



## The Prospect of Investment in Medicinal Plants at Sistan Region<sup>1</sup>

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### Abstract

The presence of various medicinal and ornamental plant species in the Sistan and Baluchistan region has turned this region into a paradise for investors in these plants. The relative advantages of this region for medicinal plants include climatic range and diversity, the feasibility of off-season cultivation in open air, abundant and inexpensive labor, and the availability of the ground for the production of safe and organic crops, facility of commercial exchanges and crop export, and having a long and dynamic history in folklore medicine. As well, the profitability of this treasure hidden in the soils of the region has made it imperative to invest in their production. To explore economical combination of medicinal plants based on regional potentials for investment, the present study used the data of research projects on several medicinal plants including *Foeniculum vulgare* Mill., *Matricaria chamomilla* L., *Cuminum cyminum* L., *Trachys permum amm* L., *Nigella sativa* L., *Platogo cyminum*, and the intercropping of bitter melon and watermelon conducted in an area of 1 ha. Data were analyzed by engineering economic techniques and the criteria of the net present value and cost- benefit ratio. The results showed that these plants had cost- benefit ratio of *F. vulgare* 3.78, *M. chamomilla* 3.89, *C. cyminum* 4.6, *T. permum amm* 4.7, *N. sativa* 4.7, *P. cyminum* 5.3, and *M. charantia* L. & *Hibiscus gossypifolius* Mill. 2.55, respectively. So, given the yield and the positive sign of this ratio for all studied medicinal plants, the cultivation of all of them is economical and they can contribute to diversifying farming and increasing income. Furthermore, was selected to be the most economical plant with a ratio of 5.37. Also, the results revealed that given the significance of producing medicinal plants in the region, the intercropping *Momordica charantia* & *H. gossypifolius* can produce a high yield with a benefit-to-cost ratio of 2.55 and can be effective in employment generation in the region, so this system is economical as its benefit-to-cost ratio is >1 and its net current value is positive. Hence, the medicinal plants have a great potential to be a source of development and productive employment generation in the region if adequate and reliable water is available during their growth periods, they are packaged appropriately and marketed soundly, and they can be processed in industries.

**Keywords:** Herbal, Investment, Intercropping, Economic Assessment, Medicinal Plants

### Introduction

The economy of many developing countries is dependent on the agricultural sector. The main goal of this sector is focused on food production to meet the demands of the population, who are responsible for the development of the other sectors of the economy [1]. In addition to this

role, the agricultural sector is also expected to generate a surplus capital for the movement of the other economic sectors [2].

In fact, the features lying in the production resources and the produced crops, as well as the potential facilities that this sector owns, allows such development such as the

<sup>1</sup>Data are solicited from a research project 'Determining optimal plant pattern of crops in the villages of Kikha and Deh Boland, Hamoun County in Sistan and Baluchistan province, Iran over the crop year 2017-2018'.

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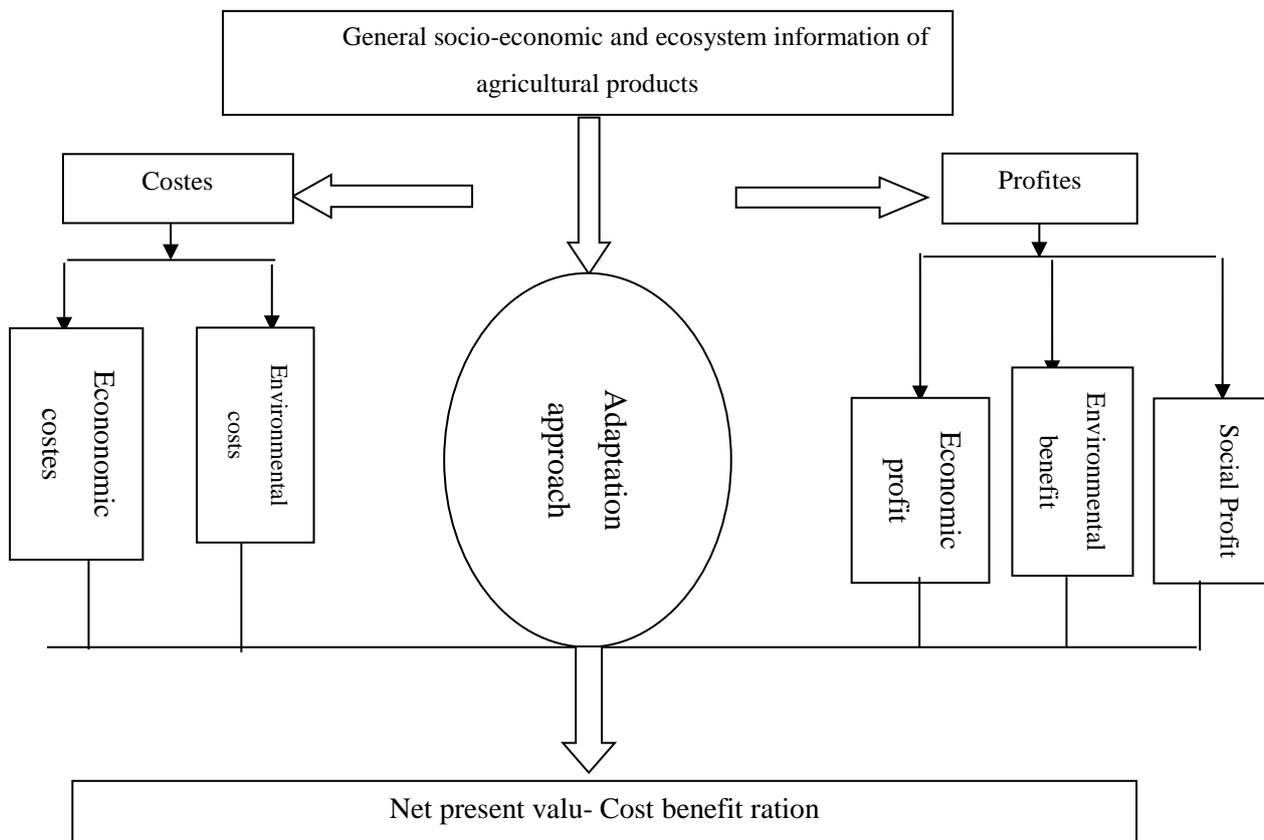
agricultural sector can play its key role in the process of economic development in diverse ways. As such, attention to regional potentials can lay the ground for enhancing the productivity of the production factors as the prerequisite for economic development [3]. In the last two decades, sustainability in agriculture has increasingly drawn the attention of the experts. Agriculture is sustainable if it is technically feasible, economically viable, politically sound, managerially executable, socially acceptable, and environmentally friendly [4]. Given the resource constraints and the significance of inhibiting resource wastage, especially in developing countries, it is imperative to evaluate investment projects from three perspectives—technical, financial, and economic. The question that should be answered when undertaking a project or economic plan is whether the benefits of the project cover its costs. In other words, which projects have the most economic benefits for society? Accordingly, a popular way to assess investment projects financially and economically is the cost-benefit analysis [5]. Fanaei *et al.* [6] report that although medicinal plants have low quantitative yields per unit area, these lower yields are compensated by the higher economic value

added per unit area so that farmers will benefit more for every penny that they invest in medicinal herbs. Research shows that Sistan and Baluchistan province in Iran has about 1200 plant species of which 300 species have potential medicinal and industrial uses [7]. Indeed, this province is the second leading province of Iran in terms of plant diversity. Therefore, the present study aimed to explore the feasibility of investing in the cultivation of medicinal plants based on regional potentials using potential crops with a high tolerance range and direct and indirect impacts on the liquidity of local farmers.

**Material and Methods**

**Cost-benefit Analysis Method**

Various methods have been proposed to assess the performance of a crop by measuring its costs versus its benefits. One population method is cost-benefit analysis [8,9]. Cost-benefit analysis is defined as the index of profitability too which represents discounted profits per unit of discounted costs. When benefits result from the alleviation of adverse consequences, this ratio is called an investment saving ratio [10,11].



Accordingly, we used two main indicators of engineering economics techniques for the economic selection of crops [12-14].

1. Net Present Value: The difference between the present value of costs and the present value of benefits

$$NPV = EUA(B) - EUA(C)$$

2. Cost- benefit ratio: The ratio of the present value of profits to the present value of costs

$$\text{benefit - cost Ratio} = \frac{EUAB}{EUAC}$$

EUAB: Uniform annual value of benefits and EUAC Uniform annual value of cost. For example, if the benefit-cost ratio is greater than one, the relevant activity would be justified. And the investment will be affordable.

#### Characteristics of the Study Site

Sistan is a large area located in the southeastern part of the Iranian Qalat. Just as the life of Egypt depends on the Nile, the life of Sistan throughout its several thousand years depends on the Hirmand River [15]. The climate of the region is assessed as arid and arid, and in terms of rainfall, it is in a heterogeneous state. Statistics from Zabul station show that the average annual rainfall in Zabul in the last 40 years has been about 61 millimeters, the lowest of which was in 2001 with a total of 2.7 millimeters and the highest in 2005 with a total of 5.129 millimeters. Low annual rainfall, strong winds, high temperatures and sunny hours have caused the Sistan region to have the highest annual evaporation potential compared to other parts of the country [16]. According to the measurements made from the surface of the pan, the total annual total was about 4747 mm and evaporation from the free surface of the water was 3584 mm, which is one of the highest evaporation values in the world [17]. The occurrence of various medicinal and ornamental plant species in Sistan and Baluchistan has been a motive for the investment of the private sector so that knowledge-intensive enterprises can play a key role by the specialized efforts they have [18]. In addition, the other potentials of the province that can motivate the investment of the private sector include the presence of over 1200 plant species of which over 392 species have medicinal and industrial value, the development of wood cultivation due to the potentials of the southern regions of the province, the production of medicinal plants and productive non-wood species, the development and construction of small-sized oil-extraction centers to extract oil from moringa, the use of 80 tons of *Pistacia atlantica* Desf. in the forests of the province, and the use of 500 tons of bitter almond in the forests of the province [19].

Some important medicinal plants in this region include yarrow, common rue, alhagi, flixweed, licorice, *Plantago ovata* Forssk., felty germander, *Otostegia persica*

(Burm.f.) Boiss., thyme, mugworts, *Artemisia vulgaris* Burm.f., esfand, *Salvia mirzayanii* Rech.f. & Esfand., mushrooms, parsley, mint, wild spinach, rhubarb, spearmint, borage, *Pistacia atlantica*, almond, fig, jujube. Persian turpentine tree is a major medicinal herb in the Sistan and Baluchistan region. The investment in processing industries of medicinal plants in this province not only has economic justification, but it can also bolster employment in this region [20].

In fact, the rich vegetation in Sistan and Baluchistan has fueled the growth of many medicinal plants such as asafoetida, dorema, common myrtle, moringa, aloe vera, colchicum, licorice roots, caraway, roselle, sage, almond, and spearmint in the region, boosting the market, employment and investment and it can even be a source of earning foreign currency.

As well, the climatic conditions of the province have made it a habitat for scarce medicinal plants. So, the private sector is expected to be actively involved in the production of medicinal plants in this region in order to contribute to its growth and prosperity.

## Results and Discussion

In this study, we derived data for the medicinal plants including *F. vulgare*, *M. chamomilla*, *C. cuminum*, *Nigella sativa*, and *M. charantia* & *H. gossypifolius* intercropping with watermelon, from the research projects conducted in Agricultural and Natural Resources Research and Education Center of Sistan. To measure seed yield, a 1-m<sup>2</sup> area was harvested after eliminating the marginal effect. All production costs of the plants over the growing season were calculated at the daily rate and after deducting them from the gross income, the net income was specified for each plant species. Investment costs for the crops included the purchase of equipment and infrastructure too. Fixed costs occurred excluding agricultural labor and represented depreciation value and interest. Operating costs included daily activities of farmers in conventional farming practices, especially labor costs.

#### Most Economical Medicinal Herb for Investment in the Sistan Region

To make the final decision on the most economical medicinal plant for investment in the Sistan region, the above table was used to calculate the decision-making table (Table 1)

Given the criteria of decision-making based on the pairwise comparisons and the description of the research method, the first choice was *F. vulgare* matricayia. Since  $\Delta EUAB / \Delta EUAC \geq 1$  at the second step, out of *F. vulgare* and *M. chamomilla*, *M. chamomilla*

was selected because we had  $\Delta EUAB/\Delta EUAC \geq 1$ . At the third step, between *M. chamomilla* and *C. cyminum*, *C. cyminum* was selected as we had  $\Delta EUAB/\Delta EUAC \geq 1$ . At the fourth step, ajwain was chosen between cumin and ajwain because of  $\Delta EUAB/\Delta EUAC \geq 1$ . At the fifth step, black cumin was selected between ajwain and black cumin due to  $\Delta EUAB/\Delta EUAC \geq 1$ . Finally, at the sixth step, psyllium was selected between ajwain and psyllium because we had  $\Delta CPV/\Delta BPV \geq 1$ . So, the most economical plant was selected to be psyllium at the sixth step. In other words, 1

IRR investment in the production of this plant will have a benefit of 5.3 IRR for the farmer.

Also, to decide on the intercropping *H. gossypifolius* and watermelon in the Sistan region, Table 2 was calculated.

Most Economical Intercropping of Medicinal Plants and Summer Plants in the Sistan Region

To make the final decision on the selection of the most economical intercropping system of medicinal and summer plants in the Sistan region with respect to the above table, the decision-making table (Table 3) was calculate

**Table 1** Decision making table for choosing the most economical medicinal plant for investment in sistan area (The unit of values in tables is Rials)

Decision	$\Delta EUAB/\Delta$	$\Delta EUAB$	$\Delta EUAC$	x-y	EUAB	EUAC	X
Selection 1	3.78	11826868	79.38870	1-0	11826868	79.38870	1 <i>F. vulgare</i>
Selection 2	3.89	20893	5439	2-1	139162	38.44309	2 <i>M. chamomilla</i>
Selection 3	4.6	149004	32575038	3-2	156392	67.45250	3 <i>C. cyminum</i>
Selection 4	4.7	19597	4212	4-3	160797	40.49462	4 <i>T. permum amm N.</i>
Selection 5	4.7	299578	64757	5-4	177176	78.68969	5 <i>sativa</i>
Selection 6	5.3	237584	4985384	6-5	187793	50.74129	6 <i>P. cyminum</i>

Reference: Researcher's calculations

**Table 2** Calculate the present value of the benefits and costs of cultivation intercropping *H. gossypifolius* Compared with watermelon (The unit of values in tables is Rials)

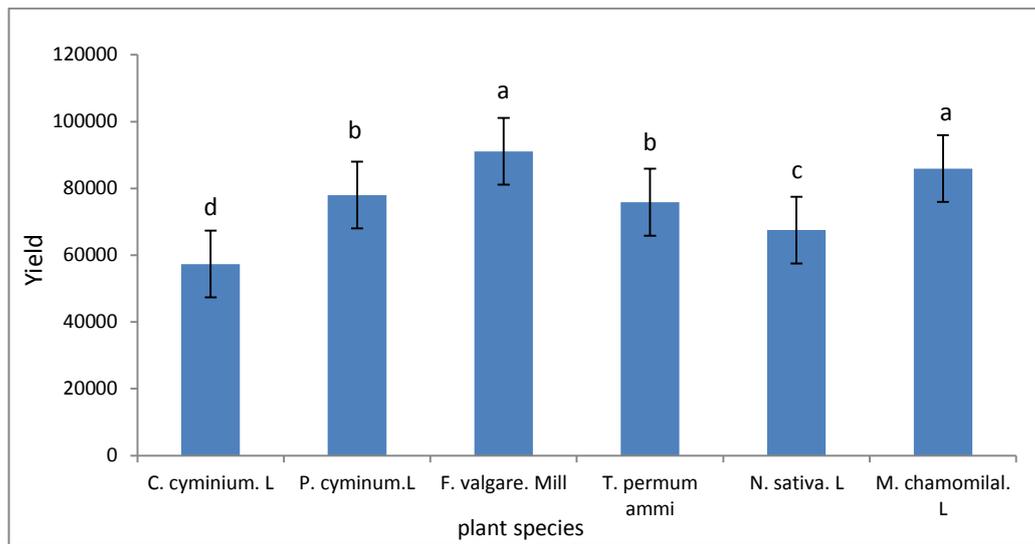
EUAC	EUAB	R,1,18%	P=TR-TC	Incomes (B)	Costs (C)	Product
16706250	41250000	1.1000	22312500	37500000	15187500	<i>M. charantia</i> & <i>H. gossypifolius</i>
13076250	31350000	1.1000	16612500	28500000	11887500	<i>H. gossypifolius</i>
9171250	22000000	1.1000	1662500	20000000	8337500	watermelon
8346250	9900000	1.1000	1412500	90000000	7587500	<i>M. charantia</i>

Reference: Researcher's calculations

**Table 3** Decision making table for selection of the most economical combination of medicinal plant with safflower in sistan area (The unit of values in tables is Rials)

Decision	$\Delta EUAB/\Delta EUAC$	$\Delta EUAB$	$\Delta EUAC$	x-y	EUAB	EUAC	X
Selection 1	2.39	22000000	9171250	1-0	22000000	9171250	1 <i>watermelon</i>
Selection 2	2.55	19250000	7535000	2-1	41250000	16706250	2 <i>M. charantia</i> & <i>H. gossypifolius</i>

Reference: Researcher's calculations



**Fig. 1** Average net income of the medicinal plants under study

In Table 3, the choices are arranged in the ascending order of EUAC. When the choice  $x = 1$  is compared with the choice  $x = 0$ , it is found that the choice  $x = 1$  is superior over the choice  $x = 0$ . The  $x$ - $y$  column represents the pairwise comparison of the most cost choice and the choice  $y$ , which is the least costly choice. As a result, the calculations should be completed in each line to allow deciding on the pair that should be compared in the next line. This means that since  $x = 1$  is selected at the end of the first line, we will have  $y = 1$  in the second line. Similarly, when  $x = 1$  is selected after doing calculations for the second line, we have  $y = 2$  in the third line and therefore, given the criterion of decision making based on the pairwise comparison, watermelon is selected in the first choice since  $\Delta EUAB / \Delta EUAC > 1$ . At the second step in which a selection should be made between watermelon, and *M. charantia* & *H. gossypifolius*, the intercropping of *M.*

*charantia* & *H. gossypifolius* is selected due to  $\Delta EUAB / \Delta EUAC > 1$ , implying that this intercropping system is the most economical.

#### Conclusions and Recommendations

According to Table 1, all studied medicinal plants are economical and can be effective in diversifying crop production and increasing income. In addition, psyllium was selected to be the most economical plant as it exhibited the highest benefit-to-cost ratio. Based on Table 6, the intercropping of bitter melon and roselle had the highest benefit-to-cost ratio among the intercropping systems. Therefore, the relative advantages of medicinal plants in the region provide a great opportunity for the developing and increasing attention to this rich national resource. If sound and technical plans can be developed for these plants, they can induce a huge revolution in improving the users' economic status.

The development of medicinal plants is an approach of the government for economic prosperity. The medicinal plants have a great potential to be a source of development and productive employment generation in the region if adequate and reliable water is available during their growth periods, they are packaged appropriately and marketed soundly, and they can be processed in industries. If Sistan region invests in the private sector in the field of cultivation development and the creation of transformation industries and obtaining a cohesive market for sales and exports, it can be a healing prescription for the treatment of diseases, economy and employment and become a paradise for investors.

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#### Conflict of Interest

The authors declare that there is not any conflict of interests regarding the publication of this manuscript.

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