

SAFFRON HERITAGE SITE OF KASHMIR IN INDIA

GIAHS Saffron Site Report (Part-1)

31st May, 2012

Summary

One of the legacies of saffron farming practice for centuries in and around the Pampore Karewas of Kashmir in India is that this ancient farming system continues to inspire family farmers and local communities through their livelihood security that it provides for more than 17,000 farm families. Kashmiri village women contribute to this agriculture heritage site through traditional tilling to flower picking over 3,200 hectares dedicated to the legendary saffron crop cultivation at Pampore. However, it has been facing grave challenges of sustainability and livelihood security with urgent need to adopt appropriate technologies, *inter-alia*, to address water vagaries, productivity loss and market volatilities. Thanks to GIAHS (Globally Important Agricultural Heritage System programme hosted by FAO of the UN at Rome), appropriately innovative scientific and technical approaches have been and are being tested and adopted at the pilot site for dynamically adapting to changing environment with due awareness-raising. A Follow-up Action Plan was drafted, dialogued and upscaled as National Saffron Mission. It has been approved by the national and local authorities and is now under way with due responsibility for on-site execution under the leadership of GIAHS pilot project advisor, Dr. F. Nehvi, and colleagues of SKUAST-K (the Shere-i-Kashmir University of Agricultural Science and Technology). The follow-up Action Plan is attached herewith.

Introduction

Kashmir is part of North western Himalayan mountain range full of renewable natural resources of great economic potential and human wellbeing, of which land, water, shrubs, trees and forests are most valuable. The physiographic location imposes a number of constraints, particularly in agriculture and allied sectors. The initial land-use pattern in the state was purely agri-culture. It has changed over a period of time to agri-horticultural-silvo-pastoral process.

Although the net area sown has remained more or less same - 7.35 lakh hectares, the area under fruit and vegetable cultivation has marginally increased to 228 thousand hectares. Rice, is the most important staple crop, and maize the second-most important. The best soil for maize is reclaimed swamp and crops are raised from the black peaty land, which lies under the banks of river Jhelum. In the high villages occupied by the nomadic grazers, very fine crops of maize are grown. Other important summer crops are millet, pulses (legumes such as peas, beans and lentils). Wheat and barley are the chief spring crops. Food grains production has increased to 15,253 quintals. Many temperate fruits are grown with orchards in the Kashmir valley orchards including almonds, apples, cherries, pears, peaches, and walnuts.

Of all the items, Kashmir is famous for its traditional heritage of saffron and remains its largest producer in the Indian subcontinent; that too for centuries. But it has suffered decline in the recent past and merits improved awareness, technical support and public attention that it has recently received from FAO of the UN through the GIAHS program pilot site and now from the State and Central governments and the civil society with the formulation and launching of a follow-up Action Plan through the national saffron mission for the next 4 to 5 years.

Agriculture, Saffron and Land use

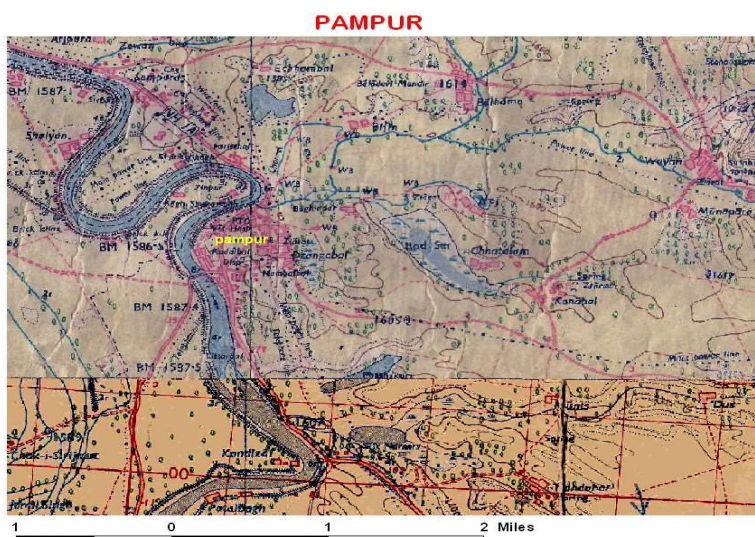
Agriculture is the most important activity of the people of Kashmir. It is essentially traditional family farming system. Even those engaged in other activities depend on agriculture for raw material. About 80% people in the State are cultivators in one form or the other. The total land area of the State is 24.15 lakh hectares, mainly rural area with villagers and cultivators. About 8.26 lakh hectares are agricultural rural land and the rest of the area is under forests and mountains, the latter involving pastoral activities, mainly devoted to sheep and goats.

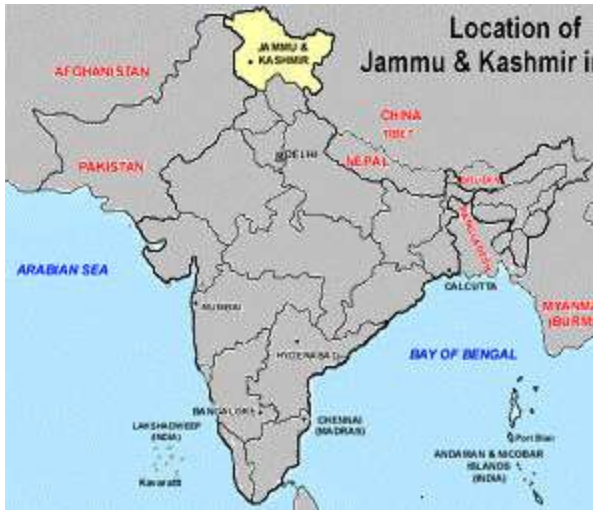
Rice is the main agricultural crop, sown in March-April, planted in May and harvested in late September is grown mostly in the valley of Kashmir at 2100 metres above sea level. Total area under rice cultivation in the valley is 374,000 acres, having a yield of 25.5 quintals per acre. Wheat is another crop sown in August and harvested in March and April. It is cultivated in the entire Outer Plain and the Outer Hills. In Kashmir, it is grown like grass. Total area under wheat cultivation in Jammu region is 31,000 acres, in Kashmir 78,000 acres and in Ladakh 7,000 acres. Maize is sown in May-July and harvested in August-November. It is cultivated on Karewa lands in the valley of Kashmir on about

303,000 acres near, also in and around the saffron site. Rape seed, mustard, linseed, sesamum, toria, and cottonseed are the chief varieties of oil-seeds. They are grown all over Kashmir province with the chief oil seed producing areas in Anantnag and Srinagar districts, spread over 6,700 acres in Kashmir. Pulses are of Kashmir Valley are well known for their quality and are grown on small patches of land left unused.

Saffron is a cash crop and cultivated in the Pampore district of the Kashmir valley. For this the Pampore Karewa soil are specially made as square beds. Each bed measures 1.5m and is provided with narrow trench on all sides to prevent the accumulation of water. The soil is alluvial and lucustrine. About 3,000 acres are under saffron cultivation in Pampore or as some call it as Pampur.

Saffron site Map 2011





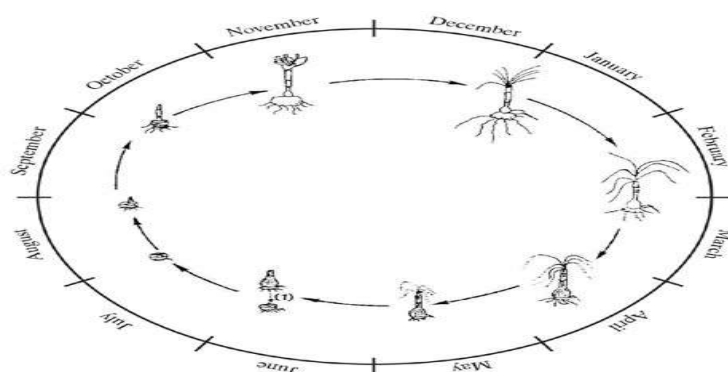
Stocktaking Survey and Assessment

Saffron heritage site “Pampore” has been famous, *ab-initio*, by its original name Padam-pore, situated on the bank of river Vatista, which flows down to the North-South Ward bank in which direction the prominent historical places are in-habitated, such as Chandhara, Woyan, Khrew, Shar and Balhama. The last prominent historical village is situated to the North East Ward of Pampore and GIAHS Saffron Part 1Report4

to its South-West ward comes Kakapore. Pampore is located at 34°01'N and 74°56'E with average elevation of 1,574 metres, about 25 km south-east of Srinagar in Kashmir. Khunmoh, Zewan, Balhama, Sampora, Ladhoo, Konibal, Dussu, Namblabal, Kadlabal, Hatiwara, Samboora and Lethpora are other prominent saffron villages of Pampore.

Saffron is mentioned in the 5th century B.C in Kashmiri records (Nauriyal et al., 1997). It is said to have originated from the Takshak spring located in Zewan village, 10 km. towards the east of Srinagar city and that its cultivation has spread in its neighbourhood. Veghbhata and Sushtra used saffron as an important ingredient in Auyurvedic medicines. However, according to the Kashmiri legends, saffron was brought to the region by two sufi ascetics, Khawja Masood wali (r.a) and Sheikh Sharif-u-din wali (r.a) According to Abul Fazl there was twelve thousand bighas under Saffron cultivation at Pampore and Saffron fields extended about a Kos at Andarki. According to Jehangir the yearly produce of Saffron was about 500 Hindustani maunds, saying that, “it is not known whether such a huge quantity is grown anywhere in the world.”

Saffron (*Crocus sativus*) is a perennial, herbaceous plant. Activation stage in saffron begins annually from September when the day temperature reaches to around 25⁰ C and night temperature to around 15⁰C. Corms begin to sprout with floral and vegetative structures growing in length inside the cataphylls. Each corm produces 1-4 sprouts with some of them producing flowers. During the month of October, sprouts are visible above the ground and the sub-soil stem is short .Very fine roots also start to protrude in the form of crown from the third basal internodes, possibly reaching a length of 5 cm (Dhar and Mir, 1997; Botella *et al.*,2002; Nehvi *et al.*;2011).



Biological Cycle of Saffron

Flowering starts in the second fortnight of October and lasts up to the first week of November. Flowers emerge in 3-4 flushes with massive emission known as covering in the 2nd flush. Each flush lasts for 2-6 days. Vegetative phase begins with the appearance of young leaves emerging from the corms in November, immediately after flowering is over. The young sprouts are being transformed into daughter corms start developing due to photosynthesis besides contribution from the mother corm, which becomes wrinkled and leaves space for new corms (Rucedá, 2003). All sprouts produce leaves growing to a height of 40-60 cm till April. Good foliage is the success of future crop as it leads to good corm growth and multiplication. By the first fortnight of April, contractile roots look like a dried up appendage and falls off the daughter corms (Oromi, 1992). Leaves also start to change colour. Corms enter a dormant stage from May. Although important ontogenic process leading to differentiation of floral and vegetative buds take place (Koul and Farooq, 1984), nothing is observed externally. During this period growers prepare the corms for fresh plantation after digging followed by sorting and cleaning to rejuvenate their saffron crop.

Saffron site has temperate type of climate with annual precipitation ranging from 800-900 mm. Mean monthly temperature of the saffron heritage site ranges from -3 to 29^oc .as shown in Table below:

Table 1: Weather parameters of heritage site

| Month | Mean Monthly Temperature (°c) | | Precipitation (mm) |
|----------|--------------------------------|---------|--------------------|
| | Minimum | Maximum | |
| January | -3 | 10 | 120 |
| February | -2 | 12 | 150 |
| March | 5 | 15 | 100 |

| | | | |
|-----------|-------|----|-----|
| | | | |
| April | 10 | 20 | 125 |
| May | 10 | 23 | 60 |
| June | 14 | 28 | 40 |
| July | 18 | 29 | 80 |
| August | 16 | 29 | 60 |
| September | 12 | 26 | 20 |
| October | 10 | 23 | 23 |
| November | 6 | 13 | 20 |
| December | 4 | 9 | 60 |
| | Total | | 858 |

Over 17,000 family farmers are stewards of this traditional crop in Kashmir with almost 9, 000 farm families from the heritage site consisting of about 66% from rural and 34% from peri-urban background. In general, male population is observed to be more than female in all the saffron villages excepting Dussu and Wuyan (Table-2)

Table-2:Population Statistics of Saffron Site

| | Rural | Peri-Urban | Total |
|------------|-------|------------|-------|
| Population | 45570 | 24129 | 69699 |
| Male | 23234 | 12397 | 35631 |
| Female | 22336 | 11732 | 34068 |
| Children | 5620 | 2217 | 7837 |

Maximum literacy rate (80.6%) is recorded in Dussu village. The working population accounts for 12.69 to 39.98 per cent of total village population with

highest number of cultivators equal to 945 accounting for 43.01 per cent of village working population in Namblabal (Pampore) and with minimum number (36) in village Kanilbagh, revealing maximum percentage of rural artisans (50.5 %). Highest percentage of cultivators (79.7%) is observed in village Gundbal followed by Dusoo (60.6 %) and Wuyan (50.6%), whereas in rest of the villages it was less than 50 per cent. Family size varies from 3-20 members. The farmers falling in classes <4, 5-9 and >10 members are 1%, 91% and 8%, respectively. Maximum farmers (42%) have land holding size of <1.0 ha and are categorised as marginal farmers, followed by 38% having land holding size between 1.0 ha to 1.99 ha, thus categorised as small farmers. Whereas 15% farmers are categorized as semi medium farmers with an average land holding size ranging from 2.0 to 3.99 ha. 5% farmers are categorized as medium farmers having 4.0-9.99 ha land holding size. The study thus confirmed that majority of the farmers in the saffron villages are marginal, having a low risk bearing capacity (Nehvi et al, 2011, Census of India, 2011).

With respect to occupation, only 1 per cent of saffron growers are dependent on any other agriculture, while rest of the farmers have subsidiary source of income in addition to agriculture. Apart from Agriculture, 76 per cent farmer families are engaged in animal husbandry. Families of 11 per cent farmers are involved in agriculture + animal husbandry+ related business, 8 per cent in agriculture + service and 4 per cent in agriculture + service + animal husbandry. With respect to assets related to agriculture, 2 percent farmers have tractor, whereas 98 percent have livestock based hand-held ploughs. None of the farmers possess mini tractor, trailer, cultivator or disc harrow.

Maximum annual income per farmer comes from saffron production followed by apple cultivation. On an average, farmers possess an area of about 0.6995 ha per farmer under saffron with an average production of 0.016732 quintals, enabling the farmers to fetch an annual income of 6,300 U.S \$.Maximum number of farmers (93%) report a net revenue of <1,111U.S.\$ from agriculture/ horticulture sector and 7% farmers obtain 1,111 to 2,222 U.S.\$ net revenue. None of the farmers report a gross income of more than 3,333 U.S.\$

Soils of the saffron site are heavy textured with clay loam as the predominant texture in upper horizons and silty clay in lower horizons. These soils are placed in the order of alfisols, are well drained, slightly alkaline in reaction and normal in soluble salt content. The available nitrogen and phosphorous content of these soils are low to medium, whereas the available potassium is medium to high.

The soils have low available zinc and adequate available copper, manganese and iron. The soils are calcareous in nature and slightly alkaline with normal electrical conductivity. The average organic carbon and calcium carbonate content is 0.35 and 4.61 per cent, respectively in the samples analyzed. The soil pH ranges from 6.3 to 8.3 with the mean value of 7.5 and EC varies from 0.09 to 0.30 dsm^{-1} with the mean value of 0.17 dsm^{-1} . These values are within the safe limits for growth of the crop. No organic or chemical fertilizers are used in majority of saffron fields in Pampore area, and hence the entire crop thrives on soil nutrients (Ganai, *et al*,2000; Ganai,2002)

Saffron is the predominant crop of the heritage site, besides maize, rice and some fruit and vegetable crops. Wuyun reveals the maximum geographical area (1,160.55 ha) followed by Ladhoo (908.94 ha), Lethpora (720 ha) and Shar-i-Shali (670.73 ha). Konibal reveals highest percentage of net area sown (89%). There is wide variation in the cropping pattern, depending upon water availability and soil type. More than 66 % of net area sown in the heritage site is under saffron cultivation followed by 20% under rice, 6% under maize, 4 % under fruits, 1.6 % under vegetables and 1.3% under pulses.(Table-3)

Table-3: Cropping Pattern of Heritage Site

| Total Geographical area (ha) | Saffron (ha) | Rice (ha) | Maize (ha) | Pulses (ha) | Fruits (ha) | Vegetables (ha) |
|------------------------------|--------------|-----------|------------|-------------|-------------|-----------------|
| 6,043.67 | 3,200 | 981.77 | 299.72 | 61.00 | 213.53 | 79.05 |

Saffron at present is cultivated over an area of 3,785 ha producing 9.5 metric tons with an overall productivity of 2.5 kg/ha (Nehvi, 2010 a) and the site is contributing 85 percent to the State saffron area (3200 ha) and production (8 M.T) with a total value of 52.56 million U.S\$ (Table-4). Saffron is generally followed with linseed/oats/wheat under crop rotation. However, in some villages, rajmah/lentil is also being cultivated. Maximum area under fruit crops is observed in village Sher-i-Shali (110.25 ha) and Chandhara (54.47 ha). In rest of the saffron site villages, the area under fruit crops is less than 20 ha.

Table-4: Contribution of saffron to the livelihood security

| Area (ha) | Production (MT) | Total Value Million \$ | Export | |
|--------------|--------------------|---------------------------|--------|------------|
| | | | M.T | Million \$ |
| 3200 | 9.462 | 52.56 | 1.59 | 7.6 |

In Kashmir, saffron is traditionally cultivated in September by planting saffron corms after plough by hand dropping as a mixture of grades under traditional system for longer economic benefits. Before fresh plantation, saffron soils are well pulverized 13 to 14 times starting from April till September. Planting system generally followed by saffron growers has been a of low productivity. Ungraded/unsorted corms weighing around 3 to 15 gms are planted at the seed rate of 1 to 1.5 q/ha behind plough without any consideration for proper plant geometry. No management practices are being followed by the saffron growers leading to productivity loss. In existing fields the soil is hoed twice in June and September to facilitate aeration to the corms and to allow corm sprouts to emerge out of soil. Saffron fields are attended for control of rodents during vegetative phase (November to May) and dry foliage is harvested in May as fodder for livestock. However, under improved appropriate technologies, saffron fields are being rejuvenated with graded saffron corms weighing above 8 g at a plant geometry of 20x10 cm after application of FYM @10 tons/ha in combination with N:P:K @90:60:50 kg/ha with vermicompost @5 q/ha. (Nehvi,*et al*,2011).

With the onset of autumn (October), Pampore Karewa plateau, turns purple with saffron flowers. It is an incredible experience to watch hundreds of Kashmiri women, with baskets on their backs, standing in the midst of a profusion of purple flowers. As they pluck the blossoms, the lilt of their voices wafts through the air as they sing their folk songs. Kashmiri women are behind the whole saffron story. They till the soil, and, most importantly, pick and gently dry the flowers. This is an art that can only be executed by women because it involves a lot of patience and effort to take tender care of the flowers. Once dried, tossed and sorted, it is time for the flowers to be handed over to the men folk. Stripping away the insides of the flowers, the men grade the saffron, now ready to be packed in moisture-proof containers. To maintain high quality of Kashmir

saffron, picking is advocated within 2 days of flower opening with stigma separation within 10 hours followed by drying in scientific solar/hot air dryers, especially through the GIAHS project based appropriate technology up-scaling demonstrated for improved drying and storage.

Market Practices/Information

Kashmir Saffron is marketed in 3 forms viz; Lacha, mongra and gucchha. In general produce is sold through middlemen/firms and whole-sale seller, particularly in case of saffron. However, for fruits and vegetables Kashmir has a well organized marketing system in the form of mandis recognized by the Government agencies. Main source of market information is middleman, fellow farmers, T.V and Radio. Prices of the market are displayed and announced on T.V and Radio programmes like “Butrat” and “Gami Bayon Ke liye” . For saffron, no such official information is available as no saffron mandis are available. No price is fixed by the Government authorities for saffron sale. This and related issues having been identified through the GIAHS pilot project as important for improving returns and rewards to family farmers, buyers and sellers and motivating them for the site’s dynamic conservation and for investment in harnessing adaptive technology is being better understood and should be addressed through the follow-up National Saffron Mission. Also for better branding and marketing domestically and globally the special attributes of the traditionally propagated saffron varieties of the Saffron site of Kashmir in India. These characteristics have been got studied and are adumbrated below.

Kashmiri saffron should be recognized by the market and valued for high concentration of sugar (25-27%), proteins (12-14%), vitamins in terms of riboflavin and thiamine(0.3-1.39 µg/g), total nitrogen (2.02%), potassium (3.06%), iron (318.mg/kg), Zinc (29.66mg/kg), Sodium (623.63%), Manganese (20.46mg/kg), Copper (31.08mg/kg), Crocin (366), Saffranal (59), Picrocrocin (121) (Nehvi, 2010b). Saffron has anti-oxidant and anti-cancer properties on account of flavonoids, tannins, anthocynins, alkaloids, saponins and carotinoids that provide saffron health benefits for reducing inflammation, treats acne, acts as antidepressant, anti-parkinsonian, anti tumor cancer, and stimulates vigor

Knowledge Networking

Agriculture Face (Krishi Darshan) and Butrat programmes for villagers and programme for cultivators were initiated as the main source of information related to saffron and related agricultural activities/mall mandi price, telecasted GIAHS Saffron Part 1Report11

and broadcasted by Doordarshan Srinagar and Radio Kashmir. Local news papers with special articles in agricultural section, but rarely if ever saffron was highlighted earlier. Now it is getting into news as part of the GIAHS pilot project's awareness raising effort and its follow-up Action Plan. Besides, the pilot project partners of Agricultural Universities and State Departments serve as a source of information for the farmers and as a conduit for imparting training as envisaged under GIAHS pilot; also for functionaries of the concerned line Department. Designing has been done to transfer monthly messages regarding cultivation and harvesting problems and activities. Access to different sources of information was undertaken and collected from the farmers during the survey. It was observed that the source of knowledge was obtained by almost all the farmers through TV and radio channels. This is mainly due to common use of TV and Radio in the village, but it was observed that there is limited or no access to the saffron heritage system knowledge. The agriculture university and Govt. Department are the second best source of knowledge for the farmers and this has been initiated. Seminars, workshops, training and internet facility as a source of knowledge is seldom used by the farmers and this could be considered as an input sources provisioned through the GIAHS pilot project. 81 farmers have thereby already reported to have received advanced training on improved methods of saffron cultivation through SKUAST-K and this shall continue as a follow-up of the GIAHS pilot project effort.

Challenges and Prospects of Saffron Heritage

Livelihood security, motivating youth to adopt appropriate technologies to enhance productivity and to address water vagaries and market volatilities are among the challenges of saffron heritage system of Kashmir in India. Access to adaptive traditional and appropriate technologies with better returns and their adoption for increase in productivity and improvement in quality in the traditional areas and introduction in the non-traditional belts with proven potential, involvement of youth in corm production, high-tech saffron processing and marketing, support for development of sustainable irrigation sources and establishment of spice park with electronic marketing system are the new strengths oriented to overcome prevailing challenges, as tested and demonstrated during the pilot project's training sessions and seminars (Salwee *et al*, 2011). Innovative scientific and technical approach is being tested and adopted at the GIAHS pilot site with due stocktaking and awareness raising

about addressing these challenges. This includes skills support for improving productivity and marketing and for upscaling into the national saffron mission to ensure the sustainability of the traditional Saffron Heritage System.

Follow-up Action Plan through the National Saffron Mission with financial support from the Government of India to the tune of US \$ 8.28 million is now getting under implementation at Pampore Pilot GIAHS site with a 5 year implementation plan. The mission aims at doubling overall production from 9.5 MT to 19 M.T through vertical and horizontal expansion, input support, infrastructure development, improved tillage, suitable sprinkler and assured irrigation system, transfer of appropriate technologies and continued research and development with extension facilities and enhanced local capabilities, as advocated, tried and tested during the GIAHS oriented site-specific action research and pilot activities.

Concluding Remarks

The GIAHS pilot initiative has been a timely and good opportunity to present, highlight and raise awareness about the challenges and opportunities of the saffron heritage system of Kashmir. This shall ensure its sustainability through the follow-up action plan with the support of the national saffron mission that has been designed and developed for the purpose. Thanks are due to the SKUAST-K and national and State level authorities for working on and getting the mission proposal approved. Appreciation is also due to the local communities and saffron growers for participating in awareness raising and multi-stakeholder workshops and in the process of stock-taking, testing, training and demonstration of appropriate technologies for addressing the issues of improved soil and water management, cultivation practices and harvesting systems. Buyers, sellers and traders have also cooperated in the process of implementing the GIAHS-oriented saffron site studies and for participating in workshops for better buyer-seller relations, branding and marketing of the organically produced and traditionally unique saffron of Kashmir, India. This has opened new avenues and opportunities for improved productivity and livelihoods, value addition of the saffron product and its processing, and gainful employment and incentives for the family farmers and local communities, thereby ensuring the sustainability of this unique GIAHS site through their stewardship, ownership and entrepreneurship.

Acknowledgement

Thanks are due to the FAO's GIAHS initiative for promoting the cause of Kashmir-India saffron propagation and for providing the opportunity to show case this unique heritage system at the Beijing international conference in 2011. This and the GIAHS certificate has motivated the authors, scientists and stakeholders at SKUAST-K and also the saffron family farmers, buyers and sellers to continue to focus on the dynamic conservation and sustainable development of the globally important saffron site of India with the valuable follow-up support of the action-oriented Saffron Mission prompted by the pilot project initiative.

References

- Botella ,O.,De Juan, J.A., Munoz, M.R.,Moya, A., Lopez,H. 2002. Descripcion morfologia y ciclo anual dela zafran (crocus sativus L).*Cuadernos de Fitopatologia*,71:18-28
- Census of India,2011. Primary Census Abstract.Data Product N0:090-54-2001-cen CD. Office of the Registrar General, India, New Delhi
- Dhar, A.K and Mir, G.M. 1997.Saffron in Kashmir VI. A review of distribution and production. *J.Herbs , Spices and Medicinal Plants*,4:83-90
- F.A.Nehvi. 2009. A Value Chain On Kashmir Saffron. Report Submitted to Project Implementation Unit, NAIP, ICAR, New Delhi
- F.A.Nehvi, G.L.Koul, Anwar Alam ,Shafiq A. Wani and M.I.Makhdoomi.2011. Saffron Production in Jammu & Kashmir State- A-Survey. 10: 167-182
- F.A.Nehvi., Henna Qadri and S.P.Singh.2008. Saffron in India and Iran: A review of Production, Processing and Marketing. *Indian Journal Of Crop Sciences*. 3(1): 15-20
- F.A.Nehvi, Anwar Alam and Salwee Yasmin. Saffron Farming in India. 2010. *Financing Agriculture*. 42(5): 9-16
- F.A.Nehvi.2011a. Forthcoming Challenges For Improving Saffron Farming System In Kashmir. *Acta Horticulturae*.850: ISH281-85
- F.A.Nehvi.2011b.Saffron as a Functional Food.. International Seminar on New Drivers in The Food Processing Sector. Indian Premier Biennial Agro Technology and Business Fair . 3-6 December, Chandigarh
- F.A.Nehvi,Salwee Yasmin,Joyti Sethi,Ameeq Arshid Wani,Asif M.Iqbal,Aiojaz A.John and Sheikh Sammar Sameer.2011.Good Practices for Saffron Cultivation in Kashmir.A Practical Manual.SKUASI-K Publication :pp:1-31

Ganai, M.R.D.; M.A. Wani and G.H. Zargar. 2011. Characterization of saffron growing soils of Kashmir. *Applied Biological Research*: 2(1&2): 27-30

Ganai, M.R.D. 2002. Nutrient status of saffron soils and their management. *Proceedings of Seminar cum workshop on the Development of saffron*. 2001. PP: 51-54

Koul, K. K and Farooq, S. 1984. Growth and differentiation in the shoot apical meristem of saffron plant (*crocus sativus* L.). *J. Ind Bot Soc.*, 63: 153-169

Nauriyal, J.P., Gupta, R., & George, C.K. 1997. Saffron in India. *Arecaunt Spices Bull.*, 8, 59-72

Oromi, M.J. 1992. *Biología de crocus sativus* L. Y factores agro climáticos que inciden en el rendimiento y época de floración de su cultivo en la Mancha Tesis Doctoral. Universidad de Navarra, Pamplona, España

Salwee Yasmin, F.A. Nehvi, Jyoti Sethi and Ameerque Arshid Wani. 2011. Future of Kashmir Saffron. Abstracts and Sovenir. Ist Jammu & Kashmir Agricultural Science Congress-Mountain Agriculture in Transition; Challenges and way-forward. September, 9-10, 2011. 54 Pp