ECONOMIC ANALYSIS OF SAFFRON PRODUCTION IN IRAN

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ABSTRACT

The purpose of this paper is to analyse the economics of saffron production in Iran. It is based on primary data collected from 350 saffron growers - 175 in Torbat Heydarieh and 175 in Ghaen Counties – selected on the basis of multistage random sampling technique. Apart from computing the per-hectare costs, returns and profits in saffron cultivation, the economic viability of saffron cultivation was worked out by working out: (1) pay back period (2) benefit-cost ratio (3) net present value and (4) internal rate of return. The economic analysis indicated that the saffron crop in Iran is economically viable and profitable. The study revealed that saffron cultivation is highly remunerative and it has ample scope for employment generation and income enhancement for Iranian farmers. Saffron cultivation is found to be a lucrative proposition for all the categories of farmers in two counties because of substantially large element of profit in the cultivation of this high value crop. The economic analysis in terms of cost and returns, NPV, BCR, payback period, IRR, indicated that the crop is economically viable and profitable. Another important aspect of this high value crop is its international competitiveness. Iranian saffron is highly competitive in the world market (Kheirandish, 2010). Hence, Iranian saffron also has the potential of becoming an important source of foreign exchange provided the Iranian Government takes effective measures to increase saffron production, productivity and marketing through rigorous research, development and extension education.

KEYWORDS
Iran, Saffron, Cost of Cultivation, Returns, Profits, NPV, BCR, payback period, IRR.

INTRODUCTION

Agriculture plays an important role in the Iranian economy. Among the different products cultivated in Iran, saffron is a special and traditional product. It has a specific role in non-oil product range because of its high price. It also has a higher rank in the agricultural economy of Iran due to the importance of its production, cultivated area, job potentialities and export developing abilities. Iran accounts for 95 percent of world production, 90 percent of cultivated lands and nearly 200 tons of saffron. It ranks first among the saffron producers in the world and the countries in the 2nd and further lower ranks are far below Iran, producing altogether not more than 20 tons and accounting for less than 4 percent of the world's saffron production.

Saffron is the most popular and expensive spice in the world. It is in demand the world over because of its great aroma, coloring capacity and proven medicinal properties and also because it involves heavily labour-intensive production and processing. The history of saffron cultivation dates back to more than 3,000 years. Ancient Persians cultivated Persian saffron in Isfahan and Khorasan provinces by the 10th century BC (Wikipedia). Due to long experience of Iran in cultivation, and the transfer of methods of growing and harvesting from person to person and or generation to generation, Iranian saffron has managed to keep its distinctive qualities in comparison with that produced in other regions of the world with exceptional recognition for its fragrance, flavor and color at the international markets (saffron gold 2006).

As saffron does not need great amount of water, its cultivated area and production have increased in recent years substantially so that many farmers completely depend on saffron. As a large amount of this product is exported. It fetches considerable amount of foreign exchange. So, in view of the economic, historic and social importance and due to the special situation of Iranian saffron in the world it is important to pay attention to the economic aspects of production and exporting of saffron in order to enhance its place in the world market.

METHODOLOGY

For the purpose economic analysis of saffron cultivation in Iran, multistage random sampling technique was used to draw the ultimate study sample. Torbat Heydarieh and Ghaen Counties of Khorasan Provinces (Razavi & Southern) were purposively selected since they have the largest area and production of saffron. The cultivated area owned by the growers was classified into eight age-groups on the basis of the age of the croup, i.e. 1 year old, 2 year old …… 8 year old. In all 350 saffron growers consisting of 175 in Torbat Heydarieh and 175 in Ghaen Counties, and also size group small, medium and large were selected (Table 1). Economic viability of saffron cultivation was worked out by determining: (1) pay back period (2) benefit-cost ratio (3) net present value and (4) internal rate of return.

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TABLE 1: CROP AGE WISE DISTRIBUTION OF SELECTED FARMERS IN TORBAT HEYDARIEH AND GHAEN COUNTIES

Production Year	Torbat Heydarieh				Ghaen			
	Small (up to 1 ha)	Medium (1-2 ha)	Large (2 ha & above)	**Total**	Small (up to 1 ha)	Medium (1-2 ha)	Large (2 ha & above)	**Total**
1st year	4	8	3	**15**	7	8	2	**17**
2nd year	6	14	2	**22**	10	11	3	**24**
3rd year	5	13	4	**22**	9	8	2	**19**
4th year	13	8	2	**23**	11	7	2	**20**
5th year	15	14	3	**32**	12	6	3	**21**
6th year	9	9	4	**22**	17	8	2	**27**
7th year	6	10	5	**21**	14	9	2	**25**
8th year	4	12	2	**18**	16	4	2	**22**
Total	**62**	**88**	**25**	**175**	**96**	**61**	**18**	**175**

FINANCIAL FEASIBILITY ANALYSIS

Financial feasibility of investment in saffron plantation was assessed using the methods like Net Present Value (NPV), Benefit-Cost Ratio (BCR), Pay Bank Period (PBP) and Internal Rate of Return (IRR).

NET PRESENT VALUE (NPV)

This is considered to be a more meaningful measure of appraising the long-term investment proposal and is useful in comparing the different investment proposals. It is the difference between the present value of net benefits and initial investments. If the appraisal shows NPV greater than zero, the project is economically viable, as it can generate returns in excess of all the costs. The general mathematical formula for NPV is given below

$$NPV = \Sigma [B_t (1+ r) -n] - [I] \quad (1)$$

i = 1

Where,

B_t = Benefits in each year

I = Initial investment

n = Number of years

r = Discount rate

BENEFIT-COST RATIO (BCR)

It is the ratio of the present value of net benefits to the present value of all costs. For an investment to be worthwhile, the BCR must be more than unity.

BCR= [Σ Discounted Net Returns] / [Σ Discounted costs] (2)

INTERNAL RATE OF RETURN (IRR)

The rate of return that equates the discounted flow of annual returns with the discounted flow of annual cost is the IRR and it renders the NPV to zero. It indicates the average earning capacity of an investment over the economic life span of an investment.

$$IRR = \{\text{Lower discount}\} + \{\text{Difference between the two discount}\} \left\{ \frac{\text{NPV of the cash flows of lower discount rate}}{\text{----------}} \right\}$$

PAY BACK PERIOD (PBP)

The pay back period is the length of time in years required to liquidate the investment estimated by summing up all the discounted net returns over the years to make up the initial investment.

COST OF CULTIVATION

Data on cost of cultivation of saffron per hectare in two major counties and different size groups are presented in Table 2. The major item of cost incurred in saffron cultivation by all the three size groups of grower, was the cost of human labour. The establishment costs during the first year of cultivation worked out to Rial 253,373,605, Rial 239,608,132 and Rial 238,446,368 in Torbat Heydarieh and Rial 235,946,721, 226,234,555 and 222,740,896 in Ghaen for first, second and a third size group respectively. This means that 22-24 percent of the total costs are incurred during first year of saffron cultivation. The cost incurred on seed corms formed the major component. It was 65.23 percent, 63.96 percent and 62.69 percent respectively of the establishment cost in the first, second and third size groups in Torbat Heydarieh, while it was 56.64 percent, 53.91 percent and 52.94 percent respectively in Ghaen. The total cost of cultivation was higher for the first size group followed by the second and third size groups in Torbat Heydarieh compare to Ghaen County. Thus there is an inverse relationship between the size of the saffron farm and the per-hectare cost of seed corms.

The cost incurred on hired human labour and share of the family labour was higher for size group 1st followed by 2nd, and 3rd size groups in all areas. Similar trend was observed in the case of female labour utilization. The employment of more number of family members on small farms as compared to medium and large farms is due to the fact that as the size of the farm increased, the number of hired labourers also increased. Thus, the results indicated that the percentage of hired human labour increased with the increase in farm size. The expenses on manures, fertilizers, irrigation, plant protection measures and machine power, etc formed the other cost components. The total fixed cost ranged from 34 to 37 percent of the total cost of cultivation over the period of eight years of the crop cycle. The cost of cultivation in the eighth year also included expenses on the digging-out of the aged saffron corms and their cleaning etc, an operation usually taken up in the July of every year. Picking, separation of stigmas and drying are very important operations in the cultivation of saffron. The total cost of cultivation was higher for the first size group followed by second and third size groups. This was also due to the higher per unit overhead charges on smaller farms. Thus, the existence of economies of scale in the cultivation of saffron crop was evident.

Year-wise analysis indicated that the cost of cultivation was higher during the first year of establishment; it declined from the second year onwards in all the three size groups, due to saving in the use of variable inputs. The results indicated that saffron is a highly labour intensive crop. Since no effective method of mechanized harvesting can be followed, this operation essentially carried out manually, hence resulting in high labour requirement.

The cost of cultivation of saffron was further studied by using all various costs together. The break-up of the total costs was attempted for each size group in both counties under study. Different income/profitability measures are derived using cost concepts. The results have been presented in Tables 3.

TABLE 2: YEAR-WISE TOTAL COST OF CULTIVATION OF SAFFRON IN TORBAT HEYDARIEH AND GHAEN COUNTIES (in Iranian Rials)

Crop year	Torbat Heydarieh			Ghaen		
	Size Group-I	Size Group-II	Size Group-III	Size Group-I	Size Group-II	Size Group-III
1	57,909,963	57,128,356	56,275,105	50,847,429	49,084,397	47,533,654
2	15,453,646	13,437,953	14,286,037	15,759,615	13,941,520	13,604,348
3	26,419,041	24,358,865	24,055,463	22,897,531	19,836,364	21,040,714
4	34,741,570	34,005,934	34,516,185	29,724,684	29,134,615	29,616,541
5	35,406,714	33,131,129	32,787,075	35,345,455	32,210,526	31,289,720
6	34,871,278	32,450,199	31,887,254	33,145,833	32,177,528	29,831,250
7	25,547,036	23,963,107	23,117,454	24,670,545	24,084,036	23,738,851
8	23,024,356	21,132,589	21,521,795	24,831,692	25,765,568	26,085,818
Total	253,373,605	239,608,132	238,446,368	237,222,784	226,234,555	222,740,896

It is observed from Table 2 the cost was highest during the initial year of establishment of the crop and lowest during the second year, in all the three size groups with in Counties.

The results of analysis of returns revealed that returns were negative during the first year of cultivation across all the three size groups. The net returns turned positive from the second year onwards. The returns were highest during the fifth year of cultivation and declined there after in each size group. The highest gross returns during the eighth year of cultivation were on account of yield of daughter corms.

RETURNS FROM SAFFRON

The returns from saffron include the returns from the main product, by-product and daughter corms. The yield from saffron during the first year remains very low and it increases considerably from the second year onwards. The yield from daughter corms is realised at the end of the crop cycle in the eighth year. The results of the returns analysis are presented in Tables 3 and 4 for Torbat Heydarieh and Ghaen.

Tables 3 and 4, indicate that saffron yield per hectare was found to be higher for smaller farms and medium farms as compared to large farms. The higher productivity of saffron per hectare for small and medium farmers as compared to their large counterparts might be due to more personnel attention and use of more family labour in farm activities. The gross returns were lowest during the first year and highest during the fifth year of the crop cycle, and thereafter declined. The net returns were negative during the first year and increased sharply up to fifth year and declined gradually afterwards, in all the three size groups. Saraf (2006) reported the similar results.

It may be noted that the returns during eighth year were high on account of yield of daughter corms after the completion of the crop cycle; otherwise saffron yields were lowest during that year. The same trend was observed in all the three size groups. The net returns per hectare were negative in the first year, obviously due to high expenditure on seed corms and labour, and lower yield of saffron. The gross returns from saffron also included income from by product. The results are in accordance with the findings of Ghorbani (2008). The cost of production of saffron main product and by product per Mesghal (4.6875 gm) was evaluated and the results indicated that cost of production was highest during the first year, due to low yield and high cost, in all the three size groups of areas. In the calculation of cost of production, the value of seed corms has been taken into account. The cost of production of saffron also included the marketing charges borne by the grower.

ECONOMIC VIABILITY OF SAFFRON CULTIVATION

Economic viability of saffron cultivation was worked out by determining: (1) pay back period (2) benefit-cost ratio (3) net present value and (4) internal rate of return. The results are presented in Table 5.

The economic viability of saffron enterprise was examined for the crop cycle of eight years. The results indicated that PBP was around 4 years for all the three size groups. This means that the time required to fully recover the cost incurred in saffron cultivation is the fourth year of cultivation. The NPV was worked out discounting both the costs as well as returns at 12 percent rate of interest. The average NPV for Torbat Heydarieh was reasonably higher than for Ghaen, which was calculated as Rial 176,756,485 and Rial 165,790,114 at 12 percent respectively.

The net present value for Torbat Heydarieh at 12 percent discounting rate was higher at Rial 186,956,547 for the first size group, Rial 174,619,001for the second size group and Rial 168,693,907 for the third size group. The net present value for Ghaen at 12 percent discounting rate was calculated at Rial 174,640,907, Rial 165,348,284 and Rial 157,381,151 for the first, second and third size groups respectively. The investment in saffron cultivation showed positive net present values and reasonably higher returns at 12 percent discounting rate.

The benefit-cost ratios for different size groups were estimated as 2.14, 2.12 and 2.09 at 12 percent discounting rate, for the first, second and third size groups respectively in Torbat Heydarieh. The BCR's at 12 percent discounting rate estimated for Ghaen were 2.16, 2.15 and 2.11 for the first, second and third size groups respectively. The undiscounted benefit-cost ratios were found to the 2.51, 2.50 and 2.46 for the first, second and third size groups respectively in Torbat Heydarieh, while for Ghaen they were as 2.58, 2.57 and 2.52 for the first, second and third size groups respectively.

Benefit cost ratios on an average in two counties were estimated at 2.12 percent and 2.14 respectively. This indicated that at the prevailing rate of interest, an investment of Rial 10.00 fetched a return of Rial 2.12 and 2.14 at 12 percent discounting rate. The undiscounted average BCR was calculated at 2.49 and 2.56 for Torbat Heydarieh and Ghaen respectively. Since the BCR was greater than one, it showed that the investment in saffron cultivation was economically viable. Thus, all the indicators measured showed that saffron cultivation was economically viable in the study area.

To find the IRR, the values were discounted till the difference between the sums of discounted streams of returns and costs got reduced either to zero or to a lowest minimum. It was found that the internal rate of return in Torbat Heydarieh was 75 percent which has more than in Ghaen with 66 percent.

The internal rates of return were estimated at 77 percent, 74 percent and 73 percent for the first, second and third size groups of Torbat Heydarieh saffron farms respectively and the average internal rate of return (IRR) was calculated as 75 percent. It was found that for Ghaen the internal rates of return at 12 percent discounting rate were 66 percent, 66 percent and 65 percent for the first, second and third size groups, the average working out to 66 percent.

Any enterprise to be economically viable must have benefit–cost ratio (BCR) more than unity, a positive net present value (NPV) and a short pay back period. It is obvious from the results that all these conditions were fulfilled in saffron cultivation and hence it could be inferred that saffron cultivation in Iran is economically viable.

TABLE 5: MEASURE OF ECONOMIC VIABILITY OF SAFFRON CULTIVATION IN TORBAT HEYDARIEH AND GHAEN (per hectare)

Economic Viability in Saffron Cultivation in Torbat Heydariye					
Sl. No.	Particulars	Size Group-I	Size Group-II	Size Group-III	Average
A)	Benefit- Cost Ratio				
i	At 12% Discount Rate	2.14	2.12	2.09	2.12
ii	Un Discounted Rate	2.51	2.50	2.46	2.49
B)	Net Present Value (Rial)				
	At 12% Discount Rate	186,956,547	174,619,001	168,693,907	176,756,485
C)	Pay Back Period (year)	4th	4th	4th	4th
D)	Internal Rate of Return	77%	74%	73%	75%
Economic Viability in Saffron Cultivation in Ghaen					
A)	Benefit- Cost Ratio				
i	At 12% Discount Rate	2.16	2.15	2.11	2.14
ii	Un Discounted Rate	2.58	2.57	2.52	2.56
B)	Net Present Value (Rial)				
	At 12% Discount Rate	174,640,907	165,348,284	157,381,151	165,790,114
C)	Pay Back Period (year)	4th	4th	4th	4th
D)	Internal Rate of Return	66%	66%	65%	66%

CONCLUSION

The study revealed that saffron cultivation is highly remunerative and it has ample scope for employment generation and income enhancement for Iranian farmers. Saffron cultivation is found to be a lucrative proposition for all the categories of farmers in two counties because of substantially large element of profit in the cultivation of this high value crop. The economic analysis in terms of cost and returns, NPV, BCR, payback period, IRR, indicated that the crop is economically viable and profitable.

Another important aspect of this high value crop is its international competitiveness. Iranian saffron is highly competitive in the world market (Kheirandish, 2010). Hence, Iranian saffron also has the potential of becoming an important source of foreign exchange provided the Iranian Government takes effective measures to increase saffron production, productivity and marketing through rigorous research, development and extension education.

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TABLES

TABLE 3: YEAR-WISE TOTAL COST OF CULTIVATION, GROSS RETURNS, AND NET RETURNS FROM SAFFRON IN TORBAT HEYDARIEH COUNTY

Year of Planting	Size Group-I			Size Group-II			Size Group-III		
	Total Cost of Cultivation	Gross Returns	Net Returns/ loss	Total Cost of Cultivation	Gross Returns	Net Returns/ loss	Total Cost of Cultivation	Gross Returns	Net Returns/ loss
y1	57,909,963	5,074,627	-52,835,336	57,128,356	4,716,763	-52,411,593	56,275,105	4,238,227	-52,036,878
y2	15,453,646	36,428,571	20,974,926	13,437,953	32,771,084	19,333,131	14,286,037	35,214,286	20,928,249
y3	26,419,041	70,649,351	44,230,310	24,358,865	68,971,429	44,612,564	24,055,463	66,470,588	42,415,126
y4	34,741,570	98,550,725	63,809,154	34,005,934	89,226,519	55,220,585	34,516,185	86,140,940	51,624,755
y5	35,406,714	112,515,042	77,108,328	33,131,129	108,639,053	75,507,924	32,787,075	104,132,841	71,345,766
y6	34,871,278	105,731,707	70,860,429	32,450,199	99,142,367	66,692,168	31,887,254	96,373,239	64,485,985
y7	25,547,036	66,341,463	40,794,427	23,963,107	61,920,530	37,957,423	23,117,454	61,928,571	38,811,118
y8	23,024,356	140,060,606	117,036,250	21,132,589	133,420,561	112,287,972	21,521,795	132,352,174	110,830,379
Total	**253,373,605**	**635,352,092**	**381,978,488**	**239,608,132**	**598,808,306**	**359,200,174**	**238,446,368**	**586,850,867**	**348,404,499**

TABLE 4: YEAR-WISE TOTAL COST OF CULTIVATION, GROSS RETURNS, AND NET RETURNS FROM SAFFRON IN GHAEN COUNTY

Year of Planting	Size Group-I			Size Group-II			Size Group-III		
	Total Cost of Cultivation	Gross Returns	Net Returns/ loss	Total Cost of Cultivation	Gross Returns	Net Returns/ loss	Total Cost of Cultivation	Gross Returns	Net Returns/ loss
y1	50,847,429	1,821,429	-49,026,000	49,084,397	1,687,943	-47,396,454	47,533,654	1,603,774	-45,929,880
y2	15,759,615	20,487,179	4,727,564	13,941,520	19,783,626	5,842,105	13,604,348	18,961,538	5,357,191
y3	22,897,531	56,325,301	33,427,770	19,836,364	52,389,937	32,553,573	21,040,714	51,764,706	30,723,992
y4	29,724,684	80,526,316	50,801,632	29,134,615	77,448,747	48,314,132	29,616,541	76,367,188	46,750,646
y5	35,345,455	114,050,633	78,705,178	32,210,526	105,649,718	73,439,191	31,289,720	102,037,792	70,748,072
y6	33,145,833	110,270,270	77,124,437	32,177,528	100,280,899	68,103,371	29,831,250	96,030,534	66,199,284
y7	24,670,545	84,185,304	59,514,758	24,084,036	81,479,290	57,395,254	23,738,851	75,215,827	51,476,976
y8	24,831,692	143,460,606	118,628,914	25,765,568	142,126,941	116,361,372	26,085,818	138,918,182	112,832,364
Total	**237,222,784**	**611,127,038**	**373,904,254**	**226,234,555**	**580,847,100**	**354,612,545**	**222,740,896**	**560,899,541**	**338,158,644**

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