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Assess the adoption rate of micro-irrigation technologies on apple and grape orchards: A case study of district Quetta Balochistan, Pakistan

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Abstract

In order to determine the perceived perceptions of the farmers regarding assess the adoption rate of micro-irrigation technologies on apple and grape orchards at district Quetta Balochistan present study was carried out. One 100 growers who adopted the modern irrigation technique were purposively picked by utilizing the sample random sampling. The result reveals that most (50%) of the growers were fall in age category (19 to 30). Most (50%) of the growers were illiterate. Most of the growers were male. Most of the growers were viewed that the water saved at 39%, enhancement of yield 23%, and improvement of irrigation efficiency 12% respectively. Most of the growers were perceived that they had problem in following areas such as quality of the material 46%, insufficient after sale/installation service 20%, and damage of plastic material 20% respectively. Most of growers were perceived that micro-irrigation input cost / acre of apple and grape orchards had increased 12%, and water requirement application 18%. The ratio of adoption of micro-irrigation on apple and grape orchards in Quetta District had enhanced (14%), and number of apple and grape orchards installed/connected with micro-irrigation 9% respectively. Most of the growers were perceived that they adopted the drip-irrigation technology (70%).So as to improve water use efficacy farmers have to plan their cropping pattern well in advance on the basis of water availability. Based on achieved results following recommendations put forward. The farm mechanization and type of irrigation must be modernized. Instead of flooding system of irrigation the drip irrigation for apple and grapes should be recommended.The farmers must plan well in advance about the cropping pattern for the agricultural year.The government subsidies in purchasing these irrigation implements will help the farmers to buy them at affordable prices and institutional financingshould also be available to purchase these implements so that increase the food security options for the masses.

Keywords: micro-irrigation, measure, adoption rate, apple, grape, Quetta Balochistan.

Overview

Agriculture is the life saver and income generation figure of as massive aspect of Pakistan's economy that representing the nineteen point five or (19.5%) of the total GDP, contributing 42.3% percent of the work forces and giving crude as raw material for a few value-added as divisions/ sectors. It in this way the agriculture sector plays a focal or dominant starring role in nation-wide improvement poverty eradication and nutrition safety. The present administration is centring toward build profit for cultivators from side to side significant framework speculations counting dependable means of transport systems as well as other structure hinders for present day source as the supply chains. *China-Pakistan Economic Corridor (CPEC)*will go far in the improvement of agroindustry profits by rhythm the value-added invention modernization items, development in additionto supply chain network as reported by economy Survey of Pakistan (GoP, 2016-17).

Throughout the year of (2016-17) execution of the agriculture sector as the farming part stayed up to mould and accomplished target of 3.46% against the objective of 3.5% and the last year the minor development occurred (0.27%). This was conceivable by better collecting of tangible products as the major crops (wheat, rice, cotton sorghum, corn etc.) through more prominent accessibility of horticulture inputs like water, agribusiness credit and concentrated manures off take. The development in produces was itemised at 3.02% in contradiction of the adverse development of 4.97% in a similar period a year ago (GoP, 2016-17).

Irrigation ailment

Monsoon and rainstorm period (July-August-September) in the year of 2016, the typical usual precipitation or torrential rain is 140.9 mm, whereas real precipitation got was and rained in 176.2 mm, which is decreased as the 25.1 percent upstairs ordinary precipitation. For duration of winter period (October-November-December) in the year of 2016, typical precipitation is 26.4 mm, despite the fact that the unpretentious precipitation got was remained as 3.0 mm, beneath ordinary precipitation. Throughout winter time or season in the year of 2017 (January-Feb-March), typical usual precipitation is 74.3 mm in addition the average precipitation got was 1.6% over ordinary usual precipitation (GoP, 2016-17).

Water part's as a sector present and future systems/procedures are away to meet the expanding pit amongst request and supply. It bases on two dimensional procedures; an) ask for organization and b) overhauling the water availability. The frameworks are to begin promote forces to change over water from social elements to budgetary elements. The specific course of action will be established on Integrated Water Resources Management (IWRM) approach. A measure of Rs.31.716 billion was distributed for water area's improvement ventures/programs amid the FY 2016-17, out of which more than Rs.24.00 billion (76 percent) are required to be used before the finish 2017 (GoP, 2016-17).

Irrigation practice dynamics

Water system progressions inside the most recent decade have been dumbfounding. Miniaturized scale water system is one of the most recent developments for applying water and it speaks to a clear progression in water system innovation. It can be characterized as the continuous use of little amounts of water on or beneath the dirt surface as drops, minor streams or smaller than expected splashes through producers or instruments put along a water conveyance sidelong line. It contrasts from sprinkler water system by the way that lone piece of the dirt surface is wetted. Small scale water system envelops various techniques or ideas, for example, bubblers, dribble, stream, fog or splash and subsurface water system.

Surface Drip Irrigation

Utilization of water to the dirt surface as drops or small streams through producers with release rate for point – source producers under 8 l/h for single outlet producer and for line-source producers under 4 l/h. Frequently the terms dribble and stream water system are viewed as synonymous.

Subsurface Drip Irrigation

The use of water beneath the dirt surface through producers, with release rate for the most part in the scope of 0.6 to 4 l/h. This strategy for water application is not the same as and not to be mistaken for the technique where the root zone is inundated by water table control, in this alluded to as sub water system.

Spray Irrigation

The use of water by a little shower or fog to the dirt surface, water travel through the air ends up instrumental in the appropriation of water. In this class two sorts of gear are in viz., miniaturized scale sprayers and smaller scale sprinklers. Small scale sprayers and static miniaturized scale planes are non-pivoting type with stream rates extending from 20 to 150 l/h, while, smaller scale sprinklers are turning compose with stream rates running from 100 to 300 l/h.

Bubbler Irrigation

The use of water to the surface at a little stream or wellspring where the release rate for point source bubbler producers are more prominent than the dribble or subsurface producers however by and large under 225 l/h. Since the producer release rate for the most part surpasses the rate of the dirt, a little bowl is generally required to contain or control the water.

Enhanced plant development, yield and quality

The dirt water content in a segment of the plant root zone remains genuinely steady since water system water can be provided and as often as possible at a foreordained rate utilizing trickle water system. For the most part, the aggregate soil water potential expands (the dirt water suction diminishes) with end of the wide changes in the dirt water content, which regularly result from traditional sprinkler and surface water system techniques (Bresler, 1977). Under customary water system strategies plants remove water from the dirt from Field Capacity down towards permanent shrivelling point. Amid this progress in the dirt dampness, it turns out to be progressively troublesome for the plant to remove water and consequently the immoderate water utilize rate diminishes. This diminishment in water utilize joined by a lessening in development of the plants brings about decreased yields. In a perfect world to accomplish most extreme yields the dirt dampness level ought to be somewhat beneath field limit. The trickle water system framework with its controlled utilization of water makes conceivable the undertaking of keeping up the dirt dampness near the field limit, therefore bringing about recognizable increment in development and yield.

There is a general understanding that water system water prerequisites can be less with dribble water system than with traditional surface and sprinkler water system techniques (Aljibury et al., 1974; Davis et al., 1975; Shoji, 1977; Bresler, 1977; Hillel, 1980; Howell et al., 1980). The investment funds, obviously, rely upon the harvest, soil, ecological conditions and the achievable on-cultivate water system effectiveness. Essential reasons given for the water investment funds incorporate water system of a little bit of the dirt volume, diminished direct soil surface dissipation, decreased water take-up by weeds because of dry surfaces between columns/trees (Lemon, 1956), lessened water system spill over from the field (the dry soil between lines could likewise store more precipitation), avoidance of overflow from soak slopes and especially for low porousness or crusted soils (Kemper and Noonan, 1970) and controlled profound permeation misfortunes (Rawlins, 1973) particularly on sandy soils (Reddy et al., 2004) underneath the yield root zone. Sprinkler water system is liable to water misfortune by wind float, expanded dissipation, or poor application consistency, particularly with solid breezes (Seginer, 1969). Encourage the expansion in yields joined with water investment funds brings about higher water utilize productivity (WUE).

Table-1, Drip irrigation with the term of yield improvement

Crops	Yield (t/ha)		
	Conventional	**Drip**	**% yield increased**
Banana	57.5	87.5	52
Grape	26.4	32.5	23
Sweet lime	100.0	150.0	50
Pomegranate	55.0	109.0	98
Papaya	13.4	23.5	75
Tomato	32.0	48.0	50
Water Melon	24.0	45.0	88
Okra	15.3	17.7	16
Chillies	4.2	6.1	44
Sweet potato	4.2	5.9	39
Sugarcane	128.0	170.0	33
Cotton	2.3	2.9	26

Source: INCID. 1994. Drip Irrigation in India. Indian National Committee on Irrigation and Drainage, New Delhi.

Problem statement

Balochistan province was viewed as the underprivileged province of Pakistan and having has the inferior Human Index (HI) such as absence of safety and security, not as good as communication configurations, thrilling poverty, low education opportunity for the female in rustic areas, gender bias, tribalism, inferior infrastructure, political preference, eliminate the female part in the decision-making process. Agriculture sector is the prime standing as eminence figure for livelihood options for the rural masses. The department of agriculture provide the advisory services for the stakeholders like farmers but unsuccessful fruits of these effort did not ingathered as yet (Mengal *et al.*, 2012; Mengal *et al.*, 2014).. That indicate there was gap between technology dissemination and adoption process. Hereafter, keeping in the view or opinion, present study was carried out so as to elicit those areas whereby the support with the term of adoption rate as dependent variable was determined. Therefore, present research was concentrated to assess the adoption rate of micro-irrigation technologies on apple and grape orchards at district Quetta Balochistan.

Purpose of study

Overall concentration of present study was to assess the adoption rate of micro-irrigation technologies on apple and grape orchards at district Quetta, Balochistan.

Objective

1. To discover the perceived perception of growers as demographic characteristics.
2. To measure the adoption rate of micro-irrigation technologies on apple and grape orchards growers in Quetta district.
3. To develop the material suggestion for the policy-makers and stakeholders regarding modern-micro-irrigation technologies.

Methodology

Philosophy of research methodology one of the basic part of any research enquiry either qualitative or quantitative perspective.

Target population

It is imperative to have an outline of the investigation step together with its demography measurements and wide range confirmation of the shared traits. This examination was carried out in Quetta city. 100 respondents who adopted the modern irrigation technique were purposively picked by utilizing the sample random sampling. The target population was determine the table of Wunsch, (1986) for "sample size form given population".

Questionnaire advancement

A comprehensive questionnaire was developed so as to gather the data at field level.

Data gathering

Face–to-face communication or process was deemed to fit. Open ended interview as preferred to obtain the orchard grower shaving modern irrigation technique perceptions.

Analysis of information

The data was analysis by utilizing the (SPSS) Statistical Package for the Social Sciences and *t-test*, was calculated so as to detect the perception variations.

Results

Present study was determine the perceived perceptions of the micro-irrigation techniques in purposively district of Quetta due to the facts most of the modern irrigation techniques were install at field in the respective district. In this regard, demographic information was also obtained and analysis with the help of SPSS, so as to examine the perception of the respondents about socio-economic condition, their profile and other pertinent information.

Table-1,Distribution of sample according to age.

S. No	Educational level	*Frequency*	%
1.	Up to 18	13	13.0
2.	19 to 30	19	19.0
3.	31 to 40	50	50.0
4.	41 and above	18	18.0
Total		**100**	**100.0**

Age composition was the imperative aspect of the present study. In this regard, the data was collected at field level. The results of table-1 shows that most (50%) of the growers were fall in age category 19 to 30. While 19-18% of the adoption of micro-irrigation techniques (farmers) were having 19 to 30 and 41 and above years of age respectively.

Table-2,Distribution of sample according to educational profile.

S. No	Educational level	*Frequency*	%
1.	Illiterate	50	50.0
2.	Matriculation	18	18.0
3.	Intermediate	12	12.0
4.	Graduation	9	9.0
5.	Master	7	7.0
6.	Others	4	4.0
Total		**100**	**100.0**

Education as encouragement tool was to bringing about desirable modification of human attitude. The outcome of the present study reveals that most (50%) of the growers were illiterate. Followed by 18% of the growers were perceived that they have matriculation certificate. While most (12%) of the growers were perceived that they have Intermediate certificate. Only 7% of the growers having master degree.

Table-3,Distribution of sample according gender.

S. No	Educational level	*Frequency*	%
1.	Male	100	100.0
2.	Female	00	00.0
Total		**100**	**100.0**

Most of the growers were of the view that they were male as shown in table -3. In this regard, there were no any female growers were go-out in the study area.

Table-4, Distribution of sample according to effectiveness of irrigation system.

S. No	Educational level	*Frequency*	%
1.	Water saving	39	39.0
2.	Control of weeds	5	5.0
3.	Enhanced yield	23	23.0
4.	Reduction in plant protection measures	8	8.0
5.	Improvement of irrigation efficiency	12	12.0
6.	Saving in labour	5	5.0
7.	Improvement in fertilizer use efficiency	8	8.0
Total		**100**	**100.0**

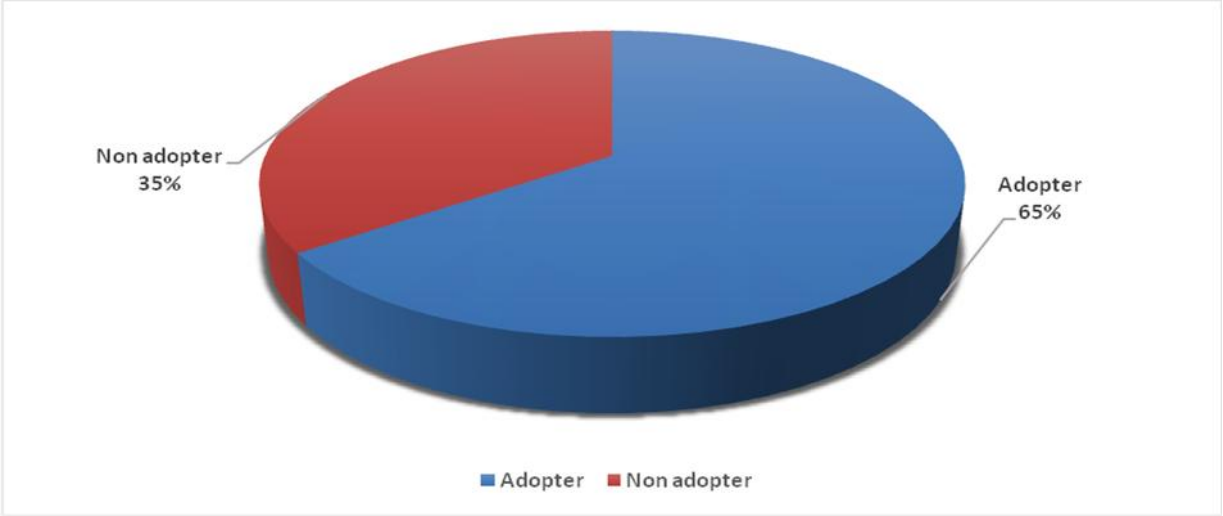
The growers were asked to deliver their perception about the effectiveness of the irrigation system as shown in table-4. Most of the growers were viewed that the water saved at 39%, enhancement of yield 23%, improvement of irrigation efficiency 12%, reduction in plant protection measures 8%, improvement in fertilizer use efficiency 8%, control weed 5% and labour saving % separately.

Table-5,Distribution of sample according to their problem.

S. No	Educational level	*Frequency*	%
1.	Extension wing services	2	2.0
2.	Insufficient after sale/installation service	20	20.0
3.	Quality of the material	46	46.0
4.	Lack of adequate technical knowledge	8	8.0
5.	Clogging of drippers	5	5.0
6.	Damage of plastic material	9	9.0
7.	Life of the system	10	10.0
Total		**100**	**100.0**

Perceived perception regarding problem of system irrigation was determine by using the comprehensive questionnaire as shown in table-5. Most of the growers were perceived that they had problem in following areas such as quality of the material 46%, insufficient after sale/installation service 20%, damage of plastic material 20%, life of the system 10%, lack of adequate technical knowledge 8%, clogging of drippers 5% and extension services 2% respectively.

Figure-1, Distribution of sample according adopter and non- adopter growers



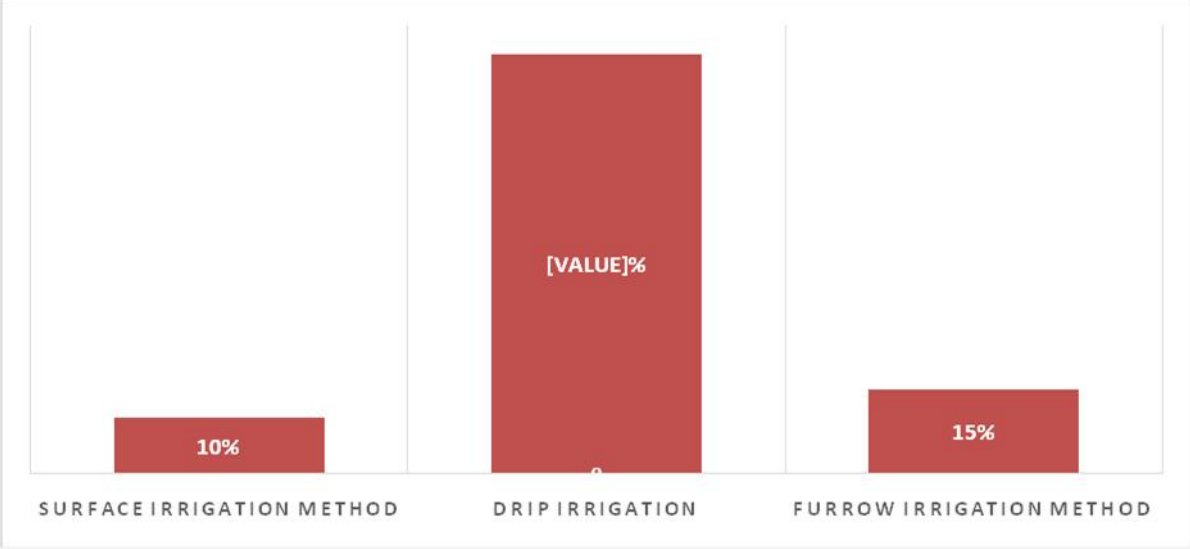
The results of figure-1 shows that majority (65%) of the growers were adopted the modern irrigation technology the remaining were 35% who did not adopted the modern irrigation technology.

Table-6, Distribution of sample according different variables as items.

S. No	Educational level	*Frequency*	%
1.	Number of apple and grape orchards installed/connected with micro-irrigation	9	9.0
2.	Water requirement application of apple and grape orchards.	18	18.0
3.	Water saving percentage of apple and grape orchards.	7	7.0
4.	Ratio of adoption of micro-irrigation on apple and grape orchards in Quetta District.	10	10.0
5.	Micro-irrigation input cost / acre of apple and grape orchards.	12	12.0
6.	Farmer's views percentage of adoption of micro-irrigation.	8	8.0
7.	Efficient ratio of micro-irrigated apple and grape orchards.	5	5.0
8.	Yield/hectare of micro-irrigation adopted apple and grape orchards.	14	14.0
9.	Total area (in hectares) cultivated under micro-irrigation of apple and grape orchard in Quetta District.	8	8.0
10.	Total production (in tonnes) of apple and grape orchards cultivated under micro-irrigation in District Quetta.	9	9.0
Total		**100**	**100.0**

Perceived perception regarding problem of system irrigation was determine by using the comprehensive questionnaire as shown in table-6. Most of the growers were perceived that they various concepts about irrigation related variables such as micro irrigation input cost / acre of apple and grape orchards.12%, water requirement application of apple and grape orchards.18%, yield/hectare of micro-irrigation adopted apple and grape orchards. 14%, ratio of adoption of micro-irrigation on apple and grape orchards in Quetta District 14%, number of apple and grape orchards installed/connected with micro-irrigation 9%, total production (in tonnes) of apple and grape orchards cultivated under micro-irrigation in District Quetta 9%, total area (in hectares) cultivated under micro-irrigation of apple and grape orchard in Quetta District 8%, farmer's views percentage of adoption of micro-irrigation 8%, water saving percentage of apple and grape orchards 7% and efficient ratio of micro-irrigated apple and grape orchards 5%.Life of the system 10%, lack of adequate technical knowledge 8%, clogging of drippers 5% and extension services 2% respectively.

Figure-2, Distribution of sample according adopter of modern irrigation growers



Most of the growers were perceived that they adopted the drip irrigation technology (70%). Followed by 15-10% of the growers were agreed that they were adopted the furrow irrigation and surface irrigation method.

Conclusion and Recommendations

Noted benefits due to micro-irrigation technology are increase in yield, improvement in the Micro-Irrigation: An Efficient Technology and water use efficiency, reduction in the cost of water, fertilizers and manures and weed removal. All these added up in the increase in the overall economic benefits accrued due optimum utilization of water. Since the technology offers higher benefits like irrigation efficiency. This technology is highly relevant and praise worthy. Micro-irrigation is an intervention to address various issues of agricultural growth and hence it is considered as a leveraging technology to sustainable agriculture. Farmers was adopt the technology if economic return is more. Hence economic considerations can be incorporated with more engineering approaches to keep water productivity more relevant in economic criteria.

Recommendations

Following recommendations were put forward:

So as to improve water use efficacy farmers have to plan their cropping pattern well in advance on the basis of water availability. This necessitates selection of appropriate variety of crops and fruits. The farm mechanization and type of irrigation must be modernized. Instead of flooding which is a popular methods of irrigation farmers can switch on to drip irrigation for apple. The technology adoption is very important to develop water use productivity. Modern irrigation techniques like drip irrigation as well as sprinkler can be used by the farmers. The government subsidies in purchasing these irrigation implements will help the farmers to buy them at affordable prices and institutional finance is also available to purchase these implements. The government should strengthen the irrigation system. These initiatives are posing food security to the farmers.

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