Analysis of Sustainable Water Resources Management (SWRM) in Agriculture

Ahmad Reza Ommani
Assistant Professor Islamic Azad University Shoushtar Branch, Iran
Mohammad Chizari
Professor Tarbiat Modares University, Tehran, Iran

Abstract

The purpose of this research was analysis Sustainable Water Resources Management (SWRM) in agriculture of Khouzestan Province of Iran. The research method was quantitative research. Total population of experts in the study included all agricultural extension experts (N=96) of Agricultural-Jihad Organization of Khuzestan Province, Iran.

Based on frequency of respondents about importance rate of supportive policies regarding SWRM in agriculture, 70.8% of respondents stated that encouraging farmers for using sustainable methods had very high importance. In reference to the frequency of respondents about extension system roles on realization of SWRM dimensions in agriculture, 52.8% of respondents stated conservation of water resources had very high importance for supporting SWRM in agriculture.

Keywords: Sustainable Water Resources Management (SWRM), Extension Experts, Farmers

Introduction

Sustainable agriculture practices have tended to reduce the use of fertilizer, pesticides and maximal tillage worldwide (Chizari, Ommani & Noorivandi, 2006). Sustainable resource management is related to practices which local human populations use resource in sustainable manner (FAO, 1990; Chizari, Ommani & Noorivandi, 2006). Agricultural productivity reduces when ecosystems are changed and water resource decreased (Chen, 2005).

The success of sustainable agriculture depends on the motivation, skills, and knowledge of farmers (Ommani, 2001). Extension programs have vital roles in this content. Extension can demonstrate the feasibility of sustainable practices. Consequently, sustainability is the successful management of resource to satisfy the challenging human needs, while maintaining or enhancing the quality of environment and conserving natural resource.

In Iran, many researches have done about water management in the agro-business sector. They have looked at the problems and suggested possible solutions to improve the situation. Most of these researchers have tried to integrate certain facets of water management in the agricultural field (e.g. Keshavarz, Heydari & Ashrafi, 2003; Sepaskhah & Fooladmand, 2003; Tavakoli & Ahmadnejad, 2003; Arasteh, Shokohi & Saghafian, 2003; Ommani & Noorivandi, 2003; Khatoonabadi, 2003; Najafi, 2006; Aghaee et al, 2003; Chizari, Ommani & Noorivandi, 2006). Based on the above consideration, one of the major objectives of environmental, social and economical programs of Iran has been to identify ways such as supportive policies and dimensions of sustainable water resources management in agriculture and appropriate characteristics of agents and target groups of extension system.

Iran is located in arid and semiarid areas of the world. The average precipitation is 250 mm that is less than one-third of the world average precipitation. Also, the evaporation in Iran is more than the world average (between 1500 to 200 mm) and about 72% of total rainfall directly evaporates (Ommani and Noorivandi, 2003 and Najafi, 2006). Therewith, spatial variation precipitation of the country is varied. Approximately, 50% of precipitation is raining at 24% of area of country and other 50% is raining at 76% of the country (Najafi, 2006).

Province of Khuzestan is located in the Southwest of the country, bordering Iraq and the Persian Gulf. Its capital is Ahwaz and it covers an area of 63,238 km^2. Khuzestan is the most ancient Iranian province and is often referred to in Iran as the "birthplace of the nation"(Ommani, 2001). The variety of agricultural products such as wheat, barley, oily seeds, rice, eucalyptus, medical herbs; the existence of many palm and citrus farms; having mountains suitable for raising olives, and of course sugar cane - from which Khuzestan takes its name - all show the great potential of this fertile plain (Chizari, Ommani & Noorivandi , 2006).

In recent years, Khuzestan Province encountered shortage of water resource. Water resources management in agriculture and increasing the water use efficiency in Khuzestan province has a vital role for conservation of water resource (Organization of Agricultural-Jihad of Khuzestan, 2004).

Therefore, focus on efficient use of water through irrigation efficiency and improvements in management of water use will be the major challenges in the coming years. Recent events of drought in the country have resulted in the reduction of water

productivity in farming (Organization of Agricultural-Jihad of Khuzestan, 2004). Sustainable water resources management in agriculture and increasing the water use efficiency in Khuzestan Province has a vital role in conservation of water resources.

Research Questions

The three main research questions are:

What are the supportive policies and dimensions of sustainable water resources management in agriculture?

What are the new challenges regarding sustainable water resources management in agriculture?

What is the level of using SWRM in Khouzestan province of Iran?

Basic challenges

Environmental pollution and destruction of natural resource is one of the serious problems faced by the people in Iran. Rapid population growth, industrialization and urbanization in country have been adversely affecting the environment. Though the relationship is complex, population size and growth tend to expand and accelerate negative impacts on the environment (Razavi, 2001). All these in turn lead to increase in the pollution levels. However, environmental pollution not only leads to deteriorating environmental conditions but also has adverse effects on the health of people.

Population Growth and Natural Resource Depletion

Expand of Farm Lands and Its Effect on Destruction of Environment

Impact of Agriculture on Soil Degradation and Erosion

Impact of Agriculture on Water Resource Pollution

Opportunities for Improving

In Iran, like other developing countries, agriculture is one of the most important economic sectors and includes a high percentage of production and employment (Keshavarz, Heydari and Ashrafi, 2003). Sustainable water resources management (SWRM) is one of the major objectives of the Agricultural Development Programs of Iran (Keshavarz, Heydari and Ashrafi, 2003; Ommani and Noorivandi, 2003). Karami, Rezaei-Moghadam and Ebrahimi (2006) have marked period of 1980-present of Iran by an increasing awareness and concern for environmental problems caused by agricultural practices, in fact, period of crisis in development theory. Some of the approaches suggested for access to on-farm SWRM at period of crisis, as elaborated below.

Special attention to the integrated use of water and other agricultural inputs (e.g. fertilizer, pesticides, etc.) and their impact on environment (Keshavarz, Heydari and Ashrafi, 2003), allocation of water to the farm based on crop water requirement, appropriate farm size to improve irrigation efficiency, usage pressurized irrigation systems to substitute for surface irrigation methods, reduction of evaporation losses from soil surface(Hasheminia, 2004), using methods for storage and conservation of rain water, cultivation of crop varieties with short length of growth period (Keshavarz, Heydari and Ashrafi, 2003).

Methodology

A major form of nonexperimental quantitative research that has been used in this research was correlation study.

Total population of experts are include total agricultural extension experts (N1=96) of Agricultural-Jihad organization of Khuzestan province. Return rate were determined as 92.71% (N1=89).

For examine reliability evidence of questionnaire of farmers and experts, 30 copies of each questionnaire distributed among Esfahan experts. For examine reliability evidence used Cronbach Alpha (Table 1).

Agricultural Extension Experts' Demographic Profile

The first section was to describe agricultural extension experts**'** demographic profile in Khuzestan Province of Iran. Approximately, 38.2% of respondents were between 20 to 30 years of age and 41.6% of them between 31 to 40 years of age (Table 2). The majority of respondents (52%) reported work experience, in extension organizations between 1 to 10 years and the vast majority of them were male (84.27%).

In reference to the frequency of respondents' regarding contact with the research centers, 7.9% of experts stated that they have often having direct contact with the research centers. About 86.5 % of experts had a bachelor degree level of education.

Supportive Policies Regarding SWRM in Agriculture

The importance of conserving and protecting water resources has become an important part of resource management in rural areas. Sustainable water management is recognized in international agreements, and a variety of strategies and programs in all levels of government (Anonymous, 2005).

Agricultural extension experts were asked to mention importance rate of different supportive policies regarding SWRM in agriculture by 5-point scale (1=very low, 2=low, 3=moderate, 4=high, 5=very high). Ranking indicated that the three most important supportive policies regarding SWRM in agriculture were: (1) encouraging farmers for using sustainable methods, (2) increasing knowledge of farmers regarding SWRM, (3) dissemination of organic farming (Table 3).

Based on frequency of respondents about importance rate of supportive policies regarding SWRM in agriculture, 70.8% of respondents stated that the considering encouraging farmers for using sustainable methods had very high importance.

Role of Extension System on Realization of SWRM Dimensions in Agriculture

In the present study the agricultural extension experts were also questioned about the importance rate of extension system roles on realization of SWRM dimensions in agriculture by 5-point scale (1=very low, 2=low, 3=moderate, 4=high, 5=very high). As Table 4 indicates, the four most important extension system roles according to the agricultural extension experts were: (1) conservation of water resources, (2) dissemination of new irrigation, (3) reduce salinization, and (4) reduce chemical material in agriculture.

In reference to the frequency of respondents about extension system roles on realization of SWRM dimensions in agriculture, for example 52.8% of respondents stated

that the conservation of water resources role had very high importance for supporting SWRM in agriculture and 38.2% of them stated that this item had high importance (Table 4).

New Challenges Regarding SWRM in Agriculture

In the present study the agricultural extension experts were also questioned about the importance rate of new challenges regarding SWRM in agriculture by 5-point scale (1=very low, 2=low, 3=moderate, 4=high, 5=very high). As Table 4.13 indicates, the four most important challenges regarding SWRM in agriculture according to the agricultural extension experts were: (1) Systemic thinking, (2) Participatory approaches, (3) Information and communication technology, and (4) Biotechnology and genetic engineering.

In reference to the frequency of respondents about new challenges regarding SWRM in agriculture, for example 64% of respondents stated that the Systemic thinking had high importance for SWRM in agriculture and 5.6% of them stated that this item had very high importance (Table 5).

Recommendation

In-service training programs play a critical role in reinforcing staff capability, as well as renewing their skills. The organizations and institutes which are responsible for in-service training both for agricultural experts must consider training needs of them.

The results of this study were identified important supportive policies regarding SWRM in agriculture. Agricultural extension organizations in provincial and national levels can benefit from these proposed policies. The most important supportive policies regarding SWRM in agriculture were: encouraging farmers for using sustainable methods, considering financial credit for SWRM in agriculture, increasing knowledge of farmers regarding SWRM, dissemination of organic farming and limitations in pesticide using.

In sum, it could be said that agricultural extension, as a whole, aims at improving the competencies (knowledge, skills and perceptions) of farmers in order to improve their career performance. Therefore, the researchers suggested that adjustable and flexible extension and research programs would improve the understanding of complex farming system and effectiveness of relevant activities.

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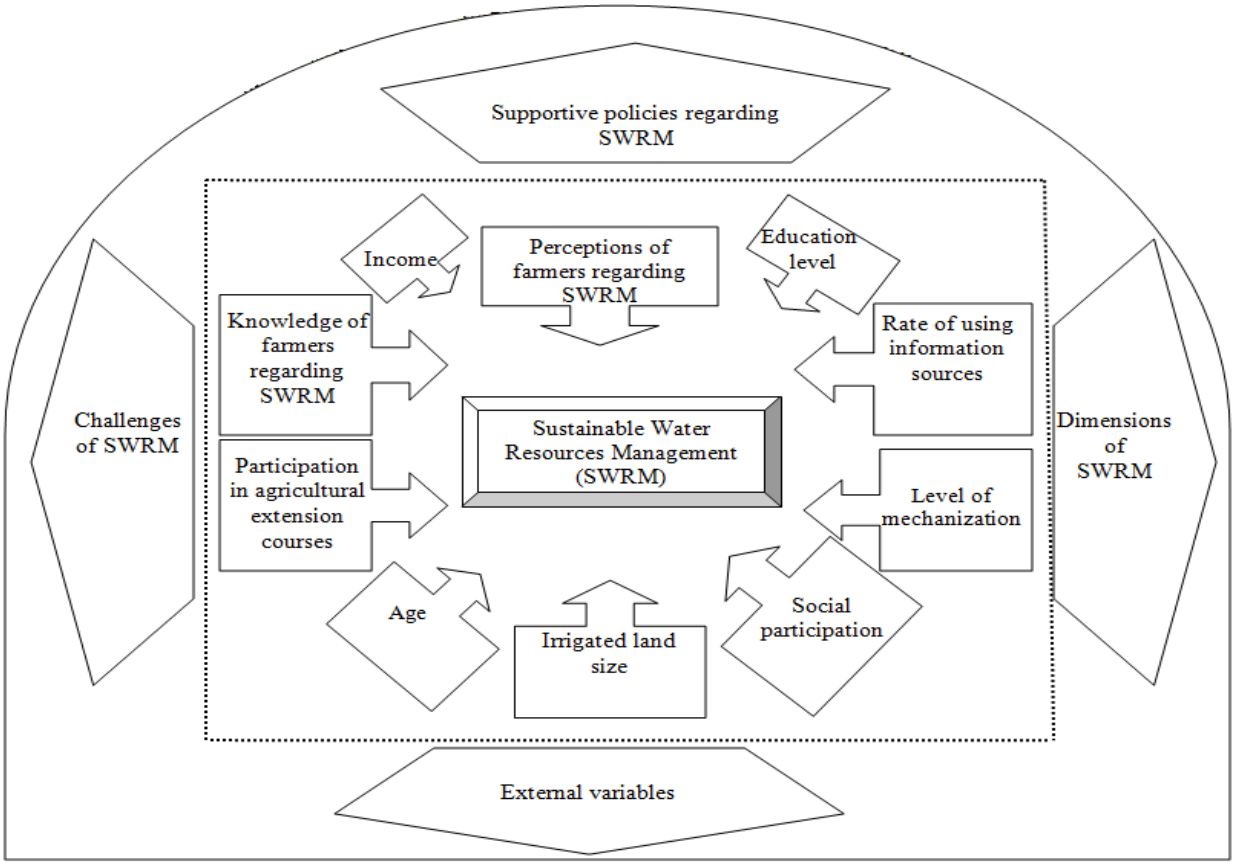

Figure 1. Theoretical framework of Research

Table 1 . Cronbach Alpha for each part of experts' questionnaire.

Variable	Cronbach Alpha
Perceptions regarding SWRM	0.915
Supportive policies regarding SWRM	0.811
Dimensions of SWRM	0.838
Resources of SWRM	0.888
New challenges regarding SWRM	0.828

Table 2. Agricultural extension experts' demographic profile

Variables	f	%	Cum %
Age (years)			
20 to 30	34	38.2	38.2
31 to 40	37	41.6	79.8
41 to 50	14	15.7	95.5
50<	4	4.5	100
Total	89	100	
Level of Education			
Bachelor of Science	77	86.5	86.5
Master of Science	11	12.4	98.9
Doctorate	1	1.1	100
Total	89	100	
Gender			
Male	75	84.3	84.3
Female	14	15.7	100
Total	89	100	
Work Experience (years)			
5 or less	23	25.8	25.8
6 to 10	20	22.5	48.3
11 to 15	18	20.2	68.5
16 to 20	16	18.0	86.5
21 or more	12	13.5	100
Total	89	100	

Table 3. Importance of supportive policies regarding SWRM in agriculture

Supportive policies	Very Low		Low		Average		High		Very High		Mean	SD*	CV**	Rank
	f	%	*f*	%	*f*	%	*f*	%	*f*	%				
Encouraging farmers for using sustainable methods	----	----	----	----	----	----	26	29.2	63	70.8	4.707	0.457	0.097	1
Increasing knowledge of farmers regarding SWRM	----	----	----	----	7	7.9	29	32.6	53	59.6	4.516	0.641	0.141	2
Dissemination of organic farming	----	----	----	----	15	16.9	50	56.2	24	27	4.101	0.657	0.160	3
Considering financial credit for SWRM	----	----	----	----	14	15.7	15	16.9	60	67.4	4.516	0.755	0.167	4
Development of local groups	----	----	----	----	15	16.9	24	27	50	56.2	4.393	0.763	0.173	5
Considering participatory technology development	----	----	----	----	22	24.7	35	39.3	32	36	4.112	0.775	0.188	6
Investigation on biotechnology and genetic engineering	----	----	8	9	34	38.2	34	38.2	13	14.6	3.584	0.850	0.237	7
Legal limitation l in pesticide using	----	----	18	20.2	17	19.1	35	39.3	19	21.3	3.618	1.039	0.289	8

Scale: 1=very low, 2=low, 3=moderate, 4=high, 5=very high * Standard Deviation ** Coefficient of Variation

Table 4. Importance of extension system roles on realization of SWRM dimensions in agriculture

Dimensions	Very Low		Low		Average		High		Very High		Mean	SD*	CV**	Rank
	f	%	*f*	%	*f*	%	*f*	%	*f*	%				
Conservation of water resources	----	----	----	----	8	9	34	38.2	47	52.8	4.438	0.656	0.147	1
Dissemination of new irrigation	----	----	----	----	14	15.7	45	50.6	30	33.7	4.179	0.683	0.163	2
Reduce salinization	----	----	----	----	14	15.7	41	46.1	34	38.2	4.224	0.703	0.166	3
Reduce chemical material in agriculture	----	----	----	----	15	16.9	23	25.8	51	57.3	4.404	0.764	0.173	4
Increasing efficiency and productivity	----	----	----	----	15	16.9	26	29.2	48	53.9	4.370	0.759	0.174	5
Social and economic equality	----	----	7	7.9	15	16.9	40	44.9	27	30.3	3.977	0.891	0.224	6
Development of organic farming	----	----	6	6.7	36	40	27	30.3	20	22.5	3.674	0.914	0.248	7
Dissemination of food security dimensions	----	----	7	7.9	27	30.3	22	24.7	33	37.1	3.910	0.995	0.254	8
Improvement long-term economic situation	----	----	14	15.7	13	14.6	39	43.8	23	25.5	3.797	1.002	0.263	9

Scale: 1=very low, 2=low, 3=moderate, 4=high, 5=very high * Standard Deviation ** Coefficient of Variation

Table 5. Importance of new challenges regarding SWRM in agriculture

Challenges	Very Low		Low		Average		High		Very High		Mean	SD*	CV**	Rank
	f	%	*f*	%	*f*	%	*f*	%	*f*	%				
Systemic thinking	----	----	7	7.9	20	22.5	57	64	5	5.6	3.674	0.703	0.192	1
Participatory approaches	----	----	7	7.9	1	1.1	23	25.8	58	65.2	4.483	0.867	0.193	2
Information and communication technology	----	----	----	----	31	34.8	32	36	26	29.2	3.943	0.802	0.203	3
Biotechnology and genetic engineering	----	----	7	7.9	11	12.4	49	55.1	22	24.7	3.966	0.831	0.209	4
Privatization	6	6.7	26	29.2	14	15.7	16	18	27	30.3	3.348	1.374	0.402	5
Globalization	13	14.6	19	21.3	18	20.2	4	4.5	35	39.3	3.325	1.528	0.459	6