

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani



Status Report on Installation and Setup of Lysimeters

Project On

**Determination of crop coefficients for major crops by
Lysimetric studies**

at

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani



**Department of Irrigation and Drainage Engineering
College of Agricultural Engineering and Technology
VNMKV, Parbhani (Maharashtra)
2022**

Status Report on Installation and Set-up of Lysimeters
“Determination of crop coefficients for major crops by Lysimetric studies”
at Vasantnao Naik Marathwada Krishi Vidyapeeth Parbhani

Title of the project : Determination of crop coefficients for major crops by Lysimetric studies” at Vasantnao Naik Marathwada Krishi Vidyapeeth Parbhani.

Location : Department of Irrigation & Drainage Engineering,
College of Agricultural Engineering Research Field,
Vasantnao Naik Marathwada Krishi Vidyapeeth Parbhani

Duration : Three years

Total outlay : Rs. 38.38 lakhs

Investigators :

Principal Investigator : **Dr. U. M. Khodke**
Associate Dean & Principal, College of Agricultural
Engineering & Technology VNMKV Parbhani

Co-Principal Investigators : 1) **Dr. H.W. Awari**
Head, Deptt. of Irrigation & Drainage Engineering,
CAET, VNMKV Parbhani
2) **Dr. V.K. Ingle**
Assistant Professor, Deptt. of Irrigation & Drainage
Engineering, CAET, VNMKV Parbhani

Coordinator for the project **Dr. S.D. Gorantiwar**
PI CAAST-CSAWM and Head, Deptt. of Agril. Engg.,
MPKV, Rahuri



Principal Investigator
Lysimetric Studies Research Project (PoCRA)
Dept. of IDE, CAET, VNMKV, Parbhani

MEMORANDUM OF UNDERSTANDING:

The Memorandum of Understanding between Nanaji Deshmukh Krishi Sanjeevani Prkalp (NDKSP), Government of Maharashtra earlier referred as Project on Climate Resilient Agriculture (PoCRA) a World Bank Funded Project and Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani was signed on January 17, 2020 at Mumbai by Project Director, PoCRA and PI of the project from VNMKV Parbhani in the presence of ADG (NRM), Director of Research MPKV Rahuri; NDKSP Authorities and PI of the project from MPKV, Rahuri.

This Project is being executed at Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani. Following activities are taken which are related to installation and setup of Lysimeters on the experimental farm.

IMPORTANCE OF THE EXPERIMENT:

Water is very critical natural input for agricultural production and plays a vital role in crop growth and development which directly or indirectly affects the yield and productivity of crops. But due to population growth, urbanization and climate change, the competition for water resources is expected to increase day by day with the negative impacts on agriculture. Currently Indian farmers have to face different problems such as climate change, famines & droughts, extreme precipitation and flooding, hurricanes and dry spell etc.

To overcome these problems, it is essential to adopt and develop the climate resilient technology according to the need of local climate. To obtain the potential yield and productivity from a unit area, it is essential to know the optimum water requirement of the crops. Excess or deficit amount of water has negative impacts on the crop growth and hence optimum water application is essential to maintain the soil health, increase the production and productivity and to avoid the excess use of irrigation water. Crop evapotranspiration is essential parameter to determine the water requirement of the crops. Evapotranspiration (ET) corresponds to the sum of evaporation (E) and transpiration (T) processes in vegetated surfaces that occur simultaneously, and it is often difficult to separate these two physical processes. The knowledge of ET forms a fundamental basis for designing and managing irrigation systems including irrigation scheduling. With the help of lysimetric studies, we can directly estimate daily/ stage wise crop coefficient value and ET which play major role in water requirement of the crops.

PROCUREMENT OF LYSIMETERS:

As per order given by PoCRA, M/S. Pratik enterprises, Sehakar Nagar, Parvati, Pune has supplied three lysimeters with its accessory on dated 18-07-2021 (Challan No.21103) and successfully installed them in the field during 4-5 December 2021.

Table 1: Materials received from M/S. Pratik enterprises.

Sr. No	Material Description	Quantity
1	S.S. Inner tank size 1500 x 1500 x 1000 mm	3
2	S.S. outer tank size 1600 x 2100 x 1250 mm	3
3	Weighing scale 1500 x 1500 x 1000 mm	3
4	Perforated frame	3
5	Panel Box S.S.	3
6	Solar Panel	3
7	GI Pipe	3
8	Solar Panel Frame	3

INSTALLATION SITE:

Lysimeters are installed at the Experimental farm of Department of Irrigation and Drainage Engineering, VNMKV, Parbhani under the guidance and presence of Principal Investigator and Co- Principal Investigator of the PoCRA project during 4-5 December 2021. The details of location with latitude and longitude is presented in Table 2.

Lysimeter Installation:



Image 1: Field layout



Image 2: Manual excavation of pits and measurement of the depth of first layer (20 cm)

In order to install the lysimeters, three dug-out (1.5m x 1.5m x 1.0m) excavations were made in the experimental field. The soil was manually withdrawn from the dugouts. During excavation, the soil was carefully removed in five layers each of 20 cm depth and placed aside separately on plastic sheet for backfilling. Each soil layer was placed in separate pile with a care of non-mixing without disturbing with each other. For easy identification, excavated soil of each layer was labelled as L1, L2, L3, L4 and L5.



Image 3: layer wise soil collection

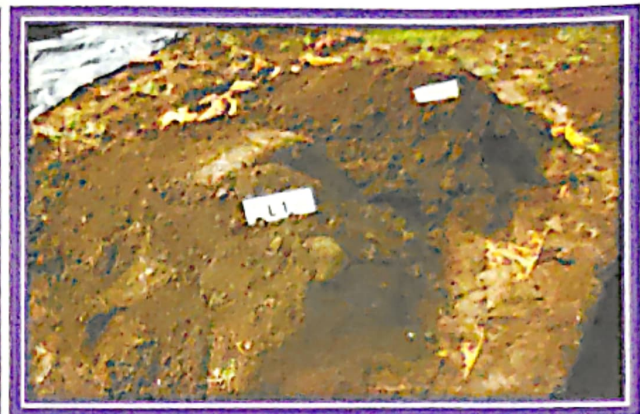


Image 4: layer wise soil collection

After the achievement of desired dimension of holes to match the inner tank of lysimeter, a pit sufficiently larger and deeper than the lysimeter outer tank was dug by machine. The accurate measurement of inner tank pit was taken.

After enlarging and widening of the pit for the outer tank, a sand layer approximately 2-3 cm thick was sprayed at the bottom of the pit and then burnt brick layer was placed on it.



Image 5: Sand and bricks layer laid at bottom of pit



Image 6: Installation of outer tank in pit

The outer tank was placed in the pit by using crane machine and there after the inner tank was placed in the outer tank by maintaining 5-10 cm spacing between inner and outer tank from all four sides. The soil was filled around the outer tank of Lysimeter.



Image 7: Installation of outer tank in pit



Image 8: Steel net installation at bottom of inner tank

Steel net was placed at bottom of inner tank in order to prevent soil loss along with drainage water. After successful installation of outer and inner tank, the soil moisture sensors were placed at 20, 40 and 60 cm depth respectively and the marking was done in the inner tank at every 20 cm depth, for filling the soil exactly in the same manner in which it was excavated. The undisturbed soil was filled in inner tank of the lysimeters to match the natural soil profile.

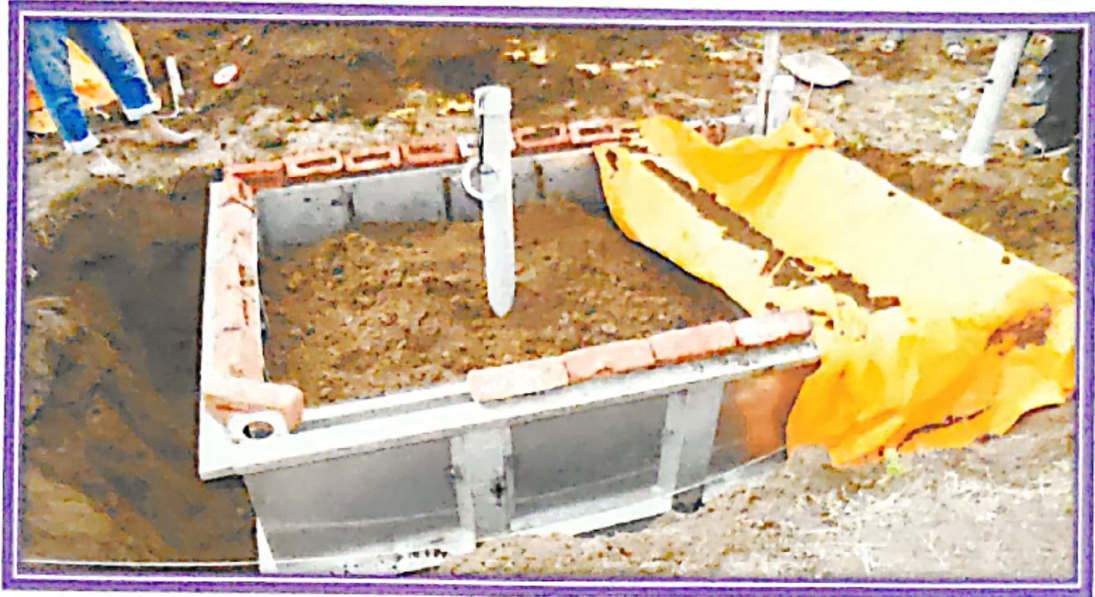





Image 9: Installation of moisture and temperature sensor



Image 10: Installation of solar panel

Additionally, the soil of each layer was slightly compacted to match the soil density in the lysimeters to that in the field. The inner tank of each lysimeter was filled layer by layer with maintaining its original homogeneity and bulk density. All the accessories of lysimeter were assembled after that. A small surplus of top soil was added in the inner tank later. Continuous watering lowered the soil surface in inner tank sufficiently. Finally, Lysimeters were calibrated in the field using standard loads of known mass.

Table 2: The Geographical locations of lysimeters installed in field

Sr. No.	Lysimeter No.	Latitude	Longitude	Location
1	Lysimeter No.1	19.242938	76.788385	
2	Lysimeter No.2	19.242763	76.788672	
3	Lysimeter No.3	19.242726	76.788333	

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Glimpse of Research field Development:



Image 11 : Laying of road at research field



Image 12: Installation of irrigation pipes in the field



Image13 : Installation drip irrigation system to Okra crop



Image14 : Groundnut and Okra crop in the research field

[Signature]
Principal Investigator
Lysimetric Studies Research Project (PoCRA)
Dept. of IDE, CAET, VNMKV, Parbhani



Image15: Geophysical investigation for identification of well location in research field



Image 16: Construction of Bore well in the research field



Image 17,18: Visit of Project Director, PoCRA and team members to research field at Parbhani



Image 19: Visit of Hon. Vice Chancellor to research field

RECRUITEMENT OF CONTRACTUAL STAFF IN THE SCHEME

The advertisement was published for recruitment of contractual staff under the project viz; one Senior Research Fellow and one Field Assistant, on university website on 30/11/2021. Interviews were conducted on 14/03/2022 and orders were issued to the selected candidates. Mr. G. V. Khange, Field Assistant has joined his duties however the selected Senior Research Fellow did not join the project. The recruitment for the vacant post of SRF post is in progress.

ABOUT LYSIMETER EXPERIMENT

A lysimeter is a device in which a volume of soil, with or without crop is located in a container to isolate it hydrologically from the surrounding. For accurate and reliable measurement of evapotranspiration the lysimeter is installed and operated properly. As per Singh (1987), the design requirements on lysimeter depth, water control, drainage area, filling of soil, soil moisture, soil heat flux and comparability of plant cover are important points for proper installation of lysimeter. Lysimeter contains either disturbed or undisturbed soil profile. Lysimeter is employed to measure actual evapotranspiration which contains a representative soil profile.

The soil and crop condition in the Lysimeter are kept similar to the surrounding natural condition. The set-up of Lysimeter is fabricated such that there should not be any difficulty to measure the water balance. These measurements include amount of water added, amount of water retained by the soil, and loss of water from the others sources such as evaporation, transpiration and deep percolation by Weighing type Lysimeter. The measured amount of water is supplied to the surrounding cropped area. The supplied water or precipitation are excluded from the outflow, it gives amount of water used by the crop. The lysimeter device gives the precise accurate and direct measurement of water supplied to field, utilised by crop and also measures drainage water.

CROP PLANNING:

As per the crop planning two summer crops (Groundnut and Okra) are being cultivated from the month of February 2022 (Summer season) under this project. The field preparation, procurement of farm inputs and farm management practices are in progress.

The work of estimating Taluka wise weekly reference evapotranspiration for Marathwada region by using FAO-56 Penman-Monteith method and Generation of the spatial maps of reference evapotranspiration using GIS are completed. The work on estimation of Kc values for all the PoCRA crops suggested in the project is in under progress.

Investigators:

Dr. V. K. Ingle **Co-Principal Investigator**

Dr. H.W. Awari **Co-Principal Investigator.**

Dr. U. M. Khodke **Principal Investigator.**






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Abstract : Submission and Acceptance of report on Lysimeter setup

ABSTRACT

PoCRA (NDKSP) and VNMKV, Parbhani signed a MoU on 17th January 2020 for “Determination of crop coefficients for major crops by Lysimetric studies” at Department of Irrigation and Drainage Engineering, VNMKV, Parbhani. The project development objective is to enhance climate-resilience and profitability of small holder farming systems in Maharashtra. Water is very critical natural input for agricultural production and plays a vital role in crop growth and development which directly or indirectly affects the yield and productivity of crops. But due to population growth, urbanization and climate change, the competition for water resources is expected to increase day by day with the negative impacts on agriculture. To overcome these problems, it is essential to adopt and develop the climate resilient technology according to the need of local climate.

The crop water requirement plays an important role in management of scanty water resource in the project area with enhanced water use efficiency. Therefore, aims of these projects to determine the values of crop coefficients of important field crops over their growth period by using lysimetric study and estimate water requirement of different field crops for efficient irrigation water management.

M/S. Pratik enterprises, Sehakar Nagar, Parvati, Pune has supplied three lysimeters with its accessory on dated 18-07-2021 and successfully installed them in the field during 4-5 December 2021 as per the standard installation procedure. For installation lysimeter soil was manually withdrawn in five layers each of 20 cm layer. the soil moisture sensors were placed at 20, 40 and 60 cm depth respectively. The undisturbed soil layer was again filled in inner tank of the lysimeters to match the natural soil profile. Finally, Lysimeters were calibrated in the field using standard loads of known mass.

The advertisement was published for recruitment of contractual staff under the project viz; one Senior Research Fellow and one Field Assistant, on university website on 30/11/2021. Field Assistant has joined his duties however the selected Senior Research Fellow did not join the project. The recruitment for the vacant post of SRF post is in progress.



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