American-Eurasian J. Agric. & Environ. Sci., 3 (2): 233-240, 2008
ISSN 1818-6769

Attitudes of Nahavand Township, Iran Wheat Farmers Toward On-Farm Water Management (OFWM)

Mohammad Chizari and Omid Noroozi

Department of Agricultural Extension and Education,
College of Agriculture, Tarbiat Modares University, Tehran, Iran

Abstract: The purpose of this study was to examine the attitudes of wheat farmers regarding OFWM in Nahavand Township, Iran. A descriptive-correlation design was used and data collected by means of questionnaire and interview with wheat farmers (N=15365) in the Nahavand township as the target population. The sample was obtained through proportional stratified sampling (n=375). Instrument validity was established by a panel of experts and reliability analysis yielded with an alpha value of 0.84. Study results showed that the attitudes of a majority of the respondents toward On-Farm Water Management were in the "relatively negative" range. Certain independent variables (respondents' personal, farming, economic and social characteristics) were associated linked with their attitudes toward OFWM. Stepwise regression revealed that 71% ($R^2 = 0.710$) of the variance in respondents' attitudes could be explained by yield per hectare, knowledge about OFWM, their contact with information sources, and their age.

Key words: Attitudes · On-Farm Water Management (OFWM) · Wheat Farmers · Nahavand Township

INTRODUCTION

Experimental evidence indicates that the continuous increase in the earth's population increases demand for water. The agricultural sector is the largest user of water resources despite social pressures to reduce agricultural water consumption [1]. Most of the past studies show that water shortage is a serious problem threatening long-term agricultural development. Farmers often face deficiencies in water delivery, resulting in reduced yields and incomes [2]. Water is becoming the limiting factor for development in many parts of the world [3]. Furthermore, poor management of available water for irrigation has led to a range of problems, further aggravating water availability and reducing the benefits of investments in irrigation. There is therefore, a need to maximize the efficiency of on-farm water use application. Increasing the productivity of water in agriculture will play a vital role in easing competition for scarce water resources, preventing environmental degradation and ensuring food security [4-6]. Irrigated agriculture has been an extremely important source of food production over recent decades; the yields that can be obtained from irrigation are more than double the yields possible from rainfed agriculture. Even low-input irrigation is more productive than high-input rainfed agriculture [7].

It is essential to meet the food and fiber needs of an ever increasing world population. Enhancing production of cereals, particularly wheat, is therefore strategically important to ensure food self sufficiency. In 1999 world wheat production was 588 million tons, the total area planted to wheat was 224 million ha, and the average wheat yield was 2,624 kg ha^{-1} [8]. The improvement and development of water-conserving agricultural practices is essential to effective water use and increase productivity [9-11].

Changing knowledge and skills of target audiences and bringing attitudinal change are emphasized in agricultural development planning. Attitude, as an intrinsic concept, is difficult to measure quantitatively and descriptive information may not be enough to convince program stakeholders, particularly planners [12]. Methods to measure attitude have included item score - total score method, Cronbach's alpha, inter-item correlation matrix, intra-class correlation, and two dimensional scaling techniques. Each of these methods has been helpful to examine the different items used to estimate attitude [13].

Corresponding Author: Dr. Mohammad Chizari, Department of Agricultural Extension and Education, College of Agriculture, Tarbiat Modares University, Tehran, Iran

The traditional management practices of irrigation supply and conveyance systems often contribute to high water losses. Many farmers generally lack technical and economic information on improved on-farm water management (OFWM) methods and techniques and on the related aspects of more productive cropping patterns and crop management. Therefore, proper training and capacity building at all levels of OFWM would be useful [4]. OFWM practices are concerned with how tools and resources are used to provide water for plant growth. They also include improving site conditions and protecting crops and farming property against flooding [5,6]. Therefore, OFWM can be defined as the manipulation of water within the borders of an individual farm, a farm plot, or a field. For example, in canal irrigation systems, OFWM starts at the farm gate and ends at the disposal point of the drainage water to a public watercourse, open drain or sink. OFWM generally seeks to optimize soil-water-plant relationships to achieve targeted yields [4].

Iran is concerned with the yield stability of wheat because wheat is the main source of food for the population [14]. Iran is a water-scarce country, with a mean annual precipitation of 250 mm (30 % of global mean). Drought is a recurring phenomenon and OFWM practices play a key role in increasing agricultural production. Maximizing water use efficiency through promotion of OFWM practices can help the country attain this goal.

Purpose and Objectives: The main purpose of this study was to examine the attitude of wheat farmers regarding OFWM in Nahavand Township, Iran. The specific objectives were:

1. To determine professional and demographic characteristics of wheat farmers;
2. To determine knowledge and attitudes of wheat farmers regarding OFWM;
3. To determine the relationships between selected independent variables and wheat farmers' attitudes toward OFWM;
4. To determine how much of the variance in wheat farmers' attitudes toward OFWM is explained by the independent variables of the study.

MATERIALS AND METHODS

Population and Sample: Wheat farmers (N=15,365) in the Nahavand Township of Iran were the target population for this study. The population frame was obtained from the Nahavand agricultural organization. Sample size and sampling method were determined and supported by the studies of Krejcie and Morgan [15]. The sample was obtained through proportional stratified sampling (n=375) and the Ministry of Agriculture's Extension Organization Directory was used to locate wheat farmers.

Description of the Study Region: Nahavand Township is one of the largest townships of Hamadn Province in western Iran, and produces many agricultural crops such as wheat, rye, barley, potato, tomato, corn, and a variety of fruits. It has 85,000 hectares of arable land. The township has a population of 184,160 of which 80,152 live in rural areas. With respect to climate, winters are temperate with moderate rainfall and summers are mild with very low rainfall. At the lower elevations, the temperature rises to 35°C in the summer. Because the elevation decreases from north to south, higher temperatures are found in the south. The average annual rainfall is between 370 and 480 mm.

Variables and Instrumentation: From a review of literature, the researchers developed an instrument to collect data. The study used a descriptive-correlation design and was carried out using a survey methodology; both questionnaires and interviews were used. The survey instruments and interview schedules were divided into three sections. The first section included personal, farming, economic and social characteristics of wheat farmers. The second section focused on wheat farmers' knowledge of OFWM and the third section on wheat farmers' attitudes toward to OFWM. It should be mentioned that in this study, On-Farm Water Management (OFWM) refers to all agricultural water control techniques, technologies and related economic, social, and farming activities under the direct control and responsibility of farmers.

A brief discussion of some of the variables used in this study follows: Respondent's Economic Status: Respondents' economic status was measured by assessing levels of farm size, number of livestock, irrigated farm land, irrigated wheat area, and wheat yield per hectare.

Respondent's Social Status: Respondent's Social Status was categorized using a five-point Likert-type scale: 1=very low, 2= low, 3=medium, 4= high and 5=very high. The range in responses to two questions for this section was 2–10.

Respondent's Social Participation: *Respondent's* level of social participation was categorized using a five-point Likert-type scale: 1=very low, 2= low, 3=medium, 4= high and 5=very high. The range in responses to six questions for this section was 6–30.

Contact with Information Sources: Farmers' access and contact with different mass and interpersonal communication media that provide information about OFWM was measured against 12 questions regarding these sources. Response level for this section was categorized using a five-point Likert-type scale: 0=not at all, 1= low, 2=medium, 3= high and 4=very high. The range in responses to 12 appropriate questions for this section was 0–48.

Respondent's Extension Contact: Respondent's level of extension contact was categorized using a five-point Likert-type scale: 0 =not at all, 1= low, 2=medium, 3= high and 4=very high. The range in responses to six questions for this section was 0–24.

Respondents' Knowledge of OFWM: Respondents' general knowledge of OFWM was determined using 26 multiple-choice questions. Each correct response was worth one-point. Summing correct responses for each farmer gave potential knowledge scores ranging from 0-26.

Respondent's Attitudes toward OFWM: Respondent's attitudes toward OEWM were calculated by assigning scores of 1 for disagree, 2 for slightly disagree, 3 for no opinion, 4 for slightly agree, and 5 for agree to each of 20 attitude statements and then added up.

Content and face validity of the survey instrument were established by a panel of experts consisting of faculty members in irrigation, agronomy, and extension education at the Tarbiat Modares University of Iran. Furthermore, the questionnaire was validated by agricultural officers of Nahavand Township. A pilot test was conducted with 30 wheat farmers in the Malayer Township in the Hamadan Province three weeks prior to the study. As a result of the pilot test, minor changes in wording were made to the questionnaire. Reliability for the overall instrument was estimated at 0.84.

Data Collection and Analysis: Two graduate student researchers conducted personal interviews with 330 wheat farmers in the field from September to November 2004, for a response rate of 88%. Because of the low literacy rates, instructions, concepts, terms, and the Likert-type scales were carefully explained to participants to ensure they understood the purpose of the research, the questionnaire, and how their responses would be categorized. M ost interviews lasted approximately 50 minutes.

The data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS 11.5) for Windows. Descriptive statistics (frequencies, means, standard deviations, and range, i.e., maximum and minimum) were used to describe analyze data. Factor analysis by means of principal component method was performed on the responses to the items of the questionnaire. Stepwise multiple regression, Spearman correlation coefficient, T-Test, F-Test, The Kruskal-Wallis Test, and The Wilcoxon-Mann-Whitney Test were employed to analyze the relationships between and among variables.

RESULTS AND DISCUSSION

Objective 1. To determine professional and demographic characteristics of wheat farmers: Finding for each objective will be presented in this section in the order outlined in the purpose and objective section, and will be discussed as follow.

The mean age of wheat farmers in the study was 45, as shown in Table 1. While 28.5% of wheat farmers (n=94) were illiterate, 34.8% (n=115) had a primary school education. About 16.7% of wheat farmers (n=55) had guidance level education and less than 20% (n=66) had high school or post secondary education. On average, wheat farmers had 22 years of experience in farming wheat, and 25.5 years of experience in agriculture. A majority of respondents (90%) farmed 10 hectares or less of agricultural land. In other words, farmers owned 7 hectares of land of which they devoted 5.5 hectares to wheat farming, 4.8 hectares of which was irrigated. A majority of households (80%) had more than 5 household members. Sixty percent of wheat farmers had secondary jobs. The average wheat yield per hectare was 4.7 kg/ha, which was significantly above the national average. The average distance between the farm and the agricultural service center was 3.3 Km. Seventy five percent of the sample (n=246) lived in rural villages. The majority of respondents were married (86%) and all of them were male. According to irrigation method, about 60% of farmers (n=197) had basin irrigation, nearly 30% (n=101) border irrigation, and the remaining 10% (n=32) had sprinkler irrigation. According to water sources used for irrigation, about 47% of farmers (n=156) used rivers, nearly 20%

Table 1: Respondents' professional and demographic characteristics (n = 330)

Variables	Items	f	%	Variables	Items	f	%
Age (Year)	Below 30	59	17.9	Household members	3-5	67	20.3
	30-40	66	20.0		5-8	174	52.7
	40-50	88	26.6		8-11	74	22.4
	50-60	63	19.1		Above 11	15	4.5
	Above 60	54	16.4				
Literacy	Illiterate	94	28.5	Marital status	Single	45	13.6
	Primary school	115	34.8				
	Guidance	55	16.7				
	High school	45	13.6		Married	285	86.4
	Post secondary	21	6.4				
Experience in farming wheat (Year)	1-10	75	22.7	Farm land (Hectare)	1-5	160	48.5
	10-20	110	33.4		5-10	119	36.0
	20-30	63	19.1		10-15	29	8.8
	Above 30	82	24.8		Above 15	22	6.7
Experience in farming agriculture (Year)	1-10	57	17.3	Size of wheat Irrigated	1-5	197	59.7
	10-20	103	31.2	Farming (Hectare)	5-10	97	29.4
	20-30	70	21.2		10-15	24	7.3
	Above 30	100	30.3		Above 15	12	3.6
Distance between the farm and	1-3	150	61.0	Wheat yield per	Below 3	28	8.5
the agricultural service center	3-5	123	37.3	Hectare (kg ha^{-1})	3-4	124	37.6
	5-8	44	13.4		4-6	166	50.3
	Above 8	13	3.9		Above 6	12	3.6
Type of irrigation method	Basin irrigation	197	59.7	Type of water resource	River	156	47.3
	Border irrigation	101	30.6		Spring	67	20.3
	Sprinkler irrigation	32	9.7		Subterranean canal	10	3.0
					Water well	97	29.4

Table 2: Social characteristics of respondents (n = 330)

Variables	Mean	SD	Range
Extension contact	7.75	5.38	0-24
nformation source	16.53	4.58	0-48
ocial participation	20.16	4.58	6-30
Social status	6.04	6.00	2-10

(n=67) springs, 3% (n=10) subterranean canals, and approximately 30% (n=97) well water.

As shown in Table 2, the farmers' social status ranged from 2 to 10 (M=6.04; SD=1.30). The respondents' extension contacts ranged from 0 to 24 (M=8.33; SD=4.45). The responds' social participation ranged from 6 to 30 (M=20.43; SD=2.46). The wheat farmers' use of information sources ranged from 0 to 48 (M=10.53; SD=3.87).

Objective 2. To determine knowledge and attitude among wheat farmers toward OFWM: Farmers' knowledge of OFWM was determined as described in the methodology section. For the purpose of characterization, the scores were labeled as: "weak", "mediate", "good" and "excellent". Based on means and standard deviations of the knowledge score, the four categories were determined by scores that fell within two standard deviations to the left of the mean on a normal curve, and two standard deviations to the right of the mean [16].

A = *weak*: A< Mean- Sd
B = *mediate*: Mean- Sd = B = Mean
C = *good*: Mean < C = + Sd
D = *excellent*: Mean + Sd < D

Wheat farmers' knowledge of OFWM ranged from 5 to 24 (*M=12.69* and *SD=3.34*). Table 3 details their knowledge frequency and its characterization. A total of 17.3% of wheat farmers (n=57) had "weak" knowledge and 33% (n=109) had "mediate" knowledge of OFWM. Nearly 34% (n=114) had "good" knowledge of OFWM, and approximately 15% (n=50) had "excellent" knowledge.

Table 3: Wheat farmers' knowledge and attitude toward on-farm water management (n = 330)

Variables	Items	Frequency	Percent
Wheat farmers'	Weak	57	17.3
Knowledge toward OFWM	Mediate	109	33.0
	Good	114	34.5
	Excellent	50	15.2
Wheat farmers'	Negative	57	17.3
Attitude toward OFWM	Relatively negative	114	34.5
	Relatively positive	85	25.8
	Positive	74	22.4

The results indicate that a majority of wheat farmers had "mediate and good" knowledge of OFWM.

Wheat farmers' attitudes toward OFWM were determined as described in the methodology section. For the purpose of characterization, the scores were labeled as "negative", "relatively negative", "relatively positive" and "positive". Based on means and standard deviations of the attitudes score, the four categories were determined by scores that fell within two standard deviations of the left of the mean on a normal curve, and two standard deviations to the right of the mean [16].

A = *Negative*: A< Mean-Sd
B = *Relatively Negative*: Mean-Sd = B = Mean
C = *Relatively Positive*: Mean < C =+ Sd
D = *ositive*: Mean+Sd < D

Wheat farmers' attitudes toward OFWM ranged from 5 to 24 (*M=12.69* and *SD=3.34*). Table 3 shows information on characterization of farmers' attitudes and their frequencies. A total of 17.3% of the wheat farmers (n=57) had "negative" attitudes toward OFWM and approximately 34% (n=114) had "relatively negative" attitudes. Nearly 26% (n=85) had "relatively positive" attitudes and approximately 22% (n=74) had "positive" attitudes toward OFWM. The results indicated that farmers had "negative" or "relatively negative" attitudes toward OFWM.

Objective 3. To determine the relationships between selected independent variables and attitudes of wheat farmers toward OFWM: A negative relationship was observed between wheat farmers' attitudes toward OFWM and their age (r=-0.618). Based on the Davis (1971) convention, the relationship is characterized as a "substantial association". There was a low association and negative relationship between wheat farmers' physical distance from the agricultural service center (r=-0.143) and number of household individuals (r=-0.138) and their attitudes toward OFWM.

Table 4: Correlation level between wheat farmers' attitude toward OFWM (n = 330)

	wheat farmers' attitude toward OFWM	
Variables	r	p
Age	-0.618***	0.000
Number of household individuals	-0.138*	0.012
Education Level	0.626***	0.000
Distance between the Farm and the agricultural service center	-0.143**	0.009
Years of experience in farming wheat	-0.595***	0.000
Years of experience in agriculture	-0.603	0.000
Size of farm	0.147**	0.007
Size of irrigated farming	0.178***	0.001
Size of irrigated wheat cultivated land holding	0.182***	0.001
Economical status	0.185***	0.001
Wheat yield per hectare	0.805***	0.000
Knowledge toward OFWM	0.724***	0.000
Social status	-0.007	0.899
Social participation	0.397***	0.000
Contact with Information Sources	0.549***	0.000
Extensional contacts	0.591***	0.000

p = 0.001: ***, p = 0.01: **, p = 0.05: *

There was a strong, negative significantly correlative and negative relationship between the years of experience in farming wheat (r=-0.595) and years of experience in agriculture (r=-0.603), with level of attitude toward OFWM.

In contrast there was a statistically very strong significant relationship between the wheat yields per hectare (r=0.805), with level of attitude toward OFWM. There was a significantly correlative and positive relationship between the size of the farm (r=0.147), the size of irrigated farming (r=0.178), size of irrigated wheat cultivated land holding (r=0.182) and economic status (r=0.185), with level of attitude toward OFWM. This relationship is characterized as a "low association". The farmers' level of education (r=0.626) showed to be positively and substantially associated with attitude to OFWM [17]. This implied that formal education brought about positive attitudes and understanding in OFWM and consequently, farmers with relatively higher education had a substantial positive attitude toward OFWM. The result showed a "moderate" association (r=0.379) between the farmers' extent of social participation and their attitude in OFWM.

The result showed a very strong association (r=0.724) between the wheat farmers' knowledge toward OFWM and their attitude in this regard. Also the results showed a substantial association between the farmers' access to information sources (r=0.611) and the extent of extension contact (r=0.615), with their attitude to OFWM. As the

Table 5: Differences level between independent variables and wheat farmers' attitude toward OFWM (n = 330)

Independent variables	U	Z	P
Marriage status	3501.500	-5.088	0.000***
Use of extension services	4367.500	-8.870	0.000***
Membership on production cooperative	6141	-8.250	0.000***
Membership on rural institutes	6089	-8.884	0.000***
Independent variables	df	X^2	P
Method irrigation	2	136.921	0.000***
Water resource	4	16.643	0.002**

p = 0.001: ***, p = 0.01: **, p = 0.05: *

Table 6: Multivariate linear regression analysis "wheat farmers' attitude toward OFWM as dependent variable" (n = 330)

	Unstandardized coefficients	Standardized coefficient		
Independent variables	B	Beta	T	Sig
Constant	1.876	-	0.358	0.721
Yield per hectare (X_1)	8.165	0.486	9.812	0.000
Wheat farmers' knowledge toward OFWM (X_2)	1.305	0.260	5.616	0.000
Contact with Information sources (X_3)	0.457	0.124	3.166	0.002
Wheat farmers' age (X_4)	-0.114	-0.096	-2.319	0.021

F = 196.936, Sig t = 0.000, R = 0.843, R^2 = 0.710Adjusted R^2 = 0.707

farmers' access to information sources and extension contacts increased, their attitude regarding OFWM increased at a "substantial" rate. Table 4 shows the strength and significance level between attitude toward OFWM and wheat farmers' professional characteristics.

The results of the Wilcoxon-Mann-Whitney Test showed that there were significant differences in wheat farmers' attitudes toward OFWM by marriage status, membership of production cooperatives and rural institutes, and use of extension services. The results of the Kruskal-Wallis Test showed significant differences in wheat farmers' attitudes toward OFWM by type irrigation method and type of water resource used. Table 5 presents these results.

Objective 4. To determine how much of the variance in wheat farmers' attitude toward OFWM is explained by the independent variables of the study: The independent variables in this study included the age of wheat farmers, number of individuals in the household, education level, distance between the farm and the agricultural service center, years of experience in farming wheat, years of experience in agriculture, size of farm, size of irrigated farming, size of irrigated wheat cultivated land holding, wheat yield per hectare, social status, social participation, contact with information sources, extension contacts and wheat farmers' knowledge of OFWM. Stepwise regression results (Table 6) show that 71% (R^2 = 0.710) of the variance in wheat farmers' attitudes toward OFWM could be explained by the variables of wheat yield per hectare, wheat farmers' knowledge of OFWM, wheat farmers' contact with information sources, and wheat farmers' age.

Based on the regression analysis results, the following prediction equation was formulated to estimate the wheat farmers' attitude toward OFWM.

$$Y = 1.876 + 8.165\,(X_1) + 1.305\,(X_2) + 0.457\,(X_3) - 0.114\,(X_4)$$

Y = Wheat farmers' attitudes toward OFWM
X1= Wheat yield per hectare
X2 = Wheat farmers' knowledge toward OFWM
X3 = Wheat farmers' contact with information sources
X4 = Wheat farmers' age

CONCLUSION AND RECOMMENDATIONS

This study has provided useful insight of Wheat farmers' attitudes toward OFWM in Nahavand township, Iran. Based on the study findings, the following conclusions are drawn and recommendations made.

A majority of wheat farmers (52%) have "weak" or "average" attitudes concerning OFWM practice. This implies that substantial educational work needs to be done by extension personnel and measures taken to increase the motivation, understanding, and involvement of wheat farmers with OFWM so that improvement in their attitudes bay be brought about.

There is a negative and substantial relationship between wheat farmers' attitudes toward OFWM and their age (r=-0.618). As wheat farmers get older their attitudes toward OFWM become less favorable. This implies work with older wheat farmers to increase their motivation and understanding of OFWM practice.

There is a positive relationship between wheat farmers' access to information sources (r=0.611) and extent of extension contacts (r=0.615), and attitudes toward OFWM. This implies that information for farmers should be written and presented at their level of knowledge and understanding in order to be effective, and influence positive attitudes. Only then can it impact their attitude base. This implies that if the accessible information that was presented to farmers had this condition we may have observed a substantial relationship between these variables.

Negative relationships between years of experience in farming wheat (r=-0.595) and years of experience in agriculture (r=-0.603), and attitudes toward OFWM suggest that work to improve motivation and understanding of OFWM practice should be done with more experienced farmers rather than with those having less experience.

Wheat farmers' knowledge of OFWM was strongly related to with their attitudes toward OFWM (r= 0.724). This means that increasing farmers' knowledge concerning OFWM activities would likely improve their attitudes in this regard. Regression analysis showed that social, personal, farming and economic characteristics explained about 71% of changes in the attitudes of wheat farmers toward OFWM. This implies that other factors not investigated in this study could contribute to wheat farmers' attitudes toward OFWM. Further study to uncover potential relationships should therefore be undertaken.

Educational Importance: The study showed that substantial education work needs to be done by extension personnel to improve understanding, motivation and attitudes of wheat farmers toward OFWM practice. Strategies to increase knowledge and improve attitudes of farmers regarding OFWM have the potential to improve OFWM practice. Based on farmer effectiveness ratings of extension personnel, farmers would like to see extension agents improve their availability and contact with farmers. Direct contact with extension agents appear important to wheat farmers suggesting that field-dependent learning styles need to be taken into consideration when planning dissemination efforts and seeking increased adoption rates. There has been little research done on OFWM practice in Iran. Therefore, the results of this research should guide agricultural organizations to enhance the educational foundation of extension personnel and farmers through pre-and-in-service training and workshops. In summary, substantial educational work needs to be done by extension personnel and measures should be taken to increase the wheat farmers' motivation, understanding, and involvement with OFWM, which would create more positive attitudes and lead to increased farm productivity.

REFERENCES

1. Sharma, B.R. and P.S. Minhas, 2005. Strategies for managing saline/alkali waters for sustainable agricultural production in South Asia. Agricultural Water Management, 78: 136-151.
2. Xevi, E. and S. Khan, 2005. A multi-objective optimization approach to water management. Journal of Environmental Management, 77: 269-277.
3. Peranginangin, N., R. Sakthivadivel, N.R. Scott, E. Kendy and T.S. Steenhuis, 2004. Water accounting for conjunctive groundwater/surface water management: case of the Singkarak–Ombilin River basin, Indonesia. Journal of Hydrology, 292: 1-22.
4. Wolf, P. and T.M. Stein, 2003. Improving on- farm water management–a never ending challenge. Journal of Agriculture and Rural Development in the Tropics and Subtropics, 104(1): 31-40.
5. Abu-Zeid, M., 1979. On-farm water management improvement programs; in: Water management for arid lands in developing countries, edited by BISWAS, A. E. A.; Pergamon Press, Oxford, UK; 1979.
6. Izuno, F.T., 1997. Principles on-farm water management. Florida, IFAS Extension.
7. FAO. 2003. Improving irrigation production. [On- line], available: http://www.fao.org/documents/show_cdr.asp?url_file=/docrep1005/y3918e/y3918e09.htm.
8. FAO, Yearbook. 1999. Production. Food Agricultural Organization of the United Nations, Rome.
9. Yang, Y.H., M. Watanabe, C.Y. Tang, Y. Sakura and S. Hayashi, 2002. Groundwater table and recharge changes in the piedmont region of Taihang Mountain in Gaocheng City and its relation to agricultural water use. Water SA. 28: 171-178.
10. Kang, S., L. Zhang, Y. Liang, X. Hu, H. Cai and B. Gu, 2002. Effects of limited irrigation on yield and water use efficiency of winter wheat in the Loess Plateau of China. Agricultural Water Management, 55: 203-216.
11. Yang, Y.H., M. Watanabe, X. Zhang, J. Zhang, O. Wang and S. Hayashi, 2005. Optimizing irrigation management for wheat to reduce groundwater depletion in the piedmont region of the Taihang Mountains in the North China Plain. Agricultural Water Management, 82(1-2): 25-44.
12. Betaz, F.J., J.K. Peters and W. Janssen, 1999. The influence of technology characteristics on the rate and speed of adoption in Agricultural Economics. 21: 121-130. Elsevier Science, B.V.
13. Beyene, F., 2003. Estimating attitude on farmers toward maize extension package program: [on- line], available: http://www.aiaee.org/2003/beyene90-98.pdf.

14. Chizari, M., F. Lashkarara and J.R. Linder, 2001. Identification Barriers to Sustainable Agricultural Practices: Perceptions of Wheat Farmers in Iran. [on-line], available: http://www.aiaee.org/2001/ap01.pdf.
15. Krejcie, R.V. and D.W. Morgan, 1970. Determining sample size for research activities. Educational and Psychological Measurement, 30: 607-610.
16. Sadighi, H. and J. Mohammadzadeh, 2002. Extension professional staffs' attitudes toward participatory approach of extension activities and rural development. Proceeding of the 18th Annual AIAEE Conference, Durban, South Africa. Available [On Line] at: http://www.aged.tamu.edu/aiaee/2002/sadighi521-528.pdf
17. Davis, J.A., 1970. Elementary Survey Analysis. Englewood Cliffs, NJ. Prentice-Hall.