

ADOPTION OF DRIP IRRIGATION IN SUGARCANE – A PERFORMANCE ANALYSIS

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ABSTRACT

The present investigation was carried out to analyze the socio-economic status of the sugarcane growers who laid drip irrigation system to know their perception of advantages related with the technology in sugarcane, and to identify the constraints in adoption by interviewing 60 growers from district Faisalabad. It was found that drip irrigation technology was popularized among the farmers of all income levels and low-income level was not a constraint for adoption of this technology due to loan arrangements from government institutions. The water saving measures apart from drip irrigation adopted by the respondents included trash mulching, application of additional potash and alternate furrow irrigation. However, after adopting drip irrigation, all the respondents realized water and labor saving and 91.33 per cent farmers obtained higher cane yield than conventional flood irrigation with reduced impact of drought. On average, the respondents got 29.75 per cent increase in cane yield compared to normal irrigation methods. The constraints encountered by most of the respondents in adoption were clogging of drippers, damage of lateral tubes during harvest, rat damage and poor after sales service. In spite of these constraints, all the farmers favored the continued adoption of this technology. The study also helps to get a better understanding of the performance of drip irrigation in farmer's fields and their apprehensions of this fast-spreading technology in sugarcane.

Keywords: Sugarcane; Drip irrigation system; Advantages; Constraints; Economics;

INTRODUCTION

Sugarcane originated in the wet tropics and so to achieve maximum yield, it requires an abundant supply of water, either as rainfall, irrigation or a combination of both. Under normal growing conditions, around 10 tons of cane are produced for each mega liter of soil water used. Conversely, moisture stress reduces cane yield to a significant level. Consequently, managing available water resources is one of the keys to profitable sugarcane production (Rogers, 2014).

Water is a precious natural

resource in the world and of the available water, the major share is used for agriculture and allied activities (Karpagam *et al.*, 2013; Swetha *et al.*, 2019). Given the water scarcity for irrigation and fast decline of available irrigation potential, it is a matter of concern whether cultivating sugarcane under conventional surface method irrigation is desirable for achieving sustainable agricultural development. One of the methods recently introduced in Pakistan agriculture to increase water use efficiency is drip system of irrigation. Unlike conventional flood irrigation, under drip method of

irrigation, water is supplied directly to the root zone of the crops through a network of pipes, which saves enormous amount of water by reducing evaporation and distribution losses (Rajula Shanthi and Ramanjaneyalu 2016).

In Faisalabad district, the area under sugarcane has declined due to continuous drought and production has also declined considerably. Recent trend in Faisalabad shows a stagnated yield level of around 70 t/ha and tends to decline further due to inadequate irrigation water and erratic monsoon. This situation has created a need to improve sugarcane

productivity to meet the increasing rate of domestic consumption requirement. Sociological studies among cane growers have revealed the prevalence of a wide technological gap as well as yield gap in sugarcane that leads to reduced production and productivity. It is possible to increase the productivity of sugarcane crops through adoption of recommended scientific modern technologies, of which micro irrigation is promising. This technology is not just to save irrigation water, but it is meant for high productivity particularly when it is being combined with fertigation. Keeping this in view, the present investigation attempted to know the profile of drip laid farmers, their perception related with the technology in sugarcane, the profit/loss incurred due to laying of drip irrigation system and further to help to understand the field level problems in drip irrigation.

Methodology

The study was conducted among the regular cane growers of Faisalabad who laid drip irrigation. The average cane yield level recorded in the reserved area of the mill was 60.00 t / ha as against the country average yield of 68 tons per hectare during 2019-20. This area was purposively selected because this area normally

recorded moderate level of sugarcane yield. The other considerations were that drip irrigation system (DIS) for sugarcane was laid since 2017 and there is an urgent need to assess the feedback from farmers to fine-tune the system and popularize it among other cane growers to increase the productivity of sugarcane. The particulars of the farmers were collected using an interview schedule, sociological appraisal was done through focus group discussions/ observations and yield data were recorded from the individual farms. The data collected were tabulated and analyzed using descriptive statistics.

RESULTS AND DISCUSSION

Demographic profile of sugarcane farmers adopting drip irrigation system: Demographic profile of the respondents indicated that they were mostly middle aged (35-50 years: 40.00%) to old aged (>50 years: 26.73%) and literates with up to secondary education (73.66%); Agriculture was the main occupation for all the respondent farmers and 53.33 per cent had up to 25 years of farming experience; 33.3 per cent had 21-25 years of experience in sugarcane farming. Majority of them (76.3%) owned 2-4 acres of land. Over half of the respondents (55%) were self-

sufficient in implement possession while others either fully or partially depended on hiring. Crop rotation was followed by all the respondents with fodder, pulses, sesamum or canola. Over three-fourth (78.33%) of the respondents owned livestock such as cows, buffaloes, goats, sheeps and poultry for additional source of income, apart from their own use; Mass media channels used by the respondents were mobile phones, television and newspaper; All the respondents possessed mobile phones, television and a great majority of them (97%) watch television regularly. This indicated a deep penetration of television in rural areas and television was the main entertainment for them. Regarding newspapers, it was observed that around 33.33 per cent of respondents were regular subscribers of newspapers. The majority (68.3%) of them had medium level of social participation as they were more into agriculture. Water saving measures adopted by the respondents: Drip irrigation is a technology introduced in the district in 2018, though drip irrigation for sugarcane was recommended from 2015 itself in Faisalabad. The water saving measures as adopted by the respondents are given in Table-1.

Table-1 Adoption of various water saving measures (N=60)

Water saving measures	No	%
Trash mulching	30	50.00
Application of additional potash	8	13.33
Alternate furrow irrigation	35	58.33
Drip irrigation	60	100

Table-1 reveals that all the respondents adopted drip irrigation system, as the respondents were drip laid farmers. More than half (58.33%) of the respondents followed alternate furrow irrigation and half (50%) of the respondents followed trash mulching to conserve water. Though application of additional potash (60 kg) to mitigate drought was very well popularized among the respondents, only a meagre of 13.33 per cent followed additional potash application to withstand the drought. Nevertheless, drip irrigation was accepted as the best water saving measure than trash mulching, additional potash application and alternate furrow irrigation. These findings are in line with that of Haplin *et al.*, 2008 and Kaushal *et al.*, 2012 wherein they reported that adoption of drip irrigation (surface or

subsurface) system in sugarcane is technically feasible, economically viable and needs to be strongly followed by the growers. Sources of information about drip irrigation: Various sources are available to disseminate a new technology in agriculture such as mass media like television, newspapers, posters, literatures, meetings and extension agencies like agricultural department, sugar mill cane department, sales department of drip irrigation company and scientists from various institutions. This study indicated that all the respondents got information about DIS from the cane department of sugar mills and research institutes. The role of agricultural department officials was very little (30%). After laying DIS, the respondents had doubts regarding the function and

maintenance of DIS; Majority of the respondents (83.33%) contacted Cane Assistants and Cane Officers of sugar mills for additional information about drip irrigation technology. However, the respondents depended fully on drip irrigation company officials for trouble shooting; but many times they did not get timely help to clarify their doubts.

Advantages of drip irrigation: For any new innovation, there are some advantages and disadvantages during and after adoption. If the advantages of the new technology are more than its disadvantages, then it leads to adoption of that technology. The respondents were asked to enlist advantages in drip irrigation with an open-ended schedule (Table-2).

Table-2 Perception of the respondents regarding advantages of drip irrigation technology (N=60)

Advantages	No	%
Saving in labour cost	60	100.00
Huge water saving	60	100.00
Higher cane yield than normal irrigation	59	98.33
Reduced impact of drought	59	98.33
Efficient use of fertilizer	58	96.67
Availability of water for raising another crop	57	95.00
Less evaporation loss of water	57	95.00
Avoidance/ Minimize weeds	55	91.67
Possibility of multi-ratooning	26	43.33
Drip system handling is easy irrigation	10	16.66

The advantages were perceived by the respondents after laying DIS and they have more than two years of exposure in DIS. The technology was popularized by mainly focusing on water saving and yield increase

concepts and accordingly, the respondents perceived its main advantages were water and labor saving in guiding irrigation. Labor saving was ranked first among the advantages of drip irrigation. The district experiences a

huge shortage in labor force for agricultural operations due to industrialization.

Water saving is also prime among the advantages of drip irrigation. All the respondents felt that, they experienced

around 30-40 per cent water saving by adopting DIS. The respondents were able to irrigate their entire crop even during summer months and whenever they experienced severe drought, protective irrigation was made possible. Much emphasis is given on the yield increase compared to conventional irrigation system and the respondents also had a similar perception. Almost all the respondents accepted yield increase in sugarcane due to the adoption of drip irrigation. Hardly one respondent got a reduced yield compared to conventional irrigation method and this was due to lack of proper maintenance of drip system and lack of fertigation. Studies have indicated a possibility of getting up to 200 t/ha yield under drip fertigation system. Singandhupe *et al.*, (2008) reported that drip irrigation produced 13-20 per cent higher cane yield than furrow irrigation with high water use efficiency.

The respondents also felt that application of fertilizers through drip irrigation was very easy and economical though they did not realize it prior to adoption. The respondents applied urea and white potash through DIS and felt it to be labor saving and economical. Flexibility in fertigation time was also a main reason for adoption. The respondents were able to fertigate their crop even during night hours. It also avoided wastage of fertilizers and increased fertilizers use efficiency.

Even though the majority of

respondents had small land holdings, they area was restricted due to lack of irrigation water and difficulties in managing their entire farm. Most of them adopted DIS in a part of their land. The respondents were able to increase their cultivable area due to adoption of DIS and it was realized by 95 per cent of respondents.

Limited wetting of soil though drip irrigation has minimized weed growth. Also, reduced hand weeding resulted in labor saving and effective utilization of water and nutrients by sugarcane crop by avoiding weed compaction. Nearly 91.67 per cent of the respondents perceived that there was reduction in weed growth compared to conventional irrigation methods.

The respondents felt that multi-ratooning was possible through drip irrigation. As the life of the drip system was 10 years assured by the micro irrigation company officials, at least six ratoons need to be taken through drip irrigated fields.

Constraints in drip irrigation: when farmers adopt a new technology on a large scale, they face a lot of problems which they may or may not realize. Any attempt made by the researchers to eliminate these constraints will result in increased adoption of technologies of recommended practices which will ultimately lead to increase in production, productivity and improved sugar recovery. Farmers will get monetary benefits with a

reduction in cost of production.

Clogging in drippers: Half of the respondents felt that clogging in lateral drippers was the main constraint; Even though the majority of the respondents were using good quality irrigation water, clogging is inevitable. The presence of certain salts can cause either partial (or) complete blockage of drip system. Respondents felt this as the major constraint due to lack of availability of acid for treatment, lack of knowledge about the acid treatment and iron fertilizer tank provided by some companies were not suitable for acid treatment.

Lateral damage during harvest: Around 43.3 per cent of respondents indicated that damage of laterals during sugarcane harvest was yet another major constraint. Sugarcane was harvested mainly on contract basis and the cutting laborers never bothered about the damage of laterals during harvest. Non-detrashed plot and lodged cane added to the severity of the problem. Removal of laterals before harvest was also not possible due to the lodging nature of the cane.

Rat damage: Nearly one-third of the respondents (30%) expressed rat damage as a serious problem in DIS. They cut the laterals, that leads to stoppage of irrigation water after the point of cut and cane starts drying in patches. During later stage of crop growth, the respondents could not go inside the field and verification of drippers

was found very difficult. Hence, all end caps had to be removed and checked periodically to access any rat damage in laterals.

Poor after-sales service: One fifth (20%) of the respondents experienced poor after-sales service by the drip irrigation company after installation. Some companies never turned up for after-sales service after installing their system.

Yield not up to expected level: The respondents adopted DIS with an expectation of increase in sugarcane yield compared to normal irrigation. But 16.7 per cent of the respondents complained that the yield increase was not up to their expected level.

Cost benefits ratio not economical: Laying of DIS involves huge capital investment and incur expenditure on maintenance of the system as well. Around 13 per cent of respondents felt that, the cost-benefit ratio was not economical.

Sand filter damaged within a year: Around 7 per cent of the respondents reported that the sand filter was damaged within a year due to rust. This showed the inferior quality materials supplied by the Drip Irrigation Company and poor after-sales service.

Miscellaneous constraints

Some micro irrigation companies supplied very poor-quality valves which broke due to frequent handling and the designing was also not proper.

Non availability of soluble white potash leads to non-

application of potassium fertilizer. Some respondents observed that, the drip water was not sufficient for sugarcane crop due to poor outflow from drippers and sandy nature of the soil. Distance between laterals adopted was 1.95 to 2.10m. Respondents observed that due to wider spacing between dual rows, cane population reduced leading to reduction in yield. Few respondents have modified the lateral spacing to 1m single row planting.

Another constraint noted by the respondents was reduced water pressure at lateral ends. This leads to insufficient wetting at the end of the field. Lateral pressure should be maintained at not less than 0.8 kg/cm² by checking with a hand-held pressure gauge periodically. Relationship between socio-economic profile of respondents and adoption of DIS: Correlation analysis was done to find out the relationship between the socio-economic

characteristics of the respondents with their level of adoption of drip irrigation. Twelve independent variables were selected for the study, of which except crop rotation followed, all the other eleven variables had positive correlation with the level of adoption of drip irrigation. Though the respondents had a wide choice of crops, a negative relation was seen. Independent variables viz., occupational status, size of land holding, experience in sugarcane cultivation, farm implement possession and social participation showed

positive significant relation with adoption of DIS. Farmers with more than 15 years of experience in sugarcane farming were widely prevalent in the sample and they tried to increase cane productivity by following the latest technologies.

Economics involved in drip irrigation: The yield increase in drip irrigation field (average of one plant and one ratoon crop) was compared with yield obtained in previous years under conventional irrigation methods. The data indicates that 96.67 per cent of the respondents obtained increased cane yield under DIS compared to normal flood irrigation that proved the feasibility and relative advantage of this technology. 65 per cent of the respondents could get 11-30 t/ha additional cane yield and 11.67 per cent got 31-40 t/ha increased yield. The range of increased yield obtained by respondents was 2 to 42 per cent. Overall yield analysis (n=60)

- Average yield obtained by the respondents through conventional irrigation = 72.20 t/ha
- Average yield obtained by the respondents through drip irrigation = 99.63 t/ha
- Yield increase = 27.43 t/ha
- Percentage of yield increase due to adoption of drip irrigation = 29.75 per cent

Respondents on average could get a 29.75% yield increase due to adoption of drip irrigation.

CONCLUSION

Drip irrigation for sugarcane cultivation is perceived as an essential foundation for sustainable sugarcane cultivation as water is

becoming a scarce commodity. Drip irrigation is an important viable technology for water conservation, labor saving and to overcome water stress during drought situations. The

feasibility of drip irrigation in sugarcane should be assessed and utilized along with other advanced technologies for increased productivity and judicious use of water.

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