iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** V **Month of publication:** May 2019

DOI: https://doi.org/10.22214/ijraset.2019.5504

Implementing Water Conservation Plan

Pruthviraj Wagmode[1], Rohan Naikwadi[2], Saurabh Manmode[3], Sanket Nanvare[4], Shubhan Murthdk[5], Arun Sankpal[6]
[1, 2, 3, 4, 5]Student, [6]Professor, Department of Civil, GSMCOE, Balewadi Pune, Savitribai Phule Pune University Pune India.

Abstract: Today country is facing water scarcity problem on large scale. Increase in water scarcity causes so much adverse effect on domestic, agriculture and commercial use. Due to decrease in rainfall and improper use of water increase in scarcity of water. Increase in demand side and decrease in supply causes due to improper management of water. Globally, fresh water at a tune of 3,240 M km3 is being utilized. Of this, 69% is being used in agriculture sector, 8% in domestic, 23% in industrial and other sector. In India, around 88% water is being used in agriculture sector, covering around 85Mha area under irrigation. Due to liberalization of industrial policies and other developmental activities, the demand for water in industrial and domestic sectors is increasing day by day, which forces to reduce the percentage area under irrigation. The growing demand from the population calls for more efforts to enhance agricultural production. The horticulture sector has emerged as a promising area for diversification in agriculture on account of high income generation for unit area, water and other farm inputs and environmental friendly production systems.

Keywords: Conservation Agriculture, conservation tillage, no-till, soil health, sustainability, technology adoption, tillage practices

I. INTRODUCTION

The City of Charlottetown Water and Sewer Utility has developed this Water Conservation Plan with an mate goal of reducing Charlottetown's collective water use through community action, education and incentive programs. This document outlines the reasoning for the development of the Plan and set a course of action towards meeting conservation goals The document is broken down into three sections. The first section provides an introduction and includes the reasoning behind implementing water conservation initiatives in Charlottetown. The second section provides a detailed framework for how the Plan was researched and developed as well as a description of the challenges the City of Charlottetown is facing. The final section titled The Water Conservation Strategy includes the goals and actions that have been selected to best respond to the City's unique water challenges. As information becomes readily available on the state of our global fresh water supply, more and more action plans are being created with the objective of preserving the fresh water resources that are still available. As members of the global environmental community, no one is exempt from the responsibility of preserving natural resources for present and future populations. While historically Prince Edward Island has been fortunate to be located in a climate and geographical region where water resources are readily available, climate change predictions suggest that EI may continue to experience less precipitation in the summer months when water demand is at its highest (Department of Environment, Labour and Justice, 2008)By taking action now the community of Charlottetown can better prepare for an uncertain future and mitigate any negative effects that excessive water use has been having on the surrounding natural environment. City is rapidly approaching the capacity of the existing water source located in the Winter River watershed. Extraction from this well field is unbalanced across the three well fields and aquifers do not have sufficient recharge to support the current levels of extraction. From water conservation standpoint this challenge is two sided.

II. DESIGN OF DRIP IRRIGATION SYSTEM

It shows the Micro irrigation system with different components .The components of Micro irrigation system can be grouped into two major groups viz.

1) Head control unit
2) Distribution network

A. Head Control Unit

The head control unit of Micro irrigation System includes the following components.

1) *Pump/Overhead Tank:* It is required to provide sufficient pressure in the system. Centrifugal pumps are generally used for low pressure trickle systems. Overhead tanks can be used for small areas or orchard crops with comparatively lesser water requirements.

2) *Fertilizer Applicator:* Application of fertilizer into pressurized irrigation system is done by either a by-pass pressure tank, or by venture injector or direct injection system. The detailed description of fertilizer application system is presented in subsequent section.

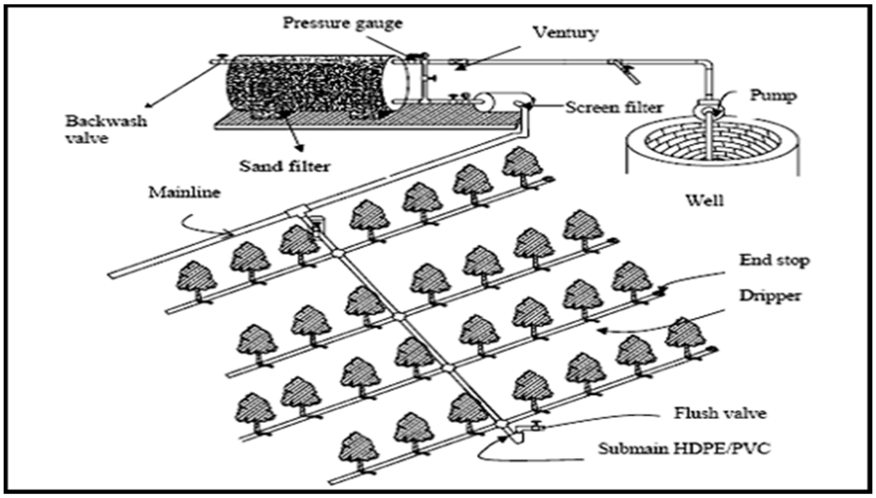


Fig-1:Microirrigation components

3) *Filters:* The hazard of blocking or clogging necessitates the use of filters for efficient and trouble free operation of the microirrigation system. The different types of filters used in microirrigation system are described below.

a) *Gravel or Media Filter:* Media filters consist of fine gravel or coarse quartz sand, of selected sizes (usually 1.5 – 4 mm in diameter) free of calcium carbonate placed in a cylindrical tank. These filters are effective in removing light suspended materials, such as algae and other organic materials, fine sand and silt particles. This type of filtration is essential for primary filtration of irrigation water from open water reservoirs, canals or reservoirs in which algae may develop. Water is introduced at the top, while a layer of coarse gravel is put near the outlet bottom. Reversing the direction of flow and opening the water drainage valve cleans the filter. Pressure gauges are placed at the inlet and at the outlet ends of the filter to measure the head loss across the filter. If the head loss exceeds more than 30 kPa, filter needs back washing. Fig. 1.2 shows different types of media filters

b) *Screen Filters:* Screen filters are always installed for final filtration as an additional safeguard against clogging. While majority of impurities are filtered by sand filter, minute sand particles and other small impurities pass through it. The screen filter, containing screen strainer, which filters physical impurities and allows only clean water to enter into the micro irrigation system (Fig. 1.3). The screens are usually cylindrical and made of non-corrosive metal or plastic material. These are available in a wide variety of types and flow rate capacities with screen sizes ranging from 20 mesh to 200 mesh. The aperture size of the screen opening should be between one seventh and one tenth of the orifice size of emission devices used

c) *Centrifugal Filters:* Centrifugal filters are effective in filtering sand, fine gravel and other high density materials from well or river water. Water is introduced tangentially at the top of a cone and creates a circular motion resulting in a centrifugal force, which throws the heavy suspended particles against the walls. The separated particles are collected in the narrow collecting vessel at the bottom. Fig.1.4 shows different types hydro cyclone/centrifugal filters.

Fig-2:Centrifugal Filter

d) Disk Filters: Disk filter contains stacks of grooved, ring shaped disks that capture debris and are very effective in the f organic material and algae. During the filtration mode, the disks are pressed together. There is an angle in the alignm adjacent disks, resulting in cavities of varying size and partly turbulent flow. The sizes of the groove determine the filtra Disk filters are available in a wide size range (25-400 microns). Back flushing can clean disk filters. However they re flushing pressure as high as 2 to 3 kg/cm2.

It mainly constitutes main line, submains line and laterals with drippers and other accessories.

i) Mainline: The mainline transports water within the field and distribute to submains. Mainline is made of rigid PVC and High Density Polyethylene (HDPE). Pipelines of 65 mm diameter and above with a pressure rating 4 to 6 kg/cm2 are used for main pipes..

ii) Submains: Submains distribute water evenly to a number of lateral lines. For sub main pipes, rigid PVC, HDPE or LDPE (Low Density Polyethylene) of diameter ranging from 32 mm to 75 mm having pressure rating of 2.5 kg/cm2 are used.

iii) Laterals

1. Laterals distribute the water uniformly along their length by means of drippers or emitters. These are normally manufactured from LDPE and LLDPE. Generally pipes having 10, 12 and 16 mm internal diameter with wall thickness varying from 1 to 3 mm are used as laterals. 4.Dripper wiresThey function as energy dissipaters, reducing the inlet pressure head (0.5 to 1.5 atmospheres) to zero atmospheres at the outlet. The commonly used drippers are online pressure compensating or online non-pressure compensating, in-line dripper, adjustable discharge type drippers, vortex type drippers and micro tubing of 1 to 4 mm diameter. These are manufactured from Poly- propylene or LLDPE.
2. Online Non-Pressure Compensating drippers: In such type of drippers discharge tends to vary with operating pressure. They have simple thread type, labyrinth type, zigzag path, vortex type flow path or have float type arrangement to dissipate energy. However they are cheap and available in affordable price.
3. In-Line Drippers or Inline tubes: These are fixed along with the line, i.e., the pipe is cut and dripper is fixed in between the cut ends, such that it makes a continuous row after fixing the dripper. They have generally a simple thread type or labyrinth type flow path. Such types of drippers are suitable for row crops.

Inline tubes are available which include inline tube with cylindrical dripper, inline tubes with patch drippers, or porous tapes or biwall tubes. They are provided with independent pressure compensating water discharge mechanism and extremely wide water passage to prevent clogging, Other accessories are take-out/starter, rubber grommet, end plug, joints, tees, manifolds etc

III. PLANNING AND DESIGN OF DRIP IRRIGATION SYSTEM

The planning and design of drip irrigation system is essential to supply the required amount of irrigation water. The water requirement of the plant per day depends on the water that is taken by the plant from the soil and the amount of water evaporating from the soil in the immediate vicinity of the root zone in a day. The plant intake is affected by the leaf area, stage of growth, climate, soil conditions etc. The water requirement and irrigation schedule can be determined from the soil or plant indicators based methods or soil water budget method, but the simplest and most commonly method is to use pan evaporimeter data. To apply the required amount of water uniformly to all the plants in the field, it is essential to design the system to maintain desired hydraulic pressure in the pipe network. The design of Microirrigation system is essentially a decision regarding selection of emitters, laterals and manifolds, sub main, main pipeline and required pumping unit.

Fig-3:Fertilizer TankThe steps needed to be followed for designing the Micro irrigation system are given below

1) Collection of general information
2) Layout of the field
3) Crop water requirement
4) Hydraulic design of the system
5) Pump horse power requirement

IV. CASE STUDY 2: LEMON

A drip irrigation system for a lemon for 1 hectors area with length and breadth of 100 m each. Citrus has been planted at a spacing of 5 m × 5.5 m. The maximum pan evaporation during summer is 8 mm/day. The other relevant data are given below:

A. Land slop = 0.40% upward slop from S-N direction
B. Water source = a well located at the S-W corner of field.
C. Soil texture = clay loan
D. Clay content = 39.8%
E. Sand content = 37.4%
F. Silt content = 22.8%
G. Bulk density = 1.4gm/cm^3
H. Field capacity = 20%
I. Wilting point = 10%
J. Crop efficient = 1.4
K. Percentage of pan coefficient = 0.7
L. Solution:-

1) STEP - 1

Estimation of water requirement

Evapotranspiration of crop = open pan evaporation ×pan coefficient ×crop coefficient

= 8×0.7×0.8

= 4.48mm/day.

Volume of water to be applied = Area covered by each plant × wetting fraction

× evapotranspiration of crop

= (5×5.5) × 0.40× 4.48

= 49.28 l/day.

2) STEP- 2

Emitter selection and irrigation time

Assuming 3 emitter of 4 l/hr,placed on each plant in triangular pattern. Total discharge delivered in one hour =4×3

= 4hrs10min

3) STEP – 3

= 12l/hr.

Irrigation time=50÷12

Discharge through each lateral.

A well is located at each end of field: length of main, sub main& lateral will be 50m, 97.25m, 47.5m. Number of plant on each lateral=(length÷2)/spacing between two plants

=(100÷2)/5

=10 crops

The lateral will extend on both side of submain each lateral will supply water to 10 lemon plant. Total number of lateral = (breadth ÷horizontal distance between two crops)×2

$$= \left(\frac{100}{5.5}\right) \times 2$$

= 36.36Consider only 36

Discharge carried by each lateral = Numbers of crops×Number of emitters× Discharge through each emitter

= 10× 3× 4

=120 lph

Total discharge carried by 36 lateral = Discharge carried by each lateral ×Number of laterals

=120 × 36

= 4320ph

Each plant is provided with one emitter

Therefore total number of emitter will be = Number of laterals× Numbers of crops × Number of emitters

=36× 10×3

= 1080

4) STEP – 4

Determination of number of manifolds Assume pump discharge = 2.5lps

=9000 lph

Number of lateral that can be operated by each manifolds $= \frac{pdischarge}{Qlateral}$

$= \frac{9000}{120}$

=75

So only one manifoldsubmain can supply water to all lateral at a time.

5) STEP – 5

Size of lateral

Total discharge through submain = Q lateral × number of lateral

= 120 ×36

=4320lph

=1.2 lps.

Once the discharge carried by each lateral is known , the size of lateral can determined by using Hazen William equation,

$H(100) = K(\frac{Q}{f})^{1.852} \times D^{-4.871}$

€

$H(100) = 1.22 \times 10^{12}(\frac{1.2}{F})^{1.852} \times 50^{-4.871}$

= 0.84m

$H = 0.84 \times \frac{47.5}{150}$

F

= 0.40

100

The permissible head loss due to friction is 10%of head 100m(head required to operate 4lph emitter)is 1m therefore selected 18mm diameter is selected.

6) STEP – 6

Size of submain

The reduction factor can determine ,

$F = \frac{1}{m+1} + \frac{1}{2N} + \_\_$

√m–1 6N2
m=1.852
N=Number of openings on lateral
= Number of emitters×Number of crops×Number of laterals
=3×10×36
=1080

F= 1 / 1.852+1
= 0.351

+ 1 / 2×1080

f (1.852–1) 6×1080 2

Total discharge through submain = Q lateral × number of lateral
= 120 ×36
=4320lph
=1.2 lps.

Assuming the diameter of submain as 50 mm The values of parameter of Hazen-Williams equation. Where,
C = 150
Q =1.2lph D = 50mm
$K = 1.22\times 10^{12}$
F =0.351
Assuming diameter 50mm

$H_f (100)= K(\frac{Q}{C})^{1.852}\times D^{-4.871}\times F$

$=H_f (100) = 1.22 \times 10^{12}(\frac{1.2}{150})^{1.852} \times 50^{-4.871}$ F

H_f =0.296m

V. RESULT AND DISCUSSION

SR.NO	PARAMETERS	SUGARCANE	LEMON	POMEGRANATE
1	Length of lateral(m)	47.5	47.5	47.5
2	Numbers of lateral	148	36	44
3	Diameter of lateral(mm)	12	18	12
4	Length of submain(m)	97.25	97.25	97.25
5	Diameter of submain(mm)	50	36	40
6	Diameter of main(mm)	60	38	50
7	Length of main(m)	50	50	50
8	Total power required(hp)	2	1	1
9	Number of mains	1	1	1

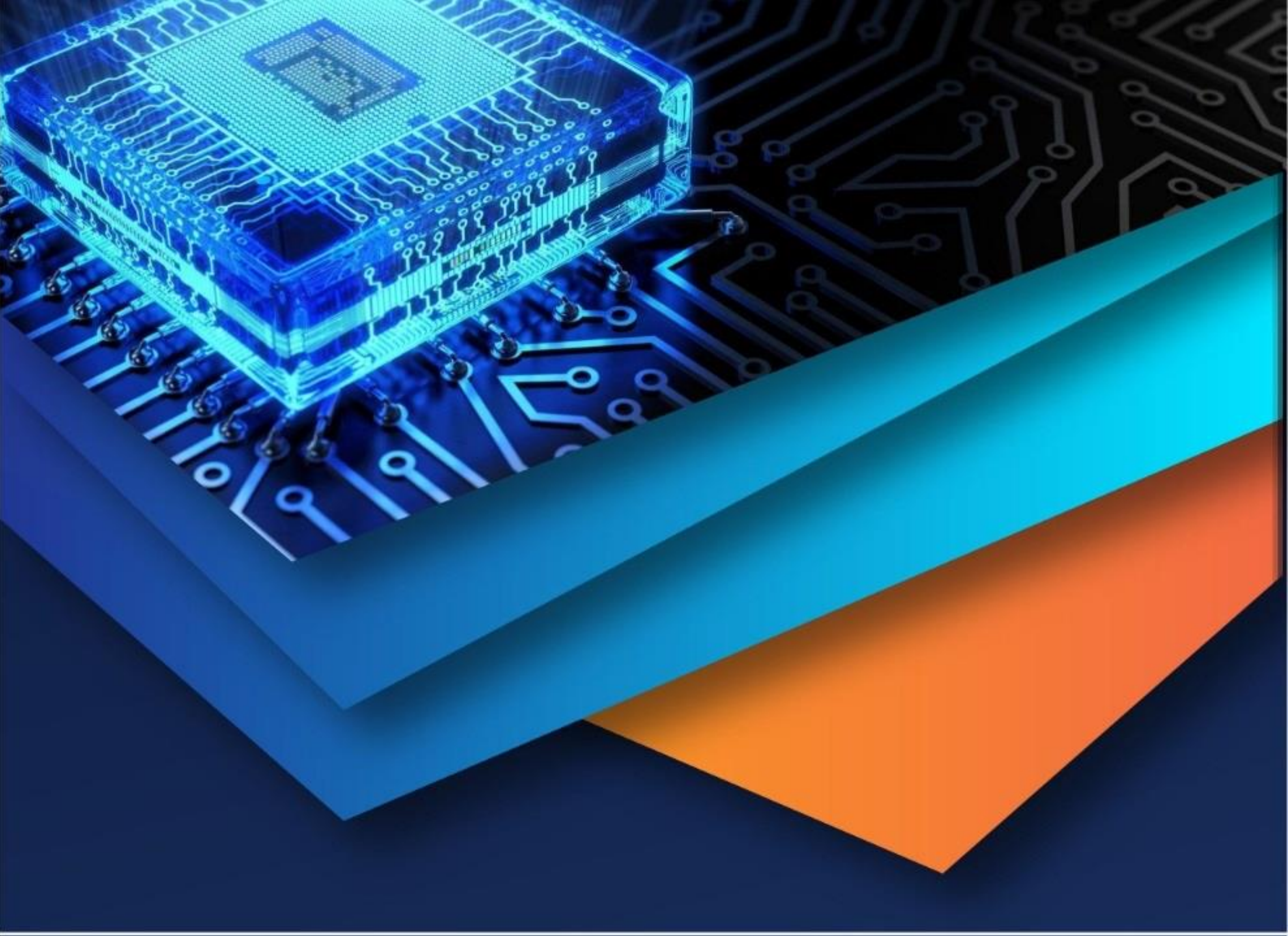
By using conventional method of agriculture large amount of water get wasted using drip irrigation technique large amount of water is conserved with efficient production in field. The amount of water wasted from conventional method of irrigation is almost 55% to amount of water supplied to agriculture field. After implementing this design water can be saved up to 45%.

VI. CONCLUSION

We have surveyed the field where farming was done by conventional method and due to improper management and technique lots of water was wasted. So,we try to design drip irrigation system for that field, due to this system not only water is conserved but also increases yield of field.We also design software program for drip irrigation system due to this program component required for drip irrigation system for different crop for any field get easily. Due to software program time, energy, costs get saved and it is user friendly.Thus,software programme and design steps of drip irrigation system are found effective in any field.

REFERENCES

[1] Amede, T., Geheb, K. and Douthwaite, B. (2009b) Enabling the uptake of livestock–water productivity interventions in the crop–livestock systems of sub-Saharan Africa.
[2] The Rangeland Journal 31, 223–230. doi:10.1071/RJ09008 Andrew, N., Béné, C., Hall, S.J., Allison, E.H., Heck, S. and Ratner, B.D. (2007) Diagnosis and management of small-scale fi sheries in developing countries. Fish and Fisheries 8, 227–240.
[3] Arora, V.K., Singh C.B., Sidhu, A.S. and Thind, S.S. (2011) Irrigation, tillage and mulching effects on soybean yield and water productivity in relation to soil texture. Agricultural Water Management 98, 563–568.
[4] Balwinder, S., Humphreys, E., Eberbach, P.L., Katupitiya, A., Yadvinder, S. and Kukal, S.S. (2011) Growth, yield and water productivity of zero till wheat as affected by rice straw mulch and irrigation schedule. Field Crops Research 121, 209–225.
[5] Barrios, E., Sileshi, G.W., Shepherd, K. and Sinclair, F. (2012) Agroforestry and soil health: linking trees, soil biota and ecosystem services. In: Wall, D.H., Bardgett, R.D., Behan Pelletier, V., Herrick, J.E., Jones, H., Ritz, K., Six, J., Strong, D.R. and van der Putten, W.H. (eds) Soil Ecology and Ecosystem Services Oxford.
[6] University Press, Oxford, UK, pp. 315–330. Bayala, J., Heng, L.K., van Noordwijk, M. and Ouedraogo, S.J. (2008) Hydraulic lift study in two native tree species of agroforestry parklands of West African dry savanna. ActaOecologia 34, 370–378. doi:10.1016/j.actao.2008.06.010
[7] Béné, C., Hersoug, B. and Allison, E.H. (2010) Not by rent alone: analyzing the pro-poor functions of small-scale fi sherries in developing countries.
[8] Development Policy Review28, 325–358.Berejena, E., Ellis-Jones, J. and Hasnip, N. (1999) Gender Sensitive Irrigation Design (Part 5): An Assessment of the Implications of Pump Breakdown and Community Participation in Masvingo Province, Zimbabwe.Report OD 143, HR Wallingford, Wallingford, UK.Berndes, G. (2002) Bioenergy and water the implications of large-scale bioenergy production for water use and supply. Global Environmental Change12, 253–271.
[9] Bindraban, P.S., Verhagen, A., Uithol, P.W.J. and Henstra, P. (1999) A Land Quality Indicator for Sustainable Land Management: The Yield GapReport 106, Research Institute for Agrobiology and Soil Fertility (AB-DLO), Wageningen, the Netherlands.Bindraban, P.S., Bulte, E. and Conijn, S. (2009) Can biofuels be sustainable by 2020? Agricultural Systems 101, 197–199.doi:10.1016/j.agsy.2009.06.005.
[10] Bindraban, P.[S.], Conijn, S., Jongschaap, R., Qi, J., Hanjra, M., Kijne, J., Steduto, P., Udo, H., Oweis, T. and de Boer, I. (eds) (2010) Enhancing Use of Rainwater for Meat Production on Grasslands: An Ecological Opportunity towards Food Security.Proceedings686.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY