Testing Laboratory, Pristina
- Dr. Ljubomir Dimovski, Consultant from Greece
- Dr. Fadi Musa, "Sara & Meti Laboratory, Pristina

A list of persons and documents consulted during (and for documents, before) the assignment is presented in Annex V.

4. Presentation

A Power point presentation was organized for different stakeholders to inform them about the feasibility of growing saffron in the regions visited. The consultant also advised the potential growers on technical practices used in growing saffron, including post-harvest methods and an overview on saffron producing countries in the world. The meeting addressed planting methods, suitable methods of saffron drying, the quality analyses and market opportunities. The following groups/persons participated during the presentation:

- Farmers growing saffron
- Head of analysis laboratories
- Saffron trader from Macedonia
- Government officials from MAFRD
- Representatives of USAID
- NOA staff

The Power Point Presentation was delivered in the Consultant's native language and translated into Albanian. The presentation in the Albanian language may be found at: <http://noakos.com/reports/Saffron-Presentation.ppt>

In addition, an overview of saffron and its production which was provided to the Program team is presented in Annex IV.

TASK FINDINGS AND RECOMMENDATIONS

The following tasks were specified in the Scope of Work for the assignment:

1. *Design the demo plots and select the optimal saffron varieties in conjunction with the assistance of the VCC and VPS;*
2. *Supervise demo plot planting.*
3. *Supply the required contact to purchase saffron corms to the selected producers. The purchase of saffron corms will be done by grant funds provided by the program;*
4. *Inspect the saffron corms for quality, disease, vigor and size.*

Tasks 1 to 4 were not performed completely because corms could not be delivered during the period of the assignment. The consultant did advise on the variety of corms to be purchased before coming to Kosovo [*crocus sativus*]. Demonstrations and discussions with farmers interested in growing saffron were conducted at field level, and the design of the demo plots were approved.

5. *Provide technical training and advice to the producers that will enable them to produce an optimal crop in terms of quality and quantity:*

For this task, field visits were performed and discussions had about the best techniques for producing a high yield and good quality of corms and saffron. A booklet was produced which includes best technical practices for growing saffron : soil selection and preparation, corms plantation, quality of corms used, crop management, processing methods, saffron quality, analysis and control, saffron storage, machinery and equipment needed for saffron processing.

The brochure may be found at:

<http://noakos.com/reports/Saffron-Handbook.docx>;

A short paper on Management Techniques may also be found at:

<http://noakos.com/reports/Management-techniques-of-saffron.docx>

6. *Organize exchange visits to producers participating in the demonstration plots that include other potential producers;*
7. *Organize field/open days to share information with other growers;*

For tasks 7 and 8, a Power Point presentation was given on saffron growing practices and processing for different stakeholders to inform them about the results of the feasibility growing saffron in the regions visited, and on technical conduct of saffron, with post picking methods and an overview on saffron producing countries in the world.

The following groups/persons participated at the presentation :

- Farmers growing saffron
- Head of analysis laboratories
- Saffron trader from Macedonia
- Government officials from MAFRD
- Representative of USAID
- NOA staff

The Presentation may be found at:

<http://noakos.com/reports/Saffron-Presentation.ppt>

8. *Organize field/open days to share information with other growers :*

A field visit was conducted in order to present recommendations to farmers who had been visited during the first week of this assignment. A quality analysis on some saffron samples from Rahovec region was then conducted in the three testing laboratories cited above to determine the quality of the saffron produced under Kosovo environmental conditions.

9. *Conduct a pre-feasibility study for saffron in Kosovo.*

Based on data collected from observations done at farm level, the yield increase over years, discussion with farmers, corms produced in the field, the yield obtained by farmers and the saffron quality analysis done in a testing laboratory, it was concluded that saffron is a viable crop that could be produced in Kosovo. However, more technical and financial assistance are needed for farmers growing saffron for at least 3 years so as to assure sustainability of this crop.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTIVITY

Saffron is a labor-intensive crop. It needs about 200 - 250 annual skilled person-days for one hectare (depending on the production). Saffron gross margin during the first year is negative if the yield is under 5 kg/ha. But the second year the gross margin is higher.

To achieve a positive gross margin from the first year, farmers should use:

- high quality corms - healthy corms with a weight > 8 g, and a diameter > 25 mm ;
- a sowing density of about 50 corms/m² so as to achieve a high yield;
- a well drained soil with a loose texture;
- good quality farm manure to be applied on time;
- irrigation when there is no rainfall during the critical saffron periods,
- combat regularly weeds, hoe, and check for diseases and rodents;
- skilled manpower during harvesting.

Farmers should also:

- avoid harming plants by stepping on them, or destroying plant leaves when harvesting flowers as not to harm corm production,
- have skilled manpower to separate stigma from flowers and styles without destroying stigma quality by hands.
- know well good drying techniques for saffron
- check the saffron quality on the basis of the saffron chemical specifications norms for the stability of the product quality
- conserve saffron stigma in hermetic bottle in a cool and dry place with a temperature between 5 and 10°C

The risks or difficulties associated with saffron spice are access to the export markets, and the market insecurity. If Kosovo is to produce high quality saffron for the international market, it is essential to improve the competitiveness of saffron spice at the international level by developing a brand name or an organic labeling by producing saffron according to organic agriculture techniques. The local market also has to be promoted to absorb production if surplus exists. The development of high quality corm production at the local level is also of great importance to lower the dependence to the external market for corms. To achieve these goals the following is necessary:

- Training Sessions must be held for farmers covering: technical procedures for growing saffron, processing methods, criteria for identification and analysis of the quality of saffron, factors influencing the composition and quality of saffron, traceability procedure to increase saffron value in order to avoid fraud in regard to the product's origin, identification of market niche and development of international trade relations and corms production methods.
- Improvement of storage conditions: the use of good structures for saffron storage has a direct impact on the quality of saffron (avoid moisture and dust).
- Support farmers with good packaging material: Saffron should be packaged in only new and clean boxes made from glass or plastic, or any other suitable material used for food packaging. The container should be firmly closed. Each

container should contain saffron of one grade designation (from one field) only. A label must be put on each container with date of packing, crop year production, net weight, names and address of the producer, name of the product (in case he has one);

- Support to producers in processing, and commercialization by looking for new opportunities to market the product;
- Improvement of saffron production and processing by gathering in the future farmers in small cooperatives with a centre for saffron storage and drying for better management;
- Continuous evaluation of saffron produced under Kosovo's particular environmental conditions.. Such quality evaluation is necessary to be informed about the quality stability and ways to improve the methods used to process the saffron before selling the product to external markets. Support to public or private testing laboratories to enable them to conduct quality saffron analysis is essential.
- Make a short study tour for selected farmers to some saffron-producing countries such as Morocco during the period of saffron harvesting, stigma separation and drying process (October/November). The selected farmers should be accompanied by agricultural staff that can technically assist them in growing saffron once they return to Kosovo.

In the near future, more agro-environmental and socio-economic zones have to be tested for saffron and corms with high quality production, especially in higher altitudes where the humidity is lower. When an agro-environmental zone is identified for its high saffron and corms qualities production, a socio-economical study must be conducted to select the best grouping of farmers that will be able to grow saffron, considering availability of family hand laborers especially women, a real interest to grow a new crop, and good neighbor relations. A description of such a socio-economic survey that should be conducted is included in Annex III.

Technical and financial assistance are very important during the first years of saffron planting because saffron crops need a lot of patience to achieve a high profit. They need good quality corms, technical and financial assistance, appropriate processing material, packaging and labeling and linkages to reliable markets. Farmers need to guarantee an appropriate, regular quantity of high quality saffron so as to maintain the interest of saffron dealers. If that is achieved, saffron could become a real source of income for small farmers in Kosovo.

ANNEX I: Field Data Analysis

a. Climate

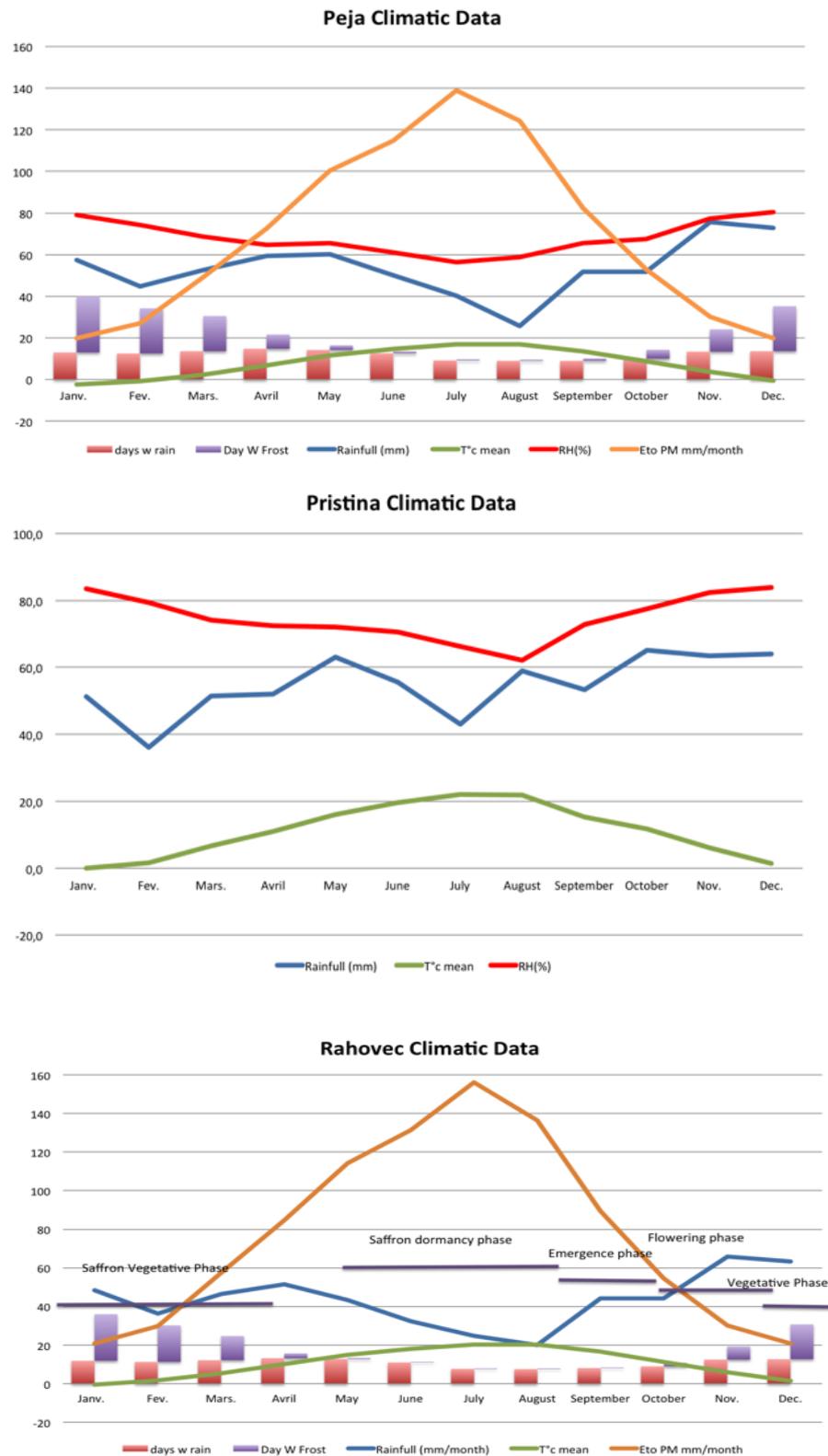


Figure 1. Climatic conditions in Peja, Pristina and Rahovec

Data are collected from Technical Report on the Hydrology of the Drini River Basin, Zhong-Hue FANG & Kujtim ZENA, 2009-2010 (For Rahovec and Peja), Data collected from the Hydrometeorological Institute of Kosovo (For Pristina and RH% of Peja) (P75 : 75% Probability)

According to the figures obtained from the available data found in Rahovec, Peja and Pristinia regions, the mean temperature during summer (saffron dormancy phase) doesn't go beyond 20°C. Saffron crop can stand many ranges of temperatures. No study has related the base temperature required for different saffron phases during all its developmental cycle, nor the minimum and the maximum tolerable temperatures were identified.

For the Rahovec and Peja regions, the climatic demand (ETo) is higher than the rainfall during March (Rahovec) and during September (Rahovec and Peja). Saffron needs water during those periods. So irrigation must be applied during those two months in case there is no rainfall.

b. Soil: Chemical soil analysis for the selected 4 farmers by the project

Table 1. Chemical soil analysis for Mr Fahim Rexhepi soil- Region Celine, Rahovec

<i>Element</i>	<i>Value</i>	<i>Interpretation</i>
pH (water)	8.31	Basic soil
EC (mmhos/cm)	1.20	No saline soil
Organic Matter (%)	3.9	Moderately Rich
C/N	9.5	GOOD mineralisation
K2O (mg/100g)	8.97	Low
P2O5 (mg/100g)	12.6	Medium
CEC (meq/100g)	23.6	A : High nutrient holding capacity. Indicating a soil with increasing clay content. Normal range: 15-40
Mg ⁺⁺	17%	In the norms
K ⁺	0.8%	VL
Na ⁺	27%	VH (normal <6%)
Ca ⁺⁺	54%	L
<u>Oligoelements (ppm)</u>		
Fe	1.4	L (A : 2.5-5.0)
Mn	4.13	A (A>2)
Cu	0.5	L (A>2)
Zn	2.01	A (A>2)

L: Low; A: Adequate, VH: Very High, VL: Very Low

Chemical analysis of this soil is generally good saffron crop. But soil is a heavy one with a slow drainage. So, the planting of saffron crop must be done on ridges as to avoid corm decomposition by a long contact with water in the soil, which can increase fungus development and rotting corms.

The height of the ridge might have to be about 25 to 30 cm. Distance between ridges is about 50 cm (if prepared manually) and more than 50 cm if prepared mechanically. He can use twin lines in one ridge separated by 20 cm (on the same ridge), so the density will be 40 corms/m². Planting depth is 20 cm below the top of the ridge. But he has to hoe his ridges at the end of August and first ten days of September in order to prevent saffron emergence damage. Ridge height should be maintained and hoed throughout the harvest, winter and spring seasons.

Table 2. Chemical analysis for Mr Sulejman Hoti' soil- Region Krusha e Madhe, Rahovec

<i>Element</i>	<i>Value</i>	<i>Interpretation</i>
pH (water)	8.04	Slightly Basic soil
EC (mmhos/cm)	1.27	no saline soil
Organic Matter (%)	3.6	Moderately Rich
C/N	13.9	GOOD mineralisation (C/N< 25)
K ₂ O (mg/100g)	31.20	Very low
P ₂ O ₅ (mg/100g)	17.90	Medium
CEC (meq/100g)	32.57	A : High nutrient holding capacity. Indicating a soil with increasing clay content
Mg ⁺⁺	20%	In the norms
K ⁺	1.8%	VL
Na ⁺	16%	VH (normal <6%)
Ca ⁺⁺	61%	L
<u>Oligoelements (ppm)</u>		
Fe	0.5	L (A : 2.5-5.0)
Mn	2.9	A (A>2)
Cu	0.8	L (A>2)
Zn	1.3	L (A>2)

L: Low; A: Adequate, VH: Very High, VL: Very Low

Also the chemical analysis for this soil fits the saffron crop. The soil is good (no physical analysis has been done), not heavy, with a good drainage. For this farmer, he can plant his saffron on flat bed. Corms have to be planted in furrows formed with a plough. They are put upright in the row, 10 cm apart, on a depth of 15 cm. The distance between rows is 20 cm. A density of 50 corms/m² in manual conduct is suitable to obtain a good yield, with 50 cm between each 5 rows to facilitate harvesting and weeding. A light harrowing follows corm planting. In case he uses mechanisation for weeding and hoeing, a distance of 60 cm must separate twin rows of saffron.

Table 3. Chemical analysis for Mr Selami Hoti' soil- Region Krusha e Madhe, Rahovec

<i>Element</i>	<i>Value</i>	<i>Interpretation</i>
pH (water)	7.25	Neutral soil
EC (mmhos/cm)	1.06	No saline soil
Organic Matter (%)	4.1	Rich
C/N	17	GOOD mineralisation
K ₂ O (mg/100g)	21.3	VL
P ₂ O ₅ (mg/100g)	12.6	Medium
CEC (meq/100g)	21,7	A : Normal range: 15-40 :High nutrient holding capacity. Indicating a soil with increasing clay content
Mg ⁺⁺	23%	In the norms
K ⁺	0.7%	VL
Na ⁺	23%	VH (normal <6%)
Ca ⁺⁺	53%	L
<u>Oligoelements</u> (ppm)		
Fe	0.40	L (A : 2.5-5.0)
Mn	2.42	A (A>2)
Cu	0.11	L (A>2)
Zn	1.63	L (A>2)

L: Low; A: Adequate, VH: Very High, VL: Very Low

The chemical analysis shows also a suitable soil for saffron. But as observed at the field level, the soil has a crusty structure, which characterises compacted soils. This farmer has not yet prepared his field for saffron plantation. He still has corn plantings on it. He has to wait one more month after ploughing and adding farm manure, before planting his saffron. He has to plant his saffron on ridges as the first farmer (Fahim Rexhepi).

Table 4. Chemical analysis for Mr Halit Avdijaj' soil- Region Syne, Istog

<i>Element</i>	<i>Value</i>	<i>Interpretation</i>
pH (water)	6.89	SLIGHTLY ACID TO NEUTRAL
EC (mmhos/cm)	1.56	No saline soil
Organic Matter (%)	2.85	Medium
C/N	9.4	GOOD mineralisation
K ₂ O (mg/100g)	24.7	VL
P ₂ O ₅ (mg/100g)	18.30	Medium
CEC (meq/100g)	39.7	A : High nutrient holding capacity. Indicating a soil with increasing clay content: Normal range: 15-40
Mg ⁺⁺	1.08%	H Norms (10-20)
K ⁺	8%	VL Norms (3-8)
Na ⁺	65%	LITTLE High (normal <6%)
Ca ⁺⁺		Desirable range DR (65-80)
<u>Oligoelements (ppm)</u>		
Fe	0.9	L (A : 2.5-5.0)
Mn	3.64	A (A>2)
Cu	0.3	L (A>2)
Zn	1.08	L (A>2)

L: Low; A: Adequate, VH: Very High, VL: Very Low

The chemical analysis shows a slightly acidic soil, which could have a very light impact on the saffron quality. The farmer could lime his soil and not apply a big quantity of farm manure. For this farmer also, he can plant his saffron on flat bed as described for the farmer Sulejman Hoti.

The chemical soil analysis for all the new saffron plantations showed a soil pH varying between slightly acidic to slightly basic. Those soils pH are generally in the norm of saffron soils. Low level of potassium is observed on soils analysed. Some scientific studies showed that potassium has no influence on saffron stigma yield. Also saffron is believed to be a low nutrient requiring plant.

A fertile soil is the basis for good saffron production, but organic manure, particularly cow manure, is tested to be the best support for saffron as a nutrient supplier. One ton of cow manure releases 3,4 kg of N, 1,3 kg of P₂O₅ and 3,5 kg of K₂O. Cow manure added to the new saffron crop plantation must be used 1 to 3 month before corm planting as to be in an advanced state of decomposition at the time of saffron crop planting and it is best to incorporate it into the soil as soon as it is brought to the field, to avoid the loss of nitrogen. Inadequately fermented fresh manure causes corm decay.

Manure should be used in ample amounts: an average manure application is about 30-50 tons/ha, for nutrient release and improvement of the physical properties of the soil. The dispersal of manure could be done with a mechanical manure spreader.

c. Saffron crop situation in some Kosovo Regions, incl. those selected by the project

Table 5. Saffron production and type of market for some small saffron plantation in Kosovo

Producer	Region	Altitude (m)	Area (ha)	Plantation date	Hand Labour	Yield kg/ha	Market
Fehim Rexhepi	Celine, Rahovec	315	0.05	2010	Family	NC	International
Sylejman Hoti	Krusha e Madhe Rahovec	304	0.06	2008	Family	8.3	International and local
Nazush Hashani	Mucivrrc, Kamenice	493	0.30	2009	Family	0.8	International
Musa Thaqi	Mucivrrc, Kamenice	493	0.30	2009	Family	1.5	International

NC: Not communicated

Saffron gave a good yield (8.3 kg/ha) on a 3 years old saffron plantation in Krush e Madhe, Rahovec for the farmer Sulejmane Hoti. This result shows that the farmer has a good knowledge about technical conduct of saffron and that saffron crop is a viable culture in that region.

d. Quality of saffron produced under Kosovo agro-environmental conditions

A sample was collected from Rahovec region (harvest 2010) and analysed on 21 July 2011, for moisture content and for the main saffron components: Picrocrocin (Flavour), Safranal (Aroma) and crocins (colour Strength) at the testing laboratory “AgroVet”, Pristina. At this testing laboratory, they don’t have all the ISO standrads for testing others characteristics for the technical specification of saffron. Nevertheless, we tried to measure moisture and the main saffron componenets using a spectrophotometer “Dr Lange Spectrophotometre UV/VIS Cadas 200”. Results of this analysis show very high quality saffron (Grade I) (Table 6). The moisture of the sample is lower than the ISO norms so the farmer has to control his drying by weighing his sample (if it is possible) during drying in oven as to meet ISO/TS standards. This analysis has to be conducted again in another laboratory more accurate preferably the “National Institute of Public Health” as to confirm the results obtained for the main saffron components (picrocrocine, safranal and crocins) and to complete the analysis according to the ISO norms. But this institute doesn’t have ISO standards for completing the analysis (ISO 928, Spices and condiments — Determination of total ash ; ISO 930, Spices and condiments — Determination of acid-insoluble ash ; ISO 941, Spices and condiments — Determination of cold water-soluble extract and ISO/TS 3632-1, Saffron (*Crocus sativus* L.) — Part 1: Specification). The Institute of Agriculture of Kosovo, during 2006 conducted an analysis on saffron quality. - Annex VI. But actually the laboratory doesn’t have those ISO standards when we asked for the analysis of the new sample. They even don’t have any specific filtrations membranes, necessary for the analysis.

Table 6. Saffron quality analysis according to ISO/TS 3632-2: Sample obtained from Sulejmane Hoti, Krusha e Madhe, Rahovec region.

Character	ISO 3632 STANDARD VALUES			SAFFRON from Sulejmane Hoti production (2010) Grade I
	Grade I	Grade II	Grade III	
Moisture	12%	12%	12%	8,8 %
Picrocrocine	70	50	44	101
Safranal (min-max)	20-50	20-50	20-50	43
Crocins	190	170	150	272

e. Observations done on the selected farms

1. Agronomic

- Soils analysed have a slightly acid, neutral pH to lightly basic, with a medium to good organic matter with a good mineralization. Soils are not salty. The Cation Exchange Capacity (CEC) is in the normal range, shows an adequate to high nutrient holding capacity indicating soils with increasing clay content
- Water is not a limiting factor to grow saffron in the region visited. Nevertheless, Saffron need irrigation only during septembre and March where the climatic demande is higher than the precipitation (figures 1)

Remarks: Saffron crop prefers calcarous, deep, friable, low-density, and well-drained soils with high organic content. Saffron can be cultivated practically anywhere, except in areas with heavy-clay soil, where poor drainage may lead to corm rotting and diseases, unless the cultural practices have to adapt to this kind of soil.

2. Post harvest

- Quality of saffron in the analysis presented in Table 6, shows a high quality saffron (Grade I) based on coloration, Taste and odour according to the norms ISO/TS3632-2. But this analysis has to be confirmed by another analysis in another laboratory.
- According to some farmers, the quality of saffron produced in the regions Rahovec and Kamenice have good quality based on trader's interest.

Remarks: Drying will have to be properly controlled to meet the standards.

3. Socio-economic

- The price of corms is very high, and constitute about more that 60% of total charges for 1ha of saffron plantation, which can limit the saffron extension;
- Families are sufficiently large. There will be obviously no problem of manpower for small saffron plots (about 10 ares to 20 ares for farms based only on family hand labour)

Remarks: Some saffron producers have to produce good quality corms if they have more disposable area; Family hand labour has to be trained on saffron harvesting and processing.

4. Market

- All the four farmers producing saffron have a connection with an international buyer

(Suisse, France, Germany)

- Reasons for choosing to plant saffron are the demand by saffron buyers. The idea to grow saffron came from buyers from outside the country who noticed that saffron is a profitable crop to grow in Kosovo (most of the farmers asked do not have an exact idea about the price of their own production sold in the international market)
- *Remarks:* In general farmers do not know much about saffron market but they accept what price traders offered to them. According to some saffron growers, marketing of saffron spice is a major problem because the price offered is low due to the lack of knowledge about the international saffron market. One farmer at Rahovec has sold one kilo of its 2010 productions of about 3500 Euro/kg. For him it is a low price. He could reach the price of 5500 Euro/kg or more with the saffron quality he produces.

f. Risks that might limit saffron to be expanded in the region

- Non availability and the price of corms;
- Lack of knowledge about the crop, crop production, processing technologies, uses and commercialisation;
- Losses due to rodent attacks. A farmer in Dragash has abandoned his saffron field because of rodent attacks.

g. Major conclusion

This major conclusion is based on :

- The diagnosis conducted at saffron level plots;
- The probable quality analysis of saffron produced during 2010 from saffron plots in Krusha Madhe and also on the observation of the saffron produced from Kamenica, and a sample analysis from Prizren conducted during 2006;
- The quality of corms produced after two years of plantation;
- The yield obtained in one exploitation (8 kg/ha) at Rahovec e Madhe;
- The discussion with farmers and their willingness to grow saffron;
- The actual demand of the buyers and their interest to buy Kosovo saffron.

Saffron crop can succeed and be developed in the regions visited where it is actually grown (Rahovec and Kamenica). However, a lot of integrated work actions have to be done to make a big success of this crop in Kosovo.

h. Recommendations

The new farmers have to produce their saffron as an organic crop for the traceability of the product and because of the quality observed, in case they want to have an organic labeling for their product at international level.

Farmers selected by the USAID project should be technically and financially assisted during all the post-harvest actions and product commercialization, for the success and the sustainability of saffron crop in the region.

ANNEX II: Detailed Records of Visits

Program of the mission to Kosovo

From 4 July to 22 July 2011

Day	Program schedule
4 July 2011	<p>Visit to NOA' office, meeting with NOA and USAID team Schedule program establishment of the 3 weeks of the assignment with Mr Faton Nagavci, NOA value Chain Specialist.</p> <p>Preparation of a general survey</p>
5 July	<p>Visit, accompanied by Mr Faton Nagavci, NOA value Chain Specialist, to two farmers in Kamenica: Mr Musa Thaqi and Mr Nazush Hashani in Mucivrrc, Kamenice, both produce saffron on 0.30 ha.</p> <p>Meeting with Mr Tony Papageorgion a Greek saffron trader</p>
6 July	<p>Visit accompanied with Mr Faton Nagavci, NOA value Chain Specialist and Mr Mike Kimes, Chief Technical Officer, to Krusha e Madhe, Rahovec to Sylejman Hoti farm, who has 0.06 ha saffron and Mr Selami Hoti, farmer interested to grow saffron and belongs to a cooperative for vegetables.</p> <p>Visit to one farmer in Celine, Rahovec Mr Fehim Rexhepi – Agro-Celina: Fruit and Vegetable collection Center- who has a very small trial on saffron on 5 ares. He wants to plant saffron on 0.4 ha.</p>
7 July	Handbook preparation
8 July	<p>Visit to Syne, Istog to meet Mr Halit Avdijaj, head of a company of medicinal and aromatic plants, which is established in different part of Kosovo. Its company collect and medicinal and aromatic plants, they also domesticate some of medicinal and aromatique plants and do some culture. They sell dried plants to Germany.It has a total area of 55ha. He wants to plant saffron in a plot on 0.50 ha. He uses workers from families living around his farm. The maximum area that he plans to grow with saffron is about 30 ha with cooperatives. He has sprinkler irrigation. He has a good knowledge of the international market.</p>
9 July	Preparation of Handbook for the producers
11 July	<p><u>Morning:</u> Preparation of Handbook for the producers</p> <p><u>Afternoon:</u> Visit to Hydrometeorology Institute of Kosovo</p>
12 July	<p><u>Morning:</u> Finalizing Handbook for the producers</p> <p><u>Afternoon:</u> Visit to two private labs – owned by Fadil Musa and Xhevdet Elezi</p>
13 July	Preparation of the presentation for meeting with stakeholders of the

	saffron value chain
14 July	<p>Visit, accompanied by Mr Faton Nagavci, NOA value Chain Specialist, to Dragash (more than 1000 m of altitude) to a compagni called "Hit Flores", leader in processing of medical herbs and mountainous fruits in Kosovo. A visit to his field with Berries to see if saffron could be planted. The soil is very acidic, so saffron can't be tested.</p> <p>A visit was also done in the same region to a parcel where saffron was planted. The grower (from Prizren) abandoned his saffron crop because of rodent attacks and the need of hand labour.</p>
15 July	Meeting with stakeholders of the saffron value chain including USAID and MAFRD. Power Point presentation
16 July	Mission report writing
18 July	Mission report writing
19 July	Finalizing Mission report
20 July	Present recommendations to producers in Rahovec Municipality
21 July	Saffron quality analysis in Testing laboratory AGROVEC » S.C. Pristina
22 July	Saffron quality analysis in Testing laboratory in the Agriculture Institute of Kosovo, Peja.

ANNEX III : Socio-Economic Summary Survey

Studime socio-ekonomike, me fermeret e interesuar per futjen dhe zgjerimin e kultivimit te shafranit ne Kosove

HYRJE

Për të futur një kulture te re në një rajon të caktuar duhet të merren parasysh mundesite fizike te rajonit sikur: (klima, llojet e tokes, mundësitë e ujitjes...), kërkesë te madhe te produktit ne treg (ne vend dhe jashte vendit), por edhe aspektet socio-ekonomike sikur: (fuqia punetore, posedimi i teknikes nga ana e fermerve, siperfaqja e tokes, kulturat e praktikuara, shkalla e interesimit te perhapjes se metodes se re...). Me qëllim që të njihemi me keto aspekte socio-ekonomike, kemi parapare qe te bejme nje studim me tetë fermere ne rajonet e Rahovecit, Kamenicës, Prizrenit dhe Istogut. Objektivat e këtij hulumtimi të shkurte do të na japin një ide të përgjithshme, duke marre parasysh mundesin e kultivimit te shafranit dhe vazhdimesine e prodhimit te saj nga fermeret e interesuar. Studimi do te zhvillohet tek fermeret qe kane shfaqur interesim per kultivimin e shafranit. Ky studim do te jap nje pasqyre per prodhuesit e mundshem te kultivimit te shafranit.

Pershkrimi i shkurter i operacionit

Gjate vizitave te fermereve kemi mbledhur te dhenat e meposhtme: cfare fuqie punetore kane, kushtet, kultivimet kryesore qe i kane bere deri tani, makineria e shfrytëzuar.

Kushtet per futjen e nje kulture te re sic eshte shafrani

- ✓ Njohja e mire e cultures se shafranit
- ✓ Nevoja per te permisuar nivelin e jetes nga te ardhurat qe sjelle kultivimi i shafranit.
- ✓ Vet fermeri te perfitoj te nga kultivimi i kesaj kulture
- ✓ Perparësia e kesaj kulture ndaj kulturave tjera konkurrenente qe gjenden ne treg.
- ✓ Rolin qe mund te luaj kjo kultur per bashkimin e fermerve ne koperativa dhe organizata-shoqata.
- ✓ Vazhdimesine e kultivimit te kesaj kulture.
- ✓ Nevojat per punimin e kesaj kulture jane te larta dhe kjo rrite kerkesen per punetore, ne vecanti te femrave dhe te rinjeve, e cila mundeson kthimin ne biznesin familjar dhe stabilizimin e te rinjeve te cilet cdo dite e me shume kane deshire ta braktisin fshatin.

Kushtet qe duhet permbushur prodhuesit per te mundesura mbjelljen e shafronit

- ✓ Nje nder kriteret kryesore eshte mundësia per ujitje, duke pasur parasysh nevojen e kesaj kulture per ujitje gjate periudhave kritike.

- ✓ Diponueshmeria e fuqise punetore ne rajon dhe menyra e pageses.
- ✓ Anetaresimi ne koperativa: ky kriter eshte marre ne konsiderat sepse anetaresimi ne nje koperative lehteson perdorimin e teknologjise, gjithashtu mundeson zgjidhjen e problemit te tregut per produktin.
- ✓ Tregtia me bime aromatizuese dhe mjeksore ose bime te tjera. Shume fermer pervec prodhimeve tjera bujqesore bejne tregti edhe me bime aromatike dhe mjeksore. Kjo lehteson tregtine e produktit te shafranit.
- ✓ Lloji i tregut te synuar.

Pervoja e meparshme e prodhuesve sa i perket kultures se shafranit

Perparesite ne planin ekonomik, problemet tashme te identifikuara ne treg, cmimet ne treg, disponueshmeria e fares, etj.

ANNEX IV: An Overview of the Saffron Crop

Crocus sativus (Saffron) is a monocot triploid species belonging to the Iridaceae family. The flowers of the saffron plant are bisexual and sterile. It possesses red-orange tripartite stigmas. Saffron crop is propagated by corm multiplication. This plant is not known to grow in the wild, but has been cultivated for its stigma for a long time by human help. It is highly valued as a culinary spice for its flavouring, taste and colouring properties. Though, due to its analgesic and sedative properties, traditional medicines have used saffron for the treatment of numerous illnesses for centuries. Currently, strong scientific researches are being carried out on saffron nutraceutical, chemopreventive, and pharmaceutical properties. Interest in the impact of saffron carotenoids on human health is growing due to their high antioxidant capacity.

Saffron crop is said to be native to the Mediterranean environment that is characterized by cool to cold winters, with rainfall during autumn, winter and spring, and warm dry summers with very little rainfall. It is also adaptable to temperate and sub-tropical climates. It grows also in arid and semi-arid lands. Its water requirements are relatively low of about 300 to 400 mm a year, and it is cultivated under irrigated or rainfed conditions. It can be grown on soils varying from sandy to well-drained clay loamy soils. It doesn't fit on heavy, bad drained soils.

Saffron plant is a fall flowering semi-perennial crop. It blooms only once a year, in autumn, and the rest of its growing season is constituted by the initiation, filling up and maturing of the daughter corms. It spends a long period of dormancy (aestivation) during summer (About 5 month).

Saffron is considered as a social crop which could be proposed as an alternative, for the diversification of agricultural production, for small farm, in order to improve the quality of farmer life by its high added value, especially for women farmers who are the most required in picking up flowers and in stigma separation procedure. It can ensure the sustainable use and conservation of the area since it is a semi-perennial no polluting and no devastating culture. It has a low input of fertilizers (only organic manure) and no chemicals when conducted in dry area in well-drained soils. This plant can be developed in marginal soils. It is well adapted to low input cropping systems. It requires family hand labour to make production more profitable. Between 100,000 to 200,000 flowers are required to yield one kilogram of Saffron spice (about 600,000 dried stigmas). Medium yield are around 10 kg of Saffron/hectare, but varying very much (from 2 to 25 kg/ha) between countries, lands, seasons, and agronomic practices.

Saffron crop is actually cultivated in Iran, India, Greece, Morocco, Spain, Pakistan, Turkey, Italy, Switzerland, and Central Asia. The world's total annual saffron production is estimated at 205 tons per year, with Iran as the big producer country in the world with more than 47,000 ha of land under saffron cultivation (Ehsanzadogh et al., 2004). European countries produce 3% of the total saffron production with a current productions in Spain, less than 1 t, Italy 100 kg, Turkey 10 kg, France 4/5 kg, and Switzerland 1 kg. This decrease in saffron production in Europe is due particularly to the rise of hand labour costs that has made production unbeneficial, in spite of the high market price of saffron. An intensive and high-priced skilled hand labour of at least 15 working days, per kilogram of dry Saffron spice, is required for flower picking and stigma separation. Also the very painful bending position of the flower pickers, besides the very short picking period conducted from the early morning hours during 20-30 days by flowering season (about 0.25–1.5 million flowers per hectare), make this crop not attractive to workers. Also, the mechanisation of flower picking in field has not succeeded.

To help farmers maintain growing saffron, the European Union has awarded the designation "Protected Designation of Origin (P.D.O. or D.O.P.)" as to increase saffron value in the market. For example "Azafrán de La Mancha", for the Spanish saffron, the Greek under the name "Krokos Kozanis", the Italians "Zafferano dell'Aquila", "Zafferano di San Gimignano", "Zafferano di Sardegna" and "Zafferano delle Colline Fiorentine", Switzerland "saffron of the Mund". France

pursues a protected status for its miniature productions (Gâtinais, Quercy, Limousin, Provence, Lauragais). Saffron corms are also produced and commercialized from the Netherlands and UK (Wales). New rise of saffron cultivations (on very small area) are appearing in Australia (Tasmania), New Zealand, USA (Pennsylvania, Texas, California), Argentina, Chile, Peru, and Bolivia.

Saffron prices at wholesale and retail rates range from €770/ US\$1,100 to €7,700/ US\$11,000 per kilogram. In Western countries, the average retail price is €1,550/US\$2,200. Its high value makes saffron the object of frequent adulteration and fraud, which is one of the main problem of this product.

Saffron trade is regulated by several quality standards, which take into account several parameters, such as the stigmas colouring power, flavour and taste, style length and flower remains (NCCEA, 1999; ISO, 2003).

ANNEX V: List of Persons encountered and Documents consulted

Persons Encountered:

Mr. Halit Avdijaj Syne village Istog, Agroproduct-Syne, future saffron producer
Mr. Sylejman A.Hoti Krushë e Madhe village Prizren, future saffron producer
Mr. Selami Xh. Hoti Krushë e Madhe village Prizren, Saffron producer
Mr Fehim Rexhepi, Agro-Celina Company, Saffron producer
Mr Nazush Hashani, Mucivrrc, Kamenice, Saffron producer
Mr Musa Thaqi, Mucivrrc, Kamenice, saffron producer
Mr Nuridin Bajrami, manager of Hit Flores- Bio Herb and Fruits in Dragash
Mr Arafat Bajrami, Sales and Marketing, Hit Flores- Bio Herb and Fruits in Dragash
Dr Sylë Tahirsylaj, Director of Hidrometeorologic Institute of Kosovo
Mr Tony Papageorgiou, saffron trader from Greece
Dr. Begolli Bardhi Chief in Analytical laboratory at Institute of Agriculture Kosovo Peja
Dr Xhevdet Elezi, Manager, N. Sh. « AGROVET » S.C. Testing Laboratory, Pristina
Dr Ljubomir Dimovski, Consultant
Dr. Fadi Musa laboratory of “Sara & Meti”, Pristina

List of documents consulted:

Kosovo Agricultural Opportunities Strategy, Final Deliverable, Pristina, Kosovo, 2010
Technical Report on the Hydrology of the Drini River Basin, Annex 24, Zhong-Hue FANG & Kujtim ZENA Reporting Period: November 2009 to January 2010
The story of introduction of saffron in Kosovo, By Bill Foxton OBE.
Environmental Review & Assessment Checklist, “AGROPRODUKT SYNE” Company
Grant for purchase of Saffron Crop
Agro-Celina Company, Grant for purchase of Saffron Crop

ANNEX VI: Quality Analysis of a Saffron Sample

International Standards for Saffron and Test Results of Kosovo Saffron			
Characteristics	Kosvo Saffron Test Results	Requirements according to ISO	Test Method
	Saffron in filaments		
Moisture and volatile matter, % (m/m), max	8.1	12	ISO 3632-2, clause 9
Total ash, % (m/m), on dry basis, max	5.6	8	ISO 928 & ISO 3632-2 clause 10
Acid-insoluble ash, % (m/m), on dry basis, max			
Categories I and II	1.08	1,0	ISO 930 & ISO 3632-2, clause 11
Categories III and IV		1,5	
Solubility in cold water, % (m/m), on dry basis, max	55	65	ISO 941
Safranal, expressed as direct reading of the absorbance at about 330 nm, on dry categories			
min.	30	20	ISO 3632-2, clause 13
max.		50	
Colouring strength, expressed as direct reading of the absorbance of crocine at about 440 nm, on dry basis, min.			
Category I	160	190	ISO 3632-2, clause 13
Category II		150	
Category III		110	
Category IV		80	
Total nitrogen, % (m/m), on dry basis, max.1)	2.75	3	ISO 1871
Crude fibre, % (m/m), on dry basis, max.1)	5.1	6	ISO 5498
Classification of saffron in filaments			
Floral waste % (m/m) max.			
Category I	0.2	0.5	
Category II		4	
Category III		7	
Category IV		10	
Extraneous matter % (m/m) max.			
Category I	0.08	0.1	
Category II		0.5	
Category III		1	
Category IV		1	

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