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Farmers' viewpoint to alternative cropping in attempt to design an optimum cropping pattern

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Abstract— **the predicted climate changes and the reduction of the Sefidrud River inflow reflect the considerable decline of available water quantity and quality for rice production in Guilan Province, Iran. The coming crisis would incur irreparable losses and damages to the single-commodity economy of Guilan Province. Optimum cropping pattern is an approach that can play an effective, decisive role in the management of water crisis. This study explores farmers' mindsets about the impediments and challenges of alternative cropping for rice in Central District of Guilan Province. The statistical population was composed of 30 expert farmers in Astaneh-ye Ashrafiyeh County in Guilan Province, Iran, selected by purposive sampling technique. The research tool was a structured questionnaire whose criteria were derived from a review of library and Internet resources and interviews with faculty members in academic and research centers and executive experts. The questionnaire's reliability was estimated at 0.70 by Cronbach's alpha test. The results showed that the most important factors inhibiting the alternative cropping in farmers' opinions were the lack of the support by the government and farmers' unions from the guaranteed purchase of the alternative crops, the lack of appropriate sale market, and the lack of successful pioneering farms. In contrast, the factors pertaining to the lack of interest to alternative cropping, unawareness with the growing and production of alternative crops, and inappropriate local climate for alternative crop were given the lowest rank mean and were not recognized as the impediments of cropping pattern development. Thus, it seems that if the loss of water resources quality and quantity persists, we will need some managerial actions like the development of optimum cropping pattern, the governmental support including guaranteed purchase, the development of pioneering farms, and attention to processing industries to hinder socioeconomic issues like immigration and land use change from agricultural to horticultural and/or to building construction.**

Keywords-: cropping pattern, rice, sale market, water resources, alternative cropping

1. Introduction

Technology progress and extensive developments of the production systems including agriculture have radically shifted production systems from subsistence production to the production of nationally and internationally competitive commodities. However, in such countries as Iran, farmers still insist on growing crops with reliable, yet less profitable markets to avoid the price and market unreliability. One effective way to improve farmers' income is to explore and present an optimum cropping pattern given the relative and local advantages. By producing profitable commodities and relying on its own resources, the agricultural sector can free itself from the government and can increase its earnings enabling the inhibition of the loss of major agricultural resources

and inputs through investment on modern technologies. In this sense, one of the most vital global challenges of the present century is to manage water resources as the most crucial renewable, but limited, natural resource. Population growth, economic development, climate changes, and improper spatial and temporal distribution of precipitation have disrupted the sustainable socioeconomic growth and development and global food production and have destabilized the natural resources. Consuming 85% of global water, agriculture is the largest water user and plays a critical role in building a balance among competing water uses. In future decades, irrigated agriculture would be responsible for two-third of the growing supply of food for the global population. It is projected that the demand for agriculture water would be doubled by 2050 (Fallahi et al., 2013).

Optimum cropping pattern can be a decisive factor in water demand management. In a study on the cropping pattern in Golestan Province, Iran, Jafari and Amini (2008) stated that crop rotation as a key principle in agriculture has been forgotten due to higher price and unilateral support of the government from some strategic crops like wheat and rice. The lack of optimum use of machinery in various farming operations is another drawback of monocropping system because the rush for monocropping system requires a high mechanization capacity in a short time period. In regions where this capacity is supplied, the machinery would be rendered useless in other seasons. In other regions where the machinery is not fully supplied, their lack in some production phases reduces crop yields remarkably. Because of the instability and unsustainability of crop production, it is impossible to make plans for such issues as transportation and processing industries and the investments in these fields is not economical due to production fluctuations (Jafari and Amini, 2008). In a study on the need for revision in crop pattern, Mahjubi (2001) listed the reasons for this need as the changes in agriculture policy-making, economic value of crops, the amount of available water, farm management change, and agricultural technology and inputs development. The concept of cropping pattern refers to the selection of the crops to plant in a certain region given the climatic, ecological, social, political, and economic factors (Kohansal and Mohamadian, 2007). The development of an optimum cropping pattern is a complicated process affected by diverse factors like production and market risk, uncertainties of production factors, future climate changes, and the decrease in water resources so that the need for revision in cropping pattern is felt more than ever in all regions of Iran because an optimum pattern can influence decisions on investments at local level on, say, processing industries and export-oriented businesses. Broadly talking, local farmers design their cropping patterns on the basis of three factors: climate, economy, and production management (Lien and Flaten, 2005). The development of the cropping pattern by farmers themselves imposes an additional pressure on natural resources including water and soil and results in environmental problems. In addition, it may cause over-production or under-production. In either case, the market would be destabilized by lower or higher prices. So, it may entail very severe fluctuations in production and economy.

Cropping pattern is the most essential tool to draw farmers' path. It tells farmers what crop to grow in a certain region with its own features. The change in cropping pattern requires, in addition to such motives as subsidy, the determination of the obstacles against the development of the alternative crops as perceived by local farmers. Then, they should be placed in governmental policy-making agenda to be solved. Otherwise, it does not suffice for mitigating water resource loss to ban the production of rice in some provinces without introducing an alternative crop. Guilan Province possesses 237,965 ha paddy fields and produces about 1,042,000 ton paddy rice, contributing significantly to Iran's rice production (Amar et al., 2013).

One economic-agricultural challenge in Guilan Province is the monocropping system based on rice. Despite Guilan Organization of Agriculture's report pertaining to the fact that out of 238,000 ha of paddy farms, about 50,000 ha can be dedicated to the production of other crops than rice with no need for infrastructural operations, the local farmers in Guilan have not shown interest for the planting of other crops than rice yet. On the other hand, the Sefidrud river as the main source of water for irrigation and drainage network serving the paddy farms in this province is losing its water and it is projected that droughts and likely climate changes would remarkably reduce the quantity and quality of water available for rice production in coming years (Navabian et al., 2012; Khosravi et al., 2012; Pirmoradian et al., 2016). The predicted loss of water quantity and quality in Guilan Province, especially in central part including Astaneh-Kuchesfahan plain, would decelerate agriculture development and would incur irreparable damages and losses to the agriculture-based economics of the

province. Given the diversity of agricultural and horticultural products in Astaneh-ye Ashrafiyeh, this study explores the impediments and challenges of alternative crop development in this county from pioneering farmers' and experts' perspective. It focuses on providing the decision-makers with a more comprehensive vision to help them with planning for the agricultural sector. Also, it provides a scientific basis for planning in this sector and mitigating the pressure on human, water and soil resources.

2. Materials and Methods

Astaneh-ye Ashrafiyeh (49°46'-59°11' E., 37°11'-37°28' N.) has an area of 423 km2 and is composed of two districts (Kiashahr and Central), two cities (Kiashahr and Astaneh-ye Ashrafiyeh), and six rural districts (Dahka, Kiashahr, Chahardah, Dehshal, Kurka, and Kisom) in the east of Guilan (Anonymous, 2014) (Figure 1).

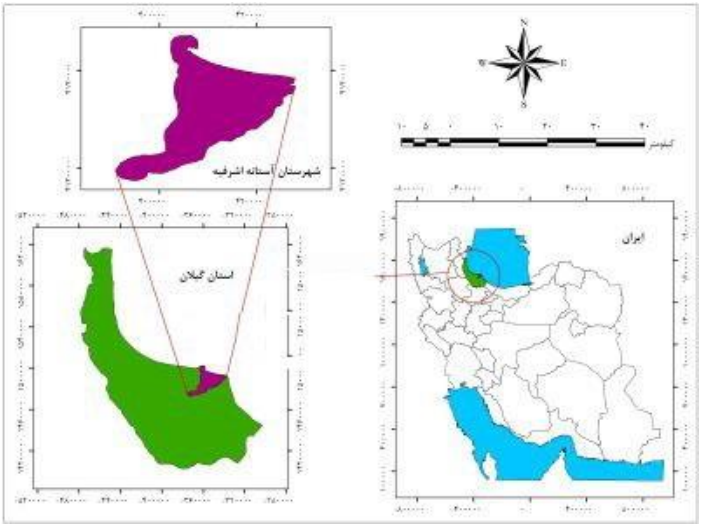

Figure 1- Introduction of the study area

This is an applied study in terms of type and nature and a descriptive-analytical study in terms of methodology. It was conducted as a structured questionnaire-based survey. The statistical population was composed of all pioneering farmers and experts in Astaneh-ye Ashrafieh and nine villages, of which 30 participants were selected by purposive method on the basis of the experts' experience in Extension Office. Then, they were interviewed. The main research tool was a questionnaire whose content validity was confirmed by a panel of five academic professors and executive experts and its construct validity was confirmed by Bartlett's test at the 0.05 significance level. Also, its reliability was estimated at greater than 0.7 by Cronbach's alpha. The farmers' attitudes towards alternative crop impediments and challenges were ranked by nine items at five-point Likert scale including completely disagree, disagree, neutral, agree, and completely agree which were scored 1-5, respectively and were considered to have 3 as their average. The farmers were requested to express the extent of their agreement/disagreement with each item. Also, the normality of the distribution of the research variables (questionnaire items) was examined by Shapiro-Wilk test. It was revealed that the nine items were non-normal at the 5% significance level ($p < 0.05$) (Table 1). Accordingly, the variables (impediments) were ranked by Friedman's nonparametric test.

Table 1. The examination of the normality of distribution of the main variables

Variable	Test statistic	Probability level	Test result
The local sale market is not appropriate for these crops.	0.769	0.0001	N*
I am not aware of how to grow and produce these crops.	0.84	0.0001	N*
I am not interested in the production of new crops.	0.858	0.001	N*
The conditions of the farm are no appropriate for the production of these crops.	0.843	0.0001	N*
The local climate is not appropriate for the production of these crops.	0.823	0.0001	N*
I do not have enough capital and machinery for the production of these crops.	0.823	0.0001	N*
Given the small size of the land, I cannot compete in the market.	0.885	0.004	N*
The production and sale of these corps need governmental support.	0.637	0.0001	N*
The alternative crops should be produced in pioneering farms under the governmental management.	0.634	0.0001	N*

* Non-normal

Results

3.1 Respondents' characteristics

Participants' demographic information showed that 73.3% were male and 26.7% were female. Also, 36.7% had academic education, 40% had diploma, and 23.3% had intermediate school degree. Participants' mean age and experience was 45.93 and 23.63 years, respectively. On average, 3.87 people were dependent on each farmer (Table 2). As data in Table 3 indicate, 53.3% of participants were selected from Central district and 46.6% from Kiashahr district. The review of water resources used for agriculture and their status showed that 70% of farmers reported river as their water resource and 46.7% believe that local water is in moderate status (Table 4).

Table 2. Frequency distribution of respondents in terms of personal characteristics

Characteristic		Frequency	Percentage	Mean	SD	Min.	Max.
Gender	Male	22	73.3				
	Female	8	26.7				
Number Of Dependent People				3.87	1.17	2	6
Age	25-35	7	23.3	45.93	11.91	25	68
	36-45	10	33.3				
	46 and older	13	43.3				
Work experience	10 years	5	16.7	23.63	11.34	5	50
	10-20 years	8	26.7				
	20 years or higher	17	56.7				
Education	Intermediate school	7	23.3				
	Diploma	12	40				
	Associate degree	2	6.7				
	Bachelor's degree	7	23.3				
	Master's degree	2	6.7				

Table 3. Frequency distribution of respondents in terms of residence village

Village	District	Frequency	Percentage
Amir Kiasar	Kiashahr	1	3.3
Dehsar	Kiashahr	4	13.3
Dahka	Kiashahr	8	26.7
Sofra Basteh	Kiashahr	1	3.3
Total		14	46.6
Dehshal	Central	4	13.3
Kisom	Central	3	10
Chahardah	Central	2	6.7
Keshel Azad Sara	Central	2	6.7
Tamchal	Central	5	16.7
Total		16	53.4

Table 4. Frequency distribution of respondents of the resource and status of water used for agriculture

Variable	Levels	Frequency	Percentage
Water resource	River	21	70
	Channel	5	16.7
	River and channel	4	13.3
Water status	Good	7	23.3
	Moderate	14	46.7
	Weak	9	30

3.2 *Respondents' opinions about impediments and challenges of alternative cropping development*

The frequency distribution of participants' replies on the basis of Likert's five-point scale is summarized in Table 5. Accordingly, 66.7% of respondents believe that the development of alternative cropping requires governmental support, 46.7% expressed their full agreement with the lack of sale market for the alternative crops, and 40% expressed their disagreement with the unfamiliarity with alternative crop production, the lack of interest for their production, and inappropriateness of farms for the development of the alternative cropping. As well, 66.7% of respondents agreed with the lack of adequate capital and machinery for alternative cropping development. Also, to 50% of respondents, the small size of farm lots was a serious obstacle against alternative cropping development. Ninety percent of respondents expressed their agreement with the government commencing the development of alternative cropping in pioneering farms.

Table 5. Frequency distribution of respondents in terms of impediments and challenges of alternative cropping development

Items	Completely disagree		Disagree		Neutral		Agree		Completely agree	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
The local sale market is not appropriate for these crops.	3	10	3	10	2	6.7	8	26.7	14	46.7
I am not aware of how to grow and produce these crops.	9	30	12	40	3	10	4	13.3	2	6.7
I am not interested in the production of new crops.	9	30	12	40	5	16.7	3	10	1	3.3
The conditions of the farm are no appropriate for the production of these crops.	2	6.7	12	40	2	6.7	7	23.3	7	23.3
The local climate is not appropriate for the production of these crops.	4	13.3	14	46.7	1	3.3	10	33.3	1	3.3
I do not have enough capital and machinery for the production of these crops.	0	0	7	23.3	3	10	11	36.7	9	30
Given the small size of the land, I cannot compete in the market.	0	0	5	16.7	10	33.3	5	33.3	5	16.7
The production and sale of these corps need governmental support.	0	0	1	3.3	1	3.3	8	26.7	20	66.7
The alternative crops should be produced in pioneering farms under the governmental management.	1	3.3	1	3.3	1	3.3	8	26.7	19	63.3

3.3 Respondents' opinions about factors underpinning alternative cropping development

In this section, the number of responses of ≤3 was compared with the number of the responses of >3 for the scores devoted to each component and the significance of the difference of the ratio of the scores >3 was determined at the 1% probability level by ratio (binominal) test. The results are presented in Table 6. Accordingly, the items pertaining to the governmental support of the production and sale of alternative crops for rice and to the production of alternative crops in pioneering farms under the governmental management were found to be the most effective factors with the amount ratios of 93 and 90%, respectively. In contrast, the items pertaining to the lack of interest to grow new crops and to unawareness of how to grow alternative crops were found to be the least effective factors with the amount ratios of 13 and 20%, respectively.

Table 6. The impact of the variables on the development of alternative cropping from the viewpoint of pioneering and expert farmers

Items	Number of scores		Ratio of scores		Probability level
	≤3	>3	≤3	>3	
The local sale market is not appropriate for these crops.	8	22	0.27	0.73	0.016*
I am not aware of how to grow and produce these crops.	24	6	0.8	0.2	0.001**
I am not interested in the production of new crops.	26	4	0.87	0.13	0.0001**
The conditions of the farm are no appropriate for the production of these crops.	16	14	0.53	0.47	0.856
The local climate is not appropriate for the production of these crops.	19	11	0.63	0.37	0.200
I do not have enough capital 15and machinery for the production of these crops.	10	20	0.33	0.67	0.099
Given the small size of the land, I cannot compete in the market.	15	15	0.5	0.5	1.000
The production and sale of these corps need governmental support.	2	28	0.07	0.93	0.0001**
The alternative crops should be produced in pioneering farms under the governmental management.	3	27	0.1	0.9	0.0001**

3.4 Prioritization of factors underpinning alternative cropping development from pioneering farmers' and experts' perspective

In this section, we used Friedman test of variance analysis. It revealed that the null hypothesis of indifferent ranking of items by respondents was rejected and it can be said by certainty that the variables had significantly different ranking in different respondents' opinions (Table 7). In other words, the extent of the impact of each factor differs on the development of alternative cropping and some variables are more important in this respect than others. Table 8 shows mean rank and prioritization of variables influencing the development of alternative crop for rice or alternative cropping.

Table 7. Friedman's variance analysis test

Hypothesis	Sig. level	E2	Test result
Rank mean of items is equal.	0.0001	116.9	Rejected

Table 8. Prioritization of factors influencing the development of alternative cropping from pioneering, expert farmers' viewpoint

Items	Mean rank	Prioritization
The local sale market is not appropriate for these crops.	7.4	1
I am not aware of how to grow and produce these crops.	7.23	2
I am not interested in the production of new crops.	5.83	3
The conditions of the farm are no appropriate for the production of these crops.	5.55	4
The local climate is not appropriate for the production of these crops.	4.98	5
I do not have enough capital 15and machinery for the production of these crops.	4.63	6
Given the small size of the land, I cannot compete in the market.	3.82	7
The production and sale of these corps need governmental support.	2.87	8
The alternative crops should be produced in pioneering farms under the governmental management.	2.68	9

4 Conclusion

As the results of the research showed, farmers believe that there are diverse obstacles against the development of alternative cropping for rice. Examples include the lack of the support by the government and farmers' unions of the guaranteed purchase of alternative crops, the lack of proper sale market, and the lack of successful pioneering farms in the region. According to the results, it is recommended to use such approaches as the guaranteed purchase by the government, the establishment of pioneering farms, the supply of financial and credit facilities with low interest rate, the development of local markets for the supply of the alternative crops, the strengthening of rural economy competitiveness, the creation of processing and packaging industries in rural areas, and the development of the marketing programs.

References

[1] Amar, T, Ghorashi Minabad M.B. and Bagheri Kodakani, S.2013 .Evaluation Of Factors Affecting the Development of Second Cultivation in the Shaft Township. Journal of Geographical Landscape. 8(23): 89-102.

[2] Anonymous. 2014. Calendar 2014 Gilan Province. Available From: Http://Mpogl.Ir. (In Persian with English Abstract).

[3] Fallahi E, Khalilian S., and Ahmadian, M. 2013. Optimizing the Cropping Pattern with an Emphasis on Limited Water Resources Case Study: Plain, Farouq Sydan- City Shiraz. Research of Agricultural Economics. 5(2): 91-115.

[4] Khosravi, M., Zahraei, A., Heydari, H. And Sarah Bani Naimeh, S. 2012. Determination of the Drought Regions of Gilan Using Rainfall Anomaly Index. Geography and Environmental Hazards.1 (3): 1-20. (In Persian with English Abstract).

[5] Kohansal, M.R., and Mohamadian, F.2007. Application of Goal Programming Phase to Determine Optimum Cropping Pattern. Journal of Agricultural Economics .1(2): 1-11

[6] Lien, G. and O. Flaten 2005, Comparison Of Risk Between Cropping Systems In Eastern Norway, 17th Congress Of The EAAE.

[7] Mahjubi, H. 2001. Necessity of Crop Pattern Revision in Irrigation Systems for Increasing Water Efficiency and Worth (Case Study In Moghan Irrigation & Drainage System) Eleventh National Committee On Irrigation And Drainage Seminar .Tehran.

[8] Navabian, M., and Aghajani, M. 2012. Evaluating the Effect of Fresh and Saline Water Irrigation Management on Hashemi Rice Yield. Journal of Water and Soil Science. Journal of Science and Technology of Agriculture and Natural Resources. 16(60):45-54. (In Farsi)

[9] Pirmoradian, A., Hadynya, H., and Ashrafzadeh, A. 2016. Prediction of Minimum and Maximum Temperature, Radiation and Precipitation in Rasht Synoptic Station Under Different Climate Change Scenarios. Journal of Geography and Planning. 20(55):29-44. (In Persian with English Abstract).