Research Bulletin - 50

MICRO IRRIGATION : EFFICIENT UTILIZATION OF WATER RESOURCES FOR SUSTAINABLE CROP PRODUCTION

ICAR-Indian Institute of Wheat and Barley Research
Karnal -132001 (Haryana)

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Mob. : +91-99965-47747, 98964-33225
E-mail : aaronmedia1@gmail.com

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MINITSTRY OF AGRICULTURE AND FARMERS WELFARE
KRISHI BHAWAN, NEW DELHI 110 001
Tel. : 23382629; 23386711 Fax : 91-11-23384773
E-mail : dg.icar@nic.in

Foreword

Amid changing climatic scenario and depleting surface and ground water resources, declining per capita water availability and polluting water bodies have posed a great challenge for agricultural activities. In India, clean water availability has significantly decreased during last few decades and is likely to further decline due to increasing population, rapid urbanization and industrialization. Indiscriminate use of ground water for irrigation and other purposes is another reason to rethink. India extracts sizeable amount of groundwater which is alarmingly and unsustainable in long run. With increasing water demand from other sectors, agricultural water use in India is likely to face a tough competition for the scarce water resource in future.

In view of the emerging scenarios, the challenge is to produce more food grains per unit amount of water through precise use of limited water resources and increasing water productivity of green (rainwater), blue water (irrigation water) and grey water (degraded water) resources for crop production. In India, crops are grown under different climatic, soil and agro-management conditions and now priority is to develop the water use efficient technologies for appropriation of natural water resources in a sustainable manner. Water footprint indicates proportion of fresh water resources used for a particular production process in economic terms. At farm level accounting procedure for estimation of water footprints of crops is required to assess the efficiency of the systems to produce more with minimum volume of water.

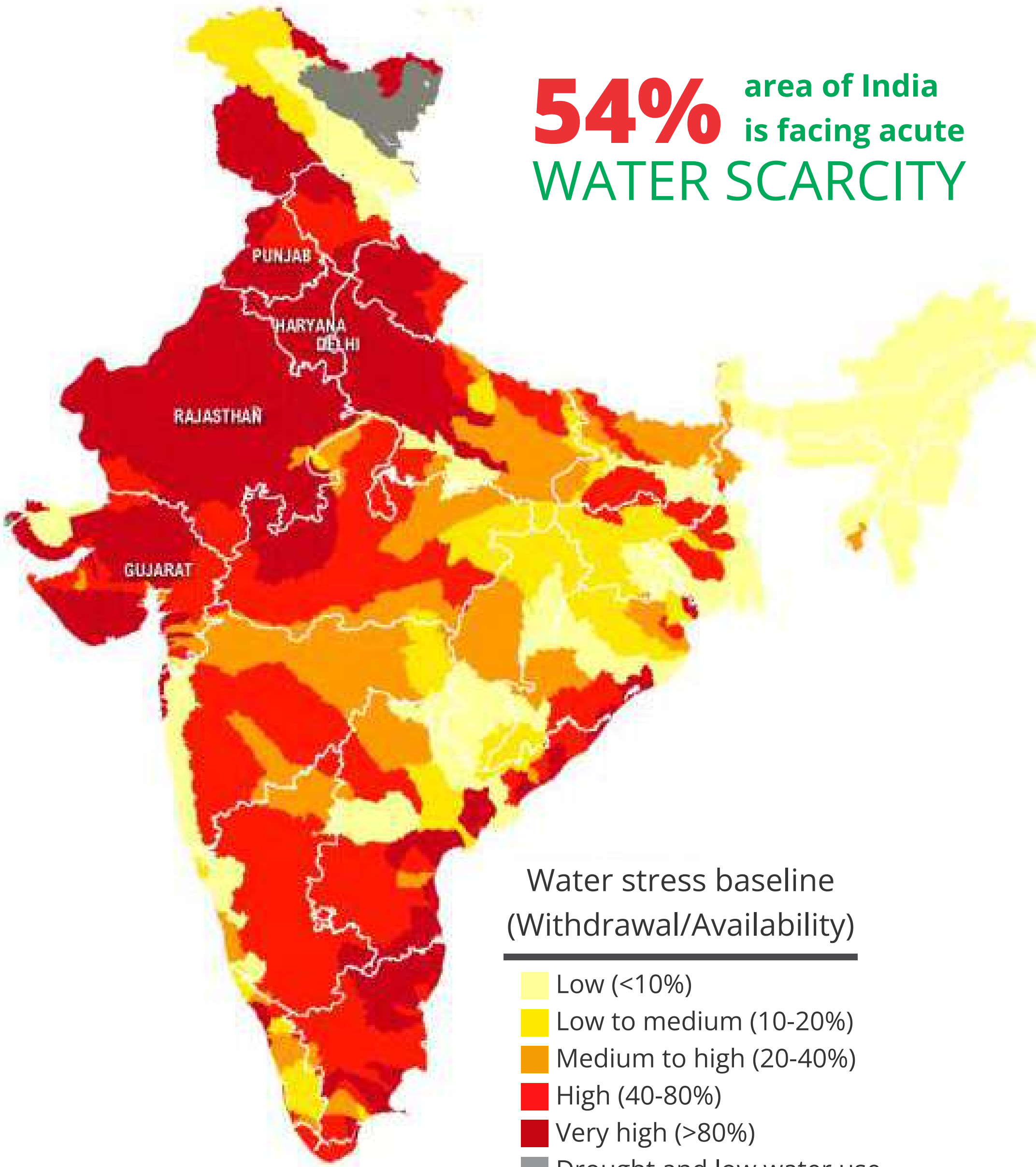
In this direction, scientists of ICAR-IIWBR, Karnal have conducted systematic study and made an attempt to document the salient findings in the form of research bulletin entitled **"Micro irrigation: Efficient utilization of depleting water resources for sustainable crop production"** for the benefit of farmers, policy planners, researchers extension workers and other stakeholders. I congratulate the authors for their efforts in bringing out the research bulletin and to disseminate the findings for enhancing the water productivity of crops with particular reference of Wheat in North-Western India.

(Himanshu Pathak)

18th August, 2023
New Delhi

CONTENTS

54% area of India is facing acute WATER SCARCITY



www.indiawatertool.in

Preface

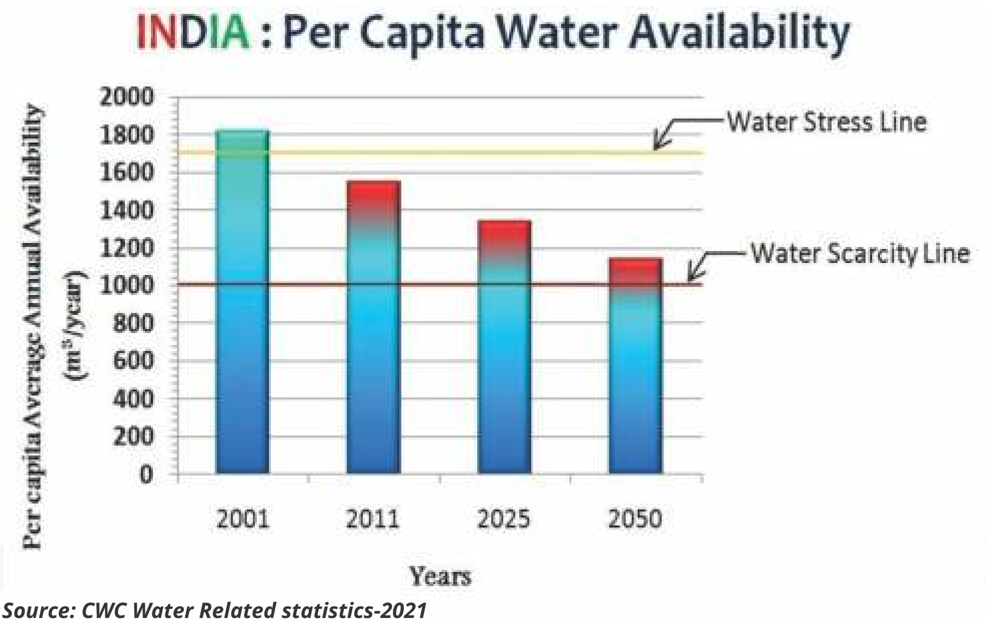
Water is the most valuable natural resource as it is essential for survival of all living beings. However, the availability of freshwater resources is under stress because of a number of factors. It affects every continent and was categorised as one of the largest global risks with respect to its potential impact over the next decade by the World Economic Forum in 2019.

Irrigated agriculture is the only proper way to ensure the food security of the nation due to uncertainty in rain-fed agriculture amidst climate change. Agricultural yields from irrigation are at least double that of rain-fed agriculture. Water resources are continuously decreasing due to increasing population, industrialization and lavish lifestyle. Keeping in mind these ever-depleting water resources and the ever-increasing food demand, it becomes very necessary to use the water resources with high efficiency. Therefore, it becomes very imminent to develop proper agricultural water management systems to achieve the goal of increasing food demand in the situation of decreasing water resources so that more production can be done by using less water "*more crop per drop*". Farmers mainly adopt surface irrigation method, which consumes a lot of water, resulting in very low water use efficiency. Micro-irrigation method is the most effective method of providing proper amount of water to the plants/crops, which saves water, because this method delivers water and nutrients directly to the root zone. Surface irrigation methods are used in more than 80 percent of the area of irrigated land in the world, but the water use efficiency of surface irrigation method is only 40-50%. Due to the absence of surface flow and other types of losses in micro irrigation method, the water use efficiency remains up to 90%. Generally, micro-irrigation is a technology to achieve higher precision and water use efficiency and it irrigates the crop in the form of spray, mist, sprinkle and droplets at low pressure. Micro-irrigation is highly advantageous in terms of reducing the irrigation cost, energy and fertilizer usage by 20-50, 31 and 7-42 %, respectively. It is further amenable to apply the water at the right time and at the precise rate based on the crop's water requirement. Globally only 4% of farmers use micro irrigation, 12% of farmers use pivot irrigation. This is also an efficient technique of irrigation whereas 84% of the farmers use surface irrigation, causing inefficient application and wastage of water. This also increases the emission of greenhouse gases and pollutes the water bodies. In micro-irrigation method, along with water, fertilizers are also delivered which does not use extra labor in applying fertilizers.

Micro irrigation method is a highly effective technique suitable for regions with limited water resources. Farmers are encouraged to adopt the micro-irrigation system on a large scale and imparting their imperative role in conserving the water for sustainable crop production system.

Problems and Strategies

The scarcity of water on a global scale is an urgent problem that is anticipated to deteriorate further as the world's population continues to grow. Water plays a crucial role in meeting various needs, especially as rapid industrialization and economic progress lead to lifestyle changes and an escalating demand for water in non-agricultural sectors. Unfortunately, the existing water sources are depleting rapidly and what remains is highly polluted. In India, water availability per person has significantly decreased from 5177 m^3 per year in 1951 to 1486 m^3 per person in 2021. Alarmingly, it is estimated to further decline to 1140 m^3 per person per year by the year 2050.



Source: CWC Water Related statistics-2021

Hydrologists typically assess scarcity by looking at the population-water equation. International norms classify countries with less than 1700 m^3 of water per person as water-stress. When annual water availability drops below 1,000 m^3 per person, the population is faced water scarcity, and below 500 m^3 "absolute scarcity". India is currently experiencing a water-stressed situation with a water availability of 1486 m^3 per person. Furthermore, India is gradually moving towards the category of water-scarcity countries, which is a matter of great concern.

India is the top user of groundwater and its major portion is used for irrigating the crops. The water requirement of every crop is different and it also depends upon varieties grown and prevailing environmental conditions. On an average, different crops like wheat (900-2000 liters), maize (1000-1800 liters) paddy (3000-5000 liters), sugarcane (1500-3000 liters) and soybean (1100-2000 liters) require high quantity of water for one kg economic output. Insufficient water availability hampers the performance of quality seeds, fertilizers, and other agricultural, inputs and thus limiting the realization of the their full potential. India is home to approximately 17 percent of the global population; however, it possesses only about 4 percent of the world's water resources. Furthermore, the distribution of water resources within the country is unequal. Additionally, there is a rising need for water in industries, construction, and domestic sectors. Consequently, the consumption of water is rapidly rising while the supply of clean water is dwindling. By the year 2050, India is projected to have a population of 1.6 billion, leading to a substantial surge in the demand for water, food, and energy. As a result, there is a pressing requirement to expand the infrastructure and enhance the efficient utilization of resources.

Water scarcity in India is primarily attributed to inadequate management systems, polluted water resources and the impacts of climate change. Consequently, the efficient utilization of the extremely scarce water resources becomes an even more urgent necessity.

India receives an average annual rainfall of approximately 4000 billion m^3, yet due to inadequate water management practices, only 48% of it effectively utilized in surface and groundwater bodies. The remaining water flows into the oceans. Insufficient storage mechanisms, inadequate infrastructure, improper water management, inefficient irrigation methods, and a lack of water awareness among the general public contribute to this situation, resulting in a utilization rate of only 18-20% of available water. A significant factor contributing to the water crisis is the uneven distribution of rainfall, with about 75% of the annual rainfall (around 1190 mm) occurring within a short span of four months during the monsoon season (June to September). Additionally, there is substantial inequality in the distribution of rainfall across regions. According to the assessment conducted by the Central groundwater Board in 2022, India's total annual groundwater resource is estimated to be 437.60 billion m^3, with an annual groundwater availability of 398.08 billion m^3. Approximately 239.16 billion m^3 (60.08%) of the annual groundwater availability in India is currently

being exploited. The indus river basin, shared between India and Pakistan, is recognized as the second most water-stressed aquifer globally, highlighting the severity of the situation.

Climate change is predicted to have adverse effects on agricultural productivity, which is of great concern considering the major and highly water-intensive crops (rice, wheat, and sugarcane) in India. To ensure the sufficient crop production while minimizing water usage for irrigation, there is an urgent need to adopt advanced and efficient irrigation methods.

The irrigation infrastructure for agricultural purposes includes various resources such as canals, groundwater, wells, tanks, and ponds. By implementing improved irrigation practices, the aim is to optimize the crop yields while minimizing water consumption. Globally, around 40% of irrigation water is sourced from groundwater, whereas in India, this proportion exceeds 50%. As a consequence, there has been a rapid depletion of groundwater levels, particularly in the northwestern region of the country, raising serious concerns and posing a significant threat to the future. The utilization of groundwater and irrigation methods in India is technically inefficient. For instance, according to India's 3^{rd} Micro-

Total water resources of India

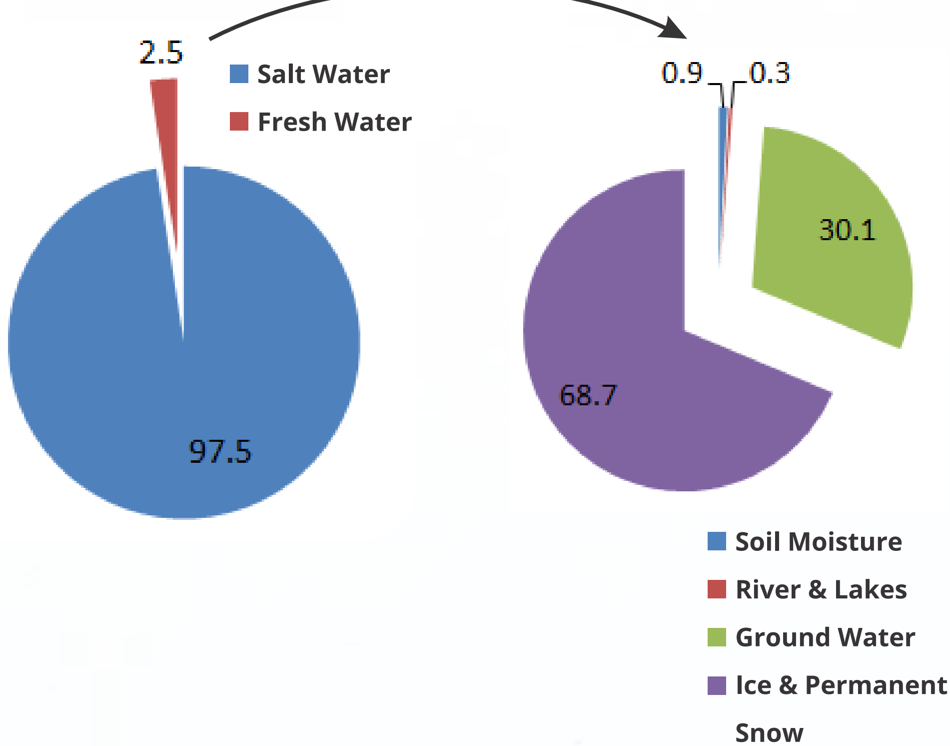
Resources	Quantity in billion cubic meters (BCM)	Remarks
Annual precipitation	4,000	100% of precipitation
Evaporation + soil water and groundwater storage	2,131	3% of precipitation
Runoff (including groundwater outflow in to rivers)	1,869	47% of precipitation
Utilizable water resources	1,123	28% of precipitation
-from surface water	690	37% of average annual run off
-from groundwater	433	11% of precipitation
Water use (2007)	684	
-from surface water	428	
-from groundwater	256	
*Projected water use		
2025	984-1043	
2050	1273-1,380	
Per capita availability (cubic meters; m^3)		
1990	1,953	
2010	1,754	
2050	1,035	

Source: CWC and Planning Commission, 2007

Irrigation Census, only 3% of the country's 8.5 million tube-well owners employed drip or sprinkler irrigation, while 88% relied on surface irrigation through open channels.

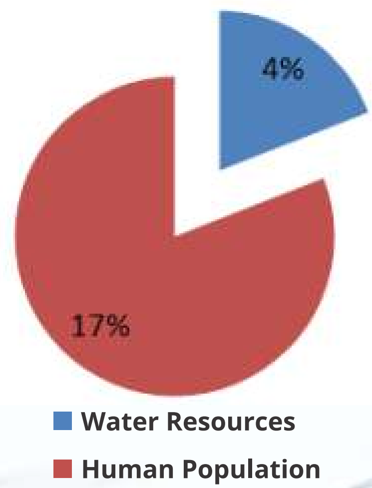
Irrigation accounts for the largest share of water usage and this trend is expected to persist in the future. Therefore, the principle of "**per drop more crop**" becomes crucial. It is imperative to enhance water use efficiency continuously and maximize water conservation efforts. Modern irrigation systems such as drip and sprinkler irrigation need to be widely adopted to increase the efficiency. Although the government provides subsidies to encourage the adoption of micro-irrigation systems, the implementation has been limited to less than five percent of the total area. While government schemes have achieved success in some states, most states have not met the expected outcomes. The feedbacks from the farmers indicate that the process is often lengthy and challenging, discouraging farmers from adopting these practices. Simplifying and ensuring farmer-friendly provisions are essential. Irrigated farming plays a pivotal role in ensuring the food security; hence, it is crucial to utilize dwindling water resources with high efficiency. Improving agricultural water management is a key factor in achieving this goal.

Global Water Budget



Source: CWC Water Related statistics-2021 (cwc.gov.in)

Availability of water Resource & Human Population of India relative to world average



Drip Irrigation System

This is considered the most advanced method of irrigation with the highest irrigation application efficiency. It involves delivering a precise and limited amount of water to the crop's root zone at regular intervals through drip emitters, using a drop-by-drop method. By releasing water in the form of drops, it gets absorbed into the soil, maintaining moisture in the root zone through the combined effects of gravity and capillary action. This system ensures that only a portion of the crop area is wetted, optimizing water usage. The lateral movement of water below the surface is more pronounced in well-structured soil, such as loamy soil, compared to sandy soil. If the discharge rate of the drip exceeds the soil's water absorption rate (hydraulic conductivity), water may accumulate at the surface, leading to lateral rather than vertical distribution of moisture. The lateral flow of water in different types of soil are presented in Table 1. The successful operation of the drip irrigation system relies on maintaining low atmospheric pressure to ensure smooth irrigation.

Drip system layout and components

A complete drip irrigation system consists of various components, including an electric pump, main control unit, venturi, filter unit, pressure gauge, main and sub-main pipelines, hydrants, control valves, lines, and drippers.

Electric pump: A pump is required for water supply, whose capacity depends on the source of water and the size of the field.

Main control unit: Its features depend on the requirements of the system. This usually includes a shut-off valve, air check, non-return valve, a filtering unit, a fertilizer injector, etc.

Table 1. Average lateral flow of water in different soils

Soil types	Mean radius of water spread (m)
Light structure	0.30
Medium structure	0.65
Heavy structure	1.20

Source: FAO, Hand book on pressurized irrigation techniques 92-5-104532-1, Page:133

Filter unit: To ensure the smooth functioning of the drip system, a filtration system is employed to prevent any type of clogging. This system typically comprises a water filter and a sand filter, which are responsible for separating impurities and sand particles, respectively. Regular servicing and cleaning of these filters are necessary to maintain their effectiveness.

Fertigation unit: This unit deliver the essential nutrients (fertilizers) to the crop along with irrigation water.

Pressure gauge: It indicates the water pressure in the drip system.

Water meter: It indicates the flow of water in the drip system.

Pipeline: Main and sub-main pipeline is manufactured from rigid

Fertigation Unit

PVC (polyvinyl chloride) and it supplies water to the laterals. They are buried into soil by digging a trench 1.5-2.0 feet deep. Otherwise, there is a possibility of their bursting due to the pressure of water. As it is buried under the soil, there are no disruptions during the tillage operations.

Hydrant: These are fitted on the main pipeline, which are equipped with shut-off valves. They are able to deliver the water flowing in the pipeline to several feeder lines.

Laterals: The drip irrigation system utilizes 12-20 mm plastic pipes made of black soft LDPE (low-density polyethylene). These pipes, known as laterals, are connected to the feeder line at specific intervals using small connectors and are laid along the crop rows. Drip emitters are installed at regular distances, such as 30 or 40 cm, within the laterals. These emitters release a controlled amount of water around the crop's root zone. The spacing of the laterals will vary based on factors like the type of crop and soil.

Dripper (drip emitter): Drippers, which are small-sized emitters made of high-quality plastic, are placed at fixed intervals along the laterals. The water enters the dripper at a low rate (1.0-2.4 liters/ hour) under an approximate atmospheric pressure of 1.0 bar, and it exits as a continuous stream of droplets at zero pressure.

Drip irrigation systems can be installed either on the soil surface or sub-surface (beneath the soil surface at desired depth). Prior to installing a sub-surface drip system, it is crucial to thoroughly assess the crop cycle and required tillage operations, including the desired depth. A trench created at the specified depth to install the drip system. Tractor-drawn equipment is available for this task, offering high efficiency and precision. Sub-surface drip irrigation offers several advantages and disadvantages. It significantly reduces evaporation and surface runoff. Weed germination and growth are often reduced due to the dry soil surface, resulting in time and cost savings. Since the drip system does not require frequent installation and removal, it also saves labour and time. Being located in the lower soil layers, it is protected from damage during the various tillage operations, and its lifespan is prolonged as it is not exposed to sunlight. However, there are also some potential disadvantages, such as limited area/pattern of

soil wetting in light soils and limited flexibility to alter crop geometry.

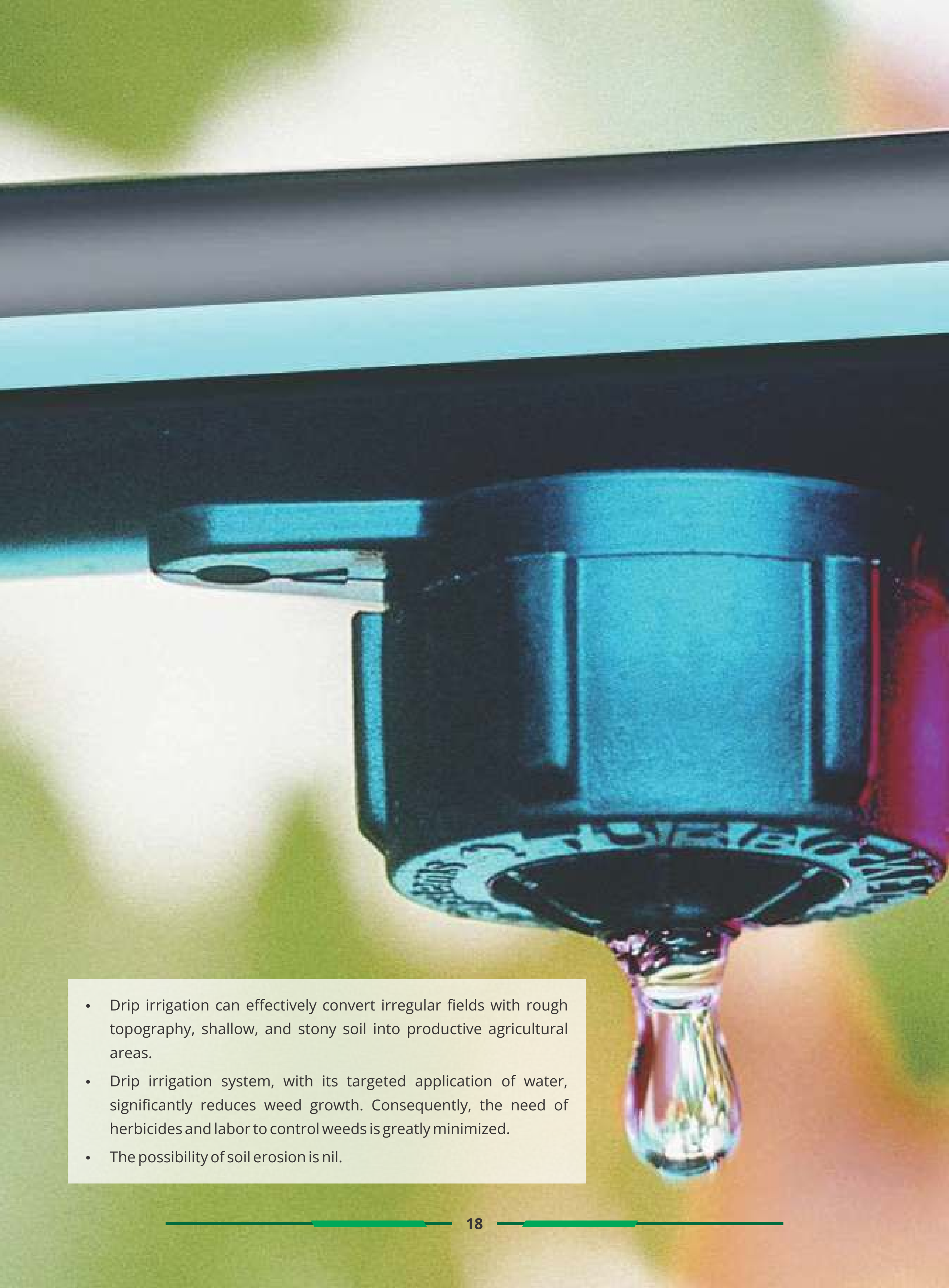
Advantages of drip irrigation system

- Implementing drip irrigation techniques can result in at least 25% water savings, which in turn can irrigate 25% additional area or conserve for the future use. By adopting this method, not only water is conserved, but it also contributes to a reduction in greenhouse gas emissions through precise fertilizer application. Drip irrigation has the added benefit of reducing nitrate leaching and minimizing the absorption of heavy metals in the soil.
- There is uniform distribution of water in the entire field, which helps in increasing the yield.

Use of saline/sodic water resources: The drip irrigation system maintains the moisture levels in the crop's root zone by providing frequent irrigation with smaller amounts of water. As water is applied to the crop's root zone, salts dissolved in the water tend to accumulate in the wet soil periphery, ensuring that the crop receives the necessary

moisture without the harmful effects of salt. Unlike other irrigation methods, the drip irrigation system has the capability to effectively utilize saline water with a total dissolved solids (T.D.S.) concentration of up to 3000 mg/liter, making it suitable for use even with water sources that may be unsuitable for other irrigation methods.

- The drip irrigation system is versatile and can be applied in various farming methods, including open fields, greenhouse farming, indoor gardens, poly house farming, lawns, vegetable gardens, orchards, etc. It can effectively irrigate all types of soils, ensuring successful water management across different agricultural practices.
- **Precautions**: The proficiency of experienced workers is crucial for the effective operation of an efficient irrigation system. It is imperative to have well-informed individuals who can proficiently handle various tasks, including the proper application of nutrients (fertilizers) with irrigation water, as well as the effective utilization and upkeep of components such as venturi, filters, injectors, and other associated equipment.



- Drip irrigation can effectively convert irregular fields with rough topography, shallow, and stony soil into productive agricultural areas.
- Drip irrigation system, with its targeted application of water, significantly reduces weed growth. Consequently, the need of herbicides and labor to control weeds is greatly minimized.
- The possibility of soil erosion is nil.

Sprinkler Irrigation System

In recent years, there have been advancements in sprinkler irrigation systems and methods to fulfil the needs of farmers. Sprinklers are strategically placed on lateral pipelines at uniform intervals (6-12 meters), which are then laid across the field at predetermined spacing (6-18 meters). This ensures that irrigation water is evenly distributed over the entire covered area. The hose pipe-operated sprinkler system has been developed to minimize water wastage and reduce labor requirements. It is an enhanced version of the traditional permanent sprinkler system, incorporating features from both semi-permanent and permanent systems. In this system, sprinkler laterals are positioned at a distance of up to 60 meters from the main pipeline. Instead of connecting the sprinkler laterals directly to the pipe, they are installed from side to side using iron rods or tripods. Flexible PE (polyethylene) hoses with a diameter of 20-25 mm are connected to the sprinkler laterals. This arrangement allows for lateral movement of the sprinkler during the irrigation. The sprinkler irrigation system can be classified as low or medium pressure, permanent or semi-permanent. It is particularly suitable for crops which cover the entire field, such as wheat, rice and others.

Layout and components of sprinkler system

A typical sprinkler system follows a standardized layout, which includes essential components such as a main controller (comprising control valves, venturi, filter, and pressure gauge), a network of pipes for distribution (main pipe, sub-main pipe, PE hose pipe), sprinklers, and hydrant laterals. The main and sub-main pipelines are usually made of PVC and have a diameter ranging from 90 to 150 mm. The sub-main pipeline is typically buried into soil at a depth of 75-110 mm.

The sprinkler system utilizes tough HDPE pipes that are laid on the ground surface. Water is released through the sprinklers, creating a circular pattern as it is sprayed into the air and falls onto the ground. Agricultural sprinklers typically operate at low to medium pressure, typically ranging from 2.0 to 3.5 bar. Each sprinkler head is equipped with two nozzles to release water into the air.

The distribution of water from the sprinkler is not uniform across the entire area but tends to be concentrated near the sprinkler itself. To ensure even water distribution, the sprinklers are positioned on the laterals in such a way that the water released by adjacent sprinklers overlaps in both directions. This arrangement is known as sprinkler spacing. The spacing pattern can be square, rectangular, or triangular, depending on the size and type of the farm.

To achieve the uniform water distribution, the sprinkler spacing should not exceed 65% of the sprinkler diameter coverage under square/rectangular patterns and moderate wind conditions. In the case of a triangular pattern, the spacing can be increased up to 70%. It is important to ensure that the rate of water release from the sprinkler does not exceed the rate of water absorption by the soil.

The soil's water absorption rate varies depending on its type, such as 25 ml/hr for sandy soil, 8-16 ml/hr for loamy soil, and 2-8 mm/hr for black soil. The height of the sprinkler should be at least 60 cm for low-height crops, while for tall crops; the sprinkler height should be adjusted accordingly to match the crop's height. Irrigating the crops with this system helps in reducing water loss, resulting in an irrigation efficiency of approximately 75 percent.

Precautions

- In areas where saline water is available for irrigation, the use of sprinkler irrigation can potentially harm the crops. Therefore, it is advisable to opt for drip irrigation systems in such locations.
- Due to strong wind, there is uneven distribution of water in sprinkler irrigation. Therefore, irrigation should not be done in case of high wind velocity.
- Sprinkler irrigation is more susceptible to water loss through evaporation. Therefore, it is recommended to schedule sprinkler irrigation in the evening rather than during the day.

Drip/sprinkler irrigation system cost

The cost of a drip irrigation system varies depending on factors such as the type of crops (field crops and their crop geometry, orchards, vegetable crops), the spacing between plants, and the proximity of the water source. Additionally, the cost may vary from state to state because taxation and subsidy on micro irrigation system differ from state to state. On average, the cost of micro irrigation system to cover one hectare area is approximately Rs. 4.0 lakhs.

Operation of micro irrigation system through solar power

Energy plays a crucial role in agricultural sector. Currently, the agriculture sector accounts for 22% of our country's non-renewable energy consumption and 80% of water usage. It is imperative to enhance the efficiency of energy and water utilization by minimizing wastage. One effective approach to achieve optimal resource utilization is through the implementation of solar-powered micro irrigation system. By utilizing solar-powered pumps, the challenges

associated with electricity availability can be addressed, ensuring timely and efficient irrigation operations.

Solar-powered drip irrigation technology enables cultivation in areas without access to electricity and relying solely on rainwater. The capacity of the solar pump is determined based on factors such as the size and depth of water tank, the irrigated area, water availability, and estimated evapotranspiration of that particular region. Currently, two types of solar panels are available in the market: fixed structure and sun tracking structure. Fixed solar panels are cost-effective and can withstand high wind speeds, but they have lower efficiency in converting solar radiation into energy. On the other hand, sun tracking structure solar panels rotate with the sun's direction, generating more electricity and providing increased water supply. However, the cost associated with sun tracking structure panels is higher.

Results of Research Conducted by ICAR-IIWBR, Karnal



In India, the rice-wheat cropping system plays a vital role, accounting for over 70% of food grain production. However, a significant challenge in this system is the excessive use of water, leading to a rapid depletion of water resources. Besides commonly adopted flood irrigation methods suffer from inefficiency, mainly due to substantial water loss through leaching and evaporation. To counter this issue, it becomes crucial to prioritize the efforts towards adopting and implementing efficient irrigation methodologies that could reverse the trend.

The research results revealed that a significant water savings of at least 25% can be achieved in wheat cultivation in Haryana and similar regions. Typically, farmers tend to flood their fields with water, using over 1000-1500 liters of water to produce one kilogram of wheat grains. However, through alternative methods such as bed irrigation, water usage can be reduced to around 830 liters (45.7% saving) per kilogram of wheat grain, and with drip irrigation, it can be further reduced to approximately 600 liters (60% saving). Similarly, in the case of paddy cultivation, where over 3000 liters of water is traditionally required for one kilogram of paddy, the adoption of micro-irrigation techniques can allow for the producing of one kilogram of paddy with approximately 2275 liters of water (24.2% saving).

Another study focused on enhancing the water use efficiency of the rice-wheat cropping system through micro-irrigation. The results

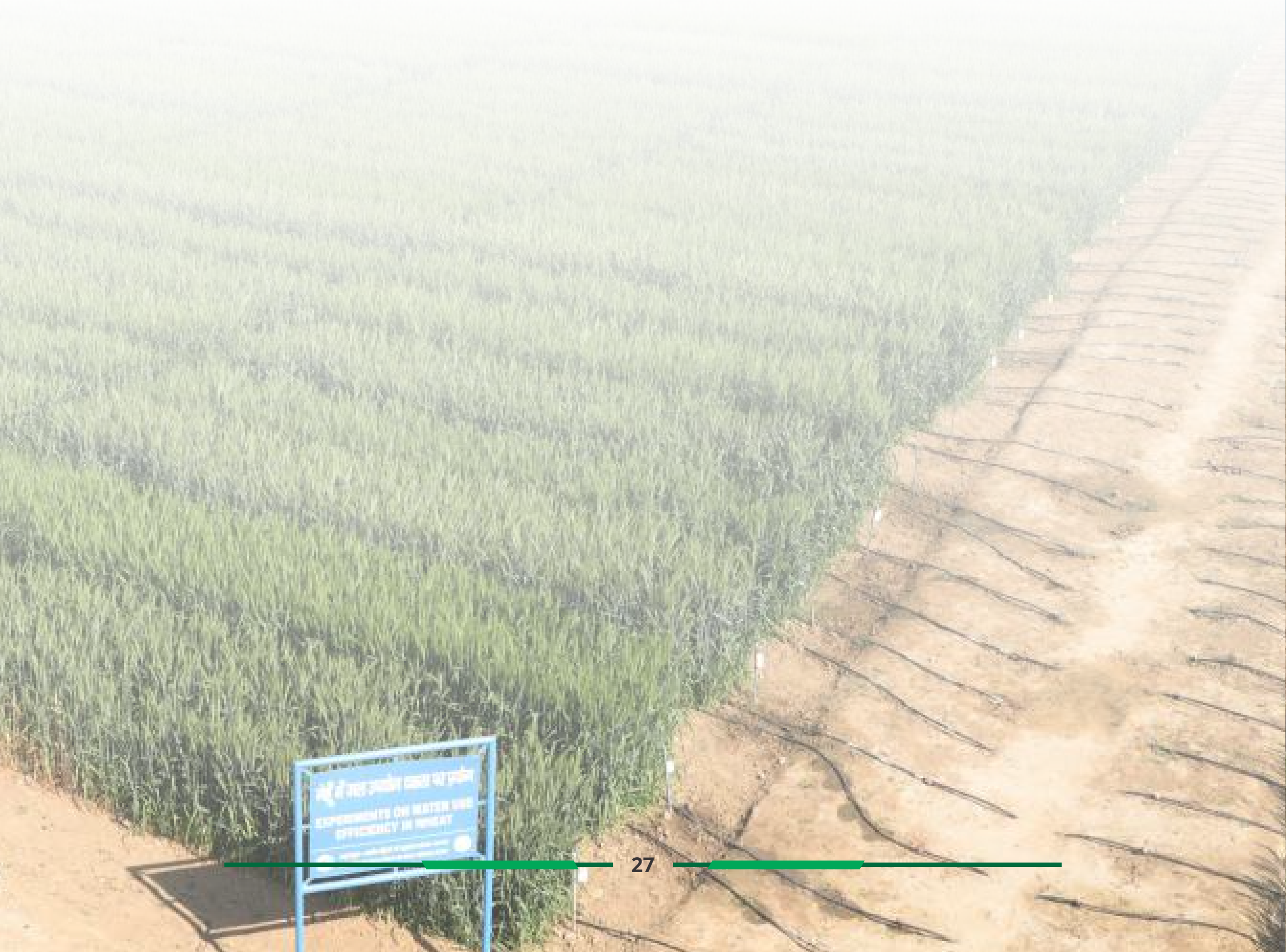
Table 2. Water use efficiency and productivity of wheat genotypes evaluated at different moisture regimes under drip irrigation system

Genotypes	WUE, Kg m^{-3}	
	irrigations @80%ET	irrigations @60%ET
DBW 110	1.88	2.11
DBW 140	1.66	1.77
DBW 16	1.61	2.10
DBW 235	1.55	2.13
DBW 88	1.79	2.06
DBW 166	1.81	2.19
DBW 222	1.87	2.14
DBW 243	1.94	2.40
PBW 550	1.46	1.73
WH1022	1.70	2.05
WH1126	1.68	1.98
HD 2967	1.79	1.99
WH 1105	1.72	1.95

revealed that the production and water use efficiency of wheat and direct-seeded paddy with micro-irrigation systems were significantly higher than flood irrigation. Another experiment investigated the production and water use efficiency of wheat varieties under conditions where 20 and 40 percent less water than ET requirement of crop was used though micro irrigation systems with high precision. The findings demonstrated that by applying irrigations with drip system with a 20 percent less than ET requirement, high water productivity achieved (Table 2). This indicates that adopting micro irrigation systems for wheat and paddy crops can lead to a minimum water saving of 20 percent or the opportunity to irrigate an additional 20 percent of the wheat area. Furthermore, this technology offers farmers the benefits of reduced labor, lower costs, and increased economic returns in agricultural practices.

Summary

The adoption of advanced irrigation techniques and equipment and genotypes holds the potential for substantial water savings and improved crop productivity. Over the years, scientists, agricultural extension workers, farmers, and the private partners have been collaborating to develop suitable irrigation systems. Water conservation has become a significant objective for farmers, governments, and the agricultural manufacturing industry, and will continue to be in the future. The realization of this objective relies on creating awareness among farmers about the latest irrigation systems, implementing supportive government policies, and ensuring that agricultural machinery and equipment are made accessible to farmers at affordable prices. To achieve this goal, the cooperation of all stakeholders involved is crucial.



Reasons behind
GROUND WATER
depletion

- Excessive exploitation of groundwater for irrigation
- Uneven distribution of rain water due to climate change
- Uncontrolled grazing, destruction of forest, cementation of land
- Growing water demanding crops even in low rainfall conditions
- Wasteful flow of rain water through fields and drains
- Neglect of soil and moisture conservation measures by the farmers
- Ignoring ponds or other structures made for water storage in fields
- Inefficient management of natural resources and forest resources
- Lack of public participation in water catchment area development and irrigation schemes
- Indiscriminate use of water in sectors other than agriculture

भास्कर खास • जनसंख्या वृद्धि कैसे पृथ्वी को प्रभावित कर रही है, 20 साल के अध्ययन से पता चला

धरती से इतना पानी निकाला कि पृथ्वी धुरी से हिलने लगी है, भरपाई नहीं हुई तो घरों और बुनियादे ढांचों तक को नुकसान पहुंच सकता है

The New York Times

पृथ्वी की ऊपरी परत बदली

ड्रिप व स्प्रिंकलर सिंचाई विधि से किसान कर सकते हैं 70 प्रतिशत तक पानी की बचत

5 एकड़ तक के प्लांट में वह आती है लागत

किसान इस तरह कर सकते हैं आवेदन

अधिक उत्पादन को बरसात के मौसम में ...

Drip by drip, Bara sarpanch sets example for others to save water

Govt schools to have rainwater harvesting

80 projects worth ₹2 crore on cards

Fresh push for crop diversification

MAKE INDIA WATER POSITIVE

GROUNDWATER LEVEL

PROGRESSIVE

Amid pandemic, Malwa farmers experimenting with drip irrigation to cultivate cotton

Water Conservation

- Deep summer ploughing
- Use of FYM and cultivation of green manuring crops (dhaincha/ moong/lobia/guar)
- Field levelling
- Seed priming
- Construction of farm pond
- Wise division of field for irrigations
- Irrigation at the right time
- Adoption of micro irrigation systems
- Use of irrigation water in the right amount
- Choosing the appropriate varieties
- Weather information should be kept through different mediums while irrigation scheduling

कृषि • इस विधि से की गई सिंचाई में सीधा पौधे की जड़ में जाता है पानी

'हाईटेक तकनीक ड्रिप इरिगेशन' से कृषि लागत कम कर सकते हैं किसान

पथरीली और पहाड़ी इलाके की पथरीली जमीन पर सिंचाई के लिए फायदेमंद है यह तकनीक

50 से 70 प्रतिशत तक पानी की बचत होती है

किसानों को दिया जाता है प्रशिक्षण

टपका सिंचाई प्रणाली कारगर, 60 प्रतिशत पानी बचाकर पैदा की प्रति एकड़ 24 क्विंटल गेहूं

गेहूं उत्पादन में प्रयोग फव्वारा से 50%, तो टपका विधि से बचाया 60% पानी

कृषि • सिंचाई की नई तकनीक से किसानों का खर्च कम, मुनाफा ज्यादा

ड्रिप इरिगेशन से 30 से 40 फीसदी खर्च बचा सकते हैं किसान

ड्रिप इरिगेशन से खेत के हर पौधे तक पहुंचेगा पानी : विज

सुविधा •

तलवाड़ा-हाजीपुर ब्लॉक में माइक्रो इरिगेशन प्रोजेक्ट से 14 गांव के 1200 किसानों को फायदा, 664 हेक्टेयर भूमि में हो रही सिंचाई

ड्रिप इरिगेशन से पानी को बचाने का संदेश दे रहे रमन वजीर

RECOMMENDED VARIETIES FOR RAINFED AND RESTRICTED IRRIGATED AREAS

Northern Hill Zone

VL 2041

Release Year	:	2023
Yield Potential	:	44.4 q/ha
Average Yield	:	29.60 q/ha
Maturity Duration	:	190 days
TGW	:	42 g

HS 562

Release Year	:	2016
Yield Potential	:	62.2 q/ha
Average Yield	:	52.7 q/ha
Maturity Duration	:	183 days
TGW	:	43 g

HPW 349

Release Year	:	2013
Yield Potential	:	61.4 q/ha
Average Yield	:	47.0 q/ha
Maturity Duration	:	171 days
TGW	:	37.3 g

VL 907

Release Year	:	2010
Yield Potential	:	50.9 q/ha
Average Yield	:	44.3 q/ha
Maturity Duration	:	167 days
TGW	:	41 g

RECOMMENDED VARIETIES FOR RAINFED AND RESTRICTED IRRIGATED AREAS

North West Plains Zone

DBW 296

Release Year	:	2021
Yield Potential	:	88.3 q/ha
Average Yield	:	56.1 q/ha
Maturity Duration	:	150 days
TGW	:	43 g

HD 3043

Release Year	:	2012
Yield Potential	:	50.2 q/ha
Average Yield	:	42.8 q/ha
Maturity Duration	:	151 days
TGW	:	39 g

PBW 660

Release Year	:	2016
Yield Potential	:	49.3 q/ha
Average Yield	:	35.3 q/ha
Maturity Duration	:	154 days
TGW	:	42 g

WH1080

Release Year	:	2011
Yield Potential	:	44.4 q/ha
Average Yield	:	30.8 q/ha
Maturity Duration	:	151 days
TGW	:	39 g

RECOMMENDED VARIETIES FOR RAINFED AND RESTRICTED IRRIGATED AREAS

North East Plains Zone

K 1317

Release Year : 2018
Yield Potential : 38.6 q/ha
Average Yield : 30.1 q/ha
Maturity Duration : 125 days
TGW : 42 g

HD 3171

Release Year : 2017
Yield Potential : 38.6 q/ha
Average Yield : 28.0 q/ha
Maturity Duration : 120 days
TGW : 39 g

HD 3271

Release Year : 2020
Yield Potential : 37.2 q/ha
Average Yield : 28.1 q/ha
Maturity Duration : 98 days
TGW : 33 g

HI 1612

Release Year : 2018
Yield Potential : 50.5 q/ha
Average Yield : 37.6 q/ha
Maturity Duration : 125 days
TGW : 41 g

RECOMMENDED VARIETIES FOR RAINFED AND RESTRICTED IRRIGATED AREAS

Central Zone

CG 1036

Release Year	:	2023
Yield Potential	:	54.9 q/ha
Average Yield	:	39.3 q/ha
Maturity Duration	:	114 days
TGW	:	47 g

HI 1655

Release Year	:	2023
Yield Potential	:	53.1 q/ha
Average Yield	:	38.8 q/ha
Maturity Duration	:	118 days
TGW	:	44.3 g

DBW 110

Release Year	:	2015
Yield Potential	:	50.5 q/ha
Average Yield	:	39.0 q/ha
Maturity Duration	:	124 days
TGW	:	43 g

MP 3288

Release Year	:	2011
Yield Potential	:	43.9 q/ha
Average Yield	:	35.1 q/ha
Maturity Duration	:	123 days
TGW	:	44 g

RECOMMENDED VARIETIES FOR RAINFED AND RESTRICTED IRRIGATED AREAS

Peninsular Zone

UAS 347

Release Year	:	2015
Yield Potential	:	24.6 q/ha
Average Yield	:	18.4 q/ha
Maturity Duration	:	96 days
TGW	:	39 g

HI1605

Release Year	:	2017
Yield Potential	:	44.0 q/ha
Average Yield	:	29.0 q/ha
Maturity Duration	:	105 days
TGW	:	36 g

HD 2987

Release Year	:	2011
Yield Potential	:	38.0 q/ha
Average Yield	:	31.5 q/ha
Maturity Duration	:	103 days
TGW	:	38 g

NIAW 1415

Release Year	:	2011
Yield Potential	:	38.2 q/ha
Average Yield	:	31.1 q/ha
Maturity Duration	:	103 days
TGW	:	35 g

भा.कृ.अनु.प.–भारतीय गेहूँ एवं जौ अनुसंधान संस्थान

करनाल–132001, भारत

ICAR-Indian Institute of Wheat and Barley Research

Karnal -132001 (Haryana)