

Development trend and status of Pressurized Irrigation in Golestan Province, Iran

Authors:

Kami Kaboosi

Institution:Islamic Azad University,
Gorgan branch,
Gorgan, Iran.**Corresponding author:**

Kami Kaboosi

Email:

kkaboosi@yahoo.com

Web Address:[http://jresearchbiology.com/
Documents/RA0014.pdf](http://jresearchbiology.com/Documents/RA0014.pdf)**ABSTRACT:**

In recent decades, specific big share of executive capabilities, capital and activities of the Iranian government have been allocating to the development of pressurized irrigation systems. Concluding these programs and specifying the development status of these systems in different locations of country can be regarded as a guideline to assign future strategies. Reliable information on irrigation methods is important for determining agricultural water demand trends. Therefore, this research, in addition to surveying of pressurized irrigation projects performed from 1990 to 2007 in Golestan province; consider development trend and status of pressurized irrigation systems in this province. Based on the result, totally 1020 pressurized irrigation projects with 22990.9 hectares area have been performed in Golestan province, which have covered only 6.64 percent of irrigated lands area or 3.2 percent of total agricultural lands area and shows the lack of pressurized irrigation development. Comparing the pressurized irrigation development trend in Golestan province with the country and their coordination shows that the most important factor in the lack of pressurized irrigation development in Golestan province is general policies on the country scale. The most important reason of very fluctuation in developing of these systems is continuous changes in policies and instability of adopted policies while, technical, social, cultural and executive factors have the least effects. Results show more than 90 percentage of sprinkler irrigation systems area allocated to cotton, soybean, wheat and barley. Also, because of petty landowner of agricultural lands in Golestan province, area average of personal farms that equipped with pressurized irrigation systems is very lesser than cooperative farms. This paper present comprehensive conclusion of sprinkler and micro irrigation projects from various aspects in Golestan province in Iran.

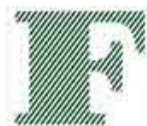
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INTRODUCTION

Reliable information on irrigation methods is important for determining agricultural water demand trends. In addition, trend of future water demand by agriculture is extremely important for water resource planning. The absence of reliable information can severely limit usefulness of long-term water planning. Water resource projects planning require reliable estimates of crop and irrigation system combinations, which are important components of water budget. To update records on irrigation methods used within each region, survey should be conducted. Then, survey data are analyzed and compared with earlier surveys to study how irrigation methods are changing and to make projections of future changes for long-term planning.

Iranian government has particularly attentions to the development of pressurized irrigation systems in order to improve water use efficiency and water application efficiency. So, in recent decades, specific big share of executive capabilities, capital and activities of the Iranian government have been allocating to the development of pressurized irrigation systems. Concluding these programs and specifying the development status of these systems in different locations of country can be regarded as a guideline to assign future strategies.

To update California's records on crops and irrigation methods, the California department of water resources conducts survey every 10 years during recent decades (Orang et al, 2008). Therefore, Orang et al. (2005 and 2008) conducted a survey of irrigation methods in California in 2001. Kahlowan and Kemper (2007) evaluated the performance of trickle systems installed in Balochistan, Pakistan during 1982–2002 by field surveys, physical verifications and interviews with farmers.

Akhavan Giglo (2006) and Akhavan Giglo and Kanooni (2008) presented the situation of pressurized irrigation systems in private and governmental agricultural lands of Ardebil province, Iran.

The purposes of this research is twofold; (1) to survey of pressurized irrigation projects that performed from 1990 to 2007 in Golestan province,

Iran and (2) to consider development trend and status of pressurized irrigation systems in this province.

Golestan province is located in the north part of Iran. It consists of 11 townships. Province area is 20437.7 Km² that consist 1.25 percentage of Iran (MPOG, 2005; MPOG, 2006; Abedi and Hatami, 2006). Because of fertile soil and good weather condition, this province has important role in the agricultural production of country. Based on published statistical information by agriculture ministry's head-office of Statistics and Information (2005), total agricultural land area of Golestan province is 717594.6 hectares that is equal to 5.32 percentage of total agricultural land area of country.

MATERIALS AND METHODS

To update records on pressurized irrigation methods, a survey was conducted. In Iran, farmers equip agricultural lands to pressurized irrigation systems by governmental loans. Therefore, data of farms that equipped with pressurized irrigation systems are available. Those are with Iranian general office on pressurized irrigation. Pressurized irrigation office in Golestan province is a branch of Iranian general office on pressurized irrigation. In the first step, total information about pressurized irrigation projects that performed from 1990 to 2007 in Golestan province gathered from pressurized irrigation office in Golestan province. Then, these data (projects) from the viewpoints of number and area of projects, variety of user, variety of pressurized irrigation systems, crops, etc were analyzed. Finally, on the basis of results, it was analyzed development trend and status of pressurized irrigation in Golestan province.

RESULTS

1- Number and area of pressurized irrigation projects

Number and area of pressurized irrigation projects that performed from 1990 to 2007 in Golestan province is present in table 1. As shown, totally 1020 pressurized irrigation projects with 22990.9 hectare land usage were performed that are mostly sprinkler systems and only 6 percentage of the number of pressurized irrigation projects (equal to 12.45 percentage of area) are allocated to micro

Table 1- Number and area (hectare) of pressurized irrigation projects

Sprinkler systems				Micro systems				Pressurized systems	
number	%	area	%	number	%	area	%	number	area
956	93.73	20129.3	87.55	64	6.27	2861.6	12.45	1020	22990.9



irrigation systems. Main reason of non-development of micro irrigation in Golestan province is the little area of orchards in this province.

2- Percentage of agricultural lands equipped with pressurized irrigation systems

Area and percentage of agricultural lands equipped with pressurized irrigation systems in Golestan province is present in the table 2. According to this table, only 6.64 percentages of total irrigated agricultural lands is equipped with pressurized irrigation systems that it is equal to 3.2 percentages of total agricultural lands. It was clearly shown that in a period of 18 years, pressurized irrigation systems have not developed in this province and at the present about 95% of total irrigated agricultural land area is irrigating with traditional surface method. Whereas more than 50 percentages of total agricultural lands in Golestan province is rainfed, obviously water saving by the development of pressurized irrigation systems

which can cause irrigated land area increases. As mention previously and shown in table 2, in Golestan province, area of orchards is much lesser than farmland area. Therefore, in spite of little area of micro irrigation projects, its percentage is more than the percentage of sprinkler irrigation projects.

3- Comparing development of pressurized irrigation in Golestan province with the country

Area and number (N.) of pressurized irrigation projects that performed in Golestan province within a period of 18 years are presented in table 3 and figure 1. In addition, area of pressurized irrigation projects that performed in country (Iran) after Zareii and Sadre Ghaen (2005) are shown in this table and figure. As seen, development trend of pressurized irrigation systems in Golestan province is completely similar to that of the country. The most number and area of pressurized irrigation systems in Golestan province and country are performed in 1996.

Table 2- agricultural land area (hectare) equipped with pressurized irrigation

Type	cultivation	area of land	% of total	area of systems	%
farmland	irrigated	327248	45.6	20129.3	6.15
	total	684766	95.43		2.94
orchards	irrigated	19243.4	2.68	2861.6	14.87
	total	32828.6	4.57		8.72
total	irrigated	346491.4	48.29	22990.86	6.64
	total	717594.6	100		3.2

Table 3- comparing development trend of pressurized irrigation in Golestan with the country

year	Sprinkler systems			Micro systems			Pressurized systems		
	Golestan		Iran	Golestan		Iran	Golestan		Iran
	N.	area	area	N.	area	area	N.	area	area
1990	0	0	2450	0	0	350	0	0	2800
1991	2	21	8594	0	0	2406	2	21	11000
1992	4	65.5	10629	0	0	2098	4	65.6	12727
1993	35	577	10778	1	3	2695	36	580	13473
1994	74	1459.6	23476	2	1	3024	76	1460.3	26500
1995	38	684.6	9875	1	1	1725	39	685.6	11600
1996	262	4454.7	66112	1	1.6	9288	263	4456.3	75400
1997	195	3304	37058	4	43	8442	199	3346.9	45500
1998	87	2031.5	27939	1	5	11061	88	2036.5	39000
1999	57	1735.1	20308	1	48.6	11692	58	1783.7	32000
2000	69	1501.8	19293	2	151	13607	71	1652.8	32900
2001	20	287.1	14467	2	126.2	9710	22	413.3	24177
2002	9	83.2	12499	3	101	15294	12	184.2	27748
2003	23	895.3	28061	4	844.4	27138	27	1739.7	55199
2004	29	526	*	5	598.8	*	34	1123.8	*
2005	16	902.4	*	8	233.9	*	24	1136.3	*
2006	25	1391.5	*	17	559.6	*	42	1951.1	*
2007	11	208.9	*	12	144.5	*	23	353.4	*
total	956	20129.3	*	64	2861.6	*	1020	22990.9	*

* Non available data

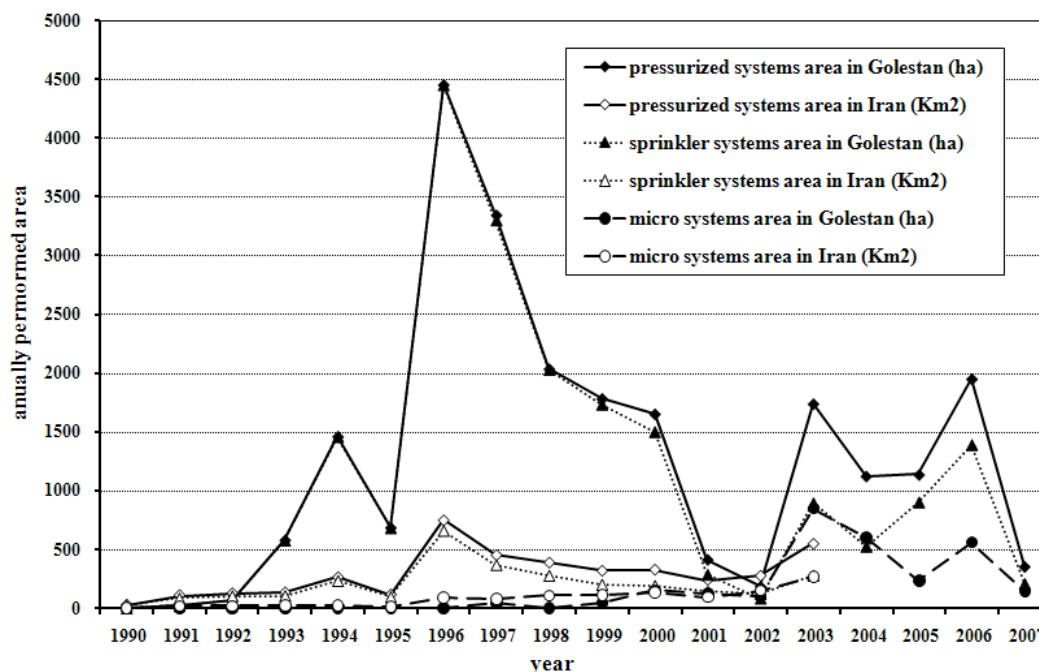
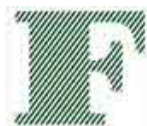


Figure 1- comparing development trend of pressurized irrigation in Golestan with the country

As mentioned previously, In Iran, farmers equip agricultural lands to pressurized irrigation systems by governmental loans. Within a period of 1990-96, governmental loans for developing of pressurized irrigation system increases but it decreases within a period of 1996-2002. Consequently, development of pressurized irrigation systems increases in 1990 to 1996 but decreases in 1966 to 2002. Governmental support henceforth increases again and it causes developing pressurized systems.

Comparing development trend of pressurized irrigation in Golestan province with the country and their coordination shows that the most important factor in the lack of pressurized irrigation development in Golestan province is general policies on the country scale. The most important reason for very fluctuation in developing of these systems is continuous changes in supporting policies and instability of adopted policies while technical, social, cultural and executive factors have the least effects.

Table 4- Variety of sprinkler and micro irrigation systems in Golestan province

system		Number		Area (ha)		average
		Number	%	Area (ha)	%	
Sprinkler	Solid Set	7	0.73	474.63	2.36	67.8
	Hand Move 1	160	16.74	5127.21	25.47	32.1
	Hand Move 2	427	44.67	4921.7	24.45	11.5
	Unknown Hand Move	147	15.38	2652.54	13.18	18
	Side Roll	17	1.78	877.7	4.36	51.6
	Travelling Gun	168	17.57	3254.69	16.17	19.4
	Center Pivot	6	0.63	1281.1	6.36	213.5
	Linear Move	3	0.31	352	1.75	117.3
	Complex of two systems	13	1.36	1067.11	5.30	82.1
	Unknown Sprinkler	8	0.84	120.58	0.60	15.1
	Total of Sprinkler	956	100	20129.26	100	21.1
Micro	Line Source Emitter	7	10.94	809.06	28.27	115.6
	Point Source Emitter	57	89.06	2052.54	71.73	36
	Total of Micro	64	100	2861.6	100	44.7
Total of Pressurized		1020	-	22990.86	-	22.54

Hand Move 1 refers to lateral hand move but Hand Move 2 refers to a system that lateral, manifold and main pipes and pump move by hand.



4- Variety of sprinkler and micro irrigation systems in Golestan province

Table 4 shows the variety of sprinkler and micro irrigation systems in Golestan province that performed from 1990 to 2007. As shown, hand move 1 and 2 and travelling gun systems allocated 25.5, 24.5 and 16.17 percentage of total sprinkler systems area, respectively. However, sum of the number and area of center pivot, linear move and side roll systems in Golestan province is in 26 projects and 2510.8 hectare, respectively. This is equal to 2.72 and 12.47 percentage of total number and area of sprinkler irrigation systems. The most important reasons of little development in center pivot, linear move and side roll systems in Golestan province are the existence of cheap workers in the region and petty landowners. Since too much percentage of agricultural lands in Golestan province have small area; developing of these systems is difficult.

Hand move 2 system has the least amount of area average. Its area average is 11.5 hectare. However, center pivot and linear move systems have the most area average. Their area averages are 213.5 and 117.3 hectare, respectively.

As seen in table 4, staple percentage of micro irrigation systems in Golestan province is point source emitter system that allocated to orchards while 28.27 percentage of micro irrigation systems area is line source emitter system that allocated to some of the farmland crop.

5- Irrigated crops by pressurized irrigation systems in Golestan province

Results showed that sprinkler irrigation systems in Golestan province are mostly used for farmland crops. Based on the results, more than 90 percentage of sprinkler irrigation system area (more than 18100 hectare) are allocated to cotton, soybean, wheat and barley. Others sprinkler projects are performed for corn and canola. Based on published statistical information by agriculture ministry's head-office of Statistics and Information (2005), 76 percentage of total farmlands area in Golestan province (more than 520000 hectare) are allocated to these four crops (cotton, soybean, wheat and barley), in that 43 percentage of it is irrigated farmland. Therefore, at present only 8 percentage of irrigated land area of these four crops is equipped with sprinkler irrigation systems.

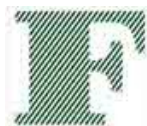
Staple percentage of micro irrigation systems in Golestan province is point source emitter system that allocated to orchards as plum, peach, eucalyptus, kiwi, olive and citrus trees while line source emitter systems mostly allocated to some of the farmland crop as cotton, tomato and soybean.

6- Variety of users of pressurized irrigation systems in Golestan province

In this research, users of pressurized irrigation systems in Golestan province is divided to 3 groups: 1- personal or individual farms 2- Governmental farms and 3- cooperative farms. Table 5 shows the variety of users of pressurized irrigation systems in Golestan province. As seen, staple percentage of pressurized irrigation projects

Table 5- Variety of users of pressurized irrigation systems in Golestan province

system	index	index	sprinkler	micro	total
Personal farms	number	number	920	47	967
		%	96.23	73.44	94.80
	Area (ha)	area	15872.17	1314.01	17186.18
		%	78.85	45.92	74.75
average		17.25	27.96	17.77	
Governmental farms	number	number	15	3	18
		%	1.57	4.69	1.76
	Area (ha)	area	575.29	2.60	577.89
		%	2.86	0.09	2.51
average		38.35	0.87	32.11	
Cooperative farms	number	number	21	14	35
		%	2.20	21.88	3.43
	Area (ha)	area	3681.80	1544.99	5226.79
		%	18.29	53.99	22.73
average		175.32	110.36	149.34	
total	number		956	64	1020
	Area (ha)		20129.26	2861.6	22990.86
	average		21.06	44.71	22.54

**Table 6- frequency distribution and average of pressurized irrigation projects**

sys.	Area (ha)	< 2	2-5	5-10	10-20	20-30	30-40	>40	total	average
sprinkler	number	5	91	293	309	153	37	68	956	21.06
	%	0.52	9.52	30.65	32.32	16	3.87	7.11	100	-
	cumulative	0.52	10.04	40.69	73.01	89.02	92.89	100	-	-
micro	number	9	10	17	8	4	3	13	64	44.71
	%	14.06	15.63	26.56	12.5	6.25	4.69	20.31	100	-
	cumulative	14.06	29.69	56.25	68.75	75	79.69	100	-	-
total	number	14	101	310	317	157	40	81	1020	22.54
	%	1.37	9.9	30.39	31.08	15.39	3.92	7.94	100	-
	cumulative	1.37	11.27	41.66	72.75	88.14	92.06	100	-	-

are performed in personal farms so that 967 projects (about 95 percentages of total projects) with 17186.18 hectare (75 percentage of total area) were performed in personal farms.

Because of petty landowners of agricultural lands in Golestan province, area average of personal farms that equipped with pressurized irrigation systems is much lesser than cooperative farms. Ratio of area average of pressurized irrigation systems in cooperative farms to personal farms is 8.4 (17.77 against 149.34 hectare). This ratio for sprinkler projects is more than 10 (175.32 against 17.25 hectare) and for micro projects is about four (110.36 against 27.96 hectare).

When data of table 5 reviews again, this found that the area average of pressurized irrigation projects (22.54 hectare) is approximately equal to the area average of personal farms pressurized irrigation projects (17.77 hectare). Its reason is that more percentage of projects is performed in personal farms.

7- Analysis of frequency distribution and area average of pressurized irrigation projects in Golestan province

In order to make easier, analyzing of projects from the point of view of area, projects are divided to 7 classes (less than 2 ha, 2-5 ha, 5-10 ha, 10-20 ha, 20-30 ha, 30-40 ha and greater than 40 ha). Number of pressurized irrigation projects for each class in Golestan province is present in table 6. As shown, the most percentage of pressurized irrigation projects performed in farms with 10-20 ha area and 50-10 ha area, respectively so that these two classes respectively allocated 31.08 and 30.39 percentage of total projects. Although area average of pressurized irrigation projects is 22.54 hectare and it is seemingly good, however, table 6 shows that the area of more than 72 percentages of projects is less than 20 hectare.

In addition, frequency distribution percentage of the area of sprinkler and pressurized irrigation projects is approximately equal because

93.73 percentage of pressurized irrigation project area are allocated to sprinkler irrigation projects. However, it is relatively different when frequency distribution percentage of area of pressurized irrigation projects on comparing with micro irrigation projects.

8- Type of used water resource for pressurized irrigation projects in Golestan province

Based on the results, water for more than 90 percentage of pressurized irrigation projects are supplied from ground water (shallow and semi deep wells). This awareness can assist in better water resource planning.

CONCLUSION

Reliable information on irrigation methods is important for determining agricultural water demand trends. The purposes of this research is to survey the pressurized irrigation projects that performed from 1990 to 2007 in Golestan province, Iran and to consider the development trend and status of pressurized irrigation systems in this province. Based on the results, totally 1020 pressurized irrigation projects with 22990.9 hectares area have been performed in Golestan province, which have covered only 6.64 percent of irrigated land area or 3.2 percent of total agricultural land area and shows the lack of pressurized irrigation development. Coordination of pressurized irrigation development trend in Golestan province and the country showed that the most important factor in the lack of pressurized irrigation development in Golestan province is general policies on the country scale. Results showed that more than 90 percentage of sprinkler irrigation systems area are allocated to cotton, soybean, wheat and barley. In addition, because of petty landowner of agricultural lands in Golestan province, area average of personal farms that equipped with pressurized irrigation systems is very lesser than cooperative farms. Because of cheap workers in the region and petty landowners,



development of center pivot, linear move and side roll systems in Golestan province is difficult.

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