Small-scale irrigation farming as a poverty alleviation strategy for smallholding farmers: a case study of two villages in Godino Peasant Association, Ada district, Oromiya Region, Ethiopia

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Abstract

The study had assessed the economic benefits that small-scale irrigation farming contributed to the livelihood of sampled households. It had also evaluated the socio-economic characteristics of sampled farmers and examined the major constraints to small-scale irrigation farming. Primary data were collected from 103 randomly sampled farmers using a set of structured questionnaire. Data analysis was carried out using SPSS. The result of the analysis revealed that the mean farm size per household was 7.40 kert (1.85 ha) whereas the mean size of irrigated land was 1.82 kert (0.46 ha). The survey had revealed that farmers had earned, on average, Birr 10,309.17 per annum from farming and from off- and non-farming activities, with Birr 7,031.93 (68.2%) from small-scale irrigated farming and the remaining Birr 3,277.24 (31.8%) was generated from rain-fed farming and other off- and non-farm activities. Four kert (1ha) of irrigated land, on average, generated an income of Birr 15,454.80 from sales of horticultural crops, whereas rain-fed farming gave only Birr 1,410.44 per hectare. To that effect, income from small-scale irrigation is significantly higher (P=0.024) than from rain-fed farming. The study confirmed that 94% of the sampled farmers considered small-scale irrigation farming as a poverty alleviation strategy, especially during prolonged dry seasons. The major constraints the study identified to small-scale irrigation farming were lack of access to improved technology, inadequate access to capital, traders' conspiracy and lack of market information. Age, farming experience, extension contact and market information significantly influenced the promotion of small-scale irrigation farming.

Key words: Irrigation farming, food, income and employment

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1. INTRODUCTION

Horticultural crops are cultivated in most part of Ethiopia, as a reliable source of food, income and employment for the increasing farming population during the prolonged dry season. However, production of horticultural crops is constrained by lack of improved technologies, inadequate infrastructure and socio-economic variables. In addition, small, asset-poor and unorganized farmers are poorly linked to markets (Stringfellow *et al*., 1997). Improving market linkage, involving government, private sectors, donors and NGOs, increases the number of farmers practicing small-scale irrigation farming. Moreover, technologies promoted by research institutions, NGOs and other organizations must be appropriate for the types of irrigation farmers practice with, and should not increase the vulnerability of farmers to external shocks (Eaton and Shepherd, 2001; Bingen *et al*., 2003). Extension agents should also gain good insight on small-scale irrigation farming, post-harvesting technologies and agricultural marketing systems in order to help farmers (Andrew, 2007, Abate Bekele and Setotaw Ferede, 2010).

The benefits of improved technology in small-scale irrigation farming are realized in terms of increase in farm output, higher income and improved standard of living (Hart *et al*., 2005). To some extent, farmers may or may not be aware of horticultural production technology. The effectiveness of these technologies is evaluated on convenience for adoption and in increase of yield and income.

Dry season horticultural production has been practiced for decades along the banks of rivers that cuts across cities and towns, inundated land closer to cities or towns characterize by high population density (Ogunjimi and Adekalu, 2002).

By taking advantage of its proximity to cities, the small-scale irrigation farming in Godino Peasant Association provides fresh vegetables to the residents of Bishoftu and Addis Ababa. However, economic information with regard to horticultural crops is limited as compared to cereals and legumes. Launching this study is thought to generate information on cost-

benefit aspect of small scale irrigation to resource poor farmers and extension personnel. This study, therefore, was intended to evaluate the economic contribution of small-scale irrigation farming to the livelihood of the farming community.

The specific objectives of the study were to: (i) describe the personal profile of small-scale irrigation farmers, (ii) assess the household food security situation and income generated from small-scale irrigation farming, (iii) examine major constraints that small-scale irrigation farmers are facing, and (iv) provide recommendations to improve the farming practices.

2. METHODOLOGY

2.1 Description of the study area

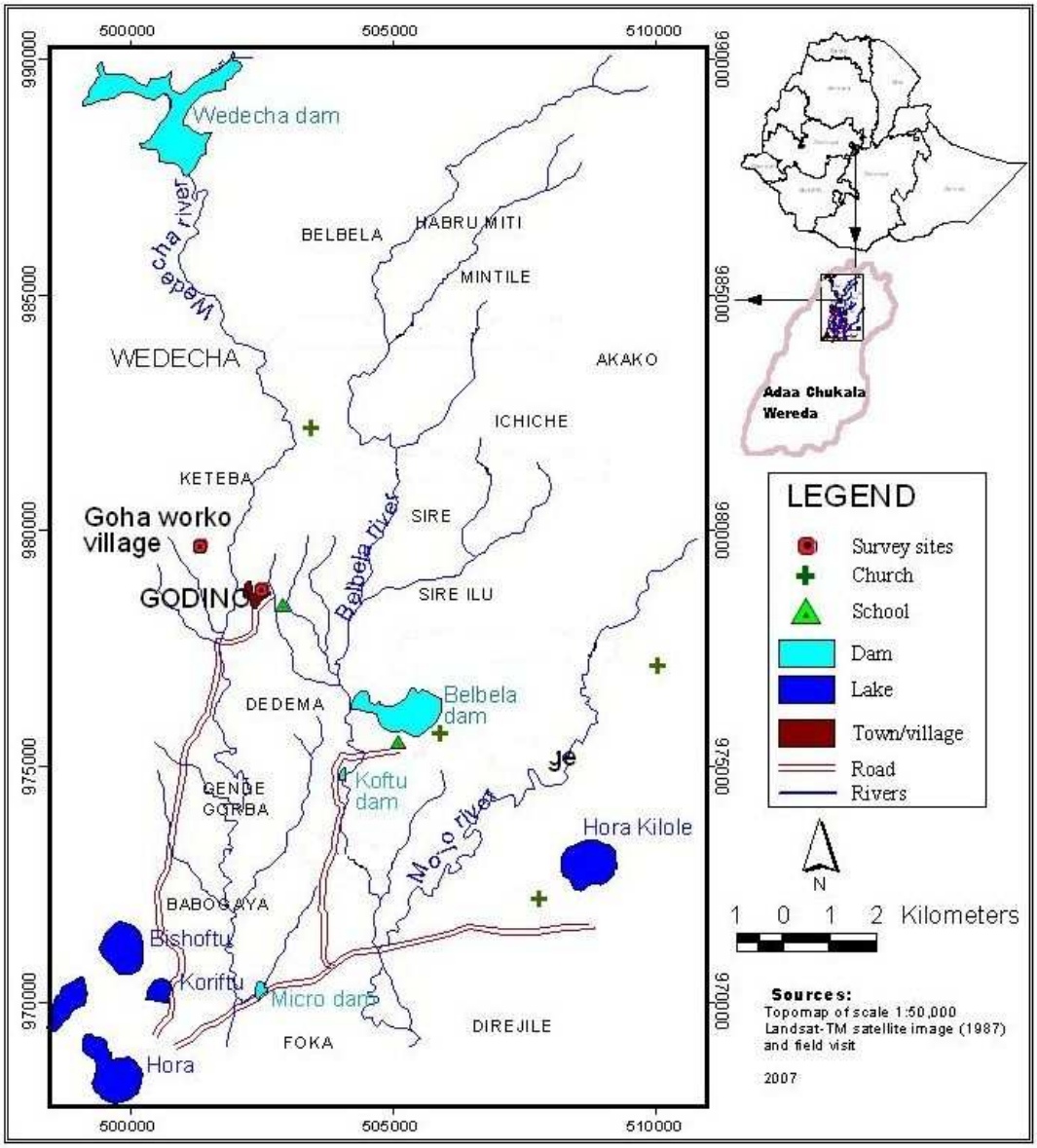
Godino is a small town in Ada district located about 11 km south-east of Bishoftu town. Farmers in the study villages have been producing horticultural crops under irrigation for many years using traditional production system. However, their livelihoods are affected by lack of improved technologies, lack of access to free market and inability to sell their produces at competitive prices, small land size, subsistence household income, relatively large family size, and low level of education. The study covered two villages where farmers are engaged in small-scale irrigation practices in Godino Peasant Association. The two villages included in the study were Gohaworko and Godino (Fig. 1).

Gohaworko village: Farmers in this village are more business minded and are aware of improved technologies than Godino village. They are concentrated more on production of shallot, sugarcane, and tomato under irrigation. Most of them practice mixed cropping system in which cabbage is grown between shallot, potato, tomato and sugarcane.

Godino village: Farmers in this village are less focused on agribusiness and produce mainly food crops for home consumption and selling where surpluses are available. They grow horticultural crops such as shallot,

potato, tomato and cabbage, and field crops, such as chickpea and lentil when there is scarcity of fertilizer for small-scale irrigation farming.

Fig. 1 Location of the study villages



2.2 Sampling

In the first phase, 103 sampled farmers who practice small-scale irrigation in the Godino Peasant Association were considered in the survey for this study. The survey was conducted between February and April 2009. Farmers who were registered as members of a peasant association and who had official access to at least 1 kert (0.25 ha) of irrigated land through the peasant association were selected randomly from the two villages.

2.3 Instruments for data collection

Semi-structured questionnaire was employed to collect data from the sampled farmers. Focus Group discussion was also carried out with farmers' leaders from each of the two villages involved in the survey. The discussion made it possible to interpret the data and explore topics raised by farmers which had not been dealt with the individual interviews, because farmers complement each other during group discussion.

Thirdly, an in-depth group discussion was held with stakeholders (experts in the MOARD, development agents and researchers). The main aim of the group discussion was to obtain a more comprehensive picture of the small-scale irrigation farming in the study area.

2.4 Data analysis

The data were coded and entered into SPSS Version 13 computer software package for analysis. Frequencies and means were computed for different variables. Based on the collected data, household cash income from rain-fed and irrigation crops were calculated.

3. RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of the households

Data collected from the survey were summarized, pooled and subjected to descriptive statistics.

The majority of farmers interviewed were male. This is an indication that irrigation farming in the study area was male dominated. Interviewed farmers were fairly educated, implying that information can be easily communicated in clear and simple language. Characteristically, most of the

farmers are resource poor, in that they irrigate less than 2 kert (0.5 ha) of land. Most farmers operate by utilizing ox-drawn plough. Farmers consider fertility and size of irrigated land as important factors for the success of small-scale irrigation farming. Farmers interviewed have had substantial experience in small-scale irrigation farming and in most cases the land allotted for horticultural production are either inherited (73%) or rented (24%).

Table 1. Socio-economic characteristics of the sampled farmers (n = 103)

Variable	N	Percentage (%)
Sex		
Male	98	95.1
Female	5	4.9
Educational level		
Illiterate	31	30.1
Read and write	28	27.2
Elementary education	24	23.3
Secondary education (7-12)	17	16.5
Higher education (above 12)	3	2.9
Age categories (year)		
20-30	30	29.1
31-40	36	35.0
41-50	19	18.5
51-60	13	12.6
>60	5	4.9
Type of farming		
Crop farming	65	63.1
Livestock	25	24.3
Crop and livestock (mixed)	13	12.6
Size of irrigated land (kert)		
0.25-0.50	20	19.4
0.51-1.00	30	29.4
1.01-1.50	17	16.5
1.51-2.00	15	14.6
>2.00	21	20.4
Source of farmland		
Inherited	75	72.8
Rented (on yearly base)	25	24.3
Share-cropping	2	1.9
Leased (long term)	1	1.0

3.2 Irrigation method

Almost all interviewed farmers (98%) had indicated that Wodicha dam is a reliable source of water during the peak period in the dry season (Table 2). However,

preference for land is high on the bank of a river that cuts across the villages. The irrigation methods applied by farmers on both villages were surface irrigation (30%) and furrow irrigation (70%). No clear cut method is available to determine the amount of water applied on each plot of land.

Table 2. Irrigation method commonly used in the study villages (n = 103)

Variable	N	Percentage (%)
Water sources		
River-dam	101	98.1
Dug-well	2	1.9
Irrigation methods		
Surface irrigation	31	30.1
Furrow irrigation	70	68.0
Motorized pump	2	1.9
Time of application		
Morning	91	88.4
Evening	8	7.8
Both morning and evening	4	3.9

3.3 Agricultural extension practices

Interviewed farmers acknowledged the assistance rendered by extension agents in their day to day farm operation, but the frequency of the visit was inadequate (Table 3). Extension agents were not executing their task properly because they lack knowledge on small-scale irrigation farming, post-harvesting and marketing. However, farmers obtained information from other farmers, sales men, neighbours and mass media (radio, television, etc.).

Table 3. Extension service provision as evaluated by farmers in the study villages (n = 103)

Variable	N	Percentage (%)
Awareness of extension agent		
Yes	101	98.1
No	2	1.9
Frequency of visit by the extension agent		
Always	13	12.6
Occasionally	20	19.4
Never	70	68.0

Usefulness of extension agents		
Very useful	25	24.3
Useful	20	19.4
Fairly useful	28	27.2
Not useful	30	29.1
Source of extension information		
Extension agent	5	4.9
Neighbour	20	19.4
Fellow farmers	70	68.0
Radio and television	8	7.8
Types of fertilizer used by farmers		
Organic	65	63.1
Inorganic	23	22.3
Rotation	15	14.6

2.4 Technology effectiveness

Information on improved technologies such as varieties and fertilizers, seed dressing, weeding and cultivation, water management, land preparation, disease and pest control, post-harvesting and marketing are considered important factors for the effectiveness of small-scale irrigation farming **(**Sabo and Zira, 2009**).**

Based on the above framework, farmers were asked to rate the effectiveness of technologies for the productivity of horticultural crops. The result had indicated that the use of fertilizer, timely watering, timely weeding and cultivating and use of improved varieties were effective technologies (Table 4). Low awareness observed in the adoption of some of the technologies could be improved through training. Hence, the need to strengthen the extension unit for proper delivery of services was strongly emphasized by interviewed farmers.

Table 4. Farmers' perception regarding effectiveness of improved technologies (n =103)

Variable	*N	Percentage (%)	Ranking
Use of fertilizer	98	95.1	1
Use of improved varieties	64	62.1	4
Good land preparation	50	48.5	6
Timely planting	17	16.5	9
Timely watering	96	93.2	2
Disease and pest control	58	56.3	5
Timely weeding and cultivating	75	72.8	3
Good soil management	34	33.0	8
Timely harvesting	44	42.7	7

Source: survey data (2009/10) *Farmers gave multiple responses

3.5 *Farmers' perception on cooperatives*

In recent years, farmers (local users) are the most effective mangers of natural resources, compared to the frequent failure of state-based resource management (Mosse, 1999). The current trend of transferring management responsibility to farmers or local users builds on conviction of cooperatives. However, farmers, most often, are reluctant to work in a cooperative fearing the cultural differences that existed among farmers. This study made an attempt to assess farmers' perception on producers' and marketing cooperatives. The study had revealed that the majority of farmers (89%) preferred to be members of marketing cooperative while very few farmers (11%) would like to be members of producers' cooperative (Table 5). Change in behaviour and attitude towards collective responsibility in a cooperative is observed.

Table 5. Farmers' perception of a cooperative (n =103)

Variable	N	Percentage (%)
Farmers' preference to be members of marketing cooperatives	92	89.3
Yes	11	10.7
No		
Farmers' preference to be members of producers' cooperatives	13	12.6
Yes	90	87.4
No		

Source: survey data (2009/10)

3.6 Food and cash status of sampled households

Information on intra-household food consumption has not been collected because farmers never recorded horticultural products used for home consumption. However, farmers in the study villages have benefited substantially from the use of small-scale irrigation farming as most farmers (94.3%) acknowledged that household food security and cash income had improved through small-scale irrigation as compared to rain-fed farming. A good number of famers have indicated that small-scale irrigation farming had enabled them to have sufficient access to food (41.8%) and cash income (46.6%) at all times (Table 6).

Table 6. Number of Farmers benefited from small-scale irrigation farming (n =103)

Description	N	Percentage (%)
Benefited farmers	96	93.2
Non-benefited farmers	7	6.7
Farmers accessed to sufficient food		
Yes	43	41.8
No	60	58.3
Farmers accessed to cash income		
Yes	48	46.6
No	55	53.4

Source: survey data (2009/10)

3.7 Famers' mechanisms to cope-up with food insecurity

Farmers were asked how to cope-up with food and cash shortages. According to their response, the various mechanisms to cope-up with food and cash shortages were irrigation farming (94%), trading/shopping (52%), migration to urban areas (40%), remittance from urban relatives (32%) and staying occasionally with minimal food (23%) borrowing from close associates (16%) and charities (9%) were the alternatives available to them (Table 7).

Table 7. The various mechanisms farmers used to cope-up with food and cash shortage, the 2009/10 cropping year

Description	N	Percentage (%)
Irrigation farming	97	94.2
Trading or shopping	54	52.4
Migration to urban areas for off-farm work	42	39.8
Remittance from urban relatives	33	32.0
Staying occasional with minimal food	24	23.3
Borrowing	16	15.5
Donation/gift	9	8.7

* Farmers gave multiple responses

3.7 Household income

According to Food and Agricultural Organization (FAO, 1997), 30 to 40% of worldwide food production comes from an estimated 260 million ha of irrigated lands, or one-sixth of the world's farmlands. Irrigated farms produce 50-200% higher yields for most crops. Thus, irrigated farmlands are inherently more productive than rain-fed farming systems.

Farmers in the study area had reported that the main income sources were from farming, off-and non-farming activities. The farm income included the sales of rain-fed crops (wheat, tef, etc.), irrigated crops (vegetables, fruits, etc.) and livestock. Working as civil servant, guarding, and teaching were the major off-farm income, whereas, fattening livestock, petty trading and weaving clothes were the major income sources of non-farm activities.

The mean annual income earned per sampled household from farming, off- and non-farming activities was Birr 10,309.17 per annum. Of this total amount, small-scale irrigation farming income's share was 68.2% while the remaining 31.8% came from rain-fed farming, off- and non-farm activities (Table 8). One hectare of irrigated land, on average, generated an income of Birr 15,454.80 from sales of horticultural crops, whereas rain-fed farming gave only Birr 1,410.44 per hectare. To that effect, income from small-scale irrigation is significantly higher (P=0.024) than from rain-fed farming.

The effects of small-scale irrigation on food production and prices and employment opportunities are probably more important than direct benefits to irrigators.

Table 8. Mean income (Birr) per household from farming and non-farming activities, 2009/10 cropping year

Description	N	Mean	Std.dev.	Min	Max
1. Farm income					
Sale of rain-fed crops	78	2609.32	2401.01	270.00	11600.00
Sale of Irrigated crops	103	7031.92	3093.11	2000.00	16220.00
Sale of livestock	39	2272.00	2165.22	160	10000.00
Off-farm income	21	1029.05	1220.87	240.00	6000.00
Non- farm income	32	744.13	504.96	200.00	2800.00
Total income (Birr)	103	10309.17	5136.55	4246.31	32300.00

Source: survey data (2009/10)

3.8 Major constraints to small-scale irrigation farming

Sampled farmers were asked to rate the main constraints to irrigation farming. Among the ten possible constraints listed in the study, five were considered to be prominent constraints to small-scale irrigation farming. Lack of improved technology (85%) was the most important constraint during the survey period. Inadequate access to capital (82%) was the second important constraint. Traders' conspiracy (73%) to reduce the real market value of products and lack of market information (70%) were other constraints farmers face in using small-scale irrigation. To a very limited extent, inadequate extension contact and land tenure situation were also

indicated as limiting factors by 58% and 44% of the interviewed farmers, respectively.

Table 9. Constraints identified by farmers in the two villages in the promotion of small scale irrigation farming during 2009/10 cropping season

Constraints*	N	Percentage (%)	Rank
Unavailability of improved technology	88	85.4	1
Inadequate access to capital	84	81.6	2
Traders' conspiracy	75	72.8	3
Lack of market information	72	69.9	4
Inadequate extension contact	60	58.3	5
Land tenure situation	45	43.7	6
Farm locations	28	27.2	7
Transport problem	15	14.6	8
Instant & excess supply of products	12	11.7	9
Shortage of water	10	9.7	10

Source: survey data (2009/10)

** Farmers gave multiple responses*

4. RELATION OF SELECTED VARIABLES AND CONSTRAINTS TO SMALL-SCALE IRRIGATION FARMING

Hypothesis was set based on the objectives of the study to test relationship between selected variables and constraints to the promotion of small-scale irrigation farming. Multiple regressions were carried out to determine correlation (Table 10).

Table 10. Multiple regression results of selected variable and constraints to the promotion of small-scale irrigation farming during 2009/10 cropping season.

			Std. coefficients		
Model	**B**	**Std.error**	**Beta**	**T**	**Sig**
Constant	45.5	14.78		3.14	0.002
Age	-0.48	0.25	-0.22	-1.92	0.05*
Education	0.37	0.41	0.08	0.84	0.40
Farming experience	0.53	0.28	0.22	1.92	0.06*
Extension contact	9.14	4.01	0.24	2.28	0.03*
Lack of market information	2.19	2.04	0.11	2.07	0.29*
Land tenure situation	6.31	5.42	0.10	1.16	0.25

** Indicate statistically significant difference at 5% test level*

Data in Table 10 show that age, farming experience, extension contact and market information had significant influence on the promotion of small-scale irrigation farming. Age of farmers had a negative effect on small-scale irrigation farming. Meaning as age increases, farmers get difficulty to run small-scale irrigation as efficient as younger farmers. The younger the farmers, the more active and innovative they will be to promote small-scale irrigation farming.

5. CONCULSIONS AND PERSPECTIVES

Improving food security status: Data on intra-household food consumption was not collected because farmers do not record horticultural products used for home consumption. However, analysis of farmer's response had revealed that 42 and 47% of farmers in the two villages had access to sufficient food and cash income at all times by using small-scale irrigation. The results had also revealed that land size per household is positively associated with food security whereas irrigated area is an important determinant of cash income (68%), signifying that horticultural production in the study area is market-led. The larger the size of the irrigated lands the higher the food security and cash income per household.

The finding of this study revealed that age, farming experience, extension contact and market information significantly influenced activities of small-scale irrigation farming. The survey results had also revealed that small-scale irrigation could increase crop yield and consequently food security and cash income. However, a much more coherent farmer support program approach will be required. These include (i) increasing minimum irrigated land size of farmers so that they operate viably (ii) provision of fertilizer during off-seasons, and (iii) creating access to markets and regular financial assistance through micro finance to encourage small-scale irrigation farming, as these farmers are resource poor.

Improving cash income: The study confirmed that the use of fertilizer and timely watering were the most important parameters to increase yield of horticultural crops. Most farmers had benefited by being members of marketing cooperatives.

To make small-scale irrigation farming more productive, coherent farmer support program approach will be required. These include:

i) Increasing minimum irrigated land size for farmers so that they operate viably;
ii) Provision of effective extension services and provision of improved seed and fertilizer during off-seasons;
iii) Creating access to markets and regular financial assistance through micro-finance are also important stimulants for small-scale irrigation farming, as these farmers are resource poor; and
iv) Organizing the supply of inputs to farmers and the collection of outputs on contract basis makes small-scale irrigation farming viable and make them free from traders' conspiracy.

General observations

1. Major differences exist between the environment in which research is carried out and the practice of farming.
2. Horticultural crop production is viewed as a value-adding process and recognized as business and employment opportunities during the long dry season.
3. There is no mechanism for actors to communicate, to exchange ideas, knowledge, experiences and practices, and work in a more coordinated way.
4. There is a gap between the developed policies and the practices that work at grass-root level.

Implications of the study results

1. There is high potential in small-scale irrigation farming, but the capacity of DAs and capacity of farmers for investment are highly crucial.
2. Farmers are not able to use recommended level of fertilizer and improved seed because they simply cannot afford them.
3. There should be a win-win strategy to use new horticultural technologies. New technology can be more effective if there are subsidies for poor farmers to absorb the various risks encountered.
4. The policies and resolutions to develop small-scale farming are there, but the policies are not implemented at grass-root level and the parties to implement them are not clearly known.

5. Public-private partnership is needed to fulfill capacity gap in small-scale irrigation development.
6. More research work is needed in order to produce more food with less water (currently, excess water seems to be used to produce 1 calorie of food).

Finally, to sustain small-scale irrigation scheme in the study villages, regular maintenance of the existing irrigation infrastructure, provision of transport and access to market are critical. Effective use and an equitable water distribution become indispensible to further expand the irrigated area. Especially, when water becomes scarcer, it is essential to expand the irrigated area without a substantial increase in total water consumption.

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