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WASTE JUTE BASED SMART IRRIGATION SYSTEM

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ABSTRACT

We have bought up a solution to reduce the soil temperature and improve the soil moisture ,growth and health ultimately reducing drought conditions to some extent .Jute has an excellent water absorption capacity which is 400 to 500% of its dry weight. Being a natural fibre, it does not cause any kind of harm to the soil .Instead it acts as a natural fertilizers after its degradation in the soil .So the use of jute will absorb the rainwater and hold it under the soil keeping the soil cooler and improving the crops growth .Thus at some extent it will help to reduce the extreme drought conditions in some places in India and help the farmers. A very simple way to implement at least cost will never be a problem to the farmers .Being cheap , easy to implement and efficient is the core idea of the solution to the problem. This will tentatively reduce the growing food prices , anti-bio-hazards medium , and remove further causing problems in the chain .

Keyword:- *Degradation, Fertilizers, Extreme, Tentatively, Anti-bio hazards*

1. INTRODUCTION

Irrigation is the process of applying water to the crops artificially to fulfil their water requirements. Nutrients may also be provided to the crops through irrigation. The various sources of water for irrigation are wells, ponds, lakes, canals, tube-wells and even dams. Irrigation offers moisture required for growth and development, germination and other related functions. The frequency, rate, amount and time of irrigation are different for different crops and also vary according to the types of soil and seasons. For example, summer crops require a higher amount of water as compared to winter crops.

Use of biodegradable jute fabrics reinforced soil column have opened up a new vistas of growing dicotyledonous crops within rice field avoiding anoxiaand providing sufficient oxygen to these crops facilitating adequate drainage by gravitational and lateral flow through messy jute bags.

Properties of jute:

(a) Jute is a natural fibre.

(b) It has high water absorption capacity.

(c) Reduce the soil temperature for long time.

(d) Long duration water retaining capacity.

(e) After decaying it can be used as fertilizers.

Harmful effect of chemical fertilizers:

. Chemical fertilizers have aided farmers in increasing crop production since the 1930's.

While chemical fertilizers have their place increasing plant nutrients in adverse weather conditions or during times when plants need additional nutrients, there are also several harmful effects of chemical fertilizers. Some of the harm chemical fertilizers may cause include waterway pollution, chemical burn to crops, increased air pollution, acidification of the soil and mineral depletion of the soil

- The use of chemical fertilizers on crops may cause ground water pollution which reduces the amount of oxygen in water.
- Over application of chemical fertilizers to plants may cause the leaves to turn yellow or brown and may reduce the crop yield.
- Excess nitrogen in crop field leads to release of green house gases such as CO2,Nitrous oxide in atmosphere.
- Chemical fertilizer may also leads to soil acidification.
- Long time use of chemical fertilizer may leads to depletion of minerals in soil

Water loss due to evaporation:

Sprinkler irrigation is one of the four basic methods of irrigation. In case of surface irrigation, losses occur due to seepage and percolation but in sprinkler irrigation, loss occurs only by evaporation. An experiment was carried out at the experimental field of the Bangladesh agricultural University, Mymensingh by using Low Energy Water Application (LEWA) sprinkler system to determine the loss. Discharge data were collected considering loss and without loss of evaporation, from which evaporation losses were predicted. Relationships were also developed between evaporation losses with discharge as well as with the other factors affecting evaporation like temperature, wind speed and humidity. The relationships indicated that evaporation loss increased with the increase of discharge, temperature and wind speed and decreased with the increase of humidity.

2. MATERAILS AND METHODS

Jute bags (gunny bags)

A burlap sack or gunny sack, also known as a gunny shoe or tow sack, is an inexpensive bag, traditionally made of hessian fabric (burlap) formed from jute, hemp or other natural fibers. Modern-day versions of these sacks are often made from synthetic fabrics such as polypropylene.

The word *gunny*, meaning coarse fabric, derives from an Indo-Aryan word. Reusable gunny sacks, typically holding about 50 kg, were traditionally used, and continue to be to some extent, for transporting grain, potatoes and other agricultural products. In Australia, these sacks, made of Indian jute, were known traditionally as 'hessian sacks', 'hessian bags' or 'sugar bags'. The term tow sack refers to their being made of tow, spun broken fibres of hemp or other plants.

Gunny sacks are sometimes used as sandbags for erosion control, especially in emergencies. Up until the latter part of the twentieth century, when they became less common, the sacks were one of the primary tools for fighting grass fires in rural areas, used while soaked with water when available. Gunny sacks are also popular in the traditional children's game of sack racing.

Bags which are made of burlap are known as gunny bags or burlap bags. Although these sacks were developed to ship and transport agricultural commodities such as wheat, potatoes, corn and coffee, it has a wide range of uses. Burlap is basically a fabric which is woven and made from natural fibers such as jute. These sacks are eco-friendly as it is made of natural fabrics. Moreover, as it is densely woven, it can be quite difficult to destroy these bags. As it features extreme strength and durability, it is used widely for carrying heavy weights. These sacks are extremely flexible and since it is made of natural fibers it is non-toxic and biodegradable. Moreover, as it features various uses, it is extensively recycled.

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Two small field:(2m X 2m)

Fig (Field without jute)

Fig(Field with jute bags)

Solar water pump for watering the field:-

Solar-powered pumps run on electricity generated by photovoltaic (PV) panels or the radiated thermal energy available from collected sunlight as opposed to grid electricity- or diesel-run water pumps. Generally, solar-powered pumps consist of a solar panel array, solar charge controller, DC water pump, fuse box/breakers, electrical wiring, and a water storage tank. The operation of solar-powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact than pumps powered by an internal combustion engine. Solar pumps are useful where grid electricity is unavailable or impractical, and alternative sources (in particular wind) do not provide sufficient energy.

METHOD

First of all we collect the jute bags which has been waste after the use of the bags(5 bags) then after we need to select the suitable field for the experiment(generally two field having area 2m*2m each).Some of the jute bags need to be cut/crushed and mixed with soil and some laid on the field ,after this we need to watering the field ,then the plant of paddy is shown. Watering should be done time to time, and at last when the crop harvesting is done then we see that the jute is completely decomposed, which may used as biodegradable fertilizer for the next crop in the same field.

NOTE:-Water requirement for the crop using jute bags is less as compare to the normal crop watering as water retained on the jute bags for the long time.

Step 1:-collection of the waste jute bags (Fig4.1)

Jute bags is collected from the different farms and government rashan shops as the grains and the different eadable food comes in that bags such as sugar, wheat etc. Some of the jute bags need to be cut/crushed and mixed with soil and some laid on the field ,after this we need to watering the field ,then the plant of paddy is shown. Watering should be done time to time, and at last when the crop harvesting is done then we see that the jute is completely decomposed

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Step2:-Taking two suitable field (2m*2m each)

.(Field 1- General field without use of jute and with fertilizer) Fig

(Field 2-Field using crushed jute and jute used in upeer layer)Fig

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Step3:-Watering the crop/ field by pipe

A network of pipes supplying water to drip irrigation and sprinkler irrigation.

Fig-watering the crop

Step 4:-Field after the harvesting of crop and soil send for the laboratory test

Fig- field after harvesting

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4. TEST, RESULTS AND DISCUSSION

A:-Evaporation pan test

Crop water requirements (CWR) are defined as the depth of water (millimeters) needed to meet the water consumed through evapotranspiration by a disease-free crop, growing in large fields under non restricting soil conditions, including soil water and fertility, and achieving full production potential under the given growing environment.

The water requirement of crops is the amount of water that is required to meet the evapotranspiration rate so that crops may thrive. The evapotranspiration rate is the amount of water that is lost to the atmosphere through the leaves of the plant, as well as the soil surface.

In this method, pan is filled with water and the loss of water from the pan is measured. Provided that there is no rainfall, the evaporation rate, which is recorded as millimeters per day, is quite easy to measure.

This method of measurement takes into account wind, temperature, radiation and humidity, which are the same factors that affect crop transpiration rate.

However, there are a few factors that prevent this recording from being entirely accurate. For one, the solar radiation results in heat storage in the pan. This can lead to increased reading of the evaporation rates at night, when transpiration usually does not occur. In addition, temperature and humidity levels above the pan surface will vary from what would naturally occur.

Fig :-A pan

Test results and graphs:-

Evaporation is a part of the hydrologic cycle and it is defined as the water-vapor flux moving from a surface towards the atmosphere. Evaporation takes place from surfaces of water, soil, crop and snow. The rate of evaporation is directly proportional to altitude, temperature, air currents and solar radiation, and indirectly proportional to air humidity.

Infiltration factors according to soil characters:-(Table 5.1)

Soil structures	**Infiltration factors**
Course sand, sub soil gravelly and course structure soils	1.5
sand	1.10
loam	1.05
Loamy clay	1.00

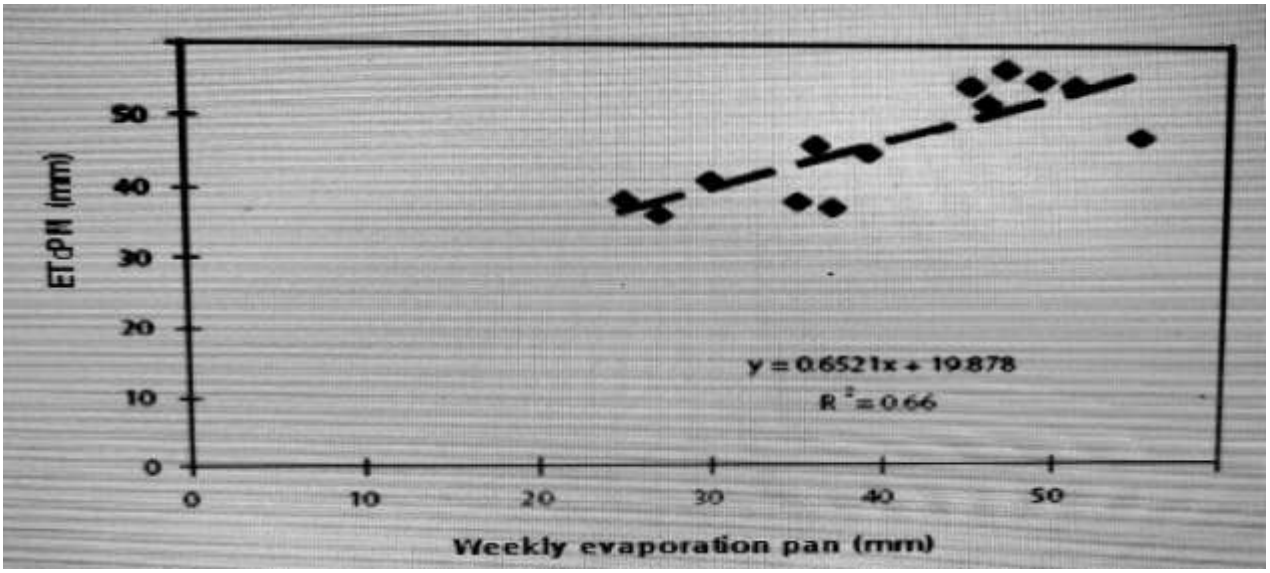

Fig:-Correlation between water consumption by penman-monteith reference evapotranspiration and pan evaporation

The amount of water allocated for agricultural production has been decreasing due to rapid population growth, industrialization and contamination. Therefore, to obtain maximum yield and avoid excessive water application, the water requirements of the cultivated plants should

be accurately determined, and irrigation water should be applied according to the needs of the plants. Crop water consumption (ETc) varies from region to region depending on crop type, stage of growth, soil, and climate conditions. Different evapotranspiration rates may be observed even in different parts of the same region. Considering global warming and climate change in recent years, it is clear that the predicted ET values of a year can not be used safely for upcoming years. Research studies have revealed a linear correlation between crop water consumption and the amount of water evaporated from open water surface. Therefore, irrigation scheduling through using the combination of proper crop-pan coefficient and pan evaporation (Class-A pan) is very important due to both ease of adjustment to the climate changes and ease of application. Even though many studies have been conducted on this issue, there is still need to collective and detailed information about use of evaporation pan for irrigation scheduling and above mentioned coefficients .

5B:-Soil fertility test

In agriculture, a **soil test** commonly refers to the analysis of a soil sample to determine nutrient content, composition, and other characteristics such as the acidity or pH level. A soil test can determine fertility, or the expected growth potential of the soil which indicates nutrient deficiencies, potential toxicities from excessive fertility and inhibitions from the presence of non-essential trace minerals. The test is used to mimic the function of roots to assimilate minerals. The expected rate of growth is modeled by the Law of the Maximum

Soil testing is often performed by commercial labs that offer a variety of tests, targeting groups of compounds and minerals. The advantages associated with local lab is that they are familiar with the chemistry of the soil in the area where the sample was taken. This enables technicians to recommend the tests that are most likely to reveal useful information.

Laboratory tests often check for plant nutrients in three categories:

- Major nutrients: nitrogen (N), phosphorus (P), and potassium (K)
- Secondary nutrients: sulfur, calcium, magnesium
- Minor nutrients: iron, manganese, copper, zinc, boron, molybdenum, chlorine

The soil texture of the experimental site was sandy and slightly acidic having pH value of 5.6. The SM and BD values were found to be 36.7% and 1.31 g/cm^3, respectively.

Table: Comparison of different nutrients after and before use of jute bags

Soil Nutrients	Soil without jute bags (%)	Soil with jute bags (%)
Nitrogen(N)	42.456	46.089
Phosphorous(P)	22.569	24.444
Potassium(k)	15.667	16.667
Sulfur	7.60	7.65

CONCLUSIONS

The application of jute in irrigation leads to use of biodegradable fertilizers

- It is ecofriendly.
- Commercialization of jute for making gunny bags.
- Minimising the problem of water loss due to evaporation.
- Decrease in use of chemical fertilizers.
- No skilled labour are required.
- Mostly suitable for drought region where less water is available for irrigation

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