On the Comparison of the Applications of Conventional Ranking Techniques in Determining the Priority Factors Affecting Seed Production of Medicinal Plants: Case of Guilan Province, Iran

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Abstract

Aimed at identifying and prioritizing promoters and deterrent affecting seed production of medicinal plants, the present study was conducted in 2014. The Delphi method was conducted using a panel of 13 experts in Guilan Natural Resources and Agriculture Organization. In the first round of the study, multiple-response techniques were used for content analysis. Based on the results of the first round, the second round questionnaire was featuring a Likert type scale that was then filled out by the first round respondents. Next, by comparing the conventional techniques, data were analyzed for investigation. The use of ranking techniques led largely to the same results or results with slight differences. The study recommends devoting due attention to the technical and environmental conditions such as proper storage, to avoid the wasteful harvesting of seeds at risk, and to provide favorable conditions for the domestication of medicinal plants. In addition, the role of research, training, and information dissemination of the economic benefits would receive high importance. Furthermore, designing and implementing a legal monitoring mechanism and an active and comprehensive policy making process, as well as providing facilities and equipment necessary for the preparation, cultivation, and harvest of seeds by decision-making, executive institutions, and organizations would notably be effective to tackle the present challenges.

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INTRODUCTION

Development of pharmaceutical, cosmetic, food, and the other related industries have increased the demand for raw materials. One of the major categories of raw materials is a medicinal plant. Although, large amounts of chemicals and synthetic ingredients with similar to medicinal plants are produced and traded, natural compounds still have a special place in the production of qualified products, and hence, many companies prefer to use raw materials of these plants. Limitations of the World Health Organization (WHO) play a key role in the use of natural ingredients in the manufacture of these products as stricter rules have been adopted since 2000. According to reports from credible sources, about 70 thousand plant species in traditional medicine and supplements are in use around the world. A study conducted by the World Health Organization found that about 80 percent of the population in developing countries relies on herbal medicine. At least 25 percent of the drugs listed in the reputable world pharmacopoeias is derived from plants. Currently, 121 types of active herbal ingredients are used in the pharmaceutical industry worldwide. Out of total 252 essential medicines introduced by the World Health Organization, 11.1% are herbal medicines and a significant number are synthetic medicines that are derived from natural materials (Ebadi & Abbasian, 2014). Overall, while demand for herbal medicines in developing countries is increasing, there are signs that consumers in developing countries have lost interest in modern medicines and started using herbal medicines (Kumar, 2008).

Medicinal plants are important natural resources that have been used by humans since the ancient times. Given the growing world population, health and human health issues have surfaced as one of the important concerns of human society. As regards plant diversity, especially medicinal plants, Iran are a unique place in the geography of the plant world. According to botanists and scientists of natural resources, there are approximately 8,000 species, and Iranian researchers' studies have shown that 2,000 species have medicinal, aromatic, spiced, and cosmetic properties. In addition, from all recognized plant species, nearly 1,850 plant species are native to Iran (endemic), which are grown exclusively in the territory of Iran and are considered as an exclusive capacity (Irvani et al., 2013; Jasemi et al., 2016). Based on the foregoing cases, there is an enormous economic potential in the production and trade of medicinal plants in the country. Exploiting these potential and managing problems in this field, jobs could be created by medicinal plant production as well as in strengthening the national economy.

Seed production is involved as one of the most important technical and economic issues in this field. Seed is the most important and basic part of the plant that has a vital role in the reconstruction, preservation, and transfer of plant genetic material as well as the mechanisms of distribution, reproduction, and survival of the plant in very difficult circumstances. Moreover, seed production, not only reduces costs, but also decreases depending on the import economically and provides the possibility for a raise in economic returns for producers (Noorhosseini et al., 2011). In addition, the seeds have multiple uses, such as pharmaceutical, industrial, and commercial. Therefore, managing medicinal plant seed production and identifying factors affecting these crops should be considered as research priorities for the planners. Despite the stated importance of the medicinal plant seed production, very few studies in the field of medicinal plant seed production have been carried out, particularly in the country.

Inspired by the studies that had been carried out in Bangladesh, Sharmin (2004) showed that factors such as education level, history of planting, cultivation of medicinal plants and the degree of satisfaction from the income of growing these plants have a positive effect on the development of cultivation.

Yadav and Misra (2012) examined the role of market information systems in the development of forest plants. The results showed that applying these systems in the market solved the problems existing in development and helped suppliers, producers, and consumers. Providing information on quality standards, packaging, and use, method of production, and detection methods increased

the quality of plants and helped consumers and suppliers to recognize medicinal plants.

Sher et al. (2013) examined medicinal plants in northern Pakistan from an economic standpoint. The study results showed that lack of awareness of medicinal properties and economic importance of these plants among local people caused damages to vegetation and led to inadequate production of herbal medicines.

Rassam et al. (2012) prioritize the factors affecting the cultivation, and development of medicinal plants in North Khorasan province. The results showed that among the four factors affecting the development of cultivation, economic criteria have the greatest impact. Support policies, training extension services, and social and cultural factors were ranked in the next priority.

Ameri et al. (2013) analyzed consumers' statistics, modes of consumption, production, and awareness of medicinal plants. The results showed that 71.5% of people in Iran use medicinal plants. 70% of men and 73.5% of women are medicinal plant users.

As noted above, although studies have been done on the medicinal plants, little research has been performed on the management of medicinal plant seed production, while based on the above discussions; this is one of the most important issues faced by planners. Accordingly, the present study aims to rank promoter and deterrents affecting medicinal plants seed production in Guilan province as one of the potential regions of medicinal plants in the country. To achieve the research objectives and to achieve more accurate responses, this study compared the common ranking techniques including average, ratio variation, Shannon entropy weighting, and triangular fuzzy numbers.

MATERIALS AND METHODS

The present study capitalized on Delphi as a qualitative research method for data collection.

Thirteen experienced and skillful experts in medicinal plant cultivation and production in Guilan, north of Iran constituted the professional panel's members in this study. It should be noted that the experts were identified after numerous interviews and then invited to participate. Each of these experts was active more than a decade in the species identification, cultivation, and production of medicinal plants in Guilan Province.

In order to rank the promoter and deterrents affecting seed production of medicinal plants, this study was conducted in two rounds: In the first phase of the research, multiple response analysis and in the second round, conventional ranking techniques (average, variation ratio, Shannon entropy weighting, and triangular fuzzy numbers) were used. In addition for evaluating experts' agreement about the promoters and deterrents affecting seed production of medicinal plants, Kendall W coefficient was used.

Multi-response analysis

Multi-response analysis is a suitable method to analyze the data from the questionnaires with open questions. Therefore, data analysis and statistical methods were used in the first round of the research. In this round, two questions were raisedregarding to the promoters and deterrents affecting seed production of medicinal plants. After analyzing the content of responses provided in the first round, a questionnaire was designed for the second round where participants were asked to explain their agreement rate regarding each problem and strategies suggested in terms of five-point Likert type scale (1= very disagreed to 5= very agreed). Factors are coded and proposed as analyzed variables presented in Table 1.

Variation ratio

Variation ratio is used to study the distribution of data measured on the nominal or ordinal

Table 1
Type and Number of Responses Raised by the Experts

Variables	Total responses	Number of respondents
Promoting factors affecting the seed production	25	11
Inhibiting factors affecting the seed production	30	16
Total	55	27

scale. In fact, this variable is used to study the consistency or non-consistency of responses. Equation (1) used for its calculation (Kalantari, 2012).

$$VR = 1 - \frac{Maximum\ frequency}{Total\ frequency} \tag{1}$$

Shannon entropy

The concept of Shannon's entropy has a dominant role in information theory. This concept has been developed in different scientific fields, such as physics, social sciences, and so on. The researchers use this formula to estimate the degree of importance of alternatives in the following rounds (Soleimani-damaneh, 2009; Ghorbani, 2012):

- Conversion of decision matrix to the unscaled matrix:

$$R_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}} \tag{3}$$

$$P_{ij} = \frac{R_{ij}}{\sum_{i=1}^{m} R_{ij}} \tag{4}$$

In the above formulas: n= number of indices, m = number of existing options, x= mean

- Calculate the amount of indices entropy:

$$E = -K \sum_{i=1}^{m} \left[P_i \times \ln P_i \right] \tag{5}$$

In the above formula: $K = 1/ln(m)$

- Calculate the amount of uncertainty or de-viation degree:

$$d_j = 1 - E_j \tag{6}$$

- Calculate index weight:

$$W_i = \frac{d_i}{\sum_{i=1}^{n} d_j} \tag{7}$$

Fuzzy sets

A fuzzy set is a continuum of grades of membership. Such a set is characterized by a membership function that assigns to each object a grade of membership ranging from zero to unity. Fuzzy sets and fuzzy logic are powerful mathematical tools for modeling. Triangular fuzzy number is a special kind of fuzzy sets. It is possible to use different fuzzy numbers according to the situation. In applications, it is often convenient to work with triangular fuzzy numbers (TFNs) because of their computational simplicity. Moreover, they are useful in promoting representation and information processing in a fuzzy environment. Therefore, in this paper, the researchers used triangular fuzzy numbers (Nazari et al., 2012).

After the data were collected, the fuzzy triangular numbers were converted into absolute fuzzy numbers by means of the Minkowski formula. The following formula is used for converting fuzzy triangular numbers into absolute fuzzy numbers:

Absolute fuzzy numbers = m + b-a/4 (8)

In the above formula (a) is expressed as low limit (bound), (b) is expressed as the top limit (bound) and (m) means the biggest membership degree.

Fuzzy triangular numbers and absolute fuzzy numbers of the linguistic variables are recorded in Table 2.

Table 1
Conversion Triangular Fuzzy Numbers to a Certain Number

Number of qualitative	Triangular fuzzy number	Final fuzzy number
Very low Importance (Very disagree)	(0,0,0.25)	0.075
Low importance (disagrees)	(0,0.3,0.5)	0.275
The medium (intermediate)	(0.2,0.5,0.8)	0.5
High-importance (I agree)	(0.5,0.7,1)	0.725
High importance (Very agree)	(0.7,1,1)	0.925

After collecting the data, the weight of each indicator is achieved by multiplying the number of acquired responses for each indicator with the deterministic numbers and dividing the product by the number of respondents. By dividing the weight of each indicator on the total weights of indicators, normalized weight is achieved.

Indicator weight =

$$\frac{very\ low\ impor\tan t\ frequency \times 0.075 + ...}{the\ number\ of}$$

$$\frac{++very\ high\ imporant\ frequenxy \times 0.925}{respondants} \quad (9)$$

Normalized weight =

$$\frac{weight\ of\ each\ indicator}{total\ weight\ of\ each\ indicator} \quad (10)$$

Kendall's *W* coefficient

In this study, Kendall's *W* consistency coefficient was used to define the consensus r`ate of panel members. The Kendal consistency coefficient is a measure for defining consistency and the agreement rate among several series of scores related to N objects or persons. In fact, by using this measure, it is possible to find the score correlation between K series of scores. Such a measure is useful, particularly in the studies relating to the "relevance among the judges". Kendall's W consistency coefficient indicates that individuals arranging several items based on their importance fundamentally applied similar measures to judge of the importance of each item thus in this regard agree with each other. This scale is calculated using following equation (Kalantari, 2012):

$$W = \frac{s}{\frac{1}{12}K^2(N^3 - N)} \quad (11)$$

$$S = \sum\left(R_j - \frac{\sum R_j}{N}\right)^2 \quad (12)$$

S = sum of square of standard deviations of R_j from means

R_j Total score relating to a factor.

K= the number of scores sets (the numbers of turns).

N= the number of ranked factors.

1/12 $K^2(N^3-N)$ = Maximum sum of squares of deviations from mean R_j.

i. e. sum of S observing if there is c

ii.

iii.

iv. Complete agreement between K rankings.

The amount of this scale is equity when there is complete consistency or agreement and is zero when there is no complete consistency. Thus, if Kendall's W consistency coefficient rate doesn't change or if it is slightly raised, it indicates that there is no increase in the agreement and opinion asking may be terminated.

Statistical calculations

Performing the calculation, using Shannon entropy weight and triangular fuzzy numbers, and acquiring unreliable result taking a number of indicators to be tested using this technique, is very time consuming and complex due to their specific structure. To facilitate achieve dependable results and reduce common errors in these calculations, SPSS, and Microsoft Excel were used.

RESULTS AND DISCUSSION

Results prioritization promoter affecting seed production of medicinal plants using the multi-response analysis indicated that items of implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1) and creation of appropriate conditions for the cultivation and domestication of medicinal plants (P9) that individually accounted for 20% of cases. Also, in the first rank, as well as the items creating research and pattern farms for cultivation of medicinal plants in the province of Guilan (P2) and enhance the quality and vigour of medicinal plants seed through proper storage and environmental conditions favorable (P7), each of which separately accounted for 16 percent of cases are in second rank. Other items were in third rank (Table 3).

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Results based on content analysis of promoter affecting seed production of medicinal plants in the second phase using three methods: ratio variation, Shannon entropy weight, and fuzzy triangular are summarized in Table 3 below.

Prioritization of each promoter affecting seed production of medicinal plants in Guilan, the ratio variation show that the items of implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1) and creating research and pattern farms for cultivation of medicinal plants in the province of Guilan (P2) were ranked first and second, respectively among promoter factors affecting production seeds of medicinal plants. The items farmers' awareness of the economic advantages of seed production of medicinal plants (P3) and access to suitable facilities getting seeds and seed storage of medicinal plants for planting season (P4) were in ranks last.

Prioritization with triangular fuzzy numbers showed that implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1) in the first rank and items planning and special attention to seed of medicinal plants in the pharmaceutical industry (P5) and farmers' awareness from the economic advantages of seed production of medicinal plants (P3) were second in importance. Moreover, the items of enhance the quality and vigor of medicinal plants seed through proper storage and environmental conditions favorable (P7) and preventing the indiscriminate harvesting of medicinal plant seeds of rare species and under threat in Guilan province (P6) were in the third rank.

The results of the Shannon entropy method to benchmark the coefficient of variation for the prioritization of promoter factors affecting seed production of medicinal plants indicated that items enhance the quality and vigor of medicinal plants seed through proper storage and environmental conditions favorable (P7), planning and special attention to seed of medicinal plants in the pharmaceutical industry (P5), preventing the indiscriminate harvesting of medicinal plants seeds of rare species and under threat in Guilan

province (P6), creation of appropriate conditions for the cultivation and domestication of medicinal plants (P9), training processing and separating seed of medicinal plants (P10) and creating research and pattern farms for cultivation of medicinal plants in the province of Guilan (P2) were ranks of first to third respectively.

Despite the fact that some minor differences in the ranking of the three methods were proposed, the common feature of all three methods was most important items in the ranks of one to five. In general, weaknesses of different methods of ranking made the compilation of the methods used in this study. The average ranking confirms the importance of the issues raised in the study is presented in Table 4. Accordingly, items of farmers' awareness from the economic advantages of seed production of medicinal plants (P3), planning and special attention to seed of medicinal plants in the pharmaceutical industry (P5), preventing the indiscriminate harvesting of medicinal plants seeds of rare species and under threat in Guilan province (P6), enhance the quality and vigour of medicinal plants seed through proper storage and environmental conditions favorable (P7), implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1) and access to suitable facilities getting seeds and seed storage of medicinal plants for planting season (P4) were more important, so that all of the items in each of the three methods with the rating of one to five.

The results prioritization deterrents affecting seed production of medicinal plants using the Multi-response analysis indicated that item lack of facilities and equipment for the harvesting and preparation of seeds (D12) that individually accounted for 20% of cases, in the first rank, as well as the item high humidity and seasonal rainfall in the province to prevent the seed production of medicinal plants (D8), each of which separately accounted for 16.67 % of cases are in second rank. Items of lack of laws prohibiting the harvesting of natural species in danger of extinction (D2) and lack of refrigerator equipment and ultracold required for seed storage of medicinal plants (D15) were in third rank and

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Table 3
Prioritize of Promoter Factors Affecting Seed Production of Medicinal Plants

Factors	Multi-response analysis (First round)			Ratio of variations (Second round)			Prioritization
	Number of Responses	Percent of Responses	Percent of Cases	Mean	SD	VR	
Implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1)	5	20.00	38.46	4.385	0.870	0.154	1
Creating research and pattern farms for cultivation of medicinal plants in the province of Guilan (P2)	4	16.00	30.77	4.539	0.660	0.231	2
Farmers' awareness from the economic advantages of seed production of medicinal plants (P3)	1	4.00	7.69	4.615	0.870	0.231	3
Access to suitable facilities getting seeds and seed storage of medicinal plants for planting season (P4)	1	4.00	7.69	4.615	0.870	0.231	3
Planning and special attention to seed of medicinal plants in the pharmaceutical industry (P5)	1	4.00	7.69	4.615	0.650	0.308	4
Preventing the indiscriminate harvesting of medicinal plants seeds of rare species and under threat in Guilan province (P6)	1	4.00	7.69	4.615	0.650	0.308	4
Enhance the quality and vigor of medicinal plants seed through proper storage and environmental conditions favorable (P7)	4	16.00	30.77	4.769	0.599	0.385	5
Buy ensure production of medicinal plants including the seed (P8)	1	4.00	7.69	4.308	0.947	0.385	6
Creation of appropriate conditions for the cultivation and domestication of medicinal plants (P9)	5	20.00	38.46	4.615	0.650	0.462	7
Training processing and separating seed of medicinal plants (P10)	1	4.00	7.69	4.539	0.660	0.462	7
Access to mechanization and agricultural equipment associated with the production seed of medicinal plants (P11)	1	4.00	7.69	4.308	1.109	0.462	8
Total	25	100.00	192.31	-	-	-	-

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Continued Table 3

Factors	Triangular fuzzy numbers (Second Round)			Shannon entropy (Second Round)			
	Importance Weight	Normalized Weight Rating	Prioritization 2	E_i	D_i	W_i	Prioritization 3
Enhance the quality and vigor of medicinal plants seed through proper storage and environmental conditions favorable (P7)	0.8442	0.0932	3	0.6009	0.3991	0.0745	1
Planning and special attention to seed of medicinal plants in the pharmaceutical industry (P5)	0.8462	0.0935	2	0.5645	0.4355	0.0813	2
Preventing the indiscriminate harvesting of medicinal plants seeds of rare species and under threat in Guilan province (P6)	0.8442	0.0932	3	0.5647	0.4353	0.0813	2
Creation of appropriate conditions for the cultivation and domestication of medicinal plants (P9)	0.7827	0.0864	6	0.5647	0.4353	0.0813	2
Training processing and separating seed of medicinal plants (P10)	0.8308	0.0918	4	0.5547	0.4453	0.0831	3
Creating research and pattern farms for cultivation of medicinal plants in the province of Guilan (P2)	0.7731	0.0854	8	0.5547	0.4453	0.0831	3
Farmers' awareness from the economic advantages of seed production of medicinal plants (P3)	0.8769	0.0969	1	0.4767	0.5233	0.0977	4
Access to suitable facilities getting seeds and seed storage of medicinal plants for planting season (P4)	0.7981	0.0881	5	0.4767	0.5233	0.0977	4
Implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1)	0.8308	0.0918	4	0.4620	0.5380	0.1005	5
Buy ensure production of medicinal plants including the seed (P8)	0.7808	0.0862	7	0.4335	0.5665	0.1058	6
Access to mechanization and agricultural equipment associated with the production seed of medicinal plants (P11)	0.8462	0.0935	2	0.3919	0.6081	0.1136	7

Table 4

Comparison of Prioritization Methods for Promoter Factors Affecting Seed Production of Medicinal Plants

Factors	VR	Triangular fuzzy	Shannon entropy	Mean
Farmers' awareness from the economic advantages of seed production of medicinal plants (P3)	3	1	4	2.67
Planning and special attention to seed of medicinal plants in the pharmaceutical industry (P5)	4	2	2	2.67
Preventing the indiscriminate harvesting of medicinal plants seeds of rare species and under threat in Guilan province (P6)	4	3	2	3.00
Enhance the quality and vigor of medicinal plants seed through proper storage and environmental conditions favorable (P7)	5	3	1	3.00
Implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1)	1	4	5	3.33
Access to suitable facilities getting seeds and seed storage of medicinal plants for planting season (P4)	3	5	4	4.00
Creating research and pattern farms for cultivation of medicinal plants in the province of Guilan (P2)	2	8	3	4.33
Training processing and separating seed of medicinal plants (P10)	7	4	3	4.67
Creation of appropriate conditions for the cultivation and domestication of medicinal plants (P9)	7	6	2	5.00
Access to mechanization and agricultural equipment associated with the production seed of medicinal plants (P11)	8	2	7	5.67
Buy ensure production of medicinal plants including the seed (P8)	6	7	6	6.33

Warehousing and inappropriate treatment and unscientific of medicinal plant seed (D13) was in fourth (Table 5).

Results based on content analysis of deterrents affecting seed production of medicinal plants in the second phase using three methods: ratio variation, Shannon entropy weight and fuzzy triangular are summarize in Table 5.

The results of the ratio of variations method for the prioritization the deterrents factors affecting the seed production of medicinal plants indicated that items the increasing destruction of forests and pastures and destruction of various species of medicinal plants (D1), lack of laws prohibiting the harvesting of natural species in danger of extinction (D2), lack of organizational policy on development of medicinal plants products (D3), lack of awareness from sale market and the demand-supply of medicinal plants seeds (D4), lack of support from farmers for the production of medicinal plants (D5) and lack of expertise for the seed production of medicinal plants (D6) were ranks of first to fifth respectively.

The two methods of ratio variation and triangular fuzzy numbers showed more or less similar results with regard to prioritize deterrent affecting

seed production of medicinal plants. In Shannon entropy method based on coefficient of variation, the displacement only between ranks one to six. It seems that the coefficient of variation is not a sufficient basis for ranking in statistical methods. It only is measure the distribution of statistical data to be handled as a normal benchmark.

In total, according to Table 6, items of the increasing destruction of forests and pastures and destruction of various species of medicinal plants (D1), lack of organizational policy on development of medicinal plants products (D3), lack of laws prohibiting the harvesting of natural species in danger of extinction (D2), lack of expertise for the seed production of medicinal plants (D6), lack of awareness from sale market and the demand-supply of medicinal plants seeds (D4) and lack of support from farmers for the production of medicinal plants (D5) were more important, so that all of the items in each of the three methods with the rating of one to five.

After performing the first and second rounds of study, given the fact that Kendall's W coefficient rates for promoter and deterrents were 0.172 and 0.159, respectively, (p<0.05 and

Table 5
Prioritize of deterrents factors affecting seed production of medicinal plants

Factors	Multi-response analysis (First round)			Ratio of variations (Second round)			Prioritization
	Number of Responses	Percent of Responses	Percent of Cases	Mean	SD	VR	1
The increasing destruction of forests and pastures and destruction of various species of medicinal plants (D1)	1	3.33	7.69	4.769	0.832	0.077	1
Lack of laws prohibiting the harvesting of natural species in danger of extinction (D2)	3	10.00	23.08	4.539	0.967	0.231	2
Lack of organizational policy on development of medicinal plants products (D3)	1	3.33	7.69	4.539	0.776	0.308	3
Lack of awareness from sale market and the demand-supply of medicinal plants seeds (D4)	1	3.33	7.69	4.385	0.961	0.385	4
Lack of support from farmers for the production of medicinal plants (D5)	1	3.33	7.69	4.385	0.961	0.385	4
Lack of expertise for the seed production of medicinal plants (D6)	1	3.33	7.69	4.385	0.870	0.385	5
Lack of sufficient information available to farmers for seed production of medicinal plants (D7)	1	3.33	7.69	4.385	0.961	0.385	6
High humidity and seasonal rainfall in the province to prevent the seed production of medicinal plants (D8)	5	16.67	38.46	4.846	1.463	0.462	7
Control of livestock and wildlife to prevent the attack on the seed of medicinal plants (D9)	1	3.33	7.69	4.231	0.927	0.538	8
Lack of encourage and promote ranging from public and private sectors for the seed production of medicinal plants (D10)	1	3.33	7.69	4.231	0.927	0.538	9
Increased importing seed of medicinal plants and a lack of willingness to invest in seed production in the country (D11)	1	3.33	7.69	3.846	1.281	0.538	10
Lack of facilities and equipment for the harvesting and preparation of seeds (D12)	6	20.0	46.15	4.308	0.630	0.615	11
Warehousing and inappropriate treatment and unscientific of medicinal plants seed (D13)	2	6.67	15.38	4.000	1.000	0.615	12
Lack of demand for buying seeds of medicinal plants (D14)	1	3.33	7.69	4.000	1.080	0.615	13
Lack of refrigerator equipment and ultra-cold required for seed storage of medicinal plants (D15)	3	10.00	23.08	4.000	1.155	0.615	14
Lack of the gene bank of medicinal plants in Guilan (D16)	1	3.33	7.69	3.846	0.987	0.692	-
Total	30	100.00	230.77	-	-	-	-

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Continued Table 5

Factors	Triangular fuzzy numbers (Second Round)			Shannon entropy (Second Round)			
	Importance Normalized Weight	Normalized Weight Rating	Prioritization 2	E_j	D_j	W_i	Prioritization 3
Lack of facilities and equipment for the harvesting and preparation of seeds (D12)	0.7846	0.0642	6.4212	5	0.616	0.384	0.045	1
Lack of organizational policy on development of medicinal plants products (D3)	0.8288	0.0678	6.7831	2	0.562	0.438	0.052	2
The increasing destruction of forests and pastures and destruction of various species of medicinal plants (D1)	0.8750	0.0716	7.1608	1	0.555	0.445	0.053	3
Lack of expertise for the seed production of medicinal plants (D6)	0.7962	0.0652	6.5156	4	0.513	0.487	0.058	4
Lack of laws prohibiting the harvesting of natural species in danger of extinction (D2)	0.8269	0.0677	6.7674	3	0.490	0.510	0.060	5
Lack of awareness from sale market and the demand-supply of medicinal plants seeds (D4)	0.7962	0.0652	6.5156	4	0.481	0.519	0.061	6
Lack of support from farmers for the production of medicinal plants (D5)	0.7962	0.0652	6.5156	4	0.481	0.519	0.061	6
Lack of sufficient information available to farmers for seed production of medicinal plants (D7)	0.7962	0.0652	6.5156	4	0.481	0.519	0.061	6
Control of livestock and wildlife to prevent the attack on the seed of medicinal plants (D9)	0.7654	0.0626	6.2638	6	0.482	0.518	0.061	6
Lack of encourage and promote ranging from public and private sectors for the seed production of medicinal plants (D10)	0.7654	0.0626	6.2638	6	0.482	0.518	0.061	6
Warehousing and inappropriate treatment and unscientific of medicinal plants seed (D13)	0.7154	0.0585	5.8546	8	0.442	0.558	0.066	7
Lack of the gene bank of medicinal plants in Guilan (D16)	0.6827	0.0559	5.5870	9	0.435	0.565	0.067	8
Lack of demand for buying seeds of medicinal plants (D14)	0.7154	0.0585	5.8546	8	0.420	0.580	0.069	9
Lack of refrigerator equipment and ultra-cold required for seed storage of medicinal plants (D15)	0.7173	0.0587	5.8703	7	0.402	0.598	0.071	10
Increased importing seed of medicinal plants and a lack of willingness to invest in seed production in the country (D11)	0.6788	0.0556	5.5556	10	0.365	0.635	0.075	11
High humidity and seasonal rainfall in the province to prevent the seed production of medicinal plants (D8)	0.6788	0.0556	5.5556	11	0.333	0.667	0.079	12

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Table 6

Comparison of Prioritization Methods for Deterrents Factors Affecting Seed Production of Medicinal Plants

Factors	VR	Triangular fuzzy	Shannon entropy	Mean
The increasing destruction of forests and pastures and destruction of various species of medicinal plants (D1)	1	1	3	1.67
Lack of organizational policy on development of medicinal plants products (D3)	3	2	2	2.33
Lack of laws prohibiting the harvesting of natural species in danger of extinction (D2)	2	3	5	3.33
Lack of expertise for the seed production of medicinal plants (D6)	5	4	4	4.33
Lack of awareness from sale market and the demand-supply of medicinal plants seeds (D4)	4	4	6	4.67
Lack of support from farmers for the production of medicinal plants (D5)	4	4	6	4.67
Lack of sufficient information available to farmers for seed production of medicinal plants (D7)	6	4	6	5.33
Lack of facilities and equipment for the harvesting and preparation of seeds (D12)	10	5	1	5.33
Control of livestock and wildlife to prevent the attack on the seed of medicinal plants (D9)	8	6	6	6.67
Lack of encourage and promote ranging from public and private sectors for the seed production of medicinal plants (D10)	8	6	6	6.67
Warehousing and inappropriate treatment and unscientific of medicinal plants seed (D13)	11	8	7	8.67
Lack of demand for buying seeds of medicinal plants (D14)	12	8	9	9.67
Lack of refrigerator equipment and ultra-cold required for seed storage of medicinal plants (D15)	13	7	10	10.00
Increased importing seed of medicinal plants and a lack of willingness to invest in seed production in the country (D11	9	10	11	10.00
High humidity and seasonal rainfall in the province to prevent the seed production of medicinal plants (D8)	7	11	12	10.00
Lack of the gene bank of medicinal plants in Guilan (D16)	14	9	8	10.33

Table 7

Kendall's W coefficient rate

Variable	Kendall's Wa	p-value
Promoter factors affecting the seed production	0.172[*]	0.027
Deterrents factors affecting the seed production	0.159[**]	0.009

**, * = significant at 5% and 1% levels respectively

p<0.01), it represents the agreement rate between the experts which removes the need to perform next Delphi stage (Table 7).

CONCLUSIONS AND RECOMMENDATIONS

Nowadays, medicinal plants due to the important role that community health are the attention focus of scientific, research and business centers. Iran is one of the few countries with a wide range of climates. Therefore, it is very diversity of vegetation and some native plant species, as well as Iran (endemic), which are grown exclusively in Iranian territory as a monopoly on the country's capacity is. Directing the massive capabilities and management problems in this area could also create jobs and self-sufficiency in the production of many products derived from these plants contributes significantly to the national economy. Meanwhile, seed production as one of the most important technical and economic issues involved in this area which should be managed as one of the priorities of the research, should be planned. Accordingly, this study sought to identify and prioritize promoter and deterrent factors affecting seed production of medicinal plants in Guilan province as one of the potential production of medicinal plants in the country. To achieve the research objectives and to achieve more precise answers, ranking study common techniques were compared. In the first stage of research, Multi-Response analysis, eleven as promoter factor affecting seed production and seed production as well as barriers to sixteen of medicinal plants established

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in Guilan Province. In the next round is to determine the priority of these factors, common techniques were compared ranked.

According to the results of common techniques of prioritization, factors of planning and special attention to seed of medicinal plants in the pharmaceutical industry (P5), preventing the indiscriminate harvesting of medicinal plants seeds of rare species and under threat in Guilan province (P6), enhance the quality and vigor of medicinal plants seed through proper storage and environmental conditions favorable (P7), implementation of appropriate cropping patterns for seed production of medicinal plants on the basis of scientific findings (P1) and access to suitable facilities getting seeds and seed storage of medicinal plants for planting season (P4) as the promoter affecting seed production of medicinal plants was in top priority. The important deterrents factors affecting seed production of medicinal plants were also include items such as The increasing destruction of forests and pastures and destruction of various species of medicinal plants (D1), lack of organizational policy on development of medicinal plants products (D3), lack of laws prohibiting the harvesting of natural species in danger of extinction (D2), lack of expertise for the seed production of medicinal plants (D6), lack of awareness from sale market and the demand-supply of medicinal plants seeds (D4) and lack of support from farmers for the production of medicinal plants (D5), respectively.

According findings of this study with regard to the appropriate warehousing as one of the most important factors affecting seed production of medicinal plants known, recommended the establishment of appropriate warehouses and the creation of a favorable the environmental conditions to improve the production of seed in the venture. In addition, the design and implementation of an active and comprehensive policy and legal regulatory system by relevant organizations helps to prevent improper harvesting seeds of rare and threatened species and will target the development of different species. Also suggested by the members of various committees, to take advantage of the benefits of research,

education, and information are necessary proper interaction between the Ministries of Agriculture Jihad, Health, and Medical Education, Research and Technology. In addition, executive institutions support for the design and construction of machinery, preparation, cultivation, and harvesting of medicinal plants and seeds.

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