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Cost Effectiveness of Non-Subsidised Drip over Subsidised Drip Irrigation System

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ABSTRACT

Water is very important in our life without water human beings we cannot survive. Water is needed in agricultural field, industrial field and in daily use. In agricultural field micro irrigation is very important it saves much water; Realising the significance of using micro irrigation system as a demand management strategy, an attempt has been made in this chapter to examine the social benefit-cost analysis of drip irrigation. As found in many earlier studies, the drip irrigation resulted in significant increase in yield over the flood method of irrigation. The social benefit-cost analysis revealed that the social benefits exceed the social costs in the water and labour scarce regions. Thus, one can conclude that the drip irrigation is a viable and more beneficial in regions where there is more water scarcity. Therefore, we decided to do drip irrigation design and cost analysis of PVC pipes and flexi lay flat pipes in area of "Genba Sopanrao Moze Institute of Technology" of size55.5×72.5 m we did design, cost analysis and as well as comparison between ISI(subsidized) and NON-ISI (non-subsidized) which sufficient, economical for farmers and easy to install. As we get result that lay flat pipes are more economical than PVC pipes, If PVC pipes of size of 800µ (micron) are used government grant them subsidy, if pipe size is less than 800µ (micron) government did not grant the subsidy. Generally, farmers accept Subsidized Rigid lateral and PVC pipes because government approve them subsidy and it has more life then lay flat but government does not allow subsidy above 10 ha. And subsidy process is to late farmers has to pay first and government return them 50% subsidy but it takes 6 months. As we compare cost of two pipes of drip irrigation system we got cost difference of 44% of total amount.

Keywords: Subsidized, Non-Subsidized, Lay flat Pipe

I.INTRODUCTION

1.1 WHAT IS DRIP IRRIGATION?

Drip irrigation is applying small amounts of water and fertilizer uniformly across a specific area. The water and fertilizer are delivered directly to the crop root zone, eliminating runoff, evaporation, and drift. A properly designed and managed drip irrigation system gives producer the best uniformity and application efficiency available, consequently saving them time, energy, and water all while maximizing yields. Drip systems often mix liquid fertilizer with the irrigation water. This is called fertigation; fertigation and chemigation (application of pesticides and other chemicals to periodically clean out the system, such as chlorine or sulfuric acid) use

chemical injectors such as diaphragm pumps, piston pumps, or aspirators. The chemicals may be added constantly whenever the system is irrigating or at intervals. Fertilizer savings of up to 95% are being reported from recent university field tests using drip fertigation and slow water delivery as compared to timed-release and irrigation by micro spray heads. Properly designed, installed, and managed, drip irrigation may help achieve water conservation by reducing evaporation and deep drainage when compared to other types of irrigation such as flood or overhead sprinklers since water can be more precisely applied to the plant roots. In addition, drip can eliminate many diseases that are spread through water contact with the foliage. Finally, in regions where water supplies are severely limited, there may be no actual water savings, but rather simply an increase in production while using the same amount of water as before.

1.2 SUITABILITY

Crops suitable for Drip Irrigation System

1	Orchard Crops	Grapes, Banana, Pomegranate, Orange, Citrus, Mango, Lemon, Custard Apple, Sapota, Guava, Pineapple, Coconut, Cashewnut, Papaya, Aonla, Litchi, Watermelon, Muskmelon etc.
2	Vegetables	Tomato, Chilly, Capsicum, Cabbage, Cauliflower, Onion, Okra, Brinjal, Bitter Gourd, Ridge Gourd, Cucumber, Peas, Spinach, Pumpkin etc.
3	Cash Crops	Sugarcane, Cotton. Arecanut, Strawberry etc.
4	Flowers	Rose, Carnation, Gerbera, Anthurium, Orchids, Jasmine, Dahilia, Marigold etc.
5	Plantation	Tea, Rubber, Coffee, Coconut etc.
6	Spices	Turmeric, Cloves, Mint etc,

Table No.1 Crops Suitable for Drip Irrigation System

Response of different crops to Drip Irrigation System:

Crops	Water Saving (%)	Increase In Yield (%)
Banana	45	52
Cauliflower	68	70
Chilly	68	28
Cucumber	56	48
Grapes	48	23
Ground nut	40	152
Pomegranate	45	45
Sugarcane	50	19

Watermelon	66	19

Response of different crops to Drip Irrigation System

1.3 Benefits of drip Irrigation:

- Increase in yield up to 230 %.
- Saves water up to 70% compare to flood irrigation. More land can be irrigated with the water thus saved.
- Early maturity results in higher and faster returns on investment. Fertilizer use efficiency increases by 30%.
- Fertilizer and Chemical Treatment can be given through Micro Irrigation System itself.
- Undulating terrains, Saline, Water logged, Sandy & Hilly lands can also be brought under productive cultivation.

1.4 ADVANTAGES OF DRIP IRRIGATION:

- Fertilizer and nutrient loss is minimized due to localized application and reduced leaching.
- Water application efficiency is high if managed correctly.
- Fields with irregular shapes are easily accommodated.
- Moisture within the root zone can be maintained at field capacity.
- Water distribution is highly uniform, controlled by output of each nozzle.
- Fertigation can easily be included with minimal waste of fertilizers.
- Foliage remains dry, reducing the risk of disease.

1.5 DISADVANTAGES OF DRIP IRRIGATION:

- Initial cost can be more than overhead systems.
- The sun can affect the tubes used for drip irrigation, shortening their usable life.
- It required filtered water; otherwise it can result in clogging or bio logging.
- For subsurface drip the irrigator cannot see the water that is applied. This may lead to the farmer either applying too much water (low efficiency) or an insufficient amount of water.
- These systems require careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions, and suitability of drip irrigation system and its components.
- The PVC pipes often suffer from rodent damage, requiring replacement of the entire tube and increasing expenses.

1.6 NECESSITY OF DRIP IRRIGATION:

Water is necessary for plant growth and maturity Irrigation, the artificial means of Supplying water, becomes important for plant growth in the following cases.

- If rainfall is less than the demand of plants, irrigation is necessary to fulfil the water requirement of plants.
- If rainfall is sufficient, for spatial distribution irrigation becomes necessary.

- If rainfall is sufficient, spatial distribution is also good but temporal distribution is not as per requirement, irrigation water is necessary for plants.
- An advanced scientific development like High Yielding Varieties Seeds (HYV) demands irrigation. Actually, irrigation is the most important input.

1.7 SUBSIDIZED DRIP:

Micro irrigation scheme (Drip system) is Centrally Sponsored Scheme under which out of the total cost of the System, 40% will be borne by the Central Government, 10% by the State Government and the remaining 50% will be borne by the beneficiary either through his/her own resources or soft loan from financial institutions. Government approved subsidy for drip pipes whose thickness has 800µ (micron). Subsidized product has more life as compare to other drip pipes products. Government approve subsidy for only farmer which has area of irrigation should be maximum 10 ha.

1.8 NON-SUBSIDIZED:

Nonsubsidized mean drip pipes thickness less than 800µ (micron) and government does not approve subsidy for them. It has less cost has compare to subsidized drip pipes. It has life of 3 to 5 years only. And pipes thickness which less than 500µ (micron) its life is 2 to 3 years.

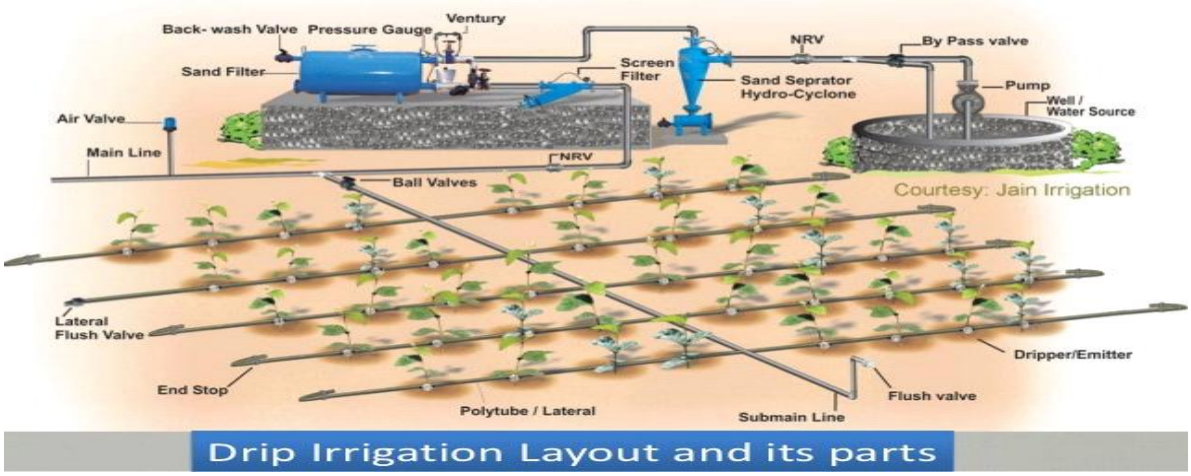

Fig. No. 1 DRIP IRRIGATION SYSTEM LAYOUT AND PARTS:

The above diagram shows layout and its components of drip irrigation system and also shows the positions of components. It contains head units and components of drip irrigation system.

II. LITRETUER REVIEW

Asif, M. Ahmad, A.G. Mangrio, G. Akbar, studied on Design, Evaluation and Irrigation Schedule of Drip Irrigation System on Citrus. B. Kahlaoui, M. Hachicha, S. Rejeb1, M.N. Rejeb, B. Hanchi and E. Misle studied on, Effects of Saline Water on Tomato under Subsurface Drip Irrigation: Nutritional and Foliar Aspects, The aim of this study was to improve irrigation water management under saline conditions of Tunisia. The trial was established in a silt clayey soil with three regimes of irrigation: 100 %, 85 % and 70 % of crop water

requirement. D. Suresh Kumar and K. Palani Sami studied on Impact of Drip Irrigation on Farming System: Evidence from Southern India, in this study the impact of drip irrigation has been studied on farming system in terms of cropping pattern, resources use and yield. Murli Krishna, J. Rama Rajeswar and M. Srini Vasulu, studied on Field Evaluation of Drip Irrigation System for small scale Cucumber Crop, in this an attempt was made to evaluate the performance of the irrigation system based on the uniformity distribution, wetting pattern, sphericity and root distribution. Patil S.T., Mane M.S., and P.M. Ingle studied on Performance and Use of Low Cost, Low Head Gravity Drip, in this they found result that, the gravity drip irrigation can play a vital role in bringing the small pockets of land holding under irrigation in a cost-effective manner and increase the cropping intensity in the region. Thus, the design and use the gravity drip irrigation system on low pressure causes water savings with major saving in initial cost, energy.

III. AIM AND OBJECTIVE:

Aim: "Comparison of cost effectiveness of non-subsidies drip over subsidies drip irrigation system"

Objective:1) Cost analysis of lay flat pipe to PVC pipes.

2) Comparison of cost effectiveness of non-subsidies drip over subsidies drip irrigation system

3) To find suitability and Economy of these pipes for drip irrigation system.

IV. METHODOLOGY

First step was the measure area of G.S.M.I.T College and then calculate area and calculation application rate, rate of flow, time required to irrigate crop. Assumption taken while designing of drip irrigation system Crop: sugarcane, spacing of row between two plants: 1.2m, dippers to dippers spacing: 0.4m, Pick water requirement (PWR): 7mm, Electricity hrs: 8 hrs. Total material required for the system to be calculated:

1) To achieve first objective should be done cost analysis between lay flat pipe and PVC pipe and the find out the material of pipe which gives minimum cost.

2) To achieve second objective the cost comparison should be done between subsidized drip over non-subsidized drip irrigation system.

3) By analysis the whole irrigation system, the economy, suitability of drip irrigation system is found out.

V. MATERIAL REQUIREMENT

1. Main Line:

The main line conveys the water from filtration system to the sub main. They are normally made of rigid PVC pipes in order to minimize corrosion and clogging. Usually they are placed below the ground i.e. 60 to 90 cm (2 to 3 ft), so that they will not interfere with cultivation practices. The velocity of flow in mains should not be greater than 1.5 m/s and the frictional head loss should be less than 5ml /1000 m running length of pipeline.

2. Submain Line:

The Sub main conveys the water mainline to the laterals. They are also buried in ground below 2 to 2.5 ft and made of rigid PVC. The diameter of Sub main is usually smaller than main line.

3. Lateral:

Laterals are small diameter flexible pipes or tubing made of low density polyethylene (LDP) or liner low density polyethylene (LLDPE) and of 12 mm, 16mm, and 20 mm size. They can withstand the maximum pressure of 2.5 to 4 kg/cm2. The pressure variation between two extreme points of lateral should not be more than 15-20 % and discharge variation should not be more than 10%.

4. Emitters or Dripers:

It is the main component of Drip irrigation system for discharging water from lateral to the soil. i.e. to the plants. There are various types and size of drippers, based on different operating principles. They are made of plastic, such as polythene or polypropylene. Their discharge range is between 1-15 ph.

5. Controls Valves (Ball Valve):

These are used to control the flow through particular pipes. Generally, they are installed on filtration system, mainline, and on all Sub main.

6. Flush Valve:

It is provided at the end of each sub main to flush out the water and dirt's.

7. Air Release cum Vacuum Breaker Valve:

It is provided at the highest point in the main line to release the entrapped air during the start of the system and to break the vacuum during shut off. It is also provided on Sub main if Sub main length is more.

8. Non-Return Valve:

It is used to prevent the damage of pump from flow of water hammer in rising main line.

9. Pressure-gauge:

It is used to indicate the operating pressure of the drip system.

10. Gromate and Take-off:

These are used to connect the lateral to Sub main. A hole is punched with hand drill of predetermined size in Sub main. Gromate is fixed into the hole. Take off is pressed into the hole. Gromate acts as a seal. The sizes are different for 12 mm, 16mm, and 20 mm lateral.

11. End Caps (End Sets):

They are used to close the lateral ends, Submain ends or mainline ends. Sub mains and mains are preferably provided with flush valve. They are convenient for flushing the line.

12. Fertilizing System:

It is used to add the chemical irrigation water; however, fertigation is not free of hazards. Chemicals added to water may be toxic human begins and animals so, safeguard must be taken to prevent back flow of irrigation water into the water source, which might be used for drinks purpose.

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13. Disk & Screen Filter:

Filter work as secondary filter which filtered water from Micro dust/garbage which pass from Primary Filter (Hydro Cyclone/sand Filter).

LAYFLAT PIPE:

PVC PIPES:

Fig. No. 2 LAYFLAT PIPE AND PVC PIPES

5.2 losses consider while designing:

Table 1: Friction Losses and Velocity in Pipes - RPVC Class II (4kg/cm2) C = 150, Pressure Loss (m) per 100 mtr of pipe													
Nom.siz	40mm			50mm			63mm			75mm			Nom.siz
Pr.Clas	6kg/cm2			6kg/cm2			4kg/cm2			4kg/cm2			Pr.Clas
Q	Friction		V	Friction		V	Friction		V	Friction		V	Q
Flow	Loss		Velocity	Loss		Velocity	Loss		Velocity	Loss		Velocity	Flow
m3/hr	m		m/sec	m		m/sec	m		m/sec	m		m/sec	m3/hr
	MIL	SWI		MIL	SWI		MIL	SWI		MIL	SWI		
2	1.13	0.43	0.57										2
3	2.41	0.92	0.86										3
4	4.1	1.56	1.15	1.08	0.41	0.66							4
5	6.19	2.35	1.44	1.63	0.62	0.83							5
6	8.69	3.30	1.72	2.28	0.87	1.00	0.66	0.25	0.6				6
7				3.04	1.16	1.16	0.88	0.33	0.7	0.37	0.14	0.49	7
8				3.88	1.47	1.33	1.12	0.43	0.8	0.48	0.18	0.56	8
9				4.83	1.84	1.49	1.4	0.53	0.9	0.59	0.22	0.63	9
10				5.87	2.23	1.66	1.69	0.64	1.00	0.73	0.28	0.70	10
11							2.02	0.77	1.10	0.87	0.33	0.77	11
12							2.38	0.90	1.20	1.01	0.38	0.84	12
13							2.76	1.05	1.30	1.18	0.45	0.91	13
14							3.17	1.20	1.40	1.35	0.51	0.98	14
15							3.6	1.37	1.49	1.53	0.58	1.05	15
16							4.06	1.54	1.59	1.73	0.66	1.12	16
17							4.53	1.72	1.69	1.94	0.74	1.19	17
18							5.04	1.92	1.79	2.15	0.82	1.26	18
19							5.58	2.12	1.89	2.38	0.90	1.33	19
20							6.13	2.33	1.99	2.62	1.00	1.40	20
21										2.86	1.09	1.47	21
22										3.11	1.18	1.54	22
23										3.39	1.29	1.62	23
24										3.66	1.39	1.69	24
25										3.95	1.50	1.76	25
26										4.25	1.62	1.83	26
27										4.56	1.73	1.9	27
28										4.87	1.85	1.97	28
29										5.2	1.98	2.04	29
30										5.53	2.101	2.11	30

Table No.2 Friction losses consider while design

The above table shows the friction losses and velocity of pipes in drip irrigation system it contains their diameters flow and how much losses appears while installation of drip irrigation system.

5.3 Assumption and calculation while design of drip irrigation system:

1) Crop: Sugarcane. 2) Spacing:1.2m 3) Dripper spacing:0.4m 4)PWR (pick water requirement): 7mm
5) Electricity hours:8hr 6) Motor capacity:3HP 7) Water available:189728litre /189m^3

Calculations:

- Application rate = $\frac{\text{Dripper discharge}}{\text{Lateral to lateral spacing x dipper to dipper spacing}}$
- Total flow rate of field = Area x Application rate
- Time required to irrigate crop = $\frac{\text{PWR (pick water requirement)}}{\text{Application rate}}$
- Our daily water requirement = $\frac{\text{PWR X Area}}{1000}$

5.4 Head Loss Consider while Drip Irrigation System:

1. Main line Head loss not more than 5m to 6m.
2. Sub main head loss not more than 0.5m or Discharge variation 10% not more pressure.
3. Lateral or drip line not more than 1m to 2m.
4. Limit of pressure loss in whole system is 20% in order to maintain uniformity.
5. The permissible length of lateral is 75m.

IRRIGATION DATA:

Head Unit	HU-1
CROP	Sugarcane
Net Area, (Ha)	0.4
Irrigation System	Non-ISI Drip
Distance between Rows, (m)	1.22
Distance between Plants, (m)	0.4
Emitter spacing (m)	0.4
No. of laterals per Row	1
Lateral spacing (m)	1.22
Emitter Discharge (l/h)	2
Emitter Operating Press., (m)	10
Application rate (mm/h)	4.1
Evaporation Equivalent (mm/day)	7
Evaporation Equivalent (Lit/P/day)	3.4

No. of Operations per day	1
Duration of one operation (hrs.)	1.71
Total operational time (hrs. per Day)	1.71
Available time for irrigation	8
Water Source	close tank

Table No.4 Irrigation Data (NON-ISI Drip)

The above table shows the irrigation data while designing drip irrigation system its contains CROP, Net Area(Ha), Irrigation System, Distance between Rows(m), Emitter spacing (m), Emitter spacing (m), No. of laterals per Row, Lateral spacing (m), Emitter Discharge l/h, Emitter Operating Press (m), Application rate (mm/h), Evaporation Equivalent (mm/day), Evaporation Equivalent (Lit/P/day), No. of Operations (per day), Duration of one operation hrs. Total operational time (hrs. per Day), Available time for irrigation and Water Source.

DESIGN OF LAY FLAT DRIP LINE (NON –SUSIDIZED)

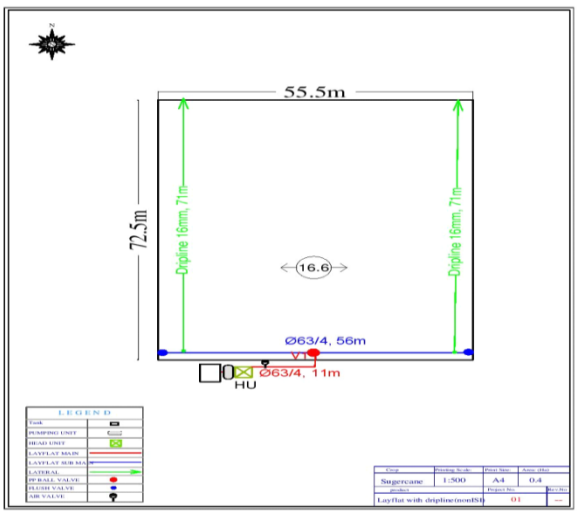

Fig No. 3 Design Of Lay Flat Drip (NON-SUBSIDIZED)

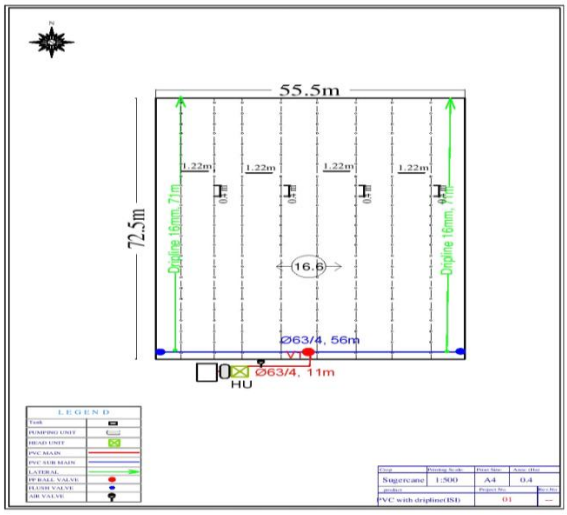

Fig No. 4 Layout of drip irrigation system

Drip Irrigation System Quotation (NON-ISI) - Flexi lateral and Lay flat Pipe:

SR NO	PARTICULARS	UNIT	QTY	RATE (RS)	AMOUNT (RS)
(A)	**Head Unit**				
	SCREEN FILTER 2" (25M3)-IND	EA	1	3,131.58	3,131.58
	PRES.GAUGE SS 304 0-7KG 1/4 BSP 2.5"-IND	EA	1	215.64	215.64
	SWING CHECK VALVE 2"	EA	1	1,493.73	1,493.73
	HU FITTINGS AND ACCESSARIES	No.	1	500.00	500.00

	SUB TOTAL(A)				**5,340.95**
B)	**PVC MANIFOLD**				
	PVC PIPE 63MM -04KG/CM2	M	6	56.75	340.50
	LAYFLAT PIPE 63 MM DIA	M	72	30.80	2,217.60
	SUB TOTAL(B)				**2,558.10**
C)	**DRIP MANIFOLD.**				
	THIN WALL DRIPLINE 16MM,500MIC, 2.00L/H 0.40M	M	3400	4.75	16,150.00
	PVC FLUSH VALVE 63MM	EA	2	74.21	148.42
	CLAMP FOR PVC /LAYFLAT CONNECTIONS	EA	4	10.00	40.00
	PVC TEE 63MM	EA	1	120.00	120.00
	SUB TOTAL(C)				**16,458.42**
D)	**DRIP FITTING ACCESSARIES**				
	RUBBER GROMMET OD DIA 16*ID 10.7 MM	EA	50	2.79	139.50
	START NIPPLE 16 MM -IND THIN WALL	EA	50	1.85	92.50 -
	RING COUPLING 16 MM W RINGS	EA	10	6.80	68.00
	RING END LINE 16 W/RING	EA	50	6.50	325.00
	SUB TOTAL(D)				**625.00**
	TOTAL (A+B+C+D)				**24,982.47**
	GST 18%				**4,496.84**
	INSTALATION CHARGES	EA	0.40	1,500.00	600.00
	GRAND TOTAL				**30,079.31**

Table No.5 Drip Irrigation System Quotation (NON-ISI) Flexi lateral and lay flat pipes.

This table shows quotation of flexi lateral and lay flat pipes non-subsidized drip and it contains costs required for system.

DESIGN OF RIGID LATERAL AND PVC PIPE:

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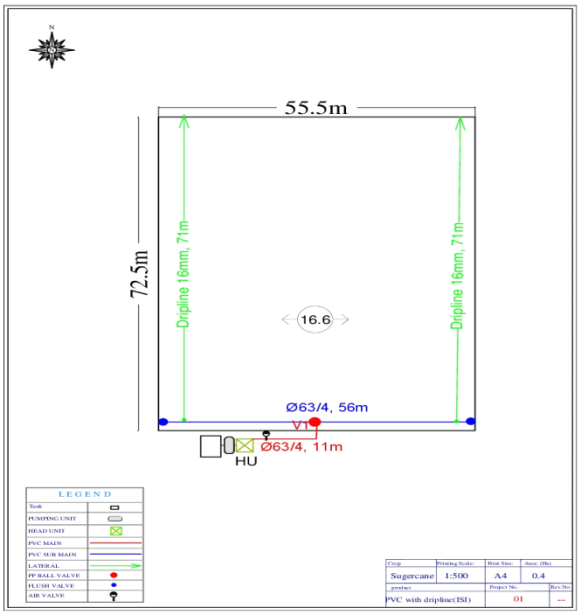


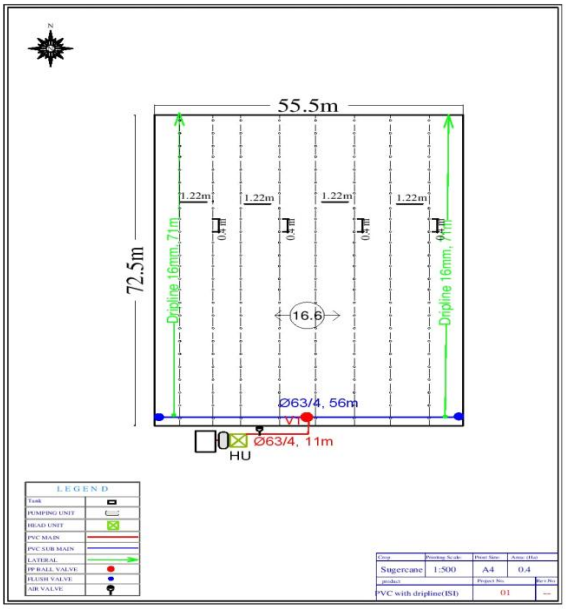


Fig. 5 Design of Rigid Lateral PVC pipe **Fig. 6 Layout of Rigid Lateral and PVC pipe**

The design shows the layout of drip irrigation table.

Drip Irrigation System Quotation (ISI) - Rigid lateral and PVC Pipe:

SR. NO	PARTICULARS	UNIT	QTY	RATE (RS)	AMOUNT (RS)
(A)	**HEAD UNIT**				
	SCREEN FILTER 2" (25M3)-IND	EA	1	3,131.58	3,131.58
	PRES.GAUGE SS 304 0-7KG 1/4 BSP 2.5"-IND	EA	1	215.64	215.64
	SWING CHECK VALVE 2"	EA	1	1,493.73	1,493.73
	HU FITTINGS AND ACCESSARIES	No.	1	500.00	500.00
	SUB TOTAL(A)				**5,340.95**
B)	**PVC MANIFOLD**				
	PVC PIPE 63MM -04KG/CM2	M	72	53.75	3,870.00
	PVC FITTINGS	HA	0.40	2,500.00	1,000.00
	SUB TOTAL(B)				**4,870.00**
C)	**DRIP MANIFOLD.**				
	PLAIN LATERAL 16MM DIA	M	1	9.00	9.00
	DRIPLINE 16MM DIA, 2.00L/H 0.40M	M	3400	10.00	34,000.00
	PP BALL VALVE 2.0"(63MM) PLAIN	EA	1	350.00	350.00

	PVC FLUSH VALVE 63MM	EA	2	74.21	148.42
	PVC TEE 63MM	EA	1		
	SUB TOTAL(C)				**34,507.42**
D)	**DRIP FITTING ACCESSARIES**				
	RUBBER GROMMET OD DIA 16*ID 10.7 MM	EA	50	2.79	139.50
	START NIPPLE 16 MM -IND	EA	50	1.85	92.50
	REDUCING COUPLING BARB17-BARB16 MT	EA	50	2.88	144.00
	END CAP 16/17 MM- IND	EA	50	2.30	115.00
	NIPPLE 17 MM BARB - IND	EA	10	2.88	28.80
	SUB TOTAL(D)				**519.80**
	TOTAL (A+B+C+D)				**45,238.17**
	GST 18%				**8,142.87**
	INSTALATION CHARGES	EA	0.40	1,500.00	600.00
	GRAND TOTAL				**53,981.04**

Table No. 6 Quotation (ISI) - Rigid lateral and PVC Pipe Drip Irrigation System.

This table shows quotation of flexi lateral and lay flat pipes non-subsidized drip and it contains costs required for system.

OPERATIONAL SCHEDULE

Shift No.	Valve	Area, m^2	Valve Area (Ha)	AR mm/hrs.	Valve Flow (m^3/h)	Shift Area (Ha)	Shift Flow (m^3/h)	Operating Time (Hrs.)
1	V1	4047	0.40	4.10	16.6	0.40	16.6	1.71
Total		4047	0.40			0.40		1.71

Table No. 7 Operational Schedule

This table shows operational schedule of when value to be open and close and it operational time.

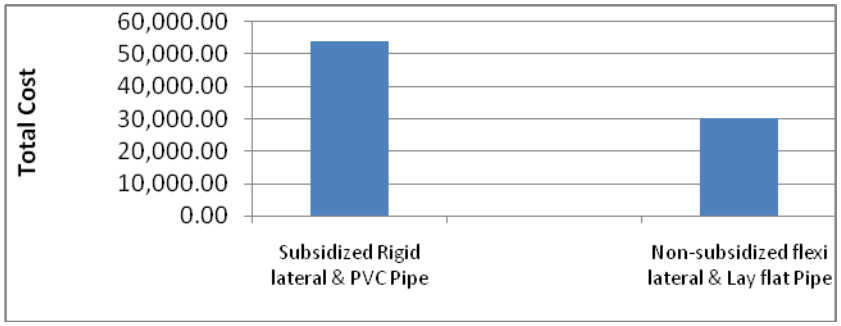
COST ANALYSIS:

Sr No.	Discription Of Item	Total Amount	Difference	Differencen In Percentage
1.	Subsidized Rigid lateral and PVC Pipe	53,981.04	23,901.73	44%
2.	Non-subsidized flexi lateral and Lay flat Pipe	30,079.31		

Table No. 8 Cost Analysis

The above table shows the cost difference of Subsidized Rigid lateral and PVC Pipe and Non-subsidized flexi lateral and Lay flat Pipe and percentage of difference

Graph:



For achieving economy cost analysis between Subsidized Rigid lateral and PVC Pipe and Non-subsidized flexi lateral should be done and get the result as shown below the graph.

VI.DISCUSSION & CONCLUSION

Generally, farmers accept Subsidized Rigid lateral and PVC pipes because government approve them subsidy and it has more life then lay flat but government does not allow subsidy above 10 ha. And subsidy process is to late farmers has to pay first and government return them 50% subsidy but it takes 6 months.

But lay flat cost is less then PVC drip. If subsidy is not offered it is suitable for farmers cost becomes same .and it suitable for small area. And its installation and dismantling are too easy. Some farmers used first lay flat pipes drip irrigation system and after some year them financial condition is more they prefer PVC pipes drip irrigation system for more life of drip irrigation system.

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