

Sustainability of Saffron Cultivation in India: An Economic Outlook

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(MSAE-2019-10)



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Sher-e-Kashmir University of Agricultural Sciences and
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partial fulfilment of requirement for the award of the degree of**

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DEDICATED

TO

MY

FAMILY

Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
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Horti-Business Management

Certificate – I

This is to certify that the thesis entitled “**Sustainability of Saffron Cultivation in India: An Economic Outlook**” submitted in partial fulfilment of the requirements for the award of the degree of **Master of Science in Agriculture (Agricultural Economics)**, to the Faculty of Horticulture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, is a record of bonafide research work carried out by **Ms. Iqra Iqbal (Regd. No. MSAE-2019-10)** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

It is further certified that any help or information received during the course of investigation have duly been acknowledged.

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ABSTRACT

Saffron is an important cash crop grown in its niche across Kashmir valley of J & K UT. This spice has appreciably sustained the farm economy especially of Pulwama district. Kashmir saffron is known for better quality which gives distinct identity to this crop. Consistent with raising standards of living the demand for saffron is increasing across the globe. However there are growing concerns about sustainability of saffron in Kashmir which warranted to take up this theme for the present study .This study intended to analyse the economic viability of saffron in relationship with other competing crops and to investigate sustainability of this crop with its determinants by considering number of indicators .Both secondary and primary data has been employed in this study .While the secondary data have been obtained from published and unpublished records of Directorate of Agriculture, primary data were collected from sample respondents selected through multistage random sampling technique .The trends in area have exhibited an unfavourable decline ,that results in significant decline in production ,An appreciable land area under saffron has been rejuvenated under NSM(National Saffron Mission) and efforts were made to enhance its productivity paid off significantly as evident from yield gains .Results revealed that saffron turned economically more viable as compared to its competing crop (Apple). The sustainability of saffron was assessed by constructing a composed index of a number of economic, social and ecological indicators. In aggregate saffron cultivation was relatively more sustainable in Pulwama. Except for social

efficiency, economic and ecological efficiency was relatively higher at district Pulwama. The aggregate value of sustainability index ranges from 0.154 in Pulwama to 0.126 in Budgam. This study emphasis the association of different factors on three different efficiency variables viz., social, economic and ecological. The estimates of regression ascertained the significant role of ecological and economic efficiency variables on sustainability of saffron cultivation. The study concluded with number of policy suggestions for sustenance of saffron economy in its niche on large term basis.

Key Words: Saffron, Farm, Sustainability, Economic viability, Kashmir, India

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Signature of Student

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Chapter-1

INTRODUCTION

Saffron (*Crocus sativus* L.), popularly known as “Golden Condiment”, is valued as a medicinal/aromatic perennial herb, a dye and has been prized the world’s most expensive spice since times immemorial. It is one of the oldest crops native of Southern Europe and cultivated in Spain, Iran, France, Italy, Austria, Greece, Turkey, England, China and India. Total world production of saffron is around 300 tons per year. Iran, India, Spain and Greece are the major saffron producing countries with Iran occupying the maximum area (43408 ha) and contributes about 88 per cent of world’s saffron production (Tantry *et al.*, 2017). Though, India occupies the 2nd largest area (3674 ha), however, produces approximately 7 per cent of the total world production (Zahid, 2016). Spain with 600 ha of land is the 3rd largest saffron producer in the world (Tantry *et al.*, 2017). In India this legendary crop is acclimatized to hillsides and plateaus (locally called *Karewas*) and perform better at altitudes between 1500 to 2400 metres. Saffron requires a well-drained loamy soil with neutral to slightly alkaline reactions and is well adapted to areas with cold, rainy winters and warm dry summers.

Saffron is an important cash crop and second largest Agri-oriented business activity after fruit production in Jammu and Kashmir. It is one of the potential foreign exchange earners, as about 50 per cent of its produce is exported outside the country (Saraf *et al.*, 2018). The saffron of Kashmir is acclaimed internationally as of a superior quality with high demand. About seven lakh people across 226 villages are solely dependent on saffron cultivation for their livelihood. The number of people associated directly or indirectly with the saffron industry is estimated to be more than ten lakhs in Jammu and Kashmir (Anonymous, 2007). Due to its unique biological, physiological, agronomic traits saffron is able to exploit marginal land and could be included in low input

cropping system, representing an alternative viable crop for sustainable agriculture.

The production of saffron is capital and labour intensive and a huge number of labourers are employed in various activities like planting, flower harvesting and separation of the stigmas. The leading saffron growing countries like Iran, Spain and Greece with intensive production technologies are able to achieve higher productivity than India which poses great challenges to our saffron industry as imports are increasing every year. The official data reveals that both area and production of saffron in J&K has come down from 5707 ha area in 1996-97 to 2742 ha during 2003-04 and the production from 15.95 MT to just 5.15 MT (Gurkoo, 2007). After 2003-04 with the inception of Horticulture Technology Mission (MM-I and MM-II), National Agriculture Technology Project (NATP) and National Agriculture Innovation Project (NAIP), this crop got the technological boost and incentives for area expansion and increase in its production and its area has increased up to 3785 ha and production up to 9.46 MT by 2009-10 (Zahid, 2016). Attempts were made to revive this crop under National Saffron Mission and recently it has got geographical indicator for its exquisite attributes which is expected to give new orientation to its economy.

The increasing demand of saffron across the world has prompted to increase its production. There is a need to bring in more area under saffron in its niche and augment its productivity by scientific management. Strengthening of value chain and emphasis on quality of produce are crucial to make Indian saffron globally competitive. A holistic approach is required to sustain the saffron economy in the valley. As a process, “Sustainable development offers a framework to generate economic growth, achieve social justice, exercise environmental stewardship and strengthen governance” (Ban Ki-moon, 2013). Sustainable development encompasses economic, and environmental efficiency. Economic sustainability refers to the ability of an economy to consistently maintain respectable level of increasing gross domestic product (or maintenance

of capital stock) over a long period of time (Daly, 1996). Social sustainability occurs when the formal and informal norms and processes are ensured; systems; structures; and relationships actively support the capacity of current and future generations to create healthy communities. Socially sustainable communities are equitable, diverse, connected & democratic and provide a good quality of life (Partridge, 2005). Environmental sustainability implies that environmental resources are utilized in a way that it becomes possible for civilizations to support themselves indefinitely (Daly, 1990). The sustenance of this crop seems uncertain with made it imperative to investigate farm level sustainability of this spice crop within the aggregate influence of various indicators. Accordingly, the present study “**Sustainability of Saffron Cultivation in India: An Economic Outlook**” has been an endeavour to investigate sustainability of saffron in its niche area of Kashmir valley. This study has been conducted with following objectives:

1. To assess the economic viability of saffron cultivation in relationship with other crops enterprises, and
2. To construct farm level sustainability index of saffron cultivation and to examine its determinants.

Organization of the study

This thesis has been divided into six distinct chapters. The context of this study has been discussed with proper justification of the selection of the theme in the introduction chapter .Second chapter puts light on the brief review of previous related studies conducted at international and national level .The methodology adopted for accomplishment of the objective of this study was discussed in the material and methods. Chapter 4 envisages the logical interpretation of the major finding of the study. Major finding with logical reasonings has been detailed in the discussion chapter. Chapter 6 summarize the brief account of entire study and the final chapter has been dedicated for the list of studies referred in this study.

Chapter -2

REVIEW OF LITERATURE

Review of previous studies is essential to identify the problem and to development a conceptual framework within which the issue can be identified to arrive at the various policy suggestions for their long-term resolutions.

Lawrence (1895) reported that saffron has been used as an ingredient in Ayurvedic medicines by the famous Kashmiri Vaid, namely, Vegbhatta and Sushtra. The recorded account of saffron cultivation in Kashmir dates to year 550 A. D., nearly four centuries earlier than its recorded cultivation in Spain by Arabs around year 961 A. D.

Bali and Sagwal (1987) stated that high economic returns can be obtained from saffron on commercial scale. They observed that profits from the crop are very high, regardless of the costs.

Munshi *et al.* (1989) observed that saffron is the most famous crop of J & K. It was grown over an area of about 3030 hectares producing 9000 kgs of dry saffron. The productivity however remained quite low.

Munshi (1990) opined that saffron is one of the most important foreign exchange earners among the spices of India. Grown mostly in the State of Jammu and Kashmir, this mono- crop is said to account for up to 2 per cent of total export revenue. But its marketing is concentrated in the hands of a few traders and exporters, and a more competitive environment is desirable to raise its profitability. He observed that government intervention in specific areas was needed to ensure a better price for the product and a consistent quality for export.

Munshi and Baba (1991) observed that saffron is the world's most expensive spice. It is the spice of commerce fetching Rs. 15000 to Rs. 20000 per kg. A yield of 2 kg per hectare has been recorded for J&K State. They also revealed that in Pampore area the average yield ranged between 2-3 kg/hectare,

whereas yield reported from Spain was much higher, being about 10 kg of dry saffron per hectare.

Mattoo and Beigh (1992) reported that saffron is also called 'Red Gold' of Jammu and Kashmir, because of its great commercial importance as it earns annually about Rs.1.25 crore of foreign exchange.

Pruthi (1992) stated that the richest soil for saffron cultivation in the valley is said to be at Pampore and this fact has been taken advantage through ages for the cultivation of the *Crocus sativus*, the stamens of whose flower, known as saffron, is a chief article of commerce in this country, yielding a revenue to the government. Kashmir valley is famous for saffron fields located on the sides of National Highway on the karewas (elevated dry table land of alluvial origins) of saffron at Pampore. Some saffron is grown also in Kishtwar region of Jammu.

Dhar and Mir (1997) observed that saffron, the dried stigmas of *Crocus sativus*, is an important commodity of commerce, prized for its delicate flavour and intense colour. They opined that saffron is one of the oldest commodities of Jammu and Kashmir agriculture, spread over more than 200 villages with 40000 families. It is an important ingredient of Ayurveda and Unani systems of medicine in India.

Smith and McDonald (1998) concluded that agricultural sustainability encompasses biophysical, economic and social factors operating at the field, farm, watershed, regional and national scales. The immediate challenge is to determine what sustainable agricultural uses are before they are implemented at the planning stage. The final section outlines a framework within which current land evaluation, environmental impact and strategic environmental assessment approaches to land use planning may be extended, and argues that these approaches must include, from the beginning, sustainability criteria.

Ghosh *et al.* (2006) stated that Sustainability Indicators are a measure to assess progress towards sustainable development, but how and why certain

indicators are produced and used is often hard to understand. There is also a lack of common ground, so that different indicators cannot be directly compared. Further they explored the suitability of some existing sustainability indicators and measurement tools in this light. It suggested that there is a need to develop simple local quantitative indicators in addition to the more commonly used qualitative indicators. A new method is outlined for the development of quantitative physical indicators as part of an integrated approach to a more sustainable urban environment.

Kamili *et al.* (2007) concluded that sustainability of saffron crop is the most vital aspect to improve the economy of growers and earn foreign exchange for the state. Therefore, immediate attention is required towards the transfer of technology through methodical extension, establishment of seed villages, value addition and ban on import of saffron, marketing and quality testing laboratory.

Ghorbani (2008) suggested that increasing the number of marketing channels cause inefficiency in marketing process of saffron. So, decreasing distance between producer and consumer by transplanting marketing process can increase producer and consumer welfare. According to special advantage of this product, creation of regional marketing board beside exchange market for coordinating production, marketing and export and maintaining market share is suggested.

Lopz (2009) suggested that type of package seems to have the main influence on the determination of retail prices, glass packaging with the highest implicit value, around 35% over the mean price. Different brand strategies also lead to distinct price premium which is maximum for brands owned by processors specialized in the processing and marketing of saffron.

Shah and Tripathi (2009) observed that the saffron cultivation is relatively complicated and expensive. Gross expenditure of crop during 5 years planting cycle of saffron was Rs: 431185 per hectare, this is because of high establishment

cost in first year and the gross returns in planting cycle of 5 years were Rs. 2366000. The net profit per annum was Rs. 386963 per hectare.

Shah and Wani (2009) observed that lack of irrigation scheduling technology was the major problem articulated by majority of the growers as a technological problem followed by lack of technical guidance for extension problems. As per the marketing constraints the non-availability of clean and competent marketing infrastructure was considered the main problem of growers and lack of insurance facilities to cover risk was reported as economic problem. Among communication problems and physical problems lack of literature regarding improved cultivation and small size of land were reported as major problems.

Baba *et al.* (2010) referred that horticulture is labour intensive in nature and requires net high labour ratio from the stage of planting to stage of marketing of production. The sector also requires also lot of support from family members and enables them to earn income, also provides indirect employment in packaging, grading, sorting and processing activities especially in horticulture belts. Indian agriculture is a prelude to economic development and a pre-requisite for poverty alleviation and overall economic development.

Reshi *et al.* (2010) stated that apple production being the main occupation in the Kashmir valley provides direct or indirect, employment to a hallowing number of some 30 lac people. Though, this is the main occupation contributing to states GDP up to a considerable level, still it has not been provided industrial status, owing to ignorance from government side, lack of infrastructure and proper marketing channels and research and development. Rather *et al.* (2013) stated that Jammu and Kashmir is the major producer of apple and walnuts in India, 77 per cent of apple and 90 per cent of walnut production in India belongs to Jammu and Kashmir and per centage share of state in India's total production is showing an increasing trend and the state has been declared as the "Agri. Export zone for Apples and Walnuts". Given the declining share of traditional agricultural

commodities in production, consumption and trade horticulture represent an important industry to improve income growth and employment in rural areas of Jammu and Kashmir. Agribusiness including export of fresh and dry fruits is the foundation of economy. The industry contributes nearly 60 per cent of the states revenue and 22 per cent of gross state domestic product (GSDP). It is also estimated that 80 per cent of population is engaged in agriculture and its allied sectors including horticulture sector in the state.

Sheykhdavodi (2010) developed an innovative policy framework based on multi-criteria decision-making (MCDM) techniques for the mechanization of crust crushing in saffron fields. Five harrowing systems (two full mechanized systems, one semi-mechanized and two traditional systems) were defined as harrowing candidates. Six key factors (time, cost, energy, availability, quality of work and employment) were considered as technical attributes. After applying MCDM techniques, results indicate that for this specific region, employment is likely the most important criterion for decision making and tiller is the optimal system. It is worth noting that this same dynamic decision-making framework will flexibly accommodate any innovations in future production systems.

Wani *et al.* (2010) observed that overall technological gap was more than 50 % of saffron regarding production technology, small growers of the valley had highest technological gap in terms of production technology. With a view to decrease technological gap, it is necessary to aware them about improved technologies of saffron production. The planners and policy makers should take steps to meet the needs and challenges of the saffron growers and promote production technologies at gross root level.

Husaini *et al.* (2010) concluded that saffron in Kashmir is totally rainfed crop and if rains are received at the sprouting and pre-flowering stage, flowering is optimum and saffron yield is normal. Any major drop in precipitation at these stages or unseasonal rains during October causes serious damage to flowering and saffron yield.

Hosseinia *et al.* (2010) analysed the criteria for investment in saffron projects and observed that these projects are very economical, because they can increase yield and more income for farmers. So, in order to improve the situation, investment on saffron research projects is recommended to strengthen qualitative and quantitative extension for transfer of new findings to the saffron farmers.

Santucci (2010) concluded that saffron, besides processed with priced packaging, has generated an interesting case of multisector development, with links to cultural heritage, gastronomy and rural tourism.

Rekha *et al.* (2011) concluded that adulteration in saffron and drawing of adequate standards need closure attention. The degree of adulteration is not well established the purity of saffron can be adulterated with many substances. Proper statistics of production, revenue and export is not completely known. Formation of saffron marketing societies at village levels in the growing areas will help to maintain records. Also, the intermediaries in the trade of saffron will be reduced. These societies can provide adequate loan to small and marginal farmers for purchasing the necessary inputs for producing greater yield. Government intervention in the marketing of the crop is necessary.

Sharma *et al.* (2012) concluded that the total cost of saffron cultivation is Rs.261254.71 while total return was 668755 per hectare upto 9th years and the benefit -cost ratio was found to be 2.56. from the total cost of saffron cultivation , the share of variable cost was found to be 82.78% and the rest was fixed cost was 17.22% respectively.

Sharma *et al.* (2012) stated that there is vast opportunity for improving the production, productivity and income of the saffron growers by improving their quality diversification of area, improving in packaging material, efficient marketing channel's proper distribution of price spread etc., will surely result in increasing the income as well as employment of the saffron growers.

Malik (2012) reveals that area under saffron in J & K has receded to 31%, and the production level of saffron reduced to 47%, while the productivity of saffron has declined to about 23% from year 1997-2010.

Kheirandish and Gowda (2012) revealed that there is considerable scope to increase the producers share in the consumers price if the number of intermediaries is reduced and the government intervenes pro-actively in order to organise and streamline the marketing cooperative unions so that the farmers use these unions as a profitable channel to sell their product. Only 4.29% of the farmers sold their produce through cooperative societies. The wholesalers in the distribution market popularly known as packaging companies purchase saffron from middlemen and very rarely directly from farmers and allow brokers to thrive at the cost of farmers.

Maner and Semwal (2013) reported the major factors responsible for decline of saffron industry in Kashmir include; lack of availability of good-quality corms as seed material, poor soil fertility, lack of assured irrigation, infestation by rodents and diseases, poor postharvest management, improper marketing facilities, increased urbanization on saffron land, helplessness of the Government in checking adulteration and clandestine smuggling of cheap saffron (allegedly from Iran), which is then sold in the name of Kashmir saffron.

Majewski (2013) analysed that significant differences in the sustainability level between the farms in the sample, as well as the potential for increasing SFS. The increase of the synthetic sustainability index can be achieved by means of farm investments, but also low-cost activities that improve environmental performance and generate positive social effects without undermining economic viability. It was also found out, that larger size, intensive farms can achieve high economic and environmental sustainability level if properly managed.

Yasmin and Nehvi (2013) concluded in a study 'saffron as a valuable spice' that cultivation is under threat of extinction and thus warrants attention of

researchers and policy makers. In Kashmir, its revival is to be taken on ‘Mission Mode’, particularly in the areas where its cultivation has been abandoned by the farmers. SKUAST-Kashmir and other International Organizations, have instituted research programme for systematic improvement of saffron from production to consumption system.

Kaloo *et al.* (2014) reported that for increasing production and productivity in saffron there is need of the development of irrigation schemes and the application of drip and sprinkler and enriching soils with recommended levels of manures and fertilizers and organic cultivation

Haq and Shafi (2014) concluded that the concerned Government Departments / agencies need to encourage and involve educated unemployed youth in the rural areas of the saffron growing belts to take over this venture on scientific basis. Organising the foreign tours especially to the countries like Spain, Netherlands and Iran etc., is very essential to motivate and encourage them. Poor economic background of these farmers compels them to borrow money in advance from dalals resulting into distress sale. This issue needs to be tackled by the government by providing cheap credit facilities to the growers. Besides, emphasis should be given on inculcating the spirit of cooperative farming. By cooperative marketing the chains of middlemen and intermediaries can be eliminated.

Golmohammadi (2014) concluded that use of more efficient methods and tools has been the centre of attraction. Packing is one of the effective measures in the process of selling products to count. Iran enjoys favourable climate conditions; therefore, it can produce many crops such as saffron and it also is the biggest producer of it in the world. But due to lack of proper facilities for packaging, the license of direct exports of the product is lost.

Saqib (2015) laid emphasis on geographic indication as a branding tool for saffron reported that Kashmir has variety of agricultural products and one

agricultural product which should immediately be registered as Geographical Indication is Saffron. “Kashmir Saffron” needs to be branded as branding of saffron will allow saffron producers to achieve market recognition, differentiate their offerings and gain legal protection and Geographical Indication can be the branding tool for it.

Manzo *et al.* (2015) suggests that the cultivation of saffron represents a viable opportunity to diversify agricultural income in multifunctional farms in mountain areas. This opportunity should be seen within a context of reduced generalized public support for agriculture and a focus on specific targets and priorities.

Toktam *et al.* (2016) measured the technical efficiency of small and large Saffron farms in Iran. They collected data from 170 questionnaires completed by saffron producers in Torbat-e-Heydarieh and Zaveh counties in year 2014. In order to ensure the accuracy of selected production function, the performance of three Cobb Douglas, Transcendental and Trans log functional forms were tested. Results suggest that Trans log functional form is the most appropriate form for expression of production technology of this product. Moreover, the comparison of technical efficiency between two groups of farms indicates that 49 per cent of small farms and 18 per cent of large farms work at inefficient level of production. The large difference between lowest and highest technical efficiency in large farm group shows that there is an option to increase technical efficiency in these fields through the use of good management practices.

Nehvi and Yasmin (2016) identified issues of traditional saffron value chain and provided solution to all missing links for making farming system sustainable and economically viable. Research lead to development and release of GAP for saffron cultivation, mechanization, water management, integrated disease management and post-harvest management with an aim to double farmers income and profitability. Technologies gave birth to National Saffron Mission for

revival of saffron Industry that has improved overall production from 9.6 MT (2009) to 15 MT (2013).

Nasseer *et al.* (2016) observed that the corms weighing more than 8 g have the potential of flowering the same year whereas the corms weighing less than 6 g are suitable for nursery management to yield bigger sized corms for the area expansion under saffron cultivation and high density.

Ali and Hakim (2017) suggested that technological intervention can help to address the issues related to post-harvest losses and will ensure better quality. Moreover, the implementation of organized way of marketing with direct grower to consumer contact will boost the confidence of saffron growers about the future prospects of saffron cultivation and will thus enhance their profitability and accordingly the sustainability in its export. Hence, further research is needed in this direction. Also, with rapid increase of saffron price in international market, growers may show more interest in investing in scientific tools and unique technology based on breeding and biotechnology for better yield, but due to marginal nature of this crop, investments by manufacturers on such scientific tools are unlikely to be repaid as quickly as they would expect. In fact, this is a general limitation with the saffron crop in Kashmir (India).

Tantry *et al.* (2017) concluded that saffron is playing a significant role in the economy of Jammu and Kashmir and contributes about 16 per cent of the total agriculture income. The basic growth retarding factors of crop are its weak research base, unscientific in all respects, discouraging marketing mechanism and non-interference attitude of government, lack of irrigation, unavailability of pesticides etc. Its marketing structure which is totally under the control of private enterprise is quite discouraging. It has been observed that intermediaries, on an average basis take about 41 per cent of total income from saffron as their commission leaving only 59 per cent to the actual growers.

Tantry (2017) concluded that saffron in J & K is function of multiple input variables. However, he takes only two independent variable factor inputs into consideration reveals that X_1 (labour) is relatively playing vital role than X_2 (fertilizer) for enhancing the productivity of saffron in state of J & K. This means that saffron is labour intensive crop needs keen watching right from plantation to recycling period.

Hamid *et al.* (2017) identified that the price/kg of saffron appears to be highest in the month of September and October due to the new arrival and harvesting season of the saffron crop. Meanwhile, the Compound annual growth rate for saffron in J&K in terms of area, production and productivity depicted a declining trend, whereas they founded that the farmer under saffron cultivation are residing in rural areas with an average landholding 5.5 to 8.0 kanals and contributing to the total production of 10 MT. Their study also determined the economic relationship between the stakeholders in different marketing channels of saffron value chain. It was found using Acharya's and Shepherd's Index techniques, that the maximum marketing margin were grabbed by the intermediaries (retailers, agents) followed by Wholesalers' leaving saffron growers an unfair margin.

Ganaie *et al.* (2017) revealed that the per hectare total cost of cultivation was higher in small size group as Rs. 273354.67 followed by medium size group as Rs. 91086.38 and large size group as Rs. 88486.80. The overall net income on different categories of farms is negative during 1st year as Rs. 126424.5 and highest during 9th year as Rs. 172953.66. It increases from 1st to 7th year and remains constant up to 7th year; decreases in 8th year and then again increases during 9th year. The output-input ratio is 1:2.49, which varies from 1:2.14 in small size group to 1:6.45 in medium size group and 1:7.42 in large size group. Thus, ratio indicates that the saffron crop is profitable.

Shabeer *et al.* (2017) revealed that the cost of cultivation per hectare of saffron crop in the first year was higher than returns and the total income was

negative, during the last year returns increased because of addition of one more operation i.e. digging out of saffron corms. The study reveals that the saffron trade is under private hand which is a big hurdle and the farmers got less benefit, because the benefits are reaped by the middle men (dalals). Nearly 90 per cent of farmers sell their produce to the dalals, about 6 per cent sell directly to the consumers and only 2-3 per cent farmers sell through co-operative agencies and other governmental agencies.

Saraf *et al.* (2018) revealed that the saffron crop is highly remunerative and offers ample scope for employment generation. The economic analysis in terms of costs and returns, net present value, benefit cost ratio, payback period, internal rate of return and farm profit measures indicated that the crop is economically viable. The results of study indicated that the marketing margins exceed the marketing costs in each channel. Saffron, being a high value and low volume product, the marketing costs remained comparatively low. The maximum marketing margins were received by brokers followed by retailers.

Qadri (2018) concluded that marketing channels expropriate a substantial proportion of the profit with both the growers as well as the consumers being losers. Saffron income being highly responsive to marketing channels or income elasticity of channel being high, government should provide support to saffron growers so that their income will increase which will escalate output as well. By cooperative marketing the chains of middlemen can be eliminated and grower's share in consumer's rupee can be increased. Harmonised link or connection between the ultimate consumers and the growers can improve their monetary status and provide them with the market incentives important for the extension of this shrinking industry. Once the marketing is regularized the demand would increase and the farmers will get better incentives and subsequently divert more land for the cultivation of this crop.

Raja *et al.* (2018) concluded that there has been a drastic change in terms of the adoption of recommended package of practices by saffron growers of the

Pulwama district after the launch of National Saffron Mission. However, a lot needs to be done to further expedite the production and productivity of the saffron in the valley. In addition to this, the flagship programme needs to be continued so as to extend its benefits to all the saffron growers of the valley.

Menia *et al.* (2018) concluded that the application of nitrogenous fertilizers especially urea results greater impact on dry and fresh stigma weights of saffron. Various types of disease control fungicides, pesticides and other materials should be used in adequate proportion by the growers so that they have easy to control these devastating disease at the earliest. The establishment of weather stations in the main saffron growing areas of the state so that it can provide daily information bulletins regarding weather to the growers. There is necessity to take steps to educate farmers of the latest developments by state government and help them to enhance their yield and productivity by adopting and good management practices.

Noori *et al.* (2018) revealed that major destination of Afghanistan saffron export was India from 2014-17 with the contribution of almost 60%. The transition probability of saffron export from Afghanistan reveals that United Arab Emirates was a highly stable destination country for saffron export from Afghanistan and India is a somewhat stable destination country. A cost and price analysis of saffron in Afghanistan indicates that the price spread was 27026 Afs/kg. The producers share in export value was 76%. Farmers prefer cultivating saffron instead of cash crop poppy which is also prohibited by law.

Irtifa *et al.* (2020) indicates that there are various factors which are responsible for the declining of the saffron industry in Kashmir. The findings suggest that climate changes, irrigation facilities, marketing, awareness and training about cultivation, availability of unexperienced labour force, illegal construction on saffron land, clandestine of cheap saffron, adulteration, and non-availability of good quality saffron corms were the major factors found in the

study responsible for declining of saffron cultivation in Kashmir and the conversion of saffron land into commercial purposes.

A survey across the available studies indicated that a good research has been conducted for this crop but the references for its sustainability seems lacking which made it essential to analyse the farm level sustainability in its niche area.

Chapter -3

MATERIALS AND METHODS

The research methodology adopted for conducting the present study has been discussed in this chapter under the following headings.

- 3.1 Data collection
- 3.2 Locale of the study
- 3.3 Sampling design
- 3.4 Analytical procedure
- 3.5 Construction of sustainability indicators
- 3.6 Construction of sustainability indicators

3.1 Data collection

The present study includes both qualitative and quantitative methods and is based upon both primary and secondary data.

Primary data: The primary data, including information on various socio-economic characteristics of respondents and various sustainability indicators, were collected from sample respondents through personal interview method on a well structured and pre- tested interview schedule during 2020-21 & 2021-22.

Secondary data: The secondary data pertaining to area, production, etc, were obtained from published/unpublished records of Directorate of Agriculture, Financial commissioners' revenue, SKUAST publications, Spices Board, etc.

3.2 Locale of the study

In India saffron crop is exclusively grown in Kashmir valley J & K (UT). In Kashmir, saffron is mainly cultivated in four districts namely Pulwama, Budgam, Srinagar and Kishtwar. District Kishtwar is the only district in Jammu division which has some area under saffron. District Pulwama, commonly known

as saffron hub of Kashmir, is the main contributor to saffron production followed by Budgam, Srinagar and Kishtwar. The study is conducted in two districts of Kashmir division *viz.*, Pulwama and Budgam.

3.3 Sampling design

Sample respondents for collection of primary data were selected by employing multistage sampling procedure.

3.3.1 Selection of districts

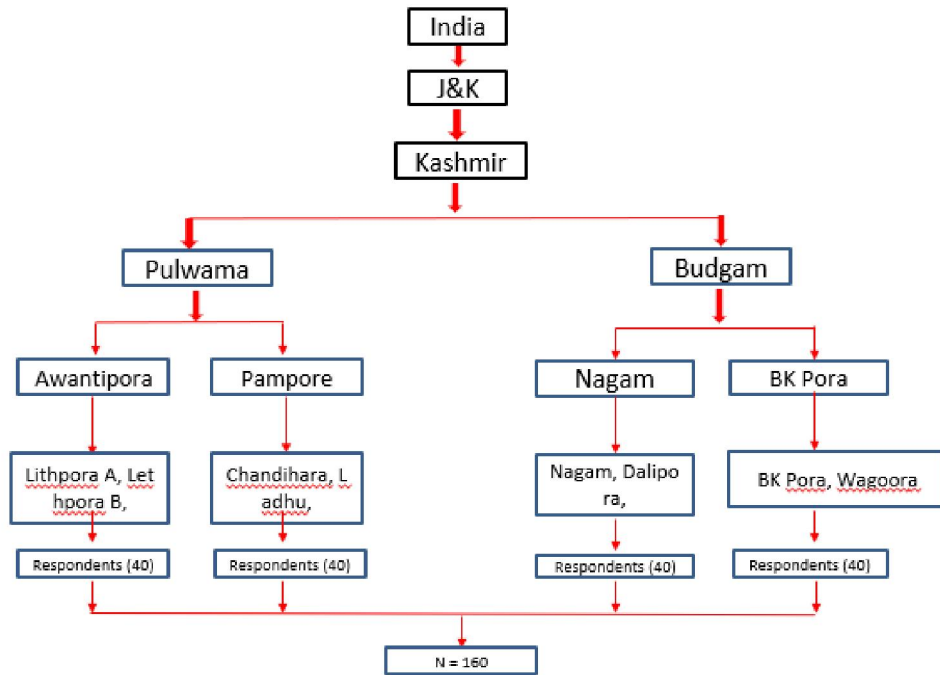
This study was conducted purposively in two districts *viz.*, Pulwama and Budgam of Kashmir division based upon higher acreage under this crop in these districts. These two districts accounted 84.5 and 7.9 per cent of saffron area in Kashmir and 84.7 and 7.9 per cent of its production.

3.3.2 Selection of blocks

In the second stage of sampling two blocks were selected from each district randomly in consultation with officials working with National Saffron Mission, and subject matter experts of saffron Research Station, SKUAST-K, thus making a total of four blocks. Accordingly Pampore and Awantipora blocks were selected from district Pulwama and Nagam and B. K. Pora blocks were selected from district Budgam.

3.3.3 Selection of villages and respondents

Finally, eight villages *viz.*, two villages from each block and respondents were selected randomly to obtain a sample size of 160. Forty respondents from each village cluster identified in each selected block were drawn randomly thus making a sample of 160 respondents from the study area.



3.4 Analytical Procedures

Various statistical and econometric tools were employed to analyse the data, based on objectives of study. Economic feasibility measures like benefit cost ratio, and net present value were used to analyse the data. The different statistical measures employed in the study are detailed as:

3.4.1 Net present value (NPV)

Net Present Value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows. NPV was used in capital budgeting to analyse the profitability of a projected investment or project.

The following is the formula for calculating NPV:

$$NPV = \sum_{t=1}^n \frac{B_t - C_t}{(1 + i)^t}$$

Where,

B = Benefits in the year t,

C = Costs in the year t,

i = Selected discount rate, and

t = Number of time periods

Generally, an investment with a positive NPV will be a profitable one and vice versa.

3.4.2 Benefit cost ratio (BCR)

A benefit cost ratio (BCR) attempts to identify the relationship between the cost and benefits of a project, to undertaking new projects or replacing old ones.

The following formula was employed to estimate the ratio

$$BCR = \frac{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t}{(1+i)^t}}$$

Where,

B =Benefits accruing in year 't'

C = Costs accruing in year 't'

i = Selected discount rate

n = No. of years for which system will operate

The BCR should be greater than 1 for any working system, and then only it can be considered worthy.

3.4.3 Pearson's correlation

In order to assess the association of different indicators under each efficiency measures viz., economic, social and ecological, correlation coefficients were estimated by employing following formula ;

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where,

r = Pearson Correlation Coefficient

x_i = x variable samples y_i = y variable sample

\bar{x} = mean of values in x variable \bar{y} = mean of values in y variable

3.5 Construction of sustainability indicators

This study developed a farm level sustainability index by considering various sustainability efficiency measures viz., economic, social and environmental .The calculation of the index included:

Economic indicators: The economic sustainability indicators include:

- a) Product price risk (0 for no product price risk and 1 for product price risk)
- b) Grade specification (0 for non-adoption of grade specification and 1 for adoption of grade specification)
- c) Market participation (0 for no direct participation in market ,1 for participation in direct marketing)
- d) Frequency of crop failure (0 for frequent crop failure after 2 years ,1 for 2-5 years and 2 for > 10 years)

- e) Beneficiary of financial institution (0 for informal sources ,1 for formal sources)
- f) Scarcity of labourer (0 for absence of scarcity of labourer,1 for presence of scarcity of labourer) etc.

Social Indicators: The social sustainability indicators include:

- a) Education level (0 for illiterate , 1 for primary ,2 for secondary ,3 for high and 4 for higher above)
- b) Public awareness programme (0 for no participation in any public awareness programme, 1 for participation in public awareness programme)
- c) Participation in extension activities (0 for no participation in any extension activity ,1 for participation in any extension activity)
- d) Membership in some organization (0 for saffron grower association , 1 for mohalla committee and 2 for civil society)
- e) Participation of younger generation in farming (0 for no participation of younger generation in farming ,1 for participation of younger generation in farming)
- f) Participation in social decision making (0 for no participation in social decision making, 1 for participation in social decision making) etc.

Ecological indicators: The ecological sustainability indicators include:

- a) Use of INM(0 for no use of INM,1 for use of INM)
- b) Soil erosion (0 for no soil erosion ,1 for soil erosion)
- c) Closeness to the road highway (0 for no closeness to the road highway ,1 for closeness to the road highway)
- d) Brick kiln /cement factory effect (0 for no effect due to brick kiln/ cement factory,1 for effect due to brick kiln/ cement factory)

- e) Use of pesticides (0 for non- adoption of plant protection measures and 1 for adoption of plant protection measures)
- f) Climate variability (0 for no climate variability ,1 for climate variability)
- g) Weed control (0 for no weed control ,1 for weed control)

3.5.1 Sustainability index

The sustainability index (SI) for each of the sustainability dimensions was constructed on the basis of Human Development Index (HDI) UNDP (1990). Weights of the indicators were calculated as per the method given by Iyenger and Sudarshan (1982). The overall sustainability was arrived by constructing composite farm level sustainability index (CSI) by averaging of the three sustainability indices. On the basis of sustainability indices values, the sustainability could be a) less sustainable (0.00 - 0.25) ,b) moderately sustainable (0.26 - 0.50) , c) sustainable (0.51 - 0.75) and d) highly sustainable (0.76 - 1.00).

3.6 Sustainability model

After the identification and quantification of above sustainability indicators, the model of following structural form was employed to analyze the determinants of farm level sustainability of saffron:

$$SI = f (EE, SoE, ECE...U)$$

SI = Sustainability index

EE = Economic efficiency

SoE = Social efficiency

ECE = Ecological efficiency

U = Error term

A number of variables were attempted in the model but only those were kept in final estimate of the model which gave best fit to it.

Chapter- 4

RESULTS

The present chapter puts forth the results obtained from the analysis of data as per the specified objectives of the study. The findings of the study have been presented under the following heads:

- 4.1 Status and trends in saffron area, production and productivity
- 4.2 Socio -economic features of respondents
- 4.3 Economic viability of saffron cultivation vis-à-vis competing crop
- 4.4 Sustainability of Saffron
- 4.5 Determinants of sustainability

4.1 Status and trends in saffron area, production and productivity

4.1.1 Trend analysis of saffron

Saffron is rainfed perennial crop grown for a red substance obtained from the stigma of flowers called the saffranil. In India saffron is exclusively grown in the Kashmir valley. Major proportion of the saffron area in Kashmir falls in district Pulwama and Budgam and constituted over 80 per cent of the total saffron area in Kashmir. At present saffron is cultivated on an area of 3.72 thousand ha with an annual production of 15.01MT. The productivity of this crop stands at 4.04kg /ha (Table 4.1). Saffron cultivation has declined from 1996-97 to 2001-02 in terms of area, production and yield, because of inadequate irrigation facilities, coupled with climate change manifestations and increasing diversion of agricultural land to urbanisation and have been important factor for declining area under this spice. After 2003-04 with the inception of Horticulture Technology Mission (MM-I and MM-II), National Agriculture Technology Project (NATP) and National Agriculture Innovation Project (NAIP) this crop got the technological break through and incentives for area expansion. Since then the area

under saffron has increased up to 3785 ha and production reached upto 9.46 MT by 2008-09. The implementation of National Saffron Mission (NSM) with its mandated activities, has rejuvenated an appreciable area under this crop. As high as 150 ha of area has been rejuvenated and brought back to saffron. This has assisted the declining trend of saffron area to a great extent (figure 1). The productivity gain under this mission has resulted in the aggregate increase in saffron production. The declining behaviour of saffron area has to be reversed and commenced with technological and policy support to enhance yield levels from this crop.

4.1.2 Status of saffron

To examine the pattern of growth in saffron, compound growth rates were estimated for area, production and productivity in case I when the role of NSM was considered and in case II when NSM was ignored. The estimates of CGR presented in the Table 4.2 revealed declining trend in area and production of saffron in case II. The decline was drastically of higher magnitude in production. NSM in case I could stop the decline in area to a great extent that could reverse the declining trend in production and productivity of saffron as well.

4.2 Socio - economic features

4.2.1 Family size and structure

Family size determines the strength of family in terms of family labourers / earners and proportion of female members. This information is important in consideration of increasing migration and feminization of farming activities. An average family size in the study area was 5.25 and it was relatively high at Pulwama. The estimates of sex ratio indicates a favourable scenario towards female members, though it was relatively inclined towards males among childrens. A majority of the households was nucleated family structure but a few families were still joint.

4.2.2 Educational status

Education provides healthy as well as clear environment for a good standard of living through a developmental change in social and cultural life of the people, living both in plains and hilly regions. The educational status of farm families is an indicator of human capital formation and economic status. Better formal education helps the farmer in improving his ability to know modern science and technology and in utilizing it for better living and in adopting appropriate technologies. As high as 10 per cent of family head were illiterate and the incidence of illiteracy was yet more prominent in Pulwama as compared to Budgam. The proportion of members having attained education more than higher secondary was relatively higher among farm families in Pulwama. The encouragement of female education among new generation is highly required to achieve desired participation of women in farm family and non- farm activities.

4.2.3 Land inventory

Since farming is a land based activity, its possession determines the extent of growth and progress of farming. The assessment of endowment of land capital is essential. It could be seen from the Table 4.5, that a household in the study area possessed an average holding of 15.6 kanal. The average holding size was relatively higher at Pulwama which was almost double the holding size in Budgam. Cultivated area constituted over 82.5 per cent of holding though the irrigated area was relatively higher at Budgam. Higher proportion of irrigated area in Budgam was expected to promote cultivation of irrigated area.

4.2.4 Cropping pattern

Cropping pattern envisages the crop sequence or spatial distribution of crops across the cropped area. It indicates the importance of a crop in terms of area allocation. The cropping pattern of the study area presented in the Table 4.6 revealed predominance of saffron, which has been raised on over 66 per cent of the cropped area. The other important crop in terms of area allocation was apple

followed by vegetable and walnut. Among the selected districts the main crop was saffron in Pulwama and apple formed the important crop in Budgam. Moreover, the availability of irrigation facilities in Budgam prompted relatively more intensification of cropping system due to multiple cropping.

4.2.5 Occupation

The occupational pattern in the study area indicated that the major proportion of working family members were engaged in farming followed by self-business like shop keeping etc. As high as 9 per cent members were dependent. The dependence was relatively higher in Budgam and the engagement in self business was higher in Pulwama. The distinctions in occupational pattern is expected to generate different level of income at the different study area .

4.3 Economic viability of saffron cultivation vis -a -vis competing crop

4.3.1 Costs and returns

The cost of cultivation is of wide interest to the users of cost data and assumes importance in planning. At the micro level, it enables the farm management experts to study the efficiency of the various cultivation practices and alter the crop planning by providing information regarding their profitability and helps to make practical recommendations for farm planning aimed at better allocation of existing resources and introduction of improved agronomic practices which would increase the efficiency of crop.

The year wise cost of cultivation and returns per kanal from saffron and competing crop has been presented in Table 4.8. Owing to poor returns and partly driven by market demands, some of the farmers have shifted some area towards competing crops like apple. The results revealed that the average cost of saffron over a crop cycle of ten years was calculated at Rs.5880 per kanal and it was relatively higher at Budgam (Rs. 6053) than Pulwama (Rs .5705). The establishment cost of saffron during the first year was found higher than other years because of capital intensive nature of corms and labours to sow them. On

the other hand the average cost of cultivation of apple over a cycle of more than ten years was Rs.10052 per kanal and it was relatively higher in Budgam due to the fact that the conversion process started much earlier in this district and the apple had come to bearing stage. The average estimated returns from saffron was Rs.22331 per kanal though the returns in monetary terms was relatively higher at Pulwama. The average return from apple over a crop cycle was worked out at Rs.13638 per kanal and it was relatively high at Budgam.

The item wise cost of cultivation of saffron and competing crop has been presented in Table 4.9. The average results of cost of cultivation per kanal of saffron over the years revealed that the major item of cost incurred in saffron cultivation was the corms and it's sowing followed by the human labour. The cost incurred on value of corms formed major component. It was 56 per cent, of the establishment cost. The cost incurred on human labour was 46 per cent of the establishment cost. The expenses on manures, fertilizers, plant protection measures, and machine power formed the other cost components. The fixed cost ranged from 10-11 per cent of the total cost of cultivation over the period of ten years of crop cycle. The total average cost of cultivation per kanal of saffron over a crop cycle of ten years was Rs. 3454, and it was relatively higher in Budgam. The average cost of cultivation per kanal of competing crop over more than ten years revealed that the major item of cost incurred in apple cultivation was the amount spent on human labour(36 per cent) followed by manures and fertilizers (33 per cent). The cost on plant protection is expected to increase significantly as the age of the orchard increases. The total cost of cultivation per kanal of apple over a crop cycle of more than ten years was Rs.10052, and it was relatively higher in Budgam.

4.3.1.3 Returns from saffron and competing crop

The returns from saffron included main product, bi product and daughter corms. The returns were calculated over a cropping cycle of 10 years. The present study estimates the returns obtained from saffron cultivation in the study area.

4.3.1.4 Net returns from saffron and competing crop

A perusal of data presented in Table 4. 10 revealed that the average net returns from saffron per kanal in a crop cycle of ten years was Rs16451, and it was relatively higher in Pulwama. The yield from saffron remained relatively low in first year and increased considerably from second year onwards. The yield from daughter corms was obtained after the completion of cropping cycle. The gross returns were lowest during the first year and highest during the tenth year. The average net returns from apple were Rs.3585 per kanal, and were relatively higher in Budgam.

4.3.2 Economic viability of saffron and competing crop

Economic viability of saffron and competing crop was worked out by analysing benefit cost ratio, and net present worth.

4.3.2.1 Economic viability of saffron and competing crop

A perusal of data presented in Table 4.11 reveals that average of benefit cost ratio (B-C ratio) at 12 per cent discounting rate for saffron was found 2.6, and it was relatively higher in Pulwama. The average of benefit cost ratio (B-C ratio) at 12 per cent discounting rate for apple was found 1.12, and it was relatively higher in Budgam.

The average of NPV at discounting rate of 12 per cent was found Rs.66580 for saffron, and it was relatively higher in Pulwama. The average of NPV at discounting rate of 12 per cent was found Rs. 5636, and it was relatively higher in Budgam.

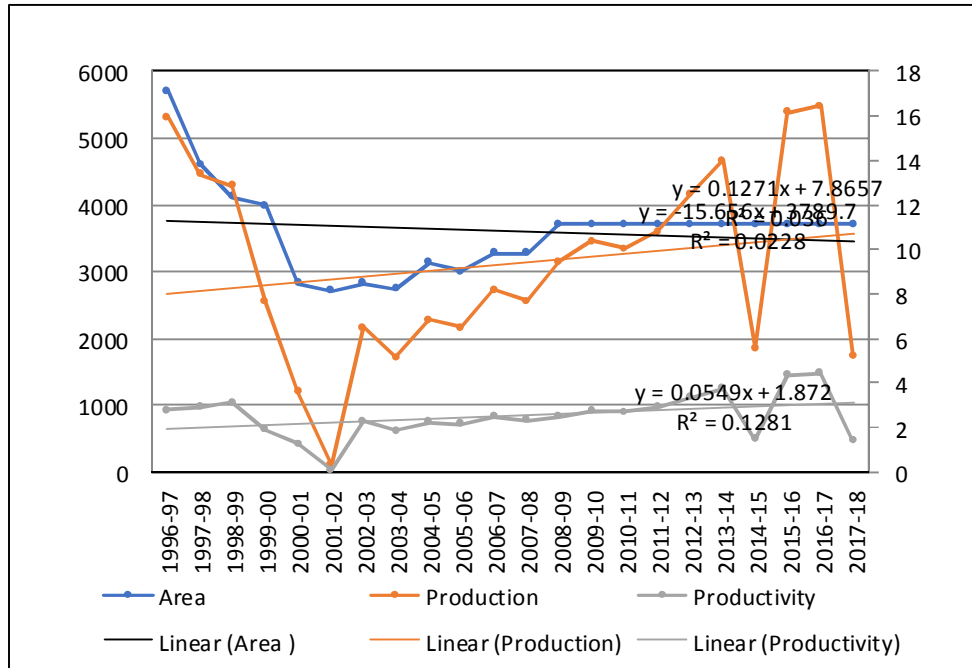


Fig. 1: Trends in area, production and productivity of saffron in J &

Trend estimate for Area is $Y = 3.74442 - 0.0101X$

Trend estimate for Yield is $Y = 1.937 + 0.0463X$

Trend estimate for production is $Y = 7.950 + 0.1116 X$

Table 4.1: Status of saffron area (000ha), production (MT) and productivity (kg/ha)

Year	Case I			Case II			Pooled		
	A	Y	P	A	Y	P	A	Y	P
1996	-	-	-	5.71	2.80	15.98	5.71	2.80	15.98
2000	-	-	-	2.83	1.27	3.60	2.83	1.27	3.60
2005	-	-	-	3.01	2.15	6.47	3.01	2.15	6.47
2010	-	-	-	3.72	2.70	10.03	3.72	2.70	10.03
2011	0.33	4.50	1.49	3.38	2.75	9.31	3.72	2.91	10.8
2015	2.14	5.50	11.74	1.58	2.80	4.42	3.72	4.35	16.17
2019	2.58	4.70	12.12	1.14	2.54	2.89	3.72	4.04	15.01

Note: Case I = With National Saffron Mission and Case II = Without National Saffron Mission

Table 4.2: Compound growth rate in saffron (CGR in %)

Particulars	Case I	Case II
	WNSM	WoNSM
Area	-0.045(0.50) *	-5.23(0.71) *
Production	2.50(2.22)	-238.71(120) *
Yield	2.46(2.50)	-1.11(2.81)

Figures within parenthesis indicates standard error

Note: Case I = with National Saffron Mission and Case II = without National Saffron Mission

Table 4.3: Demographic status in the study area (Number /family)

Particulars	Pulwama	Budgam	Pooled
Adult	5.4	5.1	5.25
Male	2.9(53.70)	2.5(49.02)	2.7(51.43)
Female	2.5(46.93)	2.6(50.98)	2.5(48.57)
Sex ratio	1164	961	1058
Children	0.58	0.41	0.49
Male	0.30(51.72)	0.19(46.34)	0.245(49.50)
Female	0.28(48.27)	0.22(53.65)	0.25(50.50)
Sex ratio	1071	863	980
Total	5.98	5.51	5.7
Male	3.20(53.52)	2.69(48.82)	2.94(51.26)
Female	2.78(46.49)	2.82(51.18)	2.8(48.74)
Sex ratio	1151	1048	1051

Figures within parenthesis indicates per centage

Table 4.4: Educational status of family head (per cent)

S.No	Particulars	Pulwama	Budgam	Pooled
1.	Illiterate	12.5	8	10
2.	Primary	19	19	19
3.	Secondary	44.5	43	44
4.	Higher	14	24	19
5.	above	10	6	8
	Total	100(80)	100(80)	100(160)

Figures within parenthesis indicates absolute value

Table 4.5: Land inventory (k/household)

S.No	Particulars	Pulwama	Budgam	Pooled
1.	Cultivated area	17.93(82.7)	7.8(81.41)	12.86(82.5)
A.	Irrigated	0.3(1.7)	1(13)	0.65(5.05)
B.	Unirrigated	17.63(98.3)	6.8(87.17)	12.3((95.6)
2.	Residential	1.25(5.8)	1.075(11.3)	1.16(7.4)
3.	Waste / fallow	2.5(11.5)	0.7(7.3)	1.6(10.25)
	Total	21.68(100)	9.5(100)	15.6 (100)

Figures within parentheses indicate percentage of total.

Table 4.6: Cropping pattern in the study area (k/household)

S.No	Crop	Pulwama	Budgam	Pooled
1.	Apple	0.7(3.88)	4(48.19)	2.35(17.9)
2.	Almond	0.3(1.66)	-	0.15(1.13)
3.	Walnut	0.5(2.78)	0.3(3.61)	0.4(3)
4.	Other fruits	-	1(12.05)	0.5(3.8)
5.	Saffron	16(88.64)	1.5(18.07)	8.75(66.5)
6.	Maize/pulses	0.125(0.69)	-	0.0625(0.5)
7.	Mustard/oats	0.125(0.69)	0.5(6.02)	0.312(2.4)
8.	Rice	-	0.5(6.02)	0.25(1.9)
9.	vegetables	0.3(1.66)	0.5(6.02)	0.4(3)
10.	Total cropped area	18.05(100)	8.3(100)	13.17(100)
11.	Cropping intensity	100.7	106.4	102.4

Figures within parentheses indicate percentage of total.

Table 4.7: Primary occupation of family members (per cent of households)

S.No	Particulars	Pulwama	Budgam	Pooled
1.	Cultivation	57.97	53.57	55.77
2.	Labourer	4.35	8.93	6.64
3.	Self -business	28.98	14.29	21.6
4.	Student	4.35	8.93	6.64
5.	Dependent	4.35	14.28	9.3
	Total	100(5.98)	100(5.51)	5.7(100)

Figures within parenthesis indicates absolute value

Table 4.8: Year wise cost of cultivation and returns from saffron and Apple in (Rupees per kanal)

	Pulwama				Budgam				Pooled			
	Saffron		Apple		Saffron		Apple		Saffron		Apple	
Years	Costs	Returns	Costs	Returns	costs	Returns	Costs	Returns	Costs	Returns	Costs	Returns
1 st	24585	9594	5200	0	27511	7307	6500	0	26048	8455	5850	0
2 nd	3452	14774	3000	0	3340	10722	3150	0	3396	12748	3075	0
3 rd	3411	19069	2500	0	3409	13969	2690	0	3410	16519	2595	0
4 th	3303	13971	2455	0	3228	13667	2650	0	3265	13819	2552	0
5 th	3627	16885	2160	0	3617	12930	2260	0	3622	14907	2210	0
6 th	3725	18054	6569	0	3769	24417	6695	0	3747	21235	6632	0
7 th	3144	24765	11650	16950	3031	31410	12650	20890	3087	28087	12150	18920
8 th	4977	15365	19620	29250	4770	15242	22661	35208	4873	15303	21140	32229
9 th	3003	24259	20294	34550	4252	14985	20341	41328	3627	19622	20317	37939
>10 th	3841	77930	23415	42625	3607	67320	24590	51963	3724	72625	24002	47294
Average	5705	23466	9686	12337	6053	21197	10418	14938	5880	22331	10052	13638

Table 4.9: Average cost of cultivation of saffron and Apple (percentage)

S.No	Particulars	Pulwama		Budgam		Pooled	
		Saffron	Apple	Saffron	Apple	Saffron	Apple
1.	Human labour	27	35	26	38	46	36
2.	Machine labour	22	4	22	3.8	38	3.9
3.	Value of seed	32	-	34	-	56	-
4.	Planting material	-	2.3	-	2.1	-	2.2
5.	Manures & Fertilizers	1.7	13	1.6	13.1	2.8	33
6.	Seed treatment	2.0	-	1.8	-	3.3	-
7.	Plant protection	1.9	20	0.7	19.4	1.6	30.5
8.	Interest on working capital @12%	7.6	12	8.5	11.3	13.3	11.7
9.	Total variable cost	78	84	80	85	13.5	11
10.	Rental value of land	12	7	11.5	7	20	7.6
11.	Depreciation	6.5	6	6.1	5.8	10	5.9
12.	Interest on fixed capital @12%	2	1.6	2.1	1.6	3	1.6
13.	Total fixed cost	21	15	19.8	15	10.5	5.5
14.	Total cost	100(5705)	100(9686)	100(6053)	100(10418)	100(3454)	10052(100)

Figures with parenthesis indicates absolute value

Table 4.10 : Year wise net returns from saffron and Apple in (Rupees per kanal)

Years	Pulwama		Budgam		Pooled	
	Saffron	Apple	Saffron	Apple	Saffron	Apple
	Net returns	Net returns	Net returns	Net returns	Net returns	Net returns
1 st	-14991	-5200	-20204	-6500	-17593	-5850
2 nd	11322	-3000	7382	-3150	9352	-3075
3 rd	15658	-2500	10560	-2690	13109	-2595
4 th	10668	-2455	10439	-2650	10554	-2522
5 th	13258	-2160	9313	-2260	11285	-2210
6 th	14329	-6569	20648	-6695	17488	-6632
7 th	21621	5300	28379	8240	25000	6770
8 th	10388	9630	10472	12547	10430	11088
9 th	21256	14256	10733	20987	15995	17621
>10 th	75089	19210	63713	27373	68901	23921
Average	17761	2651	15144	4520	16451	3585

Table 4.11: Economic viability of Saffron and Apple

S.No	Particulars	Pulwama		Budgam		Pooled	
		Saffron	Apple	Saffron	Apple	Saffron	Apple
1.	B-C Ratio						
a.	Discounted	2.89	1.06	2.4	1.18	2.6	1.12
b.	Undiscounted	4.1	1.27	3.5	1.43	3.8	1.35
2.	NPV (Rs)						
a.	Discounted	74321	2684	5924	8588	66580	5636
b.	Undiscounted	178598	26512	151435	45202	164521	35857

4.4 Sustainability indicators of saffron

The performance of saffron is significantly affected by a number of factors, of which climate variability is important (Feroz *et al.*, 2022). An attempt has been made to assess the sustainability of this crop within the frontiers of various efficiency indicators grouped under economic, social and ecological heading. The various indicators under each category along with responses from respondents have been detailed in the following sub sections.

4.4.1 Economic indicators of sustainability

Economic sustainability is usually defined as ability of a farm to persist and to produce for markets under competitive situation. The economic indicators of sustainability are used to assess the resource productivity and its efficiency .Economic efficiency indicates the potential profit from the given , amount of limited assessable resources .The set of parameters to measure the economic sustainability has been presented in Table 4.12.It is depicted from the table that product price risk and scarcity of skilled labourers were major issues which were brought towards by 80 per cent and 85 per cent of the respondents, respectively and these issues were more prominent in Budgam. Adoption of grade specification was revealed by only 38.75 per cent of respondents though it was relatively better at saffron farms in Pulwama. Distance to input or output markets were other important factors that determined economic sustainability of saffron in Kashmir valley. As high as 90 per cent of the saffron growers had input market at the distance of >4km though the proportion of sample farmers located at such distance was relatively less in Pulwama. Similar scenario was observed in the distance of output market. A good per centage of sample farmers in Pulwama were found to fall in 0-5 km distance category. The lower productivity of the detrimental factors have led to lose the commercial orientation of this crop. Only 55 per cent saffron respondents have expressed that they produced for markets. Of these farmers only a few were observed to have participated in direct sale of the produce and rest sold their small produce through contractors. A significantly

higher proportion of farmers expressed concern about frequent crop failure in every >10 years. Farmers tried to apply their own risk aversion measures though about 51 per cent farmers had shifted a part of their saffron land towards other crops either permanently or temporarily. All these responses were taken care of.

4.4.2 Social indicators of sustainability

Social sustainability indicators included distributional justice (access to resources and education, distribution of income) social bonds and participation in decision making etc., improved sustainability of crops and saffron in particular at farm level. Social sustainability indicators can help disrupt social rigidity, inertia and there by potentially improve social sustainability efforts. The set of parameters to measure the social sustainability have been presented in Table 4.13 .It is revealed from the table that participation in extension activities is essential to get information about scientific approaches of production ,finance and supply chain .However only 61.25 per cent of the saffron farmers had participated in various extension activities and their involvement in such activities was relatively higher at Pulwama. It is very disappointing that farmers had poor social bonds as indicated by their lower participation as members of saffron growers organisation . Only 24 per cent of the farmers revealed their participation in social decision making though this scenario was favourable at Pulwama. Sustainability of saffron was closely associated with the participation of younger generation in farming and only 11.25 per cent of the younger members of the family were seen having engaged in farming. About 8 per cent of the farmers also revealed incidence of land / water conflict in the study area.

4.4.3 Ecological indicators of sustainability

Ecological sustainability is defined as the responsible interaction with the environment to avoid depletion or degradation of natural resources and allow for long term environmental quality. The ultimate aim of ecological indicators is to integrate the assessment of ecological indicators with management practices.

Ecological indicators are essential tool for tracking environmental progress, supporting policy evaluation and informing the public. The set of parameters to measure the ecological sustainability has been presented in Table 4.14. Of the various indicators documented in the Table 4.14, water scarcity during critical growth stage was the major ecological concern raised by 90 per cent of the sample farmers and this indicator was highly unfavourable in Pulwama. Another persistently growing concern was the infestation of rodents including wildlife protected Porcupine. Rodents coming from abandoned saffron area is a big menace in the area that has raised sustainability issues of this crop. The negative spill over effect of development processes like installation of brick kiln / cement factories or construction of National Highway across saffron field without fencing was observed by good number of respondents. All these issues are to be addressed amicably for the farm sustenance of this crop.

Table 4.12: Responses to Economic Indicators (160) (No. multiple responses)

S.No	Particulars	Pulwama	Budgam	Pooled
1.	Distance to the input market (km)			
a.	0 – 3	22 (27.5)	5(6.25)	27(17)
b.	3 – 4	14 (17.5)	7(8.75)	21(13)
c.	> 4	44 (55)	68(85)	112(70)
2.	Distance to the output market (km)			
a.	0 – 5	22(40.75)	4(5)	26(16)
b.	5 – 10	54(67.5)	70(87.5)	124(77)
c.	> 10	4(5)	6(7.5)	10(6)
3.	Product price risk concerns (0,1)	60(75)	68(85)	128(80)
4.	Market Orientation (0,1)	42(52.5)	46(57.5)	88 (55)
5.	Adoption of Grade specification(0,1)	35 (43.75)	27(33.75)	62(38.75)
6.	Market participation (0,1)	32 (40)	38(47.5)	70(43.75)
7.	Beneficiary of financial institution			
a.	Formal			
	Banks	4(5)	1(1.25)	5(3)
b.	Informal			
	Relatives & Friends	17 (21.25)	11(3.75)	28(18)
	Money lenders & traders	33(41.25)	21(26.25)	54 (34)
8.	Frequent crop failure			
a.	2 years	2 (2.5)	3(3.75)	5 (3)
b.	5 years	6 (7.5)	8 (10)	14 (9)
c.	> 10 years	48 (60)	40 (50)	88(55)
9.	Risk aversion measures			
a.	yield risk	45 (56.25)	38(47.5)	83(52)
b.	b. output price risk	22 (27.5)	17(21.25)	39(24)
10	10.Switch to another crop			
a.	Permanent (Apple)	45 (56.25)	37(46)	82(51)
b.	b. Temporary (vegetable & others)	4 (5)	10(12.5)	14(9)
11.	11.Scarcity of labourer(0,1)	65 (81.25)	71(88.75)	136 (85)

Figures within parenthesis indicates per centage of total

Table 4.13: Responses to Social indicators (160) (No. multiple responses)

S.No	Particulars	Pulwama	Budgam	Pooled
1.	Land /water conflict (0,1)			
a.	Rare	73(91.25)	75(93.75)	148(92.5)
b.	Often	7(8.75)	5(6.25)	12(7.5)
2.	Participation in any extension Activity(0,1)	53(66.25)	45(56.25)	98(61.25)
3.	Membership in some organisation			
a.	Saffron grower association	25(31.25)	6(7.5)	31(19)
b.	Mohalla committee	7(8.75)	3(3.75)	10(6.25)
c.	Civil society	3(3.75)	1(1.25)	4(2.5)
4.	Educational level(0,1,2,3,4)			
a.	Illiterate	10(12.5)	12(15)	22(13.75)
b.	Primary	17(21.5)	16(20)	33(21)
c.	Secondary	32(44.5)	30(37.5)	62(38.75)
d.	Higher	14(17)	18(22.5)	32(20)
e.	Above	7(9)	4(5)	11(7)
5.	Participation in social decision making(0,1)	25(31.25)	14(17.5)	39(24)
6.	Participation of younger generation in farming (0,1)	10(12)	8(10)	18(11.25)
7.	Public awareness programme(0,1)	21(26.25)	7(8.75)	28(17.5)
8.	Land holding (%)	21.5	9.58	15.54
9.	Sex ratio	1151	1048	1051

Figures within parenthesis indicates per centage of total

Table 4.14: Responses to Ecological indicators (160) (No. multiple responses)

S.No	Particulars	Pulwama	Budgam	Pooled
1.	Rodent infestation(0,1)			
a.	Rare	9(11.25)	11(13.75)	20(12.5)
b.	Often	71(88.75)	69(86.25)	140(87.5)
2.	Use of INM(0,1)	12(15)	9(11.25)	21(13)
3.	Soil erosion(0,1)	15(18.75)	11(14)	26(16.25)
4.	Negative externalities of NH(0,1)	11(13.75)	-	11(7)
5.	Bricklin /cement factory effect(0,1)	34(42.5)	29(36.25)	63(39)
6.	Adoption of Plant Protection measures(0,1)	42(52.5)	28(35)	70(44)
7.	Climate variability(0,1)	61(76.25)	59(73.75)	120(75)
8.	Weed control(0,1)	60(75)	55(68.75)	115(72)
9.	Nutrient loss(0,1)	51(63.75)	49(61.25)	100(63)
10.	Adequate drainage(0,1)	80(100)	68(85)	148(92.5)
11.	Mulching(0,1)	19(23.75)	11(13.75)	30(19)
12.	Water scarcity during critical growth stage(0,1)	80(100)	64(80)	144(90)

Figures within parenthesis indicates per centage of total

4.4.4 Indexing sustainability of saffron

An attempt has been made to arrive at the sustainability measures of saffron cultivation in Kashmir valley by employing a variety of indicators under social, economic and ecological efficiency parameters. Accordingly 14 indicators in different units have been considered under economic efficiency parameters and 11 and 15 number of indicators have been considered for social and ecological efficiency parameters of sustainability. All the indicators under economic efficiency were given weights and then standardized by employing methodology adopted in the construction of Human Development Index (Hawn, Baba,2018, Baba *et al.*, 2018). The index value obtained for different indicators were then aggregated to form an economic efficiency index. Similarly indices for three major parameters were then averaged to obtain a composed sustainable indicator for saffron cultivation (Table 4.15). Sustainability index (0.140) indicated that the cultivation of saffron was least sustainable though the value were relatively higher for Pulwama. The index values for social efficiency measure was relatively lower than the other efficiency indicators. It could be seen from the Table 4.15 that except for social efficiency, all the indices had attained better values for Pulwama. The social indicator of saffron sustainability was yet lower due to poor social bonds in the study area.

Table 4.15: Sustainability of saffron

Parameters	Pulwama		Budgam		Pooled	
	Average	Stdev	Average	Stdev	Average	Stdev
Economic efficiency	0.202	0.027	0.163	0.030	0.182	0.028
Social efficiency	0.057	0.019	0.072	0.022	0.064	0.020
Ecological efficiency	0.203	0.023	0.142	0.026	0.172	0.024
Sustainability index	0.154	0.016	0.126	0.016	0.14	0.016

4.4.5 Sustainability index of saffron

This Fig.2 has depicted the indices and it is visible that Pulwama has lower efficiency in social parameter. The aggregate index for Pulwama appeared towards periphera indicating better sustainability of saffron cultivation in this district as compared to Budgam.

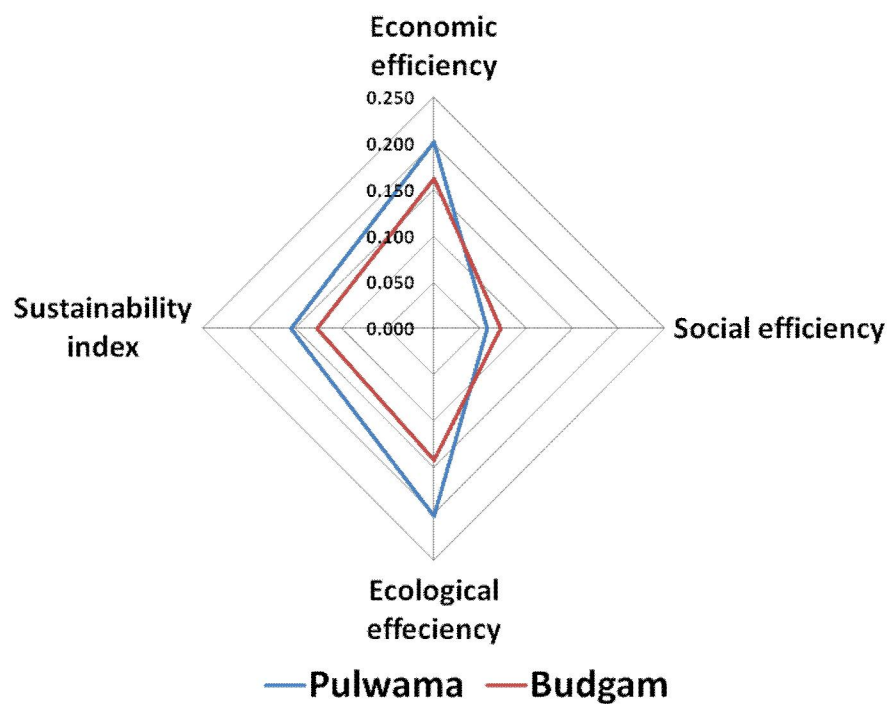


Fig. 2: Sustainability index of saffron

4.4.6 Association of economic variables with economic efficiency index and sustainability index

In order to examine the behaviour of different economic sustainability indicators on economic efficiency index, and overall sustainability index, correlation coefficients were estimated and results have been presented in Table 4.16. It could be seen from the table that out of 14 specified variables, nine variables had positive association with economic efficiency index and sustainability index in both the locations though this positive relation appeared stronger for beneficiaries of financial institutions, distance to the output market and market participation. Contrary to this, product price risk and frequent crop failure held negative association with these sustainability indices. Unlike Pulwama cost of saffron cultivation held negative relationship with economic efficiency index and sustainability index in district Budgam. The association of individual variables with the sustainability index and economic index was expected to indirectly influence on the sustainability by way of affecting economic efficiency index.

4.4.7 Association of social variables with social efficiency index and sustainability index

A total of 11 different variables have been employed to construct social efficiency index. The association of different social variables with social sustainability index presented in the Table 4.17 revealed that except for sex ratio, workers, per capita land and holdings variables turned out to be significantly correlated with sustainability index. These four variables showed positive and significant correlation with social efficiency index in Pulwama. Different social indicators exhibited same association with sustainability index in Budgam as in Pulwama. Per capita land turned out to have significant association with social efficiency index in Budgam while the association of social efficiency index with land /water conflict was observed to be negative and significant with social

efficiency index .The association of set of social variables on overall sustainability index appeared to have the same association as with social efficiency index.

4.4.8 Association of ecological variables with ecological efficiency index and sustainability index

Respondents in different locations have expressed different responses with respect to ecological indicators of sustainability as discussed in Table 4.14. An attempt has been made to observe the correlation between ecological efficiency index and various ecological indicators. The estimates of correlation documented in Table 4.18 indicated that a majority of variables was negatively correlated with ecological efficiency index. While use of INM, adequate drainage and water scarcity held positive correlation with ecological efficiency index in Pulwama. Water scarcity was the only variable in Budgam that to have positive association with ecological efficiency index in Budgam. The negative and positive association of different variables on ecological efficiency index was expected to have differential influence on sustainability index of saffron cultivation.

4.5 Determinants of saffron sustainability

An attempt has been made to quantify the influence of different efficiency indicators viz., social, economic and ecological efficiency indices on sustainability of saffron cultivation in Budgam and Pulwama, sustainability index was endogenized with these efficiency indices. The regression results indicated that sustainability / efficiency of economic and ecological were significant and positive determinants of saffron sustainability in both the locations .While social efficiency turned to be positive determinants of saffron sustainability in Pulwama, its relationship turned insignificant in district Budgam .The value for Adjusted R2 revealed that the specified variables explained over 93 per cent and 94 per cent variation in the specified dependent variable indicating model to be in best fit .

Table 4.16: Association of economic indicators with economic efficiency index and sustainability index

S.no	Indicators	Pulwama		Budgam		Pooled	
		EEI	SI	EEI	SI	EEI	SI
1.	Distance to input market	0.463**	0.272*	0.325**	0.216	0.394**	0.244**
2.	Distance to output market	0.472**	0.332**	0.336**	0.198	0.404**	0.265**
3.	Product price risk	-0.293**	-0.222*	-0.487**	-0.351**	-0.39**	-0.286*
4.	Market orientation	0.01	0.032	0.450**	0.273	0.23**	0.152
5.	Adoption of grade specification	0.362**	0.232*	0.282*	0.171	0.322*	0.201
6.	Market participation	0.467**	0.416**	0.234*	0.025	0.350*	0.220**
7.	Beneficiary of financial institutions	0.537**	0.483**	0.379**	0.375**	0.458**	0.429*
8.	Frequent crop failure	-0.368**	-0.169	-0.448**	-0.283*	-0.408**	-0.224**
9.	Risk aversion measures	0.423**	0.585**	0.522**	0.465	0.472**	0.525**
10.	Switch to another crop	-0.183	-0.176	0.390**	-0.402**	-0.292**	-0.289
11.	Scarcity of labourers	0.229*	0.205	0.069	0.15	0.189*	0.177
12.	Per capita income (000)	0.088	0.172	0.346**	0.252*	0.17**	0.212*
13.	Saffron income (% of total family income)	0.226*	0.18	0.346**	0.252*	0.286*	0.216*
14.	Cost of saffron cultivation (000/k)	-0.005	0.076	-0.541**	-0.76**	-0.273**	-0.342**
	EEI	1	0.750**	1	0.683**	1	0.716**

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed)

Table 4.17: Association of social indicators with social efficiency index and sustainability index

S.NO	Indicators	Pulwama		Budgam		Pooled	
		SEI	SI	SEI	SI	SEI	SI
1.	land /water conflict	-0.398	-0.199	-0.243*	-0.216	-0.320	-0.207
2.	Participation in any extension activity	0.321**	0.221*	0.164	0.131	0.242**	0.176*
3.	Membership in some organisation	0.321**	0.136	0.365**	0.133	0.343**	0.134
4.	.Educational level	0.253*	0.059	0.497**	0.001	0.375**	0.03
5.	Participation in social decision making	0.230*	0.047	0.232*	0.264*	0.231*	0.155*
6.	Participation of younger generation in farming	0.397**	0.196	0.343**	0.116	0.37**	0.156
7.	Public awareness programme	0.402**	0.308**	0.488**	0.199	0.445**	0.253**
8.	Sex ratio	0.004	-0.113	0.181	0.042	0.092	-0.035
9.	Workers	0.177	0.113	0.129	0.219	0.153	0.166
10.	Per capita land	0.203	0.223*	0.442**	0.076	0.322**	0.149**
11.	Holding	0.241*	0.275*	0.431**	0.016	0.336**	0.145**
	SEI	1	0.538**	1	0.411**	1	0.474

** . Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

Table 4.18: Association of ecological indicators with ecological efficiency index and sustainability index

S.No	Indicators	Pulwama		Budgam		Pooled	
		ECE	SI	ECE	SI	ECE	SI
1.	Rodent infestation	-402**	0.128	-0.401**	-0.271*	-0.401**	-0.071
2.	Use of INM	0.355**	0.278*	0.209	0.198	0.282**	0.238**
3.	Soil erosion	0.086	0.123	0.216	0.022	0.151	0.072
4.	Negative externalities of NH	-0.321**	0.029	-	-	-0.160**	0.014
5.	Bricklin /cement factory effect	0.173	0.132	0.377	0.133	0.275	0.132
6.	Adoption of Plant protection measures	-0.567**	-0.364**	-0.437**	-0.344**	-0.502**	-0.345**
7.	Climate variability	-0.074	0.02	0.305**	0.250*	0.115**	0.135
8.	Irrigation intensity	0.034	0.275*	0.067	0.016	0.050	0.145*
9.	ACU	0.134	0.037	0.625**	0.0442**	0.379**	0.040**
10.	Weed control	-0.308**	0.117	-0.319**	0.184	-0.313**	0.150
11.	Nutrient loss	0.1	0.062	0.108	0.105	0.104	0.083
12.	Adequate drainage	0.334**	0.395**	0.081	0.107	0.207	0.251**
13.	Mulching	-0.669*	-0.075	-0.288**	0.250	-0.478**	0.087
14.	Water scarcity during critical stage	0.412**	0.185	0.353**	0.245*	0.382**	0.215*
15.	%land under saffron	0.093	0.097	0.186	0.183	0.139	0.14
	ECE	1	0.623**	1	0.678**	1	0.650

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed)

Table 4.19: Regression estimates of saffron sustainability function

Particulars	Pulwama	Budgam
Intercept	-0.098 (0.009)	-0.067 (0.015)
EE	0.388* (0.008)	0.401* (0.009)
SoE	0.141* (0.004)	0.188 (0.007)
ECE	0.450* (0.011)	0.368* (0.011)
Adjusted R2	0.931	0.941

*indicates significance at 0.05 or better probability level

Chapter- 5

DISCUSSION

The findings of the investigation have been discussed in proper perspective, in relation with other relevant studies, to arrive at valid conclusion and recommendation in this chapter.

5.1 Growth and trend analysis of saffron

There was a declining trend in area, production and productivity of saffron in Kashmir upto 2010-11. However, while the area under saffron cultivation exhibited a declining trend, its production and productivity has increased over the years. Ganaie *et.al* (2019) stated the same behaviour of area and production of saffron in the state. In 2019, the area under saffron crop was 3.72 thousand hectares and production was 15.01 MT. The area under saffron cultivation has remained stagnant after the inception of National Saffron Mission, and there has been an increase in its production and productivity. The declining trends in area may be due to inadequate and uncertain irrigation facilities as observed in other studies (Shah and Wani, 2009) as well.

The estimates of compound growth rates (CGR) revealed a declining trend in area and production of saffron without various intervention made under National Saffron Mission (NSM). The decline was of higher magnitude in production. NSM with its mandates of rejuvenation of area could stop the decline in area under saffron to a great extent and reversed the declining trend in production and productivity of saffron as well. The growing behaviour of production and productivity may be attributed to adoption of modern technologies under National Saffron Mission. Nehvi and Yasmin (2016) supported this finding and revealed that technology dissemination under the mission has revived the saffron economy as evident from the improvement in overall production from 9.6 MT (2009) to 15 MT (2014). Farmers have observed high uncertainty about rains and inturn availability of irrigation water. It calls for the expansion of the

influence of mission to the entire saffron ecology. Moreover, the National Saffron Mission has to be taken beyond area rejuvenation. Provision and expansion of irrigation facilities to each farm has to be prioritized for desired results in saffron cultivation. Moreover, the restriction on conversion of Saffron area to unproductive area as envisaged under Saffron Act, 2007 needs to be strictly implemented and the existing area under this crop needs to be managed as per scientific packages. Adoption of Scientific approaches are expected to enhance saffron productivity by main folds (Allel *et al.*, 2020).

5.2 Socio – economic features

5.2.1 Family size and structure

An average family size in the study area was 5.25 due to the prevalence of the nucleated family structure and it was relatively high in Pulwama. The nucleated family structure is desired though it should not be accompanied with fragmentation of holdings. Need for joint farming and cooperative marketing is desired to achieve various economies of big scale (Baba *et al.*, 2014). The estimates of sex ratio indicated a favourable scenario which is desired owing to the fact that more activities in farming are increasingly being taken up by female members (Qadri and Bhat, 2019; Baba, 2018). The role of female labour becomes more prominent as male members are migrating out for other economic purposes.

5.2.2 Educational status

The educational status of farm families is an indicator of human capital formation and economic status. Better formal education helps the farmer in improving his ability to know modern science, technology and utilizing them for better living and farming (Baba *et al.*, 2018). As high as 10 per cent of family heads were illiterate and the incidence of illiteracy was yet more prominent in Pulwama as compared to Budgam. This scenario emphasizes upon the encouragement of both formal and informal education. Informal education about scientific approach to crop cultivation has to be encouraged to impart required

skilled among family heads. The proportion of members having attained education more than higher secondary was relatively higher among farm families in Pulwama which could be the major reason for more productivity of saffron. The encouragement of female education among new generation is highly required to achieve desired results in farm and non- farm activities.

5.2.3 Land inventory

Each household in the study area was seen to possess an average holding of 15.6 kanal. The small size of holdings was one of the principle causes of inefficiency of saffron with perceptible tendency towards a continuous decrease in size due to rapid population growth (Mir, 1992, Baba *et al.*, 2014). The average holding size was relatively higher at Pulwama which is almost double the holding size in Budgam. It will help them to increase their production of saffron. Cultivated area constitutes over 82.5 per cent of holding though the irrigated area was relatively higher at Budgam. Higher proportion of irrigated area in Budgam had prompted cultivation and multiple cropping of vegetable crops. Sprinkler irrigation could accelerate the root growth, post flowering vegetative and corm multiplication and needs to be provided in each farm wherever economically and technically feasible.

5.2.4 Cropping pattern

The cropping pattern in the study area revealed dominance of saffron, which was raised on over 66 per cent of cropped area. The other important crops in terms of area allocation was apple followed by vegetable and walnut. A good proportion of the area was allotted towards apple owing to its increasing demand and less irrigation requirement for its cultivation. Most of the apple orchards have been laid recently and have not come to the full bearing and is expected to yield better in the future which could be an alternative to saffron in case availability of irrigation water gets scarce. The main crop was saffron in Pulwama and apple in

Budgam. Moreover, the availability of irrigation facilities in Budgam prompted relatively more intensification of cropping system.

5.2.5 Occupation

The occupational pattern in the study area indicated that the major proportion of working family members were engaged in farming followed by self-business like shop keeping, etc. As high as high as 9 per cent members were dependent and the dependence was relatively higher in Budgam. Upliftment of rural masses demands development of agriculture owing to the concentration of poor/disadvantaged chunk in agriculture (Qadri, 2020). The distinctions in occupational pattern are expected to generate different level of income at the different study areas. There is a need to develop strong linkages between farm and off-farm activities to ensure engagement of labourers for the year. Encouragement of value addition would also help farm families to fetch better prices for their produce.

5.3 Costs and returns

Owing to poor returns and partly driven by market demands, farmers have shifted some area towards competing crops like apple. The results revealed that the average cost of saffron over a crop cycle of ten years was calculated at Rs. 5880 per kanal and it was relatively higher in Budgam (Rs. 6053/K) than Pulwama (Rs. 5705/K). The establishment cost of saffron during the first year was higher than later years because of capital intensive nature of corms and cost of labour to sow them. On the other hand the average cost of cultivation of fruit crop (Apple) over a cycle of more than ten years was Rs.10052 per kanal and it was relatively higher in Budgam due to the fact that the conversion process from saffron to apple had started much earlier in this district and the fruit crops (apple) had come to bearing stage. The average estimated returns from saffron was Rs.22331 per kanal though the returns in monetary terms were relatively higher at Pulwama. The average return from apple over a crop cycle was worked out at

Rs.3585 per kanal and it was relatively higher in Budgam. Presently most of the apple orchards in both the districts were in non -bearing stage but with time the production of this crop was expected to increase which may increase farm income and cropped area under the crop in future.

The item-wise cost of cultivation of saffron and apple indicated that the major item of cost incurred in saffron cultivation was the corms and there is a need to rationalize this cost. Further, there is a potential of entrepreneurship in multiplication and in vitro propagation of corms for which skill trainings could be given for the engagement of younger generation in these ventures. The cost incurred on corms formed a major component of costs constituting 56 per cent of the establishment cost. The cost incurred on human labour was 46 per cent of the establishment cost. The expenses on manures, fertilizers, plant protection measures, and machine power formed the other cost components. The fixed cost ranged from 10-11per cent of the total cost of cultivation over the period of ten years of crop cycle. Similar results came from other study conducted by Sharma *et. al* (2012) which estimated that the share of variable cost was found to be 82.78 per cent of the total cost of saffron cultivation and the rest was incurred on fixed costs. High density corm plantation and manual intercultural operations have results in increased dependence on human labour. The total average cost of cultivation per kanal of saffron over a crop cycle of ten years was Rs.3545, and it was relatively high in Budgam . The average cost of cultivation per kanal of competing crop over more than ten years revealed that the major item of cost incurred in apple cultivation was the amount spent on human labour(36 per cent) followed by manures and fertilizers (33 per cent). The cost on plant protection was expected to increase significantly as the age of the orchard increased. Baba *et al.* (2010) stated that the horticulture was labour intensive and required labour services at various stages from planting to marketing. The total average cost of cultivation per kanal of apple over a crop cycle of more than ten years was Rs. 10052, and it was relatively high at Budgam. The lower returns from saffron

relative to apple may create disinterest among farmers and they may completely shift their productive land to apple cultivation or may sell off their land to the increasing urban demands (Baba and Wani, 2018).

The average net returns from saffron per kanal in a planting cycle of ten years was Rs16451, and it was relatively high in Pulwama. The yield from saffron remained relatively low in first year and increased considerably from second year onwards. The daughter corms were received after the completion of cropping cycle. The gross returns were lowest during the first year and increased gradually towards tenth year. The overall net income on different categories of farms was negative during first year and highest during 9th year (Ganaie *et al.*, 2017). The average net returns from apple were Rs.13638, and it was relatively high in Budgam. The pesticides were irrationally used and the additional investment on fertilizers could push further the returns from apple production (Wani *et al.*, 1998).

5.3.1 Economic viability of saffron and competing crop

The benefit cost ratio (B-C ratio) at 12 per cent discounting rate for saffron was found to be 2.6, and it was relatively high in Pulwama. The benefit cost ratio (B-C ratio) for apple was 1.12, and it was relatively high in Budgam. The BCR ratio was greater than one for both saffron and apple that means both the crops were economically viable though the rate of returns was better in saffron cultivation. Saraf *et al* (2018) on the basis of economic analysis of costs and returns, net present value, benefit cost ratio, and farm profit measures brought out that the saffron was economically viable crop. The possible reason might be that the most of apple orchards were non -bearing or had not come to the full bearing though the proportion of newly laid apple orchards was higher in Pulwama. The better returns from apple in future may again accentuate the sustenance issues for saffron. Concerted efforts were required to manage the existing saffron area so that the identity of this novelty crop could be maintained in its niche areas.

5.4 Sustainability of saffron

5.4.1 Indicators of sustainability

5.4.1.1 Economic indicators

Product price risk and scarcity of skilled labourers were major issues brought out by 80 per cent and 85 per cent respondents, respectively and these issues were more prominent in Budgam. The contractors were the major market functionaries in saffron trade and any price fluctuation perceived by them was magnified and transmitted to the farmers. Although, a Saffron Park has been established to provide essential services for the encouragement of export and stabilization of its prices though all the farmers had not got benefited under this scheme. The seasonal nature of labour employment in saffron cultivation had made local skilled labour to migrate to other services therefore, cultivators observed the labour scarcity during critical stages of its growth. Non-local labours from Bihar, WB, and other regions of the country are hired for these activities but farmers expressed dissatisfaction on the labour services rendered on their farms. Poor participation of existing labourers in extension programmes have resulted in their poor work productivity as also observed by Shabeer *et al.* (2017). Adoption of grade specification was revealed by only 38.75 per cent of respondents though it was relatively better at saffron farms in Pulwama. It is due to the fact that the farmers in Pulwama showed relatively more interest in participation in different extension activities that may help them to acquire the knowledge about the good practices of saffron cultivation. Government with the help of grower associations/cooperatives and representatives of growers should create such a grading structure that will check the quality and ensure adoption of specified standards (Qadri, 2020) for the better price realization. Only 55 per cent saffron respondents expressed that they produce for markets. Of these farmers only a few were observed to have participated in direct sale of the produce and rest sold their small produce through contractors. Because of the lack of the knowledge about marketing, farmers did not participate in direct marketing, Capacity building on

cooperative farming and cooperative marketing had to be encouraged to ensure participation of small farmers in marketing for remunerative returns. A significantly higher proportion of farmers had expressed concern about frequent crop failure in every >10 years. Erratic weather condition coupled with lack of assured irrigation facilities especially during the August and September months resulted in frequent crop failures. Shah and Wani (2009) observed that lack of irrigation facilities and its scheduling technology was the major problem articulated by majority of the growers. These problems can only be eradicated when the farmers follow good practices of saffron cultivation and show more participation in different extension activities and awareness programmes. Farmers had tried to apply their own risk aversion measures though about 51 per cent farmers had shifted a part of their saffron land towards other crops either permanently or temporarily. The decline in the productivity of saffron and in turn less income had made farmers disinterested towards saffron cultivation. These problems can be eradicated by creating good irrigation facilities, improving quality of saffron, providing organised marketing facilities and a check on adulteration of Kashmiri saffron.

5.4.1.2 Social indicators

The participation in extension activities is essential to get information about scientific approaches of production, finance and supply chain. However, only 61.25 per cent of saffron farmers had participated in various extension activities and their involvement in such activities was relatively higher in Pulwama. Since the saffron was the main crop in Pulwama and livelihood of various farm operating families depended upon this crop, they took advantage by participating in various extension programmes. It was very disappointing that farmers had poor social bonds as indicated by their lower participation as members of saffron growers organisation. Only 24 per cent farmers revealed their participation in social decision making though this scenario was favourable in Pulwama. Sustainability of saffron was closely associated with participation of

younger generation in farming and only 11.25 per cent younger members of the family were seen having engaged in farming. Educated unemployed youth took less interest in saffron cultivation due to their tendency to migrate to non-farm activities including services. To increase the participation of younger generation in farming, their capacity had to be built to motivate them for the important role in post-harvest management and value chain integrations. In this direction Haq and Shafi (2014) concluded that the concerned Government Departments / agencies should encourage and involve educated unemployed youth in the rural areas of the saffron growing belts to take over this venture on scientific basis. About 8 per cent farmers also revealed incidence of land / water conflict in the study area and participation in social decision making may help them to resolve various conflicts.

5.4.1.3 Ecological indicators

Water scarcity during critical growth stages was the major ecological concern raised by 90 per cent of the sample farmers and this indicator was highly unfavourable in Pulwama, the reason for this may be that there was non-availability of irrigation facilities, farmers were dependent upon September rains for good flush of flowers and delayed rainfall is detrimental to the crop but the weather had become quite erratic from past several years Nehvi (2011).The problem can be solved by the creation of irrigation capacities like sprinkler irrigation for good development of roots and floral primodial. Another persistently growing concern was the infestation by rodents including wildlife protected Porcupine. Rodents coming from abandoned saffron area was a big menace in the area that has raised sustainability issues of this crop, Rodents cause considerable annual loss to the saffron crop by damaging the saffron corms. Measures should be taken for management of rodents and porcupine. The negative spill over effect of development processes like installation of brick kiln / cement factories or conduction of National Highway across saffron field without fencing was observed by good number of respondents. Pollution caused by the cement factories in Khrew area had unfavourably influenced saffron agronomy in general

and productivity of this crop. It had affected its corm, bulb, stigma, and petals, and as a result, it generated very low production levels Qadri (2019). This problem can be eradicated by the installation of efficient pollution control instrument in these factories.

5.4.1.4 Indexing sustainability of saffron

The farm level sustainability index of saffron was constructed by averaging indices for three broad dimensions viz., economic sustainability, social sustainability and ecological sustainability. The value for social sustainability index was relatively lower than the other efficiency indicators owing to poor social bondages in the study area. Less endowment of social capital had multiple negative influences of saffron sustainability like poor percolation of information, deficits in persuasion for adoption of scientific packages and efficient management of saffron resources. Efficiency of social dimension of sustainability had to be improved by encouraging collective approaches for common problems like unavailability of organized markets, poor irrigation facilities, etc. Other dimensions of sustainability had also acquired less values emphasizing upon systematic and holistic approaches to augment values of individual indicators so that the saffron cultivation could be sustained on long term basis. Primarily, strict restrictions on the shift of saffron land had to be imposed and mandates of NSM had to be taken vigorously across entire saffron ecology.

5.4.1.5 Association of economic variables with economic sustainability index and sustainability index

In both the locations economic variables like beneficiary of financial institution, distance to the input market and market participation had positive association with economic sustainability index. These relations directed us for provision of required amenities closer to our production centers and provision of financial assistance to come up with the needs of capital intensive activities of saffron farming is highly demand and could be a solution to number of other

issues. It is drawn up in a study conducted by Dawar (2019) that saffron is labour intensive and farmers need institutional support for execution of number of activities including marketing. Even to protect cultivators from incurring loss the Government should announce a support price for saffron (Tantray, 2017). Market participation plays an important role in increasing income of the farmer, if the farmers participate more in direct marketing they will get more profit. Contrary to this product price risk and frequent crop failure hold negative association with these sustainability indices. Expansion of irrigation facilities and replacement of corms after every 4 -5 years could enhance crop yield and ensure better produce from saffron (Nehvi , 2011). Moreover findings call for rationalization of cost by encouraging scientific practices to prevent indiscriminate use of critical inputs which would prevent drainage of farmers limited resources. Since development of seed corms through vegetative propagation takes many years of hard labour and selection trials to build up elite material, it is essential to encourage micro propagation techniques (Kamili, 2007) and supply of inputs and routing of produce through FPOs.

5.4.1.6 Association of social variables with social sustainability index and sustainability index

Except for sex ratio, workers, per capita land and holdings all the specified variables turned significantly correlated with sustainability index. These four variables showed positive and significant correlation with social efficiency index in Pulwama. There was a positive relationship between saffron production and the size of land holding under saffron (Qadri, 2018) and the need of preventing further fragmentation of holdings emerged. Different social indicators exhibited same association with sustainability index in Budgam as in Pulwama. The association of social sustainability index with land / water conflict was observed negative and significant with social efficiency index. The limited facilities of irrigation often create conflicts over the water sharing and in attraction of

attention of NSM officials to install tube wells in the study area. Assured irrigation to each farm is a common remedy to a number of related issues.

5.4.1.7 Association of ecological variables with ecological sustainability index and sustainability index

Majority of variables were negatively correlated with ecological efficiency index. While Use of INM, adequate drainage and water scarcity holds positive correlation with ecological index. The practice of growing saffron without supplementation of nutrients has drastically reduced the fertility of the soils in the saffron fields. Although only a few farmers adopt INM but it is highly desired for maintaining soil properties and texture beside better yield realization. In order to address the declining productivity of saffron due to decline in fertility status of soils, Integrated Nutrient management is considered a better option for sustainable development of crop for livelihood security (Nehvi, 2011). Water scarcity during active growth stage adversely affects saffron yield and corm multiplication (Dawar, 2019). Water scarcity was the only variable in Budgam to have positive association with ecological sustainability in Budgam. The negative and positive association of different variables on ecological efficiency index is expected to have differential influence on sustainability index of saffron cultivation.

5.5 Determinants of saffron sustainability

The regression results indicated that efficiency in economic and ecological dimension were significant and positive determinants of saffron sustainability in both the locations. It calls for a broader and holistic approach to address various issues related to these dimensions to have better influence on saffron economy. Further, there is a need to draw short and long term plans for sustenance of this novelty crop in the valley. While social efficiency turned positive determinants of saffron sustainability in Pulwama, its relationship turned insignificant in district Budgam. Strengthening of social bonds not only helped to achieve economies of scale but it also encouraged scientific approaches of farming to prevail.

Chapter-6

SUMMARY AND CONCLUSION

Saffron (*Crocus sativus* L.), popularly known as “Golden Condiment”, is valued as a medicinal/aromatic perennial herb, a dye and has been prized the world’s most expensive spice since times immemorial. It is one of the oldest crops native of Southern Europe and cultivated in Spain, Iran, France, Italy, Austria, Greece, Turkey, England, China and India. Total world production of saffron is around 300 tons per year. Iran, India, Spain and Greece are the major saffron producing countries with Iran occupying the maximum area (43408 ha) and contributes about 88 per cent to the world’s saffron production (Tantry *et al.*, 2017). Though, India occupies the 2nd largest place with respect to saffron area (3674 ha), however, it produces only approximately 7 per cent of the total world production (Zahid, 2016). Spain with 600 ha of land is the 3rd largest producer in the world (Tantry *et al.*, 2017). In India this legendary crop is acclimatized to hillsides and plateaus (locally called *Karewas*) at altitudes between 1500 to 2400 metres. The increasing demand of saffron across the world has prompted to increase its production. There is a need to bring in more area under saffron in its niche and augment its productivity by scientific management of this crop. However, the future of this crop seems doubtful given the process of urbanization, modernization and switch over to other enterprises which made it imperative to investigate farm level sustainability of this spice crop within the aggregate influence of various indicators. Accordingly, the present study “**Sustainability of Saffron Cultivation in India: An Economic Outlook**” has been conducted with following objectives:

1. To assess the economic viability of saffron cultivation in relationship with other crops enterprises, and
2. To construct farm level sustainability index of saffron cultivation and to examine its determinants.

Methodology

This study is based upon primary data and secondary data. While the secondary data has been obtained from diverse published/unpublished sources, primary data was obtained from 160 sample respondents selected in major saffron producing districts viz Pulwama and Budgam by employing multi-stage random sampling. Compound growth rates were estimated to find out the pattern of growth in area, production and productivity of saffron in the territory. Various discounted measures like Net Present Worth and Benefit Cost Ratio to see the economic viability of saffron in relationship with competing crops which for the present study area was apple. The farm level sustainability of saffron was examined within the three major efficiency components viz. economic, social and ecological measures. A number of indicators were identified, standardized and averaged to construct economic efficiency index after giving due weights to each of them. The social and ecological efficiency indices were constructed by averaging the set of standardized variables under each measure. Ultimately the composite sustainability index for saffron was constructed by averaging the economic, social and ecological sustainability efficiency indices. Simple correlation was estimated to observe the association of various indicators on overall social sustainability index and similarly the association of various individual variables with ecological and economic efficiency indices was examined by estimate correlation. Regression function was fitted to quantify the impact of various efficiency indices on overall farm level saffron sustainability.

Findings of the study

- The estimates of compound growth rates (CGR) revealed the declining trend in area and production of saffron on its traditional tracks not covered under National saffron mission (NSM). However the NSM has rejuvenated a significantly higher proportion of area under this crop and could reverse declining trend in saffron production and productivity.

- An average family size in the study area was 5.25 and it was relatively high at Pulwama. The estimates of sex ratio indicates a favourable scenario towards female members. As high as 10.5 per cent of family head were illiterate and the incidence of illiteracy was more prominent in Pulwama compared to Budgam. The proportion of members having attained education more than high secondary was relatively higher among farm families in Pulwama which has encouraged more commercial orientation of saffron in this region.
- Sample households in the study area were seen to possess an average holding of 15.6 kanal of land of which 82.5 per cent per cent is under cultivation However only 5.05 per cent of cultivated area had an assured irrigation facilities though these facilities were better in Budg.
- In the selected districts the main crop was saffron in Pulwama, where apple formed an important crop in Budgam.
- The major proportion of working family members were engaged in farming followed by self -business like shop keeping.
- The results revealed that the average cost of saffron over a crop cycle of ten years was calculated at Rs.5880 per kanal and it was relatively higher at Budgam (Rs. 6053) than Pulwama (Rs .5705). The cost incurred on value of corms formed its major component (56%) of total cost of cultivation of this crop.
- The average estimated gross returns from saffron was Rs.22331 per kanal though the returns in monetary terms was relatively higher at Pulwama. The net returns from saffron kanal⁻¹ as an average during the planting cycle of ten years was Rs16451, and it was relatively high at Pulwama. The yield from saffron remains relatively low in first year and increases considerably from second year onwards.

- The benefit cost ratio (B-C ratio) at 12 per cent discounting rate for saffron was found 2.6, and it was relatively high at Pulwama. The benefit cost ratio (B-C ratio) for apple was found 2.0, and it was relatively high at Budgam. Apple, a competing crop in the study area, was observed to be more capital intensive though it has yield lower net returns than saffron.
- Product price risk and scarcity of skilled labourers were major issues which were brought out by 80 per cent and 85 per cent respondents, respectively and these issues were more prominent in Budgam. Adoption of grade specification was revealed by only 38.75 per cent of respondents though it was relatively better at saffron farms in Pulwama. Distance to input or output markets are other important factors that determine economic sustainability of saffron in Kashmir valley. As high as 90 per cent of the saffron growers have input market at the distance of >4km though the proportion of sample farmers located at such distance is relatively less in Pulwama. Only 55 per cent saffron respondents have expressed that they produce for markets. A significantly higher proportion of farmers have expressed concern about frequent crop failure in every >10 years. Farmers have tried to apply their own risk aversion measures though about 51 per cent farmers have shifted a part of their saffron land towards other crops either permanently or temporarily.
- Only 61.25 per cent saffron farmers have participated in various extension activities and their involvement in such activities was relatively higher at Pulwama. Only 24 per cent farmers revealed their participation in social decision making though this scenario favourable at Pulwama.
- Sustainability of saffron is closely associated with participation of younger generation in farming and only 11.25 per cent younger members of the family were seen having engaged in farming. About 8 per cent farmers also revealed incidence of land / water conflict in the study area.

- Water scarcity during critical growth stage was the major ecological concern raised by 90 per cent of sample farmers and this indicator was highly unfavourable in Pulwama. Another persistently growing concern is the infestation of rodents including wildlife protected Porcupine. Rodents coming from abandoned saffron area is a big menace in the area that has raised sustainability issues of this crop. The negative spill over effect of development processes like installation of brick kiln / cement factories or construction of National Highway across saffron field without fencing was observed good number of respondents.
- The overall farm level sustainability index (0.140) indicated that the cultivation of saffron is least sustainable though the value was relatively higher for Pulwama. The index values for social efficiency measure was lower than the other efficiency indicators.
- The association of individual variables employed in economic efficiency parameters is expected to indirectly influence on the sustainability by way of affecting economic efficiency of the various variables, nine variables has positive influence on economic efficiency where as two Variables holds negative association with the economic efficiency.
- The association of set of social variables on social efficiency parameter indicates that four variables have positive association while only land / water conflict holds negative association with social efficiency index and saffron sustainability index.
- The negative and positive association of different variables on ecological efficiency index is expected to have differential influence on sustainability index of saffron cultivation. Of the various ecological variable Use of INM, Adequate drainage and water scarcity is positively correlated with overall ecological efficiency while six variables have negative correlation with ecological efficiency.

- The value for Adjusted R² revealed that the specified variables explained over 93 per cent and 94 per cent variation in the specified dependent variable indicating model to be in best fit. The regression estimates indicate a significant and positive impact of economic efficiency and ecological efficiency on saffron sustainability. Coefficients revealed weak relationship between saffron sustainability and social efficiency parameters.

CONCLUSION

- The inception of National Saffron Mission has stopped the declining behavior of saffron and reversed the declining trend of saffron production and productivity.
- Though saffron and its competing crop i.e. apple are economically viable in both districts, but Saffron turned to be relatively more viable in the study area.
- Farm level sustainability index indicates lower sustainability of saffron in the study area. Moreover the saffron cultivation appeared more sustainable in Pulwama than in Budgam.

Policy Measures

- Considering an important role of National Saffron Mission, there is a need to rejuvenate the rest of saffron area in Kashmir Valley. Concerted efforts are to be taken to expand area under saffron and adoption of scientific packages and Good Agricultural Practices (GAP) may be disseminated in the entire saffron ecology.
- The major issue in the saffron growing region in the non-availability of irrigation facilities. Creation and expansion of low gestation irrigation capacities is highly needed. Sprinkler irrigation facilities are to be

provided to every saffron farm for achieving desired results of productivity gains.

- There is rampant conversion of saffron land to unproductive uses in the study area. Legislative measures with strict enforcement are required to restrict further undesired conversion and efforts should be made to implement Saffron Act, 2007.
- Time is high to join electronic market space like eNAM for better price realization that would in turn encourage small farmers to keep up with saffron cultivation in future. The integration of saffron production with marketing through value chain integration is of dire need. .
- There is a need to impart professionalism and leadership in existing cooperatives and strengthening/encouragement of cooperative formation and joint execution of production and marketing activities in the saffron growing ecosystem. Capacity building programme for different stakeholders on scientific approaches to saffron farming and post-harvest management is essential.
- Institutional credit with simple procedures and lower interest rate with crop insurance coverage is expected to have desired results in the saffron cultivation.
- Rural youth should be the target group of developmental policies. Skill trainings and capacity development programme are to be organized on regular basis to harness the entrepreneurship potential in *in-vitro* corm propagation/multiplication, in house saffron production, vermicomposting, etc.
- The various export promotion logistics created under the NSM have to be scaled up to benefit small holders in saffron region.

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APPENDIX-I

Research Topic: Sustainability of Saffron Cultivation in India: An Economic Outlook

PART-A Personal Profile

1. Name of the farmer
2. Fathers name
3. Name of the village
4. Name of the block
5. Contact number
6. Age
7. Experience (year)
8. Working hour/day at farm

Family size and structure

Members	No.	Education	Main occupation	Subsidiary occupation	Income (Rs./year)
Self					
Male					
0 – 15 years					
15 – 60 years					
60 above					
Female					
0 – 15 years					
15 – 60 years					
60 above					

9. Land inventory

Particulars	Area	Purchase in previous year
Total holding		
Fallow land		
Operational holding		
Irrigated		
Unirrigated		

Cropping pattern

Crops	Area (kanals)	Irrigated	Production (MT)	
Kharif				
Rice				
Maize				
Pulses				
Any other, specify				
Rabi				
Mustard				
Oats				
Pulses				
Any other, specify				
Perennial				
Saffron				
Apple				
Almond				
Any other, specify				

B**Cost of Cultivation and Returns from Saffron**

Variable costs (Rs. / kanal)								
Item	1 st yr.	2 nd yr.	3 rd yr.	4 th yr.	5 th yr.	6-10 yr.	10 above	
Human Labour								
Machine labour								
Value of seed(corm)								
Value of manure								
Value of fertilizer								
Value of seed treatment								
Plant protection								
Miscellaneous								
Fixed cost								
Land rent								
Returns								
Stigma(quantity for consumption)								
Stamens (quantity for consumption)								
Daughter Corms (quantity FC)								

Price of stigma (Rs/Kg)

Stamens (Rs/Kg)

Corms(Rs/Kg)

Wage rate (Rs/md)

C**Cost of Cultivation and Returns from Apple**

Variable costs (Rs. / kanal)							
Item	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	6-10 yr.	10 above
Human Labour							
Machine labour							
Planting material							
Value of manure							
Value of fertilizer							
Plant protection							
Miscellaneous							
Fixed cost							
Land rent							
Returns							
Main (fruit)							
Bi products							

PART- C**Indicators of saffron sustainability****1. Economic indicators**

S.no	Particulars	Responses	Remarks
1. A B C	Distance to the input market 0-3 3-4 >4		Km
2 A B C	Distance to the output market 0-5 5-10 >10		Km
3	Product price risk concerns		0 OR 1
4	Market orientation		0 OR 1
5	Adoption of grade specification		0 OR 1
6	Market participation		0 OR 1
7 A B	Beneficiaries of financial institution Formal Banks Informal Relatives and friends Money lenders and traders		0 OR 1
8	Frequent crop failure 2 years 5 years >10 years		After how many years
9	Adoption of Risk aversion measure		0 OR 1
10 A B	Shifting of some saffron area to another crop Permanent (apple) Temporary (vegetable ,oats and others)		0 OR 1
10	Seasonality of labourer concern		0 OR 1

2. Social indicators

S.no	Particulars	Responses	Remarks
1	Land/ water conflict		0 OR 1
A	Rare		
B	Often		
2	Participation in Extension activities		0 OR 1
3	Membership in some organisations		0 OR 1
A	Saffron grower association		
B	Mohalla committee		
C	Civil society		
4	Education level		Illiterate /pri./sec./higher/above
5	Participation in social decision making		0 OR 1
6	Participation of younger generation in farming		0 for no, 1 for yes
7	Public awareness programme		0 OR 1

3. Ecological indicators

S.no	Particulars	Responses	Remarks
1	Rodent infestation		0 OR 1
A	Rare		
B	Often		
2	Use of INM		0 OR 1
3	Soil erosion		0 OR 1
4	Negative externalities of NH		0 OR 1
5	Brick kiln / cement factory effect		0 OR 1
6	Adoption of plant protection measures		0 OR 1
7	Climate variability		0 OR 1
8	Weed control		0 OR 1
9	Nutrient loss		0 OR 1
10	Adequate drainage		0 OR 1
11	Mulching		0 OR 1
12	Water scarcity		0 OR 1

APPENDIX-II

Table : Returns from saffron and competing crop (Quantity terms Kanal⁻¹)

Years	Pulwama				Budgam				Pooled			
	Saffron			Fruit (Apple)	Saffron			Fruit(Apple)	Saffron			Fruit (Apple)
	Main(kg)	Bi(kg)	Daughter corms(Q)	Main (kg)	Main (kg)	Bi(kg)	Daughter corms(Q)	Main (kg)	Main(kg)	Bi(kg)	Daughter corms(Q)	Main (kg)
1 st	0.038	0.019	-	-	0.039	0.019	-	-	0.038	0.019	-	-
2 nd	0.059	0.029	-	-	0.057	0.028	-	-	0.058	0.028	-	-
3 rd	0.076	0.037	-	-	0.075	0.036	-	-	0.075	0.036	-	-
4 th	0.090	0.045	-	-	0.088	0.044	-	-	0.089	0.044	-	-
5 th	0.053	0.026	-	-	0.054	0.026	-	-	0.053	0.026	-	-
6 th	0.069	0.036	-	-	0.070	0.036	-	-	0.069	0.036	-	-
7 th	0.094	0.047	-	-	0.090	0.045	-	-	0.092	0.046	-	-
8 th	0.099	0.049	-	310	0.098	0.048	-	450	0.098	0.048	-	380
9 th	0.112	0.048	-	360	0.102	0.051	-	480	0.107	0.049	-	420
>10 th	0.14	0.07	3.5	470	0.086	0.042	3	580	0.113	0.056	3.25	520
average	0.083	0.040	0.35	380	0.075	0.037	0.3	500	0.079	0.039	0.325	440

Table - Economic efficiency without weights

Indicators	Pulwama			Budgam		
	Average	Stdev	Var	Average	Stdev	Var
1.Distance to input (km)	0.581	0.231	0.053	0.448	0.198	0.039
2.Distance to output market (km)	0.684	0.266	0.071	0.512	0.205	0.042
3.Product price risk	0.583	0.323	0.104	0.708	0.286	0.082
4.Market orientation	0.362	0.250	0.062	0.375	0.484	0.234
5.Grade specification adopted(0,1)	0.208	0.309	0.095	0.150	0.241	0.058
6.Market participation (0,1)	0.137	0.267	0.071	0.156	0.245	0.060
7.Beneficiary of financial institutions (0,1)	0.571	0.432	0.187	0.358	0.443	0.197
8.Frequent crop failure (0,1)	0.467	0.476	0.227	0.421	0.462	0.213
9.Risk aversion measures	0.481	0.330	0.109	0.363	0.481	0.231
10.Switch to another crop	0.806	0.268	0.072	0.644	0.337	0.114
11.Scarcity of labourers	0.696	0.199	0.039	0.729	0.176	0.031
12.Per capita income (000)	0.441	0.194	0.038	0.264	0.242	0.058
13.Saffron income (% of total family income)	0.251	0.213	0.045	0.264	0.242	0.058
14.Cost of saffron cultivation (000/k)	0.964	0.111	0.012	0.837	0.139	0.019

Table - Economic efficiency with weights

Indicators	Pulwama		Budgam	
	Average	Stdev	Average	Stdev
1.Distance to input (km)	0.016	0.006	0.014	0.006
2.Distance to output market (km)	0.016	0.006	0.016	0.006
3.Product price risk	0.011	0.006	0.015	0.006
4.Market orientation	0.009	0.006	0.005	0.006
5.Grade specification adopted (0,1)	0.004	0.006	0.004	0.006
6.Market participation (0,1)	0.003	0.006	0.004	0.006
7.Beneficiary of financial institutions (0,1)	0.008	0.006	0.005	0.006
8.Frequent crop failure (0,1)	0.006	0.006	0.006	0.006
9.Risk aversion measures	0.009	0.006	0.005	0.006
10.Switch to another crop	0.019	0.006	0.012	0.006
11.Scarcity of labourers	0.022	0.006	0.026	0.006
12.Per capita income (000)	0.014	0.006	0.007	0.006
13.Saffron income (% of total family income)	0.007	0.006	0.007	0.006
14.Cost of saffron cultivation (000/k)	0.055	0.006	0.038	0.006

Table - Social efficiency without weights

Indicators	Pulwama			Budgam		
	Average	Stdev	Var	Average	Stdev	Var
1.land /water conflict	0.088	0.0283	0.080	0.063	0.242	0.059
2.Participation in any extension activity	0.262	0.234	0.055	0.204	0.201	0.040
3.Membership in some organisation	0.200	0.267	0.071	0.062	0.183	0.034
4.Education level	0.425	0.297	0.088	0.408	0.236	0.055
5.Participation in social decision making	0.175	0.298	0.089	0.092	0.223	0.050
6.Participation of younger generation in farming	0.083	0.239	0.057	0.050	0.167	0.028
7.Public awareness programme	0.187	0.339	0.0115	0.106	0.270	0.073
8.Sex ratio	0.190	0.226	0.051	0.192	0.207	0.043
9.Workers	0.306	0.237	0.056	0.563	0.257	0.066
10. PC land	0.151	0.158	0.025	0.497	0.257	0.066
11.Holding	0.158	0.174	0.030	0.414	0.197	0.039

Table - Social efficiency with weights

Indicators	Pulwama		Budgam	
	Average	Stdev	Average	Stdev
1.land /water conflict	0.002	0.006	0.002	0.006
2.Participation in any extension activity	0.007	0.006	0.006	0.006
3.Membership in some rganisation	0.005	0.006	0.002	0.006
4.Education level	0.009	0.006	0.011	0.006
5.Participation in social decision making	0.004	0.006	0.003	0.006
6.Participation of younger generation in farming	0.002	0.006	0.002	0.006
7.Public awareness programme	0.003	0.006	0.002	0.006
8.Sex ratio	0.005	0.006	0.006	0.006
9.Workers	0.008	0.006	0.014	0.006
10. PC land	0.006	0.006	0.012	0.006
11.Holding	0.006	0.006	0.013	0.006

Table - Ecological efficiency without weight

Indicators	Pulwama			Budgam		
	Average	Stdev	Var	Average	Stdev	Var
1.Rodent conflict	0.212	0.409	0.167	0.113	0.316	0.100
2.Use of INM	0.175	0.380	0.144	0.100	0.215	0.046
3.Soil erosion	0.929	0.172	0.030	0.919	0.216	0.047
4.Closeness to the road highway	0.917	0.233	0.054	-	-	-
5.Bricklin /cement factory effect	0.871	0.276	0.076	0.687	0.464	0.215
6.Plant protection	0.475	0.499	0.249	0.650	0.477	0.228
7.Climate variability	0.563	0.289	0.084	0.569	0.304	0.092
8.Irrigation intensity	0.158	0.174	0.030	0.414	0.197	0.039
9.ACU	0.474	0.231	0.053	0.394	0.388	0.151
10.Weed control	0.550	0.292	0.085	0.450	0.245	0.060
11.Nutrient loss	0.671	0.327	0.107	0.656	0.269	0.072
12.Adequate drainage	0.412	0.280	0.078	0.346	0.220	0.048
13.Mulching	0.833	0.274	0.075	0.062	0.176	0.031
14.Water scarcity	0.763	0.362	0.131	0.525	0.208	0.043
15.%land under saffron	0.543	0.238	0.057	0.246	0.216	0.046

Table - Ecological efficiency with weights

Indicators	Pulwama		Budgam	
	Average	Stdev	Average	Stdev
1.Rodent conflict	0.003	0.006	0.002	0.006
2.Use of INM	0.003	0.006	0.003	0.006
3.Soil erosion	0.034	0.006	0.027	0.006
4.Closeness to the road highway	0.025	0.006	-	-
5.Bricklin /cement factory effect	0.020	0.006	0.009	0.006
6.Plant protection	0.006	0.006	0.009	0.006
7.Climate variability	0.012	0.006	0.012	0.006
8.Irrigation intensity	0.006	0.006	0.013	0.006
9.ACU	0.013	0.006	0.006	0.006
10.Weed control	0.012	0.006	0.011	0.006
11.Nutrient loss	0.013	0.006	0.015	0.006
12.Adequate drainage	0.009	0.006	0.010	0.006
13.Mulching	0.019	0.006	0.022	0.006
14.Water scarcity	0.013	0.006	0.016	0.006
15.%land under saffron	0.014	0.006	0.007	0.006

Table - Sustainability of Saffron in the study area without weights

Index	Pulwama			Budgam		
	Average	Stdev	Var	Average	Stdev	Var
Economic efficiency	0.517	0.091	0.008	0.445	0.111	0.012
Social efficiency	0.202	0.070	0.005	0.241	0.071	0.005
Ecological efficiency	0.570	0.078	0.006	0.438	0.089	0.008
Sustainability index	0.430	0.051	0.003	0.375	0.055	0.003

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CERTIFICATE

Certified that all the corrections/amendments as suggested by External Examiner. **Dr. Brij Bala**, Professor (Department of Agri-Economics, Extension Education Rural Sociology, CSKHPKV, Palampur) (HP) during Viva-Voce examination held on 27-04-2022 have been incorporated in the manuscript entitled **“Sustainability of Saffron Cultivation in India: An Economic Outlook”** submitted by **Ms. Iqra Iqbal (Regd. No. MSAE-2019-10)**.

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